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Vegetation Classification and Mapping of Gauley River National Recreation Area, West Virginia

Technical Report NPS/NER/NRTR—2010/148



ON THE COVER

Gauley River, flowing past the Canyon Doors, May 2009.
Photograph by: Brian P. Streets.

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Technical Report NPS/NER/NRTR—2010/148

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Executive Summary

A vegetation classification and map were developed for Gauley River National Recreation Area (GARI) by the West Virginia Natural Heritage Program following standards of the U.S. Geological Survey / National Park Service Vegetation Mapping Program. Standards include a minimum mapping unit of 0.5 ha (1.23 ac) and classification accuracy of 80% or greater for each map class. The U.S. National Vegetation Classification (USNVC) was used as the standard for vegetation classification.

Classification was based, in part, on multivariate analysis of complete floristic data from 220 plots sampled in 1995–2009. Plots were stratified to cover the geographic range and ecological gradients within the park. Multivariate analyses of plot data included hierarchical agglomerative cluster analysis, non-metric multidimensional scaling, and indicator species analysis. The classification for the park was crosswalked to the USNVC in consultation with NatureServe.

Vegetation of the park is classified in 23 associations of the USNVC, including 14 upland associations and 9 riparian and wetland associations. Prevailing physiognomic expressions include 17 forest associations, one woodland association, three herbaceous associations, one non-vascular association, and one sparse vegetation association. Two riparian associations new to the USNVC, the Riverscour Shrub Prairie and the (Virginia, Pitch) Pine Floodplain Forest, are recognized and described for the first time based on plots from GARI and from other rivers in West Virginia.

A digital vegetation map for GARI was developed as a personal geodatabase using Environmental Systems Research Institute (ESRI) ArcGIS software. The geodatabase includes a point feature class for locations of plots and two polygon-feature classes (clipped by the park boundary and unclipped) for vegetation, including non-vegetated land cover. Delineation of vegetation map classes was based on interpretation of a digital orthophoto mosaic developed by North Carolina State University (NCSU) from leaf-off color infrared aerial photography flown in March 2003.

The vegetation map includes 31 map classes. Upland communities comprise about 86% of the park area and are represented by 13 map classes. Two upland map classes each include patches of two associations, all others represent single associations. Six major upland forest associations (Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, Sugar Maple - Yellow Buckeye - American Basswood Forest, Oak - Hickory Forest, Oak - Hickory - Sugar Maple Forest, Eastern Hemlock Plateau Forest, and Oak / Great Laurel Forest) comprise about 80% of the park area. Riparian and wetland communities comprise about two percent of the park area and are represented by nine map classes. One riparian map class is comprised of multiple associations, all others represent single associations. Six percent of the park is mapped as natural waterways, and the remaining five percent is mapped as disturbed areas and cultural and transportation features.

Spatial and thematic accuracy assessments were performed by NCSU. Thematic accuracy of 23 map classes was assessed, excluding seven non-vegetated map classes and one vegetation map class known from just one polygon. Producer's and user's accuracies of individual map classes range from 33% to 100%. Overall thematic accuracy of the vegetation map is estimated to be 87.1%.

Introduction

This report describes vegetation classification and mapping of Gauley River National Recreation Area (GARI) in south-central West Virginia. This project fulfills an important goal of the National Park Service Inventory and Monitoring Program and was completed following standards of the U.S. Geological Survey (USGS) / National Park Service (NPS) Vegetation Mapping Program (USGS 2001).

USGS / NPS Vegetation Mapping Program products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification, metadata, and spatial accuracy (FGDC 1997, 1998a, 1998b). Other standards include a minimum mapping unit of 0.5 ha (1.23 ac) and classification accuracy of 80% or greater for each map class. The U.S. National Vegetation Classification (USNVC), maintained by NatureServe, is the standard for vegetation classification.

The USNVC represents the terrestrial component in the U.S. of an International Classification of Ecological Communities (Grossman et al. 1998). Ecological communities are classified and mapped to serve as a “coarse filter” for conservation of biological diversity. Although plants are used to classify terrestrial ecological communities, these units also include and represent habitat for species in all kingdoms.

The USNVC is a hierarchical system which uses physiognomy to define the coarsest levels and floristic composition to define the finest levels of the classification (Grossman et al. 1998). The vegetation classification and map presented here for GARI utilize the finest level of the USNVC, the association, as the basic unit. The association is floristically based, and is named and described based on dominant and diagnostic plant species. Dominant species are those with the highest cover in each stratum (canopy layer) of vegetation. Diagnostic species are those which differentiate a community from others, either by abundance, constancy, or fidelity. Thus, a typical plant association may be named after dominants of one or two strata (species in the same stratum are divided by a dash, species in different strata are divided by a forward slash) with or without diagnostic taxa added for further refinement. For example *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Temporarily Flooded Woodland indicates a riparian woodland community where the tree canopy is typically dominated by American sycamore (*Platanus occidentalis*) and river birch (*Betula nigra*), the shrub layer is characterized by silky dogwood (*Cornus amomum*), and big bluestem (*Andropogon gerardii*) and/or Indian woodoats (*Chasmanthium latifolium*) have high constancy in the herb layer. Nominate species in parentheses are those which may be important in some examples or geographical range but which may be uncommon or absent in others. Because the USNVC covers a broad geographic range, the association names may not always represent local vegetation very well; it is important to consider the entire concept, including the local description for the association.

This report and related database products also use local, park-specific, GARI community type names for each association. For the example above, the GARI community type name is American Sycamore - River Birch Riverscour Woodland. Throughout the main body of this report associations are referred to by the GARI community type name. Corresponding scientific

names and alphanumeric identifiers (CEGL codes) for associations in the USNVC are listed in tables and are used in some of the appendixes to this report. The terms “association” and “community type” are conceptually synonymous within the scope of this report.

Relationships between community types and map classes are usually one-to-one, but can sometimes be more complex. Most map classes for natural and semi-natural vegetation are more-or-less equivalent (excluding ectotones, inclusions, and errors) to community types (and corresponding USNVC associations) and these are named by the corresponding GARI community type name. However, due to patchiness of vegetation or mapping constraints of scale and/or photointerpretation, some map classes include multiple community types. For example, patches of the American Sycamore - River Birch Riverscour Woodland are mapped as a distinct map class when they can be delineated from air photos, but small patches are also included along with patches of two other community types in the Riparian Zone map class. Additional map classes that do not correspond to classified GARI community types include aquatic, cultural, and disturbed areas and features.

Vegetation classification and mapping for GARI was completed by the West Virginia Natural Heritage Program (WVNHP), part of the Wildlife Resources Section of the WV Division of Natural Resources (WVDNR). WVNHP classifies, conducts inventories for, maps, and maintains databases on the natural biological diversity of the state, including natural ecological communities and rare plants and animals. North Carolina State University (NCSU) Center for Earth Observation provided supporting products and services for this project, including development of a digital orthophoto mosaic and performance of spatial and thematic accuracy assessment. NatureServe, a private non-profit organization serving as the network coordinator for Natural Heritage Programs throughout the Americas, assisted with the crosswalk to the USNVC. While contributing to the needs of the NPS, this project has also developed tools and information which can be applied to classification, mapping, and conservation of natural communities on public and private lands throughout the state and region.

Study Area

The Gauley River National Recreation Area (GARI), established as a unit of the NPS in 1988, is located in Fayette and Nicholas counties in south-central West Virginia (Figure 1). The proclamation boundary of the park encompasses approximately 4,555 ha (11,257 ac), but currently only about 1,845 ha (4,559 ac) are in federal ownership. The park and its vicinity are mapped on the Ansted and Summersville Dam USGS 1:24,000 topographic maps. Elevations in the park range from 207–611 m (679–2,005 ft).

Ecoregional assignment of the park varies depending on the mapping system and version used. The U. S. Forest Service (Keys et al. 1995) includes the park in the Western Coal Fields (M221Ca) and Eastern Coal Fields (M221Cb) Subsections of the Northern Cumberland Mountains Section (M221C). Another ecoregion map produced by the U. S. Forest Service (Bailey et al. 1994) places the park in the Allegheny Mountains Section (M221B) and Cumberland Mountains Section (M221c) of the Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province. The Nature Conservancy (TNC) (2009) places the park in the Cumberlands and Southern Ridge and Valley Ecoregion. The U. S. Environmental Protection Agency (USEPA) (Woods et al. 2003) includes the park in the Dissected Appalachian Plateau and in the Forested Hills and Mountains Level 3 Ecoregions, both of which are nested within the Central Appalachians Level 4 Ecoregion.

The climate of the park is a humid continental type characterized by marked seasonal temperature changes and relatively uniform precipitation throughout the year. Mean monthly temperature normals at nearby Summersville Lake (elevation 536 m [1760 ft]) range from -1.78° C (28.8°F) in January to 21.39° C (70.5° F) in July (NOAA 2002). Normal annual precipitation at Summersville Lake is 120.60 cm (47.48 in) and monthly precipitation normals range from 7.75 cm (3.05 in) in February to 14.05 cm (5.53 in) in July (NOAA 2002).

Bedrock geology of the park is mapped as the New River and Kanawha formations of the Pottsville group (Cardwell et al. 1968). These are nearly horizontal strata consisting of Pennsylvanian-aged sedimentary rocks. The older New River formation is primarily sandstone with some shale, siltstone, and coal. It is capped by the resistant, cliff-forming Nuttall sandstone. The New River formation is exposed in all topographic positions in the eastern end of the park and has weathered to form rolling plateaus dissected by shallow, steep-sided gorges with prominent cliff bands overlooking bedrock and boulder controlled rapids in the river channels. The younger Kanawha formation is approximately 50% sandstone with lesser amounts of shale, siltstone, and coal. The Kanawha formation lies on top of the New River formation and its exposures become more extensive in the uplands of the western end of the park. The Kanawha formation is less resistant than the New River formation and its landforms have greater topographic relief characterized by ridges rather than plateaus.

The park surrounds a 40-km (25-mi) reach of the Gauley River downstream from Summersville Dam and a 9-km (6-mi) reach of the Meadow River upstream from its confluence with the Gauley River. The Gauley and Meadow rivers are Rosgen type B2/1c streams (Bennett and McDonald 2006). Type B2/1c streams have less than two percent slope, have moderate width/depth ratios, are moderately entrenched, are dominated by boulders with bedrock controls,

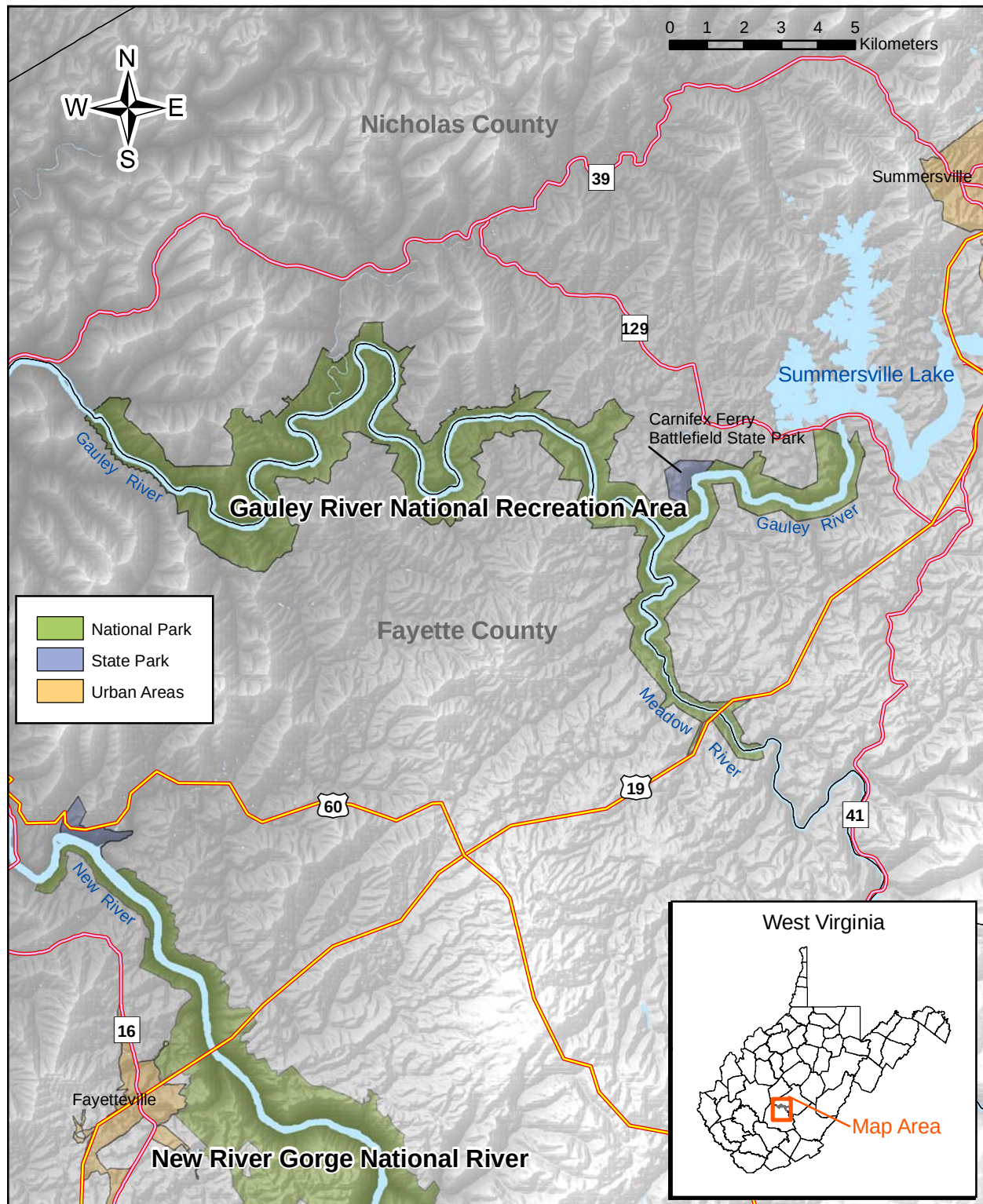


Figure 1. Gauley River National Recreation Area and vicinity in Fayette and Nicholas Counties, West Virginia.

and have bed features that often produce extensive rapids (Rosgen 1996). Since 1966, flows of the Gauley River have been regulated by Summersville Dam, just upstream from the park. Summersville Dam was constructed for flood control purposes, but since 1985, releases from the dam have also been scheduled around weekends in September and October to facilitate a white-water boating industry on the Gauley River. The Meadow River is a free-flowing river but peak flows in the park are somewhat moderated by a large wetland complex about 50 km (31 mi) upstream (Bennett and McDonald 2006).

Soils in the park are mapped by USDA Soil Conservation Service soil surveys of Fayette and Nicholas counties, which use somewhat different taxonomic systems. In Fayette County (Gorman and Espy 1975), soils are mapped as the Dekalb-Gilpin-Ernest association in the eastern three-quarters of the park and as the Muskingum-Shelocta association in the western one-quarter of the park. In Nicholas County (Carpenter 1992), soils are mapped as Gilpin-Buchanan in the eastern three-quarters of the park and as Gilpin-Pineville-Lily-Buchanan in the western one-quarter of the park.

GARI is included in the mixed mesophytic region of the eastern deciduous forest biome (Braun 1950). The vegetation of the park is characterized by extensive upland deciduous and mixed evergreen-deciduous forests with smaller areas of cliff and riparian habitats. Most forests in the eastern two-thirds of the park have a large component of eastern hemlock (*Tsuga canadensis*), while those in the western third are primarily deciduous. Common upland trees include (in decreasing order of frequency) red maple (*Acer rubrum*), eastern hemlock, tuliptree (*Liriodendron tulipifera*), blackgum (*Nyssa sylvatica*), northern red oak (*Quercus rubra*), American holly (*Ilex opaca* var. *opaca*), sweet birch (*Betula lenta*), white oak (*Quercus alba*), American beech (*Fagus grandifolia*), sourwood (*Oxydendrum arboreum*), sugar maple (*Acer saccharum* var. *saccharum*), chestnut oak (*Quercus prinus*), sassafras (*Sassafras albidum*), white ash (*Fraxinus americana*), mockernut hickory (*Carya alba*), black oak (*Quercus velutina*), mountain magnolia (*Magnolia fraseri*), and cucumber-tree (*Magnolia acuminata*). Many forested areas, especially in the eastern end of the park, have nearly impenetrable shrub layers dominated by great laurel (*Rhododendron maximum*). Additional trees that are common in riparian habitats include river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), and sweet gum (*Liquidambar styraciflua*). The riparian habitats in the park are especially distinctive and harbor a high concentration of rare herb and shrub species, including the federally listed threatened Virginia meadowsweet (*Spiraea virginiana*).

The forests in GARI are almost entirely second or third growth following logging but a few remnant trees and small old growth patches occur in the park and in adjacent Carnifex Ferry Battlefield State Park (Fortney et al. 1995). Prior to 1885, logging was limited to areas near the river, which facilitated removal of logs by drifting, but after 1885, the building of railroads and large band mills opened up more extensive lands to logging (Brooks 1910). Some federally owned tracts were logged just prior to acquisition and some private holdings within GARI were logged even more recently.

Several botany and vegetation studies have been conducted at GARI but the reports covering these studies are mostly unpublished. Norris (1992) surveyed the park and reported on populations of 11 rare plant species. The WVNHP (2004) resurveyed the park in 2003, focusing on nine rare plant species identified in the Norris (1992) report. A recovery plan for Virginia

spiraea (Ogle 1991) provides some site-specific information on the discovery and occurrence of this threatened species in the park. The WVDNR continues to monitor populations of Virginia spiraea in the park (Harmon et al. 2009). Grafton (1993) tallied plant species frequencies and identified forest cover types along seven transects in the park. Fortney et al. (1995) conducted a reconnaissance vegetation study focusing on tree species that included two plots and a tree core sampling site within GARI and three plots along a transect in Carnifex Ferry Battlefield State Park. The WVNHP (Walton and Anderson 1997) sampled 30 vegetation plots in riparian areas of the park and recognized five community types. Wood (1999) established permanent plots in the gorge of the Meadow River in GARI and in Carnifex Ferry Battlefield State Park to monitor plant communities dominated by eastern hemlock which are threatened by the hemlock woolly adelgid (*Adelges tsugae*), a nonnative insect pest. The hemlock woolly adelgid was first detected at GARI in 2004 and infestations had increased by 2006, but tree mortality attributable to this pest was not yet evident in 2007 (Wood et al. 2009). A floristic inventory of GARI (Streets and Vanderhorst 2010) was conducted in concurrence with the vegetation classification and mapping described in this report.

Methods

Vegetation Classification

The vegetation classification for GARI was based, in part, on multivariate analysis of floristic plot data. The WVNHP sampled 30 plots in 1995 for a study of riparian vegetation in GARI (Walton and Anderson 1997) and three plots in 2000 in an old growth forest in Carnifex Ferry Battlefield State Park adjacent to GARI. These two data sets were incorporated into our analysis and an additional 187 plots were sampled in or near the park during the growing seasons of 2006 through 2009.

Landform and ecological land unit (ELU) models were developed for the park to assist with plot stratification. These models were developed using ArcGIS following AML code developed by TNC (Biasi 2001) with modifications appropriate for the study area (Bender 2003). The landform model was developed from a 30-m digital elevation model, using moisture and topographic position indices combined with slope and aspect to classify 14 landform types (steep slope N/NE, steep slope S/SW, slope crest, upper slope, flat summit/ridge, sideslope N/NE, cove/ravine N/NE, sideslope S/SW, cove/ravine S/SW, dry flat, moist flat, slope bottom, stream, and river). The ELU model combines the 14 landforms with two elevation classes (<427 m and ≥ 427 m [$<1,400$ ft and $\geq 1,400$ ft]) to classify 28 units which occur in the park (Table 1). ELU types and locations of the 220 plots sampled for this project are mapped in Figure 2.

Running tallies of plots sampled within each ELU type were maintained, and an attempt was made to stratify plot sampling in ELU types in proportion to the area and community diversity within the ELU type. Representative polygons of undersampled ELU types were selected in the office using GIS, and GPS units were used in the field to navigate to these polygons to sample plots. Despite this, due to poor GPS reception and other logistical difficulties, some uncommon ELU types were not sampled, and there is some sampling inequity among more common types (Table 1). Due to the scale and precision of the digital elevation model, many areas of floodplain were classified as river, explaining the high number of plots sampled in ELU type 1142. No attempt was made to sample the two stream ELU types (1140 and 2140). A concerted effort was made to sample the two moist flat ELU types (1131 and 2131), which are the rarest ELU types in GARI, but this attempt revealed the spatial accuracy limitations of the ELU model. Using GPS, we navigated to three polygons of ELU 2131 and to one polygon of ELU 1131; however, arriving at the sites, we found wetland vegetation nearby but not within the mapped ELU. The ELU model accurately predicted the presence of the wet flat landform in the vicinity, but the ELU was offset from the actual location of the landform on the ground. In these cases, we sampled the wetland rather than the location of the ELU. This issue was less critical for more common ELU types which cover larger areas; in these cases, we tried to sample away from the boundaries of different ELU types. Plots were also sampled to document unique vegetation types which were recognized in the field or from aerial imagery.

Methods for sampling plots for this project are consistent with standards of the U.S. Geological Survey / National Park Service Vegetation Mapping Program (TNC and ESRI 1994a), the Ecological Society of America (ESA) (2004), and the FGDC (2008). The vegetation plot field

Table 1. Ecological Land Unit (ELU) codes, specifications, area, and plot sampling stratification for Gauley River National Recreation Area (GARI). ELUs are listed in decreasing order of abundance (hectares) within the GARI proclamation boundary.

ELU Code	Elevation	Landform	Hectares	# Plots Sampled
1123	< 427 m	cove/ravine S/SW	428.97	14
1121	< 427 m	cove/ravine N/NE	379.21	17
2114	≥ 427 m	flat summit/ridge	334.59	8
1133	< 427 m	slope bottom	329.97	34
1142	< 427 m	river	297.87	26
2113	≥ 427 m	upper slope	250.4	9
1113	< 427 m	upper slope	245.72	10
2123	≥ 427 m	cover/ravine S/SW	223.35	6
2130	≥ 427 m	dry flat	222.69	8
1110	< 427 m	steep slope N/NE	222.45	5
2133	≥ 427 m	slope bottom	208.25	12
2121	≥ 427 m	cove/ravine N/NE	201.13	9
1111	< 427 m	steep slope S/SW	192.62	5
1114	< 427 m	flat summit/ridge	190.58	8
1130	< 427 m	dry flat	162.93	11
2112	≥ 427 m	slope crest	103.90	6
1112	< 427 m	slope crest	88.54	4
1122	< 427 m	sideslope S/SW	87.20	4
2110	≥ 427 m	steep slope N/NE	72.42	5
1120	< 427 m	sideslope N/NE	70.15	6
2120	≥ 427 m	sideslope N/NE	67.98	3
2122	≥ 427 m	sideslope S/SW	67.86	4
2111	≥ 427 m	steep slope S/SW	53.74	3
2142	≥ 427 m	river	18.03	2
1140	< 427 m	stream	16.72	0
2140	≥ 427 m	stream	10.53	0
1131	< 427 m	moist flat	4.25	1
2131	≥ 427 m	moist flat	3.66	0
Totals			4555.71	220

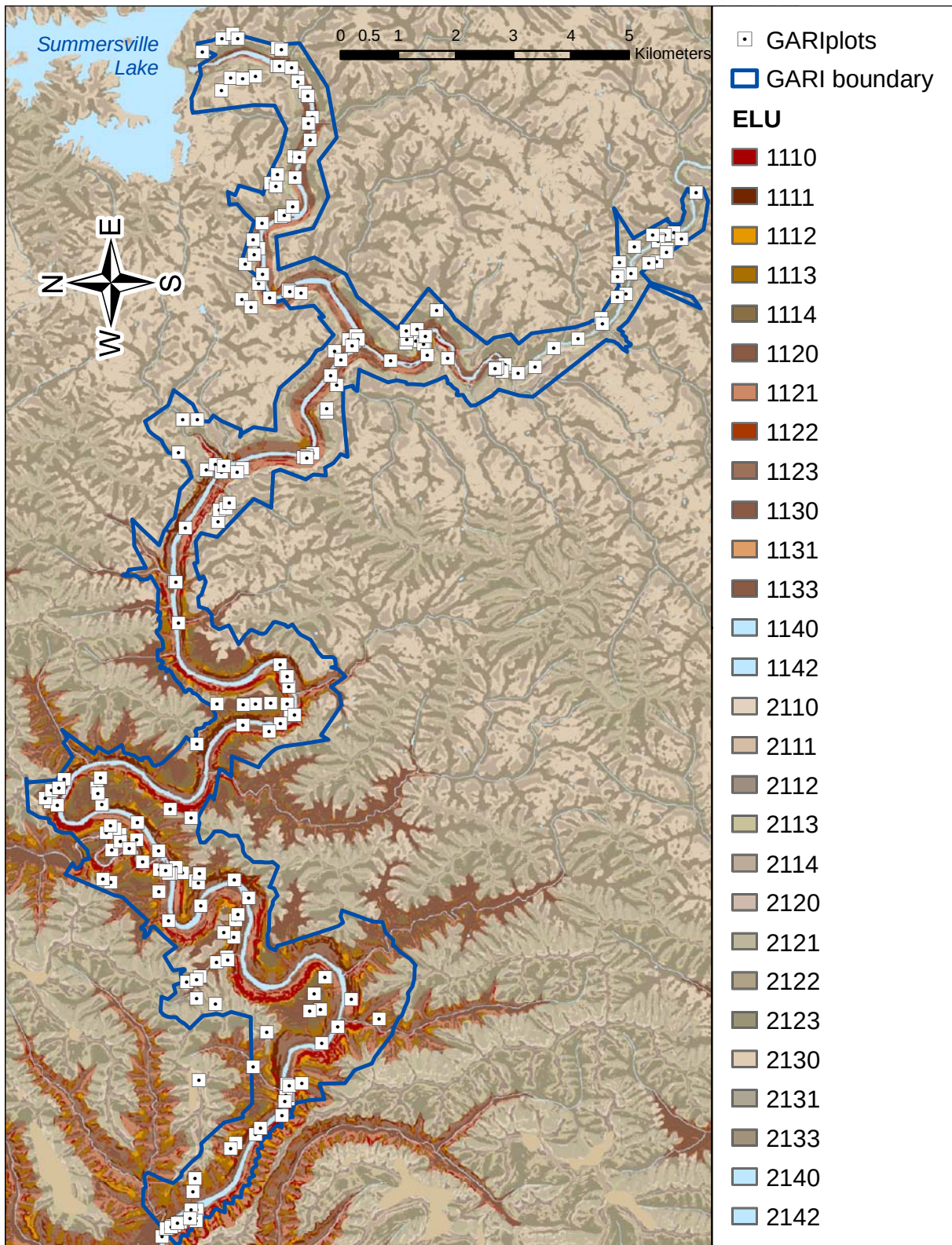


Figure 2. Ecological Land Units (ELU) and locations of plots sampled for vegetation classification and mapping of Gauley River National Recreation Area.

form for plots sampled prior to 2006 was Form 3: Quantitative Community Characterization (Sneddon 1993). In 2006–2009, the standard WVNHP Vegetation Plot Form was used. Completed examples of both of these forms are provided in Appendix A. Plots were placed in the field to sample homogenous vegetation representative of the stand (Mueller-Dombois and Ellenberg 1974) and, usually, to avoid disturbed sites and weedy areas. Plots were typically 20×20 m² (65×65 ft²), but size and shape were sometimes altered to accommodate small patch and linear communities. Three types of data were collected: metadata, environmental data, and vegetation data.

Metadata included plot code, directions to the plot, representativeness, surveyors' names, sampling date, location coordinates, and associated GPS files. Locations of plots sampled in 1995 were hand mapped on USGS topographic maps. In 2000–2009 most plot locations were determined using a global positioning system (GPS). When satellite reception was possible, coordinates for plot locations were collected using Trimble GPS units and these positions were post-process differentially corrected. When satellite reception was poor, Garmin GPS units were used or the plot locations were mapped by hand on USGS topographic maps. Photographs were taken of most plots.

Environmental plot data included environmental comments, landscape comments, slope, aspect, elevation, and information on geology, landform, topographic position, hydrology, and soils. Soil information included a profile description, texture determined by hand in the field, and pH determined in the field. Soil samples were collected from plots for chemical analysis. The surface organic layer was scraped off and soil was collected from the top 10–15 cm (4–6 in) of the mineral horizon from three to five subsamples scattered around each plot. Subsamples from each plot were combined and mixed, the soil was dried and sieved, and 50-g (1.6-oz) samples were sent to Brookside Laboratories Inc. (New Knoxville, OH) for chemical analysis; tests included total exchange capacity, pH, % organic matter, estimated N release, and ppm S, P, Ca, Mg, K, Na, B, Fe, Mn, Cu, Zn, and Al (Brookside Laboratories Inc. 2008).

Vegetation plot data included information on physiognomy (structure) and species composition. Height and percent cover of each stratum (canopy, subcanopy, tall shrub, short shrub, herb, and nonvascular) were estimated. Physiognomic type (forest, woodland, shrubland, herbaceous, non-vascular, and sparsely vegetated) of the stand was determined according to the definitions provided in Appendix B (adapted from Sneddon 1993, TNC and ESRI 1994a). Diameter at breast height (dbh) was measured for all woody stems greater than 7 cm (2.75 in) dbh. All vascular plants in plots were identified and percent cover in each stratum by each taxon was determined by ocular estimation. Total cover by each taxon (combining cover in all strata but not including overlap) was also recorded. Percent cover by individual bryophytes and lichens was recorded for species having greater than 1% cover. Primary references used in the field to key out vascular plants included Flora of West Virginia (Strausbaugh and Core 1977) and Manual of Vascular Plants of Northeastern United States and Canada (Gleason and Cronquist 1991). Bryophyte collections were identified by Dr. Susan Studlar (West Virginia University) and lichen collections were identified by Don Flenniken, author of the Macrolichens in West Virginia (Flenniken 1999).

Nomenclature for vascular plants follows the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon et al. 2006), except for *Dichanthelium* and *Panicum* which follow the Flora of

North America (Freckmann and Lelong 2003). Nomenclature for mosses and liverworts (Bryophyta) follows the Annotated Checklist of the Hornworts, Liverworts, and Mosses of West Virginia (Studlar et al. 2002). Nomenclature for lichens (Ascomycota) follows a Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada (Esslinger 2009). Nomenclature for mushrooms (Basidiomycota) follows Mushrooms of West Virginia and the Central Appalachians (Roody 2003). These references are the standards used by WVNHP for vegetation plots and represent the most complete, up-to-date, and consistent taxonomy available for West Virginia.

A collection-based floristic inventory of GARI was conducted in concurrence with plot sampling for vegetation classification. Because of this, most of the vascular plant species identified in vegetation plots were collected from the park. Many bryophytes and lichens were also collected. Specimens from this inventory are deposited in herbaria of the NPS in Glen Jean, WV, and West Virginia University in Morgantown, WV. Details on the methods and results of the floristic inventory are covered in a separate report (Streets and Vanderhorst 2010).

Data from plots were entered in the Plots database version 2.0 (NatureServe 2004), an Access application developed for the USGS / NPS Vegetation Mapping Program. Plots were assigned alphanumeric plot codes beginning with GARI, except for three plots sampled in Carnifex Ferry Battlefield State Park, which were assigned plot codes beginning with CFSP.

Multivariate analysis, utilizing PC-Ord software (McCune and Mefford 1999), was used to provide insight for classification of vegetation. This was an iterative process which involved analyses of various sets and subsets of plot data, using one-way and two-way hierarchical agglomerative cluster analysis, non-metric multidimensional scaling (NMS), and indicator species analysis. Data screening for all analyses included elimination of all nonvascular taxa, vascular taxa with uncertain identification or identified to the generic or higher taxonomic level, and taxa which occurred in only one plot. Outlier plots were identified and removed from analyses because they can have large effects on outcomes and conclusions (McCune and Grace 2002). Several data transformations were tried but most analyses performed best with cover values square-root transformed. Cluster analysis was performed on the entire data set and on various subgroups. Additional cluster analyses included plot data from outside the study area (WVNHP 2010) to provide a broader context for making classification decisions. Cluster analysis was run using the Sorenson distance measure and Flexible Beta group linkage method with Beta set to -0.25. Indicator species analysis (Dufrêne and Legendre 1997) was used to identify the species which help define the groups. NMS was run on smaller subgroups, either defined by the cluster analysis or by physiognomy (e.g. deciduous forest, herbaceous) or hydrology (e.g. upland, riparian). NMS was run using the Sorenson distance measure and the auto-pilot mode in PC-Ord set to “slow and thorough” (McCune and Mefford 1999).

An NMS ordination was also run on soil chemistry data from plots. Values for chemical variables (total exchange capacity, pH, % organic matter, estimated N release, and ppm S, P, Ca, Mg, K, Na, B, Fe, Mn, Cu, Zn, and Al) were relativized by their column totals (McCune and Grace 2002). NMS was run using the Sorenson distance measure and the auto-pilot mode in PC-Ord set to “slow and thorough” (McCune and Mefford 1999).

The final vegetation classification for the park also incorporates information gained from plot environmental data, classified plot data from other WV sites (Byers et al. 2007, Vanderhorst 2000, 2001a, 2001b, 2002a, 2002b; Vanderhorst and Streets 2006; Vanderhorst et al. 2007; Vanderhorst et al. 2008; WVNHP 2010), and aerial imagery interpretation, and has been molded by a need for conformity with the USNVC. Because of this, and the realization that plot sampling is always an imperfect representation of the total range of variability in complex systems, the classification does not conform to the results of any one multivariate analysis.

After the final classified GARI community types (putative associations) were decided upon, individual plots were attributed to each community type. One plot was not assigned to a community type because it represented an ectotone. Indicator species analysis (Dufrêne and Legendre 1997) was run on various subgroupings to identify plant species most useful for distinguishing types in the field. Floristic constancy/cover tables and plot floristic synthesis tables were developed for each community type using Access queries and Excel pivot tables. Similar summary tables were produced for environmental variables using Access queries and GIS analyses. A dichotomous key was developed to facilitate identification of GARI community types in the field based on floristic and environmental variables, and this was provided to NCSU to serve as the basis for assessing thematic accuracy of the completed vegetation map.

