National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania

A Method for Developing Ecological Systems Maps from US National Vegetation Classification Association-level Vegetation Maps for Eight National Parks in the Eastern Rivers and Mountains Network of the National Park Service

Technical Report NPS/NER/NRTR—2009/136

ON THE COVER
View of Southern Appalachain Oak Forest, Allegheny-Cumberland Dry Oak Forest and Woodland, and Cumberland Acidic Cliff and Rockhouse ecological systems within New River Gorge National River.
Photograph by: Stephanie Perles.

A Method for Developing Ecological Systems Maps from US National Vegetation Classification Association-level Vegetation Maps for Eight National Parks in the Eastern Rivers and Mountains Network of the National Park Service

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May 2009

U.S. Department of the Interior
National Park Service
Northeast Region
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Executive Summary

This report identifies an approach to developing ecological systems maps from National Vegetation Classification association-level vegetation maps for eight parks in the Eastern Rivers and Mountains Network parks. These parks include Delaware Water Gap National Recreation Area, Upper Delaware Scenic and Recreational River, New River Gorge National River, Bluestone National Scenic River, Allegheny Portage Railroad National Historic Site, Fort Necessity National Battlefield, Friendship Hill National Historic Site, and Johnstown Flood National Memorial. Ecological systems attributions were made in the association-level vegetation maps of these parks using the International Terrestrial Ecological Systems Classification and spatial review. An ecological systems map, classification, list of the component associations in each ecological system, and table summarizing the acreage of each ecological system were produced for each park. These peer-reviewed products provide a practical framework for monitoring and managing for the ecological integrity of vegetation in national parks.

Introduction

Purpose

Fine-scale association-level maps provide detailed information on individual vegetation types. It allows resource managers to understand how much of each type is in the park, where it is, and how it is configured on the landscape. Monitoring the ecological integrity of 200 individual association types in eight of the nine parks in the Eastern Rivers and Mountains Network is a daunting, if not impossible task. Furthermore, monitoring ecological integrity at this scale is generally neither desirable nor necessary.

NatureServe's Ecological Systems Classification provides a broader-scale map unit than does the U.S. National Vegetation Classification. The ecological systems classification groups multiple spatially related associations that are influenced by the same ecological processes into one map unit. This project added ecological systems data to the completed association-level vegetation maps for the following parks: Delaware Water Gap National Recreation Area (DEWA), Upper Delaware Scenic and Recreational River (UPDE), New River Gorge National River (NERI), Bluestone National Scenic River (BLUE), Allegheny Portage Railroad National Historic Site (ALPO), Fort Necessity National Battlefield (FONE), Friendship Hill National Historic Site (FRHI), and Johnstown Flood National Memorial (JOFL).

Scope and Need

The scope of this project was to add ecological systems data to the association-level vegetation maps for the parks in the Eastern Rivers and Mountains Network; quantify the area of each ecological system in each park; and provide ecological systems classifications for each park. The ecological systems classification and mapping will assist vegetation monitoring and ecological integrity assessments at a broader scale than that of the association-level maps. Each ecological systems map portrays 7–12 map classes, as a complement to the fifty small-scale map classes of the existing association-level maps. This mapping and classification effort provides broader map units than the association-level maps and greater ecological context of the associations that occur together.

Objectives

The objective of this project was to provide up-to-date digital geospatial vegetation databases and classifications containing base-line information about vegetation associations and ecological systems occurring within eight national park units in the Eastern Rivers and Mountains Network. These data will be provided to the parks' resource managers to inform effective, long-term management of the natural resources at each park.

Materials and Methods

Classifying Ecological Systems

Two complementary classification systems were used to identify and describe the vegetation identified in the spatial vegetation maps for the eight Eastern Rivers and Mountains Network national park units. Ecological systems are identified using the International Terrestrial Ecological Systems Classification (2009), and associations, also known as natural communities, are identified using the US National Vegetation Classification (USNVC), a subset of the International Vegetation Classification.

International Terrestrial Ecological Systems Classification

Ecological systems are defined as "recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. They are intended to provide a classification unit that is readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field" (Comer et al. 2003). They are defined based on biogeographic region, landscape scale, dominant cover type, and disturbance regime.

NatureServe and its Natural Heritage program members developed the International Terrestrial Ecological System Classification to provide a reasonable scale for conservation assessment, mapping, land management, monitoring, and species habitat modeling. Ecological systems are practical mid-scale units that can be mapped from remote imagery and are readily identifiable in the field. They use both spatial and temporal scales to define them. The spatial scale of an ecological system ranges from 10s to 1,000s of hectares and temporal scales range from 50 to 1,000 years. The temporal scale allows typical successional dynamics to be integrated into the concept of each ecological system. Within any given ecological system, associated natural communities may be a representation of various successional stages of development (Comer 2003).

US National Vegetation Classification System

Natural communities in this document refer to the plant association level of the US National Vegetation Classification System (USNVC). The USNVC provides a complete, standardized listing and description of all the vegetation types that represent the variation in biological diversity at the community level. It is a comprehensive system that classifies all terrestrial vegetation in the country under a common framework (Grossman et al. 1998). It identifies vegetation units based on both qualitative and quantitative data at a scale that is practical for conservation.

The USNVC was adopted by the Federal Geographic Data Committee as the reporting standard for all federal agencies involved in the management of vegetation. This standardization allows for the comparison of vegetation types across political, jurisdictional, and geographic boundaries. It provides a common language for ecological communities, thereby making it possible to assess, monitor, compare, and evaluate across jurisdictions.

A natural community is defined as "a recurring plant association with a characteristic range in species composition, specific diagnostic species, and a defined range in habit conditions and physiognomy or structure" (Vegetation Classification Panel, Ecological Society of America, 2002). All types of vegetation—natural, semi-natural, and cultural—may be classified by the USNVC, but efforts have been focused on mid-to late-seral, natural/near natural vegetation. Less-natural and earlier seral vegetation are classified on an as-needed basis for use in various applications (Grossman et al 1998). Groups of associations that re-occur on the landscape form Ecological Systems.

Attributing Ecological Systems to Association-level Vegetation Maps

The first step in this project required acquiring the association-level vegetation maps for the following parks: Delaware Water Gap, Upper Delaware Scenic and Recreational River, New River Gorge National River, Bluestone National Scenic River, Allegheny Portage Railroad National Historic Site, Fort Necessity National Battlefield, Friendship Hill National Historic Site, and Johnstown Flood National Memorial. Table 1 shows the date the association-level vegetation map shapefile was acquired and the provider of the shapefile for each park.

NatureServe reviewed the vegetation association classifications and digital vegetation maps to determine which ecological system made the most ecological sense for attribution to each park. Preliminary ecological system assignments were made for all of the associations occurring in each park by referring to the International Terrestrial Ecological Systems Classification (2008). This classification includes a list of associations likely to occur in each system. However, the ecological systems classification is modular rather than hierarchical because some, usually common, associations occur in more than one system over their range. To account for this, a number of associations were initially assigned more than one Ecological System.

Table 1. Acquisition dates and providers of association-level vegetation maps for eight parks in the Eastern Rivers and Mountains Network (ERMN).

Park	Date Vegetation Map Acquired	Provider
ALPO	1/1/2008	NPS vegetation map products website: http://biology.usgs.gov/npsveg/products/parkname.html
FRHI	1/1/2008	NPS vegetation map products website: http://biology.usgs.gov/npsveg/products/parkname.html
JOFL	1/1/2008	NPS vegetation map products website: http://biology.usgs.gov/npsveg/products/parkname.html
FONE	1/1/2008	NPS vegetation map products website: http://biology.usgs.gov/npsveg/products/parkname.html
BLUE	1/22/2008	Draft final vegetation map from Jim Vanderhorst WVNHP
NERI	1/22/2008	Draft final vegetation map from Jim Vanderhorst WVNHP
DEWA	1/20/2008	Draft final vegetation map from Greg Podniesinski PANHP
UPDE	6/20/2008	Draft vegetation map posted by Matt Marshall, ERMN

A new shapefile was created from each park's association-level vegetation map. Two attribute columns, entitled E_S_NAME (Ecological System Name) and E_S_CODE (Ecological System Code), were added to the original association-level vegetation map attribute table in ArcMap. The corresponding ecological system(s) and ecological system code(s) were entered into the attribute table for every association. Semi-natural and ruderal associations were assigned to the surrounding ecological system, or if a system could not be determined, were assigned to a Ruderal or Semi-Natural map class selected from the Northeastern Wildlife Habitat Classification legend (Gawler et al. 2008). Cultural map classes were also tagged to map classes selected from the Northeastern Wildlife Habitat Classification legend (Gawler et al. 2008).

The preliminary ecological systems maps were displayed and reviewed in ArcMap. A more detailed review was completed on a polygon-by-polygon basis for associations and ruderal vegetation tagged to multiple ecological systems. For associations with multiple assignments, the most appropriate system was selected based on a number of factors. These included the geographic ranges of the systems; whether the system overlapped in range with the association and/or park unit; expert review; PLOT and accuracy assessment point data review; local vegetation association descriptions; comment fields in the association-level vegetation map shapefile layers; and spatial layout review that included an assessment of the landscape position, adjacent ecological systems, and orthophoto signature. Natural vegetation associations that were not already assigned to an ecological system were attributed based on this same review work.

The new ecological systems layer was then displayed over the orthophoto for each park. Most polygons in the map were manually checked by comparing the ecological systems assignment to the photography to determine whether additional edits were necessary. For example, artificial breaks in systems occurred as a result of associations shared among different system types, or small polygons were mapped as a separate system rather than a smaller inclusion within the larger system. In some cases, landscape setting suggested an alternative system than what was initially mapped as a result of associations occurring in multiple systems.

Draft ecological systems maps and classifications were distributed to reviewers including Natural Heritage and National Park Service ecologists. Ecological systems descriptions were edited as a result of mapping: new environmental data, landscape setting, and associations were attributed to systems. Map review edits were incorporated and final maps and classifications were completed. A third attribute column was added to the shapefiles and populated with polygon areas in hectares. FGDC-compliant metadata fields were added to the association-level vegetation map metadata for the new ecological systems data fields.

Results

Delaware Water Gap

The following ecological systems were identified at Delaware Water Gap: Central Appalachian Dry Oak - Pine Forest, Central Appalachian Dry Oak - Pine Rocky Woodland, Appalachian (Hemlock) - Northern Hardwood Forest, Central Appalachian River Floodplain, Laurentian - Acadian Freshwater Marsh, Laurentian - Acadian Wet Meadow - Shrub Swamp, North-Central Appalachian Acidic Cliff and Talus, North-Central Appalachian Acidic Swamp, North-Central Appalachian Circumneutral Cliff and Talus, North-Central Appalachian Seepage Fen, North-Central Interior and Appalachian Acidic Peatland, and Northeastern Interior Dry - Mesic Oak Forest. The areas of the ecological systems, semi-natural, and cultural map classes at Delaware Water Gap are displayed in Table 2. Figure 1 provides a snapshot of a small portion of the Delaware Water Gap ecological systems map for reference. The ecological systems classification report for Delaware Water Gap is included as Appendix A.

Table 2. Areas of the ecological systems, semi-natural, and cultural map classes at Delaware Water Gap.

Ecological System or Map Class	Hectares	Acres
Central Appalachian Dry Oak - Pine Forest	7,274.4	17,975.5
Appalachian (Hemlock) - Northern Hardwood Forest	6,722.8	16,612.4
Northeastern Interior Dry - Mesic Oak Forest	3,318.3	8,199.7
Ruderal Forest - Northern and Central Hardwood and Conifer	3,015.8	7,452.4
Ruderal Upland - Old Field	1,463.0	3,615.1
Cultivated Crops	1,268.5	3,134.6
River	1,178.7	2,912.7
Central Appalachian River Floodplain	982.8	2,428.5
North-Central Appalachian Acidic Cliff and Talus	670.2	1,656.2
Managed Tree Plantation	472.0	1,166.2
Developed - Medium & High Intensity	369.5	913.2
Central Appalachian Pine - Oak Rocky Woodland	367.7	908.7
Pond	269.4	665.8
North-Central Appalachian Acidic Swamp	201.9	498.9
Transportation Corridor	128.9	318.5
Laurentian - Acadian Wet Meadow - Shrub Swamp	64.1	158.3
Modified/Managed Marsh	56.8	140.3
Introduced Wetland and Riparian Vegetation	34.9	86.3
North-Central Interior and Appalachian Acidic Peatland	21.4	52.9
Laurentian - Acadian Freshwater Marsh	20.2	50.0
North-Central Appalachian Circumneutral Cliff and Talus	17.1	42.2
Quarries/Pits/Stripmines	12.2	30.1
Central Appalachian Stream and Riparian	10.0	24.6
North-Central Appalachian Seepage Fen	3.7	9.2
Total	27,944.5	69,052.3

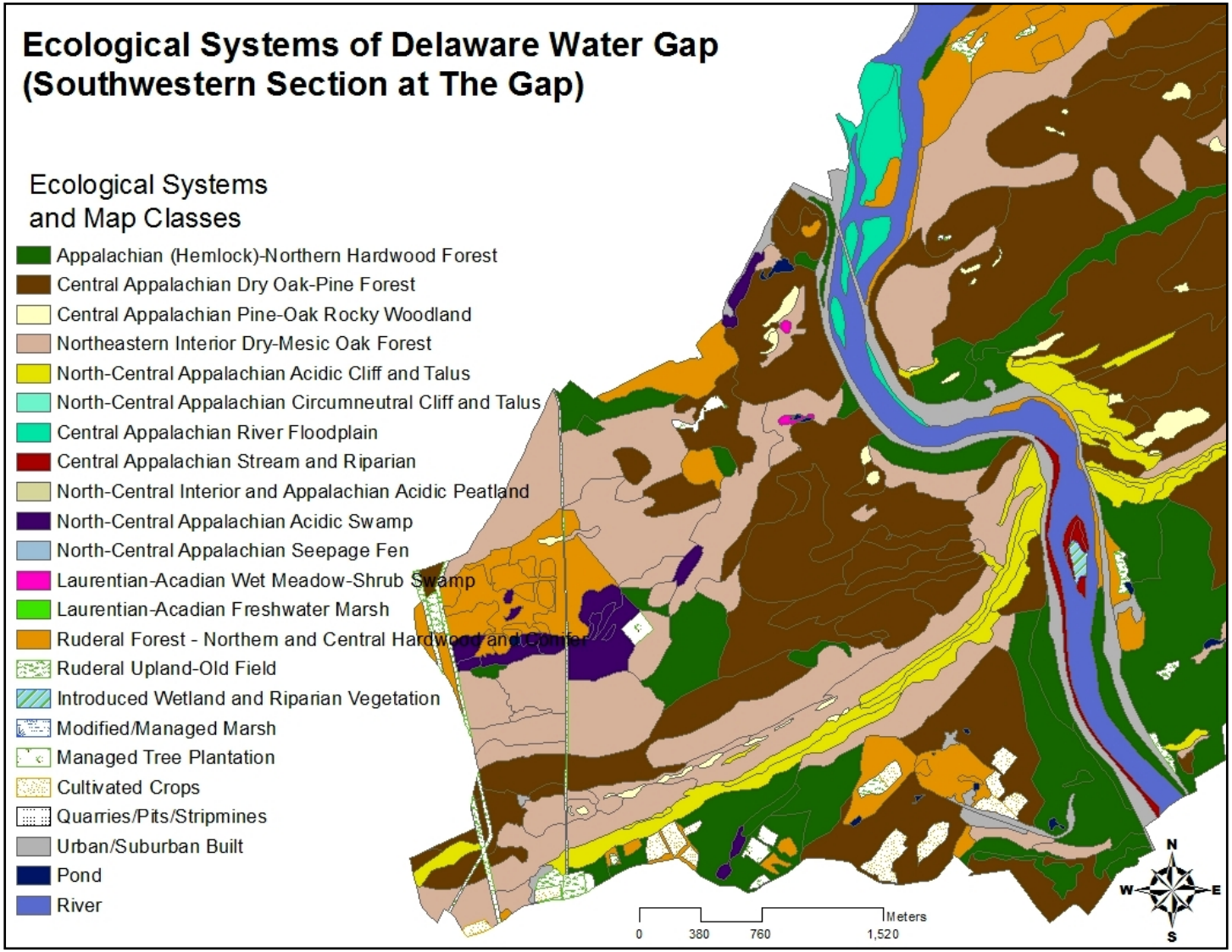

Figure 1. Reference snapshot of a small portion of the ecological systems map for the Delaware Water Gap. This image displays the southwestern corner of the park.

Association Attributions to Ecological Systems

The Delaware Water Gap vegetation associations (or map classes, where more than one association was included as a single map class in the association level map) were attributed by their park-specific, local name to ecological systems and semi-natural map classes at Delaware Water Gap as follows:

Appalachian (Hemlock) - Northern Hardwood Forest (202.593)

- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- Sugar Maple - American Beech - Sweet Birch Forest (CEGL006252)
- Eastern White Pine Forest (CEGL006328)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006125)
- Tuliptree - Beech - Maple Forest (CEGL006296)
- Eastern White Pine Successional Forest (CEGL007944)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

Northeastern Interior Dry - Mesic Oak Forest (CES202.592)

- Dry Oak - Mixed Hardwood Forest (CEGL006336)
- Dry Hickory Ridgetop Forest (CEGL006301)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine Successional Forest (CEGL007944)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

Central Appalachian Dry Oak - Pine Forest (CES202.591)

- Dry Eastern White Pine - Oak Forest (CEGL006293)
- Dry Eastern Hemlock - Oak Forest (CEGL006923)
- Dry Oak - Heath Forest (CEGL006282)
- Eastern White Pine Successional Forest (CEGL007944)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

Central Appalachian Pine - Oak Rocky Woodland (CES202.600)

- Hickory - Eastern Red-cedar Rocky Woodland (CEGL006002)
- Successional Bear Oak - Heath Shrubland (CEGL003958)
- Bear Oak - Wavy Hairgrass Shrubland (CEGL006121)
- Wavy Hairgrass - Common Sheep Sorrell Rock Outcrop (CEGL006544)
- Pitch Pine - Mixed Hardwood Rocky Summit (CEGL006116)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

North-Central Appalachian Acidic Cliff and Talus (CES202.601)

- Shale Scree Slope (CEGL006535)
- Sparsely Vegetated Cliff (CEGL006422)
- Oak - Birch Talus Forest (CEGL006565)
- Oak - Birch Talus Forest / Sandstone Talus (CEGL006565 / CEGL004142)
- Sandstone Talus (CEGL004142)
- Hickory - Eastern Red-cedar Rocky Woodland / Sparsely Vegetated Cliff (CEGL006002/CEGL006422)
- Dry Oak - Heath Forest / Oak - Birch Talus Forest (CEGL006282 / CEGL006565)
- Little Bluestem Grassland / Sparsely Vegetated Cliff (CEGL006333 / CEGL006422)

North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)

- Sugar Maple - American Basswood Forest (CEGL006020)

Laurentian - Acadian Freshwater Marsh (CES201.594)

- Mixed Forb Marsh (CEGL006446)
- Cattail Marsh (CEGL006153)

Laurentian - Acadian Wet Meadow - Shrub Swamp (CES201.582)

- Alder Wetland (CEGL005082)
- Highbush Blueberry - Steeplebush Wetland (CEGL006371)
- Buttonbush Wetland (CEGL006069)
- Tussock Sedge Marsh (CEGL006412)
- Wet Meadow (CEGL006571)

Central Appalachian River Floodplain (CES202.608)[1]

- Sycamore - Green Ash Floodplain Forest (CEGL006036)
- Silver Maple Floodplain Forest (CEGL002586)
- Bottomland Oak Palustrine Forest (CEGL006185)
- Sugar Maple Floodplain Forest (CEGL006459)
- Bitternut Hickory Lowland Forest (CEGL006445)
- Buttonbush Wetland (CEGL006069)
- Big Bluestem - Indian Grass Riverine Grassland (CEGL006518)
- Black Walnut Bottomland Forest (CEGL006449)

[1] Four associations (denoted with an *) that are more typically found in the Central Appalachian Stream and Riparian System were included in the Central Appalachian River Floodplain system at Delaware Water Gap because they were very small riparian inclusions surrounded by broad, flat, diffuse, low-gradient floodplains and associations more typical of the Central Appalachian River Floodplain system. This was done to maintain a cohesive floodplain ecological system along the Delaware River which better reflects the concept of an ecological system than mapping small inclusions as a separate system. For a finer-scale view of the floodplain and riparian associations, the map user can view them at the association-level.

- Temporarily Flooded Modified Successional Forest (CEGL006599)
- Red maple Seepage Swamp (CEGL006406)
- Mixed Forb Marsh (CEGL006446)
- Wet Meadow (CEGL006571)
- Tussock Sedge Marsh (CEGL006412)
- Riverine Scour Vegetation (CEGL006554) - riparian inclusion*
- Sycamore - Mixed Hardwood Riverine Shrubland (CEGL003896) - riparian inclusion*
- Sycamore (Willow) - Mixed Hardwood Riverine Dwarf Shrubland (CEGL006065) - riparian inclusion*
- Calcareous Riverside Outcrop / Calcareous Riverside Seep (CEGL006284 / CEGL006969) - riparian inclusion*

Central Appalachian Riparian (CES202.609)[2]

- Big Bluestem - Indian Grass Riverine Grassland (CEGL006518)
- Silver Maple Floodplain Forest (CEGL002586)
- Sycamore - Mixed Hardwood Riverine Shrubland (CEGL003896)

North-Central Appalachian Acidic Swamp (CES202.604)

- Red Maple - Black Spruce - Highbush Blueberry Palustrine Woodland (CEGL006014)
- Red maple Seepage Swamp (CEGL006406)
- Red Maple - Highbush Blueberry Palustrine Forest (CEGL006220)
- Eastern Hemlock - Mixed Hardwood Palustrine Forest (CEGL006279)
- Wet Meadow (CEGL006571)
- Blueberry Thicket (CEGL006371)

North-Central Appalachian Seepage Fen (CES202.607)

- Calcareous Fen (CEGL006367)
- Marl Fen (CEGL006013)

North-Central Interior and Appalachian Acidic Peatland (CES202.606)

- Leatherleaf Peatland (CEGL006008)
- Red Maple - Black Spruce - Highbush Blueberry Palustrine Woodland (CEGL006014)
- Highbush Blueberry - Leatherleaf Wetland (CEGL006190)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Modified Successional Forest (CEGL006599)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

[2] This system was identified southeast of Kittatiny Point for approximately 2 km along the Delaware River from The Gap.

Upper Delaware Scenic and Recreational River

The following ecological systems were identified at Upper Delaware Scenic and Recreational River: Appalachian (Hemlock) - Northern Hardwood Forest, Northeastern Interior Dry - Mesic Oak Forest, Central Appalachian Dry Oak - Pine Forest, Central Appalachian Pine - Oak Rocky Woodland, Central Appalachian Stream and Riparian, Laurentian - Acadian Freshwater Marsh, Laurentian - Acadian Wet Meadow - Shrub Swamp, North-Central Appalachian Acidic Swamp, and North-Central Interior and Appalachian Acidic Peatland. The areas of the ecological systems, semi-natural, and cultural map classes at Upper Delaware Scenic and Recreational River are displayed in Table 3. Figure 2 provides a snapshot of a small portion of the Upper Delaware Scenic and Recreational River ecological systems map for reference. The ecological systems classification report for Upper Delaware Scenic and Recreational River is included as Appendix B.

Table 3. Areas of the ecological systems, semi-natural, and cultural map classes at Upper Delaware Scenic and Recreational River.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	10,072.3	24,889.3
Northeastern Interior Dry - Mesic Oak Forest	4,884.1	12,068.9
Central Appalachian Dry Oak - Pine Forest	4,233.9	10,462.2
Urban/Suburban Built	2,249.9	5,569.4
Streams and Canals	1,553.6	3,839.0
Cropland and Pasture	909.0	2,248.7
Ruderal Forest - Northern and Central Hardwood and Conifer	521.2	1,287.3
Commercial/Industrial	467.2	1,154.6
Central Appalachian Stream and Riparian	374.5	925.4
Introduced Wetland and Riparian Vegetation	285.1	704.5
Ruderal Upland - Old Field	125.0	308.9
Managed Tree Plantation	97.2	240.2
Quarries/Pits/Stripmines	84.2	208.0
Introduced Shrubland	72.0	177.9
North-Central Appalachian Acidic Swamp	59.9	148.0
Central Appalachian Pine - Oak Rocky Woodland	46.4	114.6
Pond	43.0	106.1
Laurentian - Acadian Freshwater Marsh	14.6	36.0
Laurentian - Acadian Wet Meadow - Shrub Swamp	11.7	28.9
Reservoirs	4.8	11.8
North-Central Interior and Appalachian Acidic Peatland	1.4	3.4
Beaches	0.7	1.6
Total	26,112.5	64,525.3

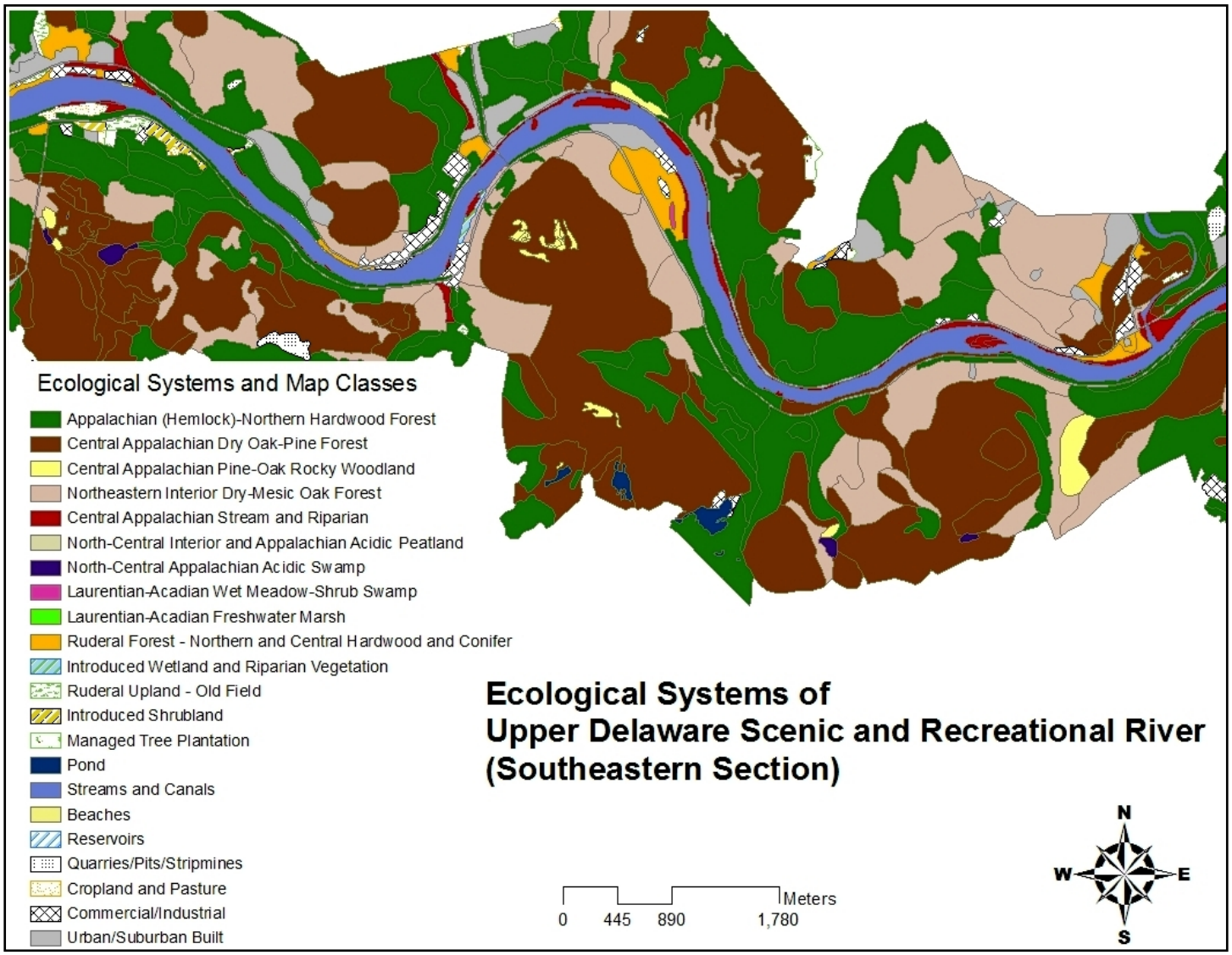

Figure 2. Reference snapshot of a small portion of the ecological systems map for Upper Delaware Scenic and Recreational River. This image displays the southeastern section of the park.

Association Attributions to Ecological Systems

The Upper Delaware Scenic and Recreational River vegetation associations (or map classes, where more than one association was included as a single map class in the association level map) were attributed by their park-specific, local name to ecological systems and semi-natural map classes as follows:

Appalachian (Hemlock) - Northern Hardwood Forest (CES202.593)

- Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)
- Central Appalachian Northern Hardwood Forest (CEGL006045)
- Eastern Hemlock - Beech - Oak Forest (CEGL006088)
- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)
- Semi-rich Northern Hardwood Forest (CEGL006211)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)

Northeastern Interior Dry - Mesic Oak Forest (CES202.592)

- Dry, Rich Oak - Hickory Forest (CEGL006236)
- Northeastern Dry Oak - Hickory Forest (CEGL006336)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)

Central Appalachian Dry Oak - Pine Forest (CES202.591)

- Red Oak - Heath Woodland / Rocky Summit (CEGL006384)
- Lower New England Slope Chestnut Oak Forest (CEGL006282)
- Inland Pitch Pine - Oak Forest (CEGL006290)
- White Pine - Oak Forest (CEGL006293)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)

Central Appalachian Pine - Oak Rocky Woodland (CES202.600)

- Central Appalachian Blueberry Shrubland (CEGL003958)
- Hickory - Eastern Red-cedar Rocky Woodland (CEGL006002)
- Pitch Pine Rocky Summit (CEGL006116)
- Ridgetop Scrub Oak Barrens (CEGL006121)
- Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening (CEGL006544)

Central Appalachian Stream and Riparian (CES202.609)[3]

- Sycamore - Green Ash Floodplain Forest (CEGL006036)
- Silver Maple Floodplain Forest (CEGL002586) - floodplain inclusion
- Bitternut Hickory Lowland Forest (CEGL006445) - floodplain inclusion
- Mixed Forb Marsh (CEGL006446)
- Hairy-fruit Sedge Wetland (CEGL006447)
- Sugar Maple Floodplain Forest (CEGL006459) - floodplain inclusion
- Riverside Prairie Grassland (CEGL006518)
- Birch - Willow Riverbank Shrubland (CEGL003896)
- Willow River-Bar Shrubland (CEGL006065)
- River Birch Low Floodplain Forest (CEGL006184) - floodplain inclusion
- Northern Riverside Rock Outcrop (CEGL006284)
- Northeastern Temperate Cobble Scour Rivershore (CEGL006536)
- Water-willow Rocky Bar and Shore (CEGL004286)

Laurentian - Acadian Freshwater Marsh (201.594)

- Eastern Cattail Marsh (CEGL006153)
- Mixed Forb Marsh (CEGL006446)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

Laurentian - Acadian Wet Meadow - Shrub Swamp (201.582)

- Speckled Alder Swamp (CEGL002381)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

North-Central Appalachian Acidic Swamp (CES202.604)

- Eastern Hemlock - Hardwood Swamp (CEGL006226)
- Red Maple Seepage Swamp (CEGL006406)
- Swamp Forest - Bog Complex (Spruce type) (CEGL006277)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

North-Central Interior and Appalachian Acidic Peatland (202.606)

- Highbush Blueberry Bog Thicket (CEGL006190)

[3] The riparian and floodplain vegetation associations along the Upper Delaware Scenic and Recreational River predominantly occur within the Central Appalachian Stream and Riparian ecological system. There are small sections of the river with broader floodplain development interdigitated with steep riparian sections. These areas are considered Central Appalachian River Floodplain inclusions within the predominant Central Appalachian Stream and Riparian ecological system and are mapped in the Central Appalachian Stream and Riparian ecological system. This was done to maintain a cohesive riparian ecological system along the Upper Delaware Scenic and Recreational River. For a finer-scale view of the riparian and floodplain associations, the map user can view them at the association-level.

Ruderal Forest - Northern and Central Hardwood and Conifer

- Modified Successional Forest (CEGL006599)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)

Managed Tree Plantation

- Mixed Pine Plantation (CEGL006313)

New River Gorge National River

The following ecological systems were identified at New River Gorge National River: Southern Appalachian Oak Forest, Allegheny-Cumberland Dry Oak Forest and Woodland, South-Central Interior Mesophytic Forest, Cumberland Acidic Cliff and Rockhouse, South-Central Interior Small Stream and Riparian, South-Central Interior Large Floodplain, and Cumberland Riverscour. The ecological systems classification report for New River Gorge National River is included as Appendix C. The areas of the ecological systems, semi-natural, and cultural map classes at New River Gorge National River are displayed in Table 4. Figure 3 provides a snapshot of a small portion of the New River Gorge National River ecological systems map for reference.

Table 4. Areas of the ecological systems, semi-natural, and cultural map classes at New River Gorge National River.

Ecological System or Map Class	Hectares	Acres
Southern Appalachian Oak Forest	14,410.0	35,608.0
South-Central Interior Mesophytic Forest	9,837.2	24,308.2
Urban/Suburban Built	1,968.7	4,864.7
Allegheny-Cumberland Dry Oak Forest and Woodland	1,429.7	3,532.9
River	1,244.8	3,076.1
Quarries/Strip Mines/Gravel Pits	774.5	1,913.9
Ruderal Forest - Northern and Central Hardwood and Conifer	414.4	1023.9
Cumberland Riverscour	375.5	927.9
South-Central Interior Large Floodplain	244.8	604.9
Powerline Right-of-Way	203.4	502.7
Managed Tree Plantation	106.2	262.5
Creek	101.1	249.8
South-Central Interior Small Stream and Riparian	85.2	210.6
Ruderal Upland - Old Field	72.2	178.5
Pasture/Hay	19.7	48.8
Pond	18.0	44.5
Cultivated Crops	15.2	37.5
Cumberland Acidic Cliff and Rockhouse	7.3	18.0
Introduced Shrubland	4.5	11.0
Total	31,332.5	77,424.2

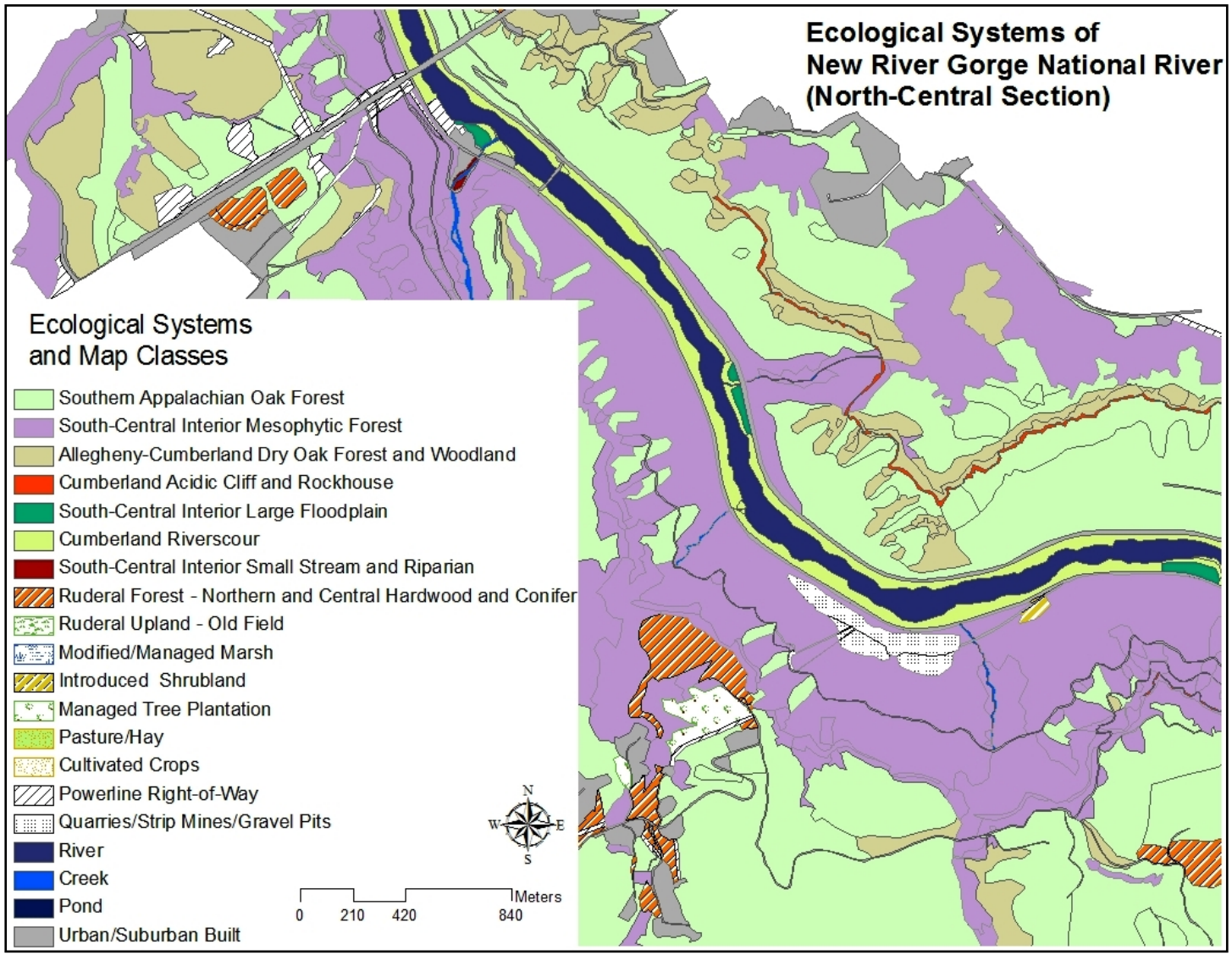

Figure 3. Reference snapshot of a small portion of the ecological systems map for New River Gorge National River. This image displays the north-central section of the park.

Association Attributions to Ecological Systems

The New River Gorge National River vegetation associations (or map classes, where more than one association was included as a single map class in the association level map) were attributed by park-specific map class name to ecological systems and semi-natural map classes as follows:

Cumberland Acidic Cliff and Rockhouse (CES202.309)

- Cliff (Lichen and Sparse Vegetation)

Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)

- Oak / Ericad Forest (CEGL006271)
- Cliff Top Virginia Pine Forest (CEGL007119)
- Cliff Top Pitch Pine Woodland (CEGL006557)

Southern Appalachian Oak Forest (CES202.886)

- Oak - Hickory Forest (CEGL007267)
- Oak - Hickory - Sugar Maple Forest (CEGL007268)
- Chinquapin Oak - Black Maple Forest (CEGL004793)
- Eastern Hemlock - Chestnut Oak / Catawaba Rhododendron Forest (CEGL008524)
- Forest Seep (CEGL007853)
- Successional Tuliptree Forest (CEGL007220/7221)
- Successional Eastern White Pine Forest (CEGL007944)

South-Central Interior Mesophytic Forest (202.887)

- Deciduous Tree / Great Laurel Forest (CEGL007543)
- Eastern Hemlock - Sweet Birch - Tuliptree / Great Laurel Forest (CEGL007543)
- Eastern Hemlock - Chestnut Oak / Catawaba Rhododendron Forest (CEGL008524)
- Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222)
- Yellow Birch Cold Cove Forest (CEGL007861)
- Forest Seep (CEGL007853)
- Successional Tuliptree Forest (CEGL007220/7221)
- Successional Eastern White Pine Forest (CEGL007944)

South-Central Interior Large Floodplain (CES202.705)

- Silver maple Floodplain Forest (CEGL002586)
- Oak - Tuliptree / Mountain Silverbell Floodplain Forest (CEGL006462)
- Successional Box Elder Floodplain Forest (CEGL005033)
- Sycamore - Ash Floodplain Forest (CEGL006458)
- Eastern Red cedar - Virginia Pine Flatrock Woodland (CEGL008449)
- Backwater Slough (CEGL007696, CEGL006483)
- Black Willow Slackwater Woodland (CEGL006463)
- Riverbank Tall Herbs (CEGL006480) and Riverbank Annuals (CEGL006483)

Cumberland Riverscour (CES202.036)

- Black Willow Slackwater Woodland (CEGL006463)
- Sycamore - River birch Riverscour Woodland (CEGL003725)
- American Water-willow Cobble Bar (CEGL004286)
- Riverscour Prairie (CEGL006283)
- Riverbank Tall Herbs (CEGL006480) and Riverbank Annuals (CEGL006483)
- Steep Riparian Edge (includes the above listed associations as one map class)
- Sycamore - Ash Floodplain Forest (CEGL006458) (floodplain inclusion)
- Cobble
- Flatrock Pavement

South-Central Interior Small Stream and Riparian (CES202.706)[4]

- Tributary floodplain forest (no equivalent USNVC association)
- Beaver influenced Wetland (CEGL003912, CEGL006464, CEGL006461, CEGL004510)
- Successional Tuliptree Forest (CEGL007221, CEGL007220)
- Forest Seep (CEGL007853)
- Steep Riparian Edge (on tributaries to the New River)
- Cobble (on tributaries to the New River)

Ruderal Forests

- Successional Tuliptree Forest (CEGL007221, CEGL007220)
- Successional Eastern White Pine Forest (CEGL007944)
- Successional Virginia Pine Forest (CEGL002591)
- Successional Black Locust Woodland (CEGL007279)
- Disturbed areas
- Recently Logged Timberland

[4] At NERI the predominant Ecological System along the steep banks of the New River is the Cumberland Riverscour Ecological System. This system occurs where there are high-energy, steep-gradient, and narrow sections along the New River where there is no floodplain development, the landscape features are linear, and where scour, rapids, and white-water are characteristic. Occasional floodplain inclusions may be present, but are not common. The South-Central Interior Large Floodplain ecological system is mapped where true, broad, flat floodplain forms, often where tributaries feed into the New River, along meander bends, and in areas where the topography is considerably more gradual. The South-Central Interior Small Stream and Riparian ecological system applies only to associations occurring along small streams and tributaries feeding into the New River and headwaters to these streams.

Bluestone National Scenic River

The following Ecological systems were identified at Bluestone National Scenic River: Central Appalachian Dry Oak - Pine Forest, Central Appalachian Dry Oak - Pine Rocky Woodland, Southern Appalachian Oak Forest, Southern and Central Appalachian Cove Forest, South-Central Large Floodplain, and South-Central Small Stream and Riparian. Areas of the ecological systems, semi-natural, and cultural map classes at Bluestone National Scenic River are displayed in Table 5. The Ecological Systems classification report for Bluestone National Scenic River is included as Appendix D. Figure 4 provides a snapshot of a small portion of the Bluestone National Scenic River ecological systems map for reference.

Table 5. Areas of the ecological systems, semi-natural, and cultural map classes at Bluestone National Scenic River.