The vegetation classification for the park was crosswalked to the USNVC in consultation with NatureServe ecologists. Data from each GARI community type were compared to existing associations in the USNVC and decisions were made either to place the local types in existing associations or to develop new associations.

Data from the floristic and environmental tables were used to write local association descriptions and new global USNVC association descriptions, and to edit existing global USNVC association descriptions to accommodate GARI vegetation. Local and global descriptions were entered in Biotics, the central database for biodiversity information maintained by NatureServe.

Aerial Photography Acquisition and Processing

Sanborn Mapping Company, Inc. acquired color infrared, stereo pair, 1:12,000 scale aerial photography for a digital orthophoto mosaic of GARI on March 27, 2003, during leaf-off conditions. The aerial photographs were delivered to the NPS, quality checked, accepted as provided, and sent to NCSU. Upon receipt at NCSU, the aerial photographs were counted to make sure that none were missing, scanned and saved in TIFF format, and placed in the data archive that NCSU maintains for the NPS Northeast Region Inventory & Monitoring Program. Associated data and information provided by Sanborn Mapping Company, Inc. that are also stored in the data archive include the airborne global positioning system (GPS) and inertial mapping unit (IMU) data files, the camera calibration certificate, and a digital flight index map.

The mosaic was produced from 98 color infrared aerial photographs, scanned at 600 dpi with 24-bit color depth. Scanned TIFF images of the aerial photographs were imported into ERDAS IMAGINE IMG format where a photo block was created using the airborne GPS and IMU data that Sanborn Mapping Company, Inc. supplied with the aerial photographs. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. At this point, single frame orthophotos (one for each aerial photograph) were generated within

IMAGINE and exported to IMAGINE LAN format. Then the LAN files were imported into ER Mapper's native (ERS) format, and an ER Mapper algorithm was created which contained the color balancing information and the cutlines for the final mosaic. Band interleaved by line (BIL) image and header files for the mosaic were generated in ER Mapper, the BIL image was imported into IMAGINE IMG format, and, finally, the IMG image was compressed using MrSID software with a 20:1 compression ratio. The final mosaic, in both IMG and MrSID formats, is stored in the NCSU data archive.

A metadata record for the mosaic was prepared in accordance with the current FGDC standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the data archive. Key information for the mosaic is summarized in Table 2.

Vegetation Mapping

A vegetation map for GARI was developed as a personal geodatabase using ESRI ArcGIS software. The geodatabase includes a point feature class for locations of plots, and two polygon feature classes (clipped by the park boundary and unclipped) for vegetation and non-vegetated land cover.

The plots point feature class (Figure 2) was produced from locational coordinates collected using GPS units (Trimble Explorer3 and GeoExplorerXT) or from coordinates mapped by hand on topographic maps. Trimble GPS units were used to collect coordinates of plot locations whenever satellite reception was available. GPS data from Trimble units were post-process differentially corrected and exported as attributed GIS files using Trimble Pathfinder Office software. Locations determined by the Garmin unit were used for 12 plots when reception using a Trimble unit was poor. Locations of the 30 plots sampled in 1995, prior to broad-scale use of GPS technology, were hand mapped on USGS topographic maps. Locations of 27 plots sampled in 2006–2009 were also hand mapped because GPS reception was not possible with any unit due to poor satellite reception (most common on north slopes and in deep, narrow canyons). All plot points were combined in one feature class which includes attribute information on GPS methods, estimated accuracy for each point, survey metadata, and GARI community type and USNVC association names for each plot determined by the vegetation classification.

Transparencies of leaf-on color infrared aerial photography flown in October 2003 (Vanderhorst et al. 2007) and the original transparencies used to produce the orthophoto mosaic for this project were examined on a light table to help distinguish signatures which were not apparent on the digital imagery. Utilization of these multiple sets of aerial photography often helped to overcome deficiencies (e.g. shading) of the primary orthophoto mosaic. Ancillary GIS layers used to assist photointerpretation included digital raster graphs of USGS topographic maps and the landform and ELU models developed for this project.

Table 2. Summary of key information for the Gauley River National Recreation Area (GARI) mosaic.

Title of metadata record:	Gauley River National Recreation Area Color Infrared Orthorectified Photomosaic - Leaf-off (ERDAS IMAGINE .img and MrSID formats)
Publication date of mosaic (from metadata):	15-Sep-2005
Date aerial photographs were acquired:	27-Mar-2003
Vendor that provided aerial photographs:	Sanborn Mapping Company, Inc.
Scale of aerial photographs:	1:12,000
Type of aerial photographs:	Color infrared, stereo pairs
Number of aerial photographs delivered:	98
Archive location of aerial photographs, airborne GPS and IMU data, flight report, camera calibration certificate, and digital flight index map:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi, 24-bit color depth
Horizontal positional accuracy of mosaic:	1.31 meters, meets Class 1 National Map Accuracy Standard (Calculated for BLUE, Gauley River National Recreation Area (GARI) and New River Gorge National River (NERI) together)
Number of ground control points upon which estimated accuracy is based:	147 (for BLUE, GARI, and NERI together)
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	IMG (uncompressed) and MrSID (20:1 compression)

Aerial imagery interpretation was initiated by examining signatures throughout the park in relation to GIS-mapped plot locations. Selection of map classes was driven by the imagery. When individual associations could be reliably mapped, these were chosen as map classes. Complex map classes were used when individual associations could not be distinguished due to tight zonation or patchiness. Map classes were also developed for aquatic, cultural, and disturbed areas and features. The stated minimum mapping unit for this project was 0.5 ha (1.23 ac), but smaller polygons were often delineated for small patch or linear types with distinct signatures. Small creeks were mapped to the extent that their courses were visible on photography, with only short gaps estimated. Polygons were drawn using the ArcGIS editing tools with the screen set at various scales, commonly 1:3,000, depending on the vegetation patch size and distinctiveness of boundaries. Polygons were attributed with the name of the map class and, sometimes, comments related to the vegetation or its photo signature. After a relatively complete list of map classes was established, an attribute domain (a constrained picklist of values) was created to limit map class names to this list. The domain was altered as a few additional map classes were identified. Topology was established to enforce rules for no gaps or overlaps. All areas within the park boundary were mapped and mapping was usually extended somewhat beyond the boundary to insure complete coverage.

A field was included in the vegetation map attribute table to indicate which United States Fish and Wildlife Service (USFWS) wetland system (Cowardin et al. 1979) a map class represents. Polygons representing USNVC associations which are classified as wetland formations (i.e. those with hydrologic modifiers of “temporarily flooded” in the formation name) were attributed “palustrine.” Polygons of the Riparian Zone map class, which is comprised of multiple USNVC associations, were also attributed as palustrine. Polygons representing USNVC associations that are not classified as wetland formations were attributed as “upland.” Wetland status of individual polygons of the Developed Area, Disturbed Area, and Utility Corridor map classes, which do not represent USNVC associations, were attributed as palustrine or upland depending on landscape position, adjacent map classes, plot data, and air photo signature. All polygons of the Road map class were attributed as upland, although some sections may cross wetlands. Polygons of the River and Creek map classes were attributed as “open water.” These attributions are not intended to represent a rigorous delineation of jurisdictional wetland status, but they do identify polygons where jurisdictional wetlands are most likely to occur. The actual area of jurisdictional wetlands contained in a polygon attributed palustrine is likely to be less than the actual area of the polygon due to inclusions of uplands in the floodplain map classes; whereas, polygons attributed upland may actually contain jurisdictional wetlands due to small wetland inclusions in the upland map classes.

A draft vegetation map was provided to NCSU Center for Earth Observation on June 29, 2009 for accuracy assessment. A few changes were made to the draft vegetation map after results of thematic accuracy assessment were received. Aerial photo signatures of all misclassified accuracy assessment points were reviewed and polygons in the vegetation feature class were edited when appropriate. Most edits involved splitting polygons and reattributing the parts of the original polygon according to the correct classification determined by the accuracy assessment point. In a few cases the entire original polygon was reattributed or comments were added to indicate gradation or inclusions within the polygon. Comments were added to all edited polygons to indicate they were edited post accuracy assessment. In addition, three polygons were added after spatial review by the NPS identified small gaps between the draft vegetation map and the

park boundary GIS layers. Post accuracy assessment editing affected 32 of the total 2,104 polygons in the final vegetation map. The final vegetation polygon feature class was clipped by the NPS park boundary layer and aerial statistics were calculated to summarize the relative abundance of each map class within the park.

Metadata records for each feature class in the vegetation map geodatabase were prepared in accordance with the current FGDC standards (FGDC 1998a). Metadata records were edited with ESRI ArcGIS, the NPS Metadata Tools and Editor, and Microsoft Notepad, and were parsed using the USGS metadata compiler (USGS 2004). All errors and omissions identified by the parser were corrected. Metadata records are included within the final geodatabase for the vegetation map.

Accuracy Assessment

Positional Accuracy Assessment

For purposes of accuracy assessment, mosaics of Bluestone National Scenic River (BLUE), Gauley River National Recreation Area, and New River Gorge National River (NERI) were treated as a single entity because the photography was acquired in a single flight with the same camera and with one set of airborne GPS and IMU data. Horizontal positional accuracy of the mosaics was assessed using guidelines of the USGS/NPS Vegetation Mapping Program (ESRI et al. 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of each mosaic in ESRI ArcView 3.3. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble Pro XRS. Mapped ground control points that were physically inaccessible were also noted. The field crew collected accuracy assessment data at 160 ground control points. The coordinate data were collected with real-time GPS and post processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, 13 ground control points were identified as outliers with SAS's JMP program and removed. The field-collected GPS coordinates for the remaining 147 points were compared to the coordinates obtained from each mosaic viewed in ESRI ArcView 3.3. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 3 shows the distribution of the ground control points within the three parks and surrounding area.

Thematic Accuracy Assessment

The thematic accuracy of the draft vegetation map dated June 29, 2009 was assessed by the NCSU Center for Earth Observation using the vegetation key dated June 29, 2009. The vegetation map consisted of 2,086 polygons representing 31 map classes (24 vegetation classes and seven other land cover classes) covering a total area of 4,794 ha (11,846 ac). In developing the accuracy assessment sampling plan, NPS personnel and NCSU staff determined that cost and time constraints limited the target number of data collection points to 150. In order to obtain

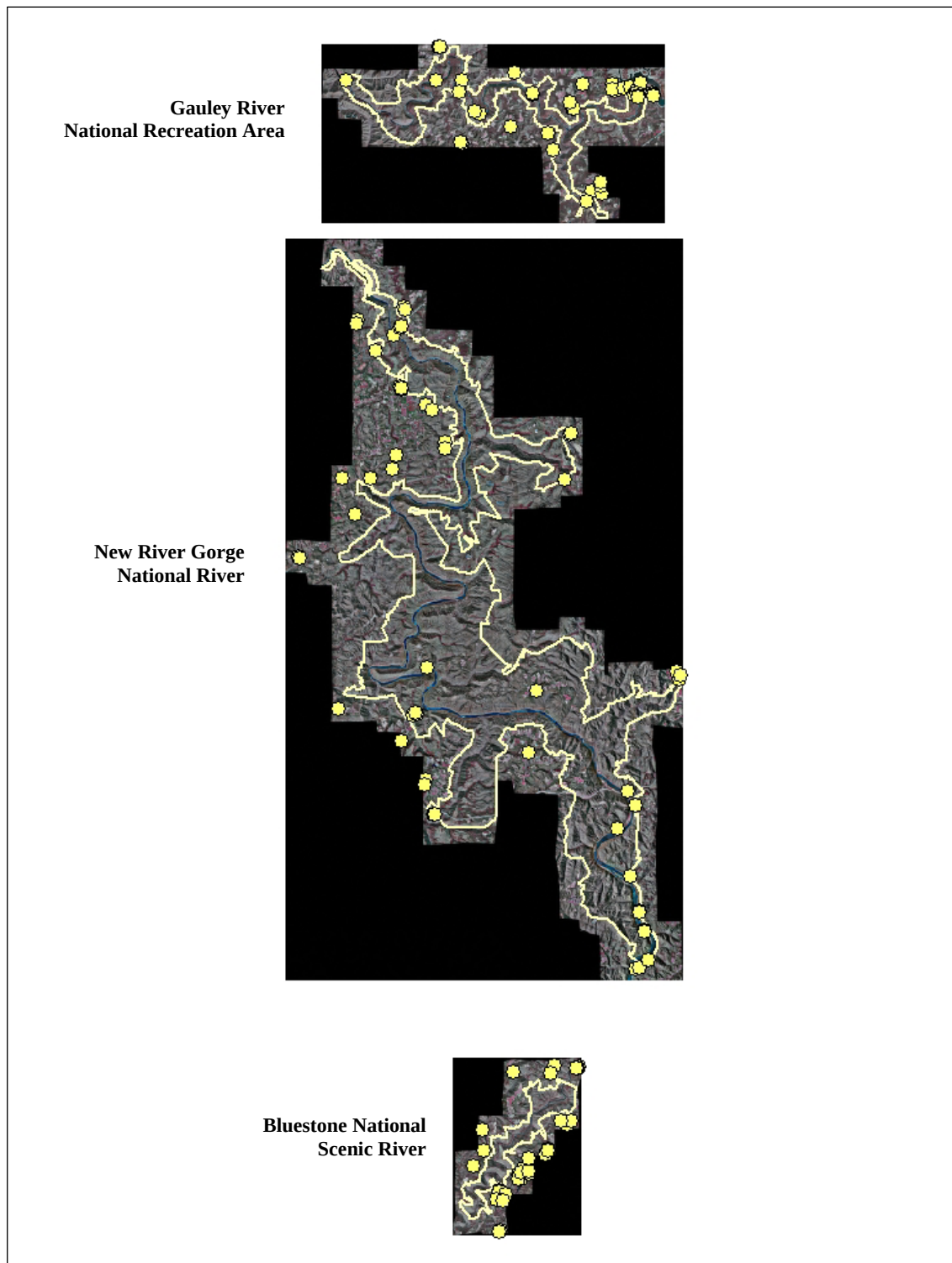


Figure 3. Ground control points used to calculate horizontal positional accuracy of the Gauley River National Recreation Area, New River Gorge National River, and Bluestone National Scenic River leaf-off mosaics.

field data from approximately 150 points, a point-based, stratified random sample (where strata are vegetation classes) of 302 points was selected from areas in polygons that represent vegetated land cover. The whole of the area representing vegetated land cover was considered available for sampling, regardless of ownership status. The sampling frame excluded seven map classes that represent non-vegetated land cover: Backchannel, Creek, Developed Area, Pond, Railroad, Road, and River.

The sample of 302 points was allocated to vegetation map classes according to class abundance and frequency as specified by USGS Accuracy Assessment (AA) Procedures (ESRI et al. 1994), as follows:

1. For map classes with fewer than five polygons that occupy less than 50 ha (123.5 ac) in total area, one sampling point was selected in each polygon, unless the polygon contained a vegetation sampling plot, in which case the polygon was not sampled.
2. For map classes with 5–29 polygons that occupy less than 50 ha (123.5 ac) in total area, nine sampling points per map class were selected with the expectation that data would be collected from at least five sampling points per map class.
3. For map classes with fewer than 30 polygons that occupy more than 50 ha (123.5 ac) in total area, 12 sampling points per map class were selected with the expectation that data would be collected from at least six sampling points per map class.
4. For map classes with 30 or more polygons that occupy more than 50 ha (123.5 ac) in total area, 18 sampling points per map class were selected with the expectation that data would be collected from at least nine sampling points per map class.

The sample of 302 accuracy assessment points was selected using the Create Random Selection tool in Hawth's Tools in ArcGIS (Beyer 2004; ESRI 2005). A few sample points fell outside the park boundary, but all points were within the geographic extent of the vegetation map.

In addition, the following criteria and decision rules were used for selecting sample points:

1. The USGS AA Procedures indicate that map classes with fewer than five polygons occupying less than 50 ha (123.5 ac) in total should be observed in their entirety. Therefore, each of these classes was allocated one sample point per polygon.
2. No sample points were selected within 30 m of a vegetation sampling plot. In cases where a vegetation sampling plot was located in a polygon of a map class with fewer than five polygons occupying less than 50 ha (123.5 ac) in total, that polygon was not sampled. As a result the Burreed Marsh map class was not sampled because it has only one polygon and that polygon contains a vegetation sampling plot.
3. The number of points recommended by the USGS AA Procedures exceeded the target sample size of 150 points. To reconcile this difference, the number of points sampled in the three most abundant classes was reduced proportionally after sampling points were allocated to the less abundant classes as described in Items 1 and 2 above.

4. To the extent possible, potentially inaccessible sample points were identified and replaced prior to field visit. Sample points that were found to be impractical to access during the field visit were dropped and, if possible, an alternative site within the same map polygon was located in the field.
5. In order to avoid transition zones (ecotones,) no points were selected within 30 m (98 ft) of a polygon boundary. Where the polygon was too narrow for this rule to be followed, the points were moved to locations equidistant from the polygon boundaries. Examples of these types of vegetation include Forest Seep and Cliff Face. Fortunately, most of these vegetation cover class polygons had fairly discrete boundaries and there was little problem identifying them in the field.
6. All sample points were required to be at least 60 m (197 ft) away from the nearest neighboring sample point.

An ArcGIS shapefile containing the 302 sample points was created and the attribute table was edited to include fields needed to record the data to be collected at each point. The shapefile was imported into Trimble .ssf format and loaded into a Trimble GeoXP global positioning system (GPS) unit. This allowed the field ecologist to enter data directly into an electronic file in real time, eliminating the need for paper forms.

In September 2009, the ecologist collected field data at a total of 147 accuracy assessment points (Table 3, Figure 4). These 147 points were chosen from the random sample of 302 potential points based on accessibility, efficiency, and abundance. For example, a reasonably accessible point from a class with a small number of potential points that was within hiking distance of additional points was more likely to be visited than an isolated point of tenuous accessibility from a class with many alternate points.

In the field, the ecologist navigated as close as possible to sample points using the Trimble GPS unit. The field observations were entered and the new GPS coordinates were stored. The GPS unit had the datum set to North American 1983 (Conus) and the coordinate system set to UTM zone 17. The GPS data for all AA points were differentially corrected. The planimetric (X, Y) accuracy is ± 5 m (16 ft) for 136 of the 147 points and ± 10 m (32 ft) for 11 points.

The vegetation or land cover at each accuracy assessment point was identified and classified based on the dichotomous vegetation key developed for the vegetation mapping project. The map classes Cliff Face and Riparian Zone include multiple vegetation associations. For accuracy assessment points in these two map classes, both the vegetation map class and the vegetation association, as determined from the key, were noted. Data collected for each sample point are described in Appendix C and include all items recommended in the USGS AA Procedures. Digital photographs were taken at 143 sample points. Data from the 147 accuracy assessment points were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform. In the PLOTS database, species were assigned standardized codes based on the PLANTS Database (USDA, NRCS 2009).

Table 3. Thematic accuracy assessment (AA) sampling strategy for the Gauley River National Recreation Area draft June 29, 2009 vegetation map.

Map Class	Number of Polygons	Area Mapped (Hectares)	Minimum Number of AA Points Recommended by Protocol	Number of AA Points Visited
Yellow Birch Cold Cove Forest	3	4.79	3	3
American Water-willow Cobble Bar	3	0.57	3	2
Oak - Hickory Floodplain Forest	6	3.06	5	7
Forest Seep	8	1.25	5	4
Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	8	3.71	5	6
Utility Corridor	10	5.04	5	5
American Sycamore - Tuliptree - Sweetgum Floodplain Forest	11	5.71	5	7
(Virginia, Pitch) Pine Floodplain Forest	13	5.10	5	8
American Sycamore - River Birch Riverscours Woodland	13	3.54	5	5
Cliff Face	81	9.39	20	6
Cliff Top Virginia Pine Forest	60	17.18	20	4
Eastern Hemlock Floodplain Forest	78	21.26	20	6
Riparian Zone	281	63.82	30	10
Oak / Ericad Forest	47	57.28	30	10
Successional (Virginia, Pitch) Pine Forest	43	96.66	30	12
Disturbed Area	151	134.81	30	10
Successional Tuliptree Forest	113	178.08	30	10
Oak / Great Laurel Forest	121	192.44	30	8
Eastern Hemlock Plateau Forest	95	266.60	30	6
Oak - Hickory - Sugar Maple Forest	167	380.14	30	6
Oak - Hickory Forest	162	438.25	30	3
Sugar Maple - Yellow Buckeye - American Basswood Forest	151	456.05	30	4
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	254	2,018.87	30	5
Total	1,879	4,363.57	431	147

^aMap class represents map class as selected from the map, not map class as observed at the site.

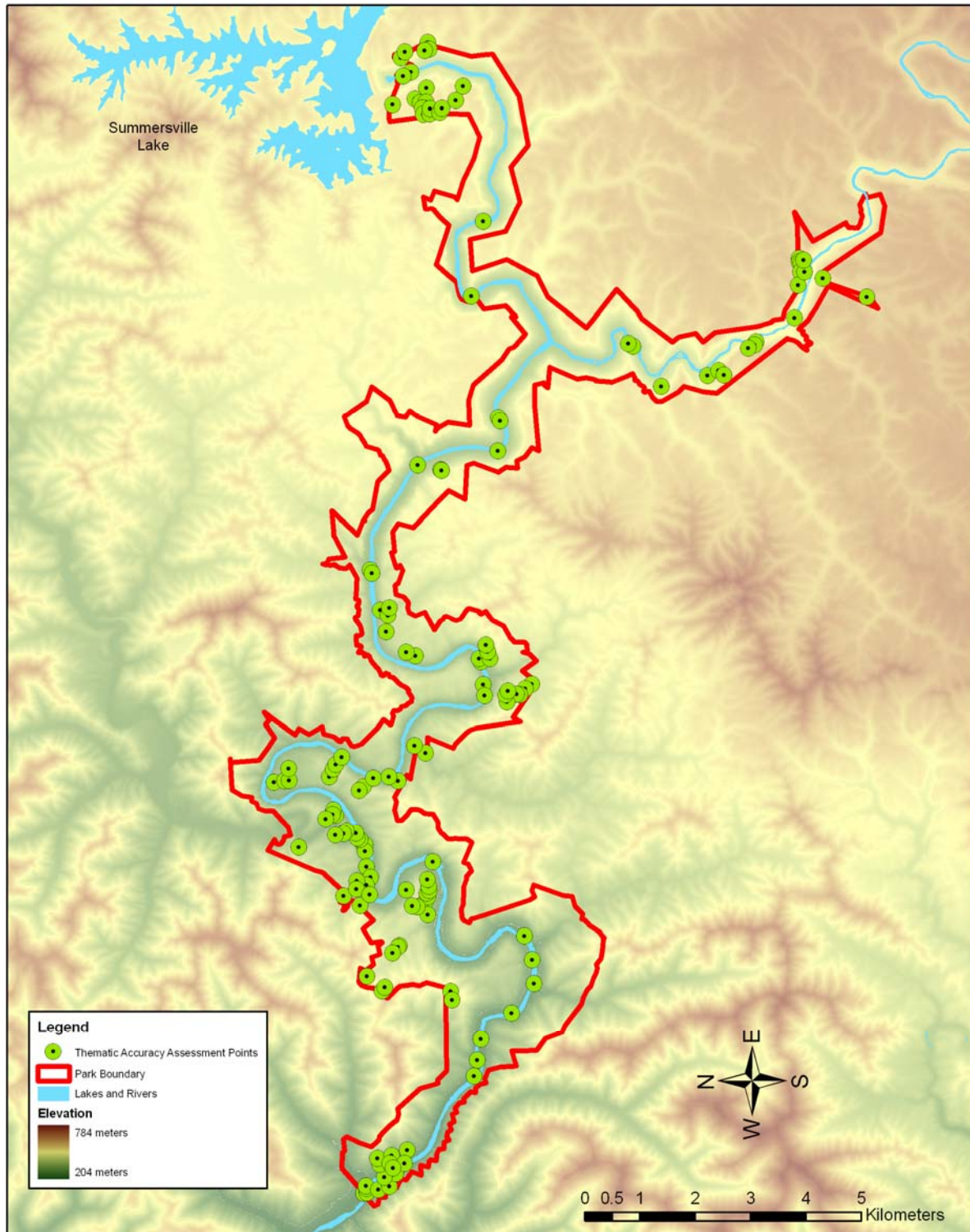


Figure 4. Locations of thematic accuracy assessment data collection points in Gauley River National Recreation Area.

Thematic accuracy of the vegetation map was tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated (ESRI et al. 1994). Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index (K)

$$K = \frac{\text{observed accuracy} - \text{chance agreement}}{1 - \text{chance agreement}}$$

is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). USGS AA Procedures specify that the Kappa index of vegetation maps should exceed 80% (ESRI et al. 1994).

Producer's accuracy and user's accuracy were also calculated in the contingency matrix. The producer's and user's accuracies for each vegetation map class should exceed 80% according to USGS AA Procedures (ESRI et al. 1994). These statistics are not independent, such that one incorrect observation point influences both the producer's and the user's accuracy.

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

User's accuracy represents the probability that a given location on the ground is classified correctly on the map. In other words, from the perspective of the real world vegetation, what are the chances the vegetation observed on the ground correctly matches the map class? User's accuracy is calculated by dividing the number of correctly classified points for a map class by the total number of points that the field observer identified as being of that map class. Error of commission is calculated as $1 - \text{user's accuracy}$. This error indicates the probability that a mapped vegetation or land cover type actually represents the vegetation or land cover on the ground.

Results

Vegetation Classification

Twenty-four vegetation community types of the park are classified in 23 associations of the USNVC, including 14 upland associations and nine riparian and wetland associations (Table 4). Two GARI upland community types, Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, are classified as variants of the same USNVC association. Prevailing physiognomic expressions include 17 forest associations, one woodland association, three herbaceous associations, one non-vascular association, and one sparse vegetation association. Two riparian associations new to the USNVC, Riverscour Shrub Prairie and (Virginia, Pitch) Pine Floodplain Forest, are recognized and described here for the first time based on data from plots at GARI and additional plots along other rivers in West Virginia.

Twenty-one USNVC associations represent natural vegetation types in the park and two associations are semi-natural successional vegetation types that have developed on land previously cleared for agriculture or excavated for dam construction. Successional status in the park is indicated in the GARI community type name. The GARI community type Successional Pitch Pine Forest is classified as a successional variant of the USNVC association for Eastern Hemlock Plateau Forest, a natural community type, because there is no existing USNVC association for successional stands dominated by pitch pine (*Pinus rigida*). The global conservation rank (Table 4) for two of the successional types is GNA (not applicable), indicating that the associations are not considered priority targets for conservation of biological diversity, although they may provide important habitat for some native species and may eventually succeed towards natural vegetation types. Global ranks assigned for 16 associations range from G2G3 (imperiled or vulnerable) to G5 (secure). Six associations have not yet been assigned global conservation ranks (GNR). State conservation ranks have not been assigned for any of the associations. State and global conservation status rank definitions are provided in Appendix D.

A list of vascular and non-vascular plant, fungi, and lichen taxa identified from plots and accuracy assessment points is provided in Appendix E. The list is alphabetically sorted by scientific name and includes common name, family, and division. Seven hundred eighty-two taxa are listed, representing 663 species; the additional 119 taxa represent multiple subspecific taxa per species and identifications made to higher taxonomic ranks. One hundred fifty-two families are represented in nine divisions, including 90 families in the Magnoliophyta (flowering plants), two families in the Pinophyta (conifers), eight families in the Polypodiophyta (ferns), two families in the Lycopodiophyta (club mosses, spike mosses, quillworts), one family in the Equisetophyta (horsetails), 23 families in the Bryophyta (mosses), ten families in the Marchantiophyta (liverworts), 12 families in the Ascomycota (cup fungi, including lichens), and four families in the Basidiomycota (club fungi). Five hundred fifty-four species of vascular plants (Magnoliophyta, Pinophyta, Polypodiophyta, Lycopodiophyta, and Equisetophyta) were identified, including 37 species that are nonnative to North America. Detailed results of a vascular plant floristic inventory, which was conducted concurrently with vegetation mapping for GARI, are provided in a separate report (Streets and Vanderhorst 2010).

Table 4. Vegetation community types occurring in Gauley River National Recreation Area (GARI), the corresponding U.S. National Vegetation Classification (USNVC) association names, and their global conservation ranks.

GARI Community Type Name	USNVC Association Name	USNVC Association Code	Global Conservation Rank
<u>Upland communities</u>			
Cliff Top Virginia Pine Forest	<i>Pinus virginiana</i> - <i>Pinus (rigida, echinata)</i> - (<i>Quercus prinus</i>) / <i>Vaccinium pallidum</i> Forest	CEGL007119	G4?
Common Rock Tripe Cliff Face	<i>Umbilicaria mammulata</i> Nonvascular Vegetation	CEGL004387	G4?
Dry Cliff Face	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation	CEGL006435	GNR
Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	<i>Quercus prinus</i> / <i>Rhododendron catawbiense</i> - <i>Kalmia latifolia</i> Forest	CEGL008524	G3?
Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	<i>Liriodendron tulipifera</i> - <i>Betula lenta</i> - <i>Tsuga canadensis</i> / <i>Rhododendron maximum</i> Forest	CEGL007543	G5
Eastern Hemlock Plateau Forest	<i>Liriodendron tulipifera</i> - <i>Pinus strobus</i> - <i>Tsuga canadensis</i> - <i>Quercus (rubra, alba)</i> / <i>Polystichum acrostichoides</i> Forest	CEGL006304	G4?
Oak / Ericad Forest	<i>Quercus (pinus, coccinea)</i> / <i>Kalmia latifolia</i> / (<i>Galax urceolata</i> , <i>Gaultheria procumbens</i>) Forest	CEGL006271	G5
Oak / Great Laurel Forest	<i>Quercus prinus</i> - <i>Quercus rubra</i> / <i>Rhododendron maximum</i> / <i>Galax urceolata</i> Forest	CEGL006286	G4
Oak - Hickory Forest	<i>Quercus prinus</i> - (<i>Quercus rubra</i>) - <i>Carya spp.</i> / <i>Oxydendrum arboreum</i> - <i>Cornus florida</i> Forest	CEGL007267	G4G5
Oak - Hickory - Sugar Maple Forest	<i>Quercus prinus</i> - <i>Carya ovata</i> - <i>Quercus rubra</i> / <i>Acer saccharum</i> Forest	CEGL007268	G4?
Successional Pitch Pine Forest	<i>Liriodendron tulipifera</i> - <i>Pinus strobus</i> - <i>Tsuga canadensis</i> - <i>Quercus (rubra, alba)</i> / <i>Polystichum acrostichoides</i> Forest	CEGL006304	G4?
Successional Tuliptree Forest	<i>Liriodendron tulipifera</i> - <i>Quercus spp.</i> Forest	CEGL007221	GNA
Successional Virginia Pine Forest	<i>Pinus virginiana</i> Successional Forest	CEGL002591	GNA
Sugar Maple - Yellow Buckeye - American Basswood Forest	<i>Liriodendron tulipifera</i> - <i>Tilia americana</i> var. <i>heterophylla</i> - <i>Aesculus flava</i> - <i>Acer saccharum</i> / (<i>Magnolia tripetala</i>) Forest	CEGL005222	G4?
Yellow Birch Cold Cove Forest	<i>Betula alleghaniensis</i> - (<i>Tsuga canadensis</i>) / <i>Rhododendron maximum</i> / (<i>Leucothoe fontanesiana</i>) Forest	CEGL007861	G2G3
<u>Riparian and wetland communities</u>			
American Sycamore - River Birch Riverscour Woodland	<i>Platanus occidentalis</i> - <i>Betula nigra</i> / <i>Cornus amomum</i> / (<i>Andropogon gerardii</i> , <i>Chasmanthium latifolium</i>) Woodland	CEGL003725	GNR
American Sycamore - Tuliptree - Sweetgum Floodplain Forest	<i>Liquidambar styraciflua</i> - <i>Liriodendron tulipifera</i> / <i>Lindera benzoin</i> / <i>Arisaema triphyllum</i> Forest	CEGL004418	G4
American Water-willow Cobble Bar	<i>Justicia americana</i> Herbaceous Vegetation	CEGL004286	G4G5

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GARI Community Type Name	USNVC Association Name	USNVC Association Code	Global Conservation Rank
<u>Riparian and wetland communities (continued)</u>			
Bur-reed Marsh	<i>Sparganium americanum</i> - (<i>Sparganium erectum</i> ssp. <i>stoloniferum</i>) - <i>Epilobium leptophyllum</i> Herbaceous Vegetation	CEGL004510	G2G3
Eastern Hemlock Floodplain Forest	<i>Tsuga canadensis</i> - <i>Quercus rubra</i> - (<i>Platanus occidentalis</i> , <i>Betula nigra</i>) / <i>Rhododendron maximum</i> / <i>Anemone quinquefolia</i> Forest	CEGL006620	GNR
Forest Seep	<i>Acer rubrum</i> - <i>Nyssa sylvatica</i> / <i>Ilex verticillata</i> - <i>Vaccinium fuscum</i> / <i>Osmunda cinnamomea</i> Forest	CEGL007853	G3G4
Oak - Hickory Floodplain Forest	<i>Quercus</i> (<i>rubra</i> , <i>velutina</i> , <i>alba</i>) / <i>Carpinus caroliniana</i> - (<i>Halesia tetraptera</i>) / <i>Maianthemum racemosum</i> Forest	CEGL006462	GNR
Riverscour Shrub Prairie	(<i>Betula nigra</i> - <i>Ilex verticillata</i>) / <i>Andropogon gerardii</i> - <i>Solidago simplex</i> var. <i>racemosa</i> Shrub Herbaceous Vegetation	CEGL006623	GNR
(Virginia, Pitch) Pine Floodplain Forest	<i>Pinus virginiana</i> - (<i>Pinus rigida</i>) - <i>Nyssa sylvatica</i> / <i>Xanthorhiza simplicissima</i> / <i>Euphorbia corollata</i> Forest	CEGL006624	GNR

Examples of graphic results of cluster analyses and NMS ordinations of plot floristic data are provided in Appendix F. These analyses represent mid-level iterations with the plot data set divided into two subsets, upland forests and riparian and wetland communities. Seven plots representing cliff face communities were not included in these analyses because they behave as extreme outliers. The final classification of plots is indicated by symbology overlain on the graphics. One upland forest plot was not assigned to a community type because it represents an ectotone. These graphics illustrate the relationships between the associations by grouping plots with most similar floristic composition closest to each other. Discrepancies between the placements of individual plots by multivariate techniques in comparison to the final classification are apparent, but the overall patterns of the classification are supported by these quantitative analyses.