Ecological System or Map Class	Hectares	Acres
Southern Appalachian Oak Forest	780.9	1,929.7
Central Appalachian Dry Oak - Pine Forest	592.2	1,463.4
Southern and Central Appalachian Cove Forest	327.9	810.2
South-Central Interior Large Floodplain	146.7	362.4
River	69.9	172.8
Central Appalachian Pine - Oak Rocky Woodland	28.1	69.5
Ruderal Upland - Old Field	20.4	50.5
South-Central Interior Small Stream and Riparian	15.3	37.7
Introduced Shrubland	11.8	29.1
Ruderal Forest - Northern and Central Hardwood and Conifer	10.6	26.3
Cultivated Crops	8.8	21.6
Powerline Right-of-Way	8.4	20.8
Urban/Suburban Built	6.2	15.3
Trail	5.5	13.7
Pasture/Hay	2.3	5.7
Creek	2.1	5.1
Total	2,037.1	5,033.8

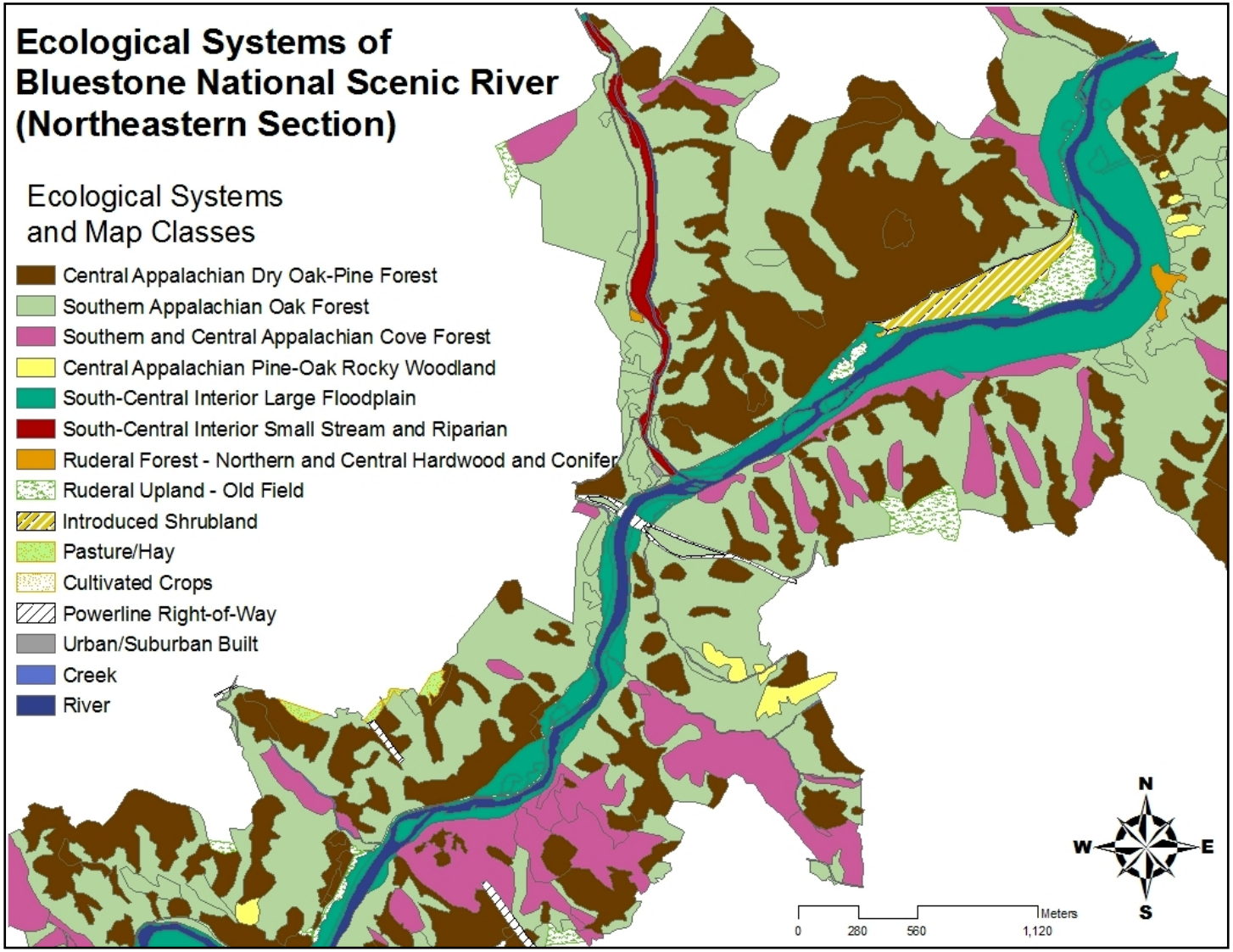

Figure 4. Reference snapshot of a small portion of the ecological systems map for Bluestone National Scenic River. This image displays the northeastern section of the park.

Association Attributions to Ecological Systems

The Bluestone National Scenic River vegetation associations (or map classes, where more than one association was included as a single map class in the association level map) were attributed by park-specific map class name to ecological systems and semi-natural map classes as follows:

Central Appalachian Dry Oak - Pine Forest (CES202.591)

- Oak - Eastern White Pine / Ericad Forest (CEGL008539)
- Eastern Hemlock - Chestnut Oak Forest (CEGL006923)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

Central Appalachian Dry Oak - Pine Rocky Woodland (CES202.600)

- Virginia Pine - Oak Shale Woodland (CEGL008540)

Southern Appalachian Oak Forest (CES202.886)

- Oak - Hickory - Sugar Maple Forest (CEGL007268)
- Calcareous Oak Forest (CEGL004793)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

Southern and Central Appalachian Cove Forest (CES202.373)

- Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222)
- Eastern Hemlock - American Basswood Forest (CEGL008407)
- Eastern Hemlock - Sweet Birch - Tuliptree / Great Laurel Forest (CEGL007543)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

South-Central Interior Floodplain (CES202.705)[5]

- River Birch Backwater Floodplain Forest (CEGL002086)
- Oak - Hickory Floodplain Forest (CEGL006462)
- Riverbank Tall Herbs (CEGL006480)
- Sycamore - Ash Floodplain Forest (CEGL006458)
- Sycamore - Yellow Buckeye Floodplain Forest (CEGL005222)

[5] Bluestone National Scenic River has more floodplain vegetation associations occurring on broad, flat, low-gradient terraces along the river's edge so most associations were attributed to the South-Central Floodplain ecological system. There are some associations more typical of riparian settings included in the attribution to the South-Central Floodplain ecological system to prevent fragmentation of the ecological system along the main river course. Riparian associations occurring along higher-gradient smaller streams with long, narrow, linear polygons were attributed to the South-Central Small Stream and Riparian ecological system.

- Eastern Hemlock Floodplain Forest (CEGL006620)
- Successional Box-elder Floodplain Forest (CEGL005033)
- Successional Black Walnut Floodplain Forest (CEGL007879)
- Sycamore - River Birch Riverscour Woodland (CEGL003725)
- Floodplain Forest and Woodland (lumped map class of all the above)
- Modified successional floodplain forest and woodland

South-Central Interior Small Stream and Riparian (CES202.706)

- Eastern Hemlock Floodplain Forest (CEGL006620)
- Floodplain Forest and Woodland (see comment above regarding component associations)
- Modified successional Floodplain Forest (CEGL006599)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Successional VA Pine Forest (CEGL002591)
- Successional Eastern Red-cedar Woodland (CEGL006024)
- Successional Black Locust Woodland (CEGL007279)

Allegheny Portage Railroad National Historic Site

The following ecological systems were identified at Allegheny Portage Railroad National Historic Site: Appalachian (Hemlock) - Northern Hardwood Forest, Central Appalachian Stream and Riparian, Central Appalachian Dry Oak - Pine Forest, North-Central Appalachian Acidic Cliff and Talus, and South-Central Interior Small Stream and Riparian. The areas of the ecological systems, semi-natural, and cultural map classes at Allegheny Portage Railroad National Historic Site are displayed in Table 6 and the systems are shown in Figure 5. The ecological systems classification report for Allegheny Portage Railroad National Historic Site is included as Appendix E.

Table 6. Areas of the ecological systems, semi-natural, and cultural map classes at Allegheny Portage Railroad National Historic Site.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	522.7	1,291.6
Urban/Suburban Built	80.6	199.2
Ruderal Forest - Northern and Central Hardwood and Conifer	58.8	145.2
Ruderal Upland - Old Field	42.2	104.2
Central Appalachian Stream and Riparian	23.9	59.1
Central Appalachian Dry Oak - Pine Forest	6.1	15.1
River	3.3	8.2
Stream	2.3	5.6
Modified / Managed Marsh	3.0	7.5
Managed Tree Plantation	2.8	7.0
Introduced Wetland and Riparian Vegetation	1.9	4.6
Pond	1.4	3.4
North-Central Appalachian Acidic Cliff and Talus	1.1	2.8
South-Central Interior Small Stream and Riparian	0.4	1.1
Total	750.5	1,854.6

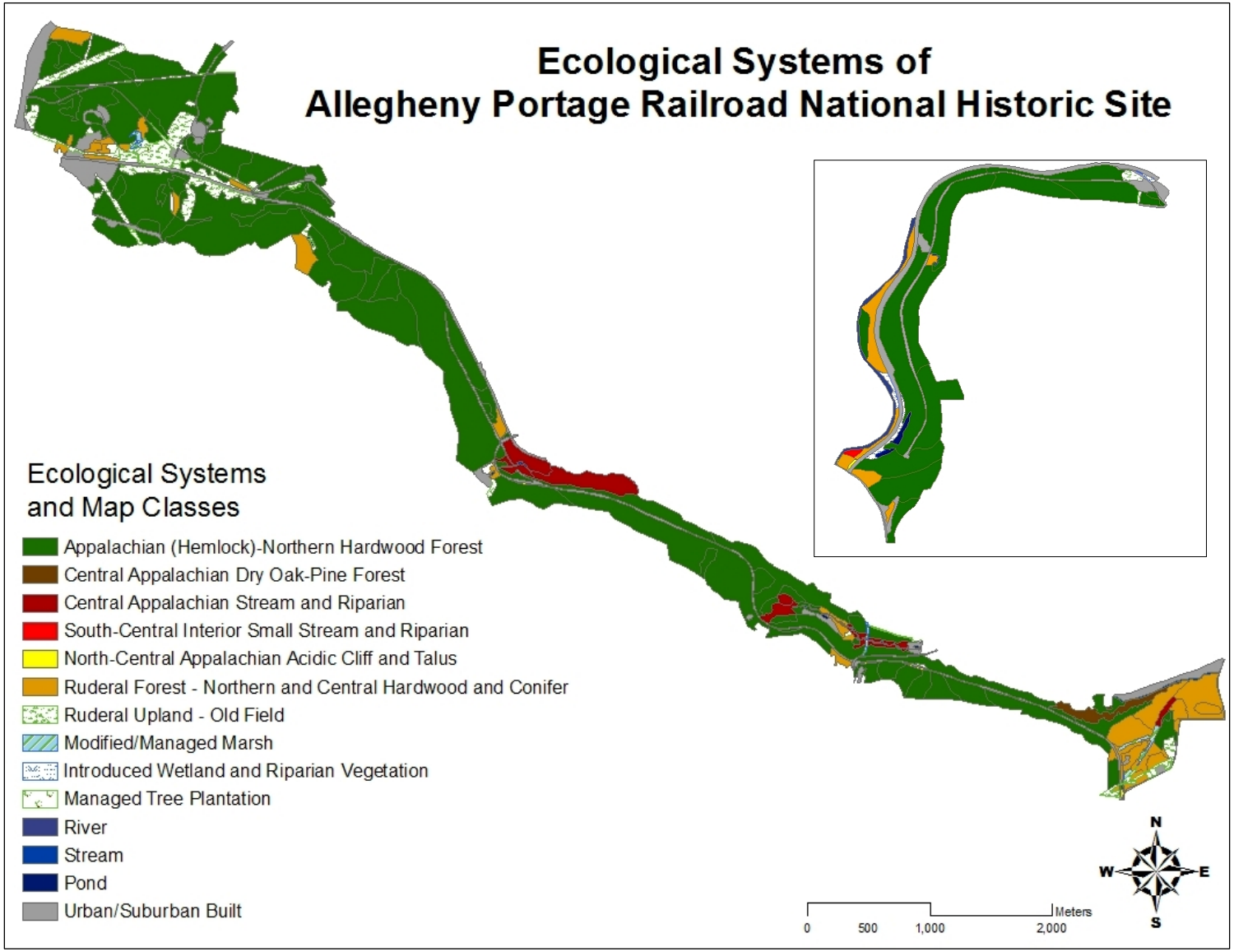

Figure 5. Ecological systems map of Allegheny Portage Railroad National Historic Site.

Association Attributions to Ecological Systems

The Allegheny Portage Railroad National Historic Site vegetation associations were attributed by park-specific, local name to ecological systems and semi-natural map classes as follows:

Appalachian (Hemlock) - Northern Hardwood Forest (202.593)

- Northern Red Oak - Northern Hardwood Forest (CEGL006125)
- Northern Hardwood Forest (CEGL006045)
- Allegheny Hardwood Forest (CEGL006045)
- Tuliptree - Beech - Maple Forest (CEGL006296)
- Dry Eastern Hemlock - Oak Forest (CEGL006293)
- Eastern Hemlock - Northern Hardwood Forest (CEGL006206)
- Allegheny Hardwood Forest / Successional Old Field (CEGL006045/CEGL006107)

Central Appalachian Dry Oak - Pine Forest (202.591)

- Dry Eastern Hemlock - Oak Forest (CEGL006293)

Central Appalachian Stream and Riparian (CES202.609)

- Sugar Maple Floodplain Forest (CEGL006504)
- Alder Riverine Shrubland (CEGL006251)
- Eastern Hemlock - Tuliptree - Birch Forest / Sugar Maple Floodplain Forest (CEGL008407 / CEGL006504)
- Eastern Hemlock - Tuliptree - Birch Forest (CEGL008407)

South-Central Interior Small Stream and Riparian (202.706)[6]

- Alder Riverine Shrubland (CEGL006251)

North-Central Appalachian Acidic Cliff and Talus (CES202.601)

- Sparsely Vegetated Cliff (CEGL006435)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Modified Successional Forest (CEGL006599)

Ruderal Upland - Old Field

- Successional Old Field (CEGL006107)

[6] The Little Conemaugh River in the Staple Bend Tunnel Unit drains to the Ohio River, therefore, the South-Central Interior Small Stream and Riparian is the appropriate ecological system for this portion of the park. The Blair Gap Run in the Main Unit drains east to the Juniata River and then the Susquehanna River and is attributed to the Central Appalachian Stream and Riparian ecological system.

Modified/Managed Marsh

- Wet Meadow (CEGL006571)
- Reed Canarygrass Riverine Grassland (CEGL006044)
- Successional Old Field / Wet Meadow (CEGL006107 / CEGL006571)

Introduced Wetland and Riparian Vegetation

- Japanese or Giant Knotweed Herbaceous Vegetation (CEGL008472)

Managed Tree Plantation

- Conifer Plantation (CEGL006313)
- Conifer Plantation / Successional Old Field (CEGL006313 / CEGL006107)

Fort Necessity National Battlefield

The following ecological systems were identified at Fort Necessity National Battlefield: Appalachian (Hemlock) - Northern Hardwood Forest, Northeastern Interior Dry Mesic Oak Forest, and Laurentian - Acadian Wet Meadow - Shrub Swamp. The areas of the ecological systems, semi-natural, and cultural map classes at Fort Necessity National Battlefield are displayed in Table 7 and the systems are shown in Figure 6. The ecological systems classification report for Fort Necessity National Battlefield is included as Appendix F.

Table 7. Areas of the ecological systems, semi-natural, and cultural map classes at Fort Necessity National Battlefield.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	138.4	342.0
Ruderal Upland - Old Field	68.1	168.2
Ruderal Forest - Northern and Central Hardwood and Conifer	62.4	154.1
Northeastern Interior Dry Mesic Oak Forest	49.9	123.3
Managed Tree Plantation	56.3	139.0
Modified/Managed Marsh	20.3	50.0
Urban/Suburban Built	24.1	59.6
Laurentian - Acadian Wet Meadow - Shrub Swamp	0.3	0.7
Total	419.6	1,036.9

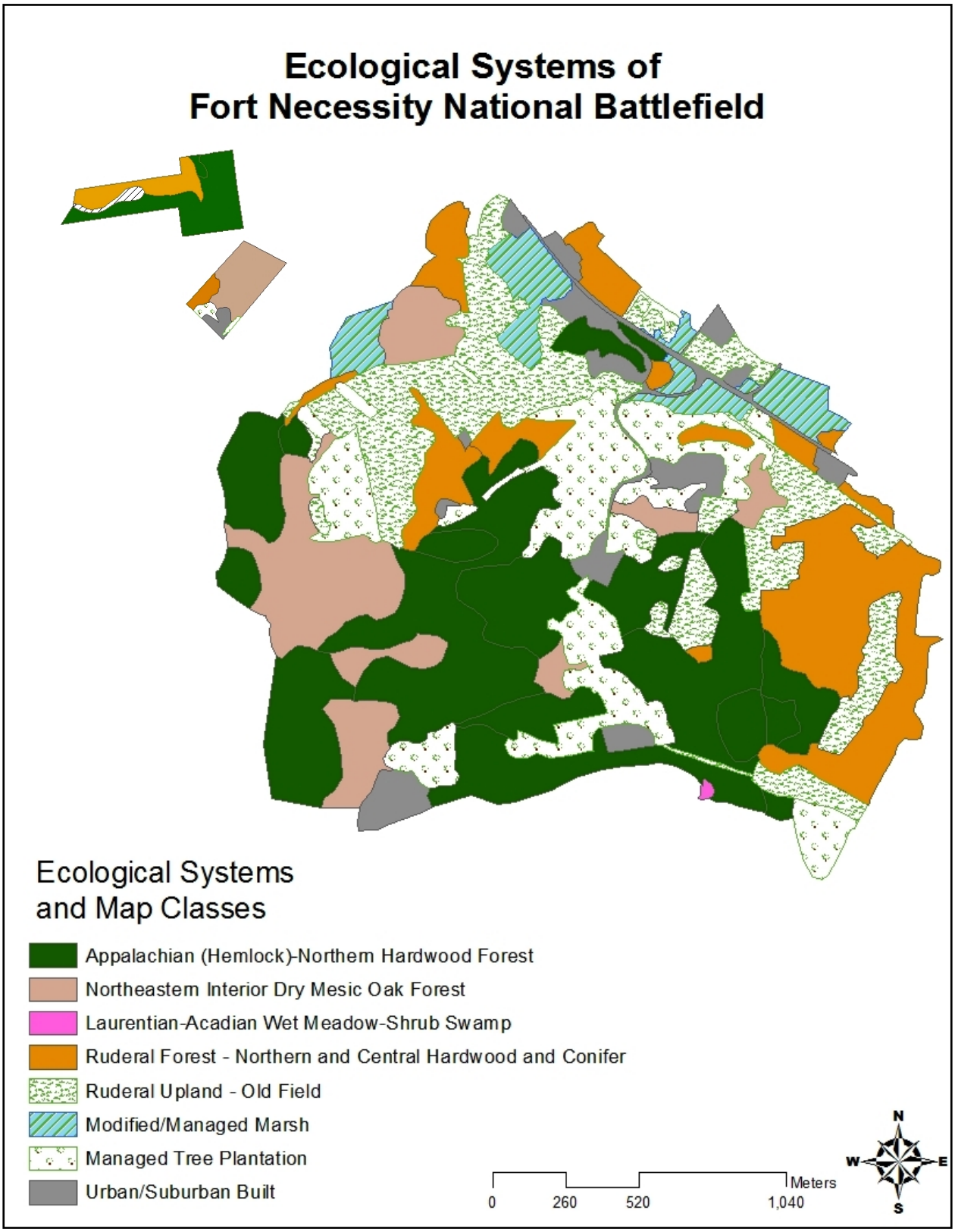

Figure 6. Ecological systems map of Fort Necessity National Battlefield.

Association Attributions to Ecological Systems

The Fort Necessity National Battlefield vegetation associations were attributed by park-specific, local name to ecological systems and semi-natural map classes as follows:

Appalachian (Hemlock) Northern Hardwood Forest (CES202.593)

- Tuliptree Forest (CEGL008510)
- Sugar Maple - Basswood Forest (CEGL006237)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006125)

Northeastern Interior Dry Mesic Oak Forest (CES202.592)

- White Oak - Mixed Hardwood Forest (CEGL006336)

Laurentian - Acadian Wet Meadow - Shrub Swamp (CES201.582)

- Wet Meadow (CEGL006412)

Ruderal Upland - Old Field

- Successional Old Field (CEGL006107)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Red Maple - Black Cherry Successional Forest (CEGL006599)

Managed Tree Plantation

- Conifer Plantation (CEGL006313)

Modified/Managed Marsh

- Wet Meadow (CEGL006412)

Friendship Hill National Historic Site

Ecological systems identified at Friendship Hill National Historic Site include Appalachian (Hemlock) - Northern Hardwood Forest, and South-Central Interior Large Floodplain. The areas of the ecological systems, semi-natural, and cultural map classes at Friendship Hill National Historic Site are displayed in Table 8 and the systems are shown in Figure 7. The ecological systems classification report for Friendship Hill National Historic Site is included as Appendix G.

Table 8. Areas of the ecological systems, semi-natural, and cultural map classes at Friendship Hill National Historic Site.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	130.3	321.9
Ruderal Forest - Northern and Central Hardwood and Conifer	67.3	166.4
Ruderal Upland - Old Field	38.4	94.8
South-Central Interior Large Floodplain	34.2	84.4
Urban/Suburban Built	29.8	73.4
River	9.3	23.1
Modified/Managed Marsh	1.6	4.0
Managed Tree Plantation	0.6	1.4
Pond	0.2	0.6
Total	311.6	770.0

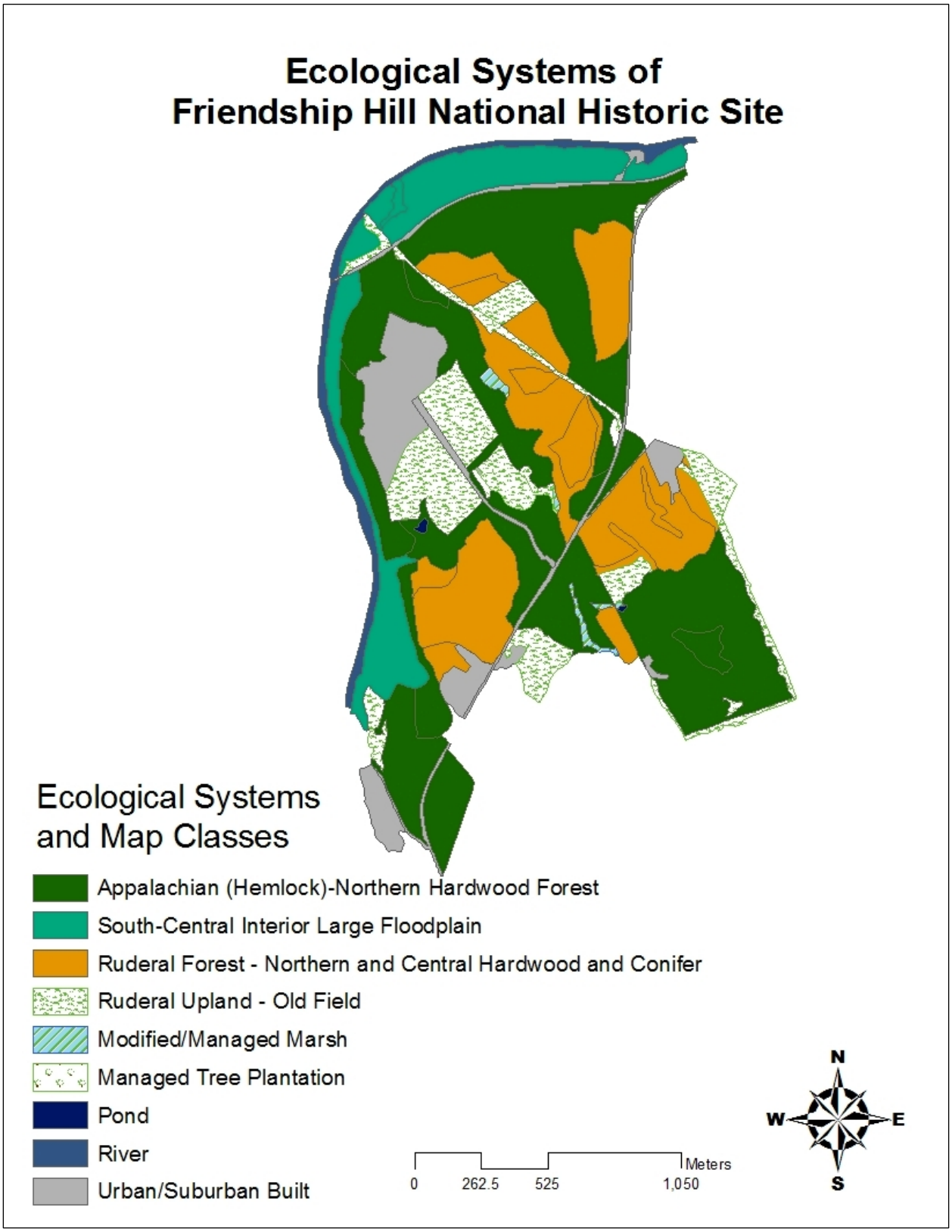

Figure 7. Ecological systems map of Friendship Hill National Historic Site.

Association Attributions to Ecological Systems

The Friendship Hill National Historic Site vegetation associations were attributed by local name to ecological systems and semi-natural map classes as follows:

Appalachian (Hemlock) - Northern Hardwood Forest (CES 202.593)

- Tuliptree - Beech - Maple Forest (CEGL006125)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006296)

South-Central Interior Large Floodplain (CES 202.705)[7]

- Sycamore Floodplain Forest (CEGL004073)
- Mixed Forb Marsh (CEGL004290)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Early Successional Hardwood Forest (CEGL006599)
- Early Successional Hardwood Forest / Successional Old Field (CEGL006599/CEGL006107)

Ruderal Upland - Old Field

- Successional Old Field (CEGL006107)

Modified/Managed Marsh

- Mixed Forb Marsh (CEGL004290)

Managed Tree Plantation

- Conifer Plantation (CEGL006313)

[7] The Monongahela River at FRHI drains to the Ohio River

Johnstown Flood National Memorial

The following ecological systems were identified at Johnstown Flood National Memorial: Appalachian (Hemlock) - Northern Hardwood Forest, South-Central Interior Small Stream and Riparian, Laurentian - Acadian Freshwater Marsh and Laurentian - Acadian Wet Meadow - Shrub Swamp. The areas of the ecological systems, semi-natural, and cultural map classes at Johnstown Flood National Memorial are displayed in Table 9 and the systems are shown in Figure 8. The ecological systems classification report for Johnstown Flood National Memorial is included as Appendix H.

Table 9. Areas of the ecological systems, semi-natural, and cultural map classes at Johnstown Flood National Memorial.

Ecological System or Map Class	Hectares	Acres
Ruderal Upland - Old Field	26.8	66.3
Appalachian (Hemlock) - Northern Hardwood Forest	17.5	43.2
Urban/Suburban Built	28.3	70.0
Modified/Managed Marsh	13.6	33.5
Ruderal Forest - Northern and Central Hardwood and Conifer	12.2	30.1
Pasture/Hay	3.6	8.9
River	2.0	4.8
Laurentian - Acadian Wet Meadow - Shrub Swamp	1.2	3.0
Managed Tree Plantation	1.1	2.6
Laurentian - Acadian Freshwater Marsh	0.8	1.9
South-Central Interior Small Stream and Riparian	0.8	2.0
Total	107.8	266.3

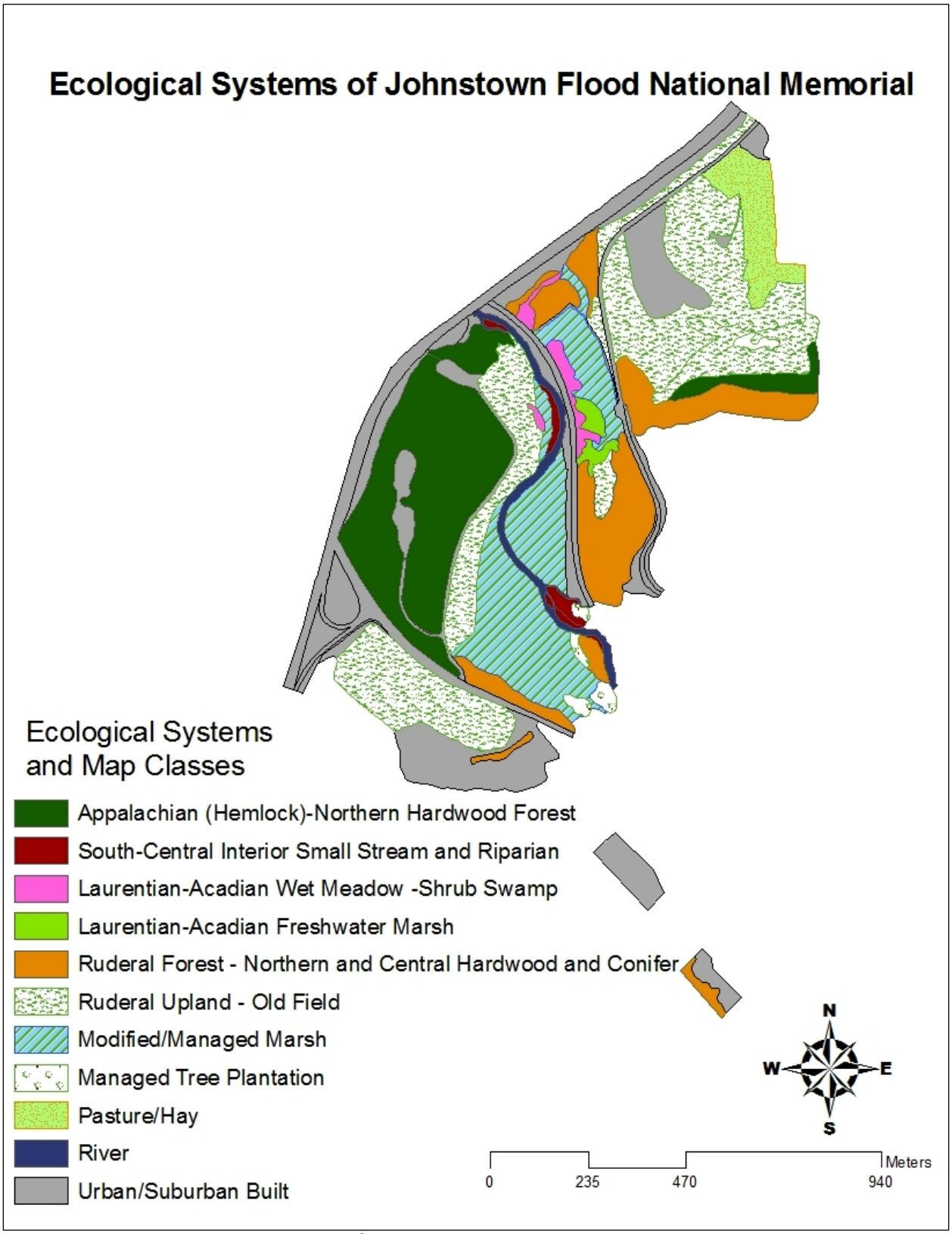

Figure 8. Ecological systems map of Johnstown Flood National Memorial.

Association Attributions to Ecological Systems

The Johnstown Flood National Memorial vegetation associations were attributed by Local Name to ecological systems and semi-natural map classes as follows:

Appalachian (Hemlock) - Northern Hardwood Forest (CES202.593)

- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- Sugar Maple - Yellow Birch - Black Cherry Forest (CEGL006045)

South-Central Interior Small Stream and Riparian (CES202.706)[8]

- Riverine Scour Vegetation (CEGL006554)

Laurentian - Acadian Freshwater Marsh (CES201.594)

- Cattail Marsh (CEGL006153)

Laurentian - Acadian Wet Meadow - Shrub Swamp (CES201.582)

- Silky Willow Shrub Swamp (CEGL006305)

Ruderal Forest - Northern and Central Hardwood and Conifer

- Red Maple - Black Cherry Successional Forest / Woodland (CEGL006599)

Ruderal Old Field & Modified/Managed Marsh

- Old Field (CEGL006017 and CEGL006571)

Managed Tree Plantation

- Conifer Plantation (CEGL006313)

[8] The Conemaugh River at JOFL drains to the Ohio River.

Discussion

This project provides ecological systems classifications and spatial ecological systems data for eight parks in the Eastern Rivers and Mountains Network of the National Park Service. Association-level vegetation maps were updated with ecological system attributions and reviewed by Natural Heritage Program, National Park Service, and NatureServe ecologists. This effort provided ecological systems classifications and quantified areas of ecological systems, semi-natural, and cultural map classes for the parks. The work also helped to refine and improve the ecological systems classification in terms of ecological system concepts, geographic ranges, and association assignments to systems.

The ecological systems maps and association-level vegetation maps complement each other and together provide baseline spatial ecological data for monitoring and comparing changes in vegetation over time. The ecological systems map offers a more cohesive management or monitoring unit than the association-level vegetation maps alone because the ecological systems concept provides ecological context to associations and groups associations that occur together under similar or related environmental conditions. For example, when monitoring *Adelges tsugae* (hemlock wooly adelgid) induced *Tsuga canadensis* (eastern hemlock) mortality in many of the parks, the ecological systems maps can be used to identify systems such as Appalachian (Hemlock) - Northern Hardwood Forest and Southern and Central Appalachian Cove Forest where groups of hemlock associations occur together in one ecological system. Association-level data can still be viewed in these shapefiles for finer scale management and monitoring such as establishing monitoring plots within specific hemlock-dominated or co-dominated associations at the park.

These ecological systems maps can inform resource management in the park in a number of ways. Uncommon, rare, and vulnerable ecological systems can easily be identified through spatial analysis. For example, at DEWA, the North-Central Appalachian Seepage Fen ecological system includes two similar associations that can be monitiored as one system. Likewise, monitoring could be more focused on the dominant associations of an ecological system, with relatively less effort needed on other associations of the system. The ecological systems maps will be useful in managing specific habitats in the parks. For example, when implementing a cliff top management plan to protect falcon habitat from pedestrian traffic at NERI, resource managers can use the ecological systems maps to identify where the cliff habitat occurs and how many acreas they have in the park through review of the Cumberland Cliff and Rockhouse ecological system. This practial application can also be used for the cliff ecological systems at DEWA, NERI, and ALPO. The ecological systems maps can also be used to help evaluate the ecological integrity of the cliff systems by identifing the surrounding ecological systems and land uses.

Ecological systems maps also contribute to the understanding of actual and potential vegetation cover to facilitate ecological restoration processes. These maps give context for the altered vegetation and provide more ecological information when determining target associations and desired future conditions for restoration efforts. For example, when looking to eradicate invasive vegetation associations and/or plant species from the floodplains, target associations and environmental conditions can be identified from the floodplain, riparian, or riverscour ecological

systems that occur within the park. Or, when identifying what forest type to restore a Northeastern Modified Successional Forest to at JOFL, FRHI, FONE, or ALPO, choices can be made using the ecological systems map for guidance. If the undesired forest stand is surrounded by the Appalachian (Hemlock) - Northern Hardwood Forest ecological system, then the resource manager could potentially select a naturally occurring forest association(s) in the Appalachian (Hemlock) - Northern Hardwood Forest already identified in the park as an option for the target association and desired conditions.

Conclusions

The addition of an ecological systems layer to the US National Vegetation Classification association-level vegetation maps for the Eastern Rivers and Mountains Network parks provides broad-scale vegetation classification and map units that provide ecological context to the association-level vegetation maps. As broader map classes that group similar associations, ecological systems maps can be an efficient and effective tool for developing and implementing natural resource monitoring and management strategies for the selected national parks. This project helped to improve the International Terrestrial Ecological Systems Classification through peer-based review of ecological system concepts and geographical ranges of the ecological systems. It also provided a useful methodology for the practical application of developing ecological systems maps from association-level vegetation maps. This will be informative and useful in future ecological systems mapping efforts and conservation planning throughout the United States.

Recommendations for Future Projects

These ecological systems maps provide a framework for the development of broad-scale conservation management strategies in all of the parks. They offer a means to efficiently assess and monitor ecological integrity. They provide baseline data on vegetation composition, structure, and extent within the park. This can help guide restoration planning for altered or semi-natural communities by providing an ecological context for desired conditions. The maps also provide a framework and appropriate scale for describing and modeling habitats of many vertebrate animals and vascular plants. Projects such as these will be greatly improved by the use of the ERMN ecological systems maps.

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Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Vol. I and II. The Nature Conservancy. Arlington, VA.

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Appendix A. Ecological Systems Classification for Delaware Water Gap.

Page

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Delaware Water Gap National Recreation Area

13 February 2009

by

NatureServe

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

11 Avenue de Lafayette, 5th Floor
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This subset of the International Ecological Classification Standard covers ecological systems attributed to Delaware Water Gap National Recreation Area. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (*IVC hierarchy*) *and association data:*

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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These data are extracted from:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

This document may be generally cited as follows:

NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Delaware Water Gap National Recreation Area. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at Delaware Water Gap: Central Appalachian Dry Oak - Pine Forest, Central Appalachian Dry Oak - Pine Rocky Woodland, Appalachian (Hemlock) - Northern Hardwood Forest, Central Appalachian River Floodplain, Laurentian - Acadian Freshwater Marsh, Laurentian - Acadian Wet Meadow - Shrub Swamp, North-Central Appalachian Acidic Cliff and Talus, North-Central Appalachian Acidic Swamp, North-Central Appalachian Circumneutral Cliff and Talus, North-Central Appalachian Seepage Fen, North-Central Interior and Appalachian Acidic Peatland, and Northeastern Interior Dry - Mesic Oak Forest. The areas of the ecological systems, semi-natural, and cultural map classes at Delaware Water Gap are displayed in Table 1.

Table A1. Areas of the ecological systems, semi-natural, and cultural map classes at Delaware Water Gap.

Ecological System or Map Class	Hectares	Acres
Central Appalachian Dry Oak - Pine Forest	7,274.4	1,7975.5
Appalachian (Hemlock) - Northern Hardwood Forest	6,722.8	1,6612.4
Northeastern Interior Dry - Mesic Oak Forest	3,318.3	8,199.7
Ruderal Forest - Northern and Central Hardwood and Conifer	3,015.8	7,452.4
Ruderal Upland - Old Field	1,463.0	3,615.1
Cultivated Crops	1,268.5	3,134.6
River	1,178.7	2,912.7
Central Appalachian River Floodplain	982.8	2,428.5
North-Central Appalachian Acidic Cliff and Talus	670.2	1,656.2
Managed Tree Plantation	472.0	1,166.2
Developed - Medium & High Intensity	369.5	913.2
Central Appalachian Pine - Oak Rocky Woodland	367.7	908.7
Pond	269.4	665.8
North-Central Appalachian Acidic Swamp	201.9	498.9
Transportation Corridor	128.9	318.5
Laurentian - Acadian Wet Meadow - Shrub Swamp	64.1	158.3
Modified/Managed Marsh	56.8	140.3
Introduced Wetland and Riparian Vegetation	34.9	86.3
North-Central Interior and Appalachian Acidic Peatland	21.4	52.9
Laurentian - Acadian Freshwater Marsh	20.2	50.0
North-Central Appalachian Circumneutral Cliff and Talus	17.1	42.2
Quarries/Pits/Stripmines	12.2	30.1
Central Appalachian Stream and Riparian	10.0	24.6
North-Central Appalachian Seepage Fen	3.7	9.2
Total	27,944.5	69,052.3

CES201.594 LAURENTIAN - ACADIAN FRESHWATER MARSH

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Graminoid; Shallow (<15 cm) Water; >180-day hydroperiod
Concept Summary: These freshwater emergent and/or submergent marshes are dominated by herbaceous vegetation. They are common throughout the northeastern United States and adjacent Canadian provinces. Freshwater marshes occur in closed or open basins that are generally flat and shallow. They are associated with lakes, ponds, slow-moving streams, and/or impoundments or ditches. The herbaceous vegetation does not persist through the winter. Scattered shrubs are often present and usually total less than 25% cover. Trees are generally absent and, if present, are scattered. The substrate is typically muck over mineral soil. Examples of vegetation in the Delaware Estuary freshwater marsh communities include *Typha latifolia, Typha angustifolia, Phragmites australis, Schoenoplectus americanus, Thelypteris palustris, Impatiens capensis, Carex* spp., *Vallisneria americana, Potamogeton perfoliatus, Nuphar lutea* ssp. *advena*, and *Nymphaea odorata*.
DEWA Associations:
- Mixed Forb Marsh (CEGL006446)
- Cattail Marsh (CEGL006153)

DISTRIBUTION

Range: This system occurs in New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania, New Jersey, and Ohio; mostly north of the glacial boundary.
Divisions: 201:C, 202:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NJ, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC

CONCEPT

Associations:
- *Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation (CEGL006446, GNR)
- *Elodea canadensis - Potamogeton* spp. Eastern Herbaceous Vegetation [Placeholder] (CEGL006431, GNR)
- *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
- *Eriocaulon aquaticum - Lobelia dortmanna* Herbaceous Vegetation (CEGL006346, GNR)
- *Juncus militaris - Eriocaulon aquaticum* Herbaceous Vegetation (CEGL006345, GNR)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Nymphaea odorata - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002562, G5)

- *Nymphaea tetragona - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002563, G4G5)
- *Pontederia cordata - Peltandra virginica - Sagittaria latifolia* Herbaceous Vegetation (CEGL006191, G5)
- *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282, G5)
- *Schoenoplectus* (*tabernaemontani, acutus*) Eastern Herbaceous Vegetation (CEGL006275, GNR)
- *Schoenoplectus acutus* - (*Schoenoplectus fluviatilis*) Freshwater Herbaceous Vegetation (CEGL002225, G4G5)
- *Schoenoplectus acutus - Carex lasiocarpa* Herbaceous Vegetation (CEGL006358, G1G2)
- *Schoenoplectus fluviatilis - Schoenoplectus* spp. Herbaceous Vegetation (CEGL002221, G3G4)
- *Schoenoplectus fluviatilis* Herbaceous Vegetation (CEGL006366, GNR)
- *Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026, G4G5)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
- *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153, G5)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229, G4?)
- *Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation (CEGL006196, G5)
- *Zizania* (*aquatica, palustris*) Herbaceous Vegetation (CEGL002382, G3G4)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.

Version: 22 Dec 2005 **Stakeholders:** Canada, East, Midwest

Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES201.582 LAURENTIAN - ACADIAN WET MEADOW - SHRUB SWAMP

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Broad-Leaved Shrub; Graminoid; Shallow (<15 cm) Water
Concept Summary: This system encompasses shrub swamps and wet meadows on mineral soils of the Northeast and upper Midwest. They are often associated with lakes and ponds, but are also found along streams, where the water level does not fluctuate greatly. They are commonly flooded for part of the growing season but often do not have standing water throughout the season. The size of occurrences ranges from small pockets to extensive acreages. The system can have a patchwork of shrub and graminoid dominance; typical species include *Salix* spp., *Cornus amomum, Alnus incana, Spiraea alba, Calamagrostis canadensis*, tall *Carex* spp., and *Juncus effusus*. Trees are generally absent and, if present, are scattered.
DEWA Associations:
- Alder Wetland (CEGL005082)
- Highbush Blueberry - Steeplebush Wetland (CEGL006371)
- Buttonbush Wetland (CEGL006069)
- Tussock Sedge Marsh (CEGL006412)
- Wet Meadow (CEGL006571)

DISTRIBUTION

Range: New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania and Ohio; mostly north of the glacial boundary.
Divisions: 201:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 222K:CC, 222M:CC, 222R:CC, 222Ue:CCC

CONCEPT

Associations:
- *Alnus incana* Swamp Shrubland (CEGL002381, G5)
- *Alnus serrulata* Swamp Shrubland (CEGL005082, G4G5)
- *Calamagrostis canadensis* - *Phalaris arundinacea* Herbaceous Vegetation (CEGL005174, G4G5)
- *Calamagrostis canadensis* - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519, GNR)
- *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257, G4G5)
- *Carex lacustris* Herbaceous Vegetation (CEGL002256, G4G5)
- *Carex stricta* - *Carex* spp. Herbaceous Vegetation (CEGL002258, G4?)

- *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412, G4G5)
- *Carex tetanica - Carex prairea - Eleocharis erythropoda - Lysimachia quadriflora* Herbaceous Vegetation (CEGL006170, G1Q)
- *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190, G4)
- *Cornus sericea - Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186, G5)
- *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland (CEGL006512, GNR)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
- *Typha latifolia - Caltha palustris* Herbaceous Vegetation (CEGL006245, G1)

High-ranked species: *Calephelis muticum* (G3), *Clonophis kirtlandii* (G2), *Platanthera leucophaea* (G2G3), *Polemonium vanbruntiae* (G3G4), *Scirpus ancistrochaetus* (G3)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.

Version: 11 Apr 2007 **Stakeholders:** Canada, East, Midwest

Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina,* and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
DEWA Associations:
- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- Sugar Maple - American Beech - Sweet Birch Forest (CEGL006252)
- Eastern White Pine Forest (CEGL006328)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006125)
- Tuliptree - Beech - Maple Forest (CEGL006296)
- Eastern White Pine Successional Forest (CEGL007944)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C,

67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C

USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)

- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)
- *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest

matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn, pers. comm., 2008) believes that it is present in that state, but investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler, pers. comm., 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.
Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.591 CENTRAL APPALACHIAN DRY OAK - PINE FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2369; ESLF 4312; ESP 1369
Concept Summary: These oak and oak-pine forests cover large areas in the low- to mid-elevation Central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits. Soils are typically coarse and infertile; they may be deep (on glacial deposits in the northern and terrace deposits in the southern parts of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. The forest is mostly closed-canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus, Pinus virginiana,* and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory and often form a dense layer. Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida,* and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic. Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum*.
Comments: This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry - Mesic Oak Forest (CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak - Heath Forest (CES202.023). Its analog from central Virginia south is Southern Piedmont Dry Oak - (Pine) Forest (CES202.339), which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda*.
DEWA Associations:
- Dry Eastern White Pine - Oak Forest (CEGL006293)
- Dry Eastern Hemlock - Oak Forest (CEGL006923)
- Dry Oak - Heath Forest (CEGL006282)
- Eastern White Pine Successional Forest (CEGL007944)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

DISTRIBUTION

Range: This system is found from central New England through Pennsylvania and south to the Roanoke River in southern Virginia. It is primarily Appalachian but overlaps slightly into the upper Piedmont and fall zone in Virginia, Maryland and the District of Columbia.
Divisions: 202:C
TNC Ecoregions: 52:C, 58:C, 59:C, 60:C, 61:C
Subnations: CT, DC, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV
Map Zones: 57:P, 60:C, 61:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 65:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 211I:CC, 221A:CC, 221B:CC, 221D:CC, 232A:CC, M221A:CC, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Bf:CCC, M221Da:CCC

CONCEPT

Associations:

- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162, GNR)
- *Castanea dentata - Quercus prinus* Forest (CEGL007196, GH)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Fagus grandifolia - Quercus* (*alba, velutina, prinus*) */ Kalmia latifolia* Forest (CEGL006919, G4)
- *Pinus rigida - Quercus* (*velutina, prinus*) Forest (CEGL006290, GNR)
- *Pinus strobus - Pinus resinosa - Pinus rigida* Forest (CEGL006259, G4G5)
- *Pinus strobus - Quercus* (*rubra, velutina*) *- Fagus grandifolia* Forest (CEGL006293, G5)
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539, G4)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) *- Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus* (*velutina, alba*) */ Vaccinium pallidum* High Allegheny Plateau, Western Allegheny Plateau Forest (CEGL006018, GNR)
- *Quercus alba - Quercus* (*coccinea, velutina, prinus*) */ Gaylussacia baccata* Forest (CEGL008521, G5)
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515, G4)
- *Quercus prinus* - (*Quercus coccinea, Quercus rubra*) */ Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299, G5)
- *Quercus prinus - Quercus* (*rubra, velutina*) */ Vaccinium angustifolium* Forest (CEGL006282, G5)
- *Quercus prinus - Quercus rubra / Vaccinium pallidum* - (*Rhododendron periclymenoides*) Forest (CEGL008523, G3G4)
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524, G3?)
- *Tsuga canadensis - Quercus prinus - Betula lenta* Forest (CEGL006923, G3)

Environment: These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. The soils are coarse and infertile; they may be deep (on glacial deposits in the northern part of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits.
Vegetation: Stands of this forest system are mostly closed-canopied but can include more open woodlands. They are dominated by a variable mixture of dry-site oak and pine species, including *Quercus prinus, Pinus virginiana,* and *Pinus strobus*. The system may include areas of pine forest and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic.
Dynamics: Disturbance agents include fire, windthrow, and ice damage.

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch (at outer range) to matrix (in center of range) system that may cover extensive hillslopes and low ridges.
Other Comments: In the Blue Ridge (EPA Level III Ecoregion 66), this extends south to the Roanoke River in central Virginia, where it is replaced by Southern Appalachian Oak Forest (CES202.886). In the northern Piedmont (EPA Level III Ecoregion 64), this extends south to Richmond, Virginia, where southward (i.e., in EPA Level III ecoregion 45) it is replaced by Southern Piedmont Dry Oak - (Pine) Forest (CES202.339). This corresponds closely to the line between USFS Sections 231I and 221D, with CES202.591 occurring in 221D and CES202.339 in 231I (SCG 7-07).

SOURCES

References: Comer et al. 2003
Version: 05 Feb 2009 **Stakeholders:** East, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

CES202.600 CENTRAL APPALACHIAN PINE - OAK ROCKY WOODLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Shrubland (Shrub-dominated); Woody-Herbaceous; Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2377; ESLF 4320; ESP 1377
Concept Summary: This system encompasses open or sparsely wooded hilltops and outcrops or rocky slopes in the Central Appalachians, High Allegheny Plateau, and Lower New England / Northern Piedmont. It occurs mostly at lower elevations, but occasionally up to 1220 m (4000 feet) in West Virginia. The substrate rock is granitic or of other acidic lithology, including traprock in New England. The vegetation is patchy, with woodland as well as open portions. *Pinus rigida* and (within its range *Pinus virginiana* are diagnostic and often are mixed with xerophytic *Quercus* spp. and sprouts of *Castanea dentata*. Some areas have a fairly well-developed heath shrub layer, others a graminoid layer. Conditions are dry and nutrient-poor, and at many, if not most, sites, a history of fire is evident. In the Central Appalachians ecoregion, this system is sometimes found on sandy soils rather than rock.
Comments: The northern extent of this system in central New England may overlap with Northern Appalachian - Acadian Rocky Heath Outcrop (CES201.571), which has *Picea* spp. prominent. The southern extent overlaps with Southern Appalachian Montane Pine Forest and Woodland (CES202.331), which is characterized by *Pinus pungens*. This type is differentiated from the similar Central Appalachian Dry Oak - Pine Forest (CES202.591) by its mosaic nature of wooded and open patches, as opposed to being merely a "thin forest."
DEWA Associations:
· Hickory - Eastern Red-cedar Rocky Woodland (CEGL006002)
· Successional Bear Oak - Heath Shrubland (CEGL003958)
· Bear Oak - Wavy Hairgrass Shrubland (CEGL006121)
· Wavy Hairgrass - Common Sheep Sorrell Rock Outcrop (CEGL006544)
· Pitch Pine - Mixed Hardwood Rocky Summit (CEGL006116)
· Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

DISTRIBUTION

Range: This system occurs from central New England south to Virginia and West Virginia, with peripheral occurrences in southeastern Ohio and easternmost Kentucky.
Divisions: 202:C
TNC Ecoregions: 49:C, 50:C, 52:C, 59:C, 60:C, 61:C, 64:C
Subnations: CT, KY, MA, MD?, ME, NH, NJ, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 57:P, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 58:C, 58a:C, 58b:C, 58c:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 60:C, 60a:C, 60b:C, 61:C, 61c:C, 62:C, 62a:C, 62b:C, 62c:C, 62d:C, 62e:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 69d:C, 69e:C, 70:C, 70a:C, 70b:C, 70c:C

USFS Ecomap Regions: 211E:CC, 211F:CC, 221A:CC, 221B:CC, M211Bb:CCC, M211Bd:CCC, M211C:CC, M221A:CC, M221B:CP

CONCEPT

Associations:

- *Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland (CEGL006002, G2G3)
- *Kalmia latifolia - Gaylussacia baccata - Vaccinium* (*angustifolium, pallidum*) - *Menziesia pilosa* Shrubland (CEGL003939, G2)
- *Penstemon hirsutus* Sparse Vegetation (CEGL006535, GNR)
- *Photinia melanocarpa - Gaylussacia baccata / Carex pensylvanica* Shrubland (CEGL008508, G1?)
- *Pinus resinosa - Quercus rubra / Sibbaldiopsis tridentata / Danthonia compressa - Antennaria virginica / Rhytidium rugosum* Woodland (CEGL003766, G1)
- *Pinus resinosa / Menziesia pilosa / Polypodium appalachianum* Forest (CEGL006108, G1)
- *Pinus rigida - Gaylussacia baccata* Shrubland (CEGL006079, G1)
- *Pinus rigida - Quercus coccinea / Vaccinium angustifolium* Woodland (CEGL006557, GNR)
- *Pinus rigida /* (*Quercus ilicifolia*) */ Photinia melanocarpa / Deschampsia flexuosa* Woodland (CEGL006116, GNR)
- *Pinus rigida / Corema conradii* Woodland (CEGL006154, G2)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus ilicifolia - Prunus pumila* Shrubland (CEGL006121, GNR)
- *Quercus prinus - Pinus virginiana -* (*Pinus pungens*) */ Schizachyrium scoparium - Dichanthelium depauperatum* Woodland (CEGL008540, G3?)
- *Quercus prinus / Quercus ilicifolia / Danthonia spicata* Woodland [Provisional] (CEGL008526, G3?)
- *Quercus rubra* - (*Quercus prinus*) */ Vaccinium* spp. / *Deschampsia flexuosa* Woodland (CEGL006134, G3G5)
- *Quercus rubra - Quercus prinus - Pinus strobus / Penstemon hirsutus* Woodland (CEGL006074, G3G5)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica / Cladonia* spp. Herbaceous Vegetation (CEGL006544, GNR)
- *Vaccinium* (*angustifolium, myrtilloides, pallidum*) Central Appalachian Dwarf-shrubland (CEGL003958, G4G5)
- *Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland (CEGL005094, GNR)

High-ranked species: *Arabis serotina* (G2), *Canis rufus* (G1Q), *Catocala herodias gerhardi* (G3T3), *Gaylussacia brachycera* (G3), *Malaxis bayardii* (G1G2), *Packera millefolia* (G2), *Pyrgus wyandot* (G1G2Q), *Taenidia montana* (G3), *Vaccinium hirsutum* (G3), *Virginia valeriae pulchra* (G5T3T4)

SOURCES

References: Comer et al. 2003, Fleming et al. 2005

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.592 NORTHEASTERN INTERIOR DRY - MESIC OAK FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Forest and Woodland (Treed); Acidic Soil; *Quercus* - *Carya*
National Mapping Codes: EVT 2303; ESLF 4109; ESP 1303
Concept Summary: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. Soils are mostly acidic and relatively infertile but not strongly xeric. Local areas of calcareous bedrock, or colluvial pockets, may support forests typical of richer soils. Oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba, Quercus velutina*, and *Quercus coccinea*) and *Carya* spp. are dominant in mature stands. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum, Betula lenta*, and *Betula alleghaniensis* may be common associates; *Acer saccharum* is occasional. With a long history of human habitation, many of the forests are early- to mid-successional, where *Pinus strobus, Pinus virginiana*, or *Liriodendron tulipifera* may be dominant or codominant. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands, including non-forested seeps or forested wetlands with *Acer rubrum, Quercus bicolor*, or *Nyssa sylvatica* characteristic.
Comments: The oak-dominated forest matrix in this region spans a range of elevational and moisture regimes, reflected in different ecological systems. Those in drier settings, within the general range of this system, are placed in either Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359) or Central Appalachian Dry Oak - Pine Forest (CES202.591).
DEWA Associations:

- Dry Oak - Mixed Hardwood Forest (CEGL006336)
- Dry Hickory Ridgetop Forest (CEGL006301)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Eastern White Pine Successional Forest (CEGL007944)
- Eastern White Pine - Successional Hardwood Forest (CEGL006454)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)

DISTRIBUTION

Range: This system is found from southern New York west through Ohio and Pennsylvania and south to Virginia. It does not extend to the southernmost part of Virginia, except in the Ridge and Valley.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: MD, NJ, NY, OH, PA, VA, WV
Map Zones: 57:C, 60:C, 61:C, 62:C, 63:C, 64:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C

USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 221A:CC, 221B:CC, 221D:CC, 221F:CC, M221A:CC, M221B:CC, M221Da:CCC

CONCEPT

Associations:

- *Carya* (*glabra, ovata*) - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236, GNR)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus* (*rubra, alba*) */ Polystichum acrostichoides* Forest (CEGL006304, G4?)
- *Pinus strobus - Quercus* (*rubra, velutina*) - *Fagus grandifolia* Forest (CEGL006293, G5)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus alba - Quercus rubra - Carya* (*alba, ovata*) */ Cornus florida* Acidic Forest (CEGL002067, G3)
- *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475, G4G5)
- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068, G4?)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059, GNR)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus muehlenbergii - Quercus* (*alba, rubra*) - *Carya cordiformis / Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus - Quercus rubra - Carya ovalis / Solidago* (*ulmifolia, arguta*) - *Galium latifolium* Forest (CEGL008516, G3G4)
- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057, G5)
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522, G4?)
- *Quercus rubra - Acer saccharum / Ostrya virginiana / Cardamine concatenata* Forest (CEGL008517, G4)
- *Quercus rubra - Carya* (*glabra, ovata*) */ Ostrya virginiana / Carex lucorum* Forest (CEGL006301, G4?)
- *Quercus rubra - Quercus alba - Fraxinus americana - Carya* (*ovata, ovalis*) */ Actaea racemosa* Forest (CEGL008518, G3)
- *Quercus rubra - Quercus prinus - Carya ovalis /* (*Cercis canadensis*) */ Solidago caesia* Forest (CEGL008514, G3G4)

High-ranked species: *Callophrys irus* (G3), *Canis rufus* (G1Q), *Carex communis* var. *amplisquama* (G5T3), *Carex polymorpha* (G3), *Coreopsis delphiniifolia* (G3?Q), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Virginia valeriae pulchra* (G5T3T4)

Environment: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally

steep. The typical landscape position is midslope to toeslope, transitioning to more xeric systems on the upper slopes and ridges. Soils are acidic and relatively infertile but not strongly xeric.
Vegetation: Mature stands are dominated by oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba*, *Quercus velutina*, and *Quercus coccinea*), along with various *Carya* spp. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum* and *Betula lenta* are frequently common associates. Local areas of calcareous bedrock may support forests typical of richer soils (e.g., with *Acer saccharum* and/or *Quercus muehlenbergii*).

SPATIAL CHARACTERISTICS

Spatial Summary: These were historically among the most important matrix forests of the Northeast. They cover extensive areas where conditions are not extreme. Upslope they may grade into more xeric oak ridge systems or rocky oak-pine forests/woodlands. Mesic cove forest systems may be embedded within this matrix in protected draws. Small pocket wetlands, not discriminated as separate systems, may also occur within these forests.

SOURCES

References: Comer et al. 2003, Vanderhorst and Streets 2006
Version: 20 Aug 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

CES202.604 NORTH-CENTRAL APPALACHIAN ACIDIC SWAMP

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Woody Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Forest and Woodland (Treed); Extensive Wet Flat; Needle-Leaved Tree; 30-180-day hydroperiod
Concept Summary: These swamps are distributed from central New England through the Central Appalachians south to Virginia and west to Ohio. They are found at low to mid elevations (generally <700 m) in basins or on gently sloping seepage lowlands. The acidic substrate is mineral soil, often with a component of organic muck; if peat is present, it usually forms an organic epipedon over the mineral soil rather than a true peat substrate (although peat layers up to 1 m deep have been found in some of these swamps). *Tsuga canadensis* is usually present and may be dominant. It is often mixed with deciduous wetland trees such as *Acer rubrum* or *Nyssa sylvatica*. *Sphagnum* is an important component of the bryoid layer. Basin swamps tend to be more nutrient-poor and less species-rich than seepage swamps; in some settings, the two occur adjacent to each other with the basin swamp vegetation surrounded by seepage swamp vegetation on its upland periphery.
Comments: This system excludes swamps with *Chamaecyparis thyoides*, a tree more characteristic of the Coastal Plain but which sometimes occurs inland. See Northern Atlantic Coastal Plain Basin Peat Swamp (CES203.522). Some examples of this system may appear similar to Southern and Central Appalachian Bog and Fen (CES202.300) or North-Central Interior and Appalachian Acidic Peatland (CES202.606); those systems are distinguished by their deeper peat substrate and overall partly forested character compared to the shallower organic soil and generally forested nature of the present system. Wetlands on the Allegheny Plateau, at higher elevations, are a distinct system, High Allegheny Wetland (CES202.069). There are many species with this type, but it is distinguished by occurring as a mosaic of open wetlands and smaller forest patches with a distinctive hydrology.
DEWA Associations:

- Red Maple - Black Spruce - Highbush Blueberry Palustrine Woodland (CEGL006014)
- Red Maple Seepage Swamp (CEGL006406)
- Red Maple - Highbush Blueberry Palustrine Forest (CEGL006220)
- Eastern Hemlock - Mixed Hardwood Palustrine Forest (CEGL006279)
- Wet Meadow (CEGL006571)
- Blueberry Thicket (CEGL006371)

DISTRIBUTION

Range: This system occurs from central New England south to western Virginia (the Central Appalachians region) and west to Ohio.
Divisions: 202:C
TNC Ecoregions: 49:C, 59:C, 60:C, 61:C, 63:C
Subnations: CT, MA, MD, NH, NJ, NY, OH, PA, RI, VA, VT
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:P
USFS Ecomap Regions: 211E:CP, 211F:CC, 211G:CC, 211I:CC, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 222I:CC, M211A:CP, M211B:CC, M211C:CC, M221A:CC

CONCEPT

Associations:

- *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) */ Lindera benzoin / Symplocarpus foetidus* Forest (CEGL006406, G4G5)
- *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014, GNR)
- *Acer rubrum - Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132, GNR)
- *Acer rubrum / Carex lacustris* Woodland (CEGL006105, GNR)
- *Acer rubrum / Carex stricta - Onoclea sensibilis* Woodland (CEGL006119, G3G5)
- *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220, G4G5)
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156, GNR)
- *Betula alleghaniensis - Acer rubrum* - (*Tsuga canadensis, Abies balsamea*) */ Osmunda cinnamomea* Forest (CEGL006380, G4?)
- *Picea rubens* - (*Tsuga canadensis*) */ Rhododendron maximum* Saturated Forest (CEGL006277, G2?)
- *Picea rubens / Rhododendron maximum - Kalmia latifolia / Eriophorum virginicum / Sphagnum* spp. Forest (CEGL006588, G2G3)
- *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226, G5)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279, G4?)

High-ranked species: *Helonias bullata* (G3)

SOURCES

References: Comer et al. 2003, Fleming et al. 2005

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.606 NORTH-CENTRAL INTERIOR AND APPALACHIAN ACIDIC PEATLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Woody Wetland
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Shrubland (Shrub-dominated); Organic Peat (>40 cm); Acidic Water; >180-day hydroperiod
Concept Summary: These *Sphagnum* and shrub peatlands occur in basins south of the Laurentian-Acadian region down to near the glacial boundary in the northeastern and north-central U.S. Unlike the true raised bogs of boreal regions, the vegetation is not raised above the groundwater level. They are found in colder regions, mostly in areas where glacial stagnation left coarse deposits and glacial depressions (many are "kettleholes"). The basins are generally closed, i.e., without inlets or outlets of surface water, and typically small in area. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. In deeper basins, the vascular vegetation grows on a *Sphagnum* mat over water, with no mineral soil development. Ericaceous shrubs and dwarf-shrubs (e.g., *Chamaedaphne calyculata*) dominate, with patches of graminoid dominance. Some peatlands may have a sparse tree layer. Although these are often called bogs, in most cases they are technically fens (albeit nutrient-poor ones), as the vegetation remains in contact with the groundwater.
Comments: This system occurs south of the Laurentian-Acadian division in the Midwest, south of the Northern Appalachian-Boreal ecoregion in the Northeast, and inland from the Coastal Plain, and these acidic peatlands are distinctive and discrete elements of the landscape. They are related to Northern Appalachian - Acadian Conifer - Hardwood Acidic Swamp (CES201.574), but occur in a different landscape setting and often have some more temperate floristic elements to distinguish them. They include treed, shrub, and graminoid associations, often occurring in a mosaic. In the Midwest, it may be necessary to split off the shrub/graminoid acid peatland (poor fen) types.
DEWA Associations:
- Leatherleaf Peatland (CEGL006008)
- Red Maple - Black Spruce - Highbush Blueberry Palustrine Woodland (CEGL006014)
- Highbush Blueberry - Leatherleaf Wetland (CEGL006190)

DISTRIBUTION

Range: This system is found from central New England to the Great Lakes and south-central Minnesota southward, generally associated with the glacial terminus or stagnation zones, and interior from the Coastal Plain.
Divisions: 202:C
TNC Ecoregions: 45:P, 46:P, 48:P, 49:P, 60:C, 61:C, 64:C
Subnations: CT, IL, IN, MA, ME, MI, MN, NH, NJ, NY, OH, ON, PA, RI, VT, WI
Map Zones: 41:?, 49:P, 50:P, 51:P, 52:P, 61:C, 62:C, 63:C, 64:C, 65:C, 66:P
USFS Ecomap Regions: 211F:CC, 211I:CP, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221Fa:CCC, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222R:CC, 222Ua:CCP, 222Ud:CCC, 222Ue:CCC

CONCEPT

Associations:

- *Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis* Woodland (CEGL006395, GNR)
- *Carex lasiocarpa - Carex oligosperma* - (*Lysimachia terrestris*) / *Sphagnum* spp. / *Spiraea tomentosa* Herbaceous Vegetation (CEGL005279, G3G4)
- *Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum* spp. Herbaceous Vegetation (CEGL005256, G4G5)
- *Chamaedaphne calyculata* - (*Gaylussacia dumosa*) - *Decodon verticillatus / Woodwardia virginica* Dwarf-shrubland (CEGL006008, G5)
- *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092, G3G4)
- *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland (CEGL006513, GNR)
- *Dulichium arundinaceum - Triadenum virginicum / Sphagnum fallax* Herbaceous Vegetation (CEGL006077, GNR)
- *Dulichium arundinaceum / Sphagnum* spp. Herbaceous Vegetation (CEGL006131, GNR)
- *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472, G4?)
- *Myrica gale - Chamaedaphne calyculata / Carex* (*lasiocarpa, utriculata*) - *Utricularia* spp. Shrub Herbaceous Vegetation (CEGL006302, G4G5)
- *Picea mariana /* (*Vaccinium corymbosum, Gaylussacia baccata*) / *Sphagnum* sp. Woodland (CEGL006098, G3G5)
- *Pinus rigida - Picea rubens / Viburnum nudum* var. *cassinoides / Sphagnum* spp. Woodland (CEGL006587, G1G2)
- *Pinus rigida / Chamaedaphne calyculata / Sphagnum* spp. Woodland (CEGL006194, G3G5)
- *Pinus rigida / Vaccinium myrtilloides / Sphagnum* spp. Woodland (CEGL006022, G1G2)
- *Sphagnum* (*cuspidatum, torreyanum*) - *Vaccinium macrocarpon* Nonvascular Vegetation (CEGL006394, GNR)
- *Sphagnum rubellum - Vaccinium oxycoccos* Nonvascular Vegetation (CEGL006135, GNR)
- *Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris* Shrubland **(CEGL005085,** G2G3)
- *Vaccinium corymbosum / Sphagnum* spp. Shrubland (CEGL006190, G3G5)

High-ranked species: *Cyzicus gynecia* (G2G3Q), *Platanthera leucophaea* (G2G3)

SOURCES

References: Comer et al. 2003, Damman and French 1987

Version: 05 May 2008 **Stakeholders:** Canada, East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.607 NORTH-CENTRAL APPALACHIAN SEEPAGE FEN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Herbaceous; Seepage-Fed Sloping
Concept Summary: This system is found in scattered locations in the central Appalachians and eastern Great Lakes regions. Mostly non-forested, these open fens develop on shallow to deep peat over a sloping substrate, where seepage waters provide nutrients. Conditions are often circumneutral to alkaline. Sedges are the major dominants. *Packera aurea, Symplocarpus foetidus*, and *Lobelia kalmii* are among the characteristic forbs. Some of these areas are kept open by grazing, and succession to shrublands may occur in the absence of disturbance.

DEWA Associations:
- Calcareous Fen (CEGL006367)
- Marl Fen (CEGL006013)

DISTRIBUTION

Range: This system is found in scattered locations from central New England and New York west to Lake Erie and south to West Virginia and western Virginia (Central Appalachians ecoregion).
Divisions: 202:C
TNC Ecoregions: 45:P, 48:P, 49:C, 59:C, 60:C, 61:C
Subnations: CT, MA, MD, NJ, NY, PA, VA, VT, WV
Map Zones: 53:C, 61:C, 62:C, 63:P, 64:C, 65:C
USFS Ecomap Regions: 221A:CC, 221Ba:CCC, 221E:CC, M221A:CC

CONCEPT

Associations:
- *Alnus serrulata - Lindera benzoin / Osmunda regalis* var. *spectabilis - Carex tetanica* Shrubland (CEGL008408, G1?)
- *Betula pumila - Toxicodendron vernix - Dasiphora fruticosa* ssp. *floribunda* Shrubland (CEGL006360, G2G3)
- *Carex canescens - Eriophorum virginicum / Sphagnum* spp. Herbaceous Vegetation (CEGL006549, GNR)
- *Carex prairea - Carex stricta - Pycnanthemum virginianum* Herbaceous Vegetation (CEGL006551, GNR)
- *Cornus amomum - Salix candida / Dasiphora fruticosa* ssp. *floribunda / Carex stricta* Shrubland (CEGL006359, G3?)
- *Cornus racemosa / Carex* (*sterilis, aquatilis, lacustris*) Shrub Herbaceous Vegetation (CEGL006123, G2G3)
- *Dasiphora fruticosa* ssp. *floribunda / Carex* (*sterilis, hystericina, flava*) Shrub Herbaceous Vegetation (CEGL006326, G2)
- *Dasiphora fruticosa* ssp. *floribunda / Carex interior - Carex flava - Sarracenia purpurea* Shrub Herbaceous Vegetation (CEGL005140, G3)
- *Deschampsia caespitosa - Claytonia virginica* var. *hammondiae* Herbaceous Vegetation (CEGL006101, G1)

- *Juniperus virginiana / Betula pumila / Carex sterilis - Oligoneuron rigidum* Shrub Herbaceous Vegetation (CEGL006367, G1)
- *Juniperus virginiana / Dasiphora fruticosa* ssp. *floribunda / Carex flava - Carex tetanica* Shrub Herbaceous Vegetation (CEGL006357, G1G2)
- *Morella pensylvanica - Dasiphora fruticosa* ssp. *floribunda / Carex sterilis - Carex flava* Shrub Herbaceous Vegetation (CEGL006103, G2)
- *Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385, G4?)

High-ranked species: *Carex schweinitzii* (G3G4), *Carex* sp. 2 (G1), *Chelone cuthbertii* (G3), *Glyptemys muhlenbergii* (G3), *Neonympha mitchellii* (G2), *Parnassia grandifolia* (G3), *Poa paludigena* (G3)

SOURCES

References: Comer et al. 2003

Version: 09 Jan 2003 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.608 CENTRAL APPALACHIAN RIVER FLOODPLAIN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Forest and Woodland (Treed); Toeslope/Valley Bottom; Riverine / Alluvial; Broad-Leaved Deciduous Tree; Intermittent Flooding; Short (<5 yrs) Flooding Interval
Concept Summary: This system encompasses floodplains of medium to large rivers in Atlantic drainages from southern New England to Virginia. This system can include a complex of wetland and upland vegetation on deep alluvial deposits and scoured vegetation on depositional bars and on bedrock where rivers cut through resistant geology. This complex includes floodplain forests in which *Acer saccharinum, Populus deltoides,* and *Platanus occidentalis* are characteristic, as well as herbaceous sloughs, shrub wetlands, riverside prairies and woodlands. Most areas are underwater each spring; microtopography determines how long the various habitats are inundated. Depositional and erosional features may both be present depending on the particular floodplain.
Comments: This system is distinguished from related floodplain systems; northward, Laurentian - Acadian Floodplain Forest (CES201.587) is characterized by the lack or unimportance of *Platanus occidentalis* and *Betula nigra,* for example; and westward, North-Central Interior Floodplain (CES202.694) drains to the midwestern rivers rather than northeastern rivers. Determining the distinctions from South-Central Interior Large Floodplain (CES202.705), which overlaps the southern and western portions of this system, needs work.
DEWA Associations:

- Sycamore - Green Ash Floodplain Forest (CEGL006036)
- Silver Maple Floodplain Forest (CEGL002586)
- Bottomland Oak Palustrine Forest (CEGL006185)
- Sugar Maple Floodplain Forest (CEGL006459)
- Bitternut Hickory Lowland Forest (CEGL006445)
- Buttonbush Wetland (CEGL006069)
- Big Bluestem - Indian Grass Riverine Grassland (CEGL006518)
- Black Walnut Bottomland Forest (CEGL006449)
- Temporarily Flooded Modified Successional Forest (CEGL006599)
- Red maple Seepage Swamp (CEGL006406)
- Mixed Forb Marsh (CEGL006446)
- Wet Meadow (CEGL006571)
- Tussock Sedge Marsh (CEGL006412)
- Eastern Woodland Vernal Pool Sparse Vegetation (CEGL006453)
- Riverine Scour Vegetation (CEGL006554)-riparian inclusion*
- Sycamore - Mixed Hardwood Riverine Shrubland (CEGL003896)-riparian inclusion*
- Sycamore (Willow) - Mixed Hardwood Riverine Dwarf Shrubland (CEGL006065)-riparian inclusion*
- Calcareous Riverside Outcrop / Calcareous Riverside Seep (CEGL006284 / CEGL006969)-riparian inclusion*

DEWA Comments: Four associations (denoted with a *) that are more typically found in the Central Appalachian Stream and Riparian System were included in the Central Appalachian

River Floodplain system at Delaware Water Gap because they were very small riparian inclusions surrounded by broad, flat, diffuse, low-gradient floodplains and associations more typical of the Central Appalachian River Floodplain system. This was done to maintain a cohesively mapped floodplain ecological system along the Delaware River which better reflects the concept of an ecological system than mapping small inclusions as a separate system. For a finer-scale view of the floodplain and riparian associations, the map user can view them at the association-level.

DISTRIBUTION

Range: Southern New England west to Lake Erie and south to Virginia. The James River in Virginia marks the southern extent of this system.
Divisions: 201:C, 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: CT, MA, MD, NH, NJ?, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C
USFS Ecomap Regions: data not available

CONCEPT

Associations:

- (*Hypericum prolificum, Leucothoe racemosa*) / *Schizachyrium scoparium - Solidago simplex* var. *racemosa - Ionactis linariifolius* Sparse Vegetation (CEGL006491, G2)
- *Acer* (*rubrum, saccharinum*) - *Fraxinus pennsylvanica - Ulmus americana / Boehmeria cylindrica* Forest (CEGL006548, G4)
- *Acer* (*rubrum, saccharinum*) - *Ulmus americana* Forest (CEGL006975, GNR)
- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer saccharinum* - (*Populus deltoides*) / *Matteuccia struthiopteris - Laportea canadensis* Forest (CEGL006147, GNR)
- *Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis* - (*Elymus virginicus*) Forest (CEGL006217, G4)
- *Acer saccharinum - Ulmus americana / Onoclea sensibilis* Forest (CEGL006001, GNR)
- *Acer saccharinum - Ulmus americana / Physocarpus opulifolius* Forest (CEGL006042, GNR)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586, G4?)
- *Acer saccharinum / Onoclea sensibilis - Boehmeria cylindrica* Forest (CEGL006176, GNR)
- *Acer saccharum - Fraxinus americana / Carpinus caroliniana / Podophyllum peltatum* Forest (CEGL006459, G3?)
- *Acer saccharum - Fraxinus* spp. *- Tilia americana / Matteuccia struthiopteris - Ageratina altissima* Forest (CEGL006114, GNR)
- *Acer saccharum - Liriodendron tulipifera / Galium concinnum - Carex laxiculmis* Forest (CEGL006473, GNR)
- *Alnus incana - Viburnum recognitum / Calamagrostis canadensis* Shrubland [Provisional] (CEGL006546, GNR)
- *Alnus serrulata - Physocarpus opulifolius* Shrubland (CEGL006251, G5)
- *Alnus serrulata* Swamp Shrubland (CEGL005082, G4G5)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Betula nigra - Platanus occidentalis / Impatiens capensis* Forest (CEGL006184, GNR)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)

- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174, G4G5)
- *Carex torta - Apocynum cannabinum - Cyperus* spp. Herbaceous Vegetation (CEGL006536, G4G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Carex trichocarpa* Herbaceous Vegetation (CEGL006447, G3)
- *Carya cordiformis - Prunus serotina / Ageratina altissima* Forest (CEGL006445, GNR)
- *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069, G4G5)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Fraxinus americana / Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium - Pycnanthemum tenuifolium* Herbaceous Vegetation (CEGL006478, G1)
- *Fraxinus pennsylvanica* - (*Juglans nigra, Platanus occidentalis*) Forest (CEGL006575, GNR)
- *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014, G3G5)
- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liriodendron tulipifera - Acer* (*rubrum, negundo*) - (*Platanus occidentalis*) */ Carpinus caroliniana / Polygonum virginianum* Forest (CEGL006492, G4)
- *Liriodendron tulipifera - Fraxinus* spp. / *Lindera benzoin - Viburnum prunifolium / Podophyllum peltatum* Forest (CEGL006314, GNR)
- *Liriodendron tulipifera - Pinus strobus* - (*Tsuga canadensis*) */ Carpinus caroliniana / Amphicarpaea bracteata* Forest (CEGL008405, G3)
- *Liriodendron tulipifera - Platanus occidentalis - Betula lenta / Lindera benzoin / Circaea lutetiana* ssp. *canadensis* Forest (CEGL006255, G3?)
- *Peltandra virginica - Polygonum amphibium* var. *emersum - Carex emoryi - Impatiens capensis* Herbaceous Vegetation (CEGL006244, G1)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696, G2G3?)
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Quercus stellata / Amelanchier stolonifera / Danthonia spicata / Leucobryum glaucum* Woodland (CEGL008449, G2?)
- *Platanus occidentalis - Acer negundo - Juglans nigra / Asimina triloba / Mertensia virginica* Forest (CEGL004073, G4)
- *Platanus occidentalis - Fraxinus pennsylvanica* Forest (CEGL006036, G4?)
- *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis / Aesculus flava* Forest (CEGL006466, GNR)
- *Prunus pumila / Andropogon gerardii - Sorghastrum nutans* Herbaceous Vegetation (CEGL006518, GNR)
- *Quercus bicolor - Acer rubrum / Carpinus caroliniana* Forest (CEGL006386, GNR)
- *Quercus bicolor - Fraxinus pennsylvanica* - (*Platanus occidentalis*) */ Chasmanthium latifolium - Dichanthelium clandestinum - Zizia aurea* Woodland (CEGL006218, G1G2)
- *Quercus palustris - Acer rubrum / Carex grayi - Geum canadense* Forest (CEGL006185, GNR)

- *Quercus palustris - Quercus bicolor / Carex tribuloides - Carex radiata* - (*Carex squarrosa*) Forest (CEGL006497, G3G4)
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463, GNR)
- *Salix sericea* Shrubland (CEGL006305, GNR)
- *Spiraea alba* Shrubland [Provisional] (CEGL006595, GNR)
- *Tilia americana - Acer saccharum - Acer nigrum / Laportea canadensis* Forest (CEGL006405, GNR)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Arabis georgiana* (G1), *Aspiromitus appalachianus* (G1), *Canis rufus* (G1Q), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Diervilla rivularis* (G3), *Eurycea junaluska* (G3), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Myotis austroriparius* (G3G4), *Plethodon aureolus* (G2G3), *Sagittaria secundifolia* (G1), *Sorex palustris punctulatus* (G5T3), *Spiraea virginiana* (G2)

SOURCES

References: Comer et al. 2003
Version: 01 Feb 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler, mod. NCR Review Team **LeadResp:** East

CES202.609 CENTRAL APPALACHIAN STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Riverine / Alluvial; Very Short Disturbance Interval; Flood Scouring; Intermittent Flooding
Concept Summary: This riparian system ranges from southern New England to Virginia and West Virginia and occurs over a wide range of elevations. It develops on floodplains and shores along river channels that lack a broad flat floodplain due to steeper sideslopes, higher gradient, or both. It may include communities influenced by flooding, erosion, or groundwater seepage. The vegetation is often a mosaic of forest, woodland, shrubland, and herbaceous communities. Common trees include *Betula nigra, Platanus occidentalis*, and *Acer negundo*. Open, flood-scoured rivershore prairies feature *Panicum virgatum* and *Andropogon gerardii*, and *Carex torta* is typical of wetter areas near the channel.
Comments: This is a high-gradient system, unlike the low-gradient system described in Central Appalachian River Floodplain (CES202.608). To the south in the Appalachians and interior, this system is replaced by South-Central Interior Small Stream and Riparian (CES202.706).
DEWA Associations:

- Big Bluestem - Indian Grass Riverine Grassland (CEGL006518)
- Silver Maple Floodplain Forest (CEGL002586)
- Sycamore - Mixed Hardwood Riverine Shrubland (CEGL003896)

DEWA Comments: This system was identified southeast of Kittatiny Point for approximately 2 km along the Delaware River from The Gap. Four associations (denoted with a * and listed in the Central Appalachian River Floodplain system description) that are more typically found in the Central Appalachian Stream and Riparian System were included in the Central Appalachian River Floodplain system at Delaware Water Gap because they were very small riparian inclusions surrounded by broad, flat, diffuse, low-gradient floodplains and associations more typical of the Central Appalachian River Floodplain system. This was done to maintain a cohesive floodplain ecological system along the Delaware River which better reflects the concept of an ecological system than mapping small inclusions as a separate ecological system. For a finer-scale view of the floodplain and riparian associations, the map user can view them at the association-level.

DISTRIBUTION

Range: This system ranges from southern New England west to Lake Erie and south to Virginia and West Virginia. The James River in Virginia marks its southern extent.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: CT, DE, MA, MD, NH, NJ?, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:P, 64:P, 65:C
USFS Ecomap Regions:

CONCEPT

Associations:

- *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) */ Lindera benzoin / Symplocarpus foetidus* Forest (CEGL006406, G4G5)
- *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416, G3)
- *Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest (CEGL007853, G3G4)
- *Alnus serrulata - Physocarpus opulifolius* Shrubland (CEGL006251, G5)
- *Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Sparse Vegetation (CEGL006284, G2)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Carex torta - Apocynum cannabinum - Cyperus* spp. Herbaceous Vegetation (CEGL006536, G4G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Carex trichocarpa* Herbaceous Vegetation (CEGL006447, G3)
- *Deschampsia caespitosa - Carex viridula* Herbaceous Vegetation (CEGL006969, GNR)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Eupatorium serotinum - Polygonum* (*lapathifolium, punctatum, pensylvanicum*) Herbaceous Vegetation (CEGL006481, GNR)
- *Hudsonia tomentosa - Paronychia argyrocoma* Dwarf-shrubland (CEGL006232, G1)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Leersia oryzoides - Sagittaria latifolia* Herbaceous Vegetation (CEGL006461, GNR)
- *Liriodendron tulipifera - Platanus occidentalis - Betula lenta / Lindera benzoin / Circaea lutetiana* ssp. *canadensis* Forest (CEGL006255, G3?)
- *Lysimachia ciliata - Apocynum cannabinum* Sparse Vegetation (CEGL006554, GNR)
- *Panicum virgatum - Andropogon gerardii* Gravel Wash Herbaceous Vegetation (CEGL006477, G2G3)
- *Pinus rigida - Hudsonia tomentosa - Pityopsis falcata* Sparse Vegetation (CEGL006391, GNR)
- *Pinus strobus - Betula populifolia / Comptonia peregrina / Schizachyrium scoparium* Woodland (CEGL006004, G2)
- *Platanus occidentalis - Acer saccharinum - Betula nigra - Fraxinus pennsylvanica / Boehmeria cylindrica - Carex emoryi* Woodland (CEGL006476, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Populus tremuloides - Betula populifolia* Forest (CEGL006560, GNR)
- *Rhododendron arborescens / Marshallia grandiflora - Triantha glutinosa - Platanthera flava* var. *herbiola* Herbaceous Vegetation (CEGL006598, G1)
- *Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland (CEGL006065, G4?)
- *Salix nigra* Temporarily Flooded Shrubland (CEGL003901, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)

· *Verbesina alternifolia - Elymus riparius - Solidago gigantea -* (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Spiraea virginiana* (G2), *Trillium rugelii* (G3), *Waldsteinia lobata* (G2G3)

SOURCES

References: Comer et al. 2003
Version: 01 Feb 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler, mod. NCR Review Team **LeadResp:** East

CES202.601 NORTH-CENTRAL APPALACHIAN ACIDIC CLIFF AND TALUS

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Barren
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland
Diagnostic Classifiers: Cliff (Substrate); Talus (Substrate); Temperate; Acidic Soil
Concept Summary: This system comprises sparsely vegetated to partially wooded cliffs and talus slopes in the Central Appalachians and adjacent ecoregions, occurring on rocks of acidic lithology and lacking any indicators of enriched conditions. This cliff system occurs at low to mid elevations from central New England south to Virginia, and up to 1500 m in West Virginia. It consists of vertical or near-vertical cliffs and the talus slopes below, formed on hills of granitic, sandstone, or otherwise acidic bedrock. In some cases, especially in periglacial areas, this system may take the form of upper-slope boulderfields without adjacent cliffs, where talus forms from freeze/thaw action cracking the bedrock. Most of the substrate is dry and exposed, but small (occasionally large) areas of seepage are often present. Vegetation in seepage areas tends to be more well-developed and floristically different from the surrounding dry cliffs. The vegetation is patchy and often sparse, punctuated with patches of small trees that may form woodlands in places. *Juniperus virginiana* is a characteristic tree species, *Toxicodendron radicans* a characteristic woody vine, and *Polypodium virginianum* a characteristic fern. Within its range, *Pinus virginiana* is often present.
DEWA Associations:
- Shale Scree Slope (CEGL006535)
- Sparsely Vegetated Cliff (CEGL006422)
- Oak - Birch Talus Forest (CEGL006565)
- Oak - Birch Talus Forest / Sandstone Talus (CEGL006565 / CEGL004142)
- Sandstone Talus (CEGL004142)
- Hickory - Eastern Red-cedar Rocky Woodland / Sparsely Vegetated Cliff (CEGL006002/CEGL006422)
- Dry Oak - Heath Forest / Oak - Birch Talus Forest (CEGL006282 / CEGL006565)
- Little Bluestem Grassland / Sparsely Vegetated Cliff (CEGL006333 / CEGL006422)

DISTRIBUTION

Range: This system is found from central New England and New York south to Virginia.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, MA, MD, NJ, NY, OH, PA, VA, WV
Map Zones: 60:C, 61:C, 62:C, 63:P, 64:P, 65:C
USFS Ecomap Regions: 221E:CC, M221A:CC, M221B:CC, M221D:CC

CONCEPT

Associations:
- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435, GNR)
- *Asplenium montanum* Central Appalachian Sandstone Sparse Vegetation (CEGL004391, GNR)
- *Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland (CEGL006320, G3G5)
- *Betula lenta - Quercus prinus / Parthenocissus quinquefolia* Woodland (CEGL006565, G3G4)

- *Hydrangea arborescens / Sedum ternatum - Polypodium virginianum* Shrubland (CEGL006479, GNR)
- *Juniperus virginiana - Corydalis sempervirens* Cliff Sparse Vegetation (CEGL006422, G4)
- *Lasallia* (*papulosa, pensylvanica*) - *Dimelaena oreina* - (*Melanelia culbersonii*) Nonvascular Vegetation (CEGL004142, G4?)
- *Lasallia papulosa - Stereocaulon glaucescens - Chrysothrix chlorina* Nonvascular Vegetation (CEGL004143, G1?)
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045, G4G5)
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287, G4G5)
- *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387, G4?)
- *Umbilicaria muehlenbergii - Lasallia papulosa* - (*Melanelia stygia*) Nonvascular Vegetation (CEGL004389, G2?)