An NMS ordination graph of plot soil chemistry data, also provided in Appendix F, shows a strong correspondence between the vegetation classification and soil fertility gradients. Riparian communities group in the bottom of the graph in soil chemistry space representing higher pH, higher Cu, and lower levels of most other nutrients, while upland communities group in the bottom of the graph in soil chemistry space representing lower pH, higher total exchange capacity and organic matter, and higher levels of most nutrients. In the upper (upland) part of the graph there is an increasing base cation gradient from right (high Fe) to left (high Ca, Mg, Mn, P, Zn) which also corresponds to the turnover in plant species composition represented by the vegetation classification. Summary statistics (mean and standard deviation) of soil nutrients in plots grouped by community type are provided in Appendix G. Mean values for most soil nutrients across all associations at GARI are near or below the means from 1,186 vegetation plots in various habitats across West Virginia (WVNHP 2010). Most notably, GARI soils have lower mean Ca, S, and P, and higher mean Al and Mn compared to statewide means.

Tables of plot floristic summary statistics for each community type that was sampled are provided in Appendix H. Association tables are arranged alphabetically by the GARI community type name listed in Table 4. Plant taxa in the tables are sorted in descending order by constancy in plots, then in descending order by mean cover, then in ascending alphabetical order. These tables provide a quick, quantitative summary of the plant species composition of each association.

A dichotomous key to vegetation associations is provided in Appendix I. This key can be used to identify the associations in the field and to increase understanding of the distinctions between closely related types.

Detailed global and local association descriptions are provided in Appendix J. These are arranged within the hierarchical structure of the USNVC (Anderson et al. 1998); however, the hierarchy is not indicated in the table of contents for Appendix J. Vegetation classified in the park is grouped within twelve formations, arranged in the following order: 1) rounded-crowned temperate or subpolar needle-leaved evergreen forest (two associations), 2) temporarily flooded temperate or subpolar needle-leaved evergreen forest (two associations), 3) lowland or submontane cold-deciduous forest (seven associations), 4) temporarily flooded cold-deciduous forest (two associations), 5) saturated cold-deciduous forest (one association), 6) mixed needle-leaved evergreen - cold-deciduous forest (three associations), 7) temporarily flooded cold-deciduous woodland (one association), 8) temporarily flooded temperate or subpolar grassland

(one association), 9) seasonally flooded temperate or subpolar grassland (one association), 10) temporarily flooded temperate perennial forb vegetation (one association), 11) alpine to submontane temperate or subpolar lichen vegetation (one association), and 12) cliffs with sparse vascular vegetation (one association). Local information provided for each association includes a photograph of a representative stand, environmental and vegetation descriptions, geographic range within the park, classification comments, and a list of plots which represent the type. Global information includes the classification hierarchy, range-wide environmental and vegetation descriptions, range-wide geographic distribution, global conservation status, classification information, and references. Appendix K is the bibliography for the global descriptions.

Accuracy Assessment

Positional Accuracy of Mosaics

The horizontal positional accuracy of the three mosaics (BLUE, GARI, NERI) together is 1.31 meters, which meets the Class 1 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is included in the data archive.

Thematic Accuracy

The thematic accuracy of the draft June 29, 2009 vegetation map was calculated with a contingency matrix (Table 5). The Kappa index for the vegetation map is $87.1\% \pm 4.89\%$ and the overall percent accuracy is estimated to be 87.8%. Both estimates meet the USGS AA Procedures requirement of 80%. User's Accuracy (error of commission) is 100% for 16 of the 23 map classes analyzed and ranges from 33% to 92% for the remaining seven map classes, while Producer's accuracy (errors of omission) is 100% for 13 map classes and ranges from 40% to 86% for the remaining 10 map classes. Only two of the 23 map classes had a User's accuracy under 50% (Oak - Hickory Forest and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest), while only one map class had a Producer's accuracy under 50% (Successional Tuliptree Forest). The high errors of commission and omission for these three classes indicate that they were not consistently distinguished by aerial photography interpretation. In addition, however, it should be noted that small sample sizes may have contributed to the low accuracies. For example, the recommended number of accuracy assessment sample points for Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest was 30, but only five sample points were visited. Had sample sizes been larger, it seems likely that the User's accuracies would have been higher.

Table 5. Contingency matrix and calculated errors for the thematic accuracy assessment of the Gauley River National Recreation Area draft June 29, 2009 vegetation map.

	Map Class	MAPPED																								Total	User's Accuracy, (% correct)
			cf	di	ff	fs	hc	hf	hp	hr	mm	oe	oh	ohf	ohs	or	rip	rw	st	svp	uc	vp	vpf	ww	yb		
OBSERVED	Cliff Face	cf	5																							5	100
	Disturbed Area	di		8																						8	100
	American Sycamore - Tuliptree - Sweetgum Floodplain Forest	ff			6																					6	100
	Forest Seep	fs				4																				4	100
	Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	hc					4															1				5	80
	Eastern Hemlock Floodplain Forest	hf						6																		6	100
	Eastern Hemlock Plateau Forest	hp							6																	6	100
	Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	hr		1			1			5									3		1				1	12	42
	Sugar Maple - Yellow Buckeye - American Basswood Forest	mm									4															4	100
	Oak / Ericad Forest	oe										10														10	100
	Oak - Hickory Forest	oh											2		2				2							6	33
	Oak - Hickory Floodplain Forest	ohf												7												7	100
	Oak - Hickory - Sugar Maple Forest	ohs											1		4											5	80
	Oak / Great Laurel Forest	or		1			1									8			1							11	73
	Riparian Zone	rip															10									10	100
	American Sycamore - River Birch Riverscour Woodland	rw																5								5	100
	Successional Tuliptree Forest	st			1														4							5	80
	Successional (Virginia, Pitch) Pine Forest	svp	1																	12						13	92
	Utility Corridor	uc																			4					4	100
	Cliff Top Virginia Pine Forest	vp																				3				3	100
	(Virginia, Pitch) Pine Floodplain Forest	vpf																					8			8	100
	American Water-willow Cobble Bar	ww																						2		2	100
	Yellow Birch Cold Cove Forest	yb																							2	2	100
Total			6	10	7	4	6	6	6	5	4	10	3	7	6	8	10	5	10	12	5	4	8	2	3	147	
Producer's Accuracy (% correct)			83	80	86	100	67	100	100	100	100	100	67	100	67	100	100	100	40	100	80	75	100	100	67		
																									Total Points Correct		129
																									Overall Accuracy		87.76%
																									Kappa Index		87.12%
																									90% Confidence Interval		4.89%

Vegetation Mapping

The final vegetation map (Figure 5) for GARI includes 31 map classes covering a total of 4,555.26 ha (11,256.30 ac) within the park boundaries (Table 6). Approximately 89% of the park area is mapped as natural and semi-natural vegetation and an additional 6% is mapped as natural waterways. The remaining 5 % is mapped as cultural and disturbed areas and transportation features.

Upland communities comprise about 86% of the park area and are represented by 13 map classes. The Cliff Face and Successional (Virginia, Pitch) Pine Forest map classes each include patches of two USNVC associations (Table 7). All other upland community map classes represent single predominating associations in the USNVC as listed in Table 4, but polygons may have inclusions of other associations less than the minimum mapping unit (0.5 ha [1.23 ac]) and may grade towards adjacent polygons of related map classes. The most abundant map class in GARI is Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, which covers about 43% of the park area. The five other most abundant map classes in GARI are, in descending order of abundance, Sugar Maple - Yellow Buckeye - American Basswood Forest, Oak - Hickory Forest, Oak - Hickory - Sugar Maple Forest, Eastern Hemlock Plateau Forest, and Oak / Great Laurel Forest. Together, these six most abundant map classes cover about 80% of the park area. Mixed evergreen-deciduous forests having a large component of eastern hemlock dominate the eastern two-thirds of the park. Deciduous forests dominate the western third of the park.

Riparian and wetland communities comprise about 2% of the park area and are represented by nine map classes. Riparian Zone is the most abundant map class in this group and may include patches of three USNVC associations (Table 7), but Riverscour Shrub Prairie is the dominant association in this map class. The other two associations in the map class, American Water-willow Cobble Bar and American Sycamore - River Birch Riverscour Woodland, occur as individual map classes as well. All other riparian and wetland community map classes represent single predominating associations in the USNVC as listed in Table 4.

Cultural areas include the Utility Corridor and Developed Area map classes which represent land without vegetation cover or with vegetation which is maintained by periodic, usually frequent, human management activities. Examples of developed areas mapped in GARI include agricultural hayfields and pastures, oil well sites, and recreational facilities (boat landings, parking lots, and camping areas).

The Disturbed Area map class represents land where natural vegetation has been significantly altered by recent human activities but which is not actively maintained by human activities. Disturbed areas typically have vegetation comprised of both native and exotic species with physiognomy often differing from typical natural stands in similar topographic positions. Examples of disturbed areas mapped in GARI include recently logged areas, areas disturbed by dam and bridge construction, and areas subject to heavy recreational use.

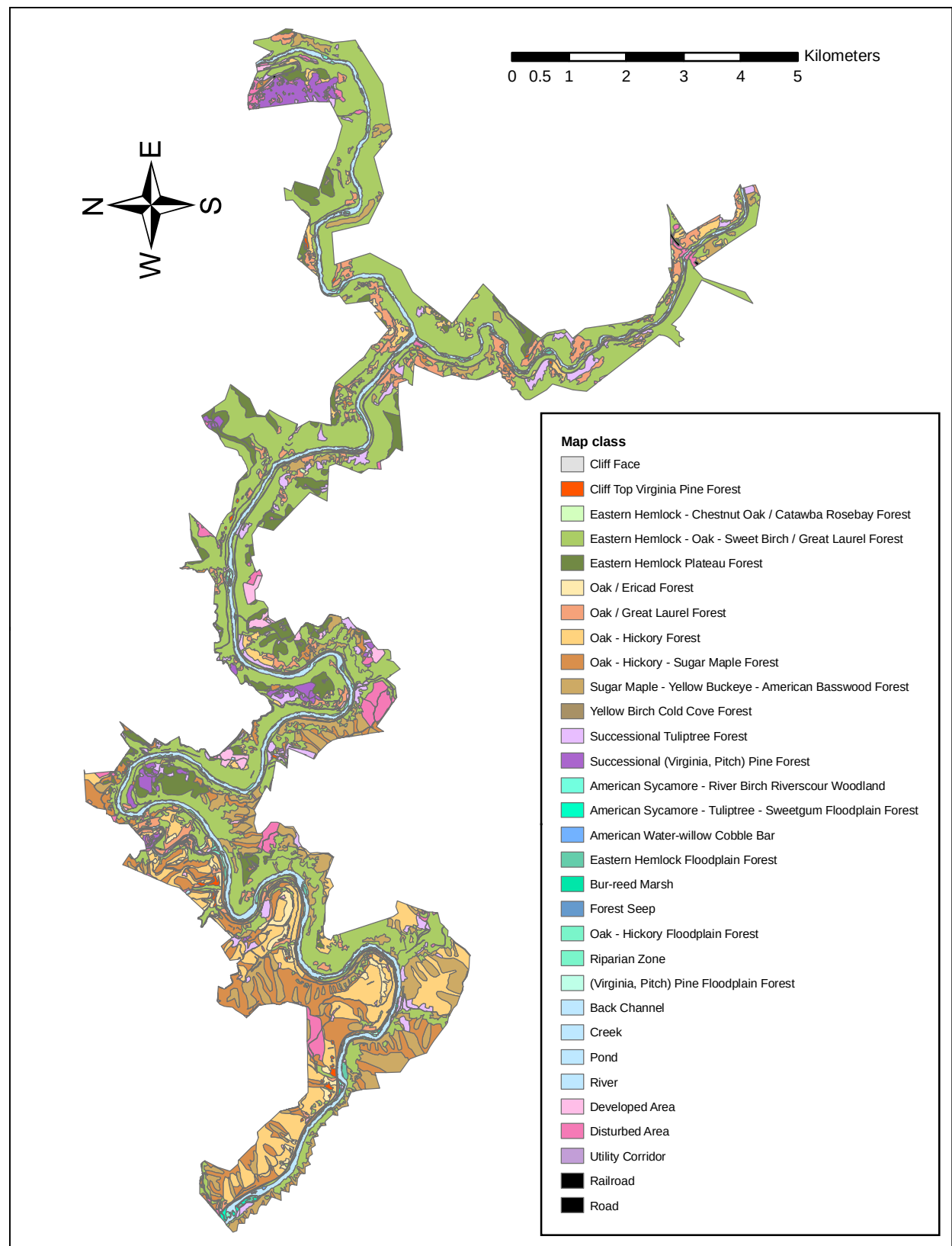


Figure 5. Final vegetation map of Gauley River National Recreation Area.

Table 6. Number of polygons and total area of vegetation map classes in Gauley River National Recreation Area.

Map Class	Map Class Name	Number of Polygons	Total Acres	Total Hectares
<u>Upland communities</u>				
cf	Cliff Face	82	21.50	8.70
vp	Cliff Top Virginia Pine Forest	60	38.85	16.13
hc	Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest	9	9.49	3.84
hr	Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest	264	4861.37	1967.33
hp	Eastern Hemlock Plateau Forest	109	601.11	243.26
oe	Oak / Ericad Forest	49	138.11	55.89
or	Oak / Great Laurel Forest	127	488.93	197.86
oh	Oak - Hickory Forest	180	1050.92	425.29
ohs	Oak - Hickory - Sugar Maple Forest	176	872.68	353.16
svp	Successional (Virginia, Pitch) Pine Forest	44	226.29	91.58
st	Successional Tuliptree Forest	114	335.09	135.61
mm	Sugar Maple - Yellow Buckeye - American Basswood Forest	157	1074.33	434.76
yb	Yellow Birch Cold Cove Forest	2	11.17	4.52
Total upland communities		1373	9730.86	3937.94
<u>Riparian and wetland communities</u>				
rw	American Sycamore - River Birch Riverscour Woodland	12	5.32	2.15
ff	American Sycamore - Tuliptree - Sweetgum Floodplain Forest	11	11.93	4.83
ww	American Water-willow Cobble Bar	3	1.40	0.57
bm	Bur-reed Marsh	1	0.07	0.03
hf	Eastern Hemlock Floodplain Forest	78	52.53	21.26
fs	Forest Seep	8	3.02	1.22
ohf	Oak - Hickory Floodplain Forest	5	7.24	2.93
rip	Riparian Zone	283	157.27	63.65
vpf	(Virginia, Pitch) Pine Floodplain Forest	13	12.60	5.10
Total riparian and wetland communities		414	251.37	101.73
<u>Aquatic features</u>				
bc	Back Channel	4	3.65	1.48
ck	Creek	10	12.94	5.24
po	Pond	3	1.72	0.70
ri	River	2	666.15	269.58
Total aquatic features		19	684.46	276.99
<u>Cultural and disturbed areas</u>				
de	Developed Area	82	112.97	45.72
di	Disturbed Area	157	282.22	114.21
uc	Utility Corridor	11	5.79	2.34
Total cultural and disturbed areas		250	400.98	162.28
<u>Transportation features</u>				
rr	Railroad	4	68.52	27.73
ro	Road	145	120.15	48.62
Total transportation features		149	188.67	76.35
Grand Total		2205	11256.34	4555.29

Table 7. Associations of the U. S. National Vegetation Classification (USNVC) occurring in complex map classes at Gauley River National Recreation Area (GARI).

Map Class	Map Class Name	GARI Community Type Names and USNVC Association Codes included in Map Class
cf	Cliff Face	Common Rock Tripe Cliff Face (CEGL004387) Dry Cliff Face (CEGL006435)
rip	Riparian Zone	American Water-willow Cobble Bar (CEGL004286) American Sycamore - River Birch Riverscour Woodland (CEGL003725) Riverscour Shrub Prairie (CEGL006623)
svp	Successional (Virginia, Pitch) Pine Forest	Successional Pitch Pine Forest (CEGL006304) Successional Virginia Pine Forest (CEGL002591)

Discussion

Vegetation patterns in GARI reflect environmental gradients related to geology, soils, solar exposure, disturbance regimes, and past land use.

Upland forests in the eastern two-thirds or so of the park are characterized by an abundance of eastern hemlock and/or great laurel (*Rhododendron maximum*). The distribution of these mixed deciduous-evergreen forest types broadly corresponds with geology mapped as the New River formation (Cardwell et al. 1968). The New River formation is composed primarily of near horizontal sandstone beds which weather to form coarse textured, strongly acidic, low fertility soils. Most cliffs in the park are formed from sandstones in the New River formation. The local moist climate, seepage from the horizontal sandstone layers, and well drained, acidic soils combine to provide a competitive advantage for dominance by eastern hemlock in most topographic positions in this area of the park. The Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest is the matrix forest on colluvial gorge slopes, Oak / Great Laurel Forests usually occupy gorge slopes with higher solar exposure, and Eastern Hemlock Plateau Forests occupy upper slopes and plateaus with residual soils. Small patch communities, which occupy specialized habitats in this area of the park, include the Cliff Top Virginia Pine Forest and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest on upper slopes and cliff tops with high solar exposure and the Yellow Birch Cold Cove Forest on lower slopes with extremely low solar exposure.

Eastern hemlock is currently threatened by infestations of the hemlock woolly adelgid, an exotic insect pest first detected in the park in 2004 (Wood et al. 2009). Significant tree mortality caused by this pest seems unavoidable and is likely to have broad ecosystem effects on bird populations, stream temperatures and nutrient levels, and amounts of soil carbon, coarse woody debris, and fire fuel loads. Considering the abundance of eastern hemlock in GARI, its imminent decline is likely to represent the biggest change in forest composition since the logging era of the early 1900s.

In contrast to the eastern part of the park, upland forests in the western third or so of the park are strongly dominated by deciduous tree species, and eastern hemlock and great laurel become restricted to small areas of moist habitat. The distribution of these deciduous forests broadly corresponds with geology mapped as the Kanawha formation (Cardwell et al. 1968). The Kanawha formation includes sandstone and significant amounts of shale, siltstone, and coal which weather to form somewhat finer textured, somewhat more fertile soils compared to soils derived from the New River formation. In this deciduous zone, Sugar Maple - Yellow Buckeye - American Basswood Forests occupy positions with relatively low solar exposure, Oak - Hickory and Oak / Ericad Forests occupy positions with higher solar exposure, and Oak - Hickory - Sugar Maple Forests occupy intermediate positions.

Three successional forest types occur in areas which were cleared and subjected to ground disturbance in the past. Stands of Successional Pitch Pine Forest and Successional Virginia Pine Forest occur on plateaus formed on sandstone of the New River formation (Cardwell et al. 1968). Most stands on abandoned farmland are currently decadent and are reverting to dominance by eastern hemlock. In contrast, on land excavated for construction of Summersville Dam, younger

stands of Successional Virginia Pine Forest currently show little evidence of succession away from pine dominance. Successional Tuliptree Forest occurs in more mesic and/or more fertile landscape positions than the successional pine types. It occurs on gorge slopes and alluvial terraces, and on areas of plateaus mapped as the Kanawha formation (Cardwell et al. 1968). Low producer's accuracy of the Successional Tuliptree Forest map class suggests that it is overmapped, most notably at the expense of the Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest map class (Table 5).

Riparian and floodplain vegetation occupies a very small area in GARI but is represented by a disproportionately high number of associations. Small patches of Eastern Hemlock Floodplain Forest, (Virginia, Pitch) Pine Floodplain Forest, and Oak - Hickory Floodplain Forest occur on upper floodplains which are subject to infrequent, short duration, or low energy floods. These communities combine plant species typically found in upland habitats with species that are tolerant of flooding disturbance. Somewhat lower floodplains are occupied by American Sycamore - Tuliptree - Sweetgum Floodplain Forest. All of the floodplain forest types are threatened by camping and trampling, especially during the whitewater boating season. These flat, sandy sites are some of the only riverside areas suitable for camping. They are also some of the rarest community types in the park and their occurrences have been greatly diminished by construction of roads and railroads, and by other riverside development, both in GARI and throughout their ranges outside the park.

Riverscour communities occur below the floodplain forests in higher positions within the active river channel. These areas are subject to frequent, high energy floods which scour and shape bedrock exposures, deposit and remove sediments (boulders, cobble, sand), and control vegetation physiognomy. The American Sycamore - River Birch Riverscour Woodland occurs in higher positions in this zone. Two phases of American Sycamore - River Birch Riverscour Woodland can be recognized at GARI. The more common phase at GARI is represented by stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, and have more open canopies and herb layers with big bluestem (*Andropogon gerardii*) prominent in late season. The less common phase at GARI is represented by stands on sand substrate, which are subject to less frequent, lower energy floods, and have taller, more closed canopies, often dominated by river birch (*Betula nigra*) over lush, tall herb layers with abundant deertongue (*Dichanthelium clandestinum*) and Indian woodoats (*Chasmanthium latifolium*). The Riverscour Shrub Prairie, the major component of the Riparian Zone map class (Table 7), occupies areas where flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. Riverscour communities at GARI have extremely high plant species richness and host a high concentration of rare plant species, including large populations of the federally listed threatened Virginia meadowsweet (*Spiraea virginiana*) and the globally rare Monongahela Barbara's buttons (*Marshallia grandiflora*).

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Appendix A. Vegetation plot field forms.

Form 3: Quantitative Community Characterization **Draft: Spring, 1993**
A. Identifiers (general EOR information) *LFSP.1*

Sci. name: 1.SNAME: <u>Hemlock / Rhododendron</u> 2.GNAME: _____	
3.Site name: <u>CARNIFAX FERRY SP</u>	
4.Survey site name: <u>PIERSON HOLLOW</u>	
5.Quad name(s): <u>Summersville Dam</u>	6.Quad code(s): _____
7.County name(s): <u>Nicholas</u>	8.County code(s): _____
9.Town (LOCAL JURIS): _____	
10.Lat: _____ N	11.Long: <u>0</u> W
12.Directions: _____	
<u>Pierston Hollow in rocky zone just above river</u>	
UTM: <u>505912.6148 E 4228839.2657 N</u>	
13.Source code: <u>2000JV015</u> 14.Survey date: <u>Sept. 8, 2000</u>	
15.Last obs: _____	16.First obs: _____
17.State: <u>WV</u>	
18.Surveyors: <u>Jim Vanderhorst, Brian Streets</u>	

B. Environmental Description *photos 6,7,8*

19.Transect / Observation point #	20.Image annotation #	21.Elevation:
22.Topographic position: ☐ Interfluvium ☐ Backslope ☐ High slope ☐ Step in slope ☐ High level ☒ Low slope ☐ Midslope ☐ Toeslope ☐ Low level ☐ Channel wall ☐ Channel bed ☐ Basin floor ☐ Other	23.Topographic sketch: 	24.Slope degrees: <u>25°</u> 25.Slope aspect: <u>180°</u> 26.Parent material: <u>sandstone</u>
27.Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth (SOILCOM)	31.Soil moisture regime: ☐ Extremely dry ☐ Somewhat wet ☐ Very dry ☐ Wet ☐ Dry ☐ Very wet ☐ Somewhat moist ☐ Permanently inundated ☒ Moist ☐ Periodically inundated	32.Stoniness: ☐ Stone free <0.1% ☐ Moderately stony 0.1-1% ☒ Stony 3-15% ☐ Very stony 15-50% ☐ Exceedingly stony 50-90% ☐ Stone piles >90%
28.Organic horizon depth: <u>10 cm</u>	33.Soil drainage: ☒ Rapidly drained ☐ Somewhat poorly drained ☐ Well drained ☐ Poorly drained ☐ Moderately well drained ☐ Very poorly drained	34.Average texture: ☐ sand ☐ clay loam ☒ sandy loam ☐ clay ☐ loam ☐ peat ☐ silt loam ☐ muck ☐ other
29.Organic horizon type: _____	35.Unvegetated surface: ☒ Bedrock <u>70</u> ☒ Litter, duff ☒ Large rocks (cobbles, boulders > 10 cm) <u>10</u> ☒ Wood (> 1 cm) ☐ Small rocks (gravel, 0.2-10 cm) ☐ Water ☐ Sand (0.1-2 mm) ☐ Other: _____ ☐ Bare soil	
30.Average pH of mineral soil: <u>5</u>	36.Environmental Comments: Note homogeneity of vegetation, erosion / sedimentation, inundation, etc. <u>Old growth forest on colluvial lower slopes dissected by stream w/ rock outcrops. Large trees include Quercus prinus, Betula lenta, Quercus rubra, Tsuga. Understory dominated by Tsuga and Rhododendron maximum. Much down wood (outside plot), snags, canopy gaps throughout community. Fire scar on Betula lenta in plot.</u>	
37.Plot representativeness: <u>Old growth on cool rocky lower slopes of Gauley Gorge. Old growth centers on stream channel (Pierston Hollow)</u>		

Handwritten notes on the left side of the form:
 10cm Litter
 10YR 4/3 w/ mottle ave 6/3
 Sandstone

USGS-NPS Vegetation Mapping Program
Gauley River National Recreation Area

C. Vegetation 38. System: ☒ Terrestrial ☐ Palustrine ☐ Estuarine 39. Plot number: 40. Plot dimensions: 20 x 20 m

41. Leaf type: ☒ Broad-leaf ☐ Semi-broad-leaf ☐ Semi-needle-leaf ☒ Needle-leaf ☐ Graminoid ☐ Broad-leaf herbaceous ☐ Peridophyte	42. Leaf phenology: ☒ Deciduous ☐ Semi-deciduous ☐ Evergreen ☒ Perennial ☐ Annual	43. Physiognomic type: ☒ Forest ☐ Sparse woodland ☐ Shrubland ☐ Dwarf shrubland ☐ Sparse dwarf shrubland ☐ Non-vascular	44. height : I cover T1 Emergent tree T2 Tree canopy T3 Tree sub-canopy S1 Tall shrub S2 Short shrub H Herbaceous N Non-vascular E Epiphyte V Vine / liana
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45. Species / percent cover: starting with uppermost stratum, list all species and I cover for each in the stratum. For forests and woodlands, list on a separate line below each tree species the DBH of all trees above 10 cm diameter. Separate the measurements with a comma and note whether in cm or inches.

T2 Quercus prinus 48, 80 (fire scar) ✓	20	S1 Rhododendron maximum 10 ✓	40	Maianthemum canadensis ✓	T
Quercus rubra 58 (no fire scar) ✓	10	Tsuga canadensis 10, 10 ✓	5	Rhododendron maximum ✓	T
Betula lenta 63 (fire scar) ✓	10			Conophylus americana ✓	T
Tsuga canadensis 30, 60 ✓	10	S2 Rhododendron maximum ✓	T		
Liriodendron tulipifera 32 ✓	5				
Acer rubrum 30 ✓	5				
Nyssa sylvatica 52 ✓	10				
Tsuga canadensis 13, 15, 18, 17 ✓	30				
23, 15, 11, 24, 28, 15 (dead), 19, 18					
Magnolia fraseri 18, 25, 23 ✓	10				
Oxydendron arborea 10, 24 ✓	5				
Acer rubrum 21, 26 ✓	5				
Robinia pseudoacacia 22 (dead), 16 (dead), 14 (dead) ✓	T				
Magnolia acuminata 13 ✓	1				

* many young Tsuga are bent over 63" DBH hemlock out of plot ~230 years.

Form 3. Quantitative Community Characterization, page 2.

West Virginia Natural Heritage Program, Vegetation Plot Form (woody version)

Revised Aug 2008

Identifiers
 Plot code: GAR1.217 Location name: Gauley River NRA
 County name: Nicholas Sublocation: Lower Gauley River Right Quad name: Ansted
 Dominant vegetation: Pinus virginiana - Betula nigra / Kalmia latifolia woodland
 Survey date: Sept 29, 2009 Time: 4:20 PM Surveyors: Jim Vanderhorst, Brian Steets
 Plot directions:

X dimension (m): 33 Y dimension (m): 12 Plot shape: rectangle
 GPS file: AN092912A GPS feature: plot ☒ corrected ☐ raw ☐ map dot
 Field UTM x: 491276 Field UTM y: 4229030
 Corrected UTM x: 491276.323 Corrected UTM y: 4229028.975 Datum: NAD83
 Photos: ☒ Camera: Olympus Photographer: BPS
 Roll #: _____ Frame #: _____

Environmental data

Hydrology evidence ☐ hydrophytes ☐ standing water ☐ saturated soil ☒ flood scour ☒ flotsam ☐ soil features ☐ other: e.g. crayfish holes	Hydrologic regime ☐ permanently flooded ☐ semi-permanently flooded ☐ seasonally flooded ☒ temporarily flooded ☐ intermittently flooded ☐ saturated ☐ moist ☐ somewhat moist ☐ dry ☐ very dry ☐ extremely dry
Elevation (m) : <u>216</u> Slope (°) : <u>12</u> Aspect (°) : <u>220</u> Slope shape-vert. : <u>concave</u> <u>straight</u> <u>convex</u> <u>undulating</u> Slope shape-horiz. : <u>concave</u> <u>straight</u> <u>convex</u> <u>undulating</u> Landform : <u>floodplain</u> Cowardin system : <u>UPL</u> Geologic unit : Surficial geology : <u>alluvium (boulders/sand)</u>	Topographic sketch
Unvegetated surface (%) <u>10</u> litter/duff <u>30</u> bedrock <u>30</u> g rocks >10 cm <u>50</u> sm rocks .2-10 cm <u>50</u> sand .1-2 mm <u>10</u> wood >1 cm <u>10</u> water <u>0</u> bare soil <u>0</u> other:	Topographic position ☐ interfluvium ☐ backslope ☐ low level ☐ high slope ☐ step in slope ☐ channel wall ☐ high level ☐ low slope ☒ channel bed ☐ midslope ☐ toeslope ☐ basin floor Stoniness ☒ <1% ☐ 15-50% ☐ 1-3% ☐ 50-90% ☐ 3-15% ☐ >90% Soil drainage ☒ rapid ☐ mod-poor ☒ well ☐ poor ☐ moderate ☐ very poor

Rosgen stream type
 A B C D DA E F G
 1 2 3 4 5 6 a+ a b c c-
Hummocks % % hollow
 height (cm): 20 ☐ peat
☐ tussocks ☐ roots
☐ tip mounds ☐ down wood
☐ woody stem clusters

Soil Depth to water table (cm): _____
Texture (mineral soil): Sand
pH (mineral soil): 6.5
Depth of organic soil (cm): _____
Depth to mottling (cm): _____
Pore water pH: _____
Pore water EC: _____
Pore water T (°C): _____
Soil map unit: DRF
Hydric indicators: ☒ Soil sample collected for lab analysis

Estimated stand size (ha): 0.1 Plot sampled after pine signature was delineated from photo!
Representativeness: Small patch, plot placed in widest portion of polygon, elsewhere this community may occur as a single line of pines.

Environmental condition: Bouldery beach downstream from the last rapids along the Gauley. Community is a woodland of mostly VA pine with river birch and shrubs. Includes mix of dry-sterile site indicators (pine, mt. laurel, gum) mixed with floodplain indicators (alder, Indian grass). Older pine are clustered around rocks but pine saplings occur in sand-rocks may provide protection from flooding.

Landscape context: Downstream river becomes wider, less rapid. Above plot is upland mesic oak forest, then railroad. Downhill is narrow zone of prairie. Up and downstream is riverscapes woodland without pine.

Ranking: size: B condition: A context: B composite: BA
Disturbance: ☐ fire ☐ exotic plants ☒ trails/roads ☐ deer trails
☐ clearing ☐ insects ☐ grazing ☐ wind-ice damage ☐ other
☐ logging ☐ disease ☐ browsing ☐ ditching/hydro alteration
Comments: railroad

Animal use evidence:
☐ insects collected

22
12/400

USGS-NPS Vegetation Mapping Program
Gauley River National Recreation Area

Species QC BPS 10/7/09

Plot code GARI 217	Leaf phenology ☐ evergreen ☐ cold-deciduous ☒ mixed evergreen-deciduous ☐ annual herb ☐ perennial herb ☐ drought-deactivated ☒ Floristically complete? +, -	Physiognomic class ☒ forest ☐ woodland ☐ shrubland ☐ dwarf shrubland ☐ herbaceous ☐ non-vascular ☐ floating aquatic ☐ submerged aquatic ☐ sparse vegetation	Height class (m) <5 35-50 6-1 >50 1.1-2 float 2.1-5 subm 5.1-10 10.1-15 15.1-20 20.1-35	Stratum T1 emergent tree T2 tree canopy T3 tree sub-canopy S1 tall shrub S2 short shrub H herbaceous N non-vascular A1 floating A2 submerged	Height (m) 10 3 <1 1	% cover 40 30 10 20 5
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Start with uppermost stratum. Note 'cf.' for uncertain taxa, © for collection (add # when available). Phenology codes (fr), (fl), (v).

Woody species	T1	T2	T3	S1	S2	H	%TC	DBH (note stratum; include age data if available)
<i>Pinus virginiana</i>		25		T	I		26	(T2) 27, 22, 14, 26, 25
<i>Quercus prinus</i>		5						(T2) 33 - on top of rock
<i>Betula nigra</i>		5		S	T		10	(T2) 28 (S) T, 10, 7
<i>Alnus cordata</i>				3				
<i>Juniperus virginiana</i>				S				(S) 10
<i>Ilex opaca</i>				S				(S) 9, 7, 8
<i>Prunus virginiana</i>		5						(T2) 18
<i>Acer saccharum</i>				T				
<i>Quercus alba</i>				T	T		T	
<i>Kalmia latifolia</i>				S	2		7	
<i>Liquidambar styraciflua</i>				I	I			(S) © BPS 3450
<i>Vaccinium corymbosum</i>				I	T			
<i>Nyssa sylvatica</i>					I			
<i>Sanicula japonica</i>					T			
<i>Rhododendron arboreum</i>					I			
<i>Smilax glauca</i>					T			
<i>Tsuga canadensis</i>				T	T		I	
<i>Chamaeneris virginica</i>					T			
<i>Athyrium filix-femina</i>					2			

Species name	% cover	
<i>Symphoricarpos patens</i> var. <i>patens</i>	1	(S2) <i>Ranunculus alba</i>
<i>Symphoricarpos lateralis</i>	T	<i>Fraxinus</i>
<i>Viola pedata</i>	P	<i>Physocarpus opulifolia</i>
<i>Sorghastrum nutans</i>	I	<i>Hypericum hypericoides</i>
<i>Dickelera pauciflora</i>	I	(S) <i>Rhododendron tulipifera</i>
<i>Solidago simplex</i>	I	<i>Physocarpus opulifolia</i>
<i>Prunella pardurata</i> cf.	T	<i>Cornus amomum</i>
<i>Erigeron pulchellus</i>	T	<i>Eleagnus umbellata</i>
<i>Erythraea divaricata</i>	T	<i>Gaylussacia bacatta</i>
<i>Deschampsia flexuosa</i>	T	<i>Eudonymus americana</i>
<i>Richardsonia dichotomum</i> dic.	T	(S) <i>Rubus phoenicolasius</i>
<i>Mitchella repens</i>	P	(S) <i>Carpinus caroliniana</i>
<i>Coreopsis tripteris</i>	T	(S) <i>Lydia ligustrina</i>
<i>Lythrum quadrifidum</i>	T	
<i>Achillea millefolium</i>	P	(H) <i>Eupatorium fistulosum</i>
<i>Rudbeckia laciniata</i>	T	<i>Dryopteris marginalis</i>
<i>Lizia trifoliata</i>	T	<i>Baptisia tinctorum</i>
<i>Legume</i>	T	<i>Eupatorium</i> (3-nerved) © BPS 3453
<i>Richardsonia laxiflorum</i>	T	<i>Iris cristata</i>
<i>Potentilla canadensis</i>	T	<i>Kiatis aspera</i> cf.
<i>Bidens frondosa</i>	T	<i>Panicum nudicaeruleum</i>
<i>Euphorbia corollata</i>	T	<i>Galax' aphylla</i> © BPS 3452
<i>Osmunda regalis</i>	T	SNAGS
<i>Symphoricarpos boreale</i>	P	(S) 23 - Pinus, 11 - Pinus
<i>Plantago virginica</i>	T	
<i>Dicentra polyanthus</i>	P	(N) <i>Lassallia pepsiosa</i>

West Virginia Natural Heritage Program Vegetation Plot Form, page 2.

Appendix B. Physiognomic type definitions.

FOREST: Trees usually over 5 m (16 ft) tall with crowns interlocking (generally forming 60–100% cover). Shrubs, herbs, and nonvascular plants may be present at any cover value.

WOODLAND: Open stands of trees usually over 5 m (16 ft) tall with crowns not usually touching (generally forming 25–60% cover). Shrubs, herbs, and nonvascular plants may be present at any cover value.

SHRUBLAND: Shrubs and/or small trees usually 0.5–5.0 m (1.6 to 16 ft) tall with individuals or clumps not touching to interlocking (generally forming >25% canopy cover). Trees may be present, but with cover of 10% or less. Herbs and nonvascular plants may be present at any cover value.

HERBACEOUS: Graminoids and/or forbs (including ferns) generally forming >10% cover. Trees, shrubs, and dwarf shrubs may be present, but with cover 10 percent or less. Nonvascular plants may be present at any cover value.

NON-VASCULAR: Non-vascular vegetation (bryophytes, lichen, or other non-vascular plants) with cover greater than 25%. Trees, shrubs, and herbs may be present, but with cover of 25% or less.

SPARSELY VEGETATED: Substrate is predominantly not vegetated, cover of trees, shrubs, herbs, and non-vascular vegetation combined is 25% or less.

Appendix C. Standard Accuracy Assessment Form for USGS/NPS Vegetation Mapping Program.

Plot Number _____ Park _____ Date _____ Observers _____
Easting: _____ E Northing: _____ N EPE/APE: _____ DOP: _____ Map datum: _____ Zone: _____
Topographic Description: _____ Elevation: _____ Aspect: _____ Canopy Closure: _____
Vegetation Association at Point: _____
Veg Assoc 1 w/in 50 m of point: _____
Veg Assoc 2 w/in 50 m of point: _____
Major Species by Strata: _____

Rationale for Classification: _____

Comments: _____

A table containing the fields that appear on this standard accuracy assessment form was created in ArcGIS and converted to a Trimble data dictionary file for use in the field. All field data were entered directly into the electronic data dictionary.

Descriptions of fields:

Plot Number: randomly generated in ArcGIS
Park: GARI - Gauley River National Recreation Area
Date: automatically generated in the field
Observers: name of observer
Easting / Northing: UTM coordinates automatically generated in field if GPS satellites were available, otherwise edited in ArcGIS after field data were collected
EPE / APE: estimated from GPS differential correction software if collected, otherwise estimated by observer
DOP: estimated from GPS software
Map Datum: NAD 83
Zone: 17N
Topographic Description: descriptors of slope steepness, shape of slope and position on slope
Elevation: calculated by the GPS software, otherwise taken from a topographic map

Aspect: measured to the nearest 1° Azimuth using a Silva ranger handcompass
Canopy Closure: ocular estimate in percent
Vegetation Association at Point: based on the vegetation key
Vegetation Association 1 and 2 within 50 m of point: based on vegetation key and distance to these are also recorded
Major species by strata: common names of major canopy trees seen at point
Rationale for Classification: indicate if it was a strong match to the vegetation key; if it was not record reasons why the match was not so good
Comments: any other comments

The following fields that are not on the standard form were added to the data dictionary:
Canopy height: measured to the nearest meter

Appendix D. State and global conservation status rank definitions.

West Virginia State Ranks

State ranks are assigned by the West Virginia Natural Heritage Program and refer to the conservation status of the element across its range within West Virginia.

Rank	Definition
S1	Five or fewer documented occurrences, or very few remaining individuals within the state. Extremely rare and critically imperiled; or because of some factor(s) making it especially vulnerable to extirpation.
S2	Six to 20 documented occurrences, or few remaining individuals within the state. Very rare and imperiled; or because of some factor(s) making it vulnerable to extirpation.
S3	Twenty-one to 100 documented occurrences. May be somewhat vulnerable to extirpation.
S4	Common and apparently secure with more than 100 occurrences.
S5	Very common and demonstrably secure.
SH	Historical. Species which have not been relocated within the last 20 years. May be rediscovered.
SR	Reported from state, but not yet verified.
SX	Believed extirpated. Little likelihood of rediscovery.
SU	Possibly rare, but status uncertain until more data are gathered.
S?	Unranked, or, if following a number, rank uncertain (ex. S2?).
SNR	Not ranked.

Global Ranks

Global ranks are assigned by NatureServe and refer to the conservation status across the global range of the element.

Global basic ranks

Rank	Definition
GX	Presumed Extinct (species) - Not located despite intensive searches and virtually no likelihood of rediscovery. Eliminated (ecological communities) - Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
GH	Possibly Extinct (species) - Missing; known from only historical occurrences but still some hope of rediscovery. Presumed Eliminated - (Historic, ecological communities)-Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut Forest.
G1	Critically Imperiled - At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	Imperiled - At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3	Vulnerable - At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4	Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	Secure - Common; widespread and abundant.

Global variant ranks

Rank	Definition
G#G#	Range Rank - A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community. A G2G3 rank would indicate that there is a roughly equal chance of G2 or G3 and other ranks are much less likely. Ranges cannot skip more than one rank (e.g., GU should be used rather than G1G4).
GU	Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and a question mark qualifier may be added (e.g., G2?) to express minor uncertainty, or a range rank (e.g., G2G3) may be used to delineate the limits (range) of uncertainty.
GNR	Unranked - Global rank not yet assessed.
GNA	Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Global rank qualifiers

Rank	Definition
?	Inexact Numeric Rank - Denotes some uncertainty about the numeric rank (e.g. G3? - Believed most likely a G3, but some chance of either G2 or G4).
Q	Questionable taxonomy - Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
C	Captive or Cultivated Only - At present extant only in captivity or cultivation, or as a reintroduced population not yet established.

Intraspecific taxon conservation status ranks

Intraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Intraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	Intraspecific Taxon (trinomial) - The status of intraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above for global conservation status ranks. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T-rank cannot imply the subspecies or variety is more abundant than the species as a whole-for example, a G1T2 cannot occur. A vertebrate animal population, such as those listed as distinct population segments under the U.S. Endangered Species Act, may be considered an intraspecific taxon and assigned a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status. At this time, the T rank is not used for ecological communities.

Appendix E. Vascular and non-vascular plant, fungi, and lichen taxa found in plots and at accuracy assessment points in Gauley River National Recreation Area.

Nomenclature for vascular plants follows the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon et al. 2006), except for *Dichanthelium* and *Panicum* which follow the Flora of North America (Freckmann and Lelong 2003). Nomenclature for mosses and liverworts (Bryophyta) follows the Annotated Checklist of the Hornworts, Liverworts, and Mosses of West Virginia (Studlar et al. 2002). Nomenclature for lichens (Ascomycota) follows A Cumulative Checklist for the Lichen-forming, Lichenicolous and Allied Fungi of the Continental United States and Canada (Esslinger 2009). Nomenclature for mushrooms (Ascomycota and Basidiomycota) follows Mushrooms of West Virginia and the Central Appalachians (Roody 2003). An asterisk following the common name indicates the taxon is not native to North America.

Scientific Name	Common Name	Family	Division
<i>Abrothallus cladoniae</i> R. Sant. & D. Hawksw.	lichen	Uncertain Lichen Family	Ascomycota
<i>Acalypha rhomboidea</i> Raf.	Virginia threeseed mercury	Euphorbiaceae	Magnoliophyta
<i>Acalypha virginica</i> L.	Virginia threeseed mercury	Euphorbiaceae	Magnoliophyta
<i>Acer negundo</i> L. var. <i>negundo</i>	boxelder	Aceraceae	Magnoliophyta
<i>Acer nigrum</i> Michx. f.	black maple	Aceraceae	Magnoliophyta
<i>Acer pensylvanicum</i> L.	striped maple	Aceraceae	Magnoliophyta
<i>Acer rubrum</i> L.	red maple	Aceraceae	Magnoliophyta
<i>Acer saccharum</i> Marsh. var. <i>saccharum</i>	sugar maple	Aceraceae	Magnoliophyta
<i>Acer spicatum</i> Lam.	mountain maple	Aceraceae	Magnoliophyta
<i>Achillea millefolium</i> L. var. <i>occidentalis</i> DC.	western yarrow*	Asteraceae	Magnoliophyta
<i>Actaea</i> L.	baneberry	Ranunculaceae	Magnoliophyta
<i>Actaea racemosa</i> L. var. <i>racemosa</i>	black bugbane	Ranunculaceae	Magnoliophyta
<i>Adiantum pedatum</i> L.	northern maidenhair	Adiantaceae	Polypodiophyta
<i>Adlumia fungosa</i> (Ait.) Greene ex B.S.P.	Allegheny vine	Fumariaceae	Magnoliophyta
<i>Aesculus flava</i> Ait.	yellow buckeye	Hippocastanaceae	Magnoliophyta
<i>Ageratina altissima</i> (L.) King & H.E. Robins. var. <i>altissima</i>	white snakeroot	Asteraceae	Magnoliophyta
<i>Agrimonia</i> L.	agrimony	Rosaceae	Magnoliophyta
<i>Agrimonia rostellata</i> Wallr.	beaked agrimony	Rosaceae	Magnoliophyta
<i>Agrimonia striata</i> Michx.	roadside agrimony	Rosaceae	Magnoliophyta
<i>Agrostis gigantea</i> Roth	redtop*	Poaceae	Magnoliophyta
<i>Agrostis</i> L.	bentgrass	Poaceae	Magnoliophyta
<i>Agrostis perennans</i> (Walt.) Tuckerman	upland bentgrass	Poaceae	Magnoliophyta
<i>Ailanthus altissima</i> (P. Mill.) Swingle	tree of heaven*	Simaroubaceae	Magnoliophyta
<i>Alisma subcordatum</i> Raf.	American water plantain	Alismataceae	Magnoliophyta
<i>Alnus serrulata</i> (Ait.) Willd.	hazel alder	Betulaceae	Magnoliophyta
<i>Ambrosia artemisiifolia</i> L. var. <i>elatio</i> (L.) Descourtils	annual ragweed	Asteraceae	Magnoliophyta
<i>Ambrosia trifida</i> L. var. <i>trifida</i>	great ragweed	Asteraceae	Magnoliophyta
<i>Amelanchier arborea</i> (Michx. f.) Fern. var. <i>arborea</i>	common serviceberry	Rosaceae	Magnoliophyta
<i>Amelanchier</i> Medik.	serviceberry	Rosaceae	Magnoliophyta
<i>Amelanchier stolonifera</i> Wieg.	running serviceberry	Rosaceae	Magnoliophyta
<i>Amphicarpaea bracteata</i> (L.) Fern.	American hogpeanut	Fabaceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
<i>Amphidium mougeotii</i> (Bruch & Schimp. in B.S.G.) Schimp.	Mougeot's amphidium moss	Orthotrichaceae	Bryophyta
<i>Andreaea rothii</i> Web. & Mohr	Roth's andreaea moss	Andreaeaceae	Bryophyta
<i>Andropogon gerardii</i> Vitman	big bluestem	Poaceae	Magnoliophyta
<i>Anemone lancifolia</i> Pursh	mountain thimbleweed	Ranunculaceae	Magnoliophyta
<i>Anemone quinquefolia</i> L. var. <i>quinquefolia</i>	nightcaps	Ranunculaceae	Magnoliophyta
<i>Angelica triquinata</i> Michx.	filmy angelica	Apiaceae	Magnoliophyta
<i>Anomodon attenuatus</i> (Hedw.) Hüb.	anomodon moss	Anomodontaceae	Bryophyta
<i>Antennaria plantaginifolia</i> (L.) Richards.	woman's tobacco	Asteraceae	Magnoliophyta
<i>Antennaria solitaria</i> Rydb.	singlehead pussytoes	Asteraceae	Magnoliophyta
<i>Anthoxanthum odoratum</i> L. ssp. <i>odoratum</i>	sweet vernal grass*	Poaceae	Magnoliophyta
<i>Apios americana</i> Medik.	groundnut	Fabaceae	Magnoliophyta
<i>Aplectrum hyemale</i> (Muhl. ex Willd.) Torr.	Adam and Eve	Orchidaceae	Magnoliophyta
<i>Apocynum cannabinum</i> L.	Indianhemp	Apocynaceae	Magnoliophyta
<i>Arabis canadensis</i> L.	sicklepod	Brassicaceae	Magnoliophyta
<i>Arabis laevigata</i> (Muhl. ex Willd.) Poir. var. <i>laevigata</i>	smooth rockcress	Brassicaceae	Magnoliophyta
<i>Aralia racemosa</i> L. ssp. <i>racemosa</i>	American spikenard	Araliaceae	Magnoliophyta
<i>Aralia spinosa</i> L.	devil's walkingstick	Araliaceae	Magnoliophyta
<i>Arisaema triphyllum</i> (L.) Schott ssp. <i>triphyllum</i>	Jack in the pulpit	Araceae	Magnoliophyta
<i>Aristolochia macrophylla</i> Lam.	pipevine	Aristolochiaceae	Magnoliophyta
<i>Aristolochia serpentaria</i> L.	Virginia snakeroot	Aristolochiaceae	Magnoliophyta
<i>Arnoglossum atriplicifolium</i> (L.) H.E. Robins.	pale Indian plaintain	Asteraceae	Magnoliophyta
<i>Asarum canadense</i> L.	Canadian wildginger	Aristolochiaceae	Magnoliophyta
<i>Asclepias incarnata</i> L. ssp. <i>pulchra</i> (Ehrh. ex Willd.) Woods.	swamp milkweed	Asclepiadaceae	Magnoliophyta
<i>Asclepias quadrifolia</i> Jacq.	fourleaf milkweed	Asclepiadaceae	Magnoliophyta
<i>Asclepias tuberosa</i> L. ssp. <i>tuberosa</i>	butterfly milkweed	Asclepiadaceae	Magnoliophyta
<i>Asimina triloba</i> (L.) Dunal	pawpaw	Annonaceae	Magnoliophyta
<i>Asplenium montanum</i> Willd.	mountain spleenwort	Aspleniaceae	Polypodiophyta
<i>Asplenium platyneuron</i> (L.) B.S.P.	ebony spleenwort	Aspleniaceae	Polypodiophyta
<i>Asplenium rhizophyllum</i> L.	walking fern	Aspleniaceae	Polypodiophyta
<i>Aster</i>	aster	Asteraceae	Magnoliophyta
<i>Athyrium filix-femina</i> (L.) Roth	common ladyfern	Dryopteridaceae	Polypodiophyta
<i>Athyrium filix-femina</i> (L.) Roth var. <i>angustum</i> (Willd.) Lawson	northeastern lady fern	Dryopteridaceae	Polypodiophyta
<i>Athyrium filix-femina</i> (L.) Roth var. <i>asplenioides</i> (Michx.) Farw.	asplenium ladyfern	Dryopteridaceae	Polypodiophyta
<i>Atrichum angustatum</i> (Brid.) Bruch & Schimp. in B.S.G.	atrichum moss	Polytrichaceae	Bryophyta
<i>Atrichum</i> P. Beauv.	atrichum moss	Polytrichaceae	Bryophyta
<i>Atrichum undulatum</i> (Hedw.) P. Beauv.	undulate atrichum moss	Polytrichaceae	Bryophyta
<i>Aulacomnium heterostichum</i> (Hedw.) Bruch & Schimp. in B.S.G.	aulacomnium moss	Aulacomniaceae	Bryophyta
<i>Aulacomnium palustre</i> (Hedw.) Schwaegr.	aulacomnium moss	Aulacomniaceae	Bryophyta
<i>Aureolaria flava</i> (L.) Farw.	smooth yellow false foxglove	Scrophulariaceae	Magnoliophyta
<i>Aureolaria</i> Raf.	false foxglove	Scrophulariaceae	Magnoliophyta
<i>Aureolaria virginica</i> (L.) Pennell	downy yellow false foxglove	Scrophulariaceae	Magnoliophyta
<i>Baptisia tinctoria</i> (L.) R. Br. ex Ait. f.	horseflyweed	Fabaceae	Magnoliophyta
<i>Bazzania trilobata</i> (L.) Gray	common bazzania liverwort	Lepidoziaceae	Marchantiophyta

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Scientific Name	Common Name	Family	Division
<i>Betula alleghaniensis</i> Britt. var. <i>alleghaniensis</i>	yellow birch	Betulaceae	Magnoliophyta
<i>Betula</i> L.	birch	Betulaceae	Magnoliophyta
<i>Betula lenta</i> L.	sweet birch	Betulaceae	Magnoliophyta
<i>Betula nigra</i> L.	river birch	Betulaceae	Magnoliophyta
<i>Bidens coronata</i> (L.) Britt.	crowned beggarticks	Asteraceae	Magnoliophyta
<i>Bidens frondosa</i> L.	devil's beggartick	Asteraceae	Magnoliophyta
<i>Bidens</i> L.	beggarticks	Asteraceae	Magnoliophyta
<i>Bidens vulgata</i> Greene	big devils beggartick	Asteraceae	Magnoliophyta
<i>Boehmeria cylindrica</i> (L.) Sw.	smallspike false nettle	Urticaceae	Magnoliophyta
<i>Boletus</i>	bolete mushroom	Boletaceae	Basidiomycota
<i>Botrychium dissectum</i> Spreng.	cutleaf grapefern	Ophioglossaceae	Polypodiophyta
<i>Botrychium virginianum</i> (L.) Sw.	rattlesnake fern	Ophioglossaceae	Polypodiophyta
<i>Boykinia aconitifolia</i> Nutt.	Allegheny brookfoam	Saxifragaceae	Magnoliophyta
<i>Brachyelytrum erectum</i> (Schreb. ex Spreng.) Beauv.	bearded shorthusk	Poaceae	Magnoliophyta
<i>Brachyelytrum septentrionale</i> (Babel) G. Tucker	northern shorthusk	Poaceae	Magnoliophyta
<i>Brachythecium laetum</i> (Brid.) B.S.G.	vega blanca	Brachytheciaceae	Bryophyta
<i>Brachythecium plumosum</i> (Hedw.) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
<i>Brachythecium rutabulum</i> (Hedw.) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
<i>Brachythecium salebrosum</i> (Web. & Mohr) Schimp. in B.S.G.	brachythecium moss	Brachytheciaceae	Bryophyta
<i>Bromus pubescens</i> Muhl. ex Willd.	hairy woodland brome	Poaceae	Magnoliophyta
<i>Brotherella recurvans</i> (Michx.) Fleisch.	recurved brotherella moss	Sematophyllaceae	Bryophyta
<i>Bryoandersonia illecebra</i> (Hedw.) Robins.	bryoandersonia moss	Brachytheciaceae	Bryophyta
<i>Bryum</i> Hedw.	bryum moss	Bryaceae	Bryophyta
<i>Bryum pseudotriquetrum</i> (Hedw.) Gaertn. et. al.	common green bryum moss	Bryaceae	Bryophyta
<i>Campanulastrum americanum</i> (L.) Small	American bellflower	Campanulaceae	Magnoliophyta
<i>Campsis radicans</i> (L.) Seem. ex Bureau	trumpet creeper	Bignoniaceae	Magnoliophyta
<i>Campylium</i> (Sull.) Mitt.	campylium moss	Amblystegiaceae	Bryophyta
<i>Campylopus tallulensis</i> Sull. & Lesq.	Tallul campylopus moss	Dicranaceae	Bryophyta
<i>Cardamine concatenata</i> (Michx.) Sw.	cutleaf toothwort	Brassicaceae	Magnoliophyta
<i>Cardamine diphylla</i> (Michx.) Wood	crinkleroot	Brassicaceae	Magnoliophyta
<i>Cardamine hirsuta</i> L.	hairy bittercress	Brassicaceae	Magnoliophyta
<i>Cardamine parviflora</i> L. var. <i>arenicola</i> (Britt.) O.E. Schulz	sand bittercress	Brassicaceae	Magnoliophyta
<i>Carex aestivalis</i> M.A. Curtis ex Gray	summer sedge	Cyperaceae	Magnoliophyta
<i>Carex albursina</i> Sheldon	white bear sedge	Cyperaceae	Magnoliophyta
<i>Carex amphibola</i> Steud.	eastern narrowleaf sedge	Cyperaceae	Magnoliophyta
<i>Carex atlantica</i> Bailey ssp. <i>atlantica</i>	prickly bog sedge	Cyperaceae	Magnoliophyta
<i>Carex baileyi</i> Britt.	Bailey's sedge	Cyperaceae	Magnoliophyta
<i>Carex blanda</i> Dewey	eastern woodland sedge	Cyperaceae	Magnoliophyta
<i>Carex caroliniana</i> Schwein.	Carolina sedge	Cyperaceae	Magnoliophyta
<i>Carex communis</i> Bailey var. <i>communis</i>	fibrousroot sedge	Cyperaceae	Magnoliophyta
<i>Carex crinita</i> Lam. var. <i>crinita</i>	fringed sedge	Cyperaceae	Magnoliophyta
<i>Carex cumberlandensis</i> Naczi, Kral & Bryson	Cumberland sedge	Cyperaceae	Magnoliophyta
<i>Carex debilis</i> Michx.	white edge sedge	Cyperaceae	Magnoliophyta
<i>Carex debilis</i> Michx. var. <i>rudgei</i> Bailey	white edge sedge	Cyperaceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
<i>Carex digitalis</i> Willd. var. <i>digitalis</i>	slender woodland sedge	Cyperaceae	Magnoliophyta
<i>Carex festucacea</i> Schkuhr ex Willd.	fescue sedge	Cyperaceae	Magnoliophyta
<i>Carex gracilescens</i> Steud.	slender looseflower sedge	Cyperaceae	Magnoliophyta
<i>Carex gracillima</i> Schwein.	graceful sedge	Cyperaceae	Magnoliophyta
<i>Carex hirsutella</i> Mackenzie	fuzzy wuzzy sedge	Cyperaceae	Magnoliophyta
<i>Carex intumescens</i> Rudge	greater bladder sedge	Cyperaceae	Magnoliophyta
<i>Carex jamesii</i> Schwein.	James' sedge	Cyperaceae	Magnoliophyta
<i>Carex</i> L.	sedge	Cyperaceae	Magnoliophyta
<i>Carex laxiculmis</i> Schwein.	spreading sedge	Cyperaceae	Magnoliophyta
<i>Carex laxiculmis</i> Schwein. var. <i>laxiculmis</i>	spreading sedge	Cyperaceae	Magnoliophyta
<i>Carex laxiflora</i> Lam.	broad looseflower sedge	Cyperaceae	Magnoliophyta
<i>Carex leptalea</i> Wahlenb. ssp. <i>leptalea</i>	bristlystalked sedge	Cyperaceae	Magnoliophyta
<i>Carex lurida</i> Wahlenb.	shallow sedge	Cyperaceae	Magnoliophyta
<i>Carex pensylvanica</i> Lam.	Pennsylvania sedge	Cyperaceae	Magnoliophyta
<i>Carex plantaginea</i> Lam.	plantainleaf sedge	Cyperaceae	Magnoliophyta
<i>Carex platyphylla</i> Carey	broadleaf sedge	Cyperaceae	Magnoliophyta
<i>Carex prasina</i> Wahlenb.	drooping sedge	Cyperaceae	Magnoliophyta
<i>Carex radiata</i> (Wahlenb.) Small	eastern star sedge	Cyperaceae	Magnoliophyta
<i>Carex rosea</i> Schkuhr ex Willd.	rosy sedge	Cyperaceae	Magnoliophyta
<i>Carex scabrata</i> Schwein.	eastern rough sedge	Cyperaceae	Magnoliophyta
<i>Carex seorsa</i> Howe	weak stellate sedge	Cyperaceae	Magnoliophyta
<i>Carex swanii</i> (Fern.) Mackenzie	Swan's sedge	Cyperaceae	Magnoliophyta
<i>Carex torta</i> Boott ex Tuckerman	twisted sedge	Cyperaceae	Magnoliophyta
<i>Carex virescens</i> Muhl. ex Willd.	ribbed sedge	Cyperaceae	Magnoliophyta
<i>Carex willdenowii</i> Schkuhr ex Willd.	Willdenow's sedge	Cyperaceae	Magnoliophyta
<i>Carpinus caroliniana</i> Walt. ssp. <i>virginiana</i> (Marsh.) Furlow	American hornbeam	Betulaceae	Magnoliophyta
<i>Carya alba</i> (L.) Nutt. ex Ell.	mockernut hickory	Juglandaceae	Magnoliophyta
<i>Carya cordiformis</i> (Wangenh.) K. Koch	bitternut hickory	Juglandaceae	Magnoliophyta
<i>Carya glabra</i> (P. Mill.) Sweet	pignut hickory	Juglandaceae	Magnoliophyta
<i>Carya</i> Nutt.	hickory	Juglandaceae	Magnoliophyta
<i>Carya ovalis</i> (Wangenh.) Sarg.	red hickory	Juglandaceae	Magnoliophyta
<i>Carya ovata</i> (P. Mill.) K. Koch	shagbark hickory	Juglandaceae	Magnoliophyta
<i>Castanea dentata</i> (Marsh.) Borkh.	American chestnut	Fagaceae	Magnoliophyta
<i>Castanea</i> P. Mill.	chestnut	Fagaceae	Magnoliophyta
<i>Catalpa bignonioides</i> Walt.	southern catalpa	Bignoniaceae	Magnoliophyta
<i>Catalpa</i> Scop.	catalpa	Bignoniaceae	Magnoliophyta
<i>Caulophyllum thalictroides</i> (L.) Michx.	blue cohosh	Berberidaceae	Magnoliophyta
<i>Cephalanthus occidentalis</i> L.	common buttonbush	Rubiaceae	Magnoliophyta
<i>Cercis canadensis</i> L. var. <i>canadensis</i>	eastern redbud	Fabaceae	Magnoliophyta
<i>Chasmanthium latifolium</i> (Michx.) Yates	Indian woodoats	Poaceae	Magnoliophyta
<i>Chelone glabra</i> L.	white turtlehead	Scrophulariaceae	Magnoliophyta
<i>Chimaphila maculata</i> (L.) Pursh	striped prince's pine	Pyrolaceae	Magnoliophyta
<i>Chionanthus virginicus</i> L.	white fringetree	Oleaceae	Magnoliophyta
<i>Chrysopsis mariana</i> (L.) Ell.	Maryland goldenaster	Asteraceae	Magnoliophyta
<i>Chrysothrix insulizans</i> R.C. Harris & Ladd	lichen	Chrysotrichaceae	Ascomycota
<i>Cicuta maculata</i> L. var. <i>maculata</i>	spotted water hemlock	Apiaceae	Magnoliophyta
<i>Cinna arundinacea</i> L.	sweet woodreed	Poaceae	Magnoliophyta
<i>Circaea lutetiana</i> L. ssp. <i>canadensis</i> (L.) Aschers. & Magnus	broadleaf enchanter's nightshade	Onagraceae	Magnoliophyta
<i>Cirsium</i> P. Mill.	thistle	Asteraceae	Magnoliophyta
<i>Cladonia caroliniana</i> Tuck.	Carolina cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia cristatella</i> Tuck.	cup lichen	Cladoniaceae	Ascomycota

Scientific Name	Common Name	Family	Division
<i>Cladonia cylindrica</i> (A. Evans) A. Evans	cylinder cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia fimbriata</i> (L.) Fr.	cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia furcata</i> (Hudson) Schrader	cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia</i> P. Browne	cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia pyxidata</i> (L.) Hoffm.	cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia rangiferina</i> (L.) F. H. Wigg.	grey reindeer lichen	Cladoniaceae	Ascomycota
<i>Cladonia squamosa</i> Hoffm.	cup lichen	Cladoniaceae	Ascomycota
<i>Cladonia subtenuis</i> (Abbayes) Hale & Culb.	dixie reindeer lichen	Cladoniaceae	Ascomycota
<i>Cladonia uncialis</i> (L.) F. H. Wigg.	cup lichen	Cladoniaceae	Ascomycota
<i>Clematis virginiana</i> L.	devil's darning needles	Ranunculaceae	Magnoliophyta
<i>Clethra acuminata</i> Michx.	mountain sweetpepperbush	Clethraceae	Magnoliophyta
<i>Climacium americanum</i> Brid.	American climacium moss	Climaciaceae	Bryophyta
<i>Coccocarpia palmicola</i> (Spreng.) Arv. & D.J. Galloway	coccocarpia lichen	Coccocarpiaceae	Ascomycota
<i>Collinsonia canadensis</i> L.	richweed	Lamiaceae	Magnoliophyta
<i>Conocephalum conicum</i> (L.) Dumort.	conehead chamber liverwort	Conocephalaceae	Marchantiophyta
<i>Conopholis americana</i> (L.) Wallr. f.	American squawroot	Orobanchaceae	Magnoliophyta
<i>Coreopsis</i> L.	tickseed	Asteraceae	Magnoliophyta
<i>Coreopsis major</i> Walt.	greater tickseed	Asteraceae	Magnoliophyta
<i>Coreopsis pubescens</i> Ell. var. <i>pubescens</i>	star tickseed	Asteraceae	Magnoliophyta
<i>Coreopsis tripteris</i> L.	tall tickseed	Asteraceae	Magnoliophyta
<i>Cornus alternifolia</i> L. f.	alternatleaf dogwood	Cornaceae	Magnoliophyta
<i>Cornus amomum</i> P. Mill.	silky dogwood	Cornaceae	Magnoliophyta
<i>Cornus florida</i> L.	flowering dogwood	Cornaceae	Magnoliophyta
<i>Cornus</i> L.	dogwood	Cornaceae	Magnoliophyta
<i>Corylus americana</i> Walt.	American hazelnut	Betulaceae	Magnoliophyta
<i>Crataegus</i> L.	hawthorn	Rosaceae	Magnoliophyta
<i>Crepis pulchra</i> L.	smallflower hawksbeard*	Asteraceae	Magnoliophyta
<i>Cryptotaenia canadensis</i> (L.) DC.	Canadian honewort	Apiaceae	Magnoliophyta
<i>Cunila origanoides</i> (L.) Britt.	common dittany	Lamiaceae	Magnoliophyta
<i>Cuscuta pentagona</i> Engelm. var. <i>pentagona</i>	fiveangled dodder	Cuscutaceae	Magnoliophyta
<i>Cymophyllus fraserianus</i> (Ker-Gawl.) Kartesz & Gandhi	Fraser's cymophyllus	Cyperaceae	Magnoliophyta
<i>Cynoglossum virginianum</i> L. var. <i>virginianum</i>	wild comfrey	Boraginaceae	Magnoliophyta
<i>Cyperus strigosus</i> L.	strawcolored flatsedge	Cyperaceae	Magnoliophyta
<i>Cypripedium acaule</i> Ait.	moccasin flower	Orchidaceae	Magnoliophyta
<i>Danthonia compressa</i> Austin ex Peck	flattened oatgrass	Poaceae	Magnoliophyta
<i>Danthonia</i> DC.	oatgrass	Poaceae	Magnoliophyta
<i>Danthonia sericea</i> Nutt.	downy danthonia	Poaceae	Magnoliophyta
<i>Danthonia spicata</i> (L.) Beauv. ex Roemer & J.A. Schultes	poverty oatgrass	Poaceae	Magnoliophyta
<i>Daucus carota</i> L.	Queen Anne's lace*	Apiaceae	Magnoliophyta
<i>Delphinium tricornis</i> Michx.	dwarf larkspur	Ranunculaceae	Magnoliophyta
<i>Dennstaedtia punctilobula</i> (Michx.) T. Moore	eastern hayscented fern	Dennstaedtiaceae	Polypodiophyta
<i>Deparia acrostichoides</i> (Sw.) M. Kato	silver false spleenwort	Dryopteridaceae	Polypodiophyta
<i>Dermatocarpon luridum</i> (With.) J. R. Laundon	silverskin lichen	Verrucariaceae	Ascomycota
<i>Deschampsia flexuosa</i> (L.) Trin. var. <i>flexuosa</i>	wavy hairgrass	Poaceae	Magnoliophyta
<i>Desmodium</i> Desv.	ticktrefoil	Fabaceae	Magnoliophyta