High-ranked species: *Acrobolbus ciliatus* (G3?), *Aneides aeneus* (G3G4), *Bryum riparium* (G2G4), *Canis rufus* (G1Q), *Carex biltmoreana* (G3), *Carex misera* (G3), *Gymnoderma lineare* (G2), *Heuchera alba* (G2Q), *Hymenophyllum tayloriae* (G2), *Hypericum buckleii* (G3), *Krigia montana* (G3), *Leptohymenium sharpii* (G1), *Liatris helleri* (G2), *Liatris microcephala* (G3G4), *Lophocolea appalachiana* (G1G2Q), *Mannia californica* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Metzgeria furcata* var. *setigera* (G5T1), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila eurphyllon* ssp. *echinata* (GNRT2), *Plagiochila sullivantii* var. *spinigera* (G2T1), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plagiomnium carolinianum* (G3), *Platyhypnidium pringlei* (G2G3), *Porella japonica* ssp. *appalachiana* (G5?T1), *Radula sullivantii* (G3), *Rhododendron vaseyi* (G3), *Saxifraga careyana* (G3), *Saxifraga caroliniana* (G3), *Scutellaria arguta* (G1?Q), *Sedum nevii* (G3), *Tetrodontium brownianum* (G3G4), *Thelypteris pilosa* var. *alabamensis* (G4T1), *Tsuga caroliniana* (G3)
Environment: This cliff system consists of vertical or near-vertical cliffs at low to mid elevations and the talus slopes below, formed on hills of granitic, sandstone, or otherwise acidic bedrock. Most of the substrate is dry and exposed, but small (occasionally large) areas of seepage are often present.
Vegetation: Vegetation in seepage areas tends to be more well-developed and floristically different from the surrounding dry cliffs. The vegetation is patchy and often sparse, punctuated with patches of small trees that may form woodlands in places. *Juniperus virginiana* is a characteristic tree species, *Toxicodendron radicans* a characteristic woody vine, and *Polypodium virginianum* a characteristic fern.

SOURCES

References: Comer et al. 2003
Version: 26 Jul 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

CES202.603 NORTH-CENTRAL APPALACHIAN CIRCUMNEUTRAL CLIFF AND TALUS

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Barren
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Cliff (Substrate); Talus (Substrate); Temperate; Alkaline Soil
Concept Summary: This cliff system occurs at low to mid elevations from central New England south to Virginia and West Virginia. It consists of vertical or near-vertical cliffs and steep talus slopes where weathering and/or bedrock lithology produce circumneutral to calcareous pH and enriched nutrient availability. Substrates include limestone, dolomite and other rocks. The vegetation varies from sparse to patches of small trees, in places forming woodland or even forest vegetation. *Fraxinus* spp., *Tilia americana*, and *Staphylea trifolia* are woody indicators of the enriched setting. *Thuja occidentalis* may occasionally be present but is more characteristic of the related Laurentian-Acadian system to the north. The herb layer is typically not extensive but includes at least some species that are indicators of enriched conditions, e.g., *Impatiens pallida, Pellaea atropurpurea, Asplenium platyneuron*, or *Woodsia obtusa*.
DEWA Associations:

- Sugar Maple - American Basswood Forest (CEGL006020)

DISTRIBUTION

Range: This system ranges from central New England and New York south to Virginia and West Virginia. The extent of the Virginia range remains to be documented, but it appears to be absent from the Southern Blue Ridge and Southern Ridge and Valley portions of the state.
Divisions: 202:C
TNC Ecoregions: 52:?, 59:P, 60:?, 61:C
Subnations: MA, MD, NH, NJ, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 59:P, 61:C, 62:?, 63:P, 64:C, 65:C, 66:P
USFS Ecomap Regions: 221B:CC, 221D:CC, 221E:CC, M221A:CC, M221B:CC

CONCEPT

Associations:

- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162, GNR)
- *Acer saccharum - Quercus muehlenbergii* Forest (CEGL005010, GNR)
- *Acer saccharum - Tilia americana - Fraxinus americana / Ostrya virginiana / Geranium robertianum* Woodland (CEGL005058, G3G5)
- *Acer saccharum - Tilia americana / Staphylea trifolia / Dryopteris marginalis* - (*Impatiens pallida*) Forest (CEGL006471, G3G4)
- *Asplenium ruta-muraria - Pellaea atropurpurea* Sparse Vegetation (CEGL004476, G3G4)
- *Pellaea atropurpurea* Cliff Sparse Vegetation (CEGL006527, GNR)
- *Thuja occidentalis / Carex eburnea - Pellaea atropurpurea* Woodland (CEGL002596, G2G3)
- *Tilia americana - Fraxinus americana / Acer pensylvanicum - Ostrya virginiana / Parthenocissus quinquefolia - Impatiens pallida* Woodland (CEGL008528, G3)
- *Tilia americana - Fraxinus americana / Cornus florida* Woodland (CEGL006054, G3G5)

High-ranked species: *Aneides aeneus* (G3G4), *Arabis patens* (G3), *Clematis addisonii* (G2), *Heuchera americana* var. *hispida* (G5T3?), *Homaliadelphus sharpii* (G3?), *Leptohymenium sharpii* (G1), *Neotoma magister* (G3G4), *Paxistima canbyi* (G2), *Penstemon smallii* (G3), *Platyhypnidium pringlei* (G2G3), *Radula voluta* (G3), *Sedum nevii* (G3), *Silene virginica* var. *robusta* (G5T1Q), *Taxiphyllum alternans* (G3?)
Other Comments: Land snails are known to exhibit highest diversity and abundance on calcareous substrates (J. Vanderhorst pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Vanderhorst pers. comm.
Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

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Yahn, Brian. Personal communication. Ecologist, Kentucky State Nature Preserve Commission, Frankfort.

Appendix B. Ecological Systems Classification for Upper Delaware Scenic and Recreational River.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Upper Delaware Scenic and National River

13 February 2009

by

NatureServe

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

11 Avenue de Lafayette, 5th Floor
Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers ecological systems attributed to Upper Delaware Scenic and National River. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

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NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Upper Delaware Scenic and National River. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at Upper Delaware Scenic and Recreational River: Appalachian (Hemlock) - Northern Hardwood Forest, Northeastern Interior Dry - Mesic Oak Forest, Central Appalachian Dry Oak - Pine Forest, Central Appalachian Pine - Oak Rocky Woodland, Central Appalachian Stream and Riparian, Laurentian - Acadian Freshwater Marsh, Laurentian - Acadian Wet Meadow - Shrub Swamp, North-Central Appalachian Acidic Swamp, and North-Central Interior and Appalachian Acidic Peatland. The areas of the ecological systems, semi-natural, and cultural map classes at Upper Delaware Scenic and Recreational River are displayed in Table 1.

Table B1. Areas of the ecological systems, semi-natural, and cultural map classes at Upper Delaware Scenic and Recreational River.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	10,072.3	24,889.3
Northeastern Interior Dry - Mesic Oak Forest	4,884.1	12,068.9
Central Appalachian Dry Oak - Pine Forest	4,233.9	10,462.2
Urban/Suburban Built	2,249.9	5,569.4
Streams and Canals	1,553.6	3,839.0
Cropland and Pasture	909.0	2,248.7
Ruderal Forest - Northern and Central Hardwood and Conifer	521.2	1,287.3
Commercial/Industrial	467.2	1,154.6
Central Appalachian Stream and Riparian	374.5	925.4
Introduced Wetland and Riparian Vegetation	285.1	704.5
Ruderal Upland - Old Field	125.0	308.9
Managed Tree Plantation	97.2	240.2
Quarries/Pits/Stripmines	84.2	208.0
Introduced Shrubland	72.0	177.9
North-Central Appalachian Acidic Swamp	59.9	148.0
Central Appalachian Pine - Oak Rocky Woodland	46.4	114.6
Pond	43.0	106.1
Laurentian - Acadian Freshwater Marsh	14.6	36.0
Laurentian - Acadian Wet Meadow - Shrub Swamp	11.7	28.9
Reservoirs	4.8	11.8
North-Central Interior and Appalachian Acidic Peatland	1.4	3.4
Beaches	0.7	1.6
Total	26,112.5	64,525.3

CES201.594 LAURENTIAN - ACADIAN FRESHWATER MARSH

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Graminoid; Shallow (<15 cm) Water; >180-day hydroperiod
Concept Summary: These freshwater emergent and/or submergent marshes are dominated by herbaceous vegetation. They are common throughout the northeastern United States and adjacent Canadian provinces. Freshwater marshes occur in closed or open basins that are generally flat and shallow. They are associated with lakes, ponds, slow-moving streams, and/or impoundments or ditches. The herbaceous vegetation does not persist through the winter. Scattered shrubs are often present and usually total less than 25% cover. Trees are generally absent and, if present, are scattered. The substrate is typically muck over mineral soil. Examples of vegetation in the Delaware Estuary freshwater marsh communities include *Typha latifolia, Typha angustifolia, Phragmites australis, Schoenoplectus americanus, Thelypteris palustris, Impatiens capensis, Carex* spp., *Vallisneria americana, Potamogeton perfoliatus, Nuphar lutea* ssp. *advena*, and *Nymphaea odorata*.
UPDE Assocations:
- Eastern Cattail Marsh (CEGL006153)
- Mixed Forb Marsh (CEGL006446)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

DISTRIBUTION

Range: This system occurs in New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania, New Jersey, and Ohio; mostly north of the glacial boundary.
Divisions: 201:C, 202:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NJ, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC

CONCEPT

Associations:
- *Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation (CEGL006446, GNR)
- *Elodea canadensis - Potamogeton* spp. Eastern Herbaceous Vegetation [Placeholder] (CEGL006431, GNR)
- *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
- *Eriocaulon aquaticum - Lobelia dortmanna* Herbaceous Vegetation (CEGL006346, GNR)
- *Juncus militaris - Eriocaulon aquaticum* Herbaceous Vegetation (CEGL006345, GNR)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Nymphaea odorata - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002562, G5)

- *Nymphaea tetragona - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002563, G4G5)
- *Pontederia cordata - Peltandra virginica - Sagittaria latifolia* Herbaceous Vegetation (CEGL006191, G5)
- *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282, G5)
- *Schoenoplectus* (*tabernaemontani, acutus*) Eastern Herbaceous Vegetation (CEGL006275, GNR)
- *Schoenoplectus acutus* - (*Schoenoplectus fluviatilis*) Freshwater Herbaceous Vegetation (CEGL002225, G4G5)
- *Schoenoplectus acutus - Carex lasiocarpa* Herbaceous Vegetation (CEGL006358, G1G2)
- *Schoenoplectus fluviatilis - Schoenoplectus* spp. Herbaceous Vegetation (CEGL002221, G3G4)
- *Schoenoplectus fluviatilis* Herbaceous Vegetation (CEGL006366, GNR)
- *Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026, G4G5)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
- *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153, G5)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229, G4?)
- *Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation (CEGL006196, G5)
- *Zizania* (*aquatica, palustris*) Herbaceous Vegetation (CEGL002382, G3G4)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.

Version: 22 Dec 2005 **Stakeholders:** Canada, East, Midwest

Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES201.582 LAURENTIAN - ACADIAN WET MEADOW - SHRUB SWAMP

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Broad-Leaved Shrub; Graminoid; Shallow (<15 cm) Water
Concept Summary: This system encompasses shrub swamps and wet meadows on mineral soils of the Northeast and upper Midwest. They are often associated with lakes and ponds, but are also found along streams, where the water level does not fluctuate greatly. They are commonly flooded for part of the growing season but often do not have standing water throughout the season. The size of occurrences ranges from small pockets to extensive acreages. The system can have a patchwork of shrub and graminoid dominance; typical species include *Salix* spp., *Cornus amomum, Alnus incana, Spiraea alba, Calamagrostis canadensis*, tall *Carex* spp., and *Juncus effusus*. Trees are generally absent and, if present, are scattered.
UPDE Associations:
- Speckled Alder Swamp (CEGL002381)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

DISTRIBUTION

Range: New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania and Ohio; mostly north of the glacial boundary.
Divisions: 201:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 222K:CC, 222M:CC, 222R:CC, 222Ue:CCC

CONCEPT

Associations:
- *Alnus incana* Swamp Shrubland (CEGL002381, G5)
- *Alnus serrulata* Swamp Shrubland (CEGL005082, G4G5)
- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174, G4G5)
- *Calamagrostis canadensis - Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519, GNR)
- *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257, G4G5)
- *Carex lacustris* Herbaceous Vegetation (CEGL002256, G4G5)
- *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258, G4?)
- *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412, G4G5)
- *Carex tetanica - Carex prairea - Eleocharis erythropoda - Lysimachia quadriflora* Herbaceous Vegetation (CEGL006170, G1Q)

· *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190, G4)
· *Cornus sericea - Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186, G5)
· *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
· *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
· *Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland (CEGL006512, GNR)
· *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
· *Typha latifolia - Caltha palustris* Herbaceous Vegetation (CEGL006245, G1)

High-ranked species: *Calephelis muticum* (G3), *Clonophis kirtlandii* (G2), *Platanthera leucophaea* (G2G3), *Polemonium vanbruntiae* (G3G4), *Scirpus ancistrochaetus* (G3)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.
Version: 11 Apr 2007 **Stakeholders:** Canada, East, Midwest
Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina,* and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
UPDE Associations:

- Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)
- Central Appalachian Northern Hardwood Forest (CEGL006045)
- Eastern Hemlock - Beech - Oak Forest (CEGL006088)
- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)
- Semi-rich Northern Hardwood Forest (CEGL006211)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C

USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)

· *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
· *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn pers. comm. 2008) believes that it is present in that state, but investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.591 CENTRAL APPALACHIAN DRY OAK - PINE FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2369; ESLF 4312; ESP 1369
Concept Summary: These oak and oak-pine forests cover large areas in the low- to mid-elevation Central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits. Soils are typically coarse and infertile; they may be deep (on glacial deposits in the northern and terrace deposits in the southern parts of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. The forest is mostly closed-canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus, Pinus virginiana,* and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory and often form a dense layer. Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida,* and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic. Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum*.
Comments: This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry - Mesic Oak Forest (CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak - Heath Forest (CES202.023). Its analog from central Virginia south is Southern Piedmont Dry Oak - (Pine) Forest (CES202.339), which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda*.
UPDE Associations:

- Red Oak - Heath Woodland / Rocky Summit (CEGL006384)
- Lower New England Slope Chestnut Oak Forest (CEGL006282)
- Inland Pitch Pine - Oak Forest (CEGL006290)
- White Pine - Oak Forest (CEGL006293)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)

DISTRIBUTION

Range: This system is found from central New England through Pennsylvania and south to the Roanoke River in southern Virginia. It is primarily Appalachian but overlaps slightly into the upper Piedmont and fall zone in Virginia, Maryland and the District of Columbia.

Divisions: 202:C
TNC Ecoregions: 52:C, 58:C, 59:C, 60:C, 61:C
Subnations: CT, DC, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV
Map Zones: 57:P, 60:C, 61:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 65:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 211I:CC, 221A:CC, 221B:CC, 221D:CC, 232A:CC, M221A:CC, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Bf:CCC, M221Da:CCC

CONCEPT

Associations:
- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162, GNR)
- *Castanea dentata - Quercus prinus* Forest (CEGL007196, GH)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Fagus grandifolia - Quercus* (*alba, velutina, prinus*) */ Kalmia latifolia* Forest (CEGL006919, G4)
- *Pinus rigida - Quercus* (*velutina, prinus*) Forest (CEGL006290, GNR)
- *Pinus strobus - Pinus resinosa - Pinus rigida* Forest (CEGL006259, G4G5)
- *Pinus strobus - Quercus* (*rubra, velutina*) *- Fagus grandifolia* Forest (CEGL006293, G5)
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539, G4)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) *- Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus* (*velutina, alba*) */ Vaccinium pallidum* High Allegheny Plateau, Western Allegheny Plateau Forest (CEGL006018, GNR)
- *Quercus alba - Quercus* (*coccinea, velutina, prinus*) */ Gaylussacia baccata* Forest (CEGL008521, G5)
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515, G4)
- *Quercus prinus* - (*Quercus coccinea, Quercus rubra*) */ Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299, G5)
- *Quercus prinus - Quercus* (*rubra, velutina*) */ Vaccinium angustifolium* Forest (CEGL006282, G5)
- *Quercus prinus - Quercus rubra / Vaccinium pallidum* - (*Rhododendron periclymenoides*) Forest (CEGL008523, G3G4)
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524, G3?)
- *Tsuga canadensis - Quercus prinus - Betula lenta* Forest (CEGL006923, G3)

Environment: These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. The soils are coarse and infertile; they may be deep (on glacial deposits in the northern part of

the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits.

Vegetation: Stands of this forest system are mostly closed-canopied but can include more open woodlands. They are dominated by a variable mixture of dry-site oak and pine species, including *Quercus prinus, Pinus virginiana,* and *Pinus strobus.* The system may include areas of pine forest and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata*, and *Kalmia latifolia* are common in the understory. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic.

Dynamics: Disturbance agents include fire, windthrow, and ice damage.

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch (at outer range) to matrix (in center of range) system that may cover extensive hillslopes and low ridges.

Other Comments: In the Blue Ridge (EPA Level III Ecoregion 66), this extends south to the Roanoke River in central Virginia, where it is replaced by Southern Appalachian Oak Forest (CES202.886). In the northern Piedmont (EPA Level III Ecoregion 64), this extends south to Richmond, Virginia, where southward (i.e., in EPA Level III ecoregion 45) it is replaced by Southern Piedmont Dry Oak - (Pine) Forest (CES202.339). This corresponds closely to the line between USFS Sections 231I and 221D, with CES202.591 occurring in 221D and CES202.339 in 231I (SCG 7-07).

SOURCES

References: Comer et al. 2003

Version: 05 Feb 2009 **Stakeholders:** East, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.600 CENTRAL APPALACHIAN PINE - OAK ROCKY WOODLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Shrubland (Shrub-dominated); Woody-Herbaceous; Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2377; ESLF 4320; ESP 1377
Concept Summary: This system encompasses open or sparsely wooded hilltops and outcrops or rocky slopes in the Central Appalachians, High Allegheny Plateau, and Lower New England / Northern Piedmont. It occurs mostly at lower elevations, but occasionally up to 1220 m (4000 feet) in West Virginia. The substrate rock is granitic or of other acidic lithology, including traprock in New England. The vegetation is patchy, with woodland as well as open portions. *Pinus rigida* and (within its range *Pinus virginiana* are diagnostic and often are mixed with xerophytic *Quercus* spp. and sprouts of *Castanea dentata*. Some areas have a fairly well-developed heath shrub layer, others a graminoid layer. Conditions are dry and nutrient-poor, and at many, if not most, sites, a history of fire is evident. In the Central Appalachians ecoregion, this system is sometimes found on sandy soils rather than rock.
Comments: The northern extent of this system in central New England may overlap with Northern Appalachian - Acadian Rocky Heath Outcrop (CES201.571), which has *Picea* spp. prominent. The southern extent overlaps with Southern Appalachian Montane Pine Forest and Woodland (CES202.331), which is characterized by *Pinus pungens*. This type is differentiated from the similar Central Appalachian Dry Oak - Pine Forest (CES202.591) by its mosaic nature of wooded and open patches, as opposed to being merely a "thin forest."
UPDE Associations:

- Central Appalachian Blueberry Shrubland (CEGL003958)
- Hickory - Eastern Red Cedar Rocky Woodland (CEGL006002)
- Pitch Pine Rocky Summit (CEGL006116)
- Ridgetop Scrub Oak Barrens (CEGL006121)
- Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening (CEGL006544)

DISTRIBUTION

Range: This system occurs from central New England south to Virginia and West Virginia, with peripheral occurrences in southeastern Ohio and easternmost Kentucky.
Divisions: 202:C
TNC Ecoregions: 49:C, 50:C, 52:C, 59:C, 60:C, 61:C, 64:C
Subnations: CT, KY, MA, MD?, ME, NH, NJ, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 57:P, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 58:C, 58a:C, 58b:C, 58c:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 60:C, 60a:C, 60b:C, 61:C, 61c:C, 62:C, 62a:C, 62b:C, 62c:C, 62d:C, 62e:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 69d:C, 69e:C, 70:C, 70a:C, 70b:C, 70c:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 221A:CC, 221B:CC, M211Bb:CCC, M211Bd:CCC, M211C:CC, M221A:CC, M221B:CP

CONCEPT

Associations:

- *Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland (CEGL006002, G2G3)
- *Kalmia latifolia - Gaylussacia baccata - Vaccinium* (*angustifolium, pallidum*) - *Menziesia pilosa* Shrubland (CEGL003939, G2)
- *Penstemon hirsutus* Sparse Vegetation (CEGL006535, GNR)
- *Photinia melanocarpa - Gaylussacia baccata / Carex pensylvanica* Shrubland (CEGL008508, G1?)
- *Pinus resinosa - Quercus rubra / Sibbaldiopsis tridentata / Danthonia compressa - Antennaria virginica / Rhytidium rugosum* Woodland (CEGL003766, G1)
- *Pinus resinosa / Menziesia pilosa / Polypodium appalachianum* Forest (CEGL006108, G1)
- *Pinus rigida - Gaylussacia baccata* Shrubland (CEGL006079, G1)
- *Pinus rigida - Quercus coccinea / Vaccinium angustifolium* Woodland (CEGL006557, GNR)
- *Pinus rigida /* (*Quercus ilicifolia*) */ Photinia melanocarpa / Deschampsia flexuosa* Woodland (CEGL006116, GNR)
- *Pinus rigida / Corema conradii* Woodland (CEGL006154, G2)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus ilicifolia - Prunus pumila* Shrubland (CEGL006121, GNR)
- *Quercus prinus - Pinus virginiana -* (*Pinus pungens*) */ Schizachyrium scoparium - Dichanthelium depauperatum* Woodland (CEGL008540, G3?)
- *Quercus prinus / Quercus ilicifolia / Danthonia spicata* Woodland [Provisional] (CEGL008526, G3?)
- *Quercus rubra -* (*Quercus prinus*) */ Vaccinium* spp. / *Deschampsia flexuosa* Woodland (CEGL006134, G3G5)
- *Quercus rubra - Quercus prinus - Pinus strobus / Penstemon hirsutus* Woodland (CEGL006074, G3G5)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica / Cladonia* spp. Herbaceous Vegetation (CEGL006544, GNR)
- *Vaccinium* (*angustifolium, myrtilloides, pallidum*) Central Appalachian Dwarf-shrubland (CEGL003958, G4G5)
- *Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland (CEGL005094, GNR)

High-ranked species: *Arabis serotina* (G2), *Canis rufus* (G1Q), *Catocala herodias gerhardi* (G3T3), *Gaylussacia brachycera* (G3), *Malaxis bayardii* (G1G2), *Packera millefolia* (G2), *Pyrgus wyandot* (G1G2Q), *Taenidia montana* (G3), *Vaccinium hirsutum* (G3), *Virginia valeriae pulchra* (G5T3T4)

SOURCES

References: Comer et al. 2003, Fleming et al. 2005

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.592 NORTHEASTERN INTERIOR DRY - MESIC OAK FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Forest and Woodland (Treed); Acidic Soil; *Quercus* - *Carya*
National Mapping Codes: EVT 2303; ESLF 4109; ESP 1303
Concept Summary: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. Soils are mostly acidic and relatively infertile but not strongly xeric. Local areas of calcareous bedrock, or colluvial pockets, may support forests typical of richer soils. Oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba, Quercus velutina*, and *Quercus coccinea*) and *Carya* spp. are dominant in mature stands. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum, Betula lenta*, and *Betula alleghaniensis* may be common associates; *Acer saccharum* is occasional. With a long history of human habitation, many of the forests are early- to mid-successional, where *Pinus strobus, Pinus virginiana*, or *Liriodendron tulipifera* may be dominant or codominant. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands, including non-forested seeps or forested wetlands with *Acer rubrum, Quercus bicolor*, or *Nyssa sylvatica* characteristic.
Comments: The oak-dominated forest matrix in this region spans a range of elevational and moisture regimes, reflected in different ecological systems. Those in drier settings, within the general range of this system, are placed in either Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359) or Central Appalachian Dry Oak-Pine Forest (CES202.591).
UPDE Associations:

- Dry, Rich Oak - Hickory Forest (CEGL006236)
- Northeastern Dry Oak - Hickory Forest (CEGL006336)
- Red Maple - Sweet Birch Hardwood Forest (CEGL008503)
- Northeastern Oak - Red Maple Successional Forest (CEGL006506)

DISTRIBUTION

Range: This system is found from southern New York west through Ohio and Pennsylvania and south to Virginia. It does not extend to the southernmost part of Virginia, except in the Ridge and Valley.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: MD, NJ, NY, OH, PA, VA, WV
Map Zones: 57:C, 60:C, 61:C, 62:C, 63:C, 64:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 221A:CC, 221B:CC, 221D:CC, 221F:CC, M221A:CC, M221B:CC, M221Da:CCC

CONCEPT

Associations:

- *Carya* (*glabra, ovata*) - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236, GNR)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus* (*rubra, alba*) */ Polystichum acrostichoides* Forest (CEGL006304, G4?)
- *Pinus strobus - Quercus* (*rubra, velutina*) - *Fagus grandifolia* Forest (CEGL006293, G5)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus alba - Quercus rubra - Carya* (*alba, ovata*) */ Cornus florida* Acidic Forest (CEGL002067, G3)
- *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475, G4G5)
- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068, G4?)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059, GNR)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus muehlenbergii - Quercus* (*alba, rubra*) - *Carya cordiformis / Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus - Quercus rubra - Carya ovalis / Solidago* (*ulmifolia, arguta*) - *Galium latifolium* Forest (CEGL008516, G3G4)
- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057, G5)
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522, G4?)
- *Quercus rubra - Acer saccharum / Ostrya virginiana / Cardamine concatenata* Forest (CEGL008517, G4)
- *Quercus rubra - Carya* (*glabra, ovata*) */ Ostrya virginiana / Carex lucorum* Forest (CEGL006301, G4?)
- *Quercus rubra - Quercus alba - Fraxinus americana - Carya* (*ovata, ovalis*) */ Actaea racemosa* Forest (CEGL008518, G3)
- *Quercus rubra - Quercus prinus - Carya ovalis /* (*Cercis canadensis*) */ Solidago caesia* Forest (CEGL008514, G3G4)

High-ranked species: *Callophrys irus* (G3), *Canis rufus* (G1Q), *Carex communis* var. *amplisquama* (G5T3), *Carex polymorpha* (G3), *Coreopsis delphiniifolia* (G3?Q), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Virginia valeriae pulchra* (G5T3T4)

Environment: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. The typical landscape position is midslope to toeslope, transitioning to more xeric systems on the upper slopes and ridges. Soils are acidic and relatively infertile but not strongly xeric.

Vegetation: Mature stands are dominated by oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba, Quercus velutina*, and *Quercus coccinea*), along with

various *Carya* spp. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum* and *Betula lenta* are frequently common associates. Local areas of calcareous bedrock may support forests typical of richer soils (e.g., with *Acer saccharum* and/or *Quercus muehlenbergii*).

SPATIAL CHARACTERISTICS

Spatial Summary: These were historically among the most important matrix forests of the Northeast. They cover extensive areas where conditions are not extreme. Upslope they may grade into more xeric oak ridge systems or rocky oak-pine forests/woodlands. Mesic cove forest systems may be embedded within this matrix in protected draws. Small pocket wetlands, not discriminated as separate systems, may also occur within these forests.

SOURCES

References: Comer et al. 2003, Vanderhorst and Streets 2006

Version: 20 Aug 2007 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.604 NORTH-CENTRAL APPALACHIAN ACIDIC SWAMP

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Woody Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Forest and Woodland (Treed); Extensive Wet Flat; Needle-Leaved Tree; 30-180-day hydroperiod
Concept Summary: These swamps are distributed from central New England through the Central Appalachians south to Virginia and west to Ohio. They are found at low to mid elevations (generally <700 m) in basins or on gently sloping seepage lowlands. The acidic substrate is mineral soil, often with a component of organic muck; if peat is present, it usually forms an organic epipedon over the mineral soil rather than a true peat substrate (although peat layers up to 1 m deep have been found in some of these swamps). *Tsuga canadensis* is usually present and may be dominant. It is often mixed with deciduous wetland trees such as *Acer rubrum* or *Nyssa sylvatica*. *Sphagnum* is an important component of the bryoid layer. Basin swamps tend to be more nutrient-poor and less species-rich than seepage swamps; in some settings, the two occur adjacent to each other with the basin swamp vegetation surrounded by seepage swamp vegetation on its upland periphery.
Comments: This system excludes swamps with *Chamaecyparis thyoides*, a tree more characteristic of the Coastal Plain but which sometimes occurs inland. See Northern Atlantic Coastal Plain Basin Peat Swamp (CES203.522). Some examples of this system may appear similar to Southern and Central Appalachian Bog and Fen (CES202.300) or North-Central Interior and Appalachian Acidic Peatland (CES202.606); those systems are distinguished by their deeper peat substrate and overall partly forested character compared to the shallower organic soil and generally forested nature of the present system. Wetlands on the Allegheny Plateau, at higher elevations, are a distinct system, High Allegheny Wetland (CES202.069). There are many species with this type, but it is distinguished by occurring as a mosaic of open wetlands and smaller forest patches with a distinctive hydrology.
UPDE Associations:

- Eastern Hemlock - Hardwood Swamp (CEGL006226)
- Red Maple Seepage Swamp (CEGL006406)
- Swamp Forest - Bog Complex (Spruce type) (CEGL006277)
- Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)

DISTRIBUTION

Range: This system occurs from central New England south to western Virginia (the Central Appalachians region) and west to Ohio.
Divisions: 202:C
TNC Ecoregions: 49:C, 59:C, 60:C, 61:C, 63:C
Subnations: CT, MA, MD, NH, NJ, NY, OH, PA, RI, VA, VT
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:P
USFS Ecomap Regions: 211E:CP, 211F:CC, 211G:CC, 211I:CC, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 222I:CC, M211A:CP, M211B:CC, M211C:CC, M221A:CC

CONCEPT

Associations:

- *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) */ Lindera benzoin / Symplocarpus foetidus* Forest (CEGL006406, G4G5)
- *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014, GNR)
- *Acer rubrum - Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132, GNR)
- *Acer rubrum / Carex lacustris* Woodland (CEGL006105, GNR)
- *Acer rubrum / Carex stricta - Onoclea sensibilis* Woodland (CEGL006119, G3G5)
- *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220, G4G5)
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156, GNR)
- *Betula alleghaniensis - Acer rubrum* - (*Tsuga canadensis, Abies balsamea*) */ Osmunda cinnamomea* Forest (CEGL006380, G4?)
- *Picea rubens* - (*Tsuga canadensis*) */ Rhododendron maximum* Saturated Forest (CEGL006277, G2?)
- *Picea rubens / Rhododendron maximum - Kalmia latifolia / Eriophorum virginicum / Sphagnum* spp. Forest (CEGL006588, G2G3)
- *Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest (CEGL006226, G5)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279, G4?)

High-ranked species: *Helonias bullata* (G3)

SOURCES

References: Comer et al. 2003, Fleming et al. 2005

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.606 NORTH-CENTRAL INTERIOR AND APPALACHIAN ACIDIC PEATLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Woody Wetland
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Shrubland (Shrub-dominated); Organic Peat (>40 cm); Acidic Water; >180-day hydroperiod
Concept Summary: These *Sphagnum* and shrub peatlands occur in basins south of the Laurentian-Acadian region down to near the glacial boundary in the northeastern and north-central U.S. Unlike the true raised bogs of boreal regions, the vegetation is not raised above the groundwater level. They are found in colder regions, mostly in areas where glacial stagnation left coarse deposits and glacial depressions (many are "kettleholes"). The basins are generally closed, i.e., without inlets or outlets of surface water, and typically small in area. The nutrient-poor substrate and the reduced throughflow of water create oligotrophic conditions fostering the development of *Sphagnum* peat and the growth of peatland vegetation. In deeper basins, the vascular vegetation grows on a *Sphagnum* mat over water, with no mineral soil development. Ericaceous shrubs and dwarf-shrubs (e.g., *Chamaedaphne calyculata*) dominate, with patches of graminoid dominance. Some peatlands may have a sparse tree layer. Although these are often called bogs, in most cases they are technically fens (albeit nutrient-poor ones), as the vegetation remains in contact with the groundwater.
Comments: This system occurs south of the Laurentian-Acadian division in the Midwest, south of the Northern Appalachian-Boreal ecoregion in the Northeast, and inland from the Coastal Plain, and these acidic peatlands are distinctive and discrete elements of the landscape. They are related to Northern Appalachian - Acadian Conifer - Hardwood Acidic Swamp (CES201.574), but occur in a different landscape setting and often have some more temperate floristic elements to distinguish them. They include treed, shrub, and graminoid associations, often occurring in a mosaic. In the Midwest, it may be necessary to split off the shrub/graminoid acid peatland (poor fen) types.
UPDE Associations:

- Highbush Blueberry Bog Thicket (CEGL006190)

DISTRIBUTION

Range: This system is found from central New England to the Great Lakes and south-central Minnesota southward, generally associated with the glacial terminus or stagnation zones, and interior from the Coastal Plain.
Divisions: 202:C
TNC Ecoregions: 45:P, 46:P, 48:P, 49:P, 60:C, 61:C, 64:C
Subnations: CT, IL, IN, MA, ME, MI, MN, NH, NJ, NY, OH, ON, PA, RI, VT, WI
Map Zones: 41:?, 49:P, 50:P, 51:P, 52:P, 61:C, 62:C, 63:C, 64:C, 65:C, 66:P
USFS Ecomap Regions: 211F:CC, 211I:CP, 211J:CC, 221A:CC, 221B:CC, 221D:CC, 221E:CC, 221Fa:CCC, 222I:CC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222R:CC, 222Ua:CCP, 222Ud:CCC, 222Ue:CCC

CONCEPT

Associations:

- *Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis* Woodland (CEGL006395, GNR)
- *Carex lasiocarpa - Carex oligosperma -* (*Lysimachia terrestris*) */ Sphagnum* spp. / *Spiraea tomentosa* Herbaceous Vegetation (CEGL005279, G3G4)
- *Carex oligosperma - Carex pauciflora - Eriophorum vaginatum / Sphagnum* spp. Herbaceous Vegetation (CEGL005256, G4G5)
- *Chamaedaphne calyculata -* (*Gaylussacia dumosa*) *- Decodon verticillatus / Woodwardia virginica* Dwarf-shrubland (CEGL006008, G5)
- *Chamaedaphne calyculata / Carex oligosperma - Eriophorum virginicum* Dwarf-shrubland (CEGL005092, G3G4)
- *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland (CEGL006513, GNR)
- *Dulichium arundinaceum - Triadenum virginicum / Sphagnum fallax* Herbaceous Vegetation (CEGL006077, GNR)
- *Dulichium arundinaceum / Sphagnum* spp. Herbaceous Vegetation (CEGL006131, GNR)
- *Larix laricina / Photinia melanocarpa / Sphagnum* spp. Forest (CEGL002472, G4?)
- *Myrica gale - Chamaedaphne calyculata / Carex* (*lasiocarpa, utriculata*) *- Utricularia* spp. Shrub Herbaceous Vegetation (CEGL006302, G4G5)
- *Picea mariana /* (*Vaccinium corymbosum, Gaylussacia baccata*) */ Sphagnum* sp. Woodland (CEGL006098, G3G5)
- *Pinus rigida - Picea rubens / Viburnum nudum* var. *cassinoides / Sphagnum* spp. Woodland (CEGL006587, G1G2)
- *Pinus rigida / Chamaedaphne calyculata / Sphagnum* spp. Woodland (CEGL006194, G3G5)
- *Pinus rigida / Vaccinium myrtilloides / Sphagnum* spp. Woodland (CEGL006022, G1G2)
- *Sphagnum* (*cuspidatum, torreyanum*) *- Vaccinium macrocarpon* Nonvascular Vegetation (CEGL006394, GNR)
- *Sphagnum rubellum - Vaccinium oxycoccos* Nonvascular Vegetation (CEGL006135, GNR)
- *Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris* Shrubland (CEGL005085, G2G3)
- *Vaccinium corymbosum / Sphagnum* spp. Shrubland (CEGL006190, G3G5)

High-ranked species: *Cyzicus gynecia* (G2G3Q), *Platanthera leucophaea* (G2G3)

SOURCES

References: Comer et al. 2003, Damman and French 1987

Version: 05 May 2008 **Stakeholders:** Canada, East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.609 CENTRAL APPALACHIAN STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Riverine / Alluvial; Very Short Disturbance Interval; Flood Scouring; Intermittent Flooding
Concept Summary: This riparian system ranges from southern New England to Virginia and West Virginia and occurs over a wide range of elevations. It develops on floodplains and shores along river channels that lack a broad flat floodplain due to steeper sideslopes, higher gradient, or both. It may include communities influenced by flooding, erosion, or groundwater seepage. The vegetation is often a mosaic of forest, woodland, shrubland, and herbaceous communities. Common trees include *Betula nigra, Platanus occidentalis*, and *Acer negundo*. Open, flood-scoured rivershore prairies feature *Panicum virgatum* and *Andropogon gerardii*, and *Carex torta* is typical of wetter areas near the channel.
Comments: This is a high-gradient system, unlike the low-gradient system described in Central Appalachian River Floodplain (CES202.608). To the south in the Appalachians and interior, this system is replaced by South-Central Interior Small Stream and Riparian (CES202.706).
UPDE Comments: The riparian and floodplain vegetation associations along the Upper Delaware Scenic and Recreational River predominantly occur within the Central Appalachian Stream and Riparian ecological system. There are small sections of the river with broader floodplain development interdigitated with steep riparian sections. These areas are considered Central Appalachian River Floodplain inclusions within the predominant Central Appalachian Stream and Riparian ecological system and are mapped in the Central Appalachian Stream and Riparian ecological system. This was done to maintain a cohesive riparian ecological system along the Upper Delaware Scenic and Recreational River. For a finer-scale view of the riparian and floodplain associations, the map user can view them at the association-level**.**
UPDE Associations:

- Sycamore - Green Ash Floodplain Forest (CEGL006036)
- Silver Maple Floodplain Forest (CEGL002586)-floodplain inclusion
- Bitternut Hickory Lowland Forest (CEGL006445)-floodplain inclusion
- Mixed Forb Marsh (CEGL006446)
- Hairy-fruit Sedge Wetland (CEGL006447)
- Sugar Maple Floodplain Forest (CEGL006459)-floodplain inclusion
- Riverside Prairie Grassland (CEGL006518)
- Birch - Willow Riverbank Shrubland (CEGL003896)
- Willow River-Bar Shrubland (CEGL006065)
- River Birch Low Floodplain Forest (CEGL006184)- floodplain inclusion
- Northern Riverside Rock Outcrop (CEGL006284)
- Northeastern Temperate Cobble Scour Rivershore (CEGL006536)
- Water-willow Rocky Bar and Shore (CEGL004286)

DISTRIBUTION

Range: This system ranges from southern New England west to Lake Erie and south to Virginia and West Virginia. The James River in Virginia marks its southern extent.

Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: CT, DE, MA, MD, NH, NJ?, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:P, 64:P, 65:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:

- *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) */ Lindera benzoin / Symplocarpus foetidus* Forest (CEGL006406, G4G5)
- *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416, G3)
- *Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest (CEGL007853, G3G4)
- *Alnus serrulata - Physocarpus opulifolius* Shrubland (CEGL006251, G5)
- *Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Sparse Vegetation (CEGL006284, G2)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Carex torta - Apocynum cannabinum - Cyperus* spp. Herbaceous Vegetation (CEGL006536, G4G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Carex trichocarpa* Herbaceous Vegetation (CEGL006447, G3)
- *Deschampsia caespitosa - Carex viridula* Herbaceous Vegetation (CEGL006969, GNR)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Eupatorium serotinum - Polygonum* (*lapathifolium, punctatum, pensylvanicum*) Herbaceous Vegetation (CEGL006481, GNR)
- *Hudsonia tomentosa - Paronychia argyrocoma* Dwarf-shrubland (CEGL006232, G1)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Leersia oryzoides - Sagittaria latifolia* Herbaceous Vegetation (CEGL006461, GNR)
- *Liriodendron tulipifera - Platanus occidentalis - Betula lenta / Lindera benzoin / Circaea lutetiana* ssp. *canadensis* Forest (CEGL006255, G3?)
- *Lysimachia ciliata - Apocynum cannabinum* Sparse Vegetation (CEGL006554, GNR)
- *Panicum virgatum - Andropogon gerardii* Gravel Wash Herbaceous Vegetation (CEGL006477, G2G3)
- *Pinus rigida - Hudsonia tomentosa - Pityopsis falcata* Sparse Vegetation (CEGL006391, GNR)
- *Pinus strobus - Betula populifolia / Comptonia peregrina / Schizachyrium scoparium* Woodland (CEGL006004, G2)
- *Platanus occidentalis - Acer saccharinum - Betula nigra - Fraxinus pennsylvanica / Boehmeria cylindrica - Carex emoryi* Woodland (CEGL006476, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Populus tremuloides - Betula populifolia* Forest (CEGL006560, GNR)

- *Rhododendron arborescens / Marshallia grandiflora - Triantha glutinosa - Platanthera flava* var. *herbiola* Herbaceous Vegetation (CEGL006598, G1)
- *Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland (CEGL006065, G4?)
- *Salix nigra* Temporarily Flooded Shrubland (CEGL003901, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea -* (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Spiraea virginiana* (G2), *Trillium rugelii* (G3), *Waldsteinia lobata* (G2G3)

SOURCES

References: Comer et al. 2003

Version: 01 Feb 2007 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, mod. NCR Review Team **LeadResp:** East

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Appendix C. Ecological Systems Classification for New River Gorge National River.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of New River Gorge National River

13 February 2009

by

NatureServe

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

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Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers ecological systems attributed to New River Gorge National River. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (*IVC hierarchy*) *and association data:*

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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This document may be generally cited as follows:

NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of New River Gorge National River. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at New River Gorge National River: Southern Appalachian Oak Forest, Allegheny-Cumberland Dry Oak Forest and Woodland, South-Central Interior Mesophytic Forest, Cumberland Acidic Cliff and Rockhouse, South-Central Interior Small Stream and Riparian, South-Central Interior Large Floodplain, and Cumberland Riverscour. The areas of the ecological systems, semi-natural, and cultural map classes at New River Gorge National River are displayed in Table 1.

Table C1. Areas of the ecological systems, semi-natural, and cultural map classes at New River Gorge National River.

Ecological System or Map Class	Hectares	Acres
Southern Appalachian Oak Forest	14,410.0	35,608.0
South-Central Interior Mesophytic Forest	9,837.2	24,308.2
Urban/Suburban Built	1,968.7	4,864.7
Allegheny-Cumberland Dry Oak Forest and Woodland	1,429.7	3,532.9
River	1,244.8	3,076.1
Quarries/Strip Mines/Gravel Pits	774.5	1,913.9
Ruderal Forest - Northern and Central Hardwood and Conifer	414.4	1023.9
Cumberland Riverscour	375.5	927.9
South-Central Interior Large Floodplain	244.8	604.9
Powerline Right-of-Way	203.4	502.7
Managed Tree Plantation	106.2	262.5
Creek	101.1	249.8
South-Central Interior Small Stream and Riparian	85.2	210.6
Ruderal Upland - Old Field	72.2	178.5
Pasture/Hay	19.7	48.8
Pond	18.0	44.5
Cultivated Crops	15.2	37.5
Cumberland Acidic Cliff and Rockhouse	7.3	18.0
Introduced Shrubland	4.5	11.0
Total	31,332.5	77,424.2

CES202.359 ALLEGHENY-CUMBERLAND DRY OAK FOREST AND WOODLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Acidic Soil; Broad-Leaved Tree
National Mapping Codes: EVT 2317; ESLF 4123; ESP 1317
Concept Summary: This system encompasses dry hardwood forests on predominately acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the southern Ridge and Valley. Its range is more or less consistent with the "Mixed Mesophytic Forest Region" of Braun (1950) and Greller (1988), although it is not a mesic forest type. These forests are typically dominated by *Quercus alba, Quercus falcata, Quercus prinus, Quercus coccinea,* with lesser amounts of *Acer rubrum, Carya glabra,* and *Carya alba*. Small inclusions of *Pinus echinata* and/or *Pinus virginiana* may occur, particularly adjacent to escarpments or following fire. In addition, *Pinus strobus* may be prominent in some stands in the absence of fire. It occurs in a variety of situations, including on nutrient-poor or acidic soils. Sprouts of *Castanea dentata* can often be found where it was formerly a common tree.
Comments: Related forests on more base-rich substrates may be classified as examples of Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457), where this distinction may be made.
NERI Associations:

- Cliff Top Virginia Pine Forest (CEGL007119)
- Cliff Top Pitch Pine Woodland (CEGL006557)
- Oak / Ericad Forest (CEGL006271)

DISTRIBUTION

Range: This system is centered on the Allegheny and Cumberland plateaus from northern Alabama north to Ohio, West Virginia, and possibly western Pennsylvania.
Divisions: 202:C
TNC Ecoregions: 49:C, 50:C
Subnations: AL, GA, KY, OH, PA?, TN, VA, WV
Map Zones: 48:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: 221E:CC, 221H:CC, 221J:CC, 231C:CC, 231D:CC, M221A:CC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Be:CCC, M221C:CC

CONCEPT

Associations:

- *Pinus rigida - Quercus coccinea / Vaccinium angustifolium* Woodland (CEGL006557, GNR)
- *Pinus strobus - Quercus* (*coccinea, prinus*) / (*Gaylussacia ursina, Vaccinium stamineum*) Forest (CEGL007519, G4)
- *Pinus strobus - Quercus alba* - (*Carya alba*) / *Gaylussacia ursina* Forest (CEGL007517, G3G4)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus alba* - (*Quercus prinus*) / (*Hydrangea quercifolia*) - *Viburnum acerifolium / Carex picta - Piptochaetium avenaceum* Forest (CEGL008430, G3G4)

- *Quercus alba - Carya alba* - (*Quercus velutina*) */ Desmodium nudiflorum* - (*Carex picta*) Forest (CEGL007795, G4)
- *Quercus alba - Quercus* (*coccinea, velutina, prinus*) */ Gaylussacia baccata* Forest (CEGL008521, G5)
- *Quercus alba - Quercus falcata / Vaccinium* (*arboreum, hirsutum, pallidum*) Forest (CEGL008567, G3G4)
- *Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba - Quercus stellata / Ostrya virginiana - Acer barbatum / Chasmanthium sessiliflorum* Forest (CEGL008443, G3G4)
- *Quercus alba - Quercus velutina - Carya* (*ovata, alba, glabra*) - *Pinus* sp. Forest (CEGL007231, G4G5)
- *Quercus falcata - Quercus* (*coccinea, stellata*) */ Vaccinium* (*pallidum, stamineum*) Forest (CEGL007247, G4)
- *Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest (CEGL007244, G4G5)
- *Quercus prinus* - (*Quercus coccinea*) */ Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431, G4G5)
- *Quercus prinus - Carya* (*alba, glabra, ovata*) */ Juniperus virginiana* var. *virginiana* Forest (CEGL004786, G2G3)
- *Quercus prinus - Carya* spp. - *Quercus velutina / Vaccinium arboreum / Iris verna* var. *smalliana* Forest (CEGL007261, G3G4)
- *Quercus prinus - Quercus* (*alba, coccinea, velutina*) */ Viburnum acerifolium* - (*Kalmia latifolia*) Forest (CEGL005023, G4?)
- *Quercus prinus - Quercus rubra - Carya* (*ovata, glabra*) - *Pinus virginiana* Forest (CEGL007269, G4?)
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia, Styrax grandifolius*) Forest (CEGL007700, G4)
- *Quercus stellata - Pinus virginiana /* (*Schizachyrium scoparium, Piptochaetium avenaceum*) Woodland (CEGL008406, G2?)

High-ranked species: *Callophrys irus* (G3), *Canis rufus* (G1Q), *Carex communis* var. *amplisquama* (G5T3), *Carex polymorpha* (G3), *Coreopsis delphiniifolia* (G3?Q), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Lesquerella globosa* (G2), *Scutellaria montana* (G3), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Trillium pusillum* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system is most likely found on predominantly nutrient-poor or acidic substrates in the Allegheny and Cumberland plateaus, and ridges in the southern Ridge and Valley.
Vegetation: These forests are typically dominated by *Quercus alba, Quercus falcata, Quercus prinus, Quercus coccinea, Acer rubrum, Carya glabra,* and *Carya alba*. These occur in a variety of situations, most likely on nutrient-poor or acidic soils and, to a much lesser extent, on circumneutral soils. Sprouts of *Castanea dentata* can often be found where it was formerly a common tree. Small inclusions of *Pinus echinata* and/or *Pinus virginiana* may occur, particularly adjacent to escarpments or following fire. In addition, *Pinus strobus* may be prominent in some stands in the absence of fire.

SPATIAL CHARACTERISTICS

Adjacent Ecological System Comments: The somewhat more mesic and/or more base-rich forests of the lower slopes of the Cumberlands and the lower slopes and valleys in the Ridge and Valley are covered by South-Central Interior Mesophytic Forest (CES202.887).

Other Comments: In Georgia, it is restricted to the northwestern corner of the state.

SOURCES

References: Braun 1950, Comer et al. 2003, Evans 1991, Greller 1988

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: R. Evans, M. Pyne, C. Nordman **LeadResp:** Southeast

CES202.887 SOUTH-CENTRAL INTERIOR MESOPHYTIC FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Sideslope; Unglaciated; Eutrophic Soil; Broad-Leaved Deciduous Tree
National Mapping Codes: EVT 2321; ESLF 4127; ESP 1321
Concept Summary: These high-diversity, predominately deciduous forests occur on deep and enriched soils (in some cases due to, or enhanced by, the presence of limestone or related base-rich geology), in non-montane settings and usually in somewhat protected landscape positions such as coves or lower slopes. The core distribution of this system lies in the Cumberland and Allegheny plateaus, extending into the adjacent southern Ridge and Valley and portions of the Interior Low Plateau where it is located entirely south of the glacial boundary. Dominant species include *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Tilia americana, Quercus rubra, Magnolia acuminata,* and *Juglans nigra*. *Tsuga canadensis* may be a component of some stands. Trees may grow very large in undisturbed areas. The herb layer is very rich, often with abundant spring ephemerals. Many examples may be bisected by small streams.
Comments: Southern and Central Appalachian Cove Forest (CES202.373) (Ecoregions 51 and 59) is being treated as a separate system. The concept of this type (CES202.887) is more-or-less consistent with the "Mixed Mesophytic Communities" of both the Mixed Mesophytic Forest Region and the non-coastal plain portion of the Western Mesophytic Forest Region, extending north into unglaciated portions of the Beech-Maple Forest Region, of Braun (1950) and Greller (1988). There is much variability in different examples of this system across its range, with the composition of some occurrences in the escarpment of the Cumberland Plateau approaching that of examples of Southern and Central Appalachian Cove Forest (CES202.373). The Allegheny Front is adopted as the divide between these two similar systems: material to the west goes to this system, and material to the east goes to Southern and Central Appalachian Cove Forest (CES202.373). In limited areas of the region, some stands may contain hemlock (*Tsuga canadensis*). These are noteworthy on a local basis, as the tree is less well distributed in the range of this system than it is in corresponding environments at higher elevation in the Appalachians or to the north.

NERI Associations:
- Deciduous Tree / Great Laurel Forest (CEGL007543)
- Eastern Hemlock - Sweet Birch - Tuliptree / Great Laurel Forest (CEGL007543)
- Eastern Hemlock - Chestnut Oak / Catawba Rhododendron Forest (CEGL008524)
- Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222)
- Yellow Birch Cold Cove Forest (CEGL007861)
- Forest Seep (CEGL007853)
- Successional Tuliptree Forest (CEGL007220/7221)
- Successional Eastern White Pine Forest (CEGL007944)

DISTRIBUTION

Range: This system occurs in southeastern Ohio east to Virginia, West Virginia, Kentucky, Tennessee, Georgia, and Alabama, with disjunct occurrences in unglaciated southwestern

Pennsylvania and southwestern New York. This range is more-or-less consistent with the "Mixed Mesophytic" and "Western Mesophytic" (non-coastal plain portion only) forest regions of Braun (1950) and Greller (1988), although it does extend into unglaciated portions of the "Beech-Maple" region to the north. Thus, this system is most extensive in the Cumberland and Allegheny plateaus, as well as the unglaciated Interior Low Plateau, and becomes relatively limited in extent towards its western limit in the Ozark Hills of Illinois, and towards its northern limit in southwestern New York.. It is replaced in the Upper East Gulf Coastal Plain by other systems. Its range also includes the southern Ridge and Valley from Tennessee (and adjacent southwestern Virginia) to Alabama. Parts of the Cumberland Mountains (EPA 69 in Kentucky and Tennessee) are instead occupied by Southern and Central Appalachian Cove Forest (CES202.373). North-Central Interior Beech - Maple Forest (CES202.693) replaces this one in EPA 72b of Indiana.

Divisions: 202:C

TNC Ecoregions: 44:C, 49:C, 50:C, 60:C

Subnations: AL, GA, IL, IN, KY, NY, OH, PA, TN, VA, WV

Map Zones: 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C, 63:C

US EPA Ecoregions: 55:C, 55d:C, 67:C, 67f:C, 67g:C, 67h:C, 67i:C, 68:C, 68a:C, 68b:C, 68c:C, 68d:C, 68e:C, 68f:C, 69:C, 69d:C, 70:C, 70a:C, 70b:C, 70c:C, 70d:C, 70e:C, 70f:C, 70g:C, 70h:C, 71:C, 71a:C, 71b:C, 71c:C, 71d:C, 71e:C, 71f:C, 71g:C, 71h:C, 71i:C, 71j:C, 71k:C, 71l:C, 72:C, 72a:C, 72b:C, 72c:C, 72d:C, 72e:C, 72f:C, 72h:C

USFS Ecomap Regions: 211G:CC, 221E:CC, 221F:C?, 221H:CC, 223D:CC, 223E:CC, 223F:CC, 231C:CC, 231D:CC, M221C:CC

CONCEPT

Associations:

- *Acer saccharum - Carya ovata - Juglans nigra / Symphoricarpos orbiculatus / Galium circaezans* Forest (CEGL004741, G3G4)
- *Acer saccharum - Fraxinus americana - Tilia americana - Liriodendron tulipifera / Actaea racemosa* Forest (CEGL006237, G4?)
- *Acer saccharum - Liriodendron tulipifera - Fraxinus americana / Staphylea trifolia* Forest (CEGL006201, G4?)
- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411, G4?)
- *Fagus grandifolia - Liriodendron tulipifera / Euonymus americanus / Athyrium filix-femina* ssp. *asplenioides* Forest (CEGL007201, G4)
- *Fagus grandifolia - Quercus alba / Cornus florida* Forest (CEGL007881, G4)
- *Fagus grandifolia* Ridge and Valley Forest (CEGL007200, G3G4Q)
- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Liriodendron tulipifera - Tilia americana* var. *heterophylla - Aesculus flava - Acer saccharum /* (*Magnolia tripetala*) Forest (CEGL005222, G4?)
- *Liriodendron tulipifera /* (*Cercis canadensis*) */* (*Lindera benzoin*) Forest (CEGL007220, GNA)
- *Quercus alba -* (*Liriodendron tulipifera, Liquidambar styraciflua*) */ Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba -* (*Quercus rubra, Acer saccharum, Fagus grandifolia*) */ Aesculus flava* Forest (CEGL007233, G4)
- *Quercus alba - Fagus grandifolia / Hydrangea quercifolia - Viburnum acerifolium / Carex picta - Polystichum acrostichoides* Forest (CEGL007213, G3G4)

- *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144, GNR)
- *Quercus rubra - Acer saccharum - Tilia americana* var. *heterophylla - Aesculus flava -* (*Cladrastis kentukea*) Forest (CEGL007698, G3)
- *Quercus rubra - Tilia americana* var. *heterophylla - Carya carolinae-septentrionalis / Acer* (*barbatum, leucoderme*) */ Hydrangea quercifolia* Forest (CEGL008488, G2G3)
- *Tsuga canadensis -* (*Liriodendron tulipifera, Fagus grandifolia*) */* (*Magnolia macrophylla, Ilex opaca*) */ Polystichum acrostichoides* Forest (CEGL004767, G1G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)

High-ranked species: *Aconitum reclinatum* (G3), *Actaea rubifolia* (G3), *Aesculus parviflora* (G3), *Aneides aeneus* (G3G4), *Arabis patens* (G3), *Brachythecium rotaeanum* (G3G4), *Bryoerythrophyllum ferruginascens* (G3G4), *Calystegia catesbeiana* ssp. *sericata* (G3T3Q), *Canis rufus* (G1Q), *Cardamine clematitis* (G3), *Cardamine flagellifera* (G3), *Carex manhartii* (G3G4), *Carex radfordii* (G2), *Carex roanensis* (G2G3), *Catocala marmorata* (G3G4), *Clematis addisonii* (G2), *Collinsonia verticillata* (G3G4), *Delphinium alabamicum* (G2), *Desmognathus aeneus* (G3G4), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Desmognathus santeetlah* (G3G4Q), *Desmognathus wrighti* (G3G4), *Diervilla rivularis* (G3), *Drepanolejeunea appalachiana* (G2?), *Entodon sullivantii* (G3G4), *Euphorbia purpurea* (G3), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lophocolea appalachiana* (G1G2Q), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Megaceros aenigmaticus* (G2G3), *Metzgeria fruticulosa* (G2Q), *Metzgeria uncigera* (G3), *Microtus chrotorrhinus carolinensis* (G4T3), *Nesticus sheari* (G2?), *Neviusia alabamensis* (G2), *Panax quinquefolius* (G3G4), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila sharpii* (G2G4), *Plagiochila virginica* var. *virginica* (G3T3), *Plagiomnium carolinianum* (G3), *Platyhypnidium pringlei* (G2G3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon teyahalee* (G3), *Plethodon welleri* (G3), *Polymnia laevigata* (G3), *Prosartes maculata* (G3G4), *Riccardia jugata* (G2), *Schisandra glabra* (G3), *Scutellaria alabamensis* (G2), *Scutellaria pseudoserrata* (G3), *Scutellaria saxatilis* (G3), *Silene ovata* (G3), *Sorex palustris punctulatus* (G5T3), *Speyeria diana* (G3G4), *Thaspium pinnatifidum* (G2G3), *Trechus luculentus luculentus* (GHTH), *Trillium lancifolium* (G3), *Trillium rugelii* (G3), *Trillium simile* (G3), *Triphora trianthophora* (G3G4), *Viola appalachiensis* (G3), *Viola tripartita* var. *tripartita* (G5T3), *Virginia valeriae pulchra* (G5T3T4)

Environment: These high-diversity deciduous forests occur on deep and enriched soils, usually in somewhat protected landscape positions such as coves or lower slopes.

Vegetation: Dominant tree species include *Acer saccharum, Fagus grandifolia, Liriodendron tulipifera, Tilia americana, Quercus rubra, Magnolia acuminata*, and *Juglans nigra*. *Tsuga canadensis* may be a component of some stands. The herb layer is very rich, often with abundant spring ephemerals.

SPATIAL CHARACTERISTICS

Heterogeneity: Most stands are purely deciduous, but *Tsuga canadensis* may be a component in limited areas of the range.

Other Comments: This system is probably of limited extent in Georgia, restricted to the northwest corner of the state. Limited, disjunct occurrences of hemlock-dominated mesic stands in southern Indiana, western Kentucky (Shawnee Hills), central Tennessee, and Cumberland Alabama are placed here (i.e., in South-Central Interior Mesophytic Forest (CES202.887)).

Disjunct stands of rich mesophytic forest in unglaciated western New York and Pennsylvania are also placed here, although it is not entirely clear whether they rise to the level of system occurrences there as opposed to being small-patch inclusions in the oak or hemlock-hardwood matrix forests. The related Appalachian (Hemlock) - Northern Hardwood Forest (CES202.593) is found to the north and east.

SOURCES

References: Braun 1950, Comer et al. 2003, Edinger et al. 2002, Evans 1991, Greller 1988

Version: 20 Aug 2007 **Stakeholders:** East, Midwest, Southeast

Concept Author: M. Pyne and R. Evans **LeadResp:** Southeast

CES202.886 SOUTHERN APPALACHIAN OAK FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Unglaciated; Broad-Leaved Deciduous Tree; *Quercus* - *Carya*
National Mapping Codes: EVT 2315; ESLF 4121; ESP 1315
Concept Summary: This system consists of predominantly dry-mesic (to dry) forests occurring on open and exposed topography at lower to mid elevations in the Southern Blue Ridge and Southern Ridge and Valley ecoregions. This is the upland forest that characterizes much of the lower elevations of these areas. Substrates of stands included in this system can range from acidic to circumneutral or basic, and the vegetation varies accordingly. Bedrock may be of any type. Soils are usually deep residual soils but are often rocky. Some shallow soils and colluvium may be present locally within the group, but shallow soils tend to produce environments that are more extreme and have a larger component of various pine species. Typically, the vegetation consists of forests dominated by oaks, especially *Quercus prinus, Quercus alba, Quercus rubra, Quercus velutina*, and *Quercus coccinea*, with varying amounts of *Carya* spp., *Nyssa sylvatica, Acer rubrum*, and other species such as *Pinus strobus* and *Fraxinus americana*. Historically, *Castanea dentata* was a dominant or codominant in many of these communities until its virtual elimination by the chestnut blight fungus (*Cryphonectria parasitica*] during the early 1900s. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers of *Kalmia latifolia*, with *Rhododendron* spp. on more mesic sites. Some other areas have deciduous ericad layers, sometimes consisting of *Vaccinium* spp. or *Gaylussacia* spp. This system concept also includes many successional communities that have been impacted by logging or agriculture, such as types dominated by *Liriodendron tulipifera, Pinus* spp., and *Robinia pseudoacacia*. This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Most oaks are long-lived with typical age of mortality ranging from 200 to 400 years. Scarlet and black oaks are shorter lived with typical ages being approximately 50 to 100 years, while white oaks can live as long as 600 years.
Comments: This system is distinguished from the oak forests of the Piedmont by substantial floristic differences that probably are determined by biogeography as well as climate and topography. Compositional differences were more pronounced in the past, when *Castanea dentata* was a major species in this system and not in Piedmont oak forests. This system is distinguished from most other systems in its primary range by the canopy dominance of oaks (other than strong dominance by red oak) without a large component of yellow pines (*Pinus echinata, Pinus virginiana, Pinus pungens*) in the canopy. It shares those characteristics with Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359), which might be thought of as a subtype of this system on the more exposed and acidic substrates. The environment is intermediate within the region in topography and moisture. Northward this system grades into Northeastern Interior Dry - Mesic Oak Forest (CES202.592), which occurs in similar environmental conditions. This southern Appalachian system is characterized by the presence, in most occurrences, of plant species of southern Appalachian affinity, such as *Magnolia fraseri, Gaylussacia ursina, Rhododendron calendulaceum*, etc.

NERI Associations:
- Oak - Hickory Forest (CEGL007267)
- Oak - Hickory - Sugar Maple Forest (CEGL007268)
- Chinquapin Oak - Black Maple Forest (CEGL004793)
- Eastern Hemlock - Chestnut Oak / Catawaba Rhododendron Forest (CEGL008524)
- Forest Seep (CEGL007853)
- Successional Tuliptree Forest (CEGL007220/7221)
- Successional Eastern White Pine Forest (CEGL007944)

DISTRIBUTION

Range: This system ranges throughout the southern Appalachians, from northern Georgia and South Carolina north into the Southern Blue Ridge of Virginia to the Roanoke River in the Blue Ridge, and slightly farther south in the Ridge and Valley. It occurs in very limited montane outliers in the Piedmont, and possibly on Pine/Black mountain in Kentucky.
Divisions: 202:C
TNC Ecoregions: 50:C, 51:C, 52:C
Subnations: GA, KY, NC, SC, TN, VA, WV
Map Zones: 53:C, 57:C, 59:C, 61:P
USFS Ecomap Regions: 231Aa:CCC, M221C:CC, M221D:CC

CONCEPT

Associations:
- *Acer rubrum* var. *rubrum - Betula* (*alleghaniensis, lenta*) - *Magnolia fraseri /* (*Rhododendron maximum, Kalmia latifolia*) Forest (CEGL008558, GNA)
- *Pinus strobus - Quercus* (*coccinea, prinus*) */* (*Gaylussacia ursina, Vaccinium stamineum*) Forest (CEGL007519, G4)
- *Pinus strobus - Quercus alba* - (*Carya alba*) */ Gaylussacia ursina* Forest (CEGL007517, G3G4)
- *Quercus* (*prinus, coccinea*) */ Kalmia latifolia /* (*Galax urceolata, Gaultheria procumbens*) Forest (CEGL006271, G5)
- *Quercus alba - Quercus* (*rubra, prinus*) */ Rhododendron calendulaceum - Kalmia latifolia* - (*Gaylussacia ursina*) Forest (CEGL007230, G5)
- *Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum* Forest (CEGL007691, G2G3)
- *Quercus alba - Quercus falcata / Vaccinium* (*arboreum, hirsutum, pallidum*) Forest (CEGL008567, G3G4)
- *Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata* Forest (CEGL007692, G3)
- *Quercus alba / Kalmia latifolia* Forest (CEGL007295, G2Q)
- *Quercus muehlenbergii - Quercus* (*alba, rubra*) *- Carya cordiformis / Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus* - (*Quercus coccinea*) */ Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431, G4G5)
- *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267, G4G5)
- *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268, G4?)

- *Quercus prinus - Quercus rubra - Carya* spp. - *Fraxinus americana / Cercis canadensis / Solidago sphacelata* Forest (CEGL008549, G3?)
- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286, G4)
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522, G4?)
- *Quercus rubra - Acer rubrum / Pyrularia pubera / Thelypteris noveboracensis* Forest (CEGL006192, G4?)
- *Quercus rubra - Quercus muehlenbergii / Hamamelis virginiana / Polymnia canadensis* Forest (CEGL007215, G1Q)
- *Sassafras albidum - Quercus* spp. Forest (CEGL004096, G5)
- *Vitis aestivalis* Vine - Shrubland (CEGL003890, G2G3)

High-ranked species: *Aconitum reclinatum* (G3), *Arabis patens* (G3), *Buckleya distichophylla* (G2), *Callophrys irus* (G3), *Calystegia catesbeiana* ssp. *sericata* (G3T3Q), *Canis rufus* (G1Q), *Cardamine flagellifera* (G3), *Carex communis* var. *amplisquama* (G5T3), *Carex manhartii* (G3G4), *Carex polymorpha* (G3), *Catocala herodias gerhardi* (G3T3), *Catocala marmorata* (G3G4), *Collinsonia verticillata* (G3G4), *Coreopsis delphiniifolia* (G3?Q), *Coreopsis latifolia* (G3), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Desmognathus santeetlah* (G3G4Q), *Euphorbia purpurea* (G3), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Helianthus smithii* (G2Q), *Hexastylis contracta* (G3), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hypochilus coylei* (G3?), *Hypochilus sheari* (G2G3), *Isotria medeoloides* (G2), *Lysimachia fraseri* (G3), *Lytrosis permagnaria* (G3G4), *Microtus chrotorrhinus carolinensis* (G4T3), *Monotropsis odorata* (G3), *Panax quinquefolius* (G3G4), *Plagiochila virginica* var. *virginica* (G3T3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon shenandoah* (G1), *Plethodon teyahalee* (G3), *Plethodon welleri* (G3), *Prosartes maculata* (G3G4), *Pycnanthemum beadlei* (G2G4), *Pycnanthemum torrei* (G2), *Ruellia purshiana* (G3), *Sabatia capitata* (G2), *Sedum nevii* (G3), *Silene ovata* (G3), *Sisyrinchium dichotomum* (G2), *Sorex palustris punctulatus* (G5T3), *Speyeria diana* (G3G4), *Stygobromus* sp. 17 (G2), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Tortula ammonsiana* (G1), *Trillium rugelii* (G3), *Trillium simile* (G3), *Vaccinium hirsutum* (G3), *Viola appalachiensis* (G3), *Viola tripartita* var. *tripartita* (G5T3), *Virginia valeriae pulchra* (G5T3T4)

Environment: Occurs on open slopes, ridgetops, lower elevation peaks, and higher parts of broad valley bottoms, at low to moderate elevations. Bedrock may be of any type. Soils are usually deep residual soils, but are often rocky. Some shallow soils, colluvium, and other soils may be present locally within the system, but shallow soils tend to produce environments that are more extreme and have a larger component of *Pinus* spp. than this system. Moisture levels are intermediate for the region. Soil chemistry and topography are important determinants of different associations within the system. Topography, elevation, and soil depth are the most important factors separating this system from others.

Vegetation: Vegetation consists of forests dominated by *Quercus* species, most typically *Quercus prinus, Quercus alba,* and *Quercus coccinea*, with varying amounts of *Carya* spp., *Acer rubrum*, and other species. Less typical are stands dominated by other species, such as *Pinus strobus*, or other hardwood species. *Castanea dentata* was once dominant or codominant in many of these forests. Subcanopies and shrub layers are usually well-developed. Some

associations have dense evergreen shrub layers, while others have open shrub layers. Herbs, forbs and ferns are usually sparse to moderate in density.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Extreme wind or ice storms occasionally create larger canopy openings. Fire occurred fairly frequently in presettlement times, though there is some dispute whether most of the fires were natural or anthropogenic in origin (Abrams 1992, Delcourt and Delcourt 1997). Fires were usually low-intensity surface fires. The dominant species are fairly fire-tolerant, making most fires non-catastrophic. Fire may be important for favoring oak dominance over more mesophytic tree species within some of the topographic range of this system. Fire also can be expected to have a moderate effect on vegetation structure, producing a somewhat more open canopy and less dense understory and shrub layer than currently seen in most examples. Fire frequency or intensity may be important for determining the boundary between this system and both the more mesic and the drier systems. Virtually all examples have been strongly affected by the introduction of the chestnut blight, which killed all of the *Castanea dentata* trees, eliminating it as a canopy dominant. Past logging affected most occurrences by changing canopies to an even-aged, or more even-aged, structure. Extreme wind or ice storms occasionally create larger canopy openings. Virtually all examples have been strongly affected by introduction of chestnut blight, which killed all the American chestnut trees, eliminating it as a canopy dominant. The introduction, and now widespread establishment, of gypsy moth (*Lymantria dispar*) that favors oaks as food has also affected these forests by causing widespread mortality of overstory trees depending on topographic position and precipitation amounts around defoliation events. Past logging, and now lack of fire, has affected most occurrences by changing canopies to an even-aged, or more even-aged, structure with an understory of shade-tolerant but fire-intolerant species such as *Pinus strobus, Acer rubrum*, and *Acer pensylvanicum*. The removal of American chestnut from the overstory of these forests is thought to have benefited *Carya* spp., and their persistence and continued recruitment in contemporary oak-hickory forests may reflect fire exclusion in recent decades.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix system, covering a majority of the landscape over large areas.

Size: Occurs as a large-patch to matrix system. Contiguous bodies of tens of thousands of acres once occurred. The oak forests probably make up slightly more than 50% of the landscape in all but the higher elevations of the region. Size of existing occurrences may be strongly affected by separation distances for occurrences. A few remaining occurrences over 10,000 acres are probably present.

Heterogeneity: Though often contiguous, patches are virtually always convoluted and interfingered with other systems, especially Southern and Central Appalachian Cove Forest (CES202.373) and Southern Appalachian Low-Elevation Pine Forest (CES202.332). Small-patch systems such as rock outcrops are sometimes embedded within the system. Most occurrences are fairly homogeneous, with a single association covering large areas and seldom more than two or three associations present.

Adjacent Ecological System Comments: This system is almost always bordered by Southern and Central Appalachian Cove Forest (CES202.373) in more mesic sites. It is often bordered by Southern Appalachian Low-Elevation Pine Forest (CES202.332) on more exposed topography. It may grade into Central and Southern Appalachian Montane Oak Forest (CES202.596) at the highest elevations. Various rock outcrop systems may be present as embedded small patches.

Other Comments: There may be some inconsistencies in where this is mapped to and/or attributed to Kentucky, West Virginia, mapzone 53, mapzone 59, and Piedmont. In Kentucky, this system is restricted to the Cumberland Mountains in the extreme southeastern corner of the state (EPA Level IV Ecoregion 69e of Woods et al. (2002)).

SOURCES

References: Abrams 1992, Comer et al. 2003, Delcourt and Delcourt 1997, Woods et al. 2002

Version: 01 Oct 2007 **Stakeholders:** East, Southeast

Concept Author: M. Schafale, R. Evans, M. Pyne, R. White **LeadResp:** Southeast

CES202.036 CUMBERLAND RIVERSCOUR

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Woody Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Riverine / Alluvial; Graminoid; Short (<5 yrs) Flooding Interval; Riparian Mosaic
Concept Summary: Examples of this riverscour-influenced system may occur on high-gradient and very high-gradient streams in the gorges of the Cumberland Plateau, the Cumberland Mountains, and the more rugged parts of the Ridge and Valley in Kentucky, Tennessee, West Virginia, Alabama, and possibly in Georgia. The succession of woody plants (particularly trees) is retarded by the force of "flashy," high-velocity water traveling down the stream channels. This system may occur on flood-scoured acidic or calcareous bedrock, cobble, pebble, or sandbar substrates of sandstone, limestone, dolomite, and possibly other sedimentary and weakly metamorphosed geologies. The most distinctive parts of the system are dominated by perennial grasses, forbs, and low shrubs. In some areas, a riparian woodland composed of *Betula nigra* and *Platanus occidentalis* may be a component association, but trees are usually stunted, battered, and sparse. Grasses (typical of prairies) include *Andropogon gerardii, Sorghastrum nutans, Schizachyrium scoparium, Chasmanthium latifolium, Tripsacum dactyloides*, and/or *Panicum virgatum*. Forbs are diverse and variable from occurrence to occurrence, but can also include species with prairie affinities such as *Baptisia auatralis* and *Coreopteris tripteris*. Some common shrubs include *Alnus serrulata, Betula nigra, Cephalanthus occidentalis, Cornus amomum, Fothergilla major, Itea virginica, Salix caroliniana, Rhododendron arborescens, Toxicodendron radicans*, and *Juniperus virginiana* var. *virginiana*. This system is affected by flood-scouring in some areas and deposition in others. There is typically a gradient from dry, nutrient-poor conditions upslope to moist and relatively enriched conditions downslope. A variety of these conditions may exist at any one site. Some areas are prone to severe drought periods that may stress or kill some (particularly woody) vegetation. Flood-scouring is a powerful and ecologically important abrasive force along the riverbanks where this system is found.
Comments: Examples of the system are sometimes called "scoured riverbank prairies," "riverside prairies," "linear prairies," "rivershore grasslands," or "scoured riverine bluff prairie." River systems where it is found include the Cumberland and its tributaries, the Obed, the Obey, Chickasaw Creek (Tennessee), the Cahaba (Alabama), the New (West Virginia), the Red River Gorge (Kentucky), Rockcastle River (Kentucky), the Big South Fork of the Cumberland (Kentucky/Tennessee) and its tributaries, and others.
NERI Comments: At NERI the predominant Ecological System along the steep banks of the New River is the Cumberland Riverscour Ecological System. This system occurs where there are high-energy, steep-gradient, and narrow sections along the New River where there is no floodplain development, the landscape features are linear, and where scour, rapids, and white-water are characteristic. Occasional floodplain inclusions may be present, but are not common. The South-Central Interior Large Floodplain ecological system is mapped where true, broad, flat floodplain forms, often where tributaries feed into the New River, along meander bends, and in areas where the topography is considerably more gradual. The South-Central Interior Small

Stream and Riparian ecological system applies only to associations occurring along small streams and tributaries feeding into the New River and headwaters to these streams.

NERI Associations:

- Black Willow Slackwater Woodland (CEGL006463)
- Sycamore - River birch Riverscour Woodland (CEGL003725)
- American Water-willow Cobble Bar (CEGL004286)
- Riverscour Prairie (CEGL006283)
- Riverbank Tall Herbs (CEGL006480) and Riverbank Annuals (CEGL006483)
- Steep Riparian Edge (includes the above listed associations as one map class)
- Sycamore - Ash Floodplain Forest (CEGL006458) (floodplain inclusion)

DISTRIBUTION

Range: This system is found in the Cumberland Plateau, the Cumberland Mountains, and the more rugged parts of the Ridge and Valley, in Kentucky, Tennessee, West Virginia, and Alabama, and possibly in Georgia.

Divisions: 202:C

TNC Ecoregions: 50:C

Subnations: AL, GA?, KY, TN, WV

Map Zones: 48:C, 53:C

US EPA Ecoregions: 68:C, 68a:C, 68b:C, 68c:C, 68d:C, 68e:C, 68f:C, 69:C, 69a:C, 69b:C, 69c:C, 69d:C, 69e:C, 70:C, 70g:C

USFS Ecomap Regions: 211E:CC, 221H:CC, 231C:CC, M221C:CC

CONCEPT

Associations:

- (*Salix caroliniana, Rhododendron arborescens*) - *Andropogon gerardii - Baptisia australis* - (*Solidago simplex* var. *randii*) Herbaceous Vegetation (CEGL008471, G2?)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Hypericum densiflorum - Alnus serrulata / Jamesianthus alabamensis - Xyris tennesseensis* Shrubland (CEGL008494, G1G2)
- *Hypericum densiflorum - Alnus serrulata / Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Vallisneria americana* - (*Heteranthera dubia*) Riverine Herbaceous Vegetation (CEGL004333, G3G4)

High-ranked species: *Conradina verticillata* (G3), *Eurybia saxicastellii* (G1G2), *Eurycea junaluska* (G3), *Iliamna remota* (G1Q), *Liatris microcephala* (G3G4), *Lindernia saxicola* (G1?Q), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Myotis austroriparius* (G3G4), *Sida hermaphrodita* (G3), *Spiraea virginiana* (G2), *Vitis rupestris* (G3), *Xyris tennesseensis* (G2)

Environment: Examples may occur on high-gradient and very high-gradient streams in the gorges of the Cumberland Plateau, the Cumberland Mountains, and rugged parts of the Ridge

and Valley, in Kentucky, Tennessee, West Virginia, Alabama, and possibly in Georgia. The succession of woody plants (particularly trees) is retarded by the force of "flashy," high-velocity water traveling down the stream channels. This system may occur on flood-scoured acidic or calcareous bedrock, cobble, pebble, or sandbar substrates of sandstone, limestone, dolomite, and possibly other sedimentary and weakly metamorphosed geologies. It is presumably more extensive and better developed in materials derived from sandstone, where the erodibility creates more material circulating in the stream to create the sandbar/gravelbar areas where the system may occur in extensive patches, and where the extremely well-drained qualities of the coarse sediments further help to retard woody plant succession.

Vegetation: Examples of this system are typically dominated by shrubs, perennial grasses, and forbs. In some areas, a riparian woodland composed of *Betula nigra* and *Platanus occidentalis* may be a component association, but trees are usually stunted, battered, and sparse. Grasses (typical of prairies) include *Andropogon gerardii, Sorghastrum nutans, Schizachyrium scoparium, Chasmanthium latifolium, Tripsacum dactyloides,* and/or *Panicum virgatum*. Forbs are diverse and variable from occurrence to occurrence, but can also include species with prairie affinities such as *Baptisia auatralis* and *Coreopteris tripteris* . Some common shrubs include *Alnus serrulata, Betula nigra, Cephalanthus occidentalis, Cornus amomum, Fothergilla major, Itea virginica, Salix caroliniana, Rhododendron arborescens, Toxicodendron radicans,* and *Juniperus virginiana* var. *virginiana*. More southern examples may contain *Hydrangea quercifolia, Hypericum densiflorum,* and *Morella cerifera* (= *Myrica cerifera* var. *cerifera*). Other forbs include *Conoclinium coelestinum* (= *Eupatorium coelestinum*), *Coreopsis pubescens, Elephantopus carolinianus, Helenium autumnale, Hydrocotyle* sp., *Ludwigia leptocarpa, Lycopus* spp., *Orontium aquaticum, Osmunda regalis* var. *spectabilis, Oxypolis rigidior, Phlox carolina, Pityopsis graminifolia* var. *latifolia, Rhynchospora colorata* (= *Dichromena colorata*), *Rudbeckia laciniata,* and *Vernonia gigantea*. Patches of *Carex torta* may be present in some examples. Distinctive shoals with *Hymenocallis coronaria* and *Justicia americana* may be present as well. Some of these species are typical of prairies, and thrive in the well-lit environment.

Dynamics: This system is prone to flooding in the upper regions and deposition in the topographically lower areas. There is typically a gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. It is prone to severe drought periods that may stress or kill some vegetation. Flood scouring is a powerful and ecologically important abrasive force along the riverbanks where this system is found. Soils in sandstone areas are rapidly drained Psamments, and may be restricted to the narrow interstices of tightly packed boulders, or to small crevices in bedrock exposures. Within the system the various species are distributed patchily probably due to microsite conditions.

SOURCES

References: Bailey and Coe 2001, Comer et al. 2003, NatureServe Ecology - Southeastern U.S. unpubl. data

Version: 30 Jan 2009 **Stakeholders:** East, Midwest, Southeast

Concept Author: R. Evans, M. Pyne **LeadResp:** Southeast

CES202.705 SOUTH-CENTRAL INTERIOR LARGE FLOODPLAIN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This floodplain system is found in the Interior Highlands as far west as eastern Oklahoma, as well as throughout the Interior Low Plateau, Cumberlands, Southern Ridge and Valley, and Western Allegheny Plateau, and lower elevations of the Southern Blue Ridge. Examples occur along large rivers or streams where topography and alluvial processes have resulted in a well-developed floodplain. A single occurrence may extend from river's edge across the outermost extent of the floodplain or to where it meets a wet meadow or upland system. Many examples of this system will contain well-drained levees, terraces and stabilized bars, and some will include herbaceous sloughs and shrub wetlands resulting, in part, from beaver activity. A variety of soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates in combination with different flooding regimes that creates the mix of vegetation. Most areas, except for the montane alluvial forests, are inundated at some point each spring; microtopography determines how long the various habitats are inundated. Although vegetation is quite variable in this broadly defined system, examples may include *Acer saccharinum*, *Platanus occidentalis*, *Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed, but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.). This system likely floods at least once annually and can be altered by occasional severe floods. Impoundments and conversion to agriculture can also impact this system.
Comments: Montane alluvial forests may be difficult to place within this system because they share traits with both this system and Southern and Central Appalachian Cove Forest (CES202.373), at least in the southern Appalachians. This split from Central Appalachian River Floodplain (CES202.608) may appear somewhat arbitrary but is based on the freshwater systems classification, using roughly the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian River Floodplain (CES202.608) (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River).This system grades into Western Great Plains Floodplain (CES303.678) in the Crosstimbers region of east-central Oklahoma as eastern cottonwood (*Populus deltoides*) and willows (*Salix* spp.) become more dominant.
NERI Comments: At NERI the predominant Ecological System along the steep banks of the New River is the Cumberland Riverscour Ecological System. This system occurs where there are high-energy, steep-gradient, and narrow sections along the New River where there is no to little floodplain development, the landscape features are linear, and where scour, rapids, and white-water are characteristic. Occasional floodplain inclusions may be present, but are not common. The South-Central Interior Large Floodplain ecological system is mapped where true, broad, flat floodplain forms, often where tributaries feed into the New River, along meander bends, and areas where the topography is considerably more gradual. The South-Central Interior Small Stream and Riparian ecological system applies only to associations occurring along small streams and tributaries feeding into the New River and headwaters to these streams.

NERI Associations:

- Silver maple Floodplain Forest (CEGL002586)
- Oak - Tuliptree / Mountain Silverbell Floodplain Forest (CEGL006462)
- Successional Box Elder Floodplain Forest (CEGL005033)
- Sycamore - Ash Floodplain Forest (CEGL006458)
- Eastern Red cedar - Virginia Pine Flatrock Woodland (CEGL008449)
- Backwater Slough (CEGL007696, CEGL006483)
- Black Willow Slackwater Woodland (CEGL006463)
- Riverbank Tall Herbs (CEGL006480) and Riverbank Annuals (CEGL006483)

DISTRIBUTION

Range: This system ranges from the Ozarks, Arkansas River Valley, and Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau.
Divisions: 202:C, 205:C
TNC Ecoregions: 32:P, 37:C, 38:C, 39:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, AR, GA, IL, IN, KY, MO, NC, OH, OK, PA, SC?, TN, VA, WV
Map Zones: 32:P, 37:P, 38:?, 43:C, 44:C, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions:

CONCEPT

Associations:

- (*Diospyros virginiana, Platanus occidentalis*) / *Eupatorium serotinum - Diodia virginiana* Herbaceous Vegetation (CEGL003910, GNA)
- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer rubrum* var. *trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica* Forest (CEGL004420, G1)
- *Acer saccharinum - Betula nigra / Cephalanthus occidentalis* Forest (CEGL007810, G3Q)
- *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431, G3G4)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586, G4?)
- *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035, G2)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427, G4G5)
- *Fraxinus pennsylvanica - Ulmus crassifolia - Celtis laevigata* Forest (CEGL004618, GNR)
- *Hypericum densiflorum - Alnus serrulata / Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) / *Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Liquidambar styraciflua - Quercus michauxii - Carya laciniosa / Fagus grandifolia* - (*Aesculus flava*) Forest (CEGL007702, G2G3Q)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)

- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334, G4)
- *Platanus occidentalis - Betula nigra - Celtis laevigata - Fraxinus pennsylvanica / Arundinaria gigantea* Temporarily Flooded Forest (CEGL007999, G3?)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Fraxinus pennsylvanica - Quercus imbricaria* Forest (CEGL007339, G2Q)
- *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458, GNR)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Platanus occidentalis / Aesculus flava* Forest (CEGL006466, GNR)
- *Populus deltoides - Salix nigra* Forest (CEGL002018, G3G4)
- *Quercus* (*rubra, velutina, alba*) */ Carpinus caroliniana* - (*Halesia tetraptera*) */ Maianthemum racemosum* Forest (CEGL006462, GNR)
- *Quercus michauxii - Quercus shumardii - Liquidambar styraciflua / Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus nigra - Quercus* (*alba, phellos*) Forest (CEGL004979, G3?)
- *Quercus palustris* - (*Fraxinus nigra*) */ Lindera benzoin / Carex bromoides* Forest (CEGL007399, GNR)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda / Isoetes* spp. Forest (CEGL002101, G2G3)
- *Quercus phellos* - (*Quercus lyrata*) */ Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)
- *Quercus stellata - Quercus marilandica - Quercus falcata / Schizachyrium scoparium* Sand Woodland (CEGL002417, G2)
- *Quercus stellata /* (*Danthonia spicata, Croton willdenowii*) Woodland (CEGL005057, G1)
- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899, G4?)
- *Salix nigra* Forest (CEGL002103, G4)
- *Salix nigra* Large River Floodplain Forest (CEGL007410, G3G5)
- *Taxodium distichum / Lemna minor* Forest (CEGL002420, G4G5)
- Tennessee Valley Impoundment Mudflat Sparse Vegetation (CEGL004049, GNA)
- *Tsuga canadensis - Quercus rubra* - (*Platanus occidentalis, Betula nigra*) */ Rhododendron maximum / Anemone quinquefolia* Forest [Provisional] (CEGL006620, GNR)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Arabis georgiana* (G1), *Aspiromitus appalachianus* (G1), *Betula uber* (G1Q), *Canis rufus* (G1Q), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Diervilla rivularis* (G3), *Eurycea junaluska* (G3), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Myotis austroriparius* (G3G4), *Nardia lescurii* (G3?), *Nesticus* sp. 2 (G1G3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Potamogeton tennesseensis* (G2), *Sagittaria secundifolia* (G1), *Sorex palustris punctulatus* (G5T3), *Speyeria*

diana (G3G4), *Spiraea virginiana* (G2), *Thermopsis villosa* (G3?), *Trillium pusillum* (G3), *Vitis rupestris* (G3)

Environment: This system inhabits broad floodplains along large creeks and rivers that are usually inundated for at least part of each year.