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<i>Desmodium glutinosum</i> (Muhl. ex Willd.) Wood	pointedleaf ticktrefoil	Fabaceae	Magnoliophyta
<i>Desmodium nudiflorum</i> (L.) DC.	nakedflower ticktrefoil	Fabaceae	Magnoliophyta
<i>Desmodium paniculatum</i> (L.) DC. var. <i>paniculatum</i>	panickedleaf ticktrefoil	Fabaceae	Magnoliophyta
<i>Desmodium pauciflorum</i> (Nutt.) DC.	fewflower ticktrefoil	Fabaceae	Magnoliophyta
<i>Desmodium rotundifolium</i> DC.	prostrate ticktrefoil	Fabaceae	Magnoliophyta
<i>Diarrhena americana</i> Beauv.	American beakgrain	Poaceae	Magnoliophyta
<i>Dicentra</i> Bernh.	bleeding heart	Fumariaceae	Magnoliophyta
<i>Dicentra canadensis</i> (Goldie) Walp.	squirrel corn	Fumariaceae	Magnoliophyta
<i>Dichanthelium</i> (A.S. Hitchc. & Chase) Gould	rosette grass	Poaceae	Magnoliophyta
<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark ssp. <i>columbianum</i> (Scribn.) Freckmann & Lelong	District of Columbia panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark ssp. <i>fasciculatum</i> (Torr.) Freckmann & Lelong	western panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark ssp. <i>implicatum</i> (Scribn.) Freckmann & Lelong	western panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium boscai</i> (Poir.) Gould & C.A. Clark	Bosc's panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium clandestinum</i> (L.) Gould	deertongue	Poaceae	Magnoliophyta
<i>Dichanthelium commutatum</i> (J.A. Schultes) Gould	variable panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium commutatum</i> (J.A. Schultes) Gould ssp. <i>ashei</i> (T.G. Pearson ex Ashe) Freckmann & Lelong	variable panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium commutatum</i> (J.A. Schultes) Gould ssp. <i>commutatum</i>	variable panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium dichotomum</i> (L.) Gould	cypress panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium dichotomum</i> (L.) Gould ssp. <i>dichotomum</i>	forked panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium dichotomum</i> (L.) Gould ssp. <i>microcarpon</i> (Muhl. ex Elliott) Freckmann & Lelong	forked panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium dichotomum</i> (L.) Gould ssp. <i>yadkinense</i> (Ashe) Freckmann & Lelong	forked panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium latifolium</i> (L.) Gould & C.A. Clark	broadleaf rosette grass	Poaceae	Magnoliophyta
<i>Dichanthelium laxiflorum</i> (Lam.) Gould	openflower rosette grass	Poaceae	Magnoliophyta
<i>Dichanthelium linearifolium</i> (Scribn. ex Nash) Gould	slimleaf panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium ovale</i> (Elliott) Gould & C.A. Clark ssp. <i>villosissimum</i> (Nash) Freckmann & Lelong	stiff-leaved panicgrass	Poaceae	Magnoliophyta
<i>Dichanthelium polyanthes</i> (Shult.) Mohlenbr.	roundseed panicgrass	Poaceae	Magnoliophyta
<i>Dicranella</i> (C. Müll.) Schimp.	dicranella moss	Dicranaceae	Bryophyta
<i>Dicranella heteromalla</i> (Hedw.) Schimp.	dicranella moss	Dicranaceae	Bryophyta
<i>Dicranum condensatum</i> Hedw.	condensed dicranum moss	Dicranaceae	Bryophyta
<i>Dicranum flagellare</i> Hedw.	dicranum moss	Dicranaceae	Bryophyta

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<i>Dicranum fulvum</i> Hook.	dicranum moss	Dicranaceae	Bryophyta
<i>Dicranum fuscescens</i> Turn.	dicranum moss	Dicranaceae	Bryophyta
<i>Dicranum</i> Hedw.	dicranum moss	Dicranaceae	Bryophyta
<i>Dicranum scoparium</i> Hedw.	dicranum moss	Dicranaceae	Bryophyta
<i>Dicranum spurium</i> Hedw.	dicranum moss	Dicranaceae	Bryophyta
<i>Dioscorea</i> L.	yam	Dioscoreaceae	Magnoliophyta
<i>Dioscorea quaternata</i> J.F. Gmel.	fourleaf yam	Dioscoreaceae	Magnoliophyta
<i>Diospyros virginiana</i> L.	common persimmon	Ebenaceae	Magnoliophyta
<i>Diplazium pycnocarpon</i> (Spreng.) Broun	glade fern	Dryopteridaceae	Polypodiophyta
<i>Diplophyllum apiculatum</i> (A. Evans) Steph.	pointed mitten liverwort	Scapaniaceae	Marchantiophyta
<i>Doellingeria umbellata</i> (P. Mill.) Nees var. <i>umbellata</i>	parasol whitetop	Asteraceae	Magnoliophyta
<i>Dryopteris goldiana</i> (Hook. ex Goldie) Gray	Goldie's woodfern	Dryopteridaceae	Polypodiophyta
<i>Dryopteris intermedia</i> (Muhl. ex Willd.) Gray	intermediate woodfern	Dryopteridaceae	Polypodiophyta
<i>Dryopteris marginalis</i> (L.) Gray	marginal woodfern	Dryopteridaceae	Polypodiophyta
<i>Duchesnea indica</i> (Andr.) Focke	Indian strawberry*	Rosaceae	Magnoliophyta
<i>Elaeagnus umbellata</i> Thunb. var. <i>parvifolia</i> (Royle) Schneid.	autumn olive*	Elaeagnaceae	Magnoliophyta
<i>Eleocharis acicularis</i> (L.) Roemer & J.A. Schultes var. <i>acicularis</i>	needle spikerush	Cyperaceae	Magnoliophyta
<i>Eleocharis obtusa</i> (Willd.) J.A. Schultes	blunt spikerush	Cyperaceae	Magnoliophyta
<i>Eleocharis tenuis</i> (Willd.) J.A. Schultes	slender spikerush	Cyperaceae	Magnoliophyta
<i>Elephantopus carolinianus</i> Raeusch.	Carolina elephantsfoot	Asteraceae	Magnoliophyta
<i>Elymus canadensis</i> L.	Canada wildrye	Poaceae	Magnoliophyta
<i>Elymus hystrix</i> L. var. <i>hystrix</i>	eastern bottlebrush grass	Poaceae	Magnoliophyta
<i>Elymus riparius</i> Wieg.	riverbank wildrye	Poaceae	Magnoliophyta
<i>Entodon seductrix</i> (Hedw.) C. Müll.	seductive entodon moss	Entodontaceae	Bryophyta
<i>Epifagus virginiana</i> (L.) W. Bart.	beechdrops	Orobanchaceae	Magnoliophyta
<i>Epigaea repens</i> L.	trailing arbutus	Ericaceae	Magnoliophyta
<i>Equisetum arvense</i> L.	field horsetail	Equisetaceae	Equisetophyta
<i>Erigeron</i> L.	fleabane	Asteraceae	Magnoliophyta
<i>Erigeron philadelphicus</i> L. var. <i>philadelphicus</i>	Philadelphia fleabane	Asteraceae	Magnoliophyta
<i>Erigeron pulchellus</i> Michx.	robin's plantain	Asteraceae	Magnoliophyta
<i>Erigeron pulchellus</i> Michx. var. <i>brauniae</i> Fern.	Braun's erigeron	Asteraceae	Magnoliophyta
<i>Euonymus americana</i> L.	strawberry bush	Celastraceae	Magnoliophyta
<i>Eupatorium album</i> L.	white thoroughwort	Asteraceae	Magnoliophyta
<i>Eupatorium fistulosum</i> Barratt	trumpetweed	Asteraceae	Magnoliophyta
<i>Eupatorium godfreyanum</i> Cronq.	Godfrey's thoroughwort	Asteraceae	Magnoliophyta
<i>Eupatorium</i> L.	thoroughwort	Asteraceae	Magnoliophyta
<i>Eupatorium perfoliatum</i> L. var. <i>perfoliatum</i>	common boneset	Asteraceae	Magnoliophyta
<i>Eupatorium purpureum</i> L. var. <i>purpureum</i>	sweetscented joeypyeweed	Asteraceae	Magnoliophyta
<i>Eupatorium rotundifolium</i> L. var. <i>ovatum</i> (Bigelow) Torr.	roundleaf thoroughwort	Asteraceae	Magnoliophyta
<i>Euphorbia corollata</i> L.	flowering spurge	Euphorbiaceae	Magnoliophyta
<i>Eurhynchium hians</i> (Hedw.) Sande Lac.	eurhynchium moss	Brachytheciaceae	Bryophyta
<i>Eurybia</i> (Cass.) S.F. Gray	aster	Asteraceae	Magnoliophyta
<i>Eurybia divaricata</i> (L.) Nesom	white wood aster	Asteraceae	Magnoliophyta
<i>Eurybia schreberi</i> (Nees) Nees	Schreber's aster	Asteraceae	Magnoliophyta

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<i>Euthamia graminifolia</i> (L.) Nutt. var. <i>graminifolia</i>	flat-top goldentop	Asteraceae	Magnoliophyta
<i>Fagus grandifolia</i> Ehrh.	American beech	Fagaceae	Magnoliophyta
<i>Festuca subverticillata</i> (Pers.) Alexeev	nodding fescue	Poaceae	Magnoliophyta
<i>Fissidens dubius</i> P. Beauv.	fissidens moss	Fissidentaceae	Bryophyta
<i>Fissidens</i> Hedw.	fissidens moss	Fissidentaceae	Bryophyta
<i>Fissidens osmundioides</i> Hedw.	osmund fissidens moss	Fissidentaceae	Bryophyta
<i>Flavoparmelia baltimorensis</i> (Gyelnik & Foriss) Hale	lichen	Parmeliaceae	Ascomycota
<i>Flavoparmelia caperata</i> (L.) Hale	lichen	Parmeliaceae	Ascomycota
<i>Fraxinus americana</i> L.	white ash	Oleaceae	Magnoliophyta
<i>Fraxinus</i> L.	ash	Oleaceae	Magnoliophyta
<i>Fraxinus pennsylvanica</i> Marsh.	green ash	Oleaceae	Magnoliophyta
<i>Frullania asagrayana</i> Mont.	bronze cup liverwort	Jubulaceae	Marchantiophyta
<i>Galax urceolata</i> (Poir.) Brummitt	beetleweed	Diapensiaceae	Magnoliophyta
<i>Galium aparine</i> L.	stickywilly	Rubiaceae	Magnoliophyta
<i>Galium circaezans</i> Michx.	licorice bedstraw	Rubiaceae	Magnoliophyta
<i>Galium circaezans</i> Michx. var. <i>circaezans</i>	licorice bedstraw	Rubiaceae	Magnoliophyta
<i>Galium circaezans</i> Michx. var. <i>hypomalacum</i> Fern.	licorice bedstraw	Rubiaceae	Magnoliophyta
<i>Galium</i> L.	bedstraw	Rubiaceae	Magnoliophyta
<i>Galium lanceolatum</i> Torr.	lanceleaf wild licorice	Rubiaceae	Magnoliophyta
<i>Galium latifolium</i> Michx.	purple bedstraw	Rubiaceae	Magnoliophyta
<i>Galium tinctorium</i> L.	stiff marsh bedstraw	Rubiaceae	Magnoliophyta
<i>Galium triflorum</i> Michx.	fragrant bedstraw	Rubiaceae	Magnoliophyta
<i>Ganoderma tsugae</i> Murrill	hemlock polypore	Ganodermataceae	Basidiomycota
<i>Gaultheria procumbens</i> L.	eastern teaberry	Ericaceae	Magnoliophyta
<i>Gaylussacia baccata</i> (Wangenh.) K. Koch	black huckleberry	Ericaceae	Magnoliophyta
<i>Geranium maculatum</i> L.	spotted geranium	Geraniaceae	Magnoliophyta
<i>Geum canadense</i> Jacq. var. <i>canadense</i>	white avens	Rosaceae	Magnoliophyta
<i>Geum</i> L.	avens	Rosaceae	Magnoliophyta
<i>Geum virginianum</i> L.	cream avens	Rosaceae	Magnoliophyta
<i>Glechoma hederacea</i> L.	ground ivy*	Lamiaceae	Magnoliophyta
<i>Glyceria striata</i> (Lam.) A.S. Hitchc.	fowl mannagrass	Poaceae	Magnoliophyta
<i>Goodyera pubescens</i> (Willd.) R. Br. ex Ait. f.	downy rattlesnake plantain	Orchidaceae	Magnoliophyta
<i>Grimmia</i> Hedw.	grimmia dry rock moss	Grimmiaceae	Bryophyta
<i>Grimmia laevigata</i> (Brid.) Brid.	grimmia dry rock moss	Grimmiaceae	Bryophyta
<i>Grimmia pilifera</i> P. Beauv.	grimmia dry rock moss	Grimmiaceae	Bryophyta
<i>Hamamelis virginiana</i> L.	American witchhazel	Hamamelidaceae	Magnoliophyta
<i>Hedwigia ciliata</i> (Hedw.) P. Beauv.	ciliate hedwigia moss	Hedwigiaceae	Bryophyta
<i>Helenium autumnale</i> L. var. <i>autumnale</i>	common sneezeweed	Asteraceae	Magnoliophyta
<i>Helianthus decapetalus</i> L.	thinleaf sunflower	Asteraceae	Magnoliophyta
<i>Helianthus divaricatus</i> L.	woodland sunflower	Asteraceae	Magnoliophyta
<i>Helianthus giganteus</i> L.	giant sunflower	Asteraceae	Magnoliophyta
<i>Helianthus</i> L.	sunflower	Asteraceae	Magnoliophyta
<i>Helianthus strumosus</i> L.	paleleaf woodland sunflower	Asteraceae	Magnoliophyta
<i>Heliopsis helianthoides</i> (L.) Sweet	smooth oxeye	Asteraceae	Magnoliophyta
<i>Hemerocallis fulva</i> (L.) L.	orange daylily*	Liliaceae	Magnoliophyta
<i>Hepatica nobilis</i> Schreb. var. <i>acuta</i> (Pursh) Steyermark	sharplobe hepatica	Ranunculaceae	Magnoliophyta
<i>Heuchera americana</i> L. var. <i>americana</i>	American alumroot	Saxifragaceae	Magnoliophyta
<i>Heuchera</i> L.	alumroot	Saxifragaceae	Magnoliophyta

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<i>Heuchera villosa</i> Michx. var. <i>villosa</i>	hairy alumroot	Saxifragaceae	Magnoliophyta
<i>Hexastylis virginica</i> (L.) Small	Virginia heartleaf	Aristolochiaceae	Magnoliophyta
<i>Hieracium caespitosum</i> Dumort.	meadow hawkweed*	Asteraceae	Magnoliophyta
<i>Hieracium paniculatum</i> L.	Allegheny hawkweed	Asteraceae	Magnoliophyta
<i>Hieracium venosum</i> L.	rattlesnakeweed	Asteraceae	Magnoliophyta
<i>Houstonia caerulea</i> L.	azure bluet	Rubiaceae	Magnoliophyta
<i>Houstonia longifolia</i> Gaertn.	longleaf summer bluet	Rubiaceae	Magnoliophyta
<i>Houstonia serpyllifolia</i> Michx.	thymeleaf bluet	Rubiaceae	Magnoliophyta
<i>Hybanthus concolor</i> (T.F. Forst.) Spreng.	eastern greenviolet	Violaceae	Magnoliophyta
<i>Hydrangea arborescens</i> L.	wild hydrangea	Hydrangeaceae	Magnoliophyta
<i>Hydrastis canadensis</i> L.	goldenseal	Ranunculaceae	Magnoliophyta
<i>Hydrophyllum canadense</i> L.	bluntleaf waterleaf	Hydrophyllaceae	Magnoliophyta
<i>Hygrohypnum eugyrium</i> (Schimp. in B.S.G.) Loeske	hygrohypnum moss	Hypnaceae	Bryophyta
<i>Hypericum densiflorum</i> Pursh	bushy St. Johnswort	Clusiaceae	Magnoliophyta
<i>Hypericum ellipticum</i> Hook.	pale St. Johnswort	Clusiaceae	Magnoliophyta
<i>Hypericum hypericoides</i> (L.) Crantz ssp. <i>multicaule</i> (Michx. ex Willd.) Robson	St. Andrew's cross	Clusiaceae	Magnoliophyta
<i>Hypericum mutilum</i> L.	dwarf St. Johnswort	Clusiaceae	Magnoliophyta
<i>Hypericum perforatum</i> L.	common St. Johnswort*	Clusiaceae	Magnoliophyta
<i>Hypericum prolificum</i> L.	shrubby St. Johnswort	Clusiaceae	Magnoliophyta
<i>Hypericum punctatum</i> Lam.	spotted St. Johnswort	Clusiaceae	Magnoliophyta
<i>Hypnum curvifolium</i> Hedw.	curveleaf hypnum moss	Hypnaceae	Bryophyta
<i>Hypnum</i> Hedw.	hypnum moss	Hypnaceae	Bryophyta
<i>Hypnum imponens</i> Hedw.	hypnum moss	Hypnaceae	Bryophyta
<i>Hypoxis hirsuta</i> (L.) Coville	common goldstar	Liliaceae	Magnoliophyta
<i>Ilex montana</i> Torr. & Gray ex Gray	mountain holly	Aquifoliaceae	Magnoliophyta
<i>Ilex opaca</i> Ait. var. <i>opaca</i>	American holly	Aquifoliaceae	Magnoliophyta
<i>Ilex verticillata</i> (L.) Gray	common winterberry	Aquifoliaceae	Magnoliophyta
<i>Impatiens capensis</i> Meerb.	jewelweed	Balsaminaceae	Magnoliophyta
<i>Impatiens</i> L.	touch-me-not	Balsaminaceae	Magnoliophyta
<i>Impatiens pallida</i> Nutt.	pale touch-me-not	Balsaminaceae	Magnoliophyta
<i>Ionactis linariifolius</i> (L.) Greene	flaxleaf whitetop aster	Asteraceae	Magnoliophyta
<i>Ipomoea</i> L.	morning-glory	Convolvulaceae	Magnoliophyta
<i>Ipomoea pandurata</i> (L.) G.F.W. Mey.	man of the earth	Convolvulaceae	Magnoliophyta
<i>Iris cristata</i> Ait.	dwarf crested iris	Iridaceae	Magnoliophyta
<i>Iris</i> L.	iris	Iridaceae	Magnoliophyta
<i>Isoetes engelmannii</i> A. Braun	Appalachian quillwort	Isoëtaceae	Lycopodiophyta
<i>Juglans cinerea</i> L.	butternut	Juglandaceae	Magnoliophyta
<i>Juglans nigra</i> L.	black walnut	Juglandaceae	Magnoliophyta
<i>Juncus acuminatus</i> Michx.	tapertip rush	Juncaceae	Magnoliophyta
<i>Juncus dudleyi</i> Wieg.	Dudley's rush	Juncaceae	Magnoliophyta
<i>Juncus effusus</i> L.	common rush	Juncaceae	Magnoliophyta
<i>Juncus</i> L.	rush	Juncaceae	Magnoliophyta
<i>Juncus marginatus</i> Rostk.	grassleaf rush	Juncaceae	Magnoliophyta
<i>Juncus tenuis</i> Willd.	poverty rush	Juncaceae	Magnoliophyta
<i>Juniperus virginiana</i> L. var. <i>virginiana</i>	eastern redcedar	Cupressaceae	Pinophyta
<i>Justicia americana</i> (L.) Vahl	American water-willow	Acanthaceae	Magnoliophyta
<i>Kalmia latifolia</i> L.	mountain laurel	Ericaceae	Magnoliophyta
<i>Krigia biflora</i> (Walt.) Blake var. <i>biflora</i>	twoflower dwarf dandelion	Asteraceae	Magnoliophyta
<i>Lactarius</i>	milk cap mushroom	Russulaceae	Basidiomycota
<i>Lactuca canadensis</i> L.	Canada lettuce	Asteraceae	Magnoliophyta
<i>Lactuca</i> L.	lettuce	Asteraceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
<i>Lamium purpureum</i> L. var. <i>purpureum</i>	purple deadnettle*	Lamiaceae	Magnoliophyta
<i>Laportea canadensis</i> (L.) Weddell	Canadian woodnettle	Urticaceae	Magnoliophyta
<i>Lasallia papulosa</i> (Ach.) Llano	blistered naval lichen	Umbilicariaceae	Ascomycota
<i>Lasallia pensylvanica</i> (Hoffm.) Llano	Pensylvania blistered naval lichen	Umbilicariaceae	Ascomycota
<i>Leersia oryzoides</i> (L.) Sw.	rice cutgrass	Poaceae	Magnoliophyta
<i>Leersia</i> Sw.	cutgrass	Poaceae	Magnoliophyta
<i>Leersia virginica</i> Willd.	whitegrass	Poaceae	Magnoliophyta
<i>Lepraria caesiella</i> R.C. Harris	dust lichen	Uncertain Lichen Family	Ascomycota
<i>Lepraria lobificans</i> Nyl.	dust lichen	Uncertain Lichen Family	Ascomycota
<i>Lepraria neglecta</i> (Nyl.) Erichsen	dust lichen	Uncertain Lichen Family	Ascomycota
<i>Lepraria obscura</i> Lendemer	dust lichen	Uncertain Lichen Family	Ascomycota
<i>Lespedeza cuneata</i> (Dum.-Cours.) G. Don	Chinese lespedeza*	Fabaceae	Magnoliophyta
<i>Lespedeza frutescens</i> (L.) Hornem.	shrubby lespedeza	Fabaceae	Magnoliophyta
<i>Lespedeza</i> Michx.	lespedeza	Fabaceae	Magnoliophyta
<i>Lespedeza procumbens</i> Michx.	trailing lespedeza	Fabaceae	Magnoliophyta
<i>Lespedeza repens</i> (L.) W. Bart.	creeping lespedeza	Fabaceae	Magnoliophyta
<i>Leucanthemum vulgare</i> Lam.	oxeye daisy*	Asteraceae	Magnoliophyta
<i>Leucobryum albidum</i> (Brid. ex P. Beauv.) Lindb.	leucobryum moss	Leucobryaceae	Bryophyta
<i>Leucobryum glaucum</i> (Hedw.) Ångstr. in Fries	leucobryum moss	Leucobryaceae	Bryophyta
<i>Leucobryum</i> Hampe	leucobryum moss	Leucobryaceae	Bryophyta
<i>Leucolejeunea clypeata</i> (Schwein.) A. Evans	white caveleaf liverwort	Lejeuneaceae	Marchantiophyta
<i>Liatris scariosa</i> (L.) Willd.	devil's bite	Asteraceae	Magnoliophyta
<i>Lichenothelia</i> D. Hawksw.	lichenothelia lichen	Lichenotheliaceae	Ascomycota
<i>Lilium canadense</i> L.	Canada lily	Liliaceae	Magnoliophyta
<i>Lilium superbum</i> L.	turk's-cap lily	Liliaceae	Magnoliophyta
<i>Lindera benzoin</i> (L.) Blume	northern spicebush	Lauraceae	Magnoliophyta
<i>Lindera benzoin</i> (L.) Blume var. <i>benzoin</i>	northern spicebush	Lauraceae	Magnoliophyta
<i>Lindera benzoin</i> (L.) Blume var. <i>pubescens</i> (Palmer & Steyermark) Rehd.	northern spicebush	Lauraceae	Magnoliophyta
<i>Lindernia dubia</i> (L.) Pennell var. <i>dubia</i>	yellowseed false pimpernel	Scrophulariaceae	Magnoliophyta
<i>Linum striatum</i> Walt.	ridged yellow flax	Linaceae	Magnoliophyta
<i>Linum virginianum</i> L.	woodland flax	Linaceae	Magnoliophyta
<i>Liquidambar styraciflua</i> L.	sweetgum	Hamamelidaceae	Magnoliophyta
<i>Liriodendron tulipifera</i> L.	tuliptree	Magnoliaceae	Magnoliophyta
<i>Lobelia cardinalis</i> L.	cardinalflower	Campanulaceae	Magnoliophyta
<i>Lobelia inflata</i> L.	Indian-tobacco	Campanulaceae	Magnoliophyta
<i>Lobelia</i> L.	lobelia	Campanulaceae	Magnoliophyta
<i>Loeskeobryum brevirostre</i> (Brid.) Fleisch. in Broth.	loeskeobryum moss	Hylocomiaceae	Bryophyta
<i>Lolium arundinaceum</i> (Schreb.) S.J. Darbyshire	tall fescue*	Poaceae	Magnoliophyta
<i>Lolium pratense</i> (Huds.) S.J. Darbyshire	meadow ryegrass*	Poaceae	Magnoliophyta
<i>Lonicera japonica</i> Thunb.	Japanese honeysuckle*	Caprifoliaceae	Magnoliophyta
<i>Lonicera morrowii</i> Gray	Morrow's honeysuckle	Caprifoliaceae	Magnoliophyta
<i>Lophocolea heterophylla</i> (Schrab.) Dumort.	variable malepouch liverwort	Lophocoleaceae	Marchantiophyta

Scientific Name	Common Name	Family	Division
<i>Ludwigia palustris</i> (L.) Ell.	marsh seedbox	Onagraceae	Magnoliophyta
<i>Luzula acuminata</i> Raf.	hairy woodrush	Juncaceae	Magnoliophyta
<i>Luzula</i> DC.	woodrush	Juncaceae	Magnoliophyta
<i>Luzula echinata</i> (Small) F.J. Herm.	hedgehog woodrush	Juncaceae	Magnoliophyta
<i>Luzula multiflora</i> (Ehrh.) Lej. ssp. <i>multiflora</i> var. <i>multiflora</i>	common woodrush	Juncaceae	Magnoliophyta
<i>Lycopodium digitatum</i> Dill. ex A. Braun	fan clubmoss	Lycopodiaceae	Lycopodiophyta
<i>Lycopodium tristachyum</i> Pursh	deeproot clubmoss	Lycopodiaceae	Lycopodiophyta
<i>Lycopus</i> L.	waterhorehound	Lamiaceae	Magnoliophyta
<i>Lycopus uniflorus</i> Michx. var. <i>uniflorus</i>	northern bugleweed	Lamiaceae	Magnoliophyta
<i>Lycopus virginicus</i> L.	Virginia water horehound	Lamiaceae	Magnoliophyta
<i>Lyonia ligustrina</i> (L.) DC. var. <i>ligustrina</i>	maleberry	Ericaceae	Magnoliophyta
<i>Lysimachia ciliata</i> L.	fringed loosestrife	Primulaceae	Magnoliophyta
<i>Lysimachia lanceolata</i> Walt.	lanceleaf loosestrife	Primulaceae	Magnoliophyta
<i>Lysimachia nummularia</i> L.	creeping jenny*	Primulaceae	Magnoliophyta
<i>Lysimachia quadrifolia</i> L.	whorled yellow loosestrife	Primulaceae	Magnoliophyta
<i>Lysimachia terrestris</i> (L.) B.S.P.	earth loosestrife	Primulaceae	Magnoliophyta
<i>Magnolia acuminata</i> (L.) L.	cucumber-tree	Magnoliaceae	Magnoliophyta
<i>Magnolia fraseri</i> Walt.	mountain magnolia	Magnoliaceae	Magnoliophyta
<i>Magnolia tripetala</i> (L.) L.	umbrella-tree	Magnoliaceae	Magnoliophyta
<i>Maianthemum canadense</i> Desf.	Canada mayflower	Liliaceae	Magnoliophyta
<i>Maianthemum racemosum</i> (L.) Link ssp. <i>racemosum</i>	feathery false lily of the valley	Liliaceae	Magnoliophyta
<i>Marshallia grandiflora</i> Beadle & F.E. Boynt.	Monongahela Barbara's buttons	Asteraceae	Magnoliophyta
<i>Medeola virginiana</i> L.	Indian cucumber	Liliaceae	Magnoliophyta
<i>Meehania cordata</i> (Nutt.) Britt.	Meehan's mint	Lamiaceae	Magnoliophyta
<i>Menispermum canadense</i> L.	common moonseed	Menispermaceae	Magnoliophyta
<i>Microstegium vimineum</i> (Trin.) A. Camus	Nepalese browntop*	Poaceae	Magnoliophyta
<i>Mimulus alatus</i> Ait.	sharpwing monkeyflower	Scrophulariaceae	Magnoliophyta
<i>Mimulus ringens</i> L. var. <i>ringens</i>	Allegheny monkeyflower	Scrophulariaceae	Magnoliophyta
<i>Mitchella repens</i> L.	partridgeberry	Rubiaceae	Magnoliophyta
<i>Mitella diphylla</i> L.	twoleaf miterwort	Saxifragaceae	Magnoliophyta
<i>Mnium</i> Hedw.	mnium calcareous moss	Mniaceae	Bryophyta
<i>Mnium hornum</i> Hedw.	horn calcareous moss	Mniaceae	Bryophyta
<i>Monarda clinopodia</i> L.	white bergamot	Lamiaceae	Magnoliophyta
<i>Monarda</i> L.	bee balm	Lamiaceae	Magnoliophyta
<i>Monotropa hypopithys</i> L.	pinemap	Monotropaceae	Magnoliophyta
<i>Monotropa uniflora</i> L.	Indianpipe	Monotropaceae	Magnoliophyta
<i>Morus rubra</i> L. var. <i>rubra</i>	red mulberry	Moraceae	Magnoliophyta
<i>Muhlenbergia frondosa</i> (Poir.) Fern.	wirestem muhly	Poaceae	Magnoliophyta
<i>Muhlenbergia</i> Schreb.	muhly	Poaceae	Magnoliophyta
<i>Muhlenbergia schreberi</i> J.F. Gmel.	nimblewill	Poaceae	Magnoliophyta
<i>Muhlenbergia sylvatica</i> Torr. ex Gray	woodland muhly	Poaceae	Magnoliophyta
<i>Muhlenbergia tenuiflora</i> (Willd.) B.S.P.	slender muhly	Poaceae	Magnoliophyta
<i>Mutinus elegans</i> (Mont.) E. Fischer	elegant stinkhorn	Phallaceae	Basidiomycota
<i>Myelochroa aurulenta</i> (Tuck.) Elix & Hale	myelochroa lichen	Parmeliaceae	Ascomycota
<i>Nowellia curvifolia</i> (Dicks.) Mitt.	red crescent liverwort	Cephaloziaceae	Marchantiophyta
<i>Nyssa sylvatica</i> Marsh.	blackgum	Cornaceae	Magnoliophyta
<i>Oenothera</i> L.	evening-primrose	Onagraceae	Magnoliophyta
<i>Onoclea sensibilis</i> L.	sensitive fern	Dryopteridaceae	Polypodiophyta
<i>Osmorhiza claytonii</i> (Michx.) C.B. Clarke	Clayton's sweetroot	Apiaceae	Magnoliophyta
<i>Osmunda cinnamomea</i> L.	cinnamon fern	Osmundaceae	Polypodiophyta

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<i>Osmunda claytoniana</i> L.	interrupted fern	Osmundaceae	Polypodiophyta
<i>Osmunda regalis</i> L. var. <i>spectabilis</i> (Willd.) Gray	royal fern	Osmundaceae	Polypodiophyta
<i>Ostrya virginiana</i> (P. Mill.) K. Koch var. <i>virginiana</i>	hophornbeam	Betulaceae	Magnoliophyta
<i>Oxalis dillenii</i> Jacq.	slender yellow wood sorrel	Oxalidaceae	Magnoliophyta
<i>Oxalis grandis</i> Small	great yellow woodsorrel	Oxalidaceae	Magnoliophyta
<i>Oxalis</i> L.	woodsorrel	Oxalidaceae	Magnoliophyta
<i>Oxalis stricta</i> L.	common yellow oxalis	Oxalidaceae	Magnoliophyta
<i>Oxalis violacea</i> L.	violet woodsorrel	Oxalidaceae	Magnoliophyta
<i>Oxydendrum arboreum</i> (L.) DC.	sourwood	Ericaceae	Magnoliophyta
<i>Oxypolis rigidior</i> (L.) Raf.	stiff cowbane	Apiaceae	Magnoliophyta
<i>Packera aurea</i> (L.) A. & D. Löve	golden ragwort	Asteraceae	Magnoliophyta
<i>Packera obovata</i> (Muhl. ex Willd.) W.A. Weber & A. Löve	roundleaf ragwort	Asteraceae	Magnoliophyta
<i>Packera paupercula</i> (Michx.) A. & D. Löve	balsam groundsel	Asteraceae	Magnoliophyta
<i>Panax quinquefolius</i> L.	American ginseng	Araliaceae	Magnoliophyta
<i>Panicum dichotomiflorum</i> Michx. ssp. <i>dichotomiflorum</i>	fall panicgrass	Poaceae	Magnoliophyta
<i>Panicum</i> L.	panicgrass	Poaceae	Magnoliophyta
<i>Panicum virgatum</i> L.	switchgrass	Poaceae	Magnoliophyta
<i>Parmelia</i> Ach.	shield lichen	Parmeliaceae	Ascomycota
<i>Parmotrema hypotropum</i> (Nyl.) Hale	lichen	Parmeliaceae	Ascomycota
<i>Paronychia canadensis</i> (L.) Wood	smooth forked nailwort	Caryophyllaceae	Magnoliophyta
<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper	Vitaceae	Magnoliophyta
<i>Passiflora lutea</i> L.	yellow passionflower	Passifloraceae	Magnoliophyta
<i>Paulownia tomentosa</i> (Thunb.) Sieb. & Zucc. ex Steud.	princesstree*	Scrophulariaceae	Magnoliophyta
<i>Pedicularis canadensis</i> L. ssp. <i>canadensis</i>	Canadian lousewort	Scrophulariaceae	Magnoliophyta
<i>Pellia epiphylla</i> (L.) Corda	flap wing liverwort	Pelliaceae	Marchantiophyta
<i>Penthorum sedoides</i> L.	ditch stonecrop	Crassulaceae	Magnoliophyta
<i>Phaeocalicium polyporaenum</i> (Nyl.) Tibell	phaeocalicium fungus	Mycocaliciales	Ascomycota
<i>Phegopteris hexagonoptera</i> (Michx.) Fée	broad beechfern	Thelypteridaceae	Polypodiophyta
<i>Phlox</i> L.	phlox	Polemoniaceae	Magnoliophyta
<i>Phlox maculata</i> L.	wild sweetwilliam	Polemoniaceae	Magnoliophyta
<i>Phlox maculata</i> L. ssp. <i>maculata</i>	wild sweetwilliam	Polemoniaceae	Magnoliophyta
<i>Phlox maculata</i> L. ssp. <i>pyramidalis</i> (Sm.) Wherry	wild sweetwilliam	Polemoniaceae	Magnoliophyta
<i>Phlox paniculata</i> L.	fall phlox	Polemoniaceae	Magnoliophyta
<i>Phlyctis petraea</i> auct. R.C. Harris	lichen	Phlyctidaceae	Ascomycota
<i>Phryma leptostachya</i> L.	American lopseed	Verbenaceae	Magnoliophyta
<i>Physocarpus opulifolius</i> (L.) Maxim. var. <i>opulifolius</i>	common ninebark	Rosaceae	Magnoliophyta
<i>Physostegia virginiana</i> (L.) Benth. ssp. <i>virginiana</i>	obedient plant	Lamiaceae	Magnoliophyta
<i>Phytolacca americana</i> L. var. <i>americana</i>	American pokeweed	Phytolaccaceae	Magnoliophyta
<i>Pilea pumila</i> (L.) Gray var. <i>pumila</i>	Canadian clearweed	Urticaceae	Magnoliophyta
<i>Pinus</i> L.	pine	Pinaceae	Pinophyta
<i>Pinus rigida</i> P. Mill.	pitch pine	Pinaceae	Pinophyta
<i>Pinus strobus</i> L.	eastern white pine	Pinaceae	Pinophyta
<i>Pinus virginiana</i> P. Mill.	Virginia pine	Pinaceae	Pinophyta
<i>Plagiomnium ciliare</i> (C. Müll.) T. Kop.	plagiomnium moss	Mniaceae	Bryophyta
<i>Plagiomnium cuspidatum</i> (Hedw.) T. Kop.	toothed plagiomnium moss	Mniaceae	Bryophyta