Vegetation: Vegetation varies quite widely, encompassing shrubby and herbaceous communities, as well as forested communities with a wide array of canopy types. Examples may include *Acer saccharinum, Platanus occidentalis, Liquidambar styraciflua,* and *Quercus* spp. Understory species are mixed but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea,* and sedges (*Carex* spp.).

Dynamics: Flooding dynamics are an important factor in the development and maintenance of this system.

SPATIAL CHARACTERISTICS

Size: Examples can range in size from very small (<1 acre) to hundreds of acres in larger floodplain areas.

Other Comments: In the Southern Blue Ridge this system is of limited extent, in part due to alteration of riverine systems through impoundments and agricultural and residential development. In the Interior Low Plateau of Kentucky, this system is represented in the Ecoregions of Kentucky map (Woods et al. 2002) by the Wabash-Ohio bottomlands (72a) and by the Green River - Southern Wabash Lowlands (72c).

SOURCES

References: Comer et al. 2003, Evans 1991, Woods et al. 2002

Version: 17 Jan 2006 **Stakeholders:** East, Midwest, Southeast

Concept Author: S. Menard, M. Pyne, R. Evans, R. White **LeadResp:** Midwest

CES202.706 SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This system is found throughout the Interior Low Plateau, Southern Ridge and Valley, Western Allegheny Plateau, lower elevations of the Southern Blue Ridge, and parts of the Cumberlands. Examples occur along small streams and floodplains with low to moderately high gradients. There may be little to moderate floodplain development. Flooding and scouring both influence this system, and the nature of the landscape prevents the kind of floodplain development found on larger rivers. This system may contain cobble bars with adjacent wooded vegetation and rarely have any marsh development, except through occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include *Platanus occidentalis*, *Acer rubrum* var. *trilobum*, *Betula nigra*, *Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum*, *Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Comments: This system is closely related to Central Appalachian Stream and Riparian (CES202.609) but has been distinguished based on the precepts of the Freshwater Systems classification. This system has been divided from Central Appalachian Riparian roughly by the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian Riparian (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River). In contrast to floodplain systems, this system has little to no floodplain development. In comparison with South-Central Interior Large Floodplain (CES202.705), this system typically has somewhat higher gradients, is sometimes rocky, and may experience flash floods. Stands from somewhat larger rivers have been placed here if the river lacks substantial floodplain development (e.g., the New River of West Virginia and the Ocoee Gorge of Tennessee).
NERI Comments: At NERI the predominant Ecological System along the steep banks of the New River is the Cumberland Riverscour Ecological System. This system occurs where there are high-energy, steep-gradient, and narrow sections along the New River where there is no to little floodplain development, the landscape features are linear, and where scour, rapids, and white-water are characteristic. Occasional floodplain inclusions may be present, but are not common. The South-Central Interior Large Floodplain ecological system is mapped where true, broad, flat floodplain forms, often where tributaries feed into the New River, along meander bends, and areas where the topography is considerably more gradual. The South-Central Interior Small Stream and Riparian ecological system applies only to associations occurring along small streams and tributaries feeding into the New River and headwaters to these streams.
NERI Associations:

- Tributary floodplain forest (no equivalent USNVC association)
- Beaver influenced Wetland (CEGL003912, CEGL006464, CEGL006461, CEGL004510)
- Successional Tuliptree Forest (CEGL007221, CEGL007220)

- Forest Seep (CEGL007853)
- Steep Riparian Edge (on tributaries to the New River - see Cumberland Riverscour description for list of associations)
- Cobble (on tributaries to the New River)

DISTRIBUTION

Range: This system ranges from the Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau and portions of the Cumberlands. There would be limited and peripheral presence in the Upper East Gulf Coastal Plain.
Divisions: 202:C, 203:C
TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, GA, IL, IN, KY, NC, OH, PA, SC, TN, VA, WV
Map Zones: 46:P, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: information not available.

CONCEPT

Associations:
- (*Salix* spp.) / *Andropogon gerardii - Panicum virgatum - Salvia azurea* Cahaba Riverwash Herbaceous Vegetation (CEGL004149, G1)
- *Acer negundo* - (*Platanus occidentalis, Populus deltoides*) Forest (CEGL004690, G4)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum* var. *nudum / Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Alnus serrulata* Interior Shrubland (CEGL003894, G4?)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474, G4)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392, G2)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Fagus grandifolia - Quercus alba / Kalmia latifolia - Rhododendron canescens - Symplocos tinctoria* Forest (CEGL008551, G3?)
- *Fagus grandifolia - Quercus* spp. *- Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Juncus effusus - Chelone glabra - Scirpus* spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433, G4?)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)

- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) */ Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Orontium aquaticum* Permanently Flooded Herbaceous Vegetation (CEGL008480, G3G4)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696, G2G3?)
- *Pinus taeda - Liriodendron tulipifera / Lindera benzoin / Carex crinita* Forest (CEGL007546, GNA)
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Quercus stellata / Amelanchier stolonifera / Danthonia spicata / Leucobryum glaucum* Woodland (CEGL008449, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429, G4?)
- *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Polygonum* (*hydropiperoides, punctatum*) - *Leersia* spp. Herbaceous Vegetation (CEGL004290, G4?)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Vegetation (CEGL004725, G4?)
- *Quercus* (*alba, coccinea, falcata, velutina*) */ Kalmia latifolia* Temporarily Flooded Forest (CEGL004098, G4?)
- *Quercus alba* - (*Liriodendron tulipifera, Liquidambar styraciflua*) */ Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba - Carya* (*alba, ovata*) - *Liriodendron tulipifera* - (*Quercus phellos*) */ Cornus florida* Forest (CEGL007709, G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, G4)
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463, GNR)
- *Salix nigra - Platanus occidentalis* Forest (CEGL004626, G5)
- *Schizachyrium scoparium - Andropogon ternarius - Liatris microcephala* - (*Pityopsis ruthii*) Herbaceous Vegetation (CEGL008455, G2)
- *Schizachyrium scoparium - Schoenoplectus americanus - Juncus marginatus - Eupatorium serotinum* Herbaceous Vegetation (CEGL008496, G2)
- *Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143, G3)

· *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)
· *Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine - Shrubland (CEGL004620, GNA)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Cardamine longii* (G3), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Marshallia trinervia* (G3), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Pityopsis ruthii* (G1), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Speyeria diana* (G3G4), *Spiraea virginiana* (G2), *Trillium pusillum* (G3), *Trillium rugelii* (G3), *Vitis rupestris* (G3), *Waldsteinia lobata* (G2G3)
Environment: Found along fairly high-energy streams and rivers with steep banks, this system is subject to frequent flooding and can be subject to scouring depending upon the substrate.
Vegetation: There is wide variation in vegetation depending upon the frequency of the flooding cycle (more frequent flooding creates a better environment for forbs and shrubs, less frequent may create a better environment for the establishment of trees). Typical tree species may include *Platanus occidentalis, Acer rubrum* var. *trilobum, Betula nigra, Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum, Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Dynamics: Flooding and seed propagule dispersal caused by flooding events are the two most important processes affecting this system. The two processes vary widely depending upon size of stream, upstream land use and topography, presence or absence of invasive exotics that may displace native community types, etc.

SPATIAL CHARACTERISTICS

Spatial Summary: Small, linear patch.
Size: Can be quite long but never very wide.

SOURCES

References: Comer et al. 2003, Evans 1991
Version: 05 Jun 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S. Menard, M. Pyne, R. Evans, R. White, D. Faber-Langendoen **LeadResp:** Midwest

CES202.309 CUMBERLAND ACIDIC CLIFF AND ROCKHOUSE

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Barren
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland
Diagnostic Classifiers: Cliff (Substrate); Acidic Soil
Concept Summary: This sandstone cliff system is found in the Cumberland Plateau and Mountain regions of the southeastern United States. Examples are extremely steep or vertical rock faces exposed along bluffs often associated with rivers. Aspect is variable but best developed south and west. Plants are infrequent due to the lack of crevices capable of accumulating soil, the highly acidic nature of the bedrock, and the frequent weathering and erosion of the substrate. Lichen cover may be extensive in places, especially on the more exposed portions. These cliffs are also prone to harsh climatic conditions; frequent disturbances include drought stress and wind and storm damage. As a result, examples are characterized by sparse herbaceous cover and few, if any, trees. Vegetation consists of scattered individuals of *Asplenium montanum, Silene rotundifolia*, and other species rooted in crevices and erosion pockets. In some parts of its range, this system is the primary or sole habitat for rare endemic species, such as *Minuartia cumberlandensis* and *Ageratina luciae-brauniae*. This system includes a mosaic of cavelike features (often called "rockhouses") and associated sandstone box canyons in the western Appalachian foothills regions of Kentucky, Alabama, West Virginia, and possibly southeastern Ohio. Where present, the rockhouses are a prominent and diagnostic feature of the system.
Comments: It is unclear whether or not this system should range into the Interior Low Plateau. Also debatable is whether or not wet and dry cliffs should be included as well as the number of different physical settings possible. See also Southern Appalachian Montane Cliff and Talus (CES202.330).
NERI Associations:
· Cliff (Lichen and Sparse Vegetation - no equivalent USNVC association)

DISTRIBUTION

Range: This system occurs in a limited area of the Cumberland Plateau of northern Alabama, northwestern Georgia, eastern Kentucky, eastern Tennessee, West Virginia, and possibly southwestern Virginia. It may occur in southeastern Ohio (Rockhouse 349) and in western Pennsylvania.
Divisions: 202:C
TNC Ecoregions: 50:C
Subnations: AL, GA, KY, OH?, PA?, TN, VA?, WV
Map Zones: 46:C, 47:C, 48:C, 53:C, 57:C, 62:?
USFS Ecomap Regions:

CONCEPT

Associations:
· *Asplenium montanum - Heuchera parviflora* var. *parviflora - Silene rotundifolia* Sparse Vegetation (CEGL004392, G3G4)
· *Heuchera parviflora* var. *parviflora - Trichomanes boschianum - Thalictrum mirabile* - (*Ageratina luciae-brauniae, Solidago albopilosa*) Herbaceous Vegetation (CEGL004301, G2)

· *Osmunda cinnamomea - Rhynchospora capitellata - Thalictrum mirabile* Cumberland Seepage Cliff Herbaceous Vegetation (CEGL008432, G1G2Q)
· *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
· *Schizachyrium scoparium - Danthonia sericea - Liatris microcephala* - (*Eurybia surculosa*) Wooded Herbaceous Vegetation (CEGL004061, G3)

High-ranked species: *Aneides aeneus* (G3G4), *Canis rufus* (G1Q), *Carex misera* (G3), *Dodecatheon frenchii* (G3), *Fontigens tartarea* (G2), *Heuchera alba* (G2Q), *Homaliadelphus sharpii* (G3?), *Hymenophyllum tayloriae* (G2), *Krigia montana* (G3), *Liatris helleri* (G2), *Liatris microcephala* (G3G4), *Mannia californica* (G3?), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila eurphyllon* ssp. *echinata* (GNRT2), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plagiochila virginica* var. *virginica* (G3T3), *Porella japonica* ssp. *appalachiana* (G5?T1), *Radula sullivantii* (G3), *Radula voluta* (G3), *Scopelophila cataractae* (G3), *Sedum nevii* (G3), *Tetrodontium brownianum* (G3G4)

Environment: The rockhouses are the most unique and diagnostic feature of the system. These unusual geologic features are created by spray and rock-cracking from seasonal flowing waterfalls at the heads of canyons amidst thick layers of sandstone from the Pennsylvanian geologic period. The ceiling of the rockhouse may be 50 m tall, and they can be as much as 100 m deep (A. Weakley pers. comm. 2006). They require sufficient flowing water and freezing and thawing to weather the thick beds of sandstone. These conditions seem to be restricted to the western margin of the Appalachian Plateau.

Vegetation: Examples of this system usually include a vegetational mosaic that includes hemlock bluffs, sandstone cliffs, or overhangs near the base of a cliff (often with a sandy area beneath the overhang which is shaded and protected from direct rainfall, as well as gladelike vegetation at the horizontal portion of the cliffs). The rockhouses in the southern parts of the range are habitats for rare vascular plant species such as *Minuartia cumberlandensis* and *Ageratina luciae-brauniae* and sometimes support populations of rare nonvascular plants as well.

Other Comments: Examples with rockhouses sometimes support Woodland Period archeological sites. Human use and recreational disturbance are threats to easily accessible rockhouses. The range needs to be clarified, and concept resolved against CES202.689, CES202.330, and CES202.349.

SOURCES

References: Comer et al. 2003, Evans 1991, Weakley pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: R. Evans **LeadResp:** Southeast

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Appendix D. Ecological Systems Classification for Bluestone National Scenic River.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Bluestone National Scenic River

13 February 2009

by

NatureServe

1101 Wilson Blvd., 15th floor
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This subset of the International Ecological Classification Standard covers ecological systems attributed to Bluestone National Scenic River. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following Ecological systems were identified at Bluestone National Scenic River: Central Appalachian Dry Oak - Pine Forest, Central Appalachian Dry Oak - Pine Rocky Woodland, Southern Appalachian Oak Forest, Southern and Central Appalachian Cove Forest, South-Central Large Floodplain, and South-Central Small Stream and Riparian. Areas of the ecological systems, semi-natural, and cultural map classes at Bluestone National Scenic River are displayed in Table 1.

Table D1. Areas of the ecological systems, semi-natural, and cultural map classes at Bluestone National Scenic River.

Ecological System or Map Class	Hectares	Acres
Southern Appalachian Oak Forest	780.9	1,929.7
Central Appalachian Dry Oak - Pine Forest	592.2	1,463.4
Southern and Central Appalachian Cove Forest	327.9	810.2
South-Central Interior Large Floodplain	146.7	362.4
River	69.9	172.8
Central Appalachian Pine - Oak Rocky Woodland	28.1	69.5
Ruderal Upland - Old Field	20.4	50.5
South-Central Interior Small Stream and Riparian	15.3	37.7
Introduced Shrubland	11.8	29.1
Ruderal Forest - Northern and Central Hardwood and Conifer	10.6	26.3
Cultivated Crops	8.8	21.6
Powerline Right-of-Way	8.4	20.8
Urban/Suburban Built	6.2	15.3
Trail	5.5	13.7
Pasture/Hay	2.3	5.7
Creek	2.1	5.1
Total	2,037.1	5,033.8

CES202.591 CENTRAL APPALACHIAN DRY OAK - PINE FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2369; ESLF 4312; ESP 1369
Concept Summary: These oak and oak-pine forests cover large areas in the low- to mid-elevation Central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits. Soils are typically coarse and infertile; they may be deep (on glacial deposits in the northern and terrace deposits in the southern parts of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. The forest is mostly closed-canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus, Pinus virginiana,* and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory and often form a dense layer. Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida,* and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic. Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum*.
Comments: This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry - Mesic Oak Forest (CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak - Heath Forest (CES202.023). Its analog from central Virginia south is Southern Piedmont Dry Oak - (Pine) Forest (CES202.339), which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda*.
BLUE Associations:

- Oak - Eastern White Pine / Ericad Forest (CEGL008539)
- Eastern Hemlock - Chestnut Oak Forest (CEGL006923)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

DISTRIBUTION

Range: This system is found from central New England through Pennsylvania and south to the Roanoke River in southern Virginia. It is primarily Appalachian but overlaps slightly into the upper Piedmont and fall zone in Virginia, Maryland and the District of Columbia.
Divisions: 202:C
TNC Ecoregions: 52:C, 58:C, 59:C, 60:C, 61:C

Subnations: CT, DC, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV
Map Zones: 57:P, 60:C, 61:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 65:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 211I:CC, 221A:CC, 221B:CC, 221D:CC, 232A:CC, M221A:CC, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Bf:CCC, M221Da:CCC

CONCEPT

Associations:
- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162, GNR)
- *Castanea dentata - Quercus prinus* Forest (CEGL007196, GH)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Fagus grandifolia - Quercus* (*alba, velutina, prinus*) */ Kalmia latifolia* Forest (CEGL006919, G4)
- *Pinus rigida - Quercus* (*velutina, prinus*) Forest (CEGL006290, GNR)
- *Pinus strobus - Pinus resinosa - Pinus rigida* Forest (CEGL006259, G4G5)
- *Pinus strobus - Quercus* (*rubra, velutina*) *- Fagus grandifolia* Forest (CEGL006293, G5)
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539, G4)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) *- Betula lenta -* (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus* (*velutina, alba*) */ Vaccinium pallidum* High Allegheny Plateau, Western Allegheny Plateau Forest (CEGL006018, GNR)
- *Quercus alba - Quercus* (*coccinea, velutina, prinus*) */ Gaylussacia baccata* Forest (CEGL008521, G5)
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515, G4)
- *Quercus prinus* - (*Quercus coccinea, Quercus rubra*) */ Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299, G5)
- *Quercus prinus - Quercus* (*rubra, velutina*) */ Vaccinium angustifolium* Forest (CEGL006282, G5)
- *Quercus prinus - Quercus rubra / Vaccinium pallidum* - (*Rhododendron periclymenoides*) Forest (CEGL008523, G3G4)
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524, G3?)
- *Tsuga canadensis - Quercus prinus - Betula lenta* Forest (CEGL006923, G3)

Environment: These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. The soils are coarse and infertile; they may be deep (on glacial deposits in the northern part of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure

create dry conditions. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits.
Vegetation: Stands of this forest system are mostly closed-canopied but can include more open woodlands. They are dominated by a variable mixture of dry-site oak and pine species, including *Quercus prinus, Pinus virginiana,* and *Pinus strobus*. The system may include areas of pine forest and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic.
Dynamics: Disturbance agents include fire, windthrow, and ice damage.

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch (at outer range) to matrix (in center of range) system that may cover extensive hillslopes and low ridges.
Other Comments: In the Blue Ridge (EPA Level III Ecoregion 66), this extends south to the Roanoke River in central Virginia, where it is replaced by Southern Appalachian Oak Forest (CES202.886). In the northern Piedmont (EPA Level III Ecoregion 64), this extends south to Richmond, Virginia, where southward (i.e., in EPA Level III ecoregion 45) it is replaced by Southern Piedmont Dry Oak - (Pine) Forest (CES202.339). This corresponds closely to the line between USFS Sections 231I and 221D, with CES202.591 occurring in 221D and CES202.339 in 231I (SCG 7-07).

SOURCES

References: Comer et al. 2003
Version: 05 Feb 2009 **Stakeholders:** East, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

CES202.600 CENTRAL APPALACHIAN PINE - OAK ROCKY WOODLAND

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Shrubland (Shrub-dominated); Woody - Herbaceous; Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2377; ESLF 4320; ESP 1377
Concept Summary: This system encompasses open or sparsely wooded hilltops and outcrops or rocky slopes in the Central Appalachians, High Allegheny Plateau, and Lower New England / Northern Piedmont. It occurs mostly at lower elevations, but occasionally up to 1220 m (4000 feet) in West Virginia. The substrate rock is granitic or of other acidic lithology, including traprock in New England. The vegetation is patchy, with woodland as well as open portions. *Pinus rigida* and (within its range *Pinus virginiana* are diagnostic and often are mixed with xerophytic *Quercus* spp. and sprouts of *Castanea dentata*. Some areas have a fairly well-developed heath shrub layer, others a graminoid layer. Conditions are dry and nutrient-poor, and at many, if not most, sites, a history of fire is evident. In the Central Appalachians ecoregion, this system is sometimes found on sandy soils rather than rock.
Comments: The northern extent of this system in central New England may overlap with Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571), which has *Picea* spp. prominent. The southern extent overlaps with Southern Appalachian Montane Pine Forest and Woodland (CES202.331), which is characterized by *Pinus pungens*. This type is differentiated from the similar Central Appalachian Dry Oak - Pine Forest (CES202.591) by its mosaic nature of wooded and open patches, as opposed to being merely a "thin forest."
BLUE Associations:

- Virginia Pine - Oak Shale Woodland (CEGL008540)

DISTRIBUTION

Range: This system occurs from central New England south to Virginia and West Virginia, with peripheral occurrences in southeastern Ohio and easternmost Kentucky.
Divisions: 202:C
TNC Ecoregions: 49:C, 50:C, 52:C, 59:C, 60:C, 61:C, 64:C
Subnations: CT, KY, MA, MD?, ME, NH, NJ, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 57:P, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 58:C, 58a:C, 58b:C, 58c:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 60:C, 60a:C, 60b:C, 61:C, 61c:C, 62:C, 62a:C, 62b:C, 62c:C, 62d:C, 62e:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 69d:C, 69e:C, 70:C, 70a:C, 70b:C, 70c:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 221A:CC, 221B:CC, M211Bb:CCC, M211Bd:CCC, M211C:CC, M221A:CC, M221B:CP

CONCEPT

Associations:

- *Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland (CEGL006002, G2G3)
- *Kalmia latifolia - Gaylussacia baccata - Vaccinium* (*angustifolium, pallidum*) *- Menziesia pilosa* Shrubland (CEGL003939, G2)
- *Penstemon hirsutus* Sparse Vegetation (CEGL006535, GNR)
- *Photinia melanocarpa - Gaylussacia baccata / Carex pensylvanica* Shrubland (CEGL008508, G1?)
- *Pinus resinosa - Quercus rubra / Sibbaldiopsis tridentata / Danthonia compressa - Antennaria virginica / Rhytidium rugosum* Woodland (CEGL003766, G1)
- *Pinus resinosa / Menziesia pilosa / Polypodium appalachianum* Forest (CEGL006108, G1)
- *Pinus rigida - Gaylussacia baccata* Shrubland (CEGL006079, G1)
- *Pinus rigida - Quercus coccinea / Vaccinium angustifolium* Woodland (CEGL006557, GNR)
- *Pinus rigida /* (*Quercus ilicifolia*) */ Photinia melanocarpa / Deschampsia flexuosa* Woodland (CEGL006116, GNR)
- *Pinus rigida / Corema conradii* Woodland (CEGL006154, G2)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus ilicifolia - Prunus pumila* Shrubland (CEGL006121, GNR)
- *Quercus prinus - Pinus virginiana -* (*Pinus pungens*) */ Schizachyrium scoparium - Dichanthelium depauperatum* Woodland (CEGL008540, G3?)
- *Quercus prinus / Quercus ilicifolia / Danthonia spicata* Woodland [Provisional] (CEGL008526, G3?)
- *Quercus rubra -* (*Quercus prinus*) */ Vaccinium* spp. / *Deschampsia flexuosa* Woodland (CEGL006134, G3G5)
- *Quercus rubra - Quercus prinus - Pinus strobus / Penstemon hirsutus* Woodland (CEGL006074, G3G5)
- *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica / Cladonia* spp. Herbaceous Vegetation (CEGL006544, GNR)
- *Vaccinium* (*angustifolium, myrtilloides, pallidum*) Central Appalachian Dwarf-shrubland (CEGL003958, G4G5)
- *Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland (CEGL005094, GNR)

High-ranked species: *Arabis serotina* (G2), *Canis rufus* (G1Q), *Catocala herodias gerhardi* (G3T3), *Gaylussacia brachycera* (G3), *Malaxis bayardii* (G1G2), *Packera millefolia* (G2), *Pyrgus wyandot* (G1G2Q), *Taenidia montana* (G3), *Vaccinium hirsutum* (G3), *Virginia valeriae pulchra* (G5T3T4)

SOURCES

References: Comer et al. 2003, Fleming et al. 2005

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

CES202.886 SOUTHERN APPALACHIAN OAK FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Unglaciated; Broad-Leaved Deciduous Tree; *Quercus* - *Carya*
National Mapping Codes: EVT 2315; ESLF 4121; ESP 1315
Concept Summary: This system consists of predominantly dry-mesic (to dry) forests occurring on open and exposed topography at lower to mid elevations in the Southern Blue Ridge and Southern Ridge and Valley ecoregions. This is the upland forest that characterizes much of the lower elevations of these areas. Substrates of stands included in this system can range from acidic to circumneutral or basic, and the vegetation varies accordingly. Bedrock may be of any type. Soils are usually deep residual soils but are often rocky. Some shallow soils and colluvium may be present locally within the group, but shallow soils tend to produce environments that are more extreme and have a larger component of various pine species. Typically, the vegetation consists of forests dominated by oaks, especially *Quercus prinus, Quercus alba, Quercus rubra, Quercus velutina*, and *Quercus coccinea*, with varying amounts of *Carya* spp., *Nyssa sylvatica, Acer rubrum*, and other species such as *Pinus strobus* and *Fraxinus americana*. Historically, *Castanea dentata* was a dominant or codominant in many of these communities until its virtual elimination by the chestnut blight fungus (*Cryphonectria parasitica*] during the early 1900s. Some areas (usually on drier sites) now have dense evergreen ericaceous shrub layers of *Kalmia latifolia*, with *Rhododendron* spp. on more mesic sites. Some other areas have deciduous ericad layers, sometimes consisting of *Vaccinium* spp. or *Gaylussacia* spp. This system concept also includes many successional communities that have been impacted by logging or agriculture, such as types dominated by *Liriodendron tulipifera, Pinus* spp., and *Robinia pseudoacacia*. This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Most oaks are long-lived with typical age of mortality ranging from 200 to 400 years. Scarlet and black oaks are shorter lived with typical ages being approximately 50 to 100 years, while white oaks can live as long as 600 years.
Comments: This system is distinguished from the oak forests of the Piedmont by substantial floristic differences that probably are determined by biogeography as well as climate and topography. Compositional differences were more pronounced in the past, when *Castanea dentata* was a major species in this system and not in Piedmont oak forests. This system is distinguished from most other systems in its primary range by the canopy dominance of oaks (other than strong dominance by red oak) without a large component of yellow pines (*Pinus echinata, Pinus virginiana, Pinus pungens*) in the canopy. It shares those characteristics with Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359), which might be thought of as a subtype of this system on the more exposed and acidic substrates. The environment is intermediate within the region in topography and moisture. Northward this system grades into Northeastern Interior Dry - Mesic Oak Forest (CES202.592), which occurs in similar environmental conditions. This southern Appalachian system is characterized by the presence, in most occurrences, of plant species of southern Appalachian affinity, such as *Magnolia fraseri, Gaylussacia ursina, Rhododendron calendulaceum*, etc.

BLUE Associations:

- Oak - Hickory - Sugar Maple Forest (CEGL007268)
- Calcareous Oak Forest (CEGL004793)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

DISTRIBUTION

Range: This system ranges throughout the southern Appalachians, from northern Georgia and South Carolina north into the Southern Blue Ridge of Virginia to the Roanoke River in the Blue Ridge, and slightly farther south in the Ridge and Valley. It occurs in very limited montane outliers in the Piedmont, and possibly on Pine/Black mountain in Kentucky.
Divisions: 202:C
TNC Ecoregions: 50:C, 51:C, 52:C
Subnations: GA, KY, NC, SC, TN, VA, WV
Map Zones: 53:C, 57:C, 59:C, 61:P
USFS Ecomap Regions: 231Aa:CCC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer rubrum* var. *rubrum - Betula* (*alleghaniensis, lenta*) - *Magnolia fraseri /* (*Rhododendron maximum, Kalmia latifolia*) Forest (CEGL008558, GNA)
- *Pinus strobus - Quercus* (*coccinea, prinus*) */* (*Gaylussacia ursina, Vaccinium stamineum*) Forest (CEGL007519, G4)
- *Pinus strobus - Quercus alba* - (*Carya alba*) */ Gaylussacia ursina* Forest (CEGL007517, G3G4)
- *Quercus* (*prinus, coccinea*) */ Kalmia latifolia /* (*Galax urceolata, Gaultheria procumbens*) Forest (CEGL006271, G5)
- *Quercus alba - Quercus* (*rubra, prinus*) */ Rhododendron calendulaceum - Kalmia latifolia* - (*Gaylussacia ursina*) Forest (CEGL007230, G5)
- *Quercus alba - Quercus coccinea - Quercus falcata / Kalmia latifolia - Vaccinium pallidum* Forest (CEGL007691, G2G3)
- *Quercus alba - Quercus falcata / Vaccinium* (*arboreum, hirsutum, pallidum*) Forest (CEGL008567, G3G4)
- *Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana* var. *virginiana* Forest (CEGL007240, G4)
- *Quercus alba - Quercus rubra - Quercus prinus / Collinsonia canadensis - Podophyllum peltatum - Amphicarpaea bracteata* Forest (CEGL007692, G3)
- *Quercus alba / Kalmia latifolia* Forest (CEGL007295, G2Q)
- *Quercus muehlenbergii - Quercus* (*alba, rubra*) - *Carya cordiformis / Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus* - (*Quercus coccinea*) */ Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431, G4G5)
- *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum - Cornus florida* Forest (CEGL007267, G4G5)
- *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268, G4?)
- *Quercus prinus - Quercus rubra - Carya* spp. *- Fraxinus americana / Cercis canadensis / Solidago sphacelata* Forest (CEGL008549, G3?)

- *Quercus prinus - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (CEGL006286, G4)
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522, G4?)
- *Quercus rubra - Acer rubrum / Pyrularia pubera / Thelypteris noveboracensis* Forest (CEGL006192, G4?)
- *Quercus rubra - Quercus muehlenbergii / Hamamelis virginiana / Polymnia canadensis* Forest (CEGL007215, G1Q)
- *Sassafras albidum - Quercus* spp. Forest (CEGL004096, G5)
- *Vitis aestivalis* Vine - Shrubland (CEGL003890, G2G3)

High-ranked species: *Aconitum reclinatum* (G3), *Arabis patens* (G3), *Buckleya distichophylla* (G2), *Callophrys irus* (G3), *Calystegia catesbeiana* ssp. *sericata* (G3T3Q), *Canis rufus* (G1Q), *Cardamine flagellifera* (G3), *Carex communis* var. *amplisquama* (G5T3), *Carex manhartii* (G3G4), *Carex polymorpha* (G3), *Catocala herodias gerhardi* (G3T3), *Catocala marmorata* (G3G4), *Collinsonia verticillata* (G3G4), *Coreopsis delphiniifolia (*G3?Q), *Coreopsis latifolia* (G3), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Desmognathus santeetlah* (G3G4Q), *Euphorbia purpurea* (G3), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Helianthus smithii* (G2Q), *Hexastylis contracta* (G3), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hypochilus coylei* (G3?), *Hypochilus sheari* (G2G3), *Isotria medeoloides* (G2), *Lysimachia fraseri* (G3), *Lytrosis permagnaria* (G3G4), *Microtus chrotorrhinus carolinensis* (G4T3), *Monotropsis odorata* (G3), *Panax quinquefolius* (G3G4), *Plagiochila virginica* var. *virginica* (G3T3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon shenandoah* (G1), *Plethodon teyahalee* (G3), *Plethodon welleri* (G3), *Prosartes maculata* (G3G4), *Pycnanthemum beadlei* (G2G4), *Pycnanthemum torrei* (G2), *Ruellia purshiana* (G3), *Sabatia capitata* (G2), *Sedum nevii* (G3), *Silene ovata* (G3), *Sisyrinchium dichotomum* (G2), *Sorex palustris punctulatus* (G5T3), *Speyeria diana* (G3G4), *Stygobromus* sp. 17 (G2), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Tortula ammonsiana* (G1), *Trillium rugelii* (G3), *Trillium simile* (G3), *Vaccinium hirsutum* (G3), *Viola appalachiensis* (G3), *Viola tripartita* var. *tripartita* (G5T3), *Virginia valeriae pulchra* (G5T3T4)

Environment: Occurs on open slopes, ridgetops, lower elevation peaks, and higher parts of broad valley bottoms, at low to moderate elevations. Bedrock may be of any type. Soils are usually deep residual soils, but are often rocky. Some shallow soils, colluvium, and other soils may be present locally within the system, but shallow soils tend to produce environments that are more extreme and have a larger component of *Pinus* spp. than this system. Moisture levels are intermediate for the region. Soil chemistry and topography are important determinants of different associations within the system. Topography, elevation, and soil depth are the most important factors separating this system from others.

Vegetation: Vegetation consists of forests dominated by *Quercus* species, most typically *Quercus prinus, Quercus alba,* and *Quercus coccinea,* with varying amounts of *Carya* spp., *Acer rubrum,* and other species. Less typical are stands dominated by other species, such as *Pinus strobus,* or other hardwood species. *Castanea dentata* was once dominant or codominant in many of these forests. Subcanopies and shrub layers are usually well-developed. Some associations have dense evergreen shrub layers, while others have open shrub layers. Herbs, forbs and ferns are usually sparse to moderate in density.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration. Extreme wind or ice storms occasionally create larger canopy openings. Fire occurred fairly frequently in presettlement times, though there is some dispute whether most of the fires were natural or anthropogenic in origin (Abrams 1992, Delcourt and Delcourt 1997). Fires were usually low-intensity surface fires. The dominant species are fairly fire-tolerant, making most fires non-catastrophic. Fire may be important for favoring oak dominance over more mesophytic tree species within some of the topographic range of this system. Fire also can be expected to have a moderate effect on vegetation structure, producing a somewhat more open canopy and less dense understory and shrub layer than currently seen in most examples. Fire frequency or intensity may be important for determining the boundary between this system and both the more mesic and the drier systems. Virtually all examples have been strongly affected by the introduction of the chestnut blight, which killed all of the *Castanea dentata* trees, eliminating it as a canopy dominant. Past logging affected most occurrences by changing canopies to an even-aged, or more even-aged, structure. Extreme wind or ice storms occasionally create larger canopy openings. Virtually all examples have been strongly affected by introduction of chestnut blight, which killed all the American chestnut trees, eliminating it as a canopy dominant. The introduction, and now widespread establishment, of gypsy moth (*Lymantria dispar*) that favors oaks as food has also affected these forests by causing widespread mortality of overstory trees depending on topographic position and precipitation amounts around defoliation events. Past logging, and now lack of fire, has affected most occurrences by changing canopies to an even-aged, or more even-aged, structure with an understory of shade-tolerant but fire-intolerant species such as *Pinus strobus, Acer rubrum*, and *Acer pensylvanicum*. The removal of American chestnut from the overstory of these forests is thought to have benefited *Carya* spp., and their persistence and continued recruitment in contemporary oak-hickory forests may reflect fire exclusion in recent decades.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix system, covering a majority of the landscape over large areas.
Size: Occurs as a large-patch to matrix system. Contiguous bodies of tens of thousands of acres once occurred. The oak forests probably make up slightly more than 50% of the landscape in all but the higher elevations of the region. Size of existing occurrences may be strongly affected by separation distances for occurrences. A few remaining occurrences over 10,000 acres are probably present.
Heterogeneity: Though often contiguous, patches are virtually always convoluted and interfingered with other systems, especially Southern and Central Appalachian Cove Forest (CES202.373) and Southern Appalachian Low-Elevation Pine Forest (CES202.332). Small-patch systems such as rock outcrops are sometimes embedded within the system. Most occurrences are fairly homogeneous, with a single association covering large areas and seldom more than two or three associations present.
Adjacent Ecological System Comments: This system is almost always bordered by Southern and Central Appalachian Cove Forest (CES202.373) in more mesic sites. It is often bordered by Southern Appalachian Low-Elevation Pine Forest (CES202.332) on more exposed topography. It may grade into Central and Southern Appalachian Montane Oak Forest (CES202.596) at the highest elevations. Various rock outcrop systems may be present as embedded small patches.
Other Comments: There may be some inconsistencies in where this is mapped to and/or attributed to Kentucky, West Virginia, mapzone 53, mapzone 59, and Piedmont. In Kentucky,

this system is restricted to the Cumberland Mountains in the extreme southeastern corner of the state (EPA Level IV Ecoregion 69e of Woods et al. (2002)).

SOURCES

References: Abrams 1992, Comer et al. 2003, Delcourt and Delcourt 1997, Woods et al. 2002
Version: 01 Oct 2007 **Stakeholders:** East, Southeast
Concept Author: M. Schafale, R. Evans, M. Pyne, R. White **LeadResp:** Southeast

CES202.373 SOUTHERN AND CENTRAL APPALACHIAN COVE FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Broad-Leaved Tree
National Mapping Codes: EVT 2318; ESLF 4124; ESP 1318
Concept Summary: This system consists of mesophytic hardwood or hemlock-hardwood forests of sheltered topographic positions in the Southern Blue Ridge and central Appalachian Mountains. Examples are generally found on concave slopes that promote moist conditions. The system includes a mosaic of acidic and "rich" coves that may be distinguished by individual plant communities based on perceived differences in soil fertility and species richness (rich examples have higher diversity and density in the herbaceous layer). Both acidic and rich coves may occur in the same site, with the acidic coves potentially creeping out of the draw-up to at least midslope on well-protected north-facing slopes. Characteristic species in the canopy include *Aesculus flava, Acer saccharum, Fraxinus americana, Tilia americana, Liriodendron tulipifera, Halesia tetraptera, Tsuga canadensis, Fagus grandifolia, Magnolia acuminata,* and *Magnolia fraseri*.
Comments: This system is best distinguished from others in its range by the combination of sheltered topography, low elevation, and mesophytic flora with high species richness. Canopies can sometimes become depauperate after repeated logging. It is presently defined as not including rich, mesophytic "cove" forests of the Cumberland Plateau and Interior Low Plateau, even though some of these approach or exceed Appalachian examples in their species composition and or their "coveyness." This will be interpreted as variability within South-Central Interior Mesophytic Forest (CES202.887). The Allegheny Front is adopted as the divide between these two similar systems: material to the west goes to South-Central Interior Mesophytic Forest (CES202.887), and material to the east goes to this system.
BLUE Associations:

- Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222)
- Eastern Hemlock - American Basswood Forest (CEGL008407)
- Eastern Hemlock - Sweet Birch - Tuliptree / Great Laurel Forest (CEGL007543)
- Successional Eastern White Pine - Tuliptree Forest (CEGL007944)
- Successional Tuliptree / Northern Spicebush Forest (CEGL007220)

DISTRIBUTION

Range: This system occurs in the southern and central Appalachian Mountains, ranging into the Cumberland Mountains of Kentucky and Tennessee. This range is more-or-less consistent with the "Oak-Chestnut" forest region of Braun (1950) and Greller (1988), versus the "Mixed Mesophytic" and "Western Mesophytic" forest regions to the west.
Divisions: 202:C
TNC Ecoregions: 50:C, 51:C, 52:P, 59:C, 61:P
Subnations: GA, KY, MD, NC, SC, TN, VA, WV
Map Zones: 53:C, 57:C, 61:C, 62:C
US EPA Ecoregions: 66:C, 66a:C, 66b:C, 66c:C, 66d:C, 66e:C, 66f:C, 66g:C, 66i:C, 66j:C, 66k:C, 66l:C, 66m:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 69d:C, 69e:C

USFS Ecomap Regions: M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer* (*nigrum, saccharum*) - *Tilia americana / Asimina triloba / Jeffersonia diphylla - Caulophyllum thalictroides* Forest (CEGL008412, G4G5)
- *Acer saccharum - Fraxinus americana - Tilia americana - Liriodendron tulipifera / Actaea racemosa* Forest (CEGL006237, G4?)
- *Aesculus flava - Acer saccharum* - (*Fraxinus americana, Tilia americana* var. *heterophylla*) */ Hydrophyllum canadense - Solidago flexicaulis* Forest (CEGL007695, G3G4)
- *Betula alleghaniensis - Tilia americana* var. *heterophylla / Acer spicatum / Ribes cynosbati / Dryopteris marginalis* Forest (CEGL004982, G2G3)
- *Caltha palustris - Impatiens capensis - Viola cucullata* Herbaceous Vegetation [Provisional] (CEGL006258, GNR)
- *Diphylleia cymosa - Saxifraga micranthidifolia - Laportea canadensis* Herbaceous Vegetation (CEGL004296, G3)
- *Impatiens* (*capensis, pallida*) - *Monarda didyma - Rudbeckia laciniata* var. *humilis* Herbaceous Vegetation (CEGL004293, G3)
- *Liriodendron tulipifera - Aesculus flava* - (*Fraxinus americana, Tilia americana*) */ Actaea racemosa - Laportea canadensis* Forest (CEGL007710, G4)
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543, G5)
- *Liriodendron tulipifera - Quercus rubra - Magnolia acuminata / Cornus florida* Forest (CEGL008510, G5?)
- *Liriodendron tulipifera - Tilia americana* var. *heterophylla* - (*Aesculus flava*) */ Actaea racemosa* Forest (CEGL007291, G4?)
- *Pinus strobus - Tsuga canadensis / Rhododendron maximum* - (*Leucothoe fontanesiana*) Forest (CEGL007102, G4)
- *Quercus alba* - (*Quercus rubra, Acer saccharum, Fagus grandifolia*) */ Aesculus flava* Forest (CEGL007233, G4)
- *Quercus rubra - Tilia americana* var. *heterophylla - Halesia tetraptera* var. *monticola / Collinsonia canadensis - Tradescantia subaspera* Forest (CEGL007878, G3?)
- *Tilia americana* var. *heterophylla - Acer saccharum - Aesculus flava / Cystopteris bulbifera* Forest (CEGL006472, G3G4)
- *Tilia americana* var. *heterophylla - Fraxinus americana* - (*Ulmus rubra*) */ Sanguinaria canadensis* - (*Aquilegia canadensis, Asplenium rhizophyllum*) Forest (CEGL007711, G2G3)
- *Tsuga canadensis* - (*Fagus grandifolia, Tilia americana* var. *heterophylla*) */ Magnolia tripetala* Forest (CEGL008407, G4)
- *Tsuga canadensis - Halesia tetraptera* - (*Fagus grandifolia, Magnolia fraseri*) */ Rhododendron maximum / Dryopteris intermedia* Forest (CEGL007693, G2)
- *Tsuga canadensis - Quercus prinus - Liriodendron tulipifera / Kalmia latifolia* - (*Rhododendron catawbiense*) Forest (CEGL008512, G4)
- *Tsuga canadensis / Rhododendron maximum* - (*Clethra acuminata, Leucothoe fontanesiana*) Forest (CEGL007136, G3G4)

High-ranked species: *Aconitum reclinatum* (G3), *Actaea rubifolia* (G3), *Aneides aeneus* (G3G4), *Arabis patens* (G3), *Brachythecium rotaeanum* (G3G4), *Bryoerythrophyllum ferruginascens* (G3G4), *Calystegia catesbeiana* ssp. *sericata* (G3T3Q), *Canis rufus* (G1Q), *Cardamine clematitis* (G3), *Cardamine flagellifera* (G3), *Carex manhartii* (G3G4), *Carex radfordii* (G2), *Carex roanensis* (G2G3), *Catocala marmorata* (G3G4), *Clematis addisonii* (G2), *Collinsonia verticillata* (G3G4), *Delphinium alabamicum* (G2), *Desmognathus aeneus* (G3G4), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Desmognathus santeetlah* (G3G4Q), *Desmognathus wrighti* (G3G4), *Diervilla rivularis* (G3), *Drepanolejeunea appalachiana* (G2?), *Entodon sullivantii* (G3G4), *Euphorbia purpurea* (G3), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lophocolea appalachiana* (G1G2Q), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Megaceros aenigmaticus* (G2G3), *Metzgeria fruticulosa* (G2Q), *Metzgeria uncigera* (G3), *Microtus chrotorrhinus carolinensis* (G4T3), *Nesticus sheari* (G2?), *Neviusia alabamensis* (G2), *Panax quinquefolius* (G3G4), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila sharpii* (G2G4), *Plagiochila virginica* var. *virginica* (G3T3), *Plagiomnium carolinianum* (G3), *Platyhypnidium pringlei* (G2G3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon teyahalee* (G3), *Plethodon welleri* (G3), *Polymnia laevigata* (G3), *Prosartes maculata* (G3G4), *Riccardia jugata* (G2), *Schisandra glabra* (G3), *Scutellaria alabamensis* (G2), *Scutellaria pseudoserrata* (G3), *Scutellaria saxatilis* (G3), *Silene ovata* (G3), *Sorex palustris punctulatus* (G5T3), *Speyeria diana* (G3G4), *Thaspium pinnatifidum* (G2G3), *Trechus luculentus luculentus* (GHTH), *Trillium lancifolium* (G3), *Trillium rugelii* (G3), *Trillium simile* (G3), *Triphora trianthophora* (G3G4), *Viola appalachiensis* (G3), *Viola tripartita* var. *tripartita* (G5T3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs below 1525 m (5000 feet) elevation and generally below 1375 m (4500 feet) in low topographic positions such as valley bottoms and ravines. This cove type has two primary components, an acidic cove of lower soil fertility that ranges from the lowest slope positions up the slope on north-facing protected slopes, and a rich, high-fertility cove forest that tends to occur only at the lowest slope positions. Both are sheltered from wind and may be shaded by topography, promoting moist conditions. Local slopes are usually concave. Bedrock may be of virtually any type. Acidic rocks, such as felsic igneous and metamorphic rocks, support rich cove forests in a more limited range of sites than do basic rocks, such as mafic metamorphic rocks or marble. Soils may be rocky or fine-textured, and may be residual, alluvial, or colluvial. In the southern Appalachians, the hemlock "phase" of this ("acidic cove forest") often occurs between "richer" examples of Southern and Central Appalachian Cove Forest (CES202.373) in the lowest areas and Southern Appalachian Oak Forest (CES202.886) on the midslopes.
Vegetation: Vegetation consists of forests dominated by various combinations of mesophytic species, usually with many different species of primarily deciduous trees present. *Liriodendron tulipifera, Tilia americana, Tilia americana* var. *heterophylla, Fraxinus americana, Aesculus flava, Betula lenta, Magnolia acuminata, Magnolia fraseri, Halesia tetraptera, Prunus serotina,* and *Tsuga canadensis* are the most frequent dominant canopy species. Canopies are generally very diverse, with all species potentially occurring in one 20x50-meter plot in rich cove areas. A well-developed herb layer, often very dense and usually high in species richness, is present in all but the acid coves. Well-developed and fairly diverse subcanopy and shrub layers are often also present in all but the acid coves. Ulrey (1999) listed *Caulophyllum thalictroides, Actaea racemosa* (*= Cimicifuga racemosa*), *Laportea canadensis, Osmorhiza claytonii, Sanguinaria*

canadensis, Viola canadensis, Acer saccharum, Aesculus flava, Carya cordiformis, and *Tilia americana* var. *heterophylla* as characteristic species.

Dynamics: This system is naturally dominated by stable, uneven-aged forests, with canopy dynamics dominated by gap-phase regeneration on a fine scale. Occasional extreme wind or ice events may disturb larger patches. Natural fire dynamics are not well-known and probably only occurred in years that were extremely dry. Fires may have occurred at moderate frequency but were probably usually low enough in intensity to have only limited effects. Most of the component species are among the less fire-tolerant in the region.

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch system commonly occurring in a landscape mosaic with several other systems.

Size: Most individual patches are tens to sometimes a few hundred acres. Because it frequently occurs in mosaics with other systems, separation distance for occurrences has a strong effect on the size of occurrences. Complexes of thousands of acres of this system are possible.

Heterogeneity: Patches usually occur in a mosaic with other systems, sometimes as complexes of patches, often as branching linear bodies following valleys. Small-patch systems are occasionally embedded. Within the system, most occurrences are homogeneous, with only a single association, occasionally two, present.

Adjacent Ecological System Comments: This system is usually bordered by Southern Appalachian Oak Forest (CES202.886) in the Southern Blue Ridge. The border with adjacent systems is gradational. It may also contain small embedded patches of Southern Appalachian Montane Cliff and Talus (CES202.330) or other small-patch systems. In the southern Appalachians, the "richer" phase of Southern and Central Appalachian Cove Forest (CES202.373) occurs downslope from the hemlock "phase" ("acidic cove forests") and tends to be more mesic and more species-rich than the hemlock-dominated areas. Southern Appalachian Oak Forest (CES202.886) occurs upslope from this system and tends to be drier and even less diverse than the hemlock areas, which may grade into Southern Appalachian Low-Elevation Pine Forest (CES202.332) in especially dry occurrences.

SOURCES

References: Comer et al. 2003, Ulrey 1999

Version: 23 Jul 2007 **Stakeholders:** East, Southeast

Concept Author: M. Schafale, M. Pyne, R. White, R. Evans **LeadResp:** Southeast

CES202.705 SOUTH-CENTRAL INTERIOR LARGE FLOODPLAIN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This floodplain system is found in the Interior Highlands as far west as eastern Oklahoma, as well as throughout the Interior Low Plateau, Cumberlands, Southern Ridge and Valley, and Western Allegheny Plateau, and lower elevations of the Southern Blue Ridge. Examples occur along large rivers or streams where topography and alluvial processes have resulted in a well-developed floodplain. A single occurrence may extend from river's edge across the outermost extent of the floodplain or to where it meets a wet meadow or upland system. Many examples of this system will contain well-drained levees, terraces and stabilized bars, and some will include herbaceous sloughs and shrub wetlands resulting, in part, from beaver activity. A variety of soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates in combination with different flooding regimes that creates the mix of vegetation. Most areas, except for the montane alluvial forests, are inundated at some point each spring; microtopography determines how long the various habitats are inundated. Although vegetation is quite variable in this broadly defined system, examples may include *Acer saccharinum*, *Platanus occidentalis*, *Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed, but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.). This system likely floods at least once annually and can be altered by occasional severe floods. Impoundments and conversion to agriculture can also impact this system.
Comments: Montane alluvial forests may be difficult to place within this system because they share traits with both this system and Southern and Central Appalachian Cove Forest (CES202.373), at least in the southern Appalachians. This split from Central Appalachian River Floodplain (CES202.608) may appear somewhat arbitrary but is based on the freshwater systems classification, using roughly the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian River Floodplain (CES202.608) (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River).This system grades into Western Great Plains Floodplain (CES303.678) in the Crosstimbers region of east-central Oklahoma as eastern cottonwood (*Populus deltoides*) and willows (*Salix* spp.) become more dominant.
BLUE Comments: Bluestone National Scenic River has more floodplain vegetation associations occurring on broad, flat, low-gradient terraces along the river's edge so most associations were attributed to the South-Central Floodplain ecological system. There are some associations more typical of riparian settings included in the attribution to the South-Central Floodplain ecological system to prevent conceptual fragmentation of ecological systems along the main river course. Riparian associations occurring along higher-gradient smaller streams and tributaries to the Blue River that are depicted with narrow and/or linear polygons were attributed to the South-Central Small Stream and Riparian ecological system.
BLUE Associations:

- River Birch Backwater Floodplain Forest (CEGL002086)
- Oak - Hickory Floodplain Forest (CEGL006462)
- Riverbank Tall Herbs (CEGL006480)

- Sycamore - Ash Floodplain Forest (CEGL006458)
- Sycamore - Yellow Buckeye Floodplain Forest (CEGL005222)
- Eastern Hemlock Floodplain Forest (CEGL006620)
- Successional Box-elder Floodplain Forest (CEGL005033)
- Successional Black Walnut Floodplain Forest (CEGL007879)
- Sycamore - River Birch Riverscour Woodland (CEGL003725)
- Floodplain Forest and Woodland (lumped map class of all the above)
- Modified successional floodplain forest and woodland (CEGL006599)

DISTRIBUTION

Range: This system ranges from the Ozarks, Arkansas River Valley, and Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau.
Divisions: 202:C, 205:C
TNC Ecoregions: 32:P, 37:C, 38:C, 39:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, AR, GA, IL, IN, KY, MO, NC, OH, OK, PA, SC?, TN, VA, WV
Map Zones: 32:P, 37:P, 38:?, 43:C, 44:C, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:
- (*Diospyros virginiana, Platanus occidentalis*) / *Eupatorium serotinum - Diodia virginiana* Herbaceous Vegetation (CEGL003910, GNA)
- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer rubrum* var. *trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica* Forest (CEGL004420, G1)
- *Acer saccharinum - Betula nigra / Cephalanthus occidentalis* Forest (CEGL007810, G3Q)
- *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431, G3G4)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586, G4?)
- *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035, G2)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427, G4G5)
- *Fraxinus pennsylvanica - Ulmus crassifolia - Celtis laevigata* Forest (CEGL004618, GNR)
- *Hypericum densiflorum - Alnus serrulata / Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) / *Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Liquidambar styraciflua - Quercus michauxii - Carya laciniosa / Fagus grandifolia* - (*Aesculus flava*) Forest (CEGL007702, G2G3Q)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)

- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334, G4)
- *Platanus occidentalis - Betula nigra - Celtis laevigata - Fraxinus pennsylvanica / Arundinaria gigantea* Temporarily Flooded Forest (CEGL007999, G3?)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Fraxinus pennsylvanica - Quercus imbricaria* Forest (CEGL007339, G2Q)
- *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458, GNR)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Platanus occidentalis / Aesculus flava* Forest (CEGL006466, GNR)
- *Populus deltoides - Salix nigra* Forest (CEGL002018, G3G4)
- *Quercus* (*rubra, velutina, alba*) */ Carpinus caroliniana* - (*Halesia tetraptera*) */ Maianthemum racemosum* Forest (CEGL006462, GNR)
- *Quercus michauxii - Quercus shumardii - Liquidambar styraciflua / Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus nigra - Quercus* (*alba, phellos*) Forest (CEGL004979, G3?)
- *Quercus palustris* - (*Fraxinus nigra*) */ Lindera benzoin / Carex bromoides* Forest (CEGL007399, GNR)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda / Isoetes* spp. Forest (CEGL002101, G2G3)
- *Quercus phellos* - (*Quercus lyrata*) */ Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)
- *Quercus stellata - Quercus marilandica - Quercus falcata / Schizachyrium scoparium* Sand Woodland (CEGL002417, G2)
- *Quercus stellata /* (*Danthonia spicata, Croton willdenowii*) Woodland (CEGL005057, G1)
- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899, G4?)
- *Salix nigra* Forest (CEGL002103, G4)
- *Salix nigra* Large River Floodplain Forest (CEGL007410, G3G5)
- *Taxodium distichum / Lemna minor* Forest (CEGL002420, G4G5)
- Tennessee Valley Impoundment Mudflat Sparse Vegetation (CEGL004049, GNA)
- *Tsuga canadensis - Quercus rubra* - (*Platanus occidentalis, Betula nigra*) */ Rhododendron maximum / Anemone quinquefolia* Forest [Provisional] (CEGL006620, GNR)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Arabis georgiana* (G1), *Aspiromitus appalachianus* (G1), *Betula ube*r (G1Q), *Canis rufus* (G1Q), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Diervilla rivularis* (G3), *Eurycea junaluska* (G3), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Myotis austroriparius* (G3G4), *Nardia lescurii* (G3?), *Nesticus* sp. 2 (G1G3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Potamogeton tennesseensis* (G2), *Sagittaria secundifolia* (G1), *Sorex palustris punctulatus* (G5T3), *Speyeria*

diana (G3G4), *Spiraea virginiana* (G2), *Thermopsis villosa* (G3?), *Trillium pusillum* (G3), *Vitis rupestris* (G3)

Environment: This system inhabits broad floodplains along large creeks and rivers that are usually inundated for at least part of each year.

Vegetation: Vegetation varies quite widely, encompassing shrubby and herbaceous communities, as well as forested communities with a wide array of canopy types. Examples may include *Acer saccharinum, Platanus occidentalis, Liquidambar styraciflua,* and *Quercus* spp. Understory species are mixed but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea,* and sedges (*Carex* spp.).

Dynamics: Flooding dynamics are an important factor in the development and maintenance of this system.

SPATIAL CHARACTERISTICS

Size: Examples can range in size from very small (<1 acre) to hundreds of acres in larger floodplain areas.

Other Comments: In the Southern Blue Ridge this system is of limited extent, in part due to alteration of riverine systems through impoundments and agricultural and residential development. In the Interior Low Plateau of Kentucky, this system is represented in the Ecoregions of Kentucky map (Woods et al. 2002) by the Wabash-Ohio bottomlands (72a) and by the Green River-Southern Wabash Lowlands (72c).

SOURCES

References: Comer et al. 2003, Evans 1991, Woods et al. 2002

Version: 17 Jan 2006 **Stakeholders:** East, Midwest, Southeast

Concept Author: S. Menard, M. Pyne, R. Evans, R. White **LeadResp:** Midwest

CES202.706 SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This system is found throughout the Interior Low Plateau, Southern Ridge and Valley, Western Allegheny Plateau, lower elevations of the Southern Blue Ridge, and parts of the Cumberlands. Examples occur along small streams and floodplains with low to moderately high gradients. There may be little to moderate floodplain development. Flooding and scouring both influence this system, and the nature of the landscape prevents the kind of floodplain development found on larger rivers. This system may contain cobble bars with adjacent wooded vegetation and rarely have any marsh development, except through occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include *Platanus occidentalis, Acer rubrum* var. *trilobum, Betula nigra, Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum, Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Comments: This system is closely related to Central Appalachian Stream and Riparian (CES202.609) but has been distinguished based on the precepts of the Freshwater Systems classification. This system has been divided from Central Appalachian Riparian roughly by the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian Riparian (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River). In contrast to floodplain systems, this system has little to no floodplain development. In comparison with South-Central Interior Large Floodplain (CES202.705), this system typically has somewhat higher gradients, is sometimes rocky, and may experience flash floods. Stands from somewhat larger rivers have been placed here if the river lacks substantial floodplain development (e.g., the New River of West Virginia and the Ocoee Gorge of Tennessee).
BLUE Comments: Bluestone National Scenic River has more floodplain vegetation associations occurring on broad, flat, low-gradient terraces along the river's edge so most associations were attributed to the South-Central Floodplain ecological system. There are some associations more typical of riparian settings included in the attribution to the South-Central Floodplain ecological system to prevent conceptual fragmentation of ecological systems along the main river course. Riparian associations occurring along higher-gradient smaller streams and tributaries to the Blue River that are depicted with narrow and/or linear polygons were attributed to the South-Central Small Stream and Riparian ecological system.
BLUE Associations:

- Eastern Hemlock Floodplain Forest (CEGL006620)
- Floodplain Forest and Woodland (see comment in South-Central Interior Large Floodplain description regarding component associations)
- Modified successional Floodplain Forest (CEGL006599)

DISTRIBUTION

Range: This system ranges from the Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau and portions of the Cumberlands. There would be limited and peripheral presence in the Upper East Gulf Coastal Plain.
Divisions: 202:C, 203:C
TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, GA, IL, IN, KY, NC, OH, PA, SC, TN, VA, WV
Map Zones: 46:P, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:

- (*Salix* spp.) / *Andropogon gerardii - Panicum virgatum - Salvia azurea* Cahaba Riverwash Herbaceous Vegetation (CEGL004149, G1)
- *Acer negundo* - (*Platanus occidentalis, Populus deltoides*) Forest (CEGL004690, G4)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum* var. *nudum / Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Alnus serrulata* Interior Shrubland (CEGL003894, G4?)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474, G4)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392, G2)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Fagus grandifolia - Quercus alba / Kalmia latifolia - Rhododendron canescens - Symplocos tinctoria* Forest (CEGL008551, G3?)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Juncus effusus - Chelone glabra - Scirpus* spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433, G4?)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)

- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) */ Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Orontium aquaticum* Permanently Flooded Herbaceous Vegetation (CEGL008480, G3G4)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696, G2G3?)
- *Pinus taeda - Liriodendron tulipifera / Lindera benzoin / Carex crinita* Forest (CEGL007546, GNA)
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Quercus stellata / Amelanchier stolonifera / Danthonia spicata / Leucobryum glaucum* Woodland (CEGL008449, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429, G4?)
- *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Polygonum* (*hydropiperoides, punctatum*) - *Leersia* spp. Herbaceous Vegetation (CEGL004290, G4?)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Vegetation (CEGL004725, G4?)
- *Quercus* (*alba, coccinea, falcata, velutina*) */ Kalmia latifolia* Temporarily Flooded Forest (CEGL004098, G4?)
- *Quercus alba* - (*Liriodendron tulipifera, Liquidambar styraciflua*) */ Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba - Carya* (*alba, ovata*) - *Liriodendron tulipifera* - (*Quercus phellos*) */ Cornus florida* Forest (CEGL007709, G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, G4)
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463, GNR)
- *Salix nigra - Platanus occidentalis* Forest (CEGL004626, G5)
- *Schizachyrium scoparium - Andropogon ternarius - Liatris microcephala* - (*Pityopsis ruthii*) Herbaceous Vegetation (CEGL008455, G2)
- *Schizachyrium scoparium - Schoenoplectus americanus - Juncus marginatus - Eupatorium serotinum* Herbaceous Vegetation (CEGL008496, G2)
- *Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143, G3)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

· *Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine-Shrubland (CEGL004620, GNA)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Cardamine longii* (G3), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Marshallia trinervia* (G3), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Pityopsis ruthii* (G1), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Speyeria diana* (G3G4), *Spiraea virginiana* (G2), *Trillium pusillum* (G3), *Trillium rugelii* (G3), *Vitis rupestris* (G3), *Waldsteinia lobata* (G2G3)
Environment: Found along fairly high-energy streams and rivers with steep banks, this system is subject to frequent flooding and can be subject to scouring depending upon the substrate.
Vegetation: There is wide variation in vegetation depending upon the frequency of the flooding cycle (more frequent flooding creates a better environment for forbs and shrubs, less frequent may create a better environment for the establishment of trees). Typical tree species may include *Platanus occidentalis, Acer rubrum* var. *trilobum, Betula nigra, Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum, Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Dynamics: Flooding and seed propagule dispersal caused by flooding events are the two most important processes affecting this system. The two processes vary widely depending upon size of stream, upstream land use and topography, presence or absence of invasive exotics that may displace native community types, etc.

SPATIAL CHARACTERISTICS

Spatial Summary: Small, linear patch.
Size: Can be quite long but never very wide.

SOURCES

References: Comer et al. 2003, Evans 1991
Version: 05 Jun 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S. Menard, M. Pyne, R. Evans, R. White, D. Faber-Langendoen **LeadResp:** Midwest

Bibliography for BLUE systems (element references)

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Appendix E. Ecological Systems Classification for Allegheny Portage Railroad National Historic Site.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Allegheny Portage Railroad National Historic Site

13 February 2009

by

NatureServe

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

11 Avenue de Lafayette, 5th Floor
Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers ecological systems attributed to Allegheny Portage Railroad National Historic Site. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (*IVC hierarchy*) *and association data:*

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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This document may be generally cited as follows:

NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Allegheny Portage Railroad National Historic Site. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at Allegheny Portage Railroad National Historic Site: Appalachian (Hemlock) - Northern Hardwood Forest, Central Appalachian Stream and Riparian, South-Central Interior Small Stream and Riparian, Central Appalachian Dry Oak - Pine Forest, and North-Central Appalachian Acidic Cliff and Talus. The areas of the ecological systems, semi-natural, and cultural map classes at Allegheny Portage Railroad National Historic Site are displayed in Table 1.

Table E1. Areas of the ecological systems, semi-natural, and cultural map classes at Allegheny Portage Railroad National Historic Site.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	522.7	1,291.6
Urban/Suburban Built	80.6	199.2
Ruderal Forest - Northern and Central Hardwood and Conifer	58.8	145.2
Ruderal Upland - Old Field	42.2	104.2
Central Appalachian Stream and Riparian	23.9	59.1
Central Appalachian Dry Oak - Pine Forest	6.1	15.1
River	3.3	8.2
Stream	2.3	5.6
Modified/Managed Marsh	3.0	7.5
Managed Tree Plantation	2.8	7.0
Introduced Wetland and Riparian Vegetation	1.9	4.6
Pond	1.4	3.4
North-Central Appalachian Acidic Cliff and Talus	1.1	2.8
South-Central Interior Small Stream and Riparian	0.4	1.1
Total	750.5	1,854.6

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina*, and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
ALPO Associations:
- Northern Red Oak - Northern Hardwood Forest (CEGL006125)
- Northern Hardwood Forest (CEGL006045)
- Allegheny Hardwood Forest (CEGL006045)
- Tuliptree - Beech - Maple Forest (CEGL006296)
- Dry Eastern Hemlock - Oak Forest (CEGL006293)
- Eastern Hemlock - Northern Hardwood Forest (CEGL006206)
- Allegheny Hardwood Forest / Successional Old Field (CEGL006045/CEGL006107)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C

USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)

· *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
· *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn pers. comm. 2008) believes that it is present in that state, but investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.591 CENTRAL APPALACHIAN DRY OAK - PINE FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Ridge/Summit/Upper Slope; Acidic Soil; *Pinus* (*strobus, rigida, echinata, virginiana*) - *Quercus prinus*
National Mapping Codes: EVT 2369; ESLF 4312; ESP 1369
Concept Summary: These oak and oak-pine forests cover large areas in the low- to mid-elevation Central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits. Soils are typically coarse and infertile; they may be deep (on glacial deposits in the northern and terrace deposits in the southern parts of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. The forest is mostly closed-canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus, Pinus virginiana,* and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata,* and *Kalmia latifolia* are common in the understory and often form a dense layer. Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida,* and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic. Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum*
Comments: This system occurs in drier settings than the other matrix oak forest system of the division, i.e., Northeastern Interior Dry - Mesic Oak Forest (CES202.592). It includes the system formerly segregated as Southern Piedmont Dry Oak - Heath Forest (CES202.023). Its analog from central Virginia south is Southern Piedmont Dry Oak - (Pine) Forest (CES202.339), which has somewhat more southern floristics, for example, the typical presence of *Pinus taeda*.
ALPO Associations:

- Dry Eastern Hemlock - Oak Forest (CEGL006293)

DISTRIBUTION

Range: This system is found from central New England through Pennsylvania and south to the Roanoke River in southern Virginia. It is primarily Appalachian but overlaps slightly into the upper Piedmont and fall zone in Virginia, Maryland and the District of Columbia.
Divisions: 202:C
TNC Ecoregions: 52:C, 58:C, 59:C, 60:C, 61:C
Subnations: CT, DC, MA, MD, ME, NH, NJ, NY, PA, RI, VA, VT, WV
Map Zones: 57:P, 60:C, 61:C, 63:C, 64:C, 65:C, 66:C

US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 65:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 211I:CC, 221A:CC, 221B:CC, 221D:CC, 232A:CC, M221A:CC, M221Ba:CCC, M221Bb:CCC, M221Bd:CCC, M221Bf:CCC, M221Da:CCC

CONCEPT

Associations:

- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162, GNR)
- *Castanea dentata - Quercus prinus* Forest (CEGL007196, GH)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Fagus grandifolia - Quercus* (*alba, velutina, prinus*) */ Kalmia latifolia* Forest (CEGL006919, G4)
- *Pinus rigida - Quercus* (*velutina, prinus*) Forest (CEGL006290, GNR)
- *Pinus strobus - Pinus resinosa - Pinus rigida* Forest (CEGL006259, G4G5)
- *Pinus strobus - Quercus* (*rubra, velutina*) *- Fagus grandifolia* Forest (CEGL006293, G5)
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539, G4)
- *Pinus virginiana - Pinus* (*rigida, echinata*) - (*Quercus prinus*) */ Vaccinium pallidum* Forest (CEGL007119, G4?)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) *- Betula lenta -* (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus* (*velutina, alba*) */ Vaccinium pallidum* High Allegheny Plateau, Western Allegheny Plateau Forest (CEGL006018, GNR)
- *Quercus alba - Quercus* (*coccinea, velutina, prinus*) */ Gaylussacia baccata* Forest (CEGL008521, G5)
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515, G4)
- *Quercus prinus -* (*Quercus coccinea, Quercus rubra*) */ Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299, G5)
- *Quercus prinus - Quercus* (*rubra, velutina*) */ Vaccinium angustifolium* Forest (CEGL006282, G5)
- *Quercus prinus - Quercus rubra / Vaccinium pallidum -* (*Rhododendron periclymenoides*) Forest (CEGL008523, G3G4)
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524, G3?)
- *Tsuga canadensis - Quercus prinus - Betula lenta* Forest (CEGL006923, G3)

Environment: These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. The soils are coarse and infertile; they may be deep (on glacial deposits in the northern part of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. In the highly dissected fall zone of Maryland and the District of

Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits.
Vegetation: Stands of this forest system are mostly closed-canopied but can include more open woodlands. They are dominated by a variable mixture of dry-site oak and pine species, including *Quercus prinus, Pinus virginiana,* and *Pinus strobus.* The system may include areas of pine forest and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum, Gaylussacia baccata*, and *Kalmia latifolia* are common in the understory. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic.
Dynamics: Disturbance agents include fire, windthrow, and ice damage.

SPATIAL CHARACTERISTICS

Spatial Summary: Large-patch (at outer range) to matrix (in center of range) system that may cover extensive hillslopes and low ridges.
Other Comments: In the Blue Ridge (EPA Level III Ecoregion 66), this extends south to the Roanoke River in central Virginia, where it is replaced by Southern Appalachian Oak Forest (CES202.886). In the northern Piedmont (EPA Level III Ecoregion 64), this extends south to Richmond, Virginia, where southward (i.e., in EPA Level III ecoregion 45) it is replaced by Southern Piedmont Dry Oak - (Pine) Forest (CES202.339). This corresponds closely to the line between USFS Sections 231I and 221D, with CES202.591 occurring in 221D and CES202.339 in 231I (SCG 7-07).

SOURCES

References: Comer et al. 2003
Version: 05 Feb 2009 **Stakeholders:** East, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

CES202.609 CENTRAL APPALACHIAN STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Riverine / Alluvial; Very Short Disturbance Interval; Flood Scouring; Intermittent Flooding
Concept Summary: This riparian system ranges from southern New England to Virginia and West Virginia and occurs over a wide range of elevations. It develops on floodplains and shores along river channels that lack a broad flat floodplain due to steeper sideslopes, higher gradient, or both. It may include communities influenced by flooding, erosion, or groundwater seepage. The vegetation is often a mosaic of forest, woodland, shrubland, and herbaceous communities. Common trees include *Betula nigra, Platanus occidentalis*, and *Acer negundo*. Open, flood-scoured rivershore prairies feature *Panicum virgatum* and *Andropogon gerardii*, and *Carex torta* is typical of wetter areas near the channel.
Comments: This is a high-gradient system, unlike the low-gradient system described in Central Appalachian River Floodplain (CES202.608). To the south in the Appalachians and interior, this system is replaced by South-Central Interior Small Stream and Riparian (CES202.706).
ALPO Comments: The Blair Gap Run in the Main Unit drains east to the Juniata River and then the Susquehanna River and is attributed to the Central Appalachian Stream and Riparian ecological system. The Little Conemaugh River in the Staple Bend Tunnel Unit drains to the Ohio River and is therefore attributed to the South-Central Interior Small Stream and Riparian ecological system.
ALPO Associations:

- Sugar Maple Floodplain Forest (CEGL006504)
- Alder Riverine Shrubland (CEGL006251)
- Eastern Hemlock - Tuliptree - Birch Forest / Sugar Maple Floodplain Forest (CEGL008407 / CEGL006504)
- Eastern Hemlock - Tuliptree - Birch Forest (CEGL008407)

DISTRIBUTION

Range: This system ranges from southern New England west to Lake Erie and south to Virginia and West Virginia. The James River in Virginia marks its southern extent.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: CT, DE, MA, MD, NH, NJ?, NY, OH, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:P, 64:P, 65:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:

- *Acer rubrum - Fraxinus* (*pennsylvanica, americana*) */ Lindera benzoin / Symplocarpus foetidus* Forest (CEGL006406, G4G5)
- *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416, G3)
- *Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmunda cinnamomea* Forest (CEGL007853, G3G4)

- *Alnus serrulata - Physocarpus opulifolius* Shrubland (CEGL006251, G5)
- *Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Sparse Vegetation (CEGL006284, G2)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Carex torta - Apocynum cannabinum - Cyperus* spp. Herbaceous Vegetation (CEGL006536, G4G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Carex trichocarpa* Herbaceous Vegetation (CEGL006447, G3)
- *Deschampsia caespitosa - Carex viridula* Herbaceous Vegetation (CEGL006969, GNR)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Eupatorium serotinum - Polygonum* (*lapathifolium, punctatum, pensylvanicum*) Herbaceous Vegetation (CEGL006481, GNR)
- *Hudsonia tomentosa - Paronychia argyrocoma* Dwarf-shrubland (CEGL006232, G1)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Leersia oryzoides - Sagittaria latifolia* Herbaceous Vegetation (CEGL006461, GNR)
- *Liriodendron tulipifera - Platanus occidentalis - Betula lenta / Lindera benzoin / Circaea lutetiana* ssp. *canadensis* Forest (CEGL006255, G3?)
- *Lysimachia ciliata - Apocynum cannabinum* Sparse Vegetation (CEGL006554, GNR)
- *Panicum virgatum - Andropogon gerardii* Gravel Wash Herbaceous Vegetation (CEGL006477, G2G3)
- *Pinus rigida - Hudsonia tomentosa - Pityopsis falcata* Sparse Vegetation (CEGL006391, GNR)
- *Pinus strobus - Betula populifolia / Comptonia peregrina / Schizachyrium scoparium* Woodland (CEGL006004, G2)
- *Platanus occidentalis - Acer saccharinum - Betula nigra - Fraxinus pennsylvanica / Boehmeria cylindrica - Carex emoryi* Woodland (CEGL006476, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Populus tremuloides - Betula populifolia* Forest (CEGL006560, GNR)
- *Rhododendron arborescens / Marshallia grandiflora - Triantha glutinosa - Platanthera flava* var. *herbiola* Herbaceous Vegetation (CEGL006598, G1)
- *Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland (CEGL006065, G4?)
- *Salix nigra* Temporarily Flooded Shrubland (CEGL003901, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Bryoerythrophyllum ferruginascen*s (G3G4), *Canis rufus* (G1Q), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi*

(G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Spiraea virginiana* (G2), *Trillium rugelii* (G3), *Waldsteinia lobata* (G2G3)

SOURCES

References: Comer et al. 2003
Version: 01 Feb 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler, mod. NCR Review Team **LeadResp:** East

CES202.706 SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This system is found throughout the Interior Low Plateau, Southern Ridge and Valley, Western Allegheny Plateau, lower elevations of the Southern Blue Ridge, and parts of the Cumberlands. Examples occur along small streams and floodplains with low to moderately high gradients. There may be little to moderate floodplain development. Flooding and scouring both influence this system, and the nature of the landscape prevents the kind of floodplain development found on larger rivers. This system may contain cobble bars with adjacent wooded vegetation and rarely have any marsh development, except through occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include *Platanus occidentalis*, *Acer rubrum* var. *trilobum*, *Betula nigra*, *Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum*, *Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Comments: This system is closely related to Central Appalachian Stream and Riparian (CES202.609) but has been distinguished based on the precepts of the Freshwater Systems classification. This system has been divided from Central Appalachian Riparian roughly by the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian Riparian (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River). In contrast to floodplain systems, this system has little to no floodplain development. In comparison with South-Central Interior Large Floodplain (CES202.705), this system typically has somewhat higher gradients, is sometimes rocky, and may experience flash floods. Stands from somewhat larger rivers have been placed here if the river lacks substantial floodplain development (e.g., the New River of West Virginia and the Ocoee Gorge of Tennessee).
ALPO Comments: The Little Conemaugh River in the Staple Bend Tunnel Unit drains to the Ohio River, therefore the South-Central Interior Small Stream and Riparian is the appropriate ecological system for that portion of the park. The Blair Gap Run in the Main Unit drains east to the Juniata River and then the Susquehanna River and is attributed to the Central Appalachian Stream and Riparian ecological system.
ALPO Associations:

- Alder Riverine Shrubland (CEGL006251)

DISTRIBUTION

Range: This system ranges from the Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau and portions of the Cumberlands. There would be limited and peripheral presence in the Upper East Gulf Coastal Plain.
Divisions: 202:C, 203:C
TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, GA, IL, IN, KY, NC, OH, PA, SC, TN, VA, WV

Map Zones: 46:P, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:

- (*Salix* spp.) / *Andropogon gerardii - Panicum virgatum - Salvia azurea* Cahaba Riverwash Herbaceous Vegetation (CEGL004149, G1)
- *Acer negundo* - (*Platanus occidentalis, Populus deltoides*) Forest (CEGL004690, G4)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum* var. *nudum / Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Alnus serrulata* Interior Shrubland (CEGL003894, G4?)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474, G4)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392, G2)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Fagus grandifolia - Quercus alba / Kalmia latifolia - Rhododendron canescens - Symplocos tinctoria* Forest (CEGL008551, G3?)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Juncus effusus - Chelone glabra - Scirpus* spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433, G4?)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) */ Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Orontium aquaticum* Permanently Flooded Herbaceous Vegetation (CEGL008480, G3G4)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696, G2G3?)

- *Pinus taeda - Liriodendron tulipifera / Lindera benzoin / Carex crinita* Forest (CEGL007546, GNA)
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Quercus stellata / Amelanchier stolonifera / Danthonia spicata / Leucobryum glaucum* Woodland (CEGL008449, G2?)
- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429, G4?)
- *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Polygonum* (*hydropiperoides, punctatum*) - *Leersia* spp. Herbaceous Vegetation (CEGL004290, G4?)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Vegetation (CEGL004725, G4?)
- *Quercus* (*alba, coccinea, falcata, velutina*) */ Kalmia latifolia* Temporarily Flooded Forest (CEGL004098, G4?)
- *Quercus alba* - (*Liriodendron tulipifera, Liquidambar styraciflua*) */ Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba - Carya* (*alba, ovata*) - *Liriodendron tulipifera* - (*Quercus phellos*) */ Cornus florida* Forest (CEGL007709, G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, G4)
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463, GNR)
- *Salix nigra - Platanus occidentalis* Forest (CEGL004626, G5)
- *Schizachyrium scoparium - Andropogon ternarius - Liatris microcephala* - (*Pityopsis ruthii*) Herbaceous Vegetation (CEGL008455, G2)
- *Schizachyrium scoparium - Schoenoplectus americanus - Juncus marginatus - Eupatorium serotinum* Herbaceous Vegetation (CEGL008496, G2)
- *Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143, G3)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)
- *Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine - Shrubland (CEGL004620, GNA)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Cardamine longii* (G3), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2),

Jamesianthus alabamensis (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Marshallia trinervia* (G3), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Pityopsis ruthii* (G1), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Sagittaria secundifolia* (G1), *Speyeria diana* (G3G4), *Spiraea virginiana* (G2), *Trillium pusillum* (G3), *Trillium rugelii* (G3), *Vitis rupestris* (G3), *Waldsteinia lobata* (G2G3)
Environment: Found along fairly high-energy streams and rivers with steep banks, this system is subject to frequent flooding and can be subject to scouring depending upon the substrate.
Vegetation: There is wide variation in vegetation depending upon the frequency of the flooding cycle (more frequent flooding creates a better environment for forbs and shrubs, less frequent may create a better environment for the establishment of trees). Typical tree species may include *Platanus occidentalis, Acer rubrum* var. *trilobum, Betula nigra, Liquidambar styraciflua,* and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum, Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Dynamics: Flooding and seed propagule dispersal caused by flooding events are the two most important processes affecting this system. The two processes vary widely depending upon size of stream, upstream land use and topography, presence or absence of invasive exotics that may displace native community types, etc.

SPATIAL CHARACTERISTICS

Spatial Summary: Small, linear patch.
Size: Can be quite long but never very wide.

SOURCES

References: Comer et al. 2003, Evans 1991
Version: 05 Jun 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S. Menard, M. Pyne, R. Evans, R. White, D.Faber-Langendoen **LeadResp:** Midwest

CES202.601 NORTH-CENTRAL APPALACHIAN ACIDIC CLIFF AND TALUS

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Barren
Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Unvegetated (<10% vasc.); Upland
Diagnostic Classifiers: Cliff (Substrate); Talus (Substrate); Temperate; Acidic Soil
Concept Summary: This system comprises sparsely vegetated to partially wooded cliffs and talus slopes in the Central Appalachians and adjacent ecoregions, occurring on rocks of acidic lithology and lacking any indicators of enriched conditions. This cliff system occurs at low to mid elevations from central New England south to Virginia, and up to 1500 m in West Virginia. It consists of vertical or near-vertical cliffs and the talus slopes below, formed on hills of granitic, sandstone, or otherwise acidic bedrock. In some cases, especially in periglacial areas, this system may take the form of upper-slope boulderfields without adjacent cliffs, where talus forms from freeze/thaw action cracking the bedrock. Most of the substrate is dry and exposed, but small (occasionally large) areas of seepage are often present. Vegetation in seepage areas tends to be more well-developed and floristically different from the surrounding dry cliffs. The vegetation is patchy and often sparse, punctuated with patches of small trees that may form woodlands in places. *Juniperus virginiana* is a characteristic tree species, *Toxicodendron radicans* a characteristic woody vine, and *Polypodium virginianum* a characteristic fern. Within its range, *Pinus virginiana* is often present.
ALPO Associations:
· Sparsely Vegetated Cliff (CEGL006435)

DISTRIBUTION

Range: This system is found from central New England and New York south to Virginia.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, MA, MD, NJ, NY, OH, PA, VA, WV
Map Zones: 60:C, 61:C, 62:C, 63:P, 64:P, 65:C
USFS Ecomap Regions: 221E:CC, M221A:CC, M221B:CC, M221D:CC

CONCEPT

Associations:
· Appalachian-Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435, GNR)
· *Asplenium montanum* Central Appalachian Sandstone Sparse Vegetation (CEGL004391, GNR)
· *Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland (CEGL006320, G3G5)
· *Betula lenta - Quercus prinus / Parthenocissus quinquefolia* Woodland (CEGL006565, G3G4)
· *Hydrangea arborescens / Sedum ternatum - Polypodium virginianum* Shrubland (CEGL006479, GNR)
· *Juniperus virginiana - Corydalis sempervirens* Cliff Sparse Vegetation (CEGL006422, G4)
· *Lasallia* (*papulosa, pensylvanica*) - *Dimelaena oreina* - (*Melanelia culbersonii*) Nonvascular Vegetation (CEGL004142, G4?)
· *Lasallia papulosa - Stereocaulon glaucescens - Chrysothrix chlorina* Nonvascular Vegetation (CEGL004143, G1?)
· Sandstone Dry Cliff Sparse Vegetation (CEGL002045, G4G5)

· Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287, G4G5)
· *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387, G4?)
· *Umbilicaria muehlenbergii - Lasallia papulosa* - (*Melanelia stygia*) Nonvascular Vegetation (CEGL004389, G2?)

High-ranked species: *Acrobolbus ciliatu*s (G3?), *Aneides aeneus* (G3G4), *Bryum riparium* (G2G4), *Canis rufus* (G1Q), *Carex biltmoreana* (G3), *Carex misera* (G3), *Gymnoderma lineare* (G2), *Heuchera alba* (G2Q), *Hymenophyllum tayloriae* (G2), *Hypericum buckleii* (G3), *Krigia montana* (G3), *Leptohymenium sharpii* (G1), *Liatris helleri* (G2), *Liatris microcephala* (G3G4), *Lophocolea appalachiana* (G1G2Q), *Mannia californica* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Metzgeria furcata* var. *setigera* (G5T1), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2), *Plagiochila eurphyllon* ssp. *echinata* (GNRT2), *Plagiochila sullivantii* var. *spinigera* (G2T1), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plagiomnium carolinianum* (G3), *Platyhypnidium pringlei* (G2G3), *Porella japonica* ssp. *appalachiana* (G5?T1), *Radula sullivantii* (G3), *Rhododendron vaseyi* (G3), *Saxifraga careyana* (G3), *Saxifraga caroliniana* (G3), *Scutellaria arguta* (G1?Q), *Sedum nevii* (G3), *Tetrodontium brownianum* (G3G4), *Thelypteris pilosa* var. *alabamensis* (G4T1), *Tsuga caroliniana* (G3)
Environment: This cliff system consists of vertical or near-vertical cliffs at low to mid elevations and the talus slopes below, formed on hills of granitic, sandstone, or otherwise acidic bedrock. Most of the substrate is dry and exposed, but small (occasionally large) areas of seepage are often present.
Vegetation: Vegetation in seepage areas tends to be more well-developed and floristically different from the surrounding dry cliffs. The vegetation is patchy and often sparse, punctuated with patches of small trees that may form woodlands in places. *Juniperus virginiana* is a characteristic tree species, *Toxicodendron radicans* a characteristic woody vine, and *Polypodium virginianum* a characteristic fern.

SOURCES

References: Comer et al. 2003
Version: 26 Jul 2007 **Stakeholders:** East, Midwest, Southeast
Concept Author: S.C. Gawler **LeadResp:** East

Bibliography for ALPO systems (element references)

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Evans, M. 1991. Kentucky ecological communities. Draft report to the Kentucky Nature Preserves Commission. 19 pp.

Fleming, G. P., P. P. Coulling, K. D. Patterson, and K. Taverna. 2005. The natural communities of Virginia: Classification of ecological community groups. Second approximation. Version 2.1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. [http://www.dcr.virginia.gov/dnh/ncintro.htm]

Yahn, Brian. Personal communication. Ecologist, Kentucky State Nature Preserve Commission, Frankfort.

Appendix F. Ecological Systems Classification for Fort Necessity National Battlefield.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Fort Necessity National Battlefield

13 February 2009

by

NatureServe

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

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This subset of the International Ecological Classification Standard covers ecological systems attributed to Fort Necessity National Battlefield. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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These data are extracted from:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

This document may be generally cited as follows:

NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Fort Necessity National Battlefield. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at Fort Necessity National Battlefield: Appalachian (Hemlock) - Northern Hardwood Forest, Northeastern Interior Dry Mesic Oak Forest, and Laurentian - Acadian Wet Meadow - Shrub Swamp. The areas of the ecological systems, semi-natural, and cultural map classes at Fort Necessity National Battlefield are displayed in Table 1.