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<i>Plagiomnium ellipticum</i> (Brid.) T. Kop.	elliptic plagiomnium moss	Mniaceae	Bryophyta
<i>Plantago rugelii</i> Dcne. var. <i>rugelii</i>	blackseed plantain	Plantaginaceae	Magnoliophyta
<i>Platanthera clavellata</i> (Michx.) Luer	small green wood orchid	Orchidaceae	Magnoliophyta
<i>Platanthera</i> L.C. Rich.	fringed orchid	Orchidaceae	Magnoliophyta
<i>Platanus occidentalis</i> L.	American sycamore	Platanaceae	Magnoliophyta
<i>Platismatia tuckermanii</i> (Oakes) W.L. Culb. & C.F. Culb.	Tuckerman's ragged lichen	Parmeliaceae	Ascomycota
<i>Poa alsodes</i> Gray	grove bluegrass	Poaceae	Magnoliophyta
<i>Poa compressa</i> L.	Canada bluegrass*	Poaceae	Magnoliophyta
<i>Poa cuspidata</i> Nutt.	early bluegrass	Poaceae	Magnoliophyta
<i>Poa</i> L.	bluegrass	Poaceae	Magnoliophyta
<i>Poa sylvestris</i> Gray	woodland bluegrass	Poaceae	Magnoliophyta
<i>Podophyllum peltatum</i> L.	mayapple	Berberidaceae	Magnoliophyta
<i>Polygala polygama</i> Walt.	racemed milkwort	Polygalaceae	Magnoliophyta
<i>Polygala senega</i> L.	Seneca snakeroot	Polygalaceae	Magnoliophyta
<i>Polygonatum biflorum</i> (Walt.) Ell.	smooth Solomon's seal	Liliaceae	Magnoliophyta
<i>Polygonatum pubescens</i> (Willd.) Pursh	hairy Solomon's seal	Liliaceae	Magnoliophyta
<i>Polygonum caespitosum</i> Blume var. <i>longisetum</i> (de Bruyn) A.N. Steward	oriental ladythumb*	Polygonaceae	Magnoliophyta
<i>Polygonum convolvulus</i> L. var. <i>convolvulus</i>	black bindweed*	Polygonaceae	Magnoliophyta
<i>Polygonum cuspidatum</i> Sieb. & Zucc.	Japanese knotweed*	Polygonaceae	Magnoliophyta
<i>Polygonum hydropiperoides</i> Michx.	swamp smartweed	Polygonaceae	Magnoliophyta
<i>Polygonum</i> L.	knotweed	Polygonaceae	Magnoliophyta
<i>Polygonum scandens</i> L.	climbing false buckwheat	Polygonaceae	Magnoliophyta
<i>Polygonum virginianum</i> L.	jumpseed	Polygonaceae	Magnoliophyta
<i>Polymnia canadensis</i> L.	whiteflower leafcup	Asteraceae	Magnoliophyta
<i>Polypodium virginianum</i> L.	rock polypody	Polypodiaceae	Polypodiophyta
<i>Polystichum acrostichoides</i> (Michx.) Schott	Christmas fern	Dryopteridaceae	Polypodiophyta
<i>Polytrichum commune</i> Hedw.	polytrichum moss	Polytrichaceae	Bryophyta
<i>Polytrichum</i> Hedw.	polytrichum moss	Polytrichaceae	Bryophyta
<i>Polytrichum juniperinum</i> Hedw.	juniper polytrichum moss	Polytrichaceae	Bryophyta
<i>Polytrichum ohioense</i> Ren. & Card.	Ohio polytrichum moss	Polytrichaceae	Bryophyta
<i>Polytrichum pallidisetum</i> Funck	polytrichum moss	Polytrichaceae	Bryophyta
<i>Populus grandidentata</i> Michx.	bigtooth aspen	Salicaceae	Magnoliophyta
<i>Porella pinnata</i> L.	aquatic tongue liverwort	Porellaceae	Marchantiophyta
<i>Porpidia albocaerulescens</i> (Wulfen) Hertel & Knoph	Porpidia lichen	Porpidiaceae	Ascomycota
<i>Porteranthus trifolius</i> (L.) Britt.	Bowman's root	Rosaceae	Magnoliophyta
<i>Potentilla canadensis</i> L. var. <i>canadensis</i>	dwarf cinquefoil	Rosaceae	Magnoliophyta
<i>Potentilla</i> L.	cinquefoil	Rosaceae	Magnoliophyta
<i>Potentilla simplex</i> Michx.	common cinquefoil	Rosaceae	Magnoliophyta
<i>Prenanthes alba</i> L.	white rattlesnakeroot	Asteraceae	Magnoliophyta
<i>Prenanthes</i> L.	rattlesnakeroot	Asteraceae	Magnoliophyta
<i>Prosartes lanuginosa</i> (Michx.) D. Don	yellow fairybells	Liliaceae	Magnoliophyta
<i>Prunella vulgaris</i> L.	common selfheal*	Lamiaceae	Magnoliophyta
<i>Prunus</i> L.	plum	Rosaceae	Magnoliophyta
<i>Prunus pensylvanica</i> L. f. var. <i>pensylvanica</i>	pin cherry	Rosaceae	Magnoliophyta
<i>Prunus pumila</i> L. var. <i>depressa</i> (Pursh) Gleason	eastern sandcherry	Rosaceae	Magnoliophyta
<i>Prunus serotina</i> Ehrh. var. <i>serotina</i>	black cherry	Rosaceae	Magnoliophyta
<i>Pteridium aquilinum</i> (L.) Kuhn	western brackenfern	Dennstaedtiaceae	Polypodiophyta
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Underwood ex Heller	western brackenfern	Dennstaedtiaceae	Polypodiophyta

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<i>Punctelia rudecta</i> (Ach.) Krog	lichen	Parmeliaceae	Ascomycota
<i>Pylaisiadelphina tenuirostris</i> (Bruch & Schimp. ex Sull.) Buck	pylaisiadelphina moss	Hypnaceae	Bryophyta
<i>Pyrularia pubera</i> Michx.	buffalo nut	Santalaceae	Magnoliophyta
<i>Quercus alba</i> L.	white oak	Fagaceae	Magnoliophyta
<i>Quercus coccinea</i> Muenchh. var. <i>coccinea</i>	scarlet oak	Fagaceae	Magnoliophyta
<i>Quercus</i> L.	oak	Fagaceae	Magnoliophyta
<i>Quercus muehlenbergii</i> Engelm.	chinkapin oak	Fagaceae	Magnoliophyta
<i>Quercus palustris</i> Muenchh.	pin oak	Fagaceae	Magnoliophyta
<i>Quercus prinus</i> L.	chestnut oak	Fagaceae	Magnoliophyta
<i>Quercus rubra</i> L.	northern red oak	Fagaceae	Magnoliophyta
<i>Quercus stellata</i> Wangenh.	post oak	Fagaceae	Magnoliophyta
<i>Quercus velutina</i> Lam.	black oak	Fagaceae	Magnoliophyta
<i>Racomitrium aciculare</i> (Hedw.) Brid.	racomitrium moss	Grimmiaceae	Bryophyta
<i>Ranunculus abortivus</i> L.	littleleaf buttercup	Ranunculaceae	Magnoliophyta
<i>Ranunculus allegheniensis</i> Britt.	Allegheny Mountain buttercup	Ranunculaceae	Magnoliophyta
<i>Ranunculus hispidus</i> Michx. var. <i>hispidus</i>	bristly buttercup	Ranunculaceae	Magnoliophyta
<i>Ranunculus hispidus</i> Michx. var. <i>nitidus</i> (Chapman) T. Duncan	bristly buttercup	Ranunculaceae	Magnoliophyta
<i>Ranunculus</i> L.	buttercup	Ranunculaceae	Magnoliophyta
<i>Ranunculus recurvatus</i> Poir. var. <i>recurvatus</i>	blisterwort	Ranunculaceae	Magnoliophyta
<i>Rhabdoweisia crispata</i> (With.) Lindb.	rhabdoweisia moss	Dicranaceae	Bryophyta
<i>Rhodobryum ontariense</i> (Kindb.) Par. in Kindb.	Ontario rhodobryum moss	Bryaceae	Bryophyta
<i>Rhododendron arborescens</i> (Pursh) Torr.	smooth azalea	Ericaceae	Magnoliophyta
<i>Rhododendron calendulaceum</i> (Michx.) Torr.	flame azalea	Ericaceae	Magnoliophyta
<i>Rhododendron catawbiense</i> Michx.	Catawba rosebay	Ericaceae	Magnoliophyta
<i>Rhododendron</i> L.	rhododendron	Ericaceae	Magnoliophyta
<i>Rhododendron maximum</i> L.	great laurel	Ericaceae	Magnoliophyta
<i>Rhododendron periclymenoides</i> (Michx.) Shinnars	pink azalea	Ericaceae	Magnoliophyta
<i>Rhus copallinum</i> L.	flameleaf sumac	Anacardiaceae	Magnoliophyta
<i>Rhus</i> L.	sumac	Anacardiaceae	Magnoliophyta
<i>Rhynchospora capitellata</i> (Michx.) Vahl	brownish beaksedge	Cyperaceae	Magnoliophyta
<i>Ribes cynosbati</i> L.	eastern prickly gooseberry	Grossulariaceae	Magnoliophyta
<i>Ribes</i> L.	currant	Grossulariaceae	Magnoliophyta
<i>Robinia pseudoacacia</i> L.	black locust	Fabaceae	Magnoliophyta
<i>Rorippa palustris</i> (L.) Bess. ssp. <i>palustris</i>	bog yellowcress	Brassicaceae	Magnoliophyta
<i>Rosa carolina</i> L. var. <i>carolina</i>	Carolina rose	Rosaceae	Magnoliophyta
<i>Rosa multiflora</i> Thunb. ex Murr.	multiflora rose*	Rosaceae	Magnoliophyta
<i>Rubus allegheniensis</i> Porter	Allegheny blackberry	Rosaceae	Magnoliophyta
<i>Rubus flagellaris</i> Willd.	northern dewberry	Rosaceae	Magnoliophyta
<i>Rubus</i> L.	blackberry	Rosaceae	Magnoliophyta
<i>Rubus occidentalis</i> L.	black raspberry	Rosaceae	Magnoliophyta
<i>Rubus odoratus</i> L. var. <i>odoratus</i>	purpleflowering raspberry	Rosaceae	Magnoliophyta
<i>Rubus phoenicolasius</i> Maxim.	wine raspberry*	Rosaceae	Magnoliophyta
<i>Rudbeckia laciniata</i> L. var. <i>laciniata</i>	cutleaf coneflower	Asteraceae	Magnoliophyta
<i>Rumex crispus</i> L. ssp. <i>crispus</i>	curly dock*	Polygonaceae	Magnoliophyta
<i>Russula</i>	russula mushroom	Russulaceae	Basidiomycota
<i>Sagittaria latifolia</i> Willd.	broadleaf arrowhead	Alismataceae	Magnoliophyta
<i>Salix alba</i> L.	white willow*	Salicaceae	Magnoliophyta
<i>Salix caroliniana</i> Michx.	coastal plain willow	Salicaceae	Magnoliophyta

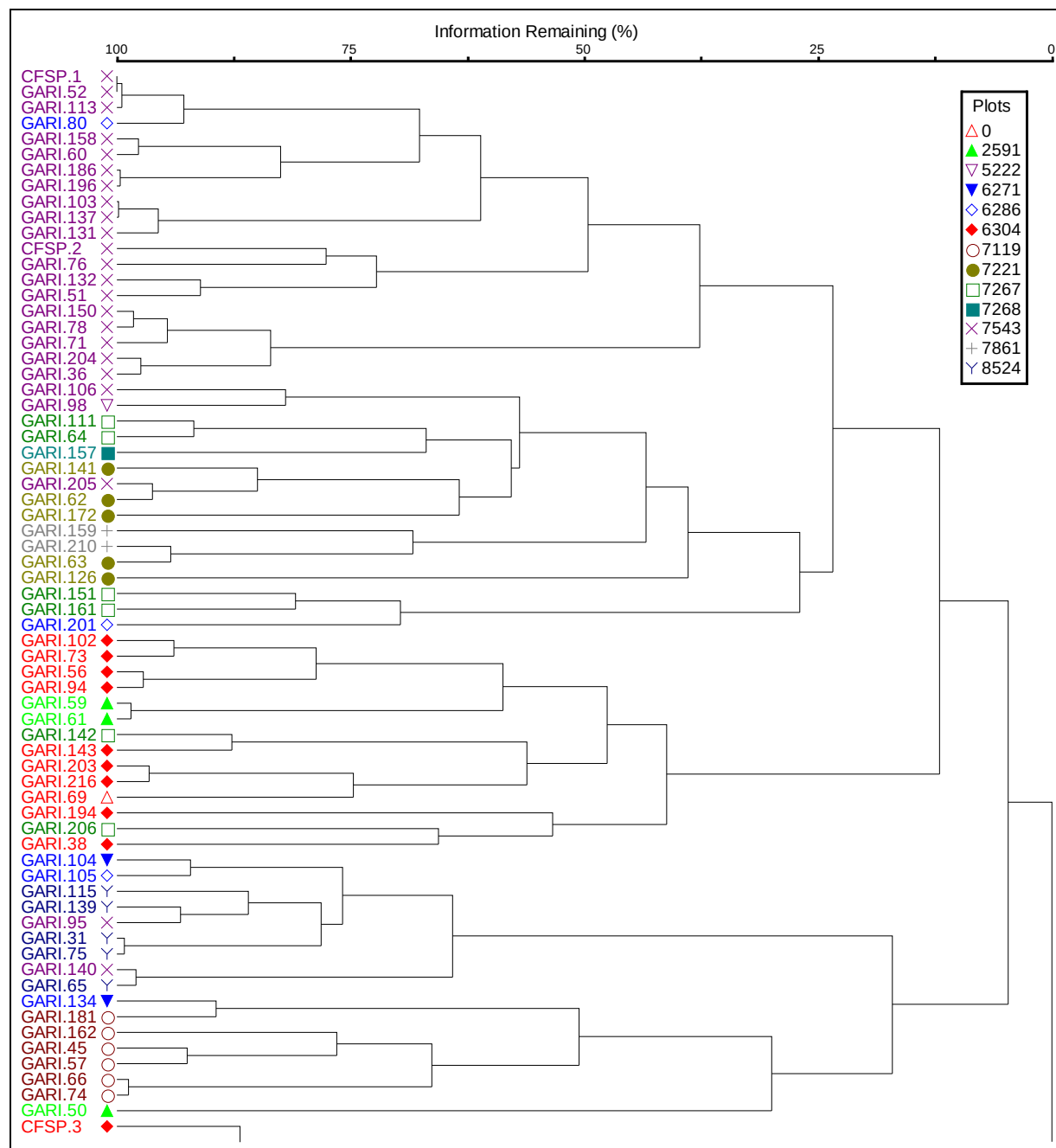
Scientific Name	Common Name	Family	Division
<i>Salix fragilis</i> L.	crack willow*	Salicaceae	Magnoliophyta
<i>Salix nigra</i> Marsh.	black willow	Salicaceae	Magnoliophyta
<i>Salix sericea</i> Marsh.	silky willow	Salicaceae	Magnoliophyta
<i>Salvia lyrata</i> L.	lyreleaf sage	Lamiaceae	Magnoliophyta
<i>Sambucus</i> L.	elderberry	Caprifoliaceae	Magnoliophyta
<i>Sambucus nigra</i> L. ssp. <i>canadensis</i> (L.) R. Bolli	common elderberry	Caprifoliaceae	Magnoliophyta
<i>Sambucus racemosa</i> L. var. <i>racemosa</i>	red elderberry	Caprifoliaceae	Magnoliophyta
<i>Sanguinaria canadensis</i> L.	bloodroot	Papaveraceae	Magnoliophyta
<i>Sanicula canadensis</i> L.	Canadian blacksnakeroot	Apiaceae	Magnoliophyta
<i>Sanicula canadensis</i> L. var. <i>grandis</i> Fern.	Canadian blacksnakeroot	Apiaceae	Magnoliophyta
<i>Sanicula</i> L.	sanicle	Apiaceae	Magnoliophyta
<i>Sanicula marilandica</i> L.	Maryland sanicle	Apiaceae	Magnoliophyta
<i>Sanicula trifoliata</i> Bickn.	largefruit blacksnakeroot	Apiaceae	Magnoliophyta
<i>Sassafras albidum</i> (Nutt.) Nees	sassafras	Lauraceae	Magnoliophyta
<i>Scapania nemorea</i> (L.) Grolle	toothy mitten liverwort	Scapaniaceae	Marchantiophyta
<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp. in B.S.G.	schistidium moss	Grimmiaceae	Bryophyta
<i>Schizachyrium scoparium</i> (Michx.) Nash var. <i>scoparium</i>	little bluestem	Poaceae	Magnoliophyta
<i>Schoenoplectus tabernaemontani</i> (K.C. Gmel.) Palla	softstem bulrush	Cyperaceae	Magnoliophyta
<i>Scirpus atrovirens</i> Willd.	green bulrush	Cyperaceae	Magnoliophyta
<i>Scirpus cyperinus</i> (L.) Kunth	woolgrass	Cyperaceae	Magnoliophyta
<i>Scirpus</i> L.	bulrush	Cyperaceae	Magnoliophyta
<i>Scirpus polyphyllus</i> Vahl	leafy bulrush	Cyperaceae	Magnoliophyta
<i>Scutellaria elliptica</i> Muhl. ex Spreng. var. <i>hirsuta</i> (Short & Peter) Fern.	hairy skullcap	Lamiaceae	Magnoliophyta
<i>Scutellaria lateriflora</i> L. var. <i>lateriflora</i>	mad-dog skullcap	Lamiaceae	Magnoliophyta
<i>Sedum ternatum</i> Michx.	woodland stonecrop	Crassulaceae	Magnoliophyta
<i>Sematophyllum demissum</i> (Wils.) Mitt.	sematophyllum moss	Sematophyllaceae	Bryophyta
<i>Sericocarpus asteroides</i> (L.) B.S.P.	toothed whitetop aster	Asteraceae	Magnoliophyta
<i>Silene</i> L.	catchfly	Caryophyllaceae	Magnoliophyta
<i>Silene stellata</i> (L.) Ait. f.	widowsfrill	Caryophyllaceae	Magnoliophyta
<i>Silene virginica</i> L. var. <i>virginica</i>	fire pink	Caryophyllaceae	Magnoliophyta
<i>Sisyrinchium angustifolium</i> P. Mill.	narrowleaf blue-eyed grass	Iridaceae	Magnoliophyta
<i>Smilax ecirrata</i> (Engelm. ex Kunth) S. Wats.	upright carrionflower	Smilacaceae	Magnoliophyta
<i>Smilax glauca</i> Walt.	cat greenbrier	Smilacaceae	Magnoliophyta
<i>Smilax herbacea</i> L.	smooth carrionflower	Smilacaceae	Magnoliophyta
<i>Smilax</i> L.	greenbrier	Smilacaceae	Magnoliophyta
<i>Smilax rotundifolia</i> L.	roundleaf greenbrier	Smilacaceae	Magnoliophyta
<i>Smilax tamnoides</i> L.	bristly greenbrier	Smilacaceae	Magnoliophyta
<i>Solanum carolinense</i> L. var. <i>carolinense</i>	Carolina horsenettle	Solanaceae	Magnoliophyta
<i>Solidago arguta</i> Ait.	Atlantic goldenrod	Asteraceae	Magnoliophyta
<i>Solidago arguta</i> Ait. var. <i>arguta</i>	Atlantic goldenrod	Asteraceae	Magnoliophyta
<i>Solidago bicolor</i> L.	white goldenrod	Asteraceae	Magnoliophyta
<i>Solidago caesia</i> L.	wreath goldenrod	Asteraceae	Magnoliophyta
<i>Solidago curtisii</i> Torr. & Gray	Curtis' goldenrod	Asteraceae	Magnoliophyta
<i>Solidago flexicaulis</i> L.	zigzag goldenrod	Asteraceae	Magnoliophyta
<i>Solidago gigantea</i> Ait.	giant goldenrod	Asteraceae	Magnoliophyta
<i>Solidago hispida</i> Muhl. ex Willd. var. <i>hispida</i>	hairy goldenrod	Asteraceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
<i>Solidago juncea</i> Ait. var. <i>juncea</i>	early goldenrod	Asteraceae	Magnoliophyta
<i>Solidago</i> L.	goldenrod	Asteraceae	Magnoliophyta
<i>Solidago roanensis</i> Porter	Roan Mountain goldenrod	Asteraceae	Magnoliophyta
<i>Solidago rugosa</i> P. Mill.	wrinkleleaf goldenrod	Asteraceae	Magnoliophyta
<i>Solidago simplex</i> Kunth ssp. <i>randii</i> (Porter) Ringius var. <i>racemosa</i> (Greene) Ringius	Rand's goldenrod	Asteraceae	Magnoliophyta
<i>Sorghastrum nutans</i> (L.) Nash	Indiangrass	Poaceae	Magnoliophyta
<i>Sparganium chlorocarpum</i> Rydb.	burreed	Sparganiaceae	Magnoliophyta
<i>Sphagnum capillifolium</i> var. <i>capillifolium</i> (Ehrh.) Hedw.	pompom hair peatmoss	Sphagnaceae	Bryophyta
<i>Sphagnum lescurii</i> Sull. in Gray	Lescur's sphagnum	Sphagnaceae	Bryophyta
<i>Sphagnum palustre</i> L.	prairie sphagnum	Sphagnaceae	Bryophyta
<i>Sphenopholis nitida</i> (Biehler) Scribn.	shiny wedgescale	Poaceae	Magnoliophyta
<i>Spiraea alba</i> Du Roi var. <i>alba</i>	white meadowsweet	Rosaceae	Magnoliophyta
<i>Spiraea virginiana</i> Britt.	Virginia meadowsweet	Rosaceae	Magnoliophyta
<i>Staphylea trifolia</i> L.	American bladdernut	Staphyleaceae	Magnoliophyta
<i>Steerecleus serrulatus</i> (Hedw.) Robins.	steerecleus moss	Brachytheciaceae	Bryophyta
<i>Stellaria media</i> (L.) Vill. ssp. <i>pallida</i> (Dumort.) Aschers. & Graebn.	common chickweed*	Caryophyllaceae	Magnoliophyta
<i>Stellaria pubera</i> Michx.	star chickweed	Caryophyllaceae	Magnoliophyta
<i>Streptopus lanceolatus</i> (Ait.) Reveal var. <i>roseus</i> (Michx.) Reveal	twistedstalk	Liliaceae	Magnoliophyta
<i>Stylophorum diphyllum</i> (Michx.) Nutt.	celandine poppy	Papaveraceae	Magnoliophyta
<i>Symphyotrichum cordifolium</i> (L.) Nesom	common blue wood aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum dumosum</i> (L.) Nesom var. <i>dumosum</i>	rice button aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum laeve</i> (L.) A. & D. Löve var. <i>concinnum</i> (Willd.) Nesom	smooth blue aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum lanceolatum</i> (Willd.) Nesom	white panicle aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum lateriflorum</i> (L.) A. & D. Löve	calico aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum</i> Nees	aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum patens</i> (Ait.) Nesom var. <i>patens</i>	late purple aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum pilosum</i> (Willd.) Nesom	hairy white oldfield aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum praealtum</i> (Poir.) Nesom	willowleaf aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum prenanthoides</i> (Muhl. ex Willd.) Nesom	crookedstem aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum puniceum</i> (L.) A. & D. Löve var. <i>puniceum</i>	purplestem aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum racemosum</i> (Ell.) Nesom	smooth white oldfield aster	Asteraceae	Magnoliophyta
<i>Symphyotrichum undulatum</i> (L.) Nesom	waxyleaf aster	Asteraceae	Magnoliophyta
<i>Taenidia integerrima</i> (L.) Drude	yellow pimpernel	Apiaceae	Magnoliophyta
<i>Taraxacum officinale</i> G.H. Weber ex Wiggers ssp. <i>officinale</i>	common dandelion*	Asteraceae	Magnoliophyta
<i>Tephrosia virginiana</i> (L.) Pers.	Virginia tephrosia	Fabaceae	Magnoliophyta
<i>Tetraphis pellucida</i> Hedw.	tetraphis moss	Tetraphidaceae	Bryophyta
<i>Thalictrum clavatum</i> DC.	mountain meadow-rue	Ranunculaceae	Magnoliophyta
<i>Thalictrum</i> L.	meadow-rue	Ranunculaceae	Magnoliophyta
<i>Thalictrum pubescens</i> Pursh	king of the meadow	Ranunculaceae	Magnoliophyta
<i>Thalictrum revolutum</i> DC.	waxyleaf meadow-rue	Ranunculaceae	Magnoliophyta

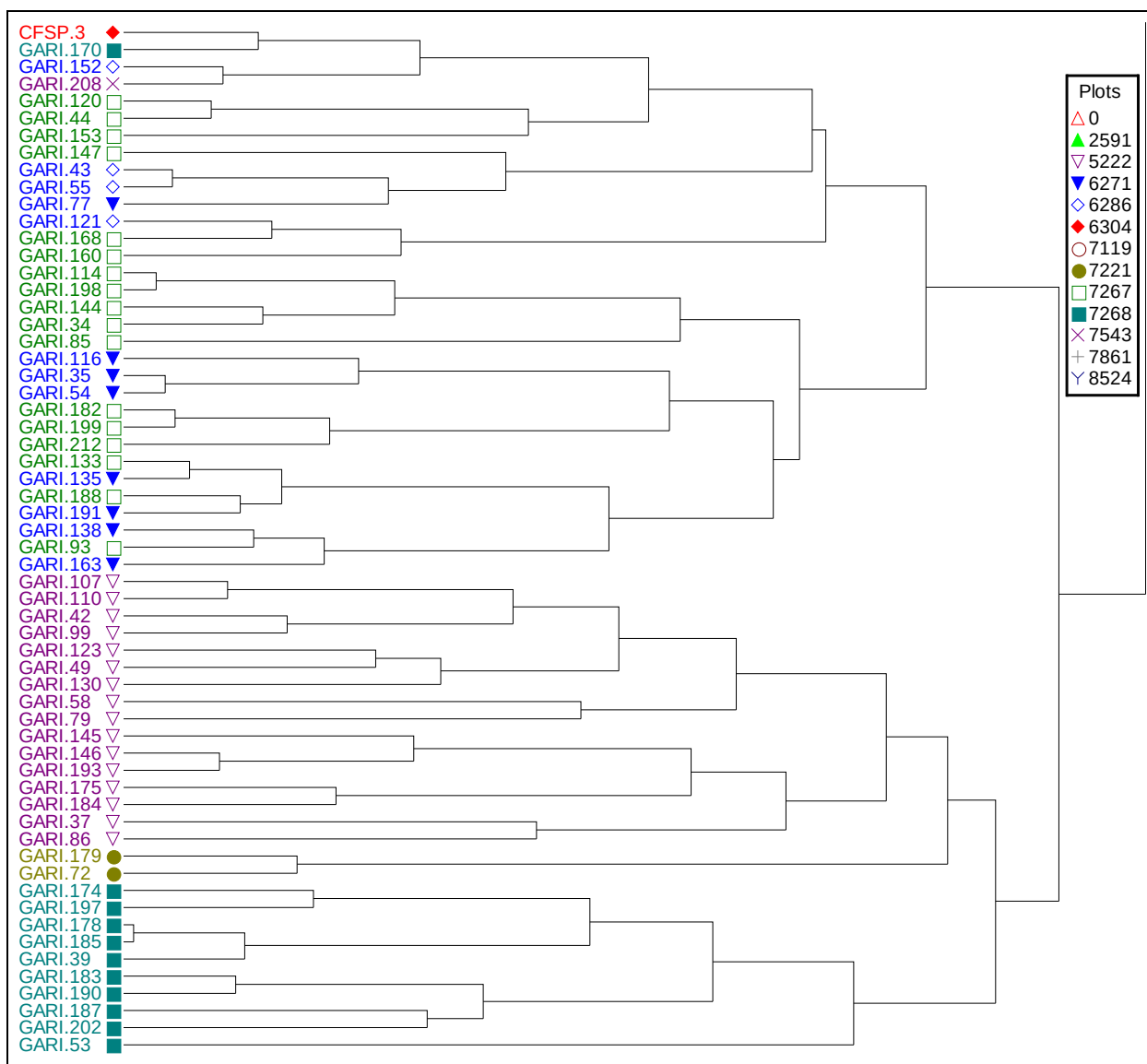
Scientific Name	Common Name	Family	Division
<i>Thalictrum thalictroides</i> (L.) Eames & Boivin	rue anemone	Ranunculaceae	Magnoliophyta
<i>Thelypteris noveboracensis</i> (L.) Nieuwl.	New York fern	Thelypteridaceae	Polypodiophyta
<i>Thuidium delicatulum</i> (Hedw.) Schimp. in B.S.G.	delicate thuidium moss	Thuidiaceae	Bryophyta
<i>Thuidium</i> Schimp. in B.S.G.	thuidium moss	Thuidiaceae	Bryophyta
<i>Tiarella cordifolia</i> L.	heartleaf foamflower	Saxifragaceae	Magnoliophyta
<i>Tilia americana</i> L.	American basswood	Tiliaceae	Magnoliophyta
<i>Tilia americana</i> L. var. <i>americana</i>	American basswood	Tiliaceae	Magnoliophyta
<i>Tilia americana</i> L. var. <i>heterophylla</i> (Vent.) Loud.	American basswood	Tiliaceae	Magnoliophyta
<i>Toxicodendron radicans</i> (L.) Kuntze	eastern poison ivy	Anacardiaceae	Magnoliophyta
<i>Trautvetteria caroliniensis</i> (Walt.) Vail var. <i>caroliniensis</i>	Carolina bugbane	Ranunculaceae	Magnoliophyta
<i>Triadenum</i> Raf.	marsh St. Johnswort	Clusiaceae	Magnoliophyta
<i>Trichocolea tomentella</i> (Ehrh.) Dumort.	woolly liverwort	Trichocoleaceae	Marchantiophyta
<i>Trifolium</i> L.	clover	Fabaceae	Magnoliophyta
<i>Trifolium pratense</i> L.	red clover*	Fabaceae	Magnoliophyta
<i>Trillium erectum</i> L.	red trillium	Liliaceae	Magnoliophyta
<i>Trillium</i> L.	trillium	Liliaceae	Magnoliophyta
<i>Tsuga canadensis</i> (L.) Carr.	eastern hemlock	Pinaceae	Pinophyta
<i>Tuckermannopsis ciliaris</i> (Ach.) Gyel.	tuckermannopsis lichen	Parmeliaceae	Ascomycota
<i>Tussilago farfara</i> L.	coltsfoot*	Asteraceae	Magnoliophyta
<i>Ulmus americana</i> L.	American elm	Ulmaceae	Magnoliophyta
<i>Ulmus rubra</i> Muhl.	slippery elm	Ulmaceae	Magnoliophyta
<i>Ulota hutchinsiae</i> (Sm.) Hammar	Hutchins' ulota moss	Orthotrichaceae	Bryophyta
<i>Umbilicaria</i> Hoffm.	navel lichen	Umbilicariaceae	Ascomycota
<i>Umbilicaria mammulata</i> (Ach.) Tuck.	navel lichen	Umbilicariaceae	Ascomycota
<i>Usnea amblyoclada</i> (Müll. Arg.) Zahlbr.	rock beard lichen	Parmeliaceae	Ascomycota
<i>Uvularia grandiflora</i> Sm.	largeflower bellwort	Liliaceae	Magnoliophyta
<i>Uvularia</i> L.	bellwort	Liliaceae	Magnoliophyta
<i>Uvularia perfoliata</i> L.	perfoliate bellwort	Liliaceae	Magnoliophyta
<i>Uvularia puberula</i> Michx.	mountain bellwort	Liliaceae	Magnoliophyta
<i>Uvularia sessilifolia</i> L.	sessileleaf bellwort	Liliaceae	Magnoliophyta
<i>Vaccinium corymbosum</i> L.	highbush blueberry	Ericaceae	Magnoliophyta
<i>Vaccinium</i> L.	blueberry	Ericaceae	Magnoliophyta
<i>Vaccinium pallidum</i> Ait.	Blue Ridge blueberry	Ericaceae	Magnoliophyta
<i>Vaccinium stamineum</i> L.	deerberry	Ericaceae	Magnoliophyta
<i>Verbena urticifolia</i> L.	white vervain	Verbenaceae	Magnoliophyta
<i>Verbesina alternifolia</i> (L.) Britt. ex Kearney	wingstem	Asteraceae	Magnoliophyta
<i>Verbesina occidentalis</i> (L.) Walt.	yellow crownbeard	Asteraceae	Magnoliophyta
<i>Vernonia gigantea</i> (Walt.) Trel. ssp. <i>gigantea</i>	giant ironweed	Asteraceae	Magnoliophyta
<i>Vernonia</i> Schreb.	ironweed	Asteraceae	Magnoliophyta
<i>Veronica chamaedrys</i> L.	germander speedwell*	Scrophulariaceae	Magnoliophyta
<i>Viburnum acerifolium</i> L.	mapleleaf viburnum	Caprifoliaceae	Magnoliophyta
<i>Viburnum</i> L.	viburnum	Caprifoliaceae	Magnoliophyta
<i>Viburnum nudum</i> L. var. <i>cassinoides</i> (L.) Torr. & Gray	withe-rod	Caprifoliaceae	Magnoliophyta
<i>Viburnum prunifolium</i> L.	blackhaw	Caprifoliaceae	Magnoliophyta
<i>Viburnum recognitum</i> Fern.	southern arrow-wood	Caprifoliaceae	Magnoliophyta
<i>Viola</i> × <i>palmata</i> L.	palmate-leaved violet	Violaceae	Magnoliophyta
<i>Viola</i> × <i>primulifolia</i> L. (pro sp.)	primrose-leaf violet	Violaceae	Magnoliophyta

Scientific Name	Common Name	Family	Division
<i>Viola blanda</i> Willd. var. <i>blanda</i>	sweet white violet	Violaceae	Magnoliophyta
<i>Viola canadensis</i> L.	Canadian white violet	Violaceae	Magnoliophyta
<i>Viola cucullata</i> Ait.	marsh blue violet	Violaceae	Magnoliophyta
<i>Viola hastata</i> Michx.	halberdleaf yellow violet	Violaceae	Magnoliophyta
<i>Viola hirsutula</i> Brainerd	southern woodland violet	Violaceae	Magnoliophyta
<i>Viola</i> L.	violet	Violaceae	Magnoliophyta
<i>Viola pedata</i> L.	birdfoot violet	Violaceae	Magnoliophyta
<i>Viola pubescens</i> Ait.	downy yellow violet	Violaceae	Magnoliophyta
<i>Viola rostrata</i> Pursh	longspur violet	Violaceae	Magnoliophyta
<i>Viola rotundifolia</i> Michx.	roundleaf yellow violet	Violaceae	Magnoliophyta
<i>Viola sagittata</i> Ait.	arrowleaf violet	Violaceae	Magnoliophyta
<i>Viola sororia</i> Willd.	common blue violet	Violaceae	Magnoliophyta
<i>Viola striata</i> Ait.	striped cream violet	Violaceae	Magnoliophyta
<i>Viola triloba</i> Schwein. var. <i>triloba</i>	three-lobed violet	Violaceae	Magnoliophyta
<i>Vitis aestivalis</i> Michx.	summer grape	Vitaceae	Magnoliophyta
<i>Vitis</i> L.	grape	Vitaceae	Magnoliophyta
<i>Vitis riparia</i> Michx.	riverbank grape	Vitaceae	Magnoliophyta
<i>Xanthium strumarium</i> L.	rough cocklebur	Asteraceae	Magnoliophyta
<i>Xanthium strumarium</i> L. var. <i>glabratum</i> (DC.) Cronq.	rough cocklebur	Asteraceae	Magnoliophyta
<i>Xanthoparmelia conspersa</i> (Ehrh. ex Ach.) Hale	xanthoparmelia lichen	Parmeliaceae	Ascomycota
<i>Xanthoparmelia plittii</i> (Gyelnk) Hale	Plitt's rock-shield lichen	Parmeliaceae	Ascomycota
<i>Xanthorhiza simplicissima</i> Marsh.	yellowroot	Ranunculaceae	Magnoliophyta
<i>Xylaria hypoxylon</i> (L.) Grev.	candlesnuff fungus	Xylariaceae	Ascomycota
<i>Xylaria magnoliae</i> J. D. Rogers	magnolia cone flickers	Xylariaceae	Ascomycota
<i>Zizia aptera</i> (Gray) Fern.	meadow zizia	Apiaceae	Magnoliophyta
<i>Zizia trifoliata</i> (Michx.) Fern.	meadow alexanders	Apiaceae	Magnoliophyta
<i>Zizia</i> W.D.J. Koch	zizia	Apiaceae	Magnoliophyta

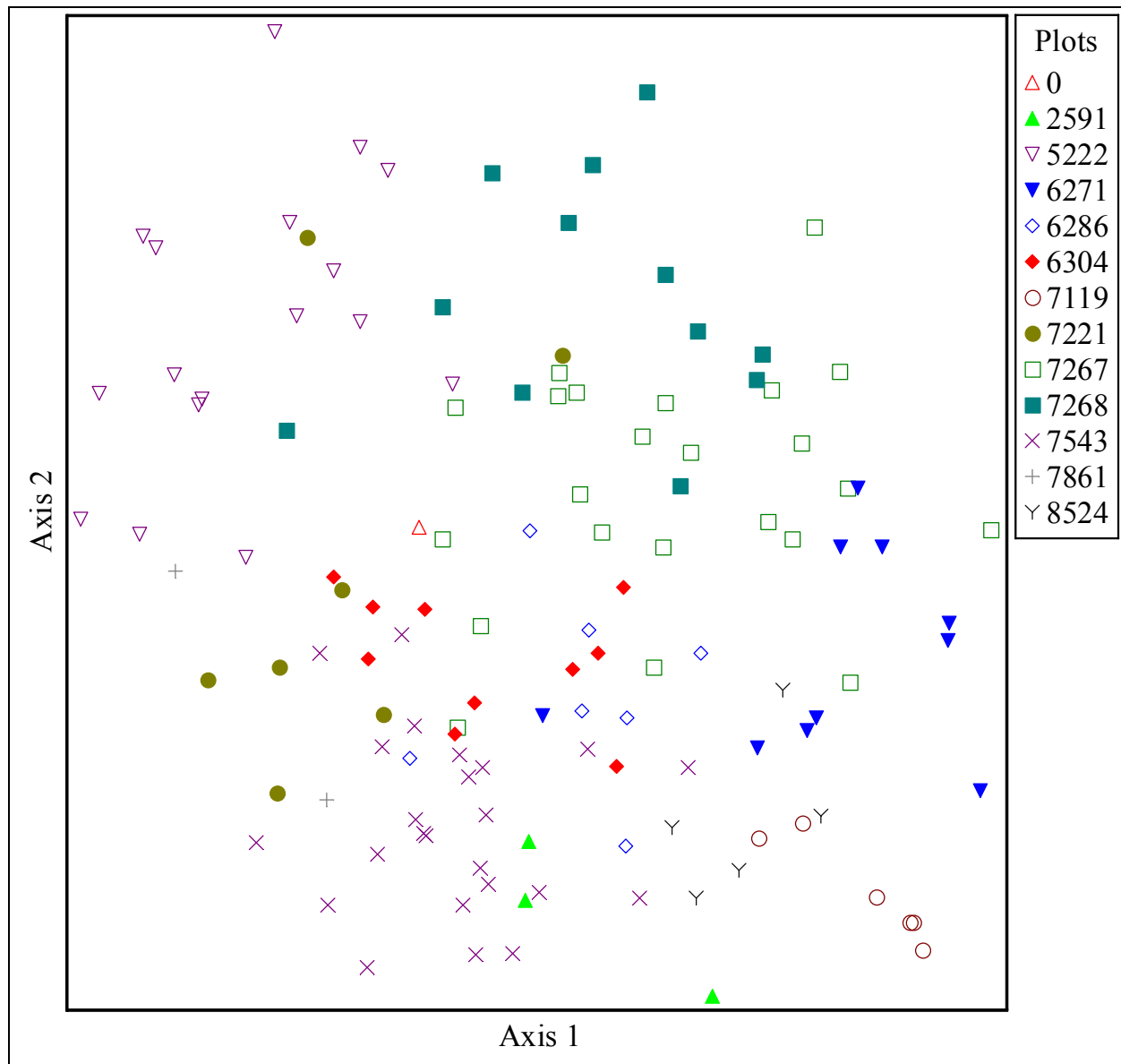
Appendix F. Cluster dendrograms and ordination graphs.



Dendrogram 1 (page 1 of 2). Hierarchical agglomerative cluster analysis of upland forests. Symbolology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

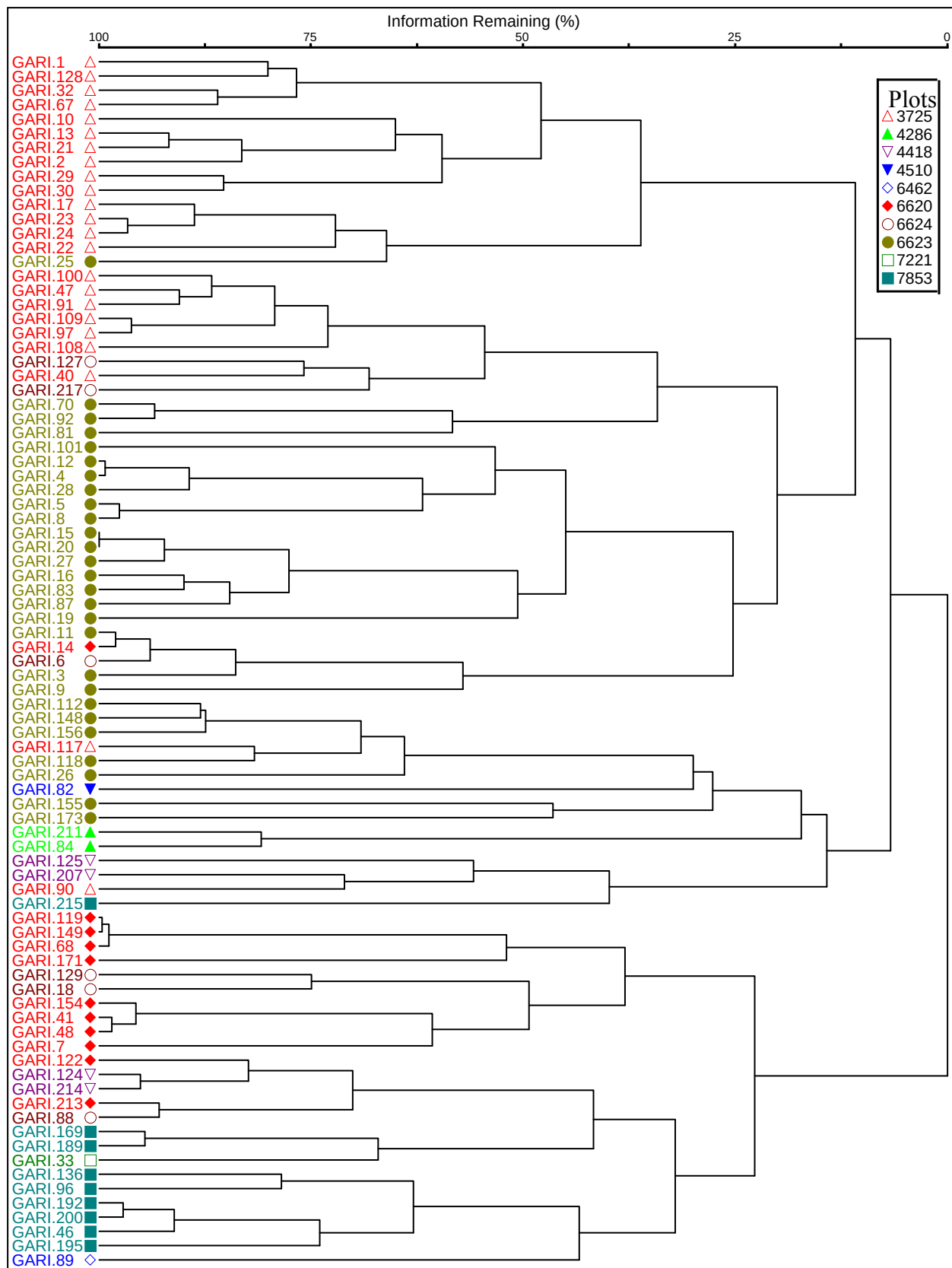


Dendrogram 1 (page 2 of 2). Hierarchical agglomerative cluster analysis of upland forests. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

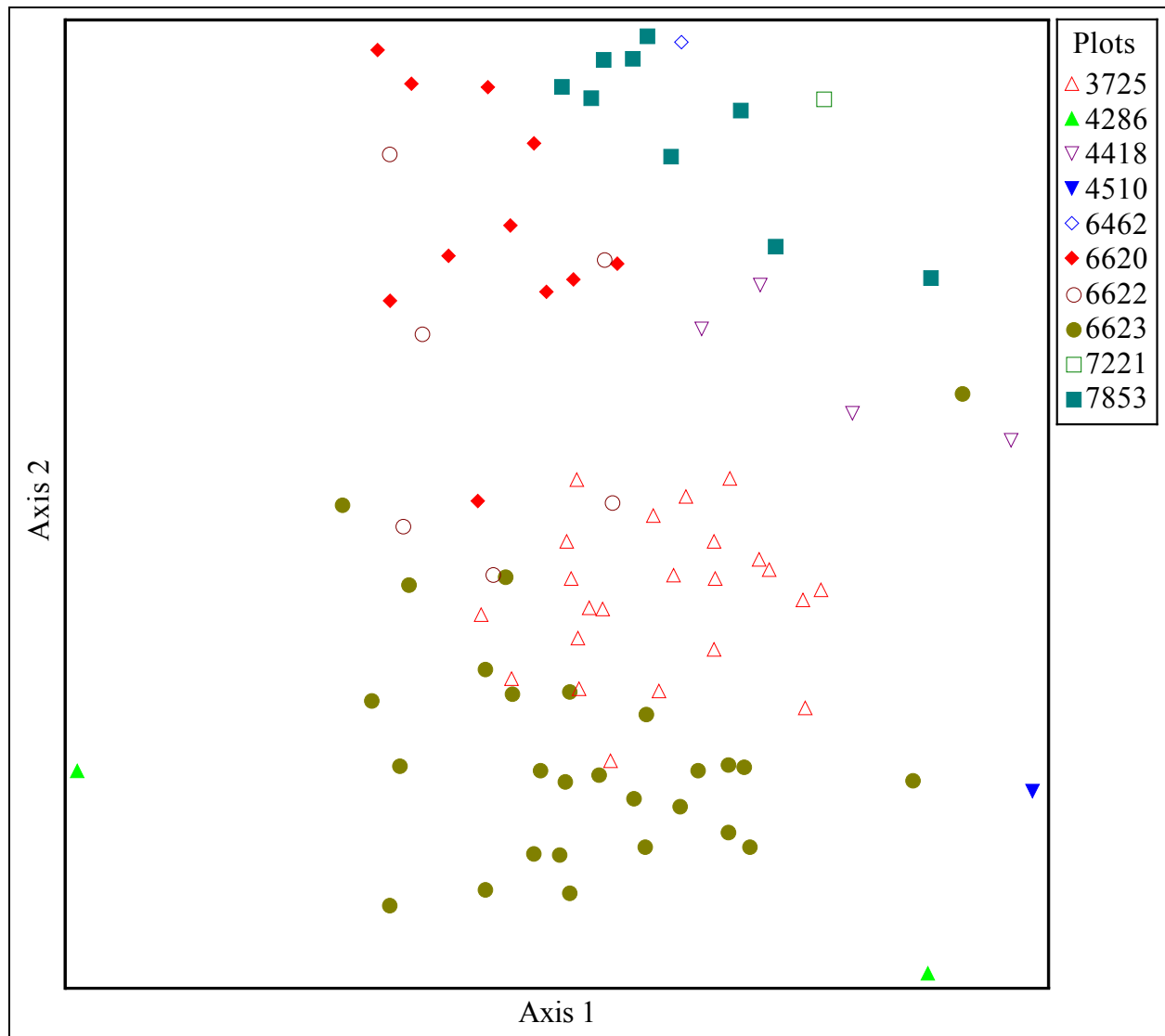


Graph 1. Nonmetric Multidimensional Scaling ordination of upland forest plots in species space. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 7119 = Cliff Top Virginia Pine Forest, 7221 = Successional Tuliptree Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

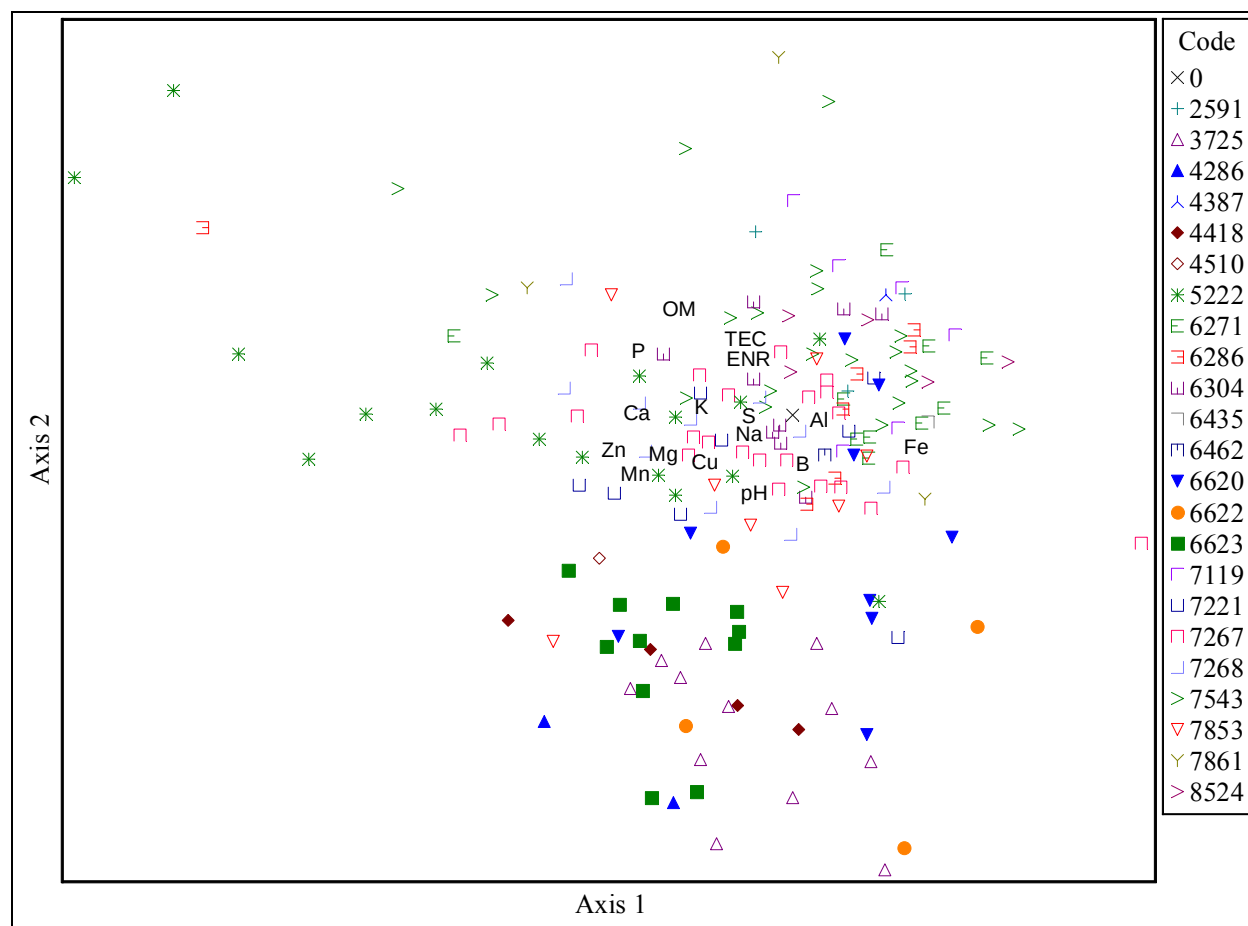
USGS-NPS Vegetation Mapping Program
Gauley River National Recreation Area



Dendrogram 2 (previous page). Hierarchical agglomerative cluster analysis of riparian and wetland communities. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 3725 = American Sycamore - River Birch Riverscour Woodland, 4286 = American Water-willow Cobble Bar, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscour Shrub Prairie, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep.



Graph 2. Nonmetric Multidimensional Scaling ordination of riparian and wetland plots in species space. Symbology indicates codes of associations in the U. S. National Vegetation Classification: 3725 = American Sycamore - River Birch Riverscour Woodland, 4286 = American Water-willow Cobble Bar, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscour Shrub Prairie, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep.



Graph 3. Nonmetric Multidimensional Scaling ordination of plots in soil chemistry space. The graph was rotated to maximize Fe to the right along axis one. Positions of chemical symbols (Al, B, Ca, Cu, ENR [estimated N release], K, Mn, Mg, Na, P, pH, S, TEC [total exchange capacity], and Zn) were manually moved slightly away from the center to reduce clutter but their relative positions as plotted by the ordination were maintained. Symbolology for plots indicates codes of associations in the U. S. National Vegetation Classification. Closed polygon symbols represent riparian and wetland associations. Open line symbols represent upland associations. 0 = unclassified plot, 2591 = Successional Virginia Pine Forest, 3725 = American Sycamore - River Birch Riverscours Woodland, 4286 = American Water-willow Cobble Bar, 4387 = Common Rocktrip Cliff Face, 4418 = American Sycamore - Tuliptree - Sweetgum Floodplain Forest, 4510 = Bur-reed Marsh, 5222 = Sugar Maple - Yellow Buckeye - American Basswood Forest, 6271 = Oak / Ericad Forest, 6286 = Oak / Great Laurel Forest, 6304 = Eastern Hemlock Plateau Forest and Successional Pitch Pine Forest, 6435 = Dry Cliff Face, 6462 = Oak - Hickory Floodplain Forest, 6620 = Eastern Hemlock Floodplain Forest, 6624 = (Virginia, Pitch) Pine Floodplain Forest, 6623 = Riverscours Shrub Prairie, 7119 = Cliff Top Virginia Pine Forest, 7267 = Oak - Hickory Forest, 7268 = Oak / Great Laurel Forest, 7543 = Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest, 7721 = Successional Tuliptree Forest, 7853 = Forest Seep, 7861 = Yellow Birch Cold Cove Forest, 8524 = Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

Appendix G. Soil chemical analysis: mean and standard deviation by community type.

	American Sycamore – River Birch Riverscour Woodland	American Sycamore - Tuliptree - Sweetgum Floodplain Forest	American Water-willow Cobble Bar	Bur-reed Marsh	Cliff Top Virginia Pine Forest	Common Rock Tripe Cliff Face	Dry Cliff Face	Eastern Hemlock – Chestnut Oak / Catawba Rosebay Forest	Eastern Hemlock Floodplain Forest	Eastern Hemlock – Oak – Sweet Birch / Great Laurel Forest	Eastern Hemlock Plateau Forest	Forest Seep	Grand Values
# of Samples	12	4	2	1	6	1	1	5	9	22	8	8	178
Mean of TEC	2.96	4.54	3.24	10.25	26.20	26.30	11.55	24.88	12.02	23.21	20.58	9.84	15.66
StdDev of TEC	1.36	1.68	1.46		9.68			6.69	8.62	6.54	6.21	3.96	8.82
Mean of pH	5.29	5.85	5.80	4.90	3.95	4.00	4.40	4.08	4.57	4.17	4.35	4.39	4.63
StdDev of pH	0.56	0.30	0.28		0.29			0.26	0.57	0.29	0.43	0.35	0.65
Mean of OrganicMatter	1.19	2.21	1.47	5.20	11.67	16.91	8.98	10.23	5.28	17.76	8.63	4.34	9.72
StdDev of OrganicMatter	0.65	1.46	0.76		5.09			5.47	2.99	16.34	3.32	1.06	12.24
Mean of ENR	40.42	60.00	48.50	101.00	121.50	128.00	120.00	116.00	90.78	120.50	113.88	92.50	100.78
StdDev of ENR	17.23	27.47	16.26		8.50			14.78	32.78	10.30	12.18	10.18	29.28
Mean of SolubleSulfur	16.00	8.50	15.50	64.00	25.17	25.00	26.00	27.00	19.22	25.86	31.25	27.00	23.13
StdDev of SolubleSulfur	3.07	1.73	2.12		6.40			4.00	7.34	11.23	11.52	16.43	9.95
Mean of Al ppm	276.08	424.25	266.50	477.00	1109.50	1282.00	1130.00	1003.80	522.33	845.77	1161.75	841.38	782.39
StdDev of Al ppm	84.81	197.58	79.90		244.03			304.22	222.84	269.25	235.28	213.54	361.54
Mean of B ppm	0.35	0.39	0.37	0.70	0.44	0.82	0.61	0.39	0.56	0.51	0.24	0.27	0.48
StdDev of B ppm	0.11	0.12	0.00		0.19			0.13	0.26	0.47	0.06	0.13	0.36
Mean of Ca ppm	392.50	635.00	464.50	512.00	372.67	172.00	166.00	285.00	317.22	389.73	502.50	395.25	568.01
StdDev of Ca ppm	173.04	255.22	225.57		315.60			275.48	162.42	226.09	269.88	194.58	573.56
Mean of Cu ppm	0.90	1.64	1.30	1.01	0.64	0.82	0.89	0.48	1.51	0.73	0.69	1.41	1.06
StdDev of Cu ppm	0.66	0.92	0.94		0.30			0.18	1.38	0.39	0.27	0.55	0.77
Mean of Fe ppm	199.50	209.75	300.00	546.00	285.83	519.00	340.00	307.20	282.44	246.41	168.63	221.63	208.49
StdDev of Fe ppm	44.28	73.46	132.94		105.67			93.73	95.96	98.26	39.17	65.29	92.93
Mean of K ppm	27.50	50.25	26.00	52.00	58.17	89.00	59.00	65.60	47.56	76.73	75.38	62.38	73.46
StdDev of K ppm	9.30	13.50	15.56		23.50			23.33	16.61	43.07	24.11	10.16	42.28
Mean of Mg ppm	78.58	138.50	93.50	113.00	37.33	38.00	36.00	41.60	65.22	51.36	51.25	90.25	82.56
StdDev of Mg ppm	29.89	44.74	31.82		7.87			13.11	31.28	23.20	20.85	35.44	66.11
Mean of Mn ppm	185.92	133.50	403.00	45.00	5.33	18.00	8.00	16.80	58.22	68.18	107.38	96.25	115.37
StdDev of Mn ppm	63.71	66.14	84.85		5.13			19.12	49.20	108.70	70.68	60.68	126.36
Average of Na ppm	13.42	18.50	16.00	16.00	16.00	17.00	16.00	16.20	17.44	18.05	20.13	23.75	17.53
StdDev of Na ppm	3.09	4.93	5.66		3.16			6.50	4.85	6.90	9.43	9.16	6.01
Mean of P ppm	6.50	4.00	5.00	12.00	13.67	7.00	2.00	10.00	9.22	16.73	16.38	17.63	15.22
StdDev of P ppm	1.62	0.82	1.41		11.31			3.16	5.54	14.57	7.80	21.08	17.77
Mean of Zn ppm	5.43	6.67	8.90	12.08	1.32	1.67	0.74	2.07	4.78	3.19	2.37	3.18	4.40
StdDev of Zn ppm	2.47	4.79	1.94		0.55			1.11	3.20	3.15	0.97	1.91	5.31

	Oak / Ericad Forest	Oak / Great Laurel Forest	Oak – Hickory Floodplain Forest	Oak – Hickory Forest	Oak – Hickory – Sugar Maple Forest	Riverscour Shrub Prairie	Successional Pitch Pine Forest	Successional Tuliptree Forest	Successional Virginia Pine Forest	Sugar Maple – Yellow Buckeye - American Basswood Forest	(Virginia, Pitch) Pine Floodplain Forest	Yellow Birch Cold Cove Forest	Grand Values
# of Samples	10	7	1	23	10	11	1	8	3	17	4	3	178
Mean of TEC	17.15	20.85	12.22	15.11	14.63	4.75	10.15	15.51	21.92	19.92	7.05	24.06	15.66
StdDev of TEC	4.00	6.52		4.89	4.43	1.89		7.17	6.86	7.17	5.28	13.30	8.82
Mean of pH	4.44	4.20	4.10	4.59	4.70	5.75	4.80	4.40	4.40	4.76	5.28	4.33	4.63
StdDev of pH	0.20	0.30		0.44	0.51	0.52		0.43	0.26	0.68	0.70	0.55	0.65
Mean of OrganicMatter	9.70	12.02	3.47	8.69	8.27	2.62	6.63	6.77	4.25	17.92	2.30	39.28	9.72
StdDev of OrganicMatter	9.29	11.39		4.38	4.10	1.55		3.25	1.02	22.02	2.26	35.14	12.24
Mean of ENR	110.00	115.43	85.00	112.61	111.90	66.18	108.00	103.75	91.67	117.18	56.25	122.33	100.78
StdDev of ENR	14.29	11.49		12.04	11.49	26.14		22.10	9.50	15.55	35.02	15.01	29.28
Mean of SolubleSulfur	26.10	23.57	27.00	23.17	20.00	18.73	27.00	20.13	45.33	24.35	14.00	13.00	23.13
StdDev of SolubleSulfur	10.65	4.58		4.91	4.67	4.43		4.64	13.05	10.02	4.76	3.00	9.95
Mean of Al_ppm	930.80	839.14	585.00	1007.04	902.10	357.91	1194.00	836.25	1393.33	719.29	325.50	470.33	782.39
StdDev of Al_ppm	291.67	105.76		267.52	113.82	87.27		384.84	226.02	383.97	111.98	168.42	361.54
Mean of B_ppm	0.44	0.37	0.23	0.59	0.45	0.48	0.77	0.60	0.43	0.63	0.47	0.38	0.48
StdDev of B_ppm	0.28	0.19		0.70	0.21	0.17		0.15	0.27	0.32	0.24	0.22	0.36
Mean of Ca_ppm	362.80	413.57	511.00	482.87	644.30	614.18	373.00	620.25	697.67	1613.29	343.25	570.67	568.01
StdDev of Ca_ppm	467.07	519.14		385.26	548.00	241.39		366.24	392.92	1108.89	237.57	686.52	573.56
Mean of Cu_ppm	0.67	1.46	0.66	0.98	1.13	1.52	0.95	1.15	0.60	1.50	0.98	0.82	1.06
StdDev of Cu_ppm	0.35	2.24		0.37	0.46	0.71		0.47	0.38	0.83	0.41	0.12	0.77
Mean of Fe_ppm	223.20	226.57	227.00	151.74	181.90	217.27	120.00	172.13	228.33	107.53	207.25	252.67	208.49
StdDev of Fe_ppm	103.57	100.18		52.71	36.17	31.95		50.18	135.32	45.06	58.09	94.33	92.93
Mean of K_ppm	69.50	80.71	66.00	92.96	108.50	44.91	63.00	81.13	66.33	117.35	29.75	85.00	73.46
StdDev of K_ppm	32.94	59.96		37.68	29.06	21.88		39.02	23.12	61.22	15.95	33.78	42.28
Mean of Mg_ppm	45.60	58.00	54.00	70.35	86.20	126.55	34.00	104.38	35.33	179.88	80.00	114.33	82.56
StdDev of Mg_ppm	29.11	38.90		54.58	37.18	51.86		67.83	7.64	122.73	44.03	126.23	66.11
Mean of Mn_ppm	47.50	168.86	54.00	138.91	123.50	188.36	147.00	91.50	29.00	198.76	110.00	25.00	115.37
StdDev of Mn_ppm	93.61	313.27		113.44	72.21	85.66		60.27	31.10	184.77	66.35	26.06	126.36
Average of Na_ppm	15.00	14.86	15.00	19.35	20.40	18.64	18.00	14.13	12.67	15.47	22.75	21.00	17.53
StdDev of Na_ppm	3.43	3.48		5.67	6.38	4.34		3.09	1.15	4.69	11.03	3.61	6.01
Mean of P_ppm	11.50	21.43	17.00	15.52	27.50	6.82	5.00	13.75	16.67	30.29	3.50	11.33	15.22
StdDev of P_ppm	6.98	30.82		6.71	23.67	1.89		5.06	1.53	39.29	1.73	5.51	17.77
Mean of Zn_ppm	2.40	3.83	1.21	4.01	3.72	6.85	2.64	3.58	1.35	9.75	3.96	2.25	4.40
StdDev of Zn_ppm	2.88	4.93		3.84	1.86	2.51		1.63	0.40	13.35	2.94	1.39	5.31

Appendix H. Plot floristic cover statistics for community types sampled in Gauley River National Recreation Area.

Tables are arranged alphabetically by the GARI community name for the association. The code for the association in the U. S. National Vegetation Classification is listed in parentheses. Plant taxa in the tables are sorted in descending order of the number of plots that a taxon occurs in (“N”), then in descending order of mean cover, then in ascending alphabetical order. N divided by the total number of plots for the association is a measure of constancy. The mean statistic is calculated based on the number of plots where the taxon is present (N).