Table F1. Areas of the ecological systems, semi-natural, and cultural map classes at Fort Necessity National Battlefield.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	138.4	342.0
Ruderal Upland - Old Field	68.1	168.2
Ruderal Forest - Northern and Central Hardwood and Conifer	62.4	154.1
Northeastern Interior Dry Mesic Oak Forest	49.9	123.3
Managed Tree Plantation	56.3	139.0
Modified/Managed Marsh	20.3	50.0
Urban/Suburban Built	24.1	59.6
Laurentian - Acadian Wet Meadow - Shrub Swamp	0.3	0.7
Total	419.6	1,036.9

CES201.582 LAURENTIAN - ACADIAN WET MEADOW - SHRUB SWAMP

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Broad-Leaved Shrub; Graminoid; Shallow (<15 cm) Water
Concept Summary: This system encompasses shrub swamps and wet meadows on mineral soils of the Northeast and upper Midwest. They are often associated with lakes and ponds, but are also found along streams, where the water level does not fluctuate greatly. They are commonly flooded for part of the growing season but often do not have standing water throughout the season. The size of occurrences ranges from small pockets to extensive acreages. The system can have a patchwork of shrub and graminoid dominance; typical species include *Salix* spp., *Cornus amomum, Alnus incana, Spiraea alba, Calamagrostis canadensis*, tall *Carex* spp., and *Juncus effusus*. Trees are generally absent and, if present, are scattered.
FONE Associations:
· Wet Meadow (CEGL006412)

DISTRIBUTION

Range: New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania and Ohio; mostly north of the glacial boundary.
Divisions: 201:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 222K:CC, 222M:CC, 222R:CC, 222Ue:CCC

CONCEPT

Associations:
· *Alnus incana* Swamp Shrubland (CEGL002381, G5)
· *Alnus serrulata* Swamp Shrubland (CEGL005082, G4G5)
· *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174, G4G5)
· *Calamagrostis canadensis - Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519, GNR)
· *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257, G4G5)
· *Carex lacustris* Herbaceous Vegetation (CEGL002256, G4G5)
· *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258, G4?)
· *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412, G4G5)
· *Carex tetanica - Carex prairea - Eleocharis erythropoda - Lysimachia quadriflora* Herbaceous Vegetation (CEGL006170, G1Q)
· *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190, G4)

· *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186, G5)
· *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
· *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
· *Myrica gale* - *Spiraea alba* - *Chamaedaphne calyculata* Shrubland (CEGL006512, GNR)
· *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
· *Typha latifolia* - *Caltha palustris* Herbaceous Vegetation (CEGL006245, G1)

High-ranked species: *Calephelis muticum* (G3), *Clonophis kirtlandii* (G2), *Platanthera leucophaea* (G2G3), *Polemonium vanbruntiae* (G3G4), *Scirpus ancistrochaetus* (G3)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.
Version: 11 Apr 2007 **Stakeholders:** Canada, East, Midwest
Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina,* and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
FONE Associations:
- Tuliptree Forest (CEGL008510)
- Sugar Maple - Basswood Forest (CEGL006237)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006125)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C
USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)
- *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn pers. comm. 2008) believes that it is present in that state, but

investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.592 NORTHEASTERN INTERIOR DRY - MESIC OAK FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Forest and Woodland (Treed); Acidic Soil; *Quercus* - *Carya*
National Mapping Codes: EVT 2303; ESLF 4109; ESP 1303
Concept Summary: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. Soils are mostly acidic and relatively infertile but not strongly xeric. Local areas of calcareous bedrock, or colluvial pockets, may support forests typical of richer soils. Oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba, Quercus velutina*, and *Quercus coccinea*) and *Carya* spp. are dominant in mature stands. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum, Betula lenta,* and *Betula alleghaniensis* may be common associates; *Acer saccharum* is occasional. With a long history of human habitation, many of the forests are early- to mid-successional, where *Pinus strobus, Pinus virginiana,* or *Liriodendron tulipifera* may be dominant or codominant. Within these forests, hillslope pockets with impeded drainage may support small isolated wetlands, including non-forested seeps or forested wetlands with *Acer rubrum, Quercus bicolor,* or *Nyssa sylvatica* characteristic.
Comments: The oak-dominated forest matrix in this region spans a range of elevational and moisture regimes, reflected in different ecological systems. Those in drier settings, within the general range of this system, are placed in either Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359) or Central Appalachian Dry Oak - Pine Forest (CES202.591).
FONE Associations:
· White Oak - Mixed Hardwood Forest (CEGL006336)

DISTRIBUTION

Range: This system is found from southern New York west through Ohio and Pennsylvania and south to Virginia. It does not extend to the southernmost part of Virginia, except in the Ridge and Valley.
Divisions: 202:C
TNC Ecoregions: 49:C, 52:C, 59:C, 60:C, 61:C
Subnations: MD, NJ, NY, OH, PA, VA, WV
Map Zones: 57:C, 60:C, 61:C, 62:C, 63:C, 64:C
US EPA Ecoregions: 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 67:C, 67b:C, 67c:C, 67d:C, 67e:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C
USFS Ecomap Regions: 211E:CC, 211F:CC, 211G:CC, 221A:CC, 221B:CC, 221D:CC, 221F:CC, M221A:CC, M221B:CC, M221Da:CCC

CONCEPT

Associations:

- *Carya* (*glabra, ovata*) - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236, GNR)
- *Fagus grandifolia - Betula lenta - Quercus* (*alba, rubra*) */ Carpinus caroliniana* Forest (CEGL006921, GNR)
- *Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus* (*rubra, alba*) */ Polystichum acrostichoides* Forest (CEGL006304, G4?)
- *Pinus strobus - Quercus* (*rubra, velutina*) - *Fagus grandifolia* Forest (CEGL006293, G5)
- *Quercus* (*alba, rubra, velutina*) */ Cornus florida / Viburnum acerifolium* Forest (CEGL006336, G4G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus alba - Quercus rubra - Carya* (*alba, ovata*) */ Cornus florida* Acidic Forest (CEGL002067, G3)
- *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475, G4G5)
- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068, G4?)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059, GNR)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus muehlenbergii - Quercus* (*alba, rubra*) - *Carya cordiformis / Viburnum prunifolium* Forest (CEGL004793, G3G4)
- *Quercus prinus - Quercus rubra - Carya ovalis / Solidago* (*ulmifolia, arguta*) - *Galium latifolium* Forest (CEGL008516, G3G4)
- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057, G5)
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522, G4?)
- *Quercus rubra - Acer saccharum / Ostrya virginiana / Cardamine concatenata* Forest (CEGL008517, G4)
- *Quercus rubra - Carya* (*glabra, ovata*) */ Ostrya virginiana / Carex lucorum* Forest (CEGL006301, G4?)
- *Quercus rubra - Quercus alba - Fraxinus americana - Carya* (*ovata, ovalis*) */ Actaea racemosa* Forest (CEGL008518, G3)
- *Quercus rubra - Quercus prinus - Carya ovalis /* (*Cercis canadensis*) */ Solidago caesia* Forest (CEGL008514, G3G4)

High-ranked species: *Callophrys irus* (G3), *Canis rufus* (G1Q), *Carex communis* var. *amplisquama* (G5T3), *Carex polymorpha* (G3), *Coreopsis delphiniifolia* (G3?Q), *Fothergilla major* (G3), *Gaylussacia brachycera* (G3), *Taenidia montana* (G3), *Thermopsis fraxinifolia* (G3?), *Thermopsis mollis* (G3G4), *Virginia valeriae pulchra* (G5T3T4)

Environment: These oak-dominated forests are one of the matrix forest systems in the northeastern and north-central U.S. Occurring in dry-mesic settings, they are typically closed-canopy forests, though there may be areas of patchy-canopy woodlands. They cover large expanses at low to mid elevations, where the topography is flat to gently rolling, occasionally steep. The typical landscape position is midslope to toeslope, transitioning to more xeric systems on the upper slopes and ridges. Soils are acidic and relatively infertile but not strongly xeric.

Vegetation: Mature stands are dominated by oak species characteristic of dry-mesic conditions (e.g., *Quercus rubra, Quercus alba, Quercus velutina*, and *Quercus coccinea*), along with

various *Carya* spp. *Quercus prinus* may be present but is generally less important than the other oak species. *Castanea dentata* was a prominent tree before chestnut blight eradicated it as a canopy constituent. *Acer rubrum* and *Betula lenta* are frequently common associates. Local areas of calcareous bedrock may support forests typical of richer soils (e.g., with *Acer saccharum* and/or *Quercus muehlenbergii*).

SPATIAL CHARACTERISTICS

Spatial Summary: These were historically among the most important matrix forests of the Northeast. They cover extensive areas where conditions are not extreme. Upslope they may grade into more xeric oak ridge systems or rocky oak-pine forests/woodlands. Mesic cove forest systems may be embedded within this matrix in protected draws. Small pocket wetlands, not discriminated as separate systems, may also occur within these forests.

SOURCES

References: Comer et al. 2003, Vanderhorst and Streets 2006

Version: 20 Aug 2007 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler **LeadResp:** East

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Appendix G. Ecological Systems Classification for Friendship Hill National Historic Site.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Friendship Hill National Historic Site

13 February 2009

by

NatureServe

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

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This subset of the International Ecological Classification Standard covers ecological systems attributed to Friendship Hill National Historic Site. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

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Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (IVC hierarchy) and association data:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Friendship Hill National Historic Site. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

Ecological systems identified at Friendship Hill National Historic Site include Appalachian (Hemlock) - Northern Hardwood Forest, and South-Central Interior Large Floodplain. The areas of the ecological systems, semi-natural, and cultural map classes at Friendship Hill National Historic Site are displayed in Table 1.

Table G1. Areas of the ecological systems, semi-natural, and cultural map classes at Friendship Hill National Historic Site.

Ecological System or Map Class	Hectares	Acres
Appalachian (Hemlock) - Northern Hardwood Forest	130.3	321.9
Ruderal Forest - Northern and Central Hardwood and Conifer	67.3	166.4
Ruderal Upland - Old Field	38.4	94.8
South-Central Interior Large Floodplain	34.2	84.4
Urban/Suburban Built	29.8	73.4
River	9.3	23.1
Modified/Managed Marsh	1.6	4.0
Managed Tree Plantation	0.6	1.4
Pond	0.2	0.6
Total	311.6	770.0

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina,* and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
FRHI Associations:
- Tuliptree - Beech - Maple Forest (CEGL006125)
- Northern Red Oak - Mixed Hardwood Forest (CEGL006296)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C
USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)
- *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn pers. comm. 2008) believes that it is present in that state, but

investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.705 SOUTH-CENTRAL INTERIOR LARGE FLOODPLAIN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This floodplain system is found in the Interior Highlands as far west as eastern Oklahoma, as well as throughout the Interior Low Plateau, Cumberlands, Southern Ridge and Valley, and Western Allegheny Plateau, and lower elevations of the Southern Blue Ridge. Examples occur along large rivers or streams where topography and alluvial processes have resulted in a well-developed floodplain. A single occurrence may extend from river's edge across the outermost extent of the floodplain or to where it meets a wet meadow or upland system. Many examples of this system will contain well-drained levees, terraces and stabilized bars, and some will include herbaceous sloughs and shrub wetlands resulting, in part, from beaver activity. A variety of soil types may be found within the floodplain from very well-drained sandy substrates to very dense clays. It is this variety of substrates in combination with different flooding regimes that creates the mix of vegetation. Most areas, except for the montane alluvial forests, are inundated at some point each spring; microtopography determines how long the various habitats are inundated. Although vegetation is quite variable in this broadly defined system, examples may include *Acer saccharinum*, *Platanus occidentalis*, *Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed, but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.). This system likely floods at least once annually and can be altered by occasional severe floods. Impoundments and conversion to agriculture can also impact this system.
Comments: Montane alluvial forests may be difficult to place within this system because they share traits with both this system and Southern and Central Appalachian Cove Forest (CES202.373), at least in the southern Appalachians. This split from Central Appalachian River Floodplain (CES202.608) may appear somewhat arbitrary but is based on the freshwater systems classification, using roughly the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian River Floodplain (CES202.608) (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River).This system grades into Western Great Plains Floodplain (CES303.678) in the Crosstimbers region of east-central Oklahoma as eastern cottonwood (*Populus deltoides*) and willows (*Salix* spp.) become more dominant.
FRHI Comments: The Monongahela River at FRHI drains to the Ohio River.
FRHI Associations:

- Sycamore Floodplain Forest (CEGL004073)
- Mixed Forb Marsh (CEGL004290)

Range: This system ranges from the Ozarks, Arkansas River Valley, and Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau.
Divisions: 202:C, 205:C
TNC Ecoregions: 32:P, 37:C, 38:C, 39:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, AR, GA, IL, IN, KY, MO, NC, OH, OK, PA, SC?, TN, VA, WV
Map Zones: 32:P, 37:P, 38:?, 43:C, 44:C, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: information not available.

CONCEPT

Associations:

- (*Diospyros virginiana, Platanus occidentalis*) */ Eupatorium serotinum - Diodia virginiana* Herbaceous Vegetation (CEGL003910, GNA)
- *Acer negundo* Forest (CEGL005033, G4G5)
- *Acer rubrum* var. *trilobum - Fraxinus pennsylvanica / Carex crinita - Peltandra virginica* Forest (CEGL004420, G1)
- *Acer saccharinum - Betula nigra / Cephalanthus occidentalis* Forest (CEGL007810, G3Q)
- *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431, G3G4)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586, G4?)
- *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035, G2)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191, G4)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427, G4G5)
- *Fraxinus pennsylvanica - Ulmus crassifolia - Celtis laevigata* Forest (CEGL004618, GNR)
- *Hypericum densiflorum - Alnus serrulata / Tripsacum dactyloides* Shrubland (CEGL008495, G1G2)
- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879, GNA)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) */ Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Liquidambar styraciflua - Quercus michauxii - Carya laciniosa / Fagus grandifolia* - (*Aesculus flava*) Forest (CEGL007702, G2G3Q)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334, G4)
- *Platanus occidentalis - Betula nigra - Celtis laevigata - Fraxinus pennsylvanica / Arundinaria gigantea* Temporarily Flooded Forest (CEGL007999, G3?)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Fraxinus pennsylvanica - Quercus imbricaria* Forest (CEGL007339, G2Q)
- *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458, GNR)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Platanus occidentalis / Aesculus flava* Forest (CEGL006466, GNR)

- *Populus deltoides* - *Salix nigra* Forest (CEGL002018, G3G4)
- *Quercus* (*rubra, velutina, alba*) / *Carpinus caroliniana* - (*Halesia tetraptera*) / *Maianthemum racemosum* Forest (CEGL006462, GNR)
- *Quercus michauxii* - *Quercus shumardii* - *Liquidambar styraciflua / Arundinaria gigantea* Forest (CEGL002099, G3G4)
- *Quercus nigra* - *Quercus* (*alba, phellos*) Forest (CEGL004979, G3?)
- *Quercus palustris* - (*Fraxinus nigra*) / *Lindera benzoin / Carex bromoides* Forest (CEGL007399, GNR)
- *Quercus palustris* - (*Quercus stellata*) - *Quercus pagoda* / *Isoetes* spp. Forest (CEGL002101, G2G3)
- *Quercus phellos* - (*Quercus lyrata*) / *Carex* spp. - *Leersia* spp. Forest (CEGL002102, G3G4Q)
- *Quercus stellata* - *Quercus marilandica* - *Quercus falcata / Schizachyrium scoparium* Sand Woodland (CEGL002417, G2)
- *Quercus stellata* / (*Danthonia spicata, Croton willdenowii*) Woodland (CEGL005057, G1)
- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899, G4?)
- *Salix nigra* Forest (CEGL002103, G4)
- *Salix nigra* Large River Floodplain Forest (CEGL007410, G3G5)
- *Taxodium distichum / Lemna minor* Forest (CEGL002420, G4G5)
- Tennessee Valley Impoundment Mudflat Sparse Vegetation (CEGL004049, GNA)
- *Tsuga canadensis* - *Quercus rubra* - (*Platanus occidentalis, Betula nigra*) / *Rhododendron maximum / Anemone quinquefolia* Forest [Provisional] (CEGL006620, GNR)
- *Verbesina alternifolia* - *Elymus riparius* - *Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)

High-ranked species: *Arabis georgiana* (G1), *Aspiromitus appalachianus* (G1), *Betula uber* (G1Q), *Canis rufus* (G1Q), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus imitator* pop. 1 (G3G4T1Q), *Diervilla rivularis* (G3), *Eurycea junaluska* (G3), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hygrohypnum closteri* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Myotis austroriparius* (G3G4), *Nardia lescurii* (G3?), *Nesticus* sp. 2 (G1G3), *Plethodon aureolus* (G2G3), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Potamogeton tennesseensis* (G2), *Sagittaria secundifolia* (G1), *Sorex palustris punctulatus* (G5T3), *Speyeria diana* (G3G4), *Spiraea virginiana* (G2), *Thermopsis villosa* (G3?), *Trillium pusillum* (G3), *Vitis rupestris* (G3)
Environment: This system inhabits broad floodplains along large creeks and rivers that are usually inundated for at least part of each year.
Vegetation: Vegetation varies quite widely, encompassing shrubby and herbaceous communities, as well as forested communities with a wide array of canopy types. Examples may include *Acer saccharinum, Platanus occidentalis, Liquidambar styraciflua*, and *Quercus* spp. Understory species are mixed but include shrubs, such as *Cephalanthus occidentalis* and *Arundinaria gigantea* ssp. *gigantea*, and sedges (*Carex* spp.).
Dynamics: Flooding dynamics are an important factor in the development and maintenance of this system.

SPATIAL CHARACTERISTICS

Size: Examples can range in size from very small (<1 acre) to hundreds of acres in larger floodplain areas.

Other Comments: In the Southern Blue Ridge this system is of limited extent, in part due to alteration of riverine systems through impoundments and agricultural and residential development. In the Interior Low Plateau of Kentucky, this system is represented in the Ecoregions of Kentucky map (Woods et al. 2002) by the Wabash-Ohio bottomlands (72a) and by the Green River-Southern Wabash Lowlands (72c).

SOURCES

References: Comer et al. 2003, Evans 1991, Woods et al. 2002

Version: 17 Jan 2006 **Stakeholders:** East, Midwest, Southeast

Concept Author: S. Menard, M. Pyne, R. Evans, R. White **LeadResp:** Midwest

Bibliography for FRHI systems (element references)

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

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Fleming, G. P., P. P. Coulling, K. D. Patterson, and K. Taverna. 2005. The natural communities of Virginia: Classification of ecological community groups. Second approximation. Version 2.1. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. [http://www.dcr.virginia.gov/dnh/ncintro.htm]

Woods, A. J., J. M. Omernik, W. H. Martin, G. J. Pond, W. M. Andrews, S. M. Call, J. A. Comstock, and D. D. Taylor. 2002. Ecoregions of Kentucky (color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. (map scale 1:1,000,000)

Yahn, Brian. Personal communication. Ecologist, Kentucky State Nature Preserve Commission, Frankfort.

Appendix H. Ecological Systems Classification for Johnstown Flood National Memorial.

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Ecological Systems of Johnstown Flood National Memorial

13 February 2009

by

NatureServe

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

11 Avenue de Lafayette, 5th Floor
Boston, MA 02111-1736

This subset of the International Ecological Classification Standard covers ecological systems attributed to Johnstown Flood National Memorial. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Ery Largay, Regional Vegetation Ecologist <ery_largay@natureserve.org>.

NatureServe
A Network Connecting Science With Conservation

Citations:

The following citation should be used in any published materials which reference ecological system and/or International Vegetation Classification (*IVC hierarchy*) *and association data:*

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

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

These data are extracted from:

NatureServe. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of 13 February 2009.

This document may be generally cited as follows:

NatureServe[1]. 2009. International Ecological Classification Standard: Terrestrial Ecological Classifications. Ecological Systems of Johnstown Flood National Memorial. NatureServe Central Databases. Arlington, VA. Data current as of 13 February 2009.

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

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

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

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

NatureServe also has partnered with many International and United States Federal and State organizations, which have also contributed significantly to the development of the International Classification. Partners include the following The Nature Conservancy; Provincial Forest Ecosystem Classification Groups in Canada; Canadian Forest Service; Parks Canada; United States Forest Service; National GAP Analysis Program; United States National Park Service; United States Fish and Wildlife Service; United States Geological Survey; United States Department of Defense; Ecological Society of America; Environmental Protection Agency; Natural Resource Conservation Services; United States Department of Energy; and the Tennessee Valley Authority. Many individual state organizations and people from academic institutions have also contributed to the development of this classification.

OVERVIEW

The following ecological systems were identified at Johnstown Flood National Memorial: Appalachian (Hemlock) - Northern Hardwood Forest, South-Central Interior Small Stream and Riparian, Laurentian - Acadian Freshwater Marsh and Laurentian - Acadian Wet Meadow - Shrub Swamp. The areas of the ecological systems, semi-natural, and cultural map classes at Johnstown Flood National Memorial are displayed in Table 1.

Table H1. Areas of the ecological systems, semi-natural, and cultural map classes at Johnstown Flood National Memorial.

Ecological System or Map Class	Hectares	Acres
Ruderal Upland - Old Field	26.8	66.3
Appalachian (Hemlock) - Northern Hardwood Forest	17.5	43.2
Urban/Suburban Built	28.3	70.0
Modified/Managed Marsh	13.6	33.5
Ruderal Forest - Northern and Central Hardwood and Conifer	12.2	30.1
Pasture/Hay	3.6	8.9
River	2.0	4.8
Laurentian - Acadian Wet Meadow - Shrub Swamp	1.2	3.0
Managed Tree Plantation	1.1	2.6
Laurentian - Acadian Freshwater Marsh	0.8	1.9
South-Central Interior Small Stream and Riparian	0.8	2.0
Total	107.8	266.3

CES201.594 LAURENTIAN - ACADIAN FRESHWATER MARSH

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Graminoid; Shallow (<15 cm) Water; >180-day hydroperiod
Concept Summary: These freshwater emergent and/or submergent marshes are dominated by herbaceous vegetation. They are common throughout the northeastern United States and adjacent Canadian provinces. Freshwater marshes occur in closed or open basins that are generally flat and shallow. They are associated with lakes, ponds, slow-moving streams, and/or impoundments or ditches. The herbaceous vegetation does not persist through the winter. Scattered shrubs are often present and usually total less than 25% cover. Trees are generally absent and, if present, are scattered. The substrate is typically muck over mineral soil. Examples of vegetation in the Delaware Estuary freshwater marsh communities include *Typha latifolia, Typha angustifolia, Phragmites australis, Schoenoplectus americanus, Thelypteris palustris, Impatiens capensis, Carex* spp., *Vallisneria americana, Potamogeton perfoliatus, Nuphar lutea* ssp. *advena*, and *Nymphaea odorata*.
JOFL Associations:
· Cattail Marsh (CEGL006153)

DISTRIBUTION

Range: This system occurs in New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania, New Jersey, and Ohio; mostly north of the glacial boundary.
Divisions: 201:C, 202:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NJ, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC

CONCEPT

Associations:
· *Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation (CEGL006446, GNR)
· *Elodea canadensis - Potamogeton* spp. Eastern Herbaceous Vegetation [Placeholder] (CEGL006431, GNR)
· *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
· *Eriocaulon aquaticum - Lobelia dortmanna* Herbaceous Vegetation (CEGL006346, GNR)
· *Juncus militaris - Eriocaulon aquaticum* Herbaceous Vegetation (CEGL006345, GNR)
· *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
· *Nymphaea odorata - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002562, G5)
· *Nymphaea tetragona - Nuphar lutea* (ssp. *pumila*, ssp. *variegata*) Herbaceous Vegetation (CEGL002563, G4G5)

- *Pontederia cordata - Peltandra virginica - Sagittaria latifolia* Herbaceous Vegetation (CEGL006191, G5)
- *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282, G5)
- *Schoenoplectus* (*tabernaemontani, acutus*) Eastern Herbaceous Vegetation (CEGL006275, GNR)
- *Schoenoplectus acutus* - (*Schoenoplectus fluviatilis*) Freshwater Herbaceous Vegetation (CEGL002225, G4G5)
- *Schoenoplectus acutus - Carex lasiocarpa* Herbaceous Vegetation (CEGL006358, G1G2)
- *Schoenoplectus fluviatilis - Schoenoplectus* spp. Herbaceous Vegetation (CEGL002221, G3G4)
- *Schoenoplectus fluviatilis* Herbaceous Vegetation (CEGL006366, GNR)
- *Schoenoplectus tabernaemontani - Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026, G4G5)
- *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
- *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153, G5)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229, G4?)
- *Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation (CEGL006196, G5)
- *Zizania* (*aquatica, palustris*) Herbaceous Vegetation (CEGL002382, G3G4)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.

Version: 22 Dec 2005 **Stakeholders:** Canada, East, Midwest

Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES201.582 LAURENTIAN - ACADIAN WET MEADOW - SHRUB SWAMP

Primary Division: Laurentian - Acadian (201)
Land Cover Class: Herbaceous Wetland
Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland
Diagnostic Classifiers: Depressional [Lakeshore]; Riverine / Alluvial; Broad-Leaved Shrub; Graminoid; Shallow (<15 cm) Water
Concept Summary: This system encompasses shrub swamps and wet meadows on mineral soils of the Northeast and upper Midwest. They are often associated with lakes and ponds, but are also found along streams, where the water level does not fluctuate greatly. They are commonly flooded for part of the growing season but often do not have standing water throughout the season. The size of occurrences ranges from small pockets to extensive acreages. The system can have a patchwork of shrub and graminoid dominance; typical species include *Salix* spp., *Cornus amomum, Alnus incana, Spiraea alba, Calamagrostis canadensis*, tall *Carex* spp., and *Juncus effusus*. Trees are generally absent and, if present, are scattered.
JOFL Associations:
· Silky Willow Shrub Swamp (CEGL006305)

DISTRIBUTION

Range: New England and northern New York west across the upper Great Lakes to Minnesota, and adjacent Canada, southward to Pennsylvania and Ohio; mostly north of the glacial boundary.
Divisions: 201:C
TNC Ecoregions: 47:C, 48:C, 49:C, 59:C, 60:C, 61:C, 63:C, 64:C
Subnations: CT, IL?, IN?, MA, ME, MI, MN, NB, NH, NY, OH?, ON, PA, QC, RI, VT, WI
Map Zones: 41:C, 49:?, 50:C, 51:C, 52:?, 60:C, 61:C, 62:P, 63:C, 64:C, 65:C, 66:C
USFS Ecomap Regions: 212Ha:CCC, 212Hb:CCC, 212Hc:CCC, 212Hd:CCC, 212He:CCC, 212Hf:CCC, 212Hg:CCC, 212Hh:CCC, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCC, 212J:CC, 212K:CC, 212L:CC, 212M:CC, 212N:CC, 212Q:CC, 212Ra:CCC, 212Rb:CCC, 212Rc:CCC, 212Rd:CCC, 212Re:CCC, 212S:CC, 212T:CC, 212X:CC, 212Y:CC, 212Z:CC, 222K:CC, 222M:CC, 222R:CC, 222Ue:CCC

CONCEPT

Associations:
· *Alnus incana* Swamp Shrubland (CEGL002381, G5)
· *Alnus serrulata* Swamp Shrubland (CEGL005082, G4G5)
· *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174, G4G5)
· *Calamagrostis canadensis - Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation (CEGL006519, GNR)
· *Carex* (*rostrata, utriculata*) - *Carex lacustris* - (*Carex vesicaria*) Herbaceous Vegetation (CEGL002257, G4G5)
· *Carex lacustris* Herbaceous Vegetation (CEGL002256, G4G5)
· *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258, G4?)
· *Carex stricta - Carex vesicaria* Herbaceous Vegetation (CEGL006412, G4G5)
· *Carex tetanica - Carex prairea - Eleocharis erythropoda - Lysimachia quadriflora* Herbaceous Vegetation (CEGL006170, G1Q)
· *Cephalanthus occidentalis / Carex* spp. Northern Shrubland (CEGL002190, G4)

· *Cornus sericea* - *Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186, G5)
· *Equisetum fluviatile* - (*Eleocharis palustris*) Herbaceous Vegetation (CEGL005258, G4)
· *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
· *Myrica gale* - *Spiraea alba* - *Chamaedaphne calyculata* Shrubland (CEGL006512, GNR)
· *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation (CEGL006349, GNR)
· *Typha latifolia* - *Caltha palustris* Herbaceous Vegetation (CEGL006245, G1)

High-ranked species: *Calephelis muticum* (G3), *Clonophis kirtlandii* (G2), *Platanthera leucophaea* (G2G3), *Polemonium vanbruntiae* (G3G4), *Scirpus ancistrochaetus* (G3)

SOURCES

References: Comer and Albert 1997, Eastern Ecology Working Group n.d.
Version: 11 Apr 2007 **Stakeholders:** Canada, East, Midwest
Concept Author: S.C. Gawler, D. Faber-Langendoen **LeadResp:** East

CES202.593 APPALACHIAN (HEMLOCK) - NORTHERN HARDWOOD FOREST

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Forest and Woodland
Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*
National Mapping Codes: EVT 2370; ESLF 4313; ESP 1370
Concept Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis,* and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera, Prunus serotina,* and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.
Comments: Northward this system is replaced by Laurentian - Acadian Pine - Hemlock - Hardwood Forest (CES201.563) and Laurentian - Acadian Northern Hardwoods Forest (CES201.564), but the limits of both are not yet clear in western New York (Allegheny Plateau) and central New England. USFS ecological province lines provide an apparently appropriate delimiter, with areas in Provinces 211 and M211 (as well as the Great Lakes part of 221 in NY and OH) falling into the Laurentian - Acadian systems, and areas in Provinces 221 and M221 falling into this Appalachian system.
JOFL Associations:
- Eastern Hemlock - Northern Hardwood Forest (CEGL006109)
- Sugar Maple - Yellow Birch - Black Cherry Forest (CEGL006045)

DISTRIBUTION

Range: This system is found from central New England south to Virginia and West Virginia, and probably in adjacent Kentucky.
Divisions: 202:C
TNC Ecoregions: 48:C, 49:C, 52:?, 59:C, 60:C, 61:C
Subnations: CT, KY?, MA, MD, ME?, NH, NJ, NY, OH?, PA, VA, VT, WV
Map Zones: 53:C, 60:C, 61:C, 62:C, 63:C, 64:C, 65:C, 66:C
US EPA Ecoregions: 45:C, 45e:C, 55:C, 55b:C, 58:C, 58d:C, 58e:C, 58f:C, 58g:C, 58h:C, 59:C, 59a:C, 59b:C, 59c:C, 59d:C, 59e:C, 61:C, 61b:C, 61c:C, 61d:C, 61e:C, 63:C, 63a:C, 64:C, 64a:C, 64b:C, 64c:C, 64d:C, 66:C, 66a:C, 66b:C, 66e:C, 66l:C, 67:C, 67a:C, 67b:C, 67c:C, 67d:C, 67e:C, 67f:C, 67g:C, 67h:C, 67i:C, 69:C, 69a:C, 69b:C, 69c:C, 70:C, 70a:C, 70b:C, 70c:C, 70e:C, 83:C, 83a:C, 84:C, 84a:C
USFS Ecomap Regions: 211E:CC, 211Fc:CCC, 211Fd:CCC, 211G:CC, 221Aa:CCC, 221B:CC, 221D:CC, 221E:CC, 221F:CC, 222I:CC, M221A:CC, M221B:CC, M221C:CC, M221D:CC

CONCEPT

Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252, G5)
- *Acer saccharum - Betula alleghaniensis - Prunus serotina* Forest (CEGL006045, G4)
- *Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia / Adlumia fungosa* Forest (CEGL006577, GNR)
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005, GNR)
- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046, GNR)
- *Betula alleghaniensis* - (*Tsuga canadensis*) */ Rhododendron maximum /* (*Leucothoe fontanesiana*) Forest (CEGL007861, G3G4Q)
- *Carex scabrata - Viola cucullata / Plagiomnium ciliare* Herbaceous Vegetation (CEGL006597, G3)
- *Chrysosplenium americanum* Herbaceous Vegetation (CEGL006193, G3G5)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296, GNR)
- *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186, G4?)
- *Picea rubens - Betula alleghaniensis - Prunus serotina* Forest (CEGL006029, GNR)
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019, G4?)
- *Pinus strobus - Tsuga canadensis* Lower New England / Northern Piedmont Forest (CEGL006328, G5)
- *Quercus* (*rubra, velutina, alba*) - *Betula lenta* - (*Pinus strobus*) Forest (CEGL006454, G4G5)
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241, GNR)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173, G4G5)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125, G4?)
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566, G4?)
- *Rhododendron maximum* Upland Shrubland (CEGL003819, G3?Q)
- *Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea* Woodland (CEGL008426, G1G2)
- *Tsuga canadensis* - (*Betula alleghaniensis, Quercus rubra*) */ Ilex montana / Rhododendron catawbiense* Forest (CEGL008513, G1?)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109, G4?)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206, G4?)
- *Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata* Forest (CEGL008533, G2)
- *Tsuga canadensis - Fagus grandifolia - Acer saccharum /* (*Hamamelis virginiana, Kalmia latifolia*) Forest (CEGL005043, G3?)
- *Tsuga canadensis - Fagus grandifolia - Quercus* (*prinus, alba*) Forest (CEGL006474, G2G3)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088, G4G5)

High-ranked species: *Aneides aeneus* (G3G4), *Buckleya distichophylla* (G2), *Catocala marmorata* (G3G4), *Cephaloziella spinicaulis* (G3G4), *Clematis addisonii* (G2), *Desmognathus wrighti* (G3G4), *Drepanolejeunea appalachiana* (G2?), *Hexastylis contracta* (G3), *Homaliadelphus sharpii* (G3?), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Microtus chrotorrhinus carolinensis* (G4T3), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4), *Plagiochila austinii* (G3), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plethodon hubrichti* (G2), *Plethodon punctatus* (G3), *Plethodon welleri* (G3), *Shortia galacifolia* var. *galacifolia* (G2G3T2T3), *Sorex palustris punctulatus* (G5T3), *Stygobromus* sp. 17 (G2), *Tetrodontium brownianum* (G3G4), *Triphora trianthophora* (G3G4), *Tsuga caroliniana* (G3), *Virginia valeriae pulchra* (G5T3T4)
Environment: This system occurs on somewhat protected low and midslopes and valley bottoms. In the central Appalachian center of its range, its ecological amplitude is somewhat broader, and it approaches matrix forest in some areas. It is considered a system of intermediate moisture regime.
Vegetation: The canopy is characterized and often usually dominated by northern hardwoods (e.g., *Fagus grandifolia* and *Acer saccharum*), often with *Tsuga canadensis*, but may also contain large amounts of *Pinus strobus* and *Quercus* spp. The understory varies quite a bit, in some places dominated by evergreen shrubs and in others by herbs.
Dynamics: This system is currently being devastated in large parts of its range by the hemlock woolly adelgid (*Adelges tsugae*). This sucking insect is continuing to cause close to 100% mortality as it spreads from the north into the southern United States. The insect will most likely cause canopy hemlocks to be replaced by other canopy trees. Historically, this system was probably only subject to occasional fires. Fires that did occur may have been catastrophic and may have lead to even-aged stands of pine and hemlock. Fire suppression appears to have increased the extent of this system at the expense of oak-pine systems.

SPATIAL CHARACTERISTICS

Spatial Summary: Matrix in the northern portion of its range to large patch on the southern end of its range in Virginia and West Virginia.
Size: Some examples may be more than 1000 acres, but smaller in the southern part of the range.
Heterogeneity: In the central Appalachians and northward, occurrences may include areas of deciduous cover as well as mixed hemlock-hardwood cover, and smaller areas of pure hemlock.
Adjacent Ecological System Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.
Other Comments: The concept of this system was revised in April 2007 to remove areas south and west of Virginia and West Virginia from its range; hemlock and mixed coves in that southern range are now within Southern and Central Appalachian Cove Forest (CES202.373), and small areas of non-cove hemlock are to be considered patches within the surrounding forest matrix system. The Region 8 National Forests and other Federal lands, as well as ecoregions and mapzones related to this area were also removed.

The range of this system south and west of Pennsylvania, West Virginia, and western Virginia is problematic. Kentucky (B. Yahn pers. comm. 2008) believes that it is present in that state, but

investigation of this is incomplete. At a minimum, it is in EPA 69a, 69c, and 70b in West Virginia, western Virginia, and adjacent Kentucky (mapzone 53) (S. Gawler pers. comm. 2008).

SOURCES

References: Comer et al. 2003, Fleming et al. 2005, Yahn pers. comm.

Version: 05 May 2008 **Stakeholders:** East, Midwest, Southeast

Concept Author: S.C. Gawler, R. White, R. Evans, M. Pyne **LeadResp:** East

CES202.706 SOUTH-CENTRAL INTERIOR SMALL STREAM AND RIPARIAN

Primary Division: Central Interior and Appalachian (202)
Land Cover Class: Mixed Upland and Wetland
Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Concept Summary: This system is found throughout the Interior Low Plateau, Southern Ridge and Valley, Western Allegheny Plateau, lower elevations of the Southern Blue Ridge, and parts of the Cumberlands. Examples occur along small streams and floodplains with low to moderately high gradients. There may be little to moderate floodplain development. Flooding and scouring both influence this system, and the nature of the landscape prevents the kind of floodplain development found on larger rivers. This system may contain cobble bars with adjacent wooded vegetation and rarely have any marsh development, except through occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include *Platanus occidentalis*, *Acer rubrum* var. *trilobum*, *Betula nigra*, *Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum*, *Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Comments: This system is closely related to Central Appalachian Stream and Riparian (CES202.609) but has been distinguished based on the precepts of the Freshwater Systems classification. This system has been divided from Central Appalachian Riparian roughly by the Mid-Continental Divide. This means that Ecoregions 50 and 51 are included in this system, whereas Ecoregions 52 and 59 are considered part of Central Appalachian Riparian (except for a small part of southernmost Ecoregion 59 in West Virginia that drains to the Ohio River). In contrast to floodplain systems, this system has little to no floodplain development. In comparison with South-Central Interior Large Floodplain (CES202.705), this system typically has somewhat higher gradients, is sometimes rocky, and may experience flash floods. Stands from somewhat larger rivers have been placed here if the river lacks substantial floodplain development (e.g., the New River of West Virginia and the Ocoee Gorge of Tennessee).
JOFL Comments: This system occurs at JOFL because the Conemaugh River drains to the Ohio River.
JOFL Associations:
· Riverine Scour Vegetation (CEGL006554)

DISTRIBUTION

Range: This system ranges from the Interior Low Plateau to the Southern Blue Ridge and north into the Western Allegheny Plateau and portions of the Cumberlands. There would be limited and peripheral presence in the Upper East Gulf Coastal Plain.
Divisions: 202:C, 203:C
TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 59:C
Subnations: AL, GA, IL, IN, KY, NC, OH, PA, SC, TN, VA, WV
Map Zones: 46:P, 47:C, 48:C, 49:C, 53:C, 57:C, 61:C, 62:C
USFS Ecomap Regions: Information not available.

CONCEPT

Associations:

- (*Salix* spp.) / *Andropogon gerardii - Panicum virgatum - Salvia azurea* Cahaba Riverwash Herbaceous Vegetation (CEGL004149, G1)
- *Acer negundo* - (*Platanus occidentalis, Populus deltoides*) Forest (CEGL004690, G4)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443, G3?)
- *Acer rubrum* var. *trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum* var. *nudum / Woodwardia areolata* Forest (CEGL004425, G2G3)
- *Alnus serrulata - Xanthorhiza simplicissima* Shrubland (CEGL003895, G3G4)
- *Alnus serrulata* Interior Shrubland (CEGL003894, G4?)
- *Alnus serrulata* Saturated Southern Shrubland (CEGL003912, G4)
- *Alnus serrulata* Southeastern Seasonally Flooded Shrubland (CEGL008474, G4)
- *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283, G2G3)
- *Arundinaria gigantea* ssp. *gigantea* Shrubland (CEGL003836, G2?)
- *Betula nigra - Platanus occidentalis / Alnus serrulata / Boehmeria cylindrica* Forest (CEGL007312, G4G5)
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086, G5)
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392, G2)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263, G2G3)
- *Carex torta* Herbaceous Vegetation (CEGL004103, G3G4)
- *Eragrostis hypnoides - Ludwigia palustris - Lindernia dubia - Cyperus squarrosus* Herbaceous Vegetation (CEGL006483, G3)
- *Fagus grandifolia - Quercus alba / Kalmia latifolia - Rhododendron canescens - Symplocos tinctoria* Forest (CEGL008551, G3?)
- *Fagus grandifolia - Quercus* spp. *- Acer rubrum - Juglans nigra* Forest (CEGL005014, G2G3)
- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285, G1)
- *Juncus effusus - Chelone glabra - Scirpus* spp. Southern Blue Ridge Beaver Pond Herbaceous Vegetation (CEGL008433, G4?)
- *Juncus effusus* Seasonally Flooded Herbaceous Vegetation (CEGL004112, G5)
- *Justicia americana* Herbaceous Vegetation (CEGL004286, G4G5)
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330, GNA)
- *Liquidambar styraciflua - Liriodendron tulipifera* - (*Platanus occidentalis*) / *Carpinus caroliniana - Halesia tetraptera / Amphicarpaea bracteata* Forest (CEGL007880, G3G4)
- *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation (CEGL002386, G4G5)
- *Orontium aquaticum* Permanently Flooded Herbaceous Vegetation (CEGL008480, G3G4)
- *Osmunda regalis* var. *spectabilis* Seepage Scour Herbaceous Vegetation (CEGL008404, G3?)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696, G2G3?)
- *Pinus taeda - Liriodendron tulipifera / Lindera benzoin / Carex crinita* Forest (CEGL007546, GNA)
- *Pinus virginiana - Juniperus virginiana* var. *virginiana - Quercus stellata / Amelanchier stolonifera / Danthonia spicata / Leucobryum glaucum* Woodland (CEGL008449, G2?)

- *Platanus occidentalis - Betula nigra - Salix* (*caroliniana, nigra*) Woodland (CEGL003896, G4G5)
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725, GNR)
- *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429, G4?)
- *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340, G5)
- *Platanus occidentalis - Liriodendron tulipifera - Betula* (*alleghaniensis, lenta*) */ Alnus serrulata - Leucothoe fontanesiana* Forest (CEGL004691, G2?)
- *Podostemum ceratophyllum* Herbaceous Vegetation (CEGL004331, G3G5)
- *Polygonum* (*hydropiperoides, punctatum*) - *Leersia* spp. Herbaceous Vegetation (CEGL004290, G4?)
- *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Permanently Flooded Herbaceous Vegetation (CEGL004725, G4?)
- *Quercus* (*alba, coccinea, falcata, velutina*) */ Kalmia latifolia* Temporarily Flooded Forest (CEGL004098, G4?)
- *Quercus alba* - (*Liriodendron tulipifera, Liquidambar styraciflua*) */ Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428, G3G4)
- *Quercus alba - Carya* (*alba, ovata*) - *Liriodendron tulipifera* - (*Quercus phellos*) */ Cornus florida* Forest (CEGL007709, G4)
- *Salix caroliniana* Temporarily Flooded Forest (CEGL007373, G4)
- *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463, GNR)
- *Salix nigra - Platanus occidentalis* Forest (CEGL004626, G5)
- *Schizachyrium scoparium - Andropogon ternarius - Liatris microcephala* - (*Pityopsis ruthii*) Herbaceous Vegetation (CEGL008455, G2)
- *Schizachyrium scoparium - Schoenoplectus americanus - Juncus marginatus - Eupatorium serotinum* Herbaceous Vegetation (CEGL008496, G2)
- *Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510, G2G3)
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143, G3)
- *Verbesina alternifolia - Elymus riparius - Solidago gigantea* - (*Teucrium canadense*) Herbaceous Vegetation (CEGL006480, GNR)
- *Vitis rotundifolia - Ampelopsis arborea - Campsis radicans* Vine - Shrubland (CEGL004620, GNA)

High-ranked species: *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q), *Cardamine longii* (G3), *Catalpa bignonioides* (G3G4), *Catocala marmorata* (G3G4), *Cicindela ancocisconensis* (G3), *Desmognathus aeneus* (G3G4), *Desmognathus wrighti* (G3G4), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2), *Hexastylis naniflora* (G3), *Hexastylis rhombiformis* (G2), *Hexastylis shuttleworthii* var. *harperi* (G4T3), *Isotria medeoloides* (G2), *Jamesianthus alabamensis* (G3), *Lejeunea blomquistii* (G1G2), *Lysimachia fraseri* (G3), *Marshallia grandiflora* (G2), *Marshallia trinervia* (G3), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4), *Pityopsis ruthii* (G1), *Plethodon hubrichti* (G2), *Plethodon*

punctatus (G3), *Sagittaria secundifolia* (G1), *Speyeria diana* (G3G4), *Spiraea virginiana* (G2), *Trillium pusillum* (G3), *Trillium rugelii* (G3), *Vitis rupestris* (G3), *Waldsteinia lobata* (G2G3)
Environment: Found along fairly high-energy streams and rivers with steep banks, this system is subject to frequent flooding and can be subject to scouring depending upon the substrate.
Vegetation: There is wide variation in vegetation depending upon the frequency of the flooding cycle (more frequent flooding creates a better environment for forbs and shrubs, less frequent may create a better environment for the establishment of trees). Typical tree species may include *Platanus occidentalis, Acer rubrum* var. *trilobum, Betula nigra, Liquidambar styraciflua*, and *Quercus* spp. Shrubs and herbaceous layers can vary in richness and cover. Some characteristic shrubs may include *Hypericum densiflorum, Salix* spp., and *Alnus* spp. Small seeps dominated by sedges (*Carex* spp.), ferns (*Osmunda* spp.), and other herbaceous species can often be found within this system, especially at the headwaters and terraces of streams.
Dynamics: Flooding and seed propagule dispersal caused by flooding events are the two most important processes affecting this system. The two processes vary widely depending upon size of stream, upstream land use and topography, presence or absence of invasive exotics that may displace native community types, etc.

SPATIAL CHARACTERISTICS

Spatial Summary: Small, linear patch.
Size: Can be quite long but never very wide.

SOURCES

References: Comer et al. 2003, Evans 1991
Version: 05 Jun 2008 **Stakeholders:** East, Midwest, Southeast
Concept Author: S. Menard, M. Pyne, R. Evans, R. White, D. Faber-Langendoen **LeadResp:** Midwest

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