American Sycamore - River Birch
Riverscour Woodland (CEGL003725) -
23 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Betula nigra</i>	21.0	0.5	45	23
<i>Cornus amomum</i>	3.9	0.01	15	22
<i>Physocarpus opulifolius</i> var. <i>opulifolius</i>	4.0	0.5	20	21
<i>Dichanthelium clandestinum</i>	2.2	0.01	10	21
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	0.9	0.01	5	21
<i>Toxicodendron radicans</i>	2.4	0.01	10	20
<i>Trautvetteria caroliniensis</i> var. <i>caroliniensis</i>	0.9	0.01	3	20
<i>Ilex verticillata</i>	7.9	0.01	25	19
<i>Eupatorium fistulosum</i>	0.9	0.01	3	19
<i>Xanthorhiza simplicissima</i>	3.0	0.01	20	18
<i>Osmunda regalis</i> var. <i>spectabilis</i>	6.9	0.5	35	17
<i>Andropogon gerardii</i>	2.7	0.5	10	17
<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i>	1.0	0.01	4	16
<i>Tsuga canadensis</i>	2.3	0.01	15	15
<i>Deschampsia flexuosa</i> var. <i>flexuosa</i>	1.2	0.01	5	15
<i>Rosa carolina</i> var. <i>carolina</i>	0.8	0.01	3	15
<i>Rubus</i>	1.4	0.5	3	14
<i>Platanus occidentalis</i>	11.8	0.01	50	13
<i>Alnus serrulata</i>	4.5	0.5	25	13
<i>Acer rubrum</i>	3.7	0.5	20	13
<i>Solidago rugosa</i>	1.5	0.5	5	13
<i>Smilax glauca</i>	1.4	0.01	5	13
<i>Viburnum nudum</i> var. <i>cassinoides</i>	1.4	0.01	8	13
<i>Packera paupercula</i>	0.8	0.01	1	13
<i>Clematis virginiana</i>	0.5	0.01	1	13
<i>Nyssa sylvatica</i>	4.4	0.01	25	12
<i>Eurybia divaricata</i>	1.9	0.01	8	12
<i>Hypericum prolificum</i>	1.8	0.5	6	12
<i>Rhododendron arborescens</i>	1.3	0.5	3	12
<i>Potentilla canadensis</i> var. <i>canadensis</i>	1.0	0.01	4	12
<i>Euphorbia corollata</i>	0.8	0.01	2	12
<i>Polystichum acrostichoides</i>	0.4	0.01	1	12
<i>Packera aurea</i>	1.8	0.5	5	11

<i>Zizia aptera</i>	1.2	0.01	5	11
<i>Diospyros virginiana</i>	5.3	0.5	25	10
<i>Dichanthelium dichotomum</i>	4.7	0.5	20	10
<i>Viola</i>	1.1	0.5	2	10
<i>Houstonia caerulea</i>	0.6	0.5	1	10
<i>Prunella vulgaris</i>	0.6	0.01	1	10
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	5.1	0.5	30	9
<i>Liriodendron tulipifera</i>	2.5	0.01	15	9
<i>Kalmia latifolia</i>	2.1	0.5	8	9
<i>Carex torta</i>	1.6	0.01	7	9
<i>Pedicularis canadensis</i> ssp. <i>canadensis</i>	0.9	0.01	5	9
<i>Symphyotrichum lateriflorum</i>	0.9	0.5	2	9
<i>Ipomoea pandurata</i>	0.7	0.01	2	9
<i>Symphyotrichum prenanthoides</i>	0.6	0.5	1	9
<i>Thalictrum</i>	0.5	0.01	1	9
<i>Smilax herbacea</i>	0.3	0.01	1	9
<i>Hypoxis hirsuta</i>	0.2	0.01	0.5	9
<i>Rosa multiflora</i>	2.8	0.5	10	8
<i>Vaccinium corymbosum</i>	2.8	0.5	7	8
<i>Verbesina alternifolia</i>	2.1	0.5	10	8
<i>Hamamelis virginiana</i>	1.9	0.01	8	8
<i>Lysimachia ciliata</i>	0.9	0.01	5	8
<i>Symphyotrichum laeve</i> var. <i>concinnum</i>	0.9	0.01	3	8
<i>Coreopsis tripteris</i>	0.8	0.01	2	8
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.5	0.01	1	8
<i>Elymus riparius</i>	0.5	0.01	1	8
<i>Rhododendron periclymenoides</i>	2.4	0.5	6	7
<i>Chionanthus virginicus</i>	2.3	1	7	7
<i>Viola cucullata</i>	0.6	0.01	2	7
<i>Muhlenbergia tenuiflora</i>	0.5	0.5	0.5	7
<i>Spiraea virginiana</i>	9.0	1	20	6
<i>Fraxinus americana</i>	5.8	0.5	15	6
<i>Symphyotrichum lanceolatum</i>	0.8	0.5	1	6
<i>Potentilla simplex</i>	0.7	0.01	1	6
<i>Ilex opaca</i> var. <i>opaca</i>	0.7	0.5	1	6
<i>Dichanthelium polyanthes</i>	0.5	0.01	1	6
<i>Liatris scariosa</i> var. <i>scariosa</i>	0.5	0.01	1	6
<i>Houstonia serpyllifolia</i>	0.3	0.01	1	6
<i>Lespedeza cuneata</i>	0.2	0.01	0.5	6

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<i>Liquidambar styraciflua</i>	5.4	0.5	15	5	<i>Bryoandersonia illecebra</i>	1.2	0.5	2	3
<i>Solidago gigantea</i>	2.7	0.5	8	5	<i>Coreopsis major</i>	0.8	0.01	2	3
<i>Smilax rotundifolia</i>	1.2	0.5	3	5	<i>Climacium americanum</i>	0.8	0.5	1	3
<i>Cephalanthus occidentalis</i>	1.0	0.01	2	5	<i>Lolium pratense</i>	0.7	0.5	1	3
<i>Ionactis linariifolius</i>	0.9	0.01	3	5	<i>Salix sericea</i>	0.7	0.5	1	3
<i>Polygonum cuspidatum</i>	0.9	0.01	3	5	<i>Oxypolis rigidior</i>	0.5	0.01	1	3
<i>Sorghastrum nutans</i>	0.9	0.5	2	5	<i>Hypericum perforatum</i>	0.5	0.5	0.5	3
<i>Aristolochia macrophylla</i>	0.8	0.5	1	5	<i>Iris</i>	0.5	0.5	0.5	3
<i>Linum virginianum</i>	0.6	0.5	1	5	<i>Ranunculus hispidus</i> var. <i>nitidus</i>	0.5	0.5	0.5	3
<i>Doellingeria umbellata</i> var. <i>umbellata</i>	0.5	0.01	1	5	<i>Marshallia grandiflora</i>	0.3	0.01	0.5	3
<i>Rubus flagellaris</i>	0.3	0.01	1	5	<i>Polygonum caespitosum</i> var. <i>longisetum</i>	0.3	0.01	0.5	3
<i>Lysimachia lanceolata</i>	0.3	0.01	0.5	5	<i>Sedum ternatum</i>	0.3	0.01	0.5	3
<i>Schistidium apocarpum</i>	1.1	0.5	2	4	<i>Linum striatum</i>	0.2	0.01	0.5	3
<i>Robinia pseudoacacia</i>	1.0	0.01	2	4	<i>Smilax tamnoides</i>	0.2	0.01	0.5	3
<i>Phlox maculata</i>	1.0	0.5	2	4	<i>Anemone quinquefolia</i> var. <i>quinquefolia</i>	0.01	0.01	0.01	3
<i>Vaccinium pallidum</i>	0.6	0.5	1	4	<i>Eleocharis tenuis</i>	0.01	0.01	0.01	3
<i>Carex</i>	0.5	0.01	1	4	<i>Phlox maculata</i> ssp. <i>pyramidalis</i>	0.01	0.01	0.01	3
<i>Erigeron pulchellus</i>	0.5	0.01	1	4	<i>Viola ×primulifolia</i>	0.01	0.01	0.01	3
<i>Fraxinus pennsylvanica</i>	0.5	0.01	1	4	<i>Acer saccharum</i> var. <i>saccharum</i>	22.8	0.5	45	2
<i>Helenium autumnale</i> var. <i>autumnale</i>	0.5	0.01	1	4	<i>Salix nigra</i>	7.8	0.5	15	2
<i>Lobelia cardinalis</i>	0.5	0.01	1	4	<i>Ulmus americana</i>	6.5	1	12	2
<i>Agrostis perennans</i>	0.4	0.01	1	4	<i>Dichanthelium</i>	3.0	1	5	2
<i>Physostegia virginiana</i> ssp. <i>virginiana</i>	0.4	0.01	1	4	<i>Glechoma hederacea</i>	2.0	1	3	2
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	0.4	0.01	1	4	<i>Pteridium aquilinum</i>	1.8	0.5	3	2
<i>Lycopus uniflorus</i> var. <i>uniflorus</i>	0.4	0.01	0.5	4	<i>Lonicera japonica</i>	1.0	1	1	2
<i>Oxalis</i>	0.4	0.01	0.5	4	<i>Agrostis gigantea</i>	0.8	0.5	1	2
<i>Viola pedata</i>	0.4	0.01	0.5	4	<i>Anthoxanthum odoratum</i> ssp. <i>odoratum</i>	0.8	0.5	1	2
<i>Boehmeria cylindrica</i>	0.3	0.01	0.5	4	<i>Carya alba</i>	0.8	0.5	1	2
<i>Salix caroliniana</i>	0.3	0.01	0.5	4	<i>Cladonia</i>	0.8	0.5	1	2
<i>Leucanthemum vulgare</i>	0.1	0.01	0.5	4	<i>Euonymus americana</i>	0.8	0.5	1	2
<i>Helianthus decapetalus</i>	5.2	0.5	10	3	<i>Lysimachia quadrifolia</i>	0.8	0.5	1	2
<i>Parthenocissus quinquefolia</i>	3.7	1	5	3	<i>Muhlenbergia</i>	0.8	0.5	1	2
<i>Thelypteris noveboracensis</i>	3.7	0.5	10	3	<i>Ranunculus hispidus</i> var. <i>hispidus</i>	0.8	0.5	1	2
<i>Phlox paniculata</i>	2.7	1	4	3	<i>Eurybia schreberi</i>	0.5	0.01	1	2
<i>Grimmia laevigata</i>	2.3	0.01	5	3	<i>Gaylussacia baccata</i>	0.5	0.01	1	2
<i>Juniperus virginiana</i> var. <i>virginiana</i>	1.8	0.5	4	3	<i>Uvularia</i>	0.5	0.01	1	2
<i>Panicum virgatum</i>	1.3	0.01	3	3	<i>Desmodium pauciflorum</i>	0.5	0.5	0.5	2
<i>Cornus florida</i>	1.2	0.01	3	3	<i>Dichanthelium commutatum</i>	0.5	0.5	0.5	2
					<i>Elaeagnus umbellata</i> var. <i>parvifolia</i>	0.5	0.5	0.5	2
					<i>Leersia virginica</i>	0.5	0.5	0.5	2

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<i>Lilium superbum</i>	0.5	0.5	0.5	2	<i>Coreopsis pubescens</i>	1.0	1	1	1
<i>Polygonum virginianum</i>	0.5	0.5	0.5	2	var. <i>pubescens</i>				
<i>Prunus</i>	0.5	0.5	0.5	2	<i>Cuscuta pentagona</i>	1.0	1	1	1
<i>Salix alba</i>	0.5	0.5	0.5	2	var. <i>pentagona</i>				
<i>Solidago bicolor</i>	0.5	0.5	0.5	2	<i>Euthamia graminifolia</i>	1.0	1	1	1
<i>Thalictrum pubescens</i>	0.5	0.5	0.5	2	var. <i>graminifolia</i>				
<i>Vaccinium stamineum</i>	0.5	0.5	0.5	2	<i>Heliopsis helianthoides</i>	1.0	1	1	1
<i>Baptisia tinctoria</i>	0.3	0.01	0.5	2	<i>Hemerocallis fulva</i>	1.0	1	1	1
<i>Chelone glabra</i>	0.3	0.01	0.5	2	<i>Leucolejeunea clypeata</i>	1.0	1	1	1
<i>Dichanthelium acuminatum</i> ssp. <i>fasciculatum</i>	0.3	0.01	0.5	2	<i>Lindera benzoin</i> var. <i>pubescens</i>	1.0	1	1	1
<i>Justicia americana</i>	0.3	0.01	0.5	2	<i>Lysimachia nummularia</i>	1.0	1	1	1
<i>Plantago rugelii</i> var. <i>rugelii</i>	0.3	0.01	0.5	2	<i>Magnolia acuminata</i>	1.0	1	1	1
<i>Poa alsodes</i>	0.3	0.01	0.5	2	<i>Menispermum canadense</i>	1.0	1	1	1
<i>Rhynchospora capitellata</i>	0.3	0.01	0.5	2	<i>Pellia epiphylla</i>	1.0	1	1	1
<i>Sphagnum lescurii</i>	0.3	0.01	0.5	2	<i>Sematophyllum demissum</i>	1.0	1	1	1
<i>Vaccinium</i>	0.3	0.01	0.5	2	<i>Solidago juncea</i> var. <i>juncea</i>	1.0	1	1	1
<i>Bidens</i>	0.0	0.01	0.01	2	<i>Symphyotrichum praealtum</i>	1.0	1	1	1
<i>Bryum</i>	0.0	0.01	0.01	2	<i>Viburnum recognitum</i>	1.0	1	1	1
<i>Chrysopsis mariana</i>	0.0	0.01	0.01	2	<i>Achillea millefolium</i>	0.5	0.5	0.5	1
<i>Iris cristata</i>	0.0	0.01	0.01	2	var. <i>occidentalis</i>				
<i>Lobelia</i>	0.0	0.01	0.01	2	<i>Ageratina altissima</i> var. <i>altissima</i>	0.5	0.5	0.5	1
<i>Mitchella repens</i>	0.0	0.01	0.01	2	<i>Agrostis</i>	0.5	0.5	0.5	1
<i>Chasmanthium latifolium</i>	15.0	15	15	1	<i>Amelanchier stolonifera</i>	0.5	0.5	0.5	1
<i>Carya glabra</i>	10.0	10	10	1	<i>Aster</i>	0.5	0.5	0.5	1
<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i>	5.0	5	5	1	<i>Athyrium filix-femina</i> ssp. <i>asplenioides</i>	0.5	0.5	0.5	1
<i>Hedwigia ciliata</i>	5.0	5	5	1	<i>Atrichum undulatum</i>	0.5	0.5	0.5	1
<i>Catalpa bignonioides</i>	3.0	3	3	1	<i>Aulacomnium palustre</i>	0.5	0.5	0.5	1
<i>Dermatocarpon luridum</i>	3.0	3	3	1	<i>Bidens coronata</i>	0.5	0.5	0.5	1
<i>Leersia</i>	3.0	3	3	1	<i>Carex gracillima</i>	0.5	0.5	0.5	1
<i>Prunus serotina</i> var. <i>serotina</i>	3.0	3	3	1	<i>Catalpa</i>	0.5	0.5	0.5	1
<i>Scapania nemorea</i>	3.0	3	3	1	<i>Collinsonia canadensis</i>	0.5	0.5	0.5	1
<i>Athyrium filix-femina</i>	2.0	2	2	1	<i>Coreopsis</i>	0.5	0.5	0.5	1
<i>Porella pinnata</i>	2.0	2	2	1	<i>Dichanthelium</i>	0.5	0.5	0.5	1
<i>Rhododendron maximum</i>	2.0	2	2	1	dichotomum ssp. <i>yadkinense</i>				
<i>Vitis riparia</i>	2.0	2	2	1	<i>Dicranum</i>	0.5	0.5	0.5	1
<i>Ambrosia trifida</i> var. <i>trifida</i>	1.0	1	1	1	<i>Equisetum arvense</i>	0.5	0.5	0.5	1
<i>Apios americana</i>	1.0	1	1	1	<i>Eupatorium</i>	0.5	0.5	0.5	1
<i>Brachyelytrum erectum</i>	1.0	1	1	1	<i>Fagus grandifolia</i>	0.5	0.5	0.5	1
<i>Bryum pseudotriquetrum</i>	1.0	1	1	1	<i>Fissidens</i>	0.5	0.5	0.5	1
<i>Coccocarpia palmicola</i>	1.0	1	1	1	<i>Galium</i>	0.5	0.5	0.5	1
<i>Conocephalum conicum</i>	1.0	1	1	1	<i>Grimmia</i>	0.5	0.5	0.5	1
					<i>Helianthus</i>	0.5	0.5	0.5	1
					<i>Helianthus giganteus</i>	0.5	0.5	0.5	1

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<i>Hypericum ellipticum</i>	0.5	0.5	0.5	1	<i>Campsis radicans</i>	0.01	0.01	0.01	1
<i>Hypericum</i>	0.5	0.5	0.5	1	<i>Campyllum</i>	0.01	0.01	0.01	1
<i>hypericoides</i> ssp.					<i>Cicuta maculata</i> var.	0.01	0.01	0.01	1
<i>multicaule</i>					<i>maculata</i>				
<i>Hypericum punctatum</i>	0.5	0.5	0.5	1	<i>Daucus carota</i>	0.01	0.01	0.01	1
<i>Hypnum imponens</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Juncus</i>	0.5	0.5	0.5	1	<i>dichotomum</i> ssp.				
<i>Lespedeza repens</i>	0.5	0.5	0.5	1	<i>microcarpon</i>				
<i>Lilium canadense</i>	0.5	0.5	0.5	1	<i>Dryopteris intermedia</i>	0.01	0.01	0.01	1
<i>Lindera benzoin</i>	0.5	0.5	0.5	1	<i>Elephantopus</i>	0.01	0.01	0.01	1
<i>Maianthemum</i>	0.5	0.5	0.5	1	<i>carolinianus</i>				
<i>racemosum</i> ssp.					<i>Elymus canadensis</i>	0.01	0.01	0.01	1
<i>racemosum</i>					<i>Eupatorium</i>	0.01	0.01	0.01	1
<i>Microstegium</i>	0.5	0.5	0.5	1	<i>purpureum</i> var.				
<i>vimineum</i>					<i>purpureum</i>				
<i>Muhlenbergia</i>	0.5	0.5	0.5	1	<i>Eurybia</i>	0.01	0.01	0.01	1
<i>schreberi</i>					<i>Glyceria striata</i>	0.01	0.01	0.01	1
<i>Muhlenbergia</i>	0.5	0.5	0.5	1	<i>Impatiens</i>	0.01	0.01	0.01	1
<i>sylvatica</i>					<i>Leucobryum albidum</i>	0.01	0.01	0.01	1
<i>Oenothera</i>	0.5	0.5	0.5	1	<i>Lonicera morrowii</i>	0.01	0.01	0.01	1
<i>Onoclea sensibilis</i>	0.5	0.5	0.5	1	<i>Muhlenbergia</i>	0.01	0.01	0.01	1
<i>Osmunda claytoniana</i>	0.5	0.5	0.5	1	<i>frondosa</i>				
<i>Parmelia</i>	0.5	0.5	0.5	1	<i>Poa cuspidata</i>	0.01	0.01	0.01	1
<i>Penthorum sedoides</i>	0.5	0.5	0.5	1	<i>Polygala polygama</i>	0.01	0.01	0.01	1
<i>Quercus</i>	0.5	0.5	0.5	1	<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1
<i>Quercus alba</i>	0.5	0.5	0.5	1	<i>Pyrularia pubera</i>	0.01	0.01	0.01	1
<i>Quercus palustris</i>	0.5	0.5	0.5	1	<i>Quercus rubra</i>	0.01	0.01	0.01	1
<i>Salix fragilis</i>	0.5	0.5	0.5	1	<i>Rhus copallinum</i>	0.01	0.01	0.01	1
<i>Sambucus nigra</i> ssp.	0.5	0.5	0.5	1	<i>Scirpus cyperinus</i>	0.01	0.01	0.01	1
<i>canadensis</i>					<i>Solidago</i>	0.01	0.01	0.01	1
<i>Sisyrinchium</i>	0.5	0.5	0.5	1	<i>Symphytotrichum</i>	0.01	0.01	0.01	1
<i>angustifolium</i>					<i>cordifolium</i>				
<i>Solidago flexicaulis</i>	0.5	0.5	0.5	1	<i>Thuidium delicatulum</i>	0.01	0.01	0.01	1
<i>Streptopus lanceolatus</i>	0.5	0.5	0.5	1	<i>Ulmus rubra</i>	0.01	0.01	0.01	1
var. <i>roseus</i>					<i>Verbesina occidentalis</i>	0.01	0.01	0.01	1
<i>Symphytotrichum</i>	0.5	0.5	0.5	1	<i>Vitis aestivalis</i>	0.01	0.01	0.01	1
<i>Symphytotrichum</i>	0.5	0.5	0.5	1	<i>Xanthium strumarium</i>	0.01	0.01	0.01	1
<i>dumosum</i> var.					var. <i>glabratum</i>				
<i>dumosum</i>									
<i>Symphytotrichum</i>	0.5	0.5	0.5	1					
<i>puniceum</i> var.									
<i>puniceum</i>									
<i>Symphytotrichum</i>	0.5	0.5	0.5	1					
<i>racemosum</i>									
<i>Tephrosia virginiana</i>	0.5	0.5	0.5	1					
<i>Thalictrum clavatum</i>	0.5	0.5	0.5	1					
<i>Thuidium</i>	0.5	0.5	0.5	1					
<i>Tilia americana</i>	0.5	0.5	0.5	1					
<i>Trifolium</i>	0.5	0.5	0.5	1					
<i>Viburnum</i>	0.5	0.5	0.5	1					
<i>Viola sororia</i>	0.5	0.5	0.5	1					
<i>Vitis</i>	0.5	0.5	0.5	1					
<i>Abrothallus cladoniae</i>	0.01	0.01	0.01	1					
<i>Amelanchier</i>	0.01	0.01	0.01	1					
<i>Anomodon attenuatus</i>	0.01	0.01	0.01	1					
<i>Bidens frondosa</i>	0.01	0.01	0.01	1					

American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418) - 4 plots.									
Species	% Cover			N					
	Mean	Min	Max						
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	28.5	2	45	4	<i>Polygonum</i> <i>virginianum</i>	0.3	0.01	0.5	2
<i>Liquidambar</i> <i>styraciflua</i>	13.8	5	24	4	<i>Smilax rotundifolia</i>	0.3	0.01	0.5	2
<i>Betula nigra</i>	11.0	2	25	4	<i>Viola</i>	0.3	0.01	0.5	2
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	3.0	0.5	10	4	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.0	0.01	0.01	2
<i>Parthenocissus</i> <i>quinquefolia</i>	1.5	0.5	3	4	<i>Deparia</i> <i>acrostichoides</i>	0.01	0.01	0.01	2
<i>Rosa multiflora</i>	1.0	0.5	2	4	<i>Duchesnea indica</i>	0.01	0.01	0.01	2
<i>Packera aurea</i>	0.8	0.5	1	4	<i>Oxalis dillenii</i>	0.01	0.01	0.01	2
<i>Dichanthelium</i> <i>clandestinum</i>	0.5	0.01	1	4	<i>Quercus alba</i>	0.01	0.01	0.01	2
<i>Platanus occidentalis</i>	19.3	15	23	3	<i>Ulmus rubra</i>	6.0	6	6	1
<i>Liriodendron</i> <i>tulipifera</i>	13.3	10	15	3	<i>Maianthemum</i> racemosum ssp. racemosum	4.0	4	4	1
<i>Xanthorhiza</i> <i>simplicissima</i>	6.8	0.01	20	3	<i>Polygonum</i> <i>cuspidatum</i>	3.0	3	3	1
<i>Toxicodendron</i> <i>radicans</i>	2.0	0.5	5	3	<i>Ulmus americana</i>	3.0	3	3	1
<i>Microstegium</i> <i>vimineum</i>	1.3	0.01	3	3	<i>Bryoandersonia</i> <i>illecebra</i>	2.0	2	2	1
<i>Helianthus</i>	1.0	0.01	2	3	<i>Podophyllum peltatum</i>	2.0	2	2	1
<i>Fraxinus</i> <i>pennsylvanica</i>	0.8	0.01	2	3	<i>Tsuga canadensis</i>	2.0	2	2	1
<i>Glechoma hederacea</i>	0.8	0.5	1	3	<i>Atrichum undulatum</i>	1.0	1	1	1
<i>Aesculus flava</i>	0.7	0.01	1	3	<i>Cornus amomum</i>	1.0	1	1	1
<i>Collinsonia</i> <i>canadensis</i>	0.5	0.01	1	3	<i>Eupatorium fistulosum</i>	1.0	1	1	1
<i>Eurybia divaricata</i>	0.5	0.01	1	3	<i>Eurybia schreberi</i>	1.0	1	1	1
<i>Thuidium delicatulum</i>	0.3	0.01	0.5	3	<i>Impatiens</i>	1.0	1	1	1
<i>Quercus rubra</i>	0.2	0.01	0.5	3	<i>Phlox paniculata</i>	1.0	1	1	1
<i>Symphyotrichum</i> <i>prenanthoides</i>	0.0	0.01	0.01	3	<i>Polygonum</i> caespitosum var. longisetum	1.0	1	1	1
<i>Acer rubrum</i>	12.5	10	15	2	<i>Verbesina alternifolia</i>	1.0	1	1	1
<i>Carya cordiformis</i>	5.0	0.01	10	2	<i>Vitis</i>	1.0	1	1	1
<i>Viola striata</i>	4.3	0.5	8	2	<i>Ambrosia</i> <i>artemisiifolia</i> var. <i>elator</i>	0.5	0.5	0.5	1
<i>Lindera benzoin</i>	1.3	0.5	2	2	<i>Asimina triloba</i>	0.5	0.5	0.5	1
<i>Lindera benzoin</i> var. <i>pubescens</i>	1.0	0.01	2	2	<i>Brachyelytrum</i> <i>erectum</i>	0.5	0.5	0.5	1
<i>Polygonatum</i> <i>pubescens</i>	0.8	0.5	1	2	<i>Carex amphibola</i>	0.5	0.5	0.5	1
<i>Polystichum</i> <i>acrostichoides</i>	0.8	0.5	1	2	<i>Carex blanda</i>	0.5	0.5	0.5	1
<i>Ilex opaca</i> var. <i>opaca</i>	0.5	0.01	1	2	<i>Dichanthelium boscii</i>	0.5	0.5	0.5	1
<i>Carex</i>	0.5	0.5	0.5	2	<i>Hypnum imponens</i>	0.5	0.5	0.5	1
<i>Lonicera japonica</i>	0.5	0.5	0.5	2	<i>Iris cristata</i>	0.5	0.5	0.5	1
<i>Viola cucullata</i>	0.5	0.5	0.5	2	<i>Lilium superbum</i>	0.5	0.5	0.5	1
<i>Poa alsodes</i>	0.3	0.01	0.5	2	<i>Oxalis violacea</i>	0.5	0.5	0.5	1
					<i>Phegopteris</i> <i>hexagonoptera</i>	0.5	0.5	0.5	1
					<i>Porella pinnata</i>	0.5	0.5	0.5	1
					<i>Prunella vulgaris</i>	0.5	0.5	0.5	1
					<i>Pylaisiadelph</i> <i>tenuirostris</i>	0.5	0.5	0.5	1
					<i>Rubus</i>	0.5	0.5	0.5	1
					<i>Sassafras albidum</i>	0.5	0.5	0.5	1
					<i>Smilax ecirrata</i>	0.5	0.5	0.5	1
					<i>Solidago qiqantea</i>	0.5	0.5	0.5	1

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<i>Thalictrum</i>	0.5	0.5	0.5	1
<i>Thelypteris</i>	0.5	0.5	0.5	1
<i>noveboracensis</i>				
<i>Vaccinium</i>	0.5	0.5	0.5	1
<i>corymbosum</i>				
<i>Verbesina occidentalis</i>	0.5	0.5	0.5	1
<i>Acer saccharum</i> var.	0.01	0.01	0.01	1
<i>saccharum</i>				
<i>Agrostis perennans</i>	0.01	0.01	0.01	1
<i>Amelanchier arborea</i>	0.01	0.01	0.01	1
var. <i>arborea</i>				
<i>Amphicarpaea</i>	0.01	0.01	0.01	1
<i>bracteata</i>				
<i>Arnoglossum</i>	0.01	0.01	0.01	1
<i>atriplicifolium</i>				
<i>Athyrium filix-femina</i>	0.01	0.01	0.01	1
var. <i>angustum</i>				
<i>Cardamine</i>	0.01	0.01	0.01	1
<i>concatenata</i>				
<i>Cardamine diphylla</i>	0.01	0.01	0.01	1
<i>Chasmanthium</i>	0.01	0.01	0.01	1
<i>latifolium</i>				
<i>Chelone glabra</i>	0.01	0.01	0.01	1
<i>Dichantheium</i>	0.01	0.01	0.01	1
<i>dichotomum</i> ssp.				
<i>dichotomum</i>				
<i>Dryopteris intermedia</i>	0.01	0.01	0.01	1
<i>Elaeagnus umbellata</i>	0.01	0.01	0.01	1
var. <i>parvifolia</i>				
<i>Elephantopus</i>	0.01	0.01	0.01	1
<i>carolinianus</i>				
<i>Galium triflorum</i>	0.01	0.01	0.01	1
<i>Hamamelis virginiana</i>	0.01	0.01	0.01	1
<i>Houstonia serpyllifolia</i>	0.01	0.01	0.01	1
<i>Kalmia latifolia</i>	0.01	0.01	0.01	1
<i>Laportea canadensis</i>	0.01	0.01	0.01	1
<i>Magnolia tripetala</i>	0.01	0.01	0.01	1
<i>Muhlenbergia</i>	0.01	0.01	0.01	1
<i>schreberi</i>				
<i>Nyssa sylvatica</i>	0.01	0.01	0.01	1
<i>Osmunda regalis</i> var.	0.01	0.01	0.01	1
<i>spectabilis</i>				
<i>Pedicularis</i>	0.01	0.01	0.01	1
<i>canadensis</i> ssp.				
<i>canadensis</i>				
<i>Phaeocalicium</i>	0.01	0.01	0.01	1
<i>polyporaenum</i>				
<i>Phlox</i>	0.01	0.01	0.01	1
<i>Pinus rigida</i>	0.01	0.01	0.01	1
<i>Plantago rugelii</i> var.	0.01	0.01	0.01	1
<i>rugelii</i>				
<i>Robinia pseudoacacia</i>	0.01	0.01	0.01	1
<i>Salvia lyrata</i>	0.01	0.01	0.01	1
<i>Scapania nemorea</i>	0.01	0.01	0.01	1
<i>Smilax herbacea</i>	0.01	0.01	0.01	1
<i>Solidago curtisii</i>	0.01	0.01	0.01	1

<i>Solidago flexicaulis</i>	0.01	0.01	0.01	1
<i>Symphyotrichum</i>	0.01	0.01	0.01	1
<i>Thalictrum clavatum</i>	0.01	0.01	0.01	1
<i>Uvularia grandiflora</i>	0.01	0.01	0.01	1

American Water-willow Cobble Bar
(CEGL004286) - 2 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Justicia americana</i>	22.5	5	40	2
<i>Betula nigra</i>	0.8	0.5	1	2
<i>Physostegia virginiana</i>	0.8	0.5	1	2
ssp. <i>virginiana</i>				
<i>Platanus occidentalis</i>	4.0	4	4	1
<i>Carpinus caroliniana</i>	0.5	0.5	0.5	1
ssp. <i>virginiana</i>				
<i>Cephalanthus</i>	0.5	0.5	0.5	1
<i>occidentalis</i>				
<i>Salix caroliniana</i>	0.5	0.5	0.5	1
<i>Boehmeria cylindrica</i>	0.01	0.01	0.01	1
<i>Osmunda regalis</i> var.	0.01	0.01	0.01	1
<i>spectabilis</i>				
<i>Polygonum</i>	0.01	0.01	0.01	1
<i>cuspidatum</i>				
<i>Viola cucullata</i>	0.01	0.01	0.01	1
<i>Xanthium strumarium</i>	0.01	0.01	0.01	1

Bur-reed Marsh (CEGL004510) - 1 plot.

Species	% Cover			N
	Mean	Min	Max	
<i>Eleocharis acicularis</i>	30.0	30	30	1
var. <i>acicularis</i>				
<i>Sparganium</i>	20.0	20	20	1
<i>chlorocarpum</i>				
<i>Leersia oryzoides</i>	10.0	10	10	1
<i>Betula nigra</i>	5.0	5	5	1
<i>Sagittaria latifolia</i>	5.0	5	5	1
<i>Alisma subcordatum</i>	1.0	1	1	1
<i>Boehmeria cylindrica</i>	1.0	1	1	1
<i>Isoetes engelmannii</i>	1.0	1	1	1
<i>Ludwigia palustris</i>	1.0	1	1	1
<i>Lycopus virginicus</i>	1.0	1	1	1
<i>Lysimachia terrestris</i>	1.0	1	1	1
<i>Penthorum sedoides</i>	1.0	1	1	1
<i>Platanus occidentalis</i>	1.0	1	1	1
<i>Polygonum</i>	1.0	1	1	1
<i>hydropiperoides</i>				
<i>Bidens</i>	0.5	0.5	0.5	1
<i>Cornus amomum</i>	0.5	0.5	0.5	1
<i>Galium tinctorium</i>	0.5	0.5	0.5	1
<i>Juncus tenuis</i>	0.5	0.5	0.5	1
<i>Spiraea alba</i> var. <i>alba</i>	0.5	0.5	0.5	1

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<i>Angelica triquinata</i>	0.01	0.01	0.01	1	<i>Rhododendron</i>	2.0	0.01	6	4
<i>Apios americana</i>	0.01	0.01	0.01	1	<i>maximum</i>				
<i>Carex crinita</i> var.	0.01	0.01	0.01	1	<i>Nyssa sylvatica</i>	1.8	1	3	4
<i>crinita</i>					<i>Smilax glauca</i>	0.6	0.01	1	4
<i>Carex lurida</i>	0.01	0.01	0.01	1	<i>Epigaea repens</i>	0.4	0.01	1	4
<i>Cinna arundinacea</i>	0.01	0.01	0.01	1	<i>Gaylussacia baccata</i>	20.3	1	40	3
<i>Dichanthelium</i>	0.01	0.01	0.01	1	<i>Rhododendron</i>	2.3	1	5	3
<i>clandestinum</i>					<i>catawbiense</i>				
<i>Eleocharis obtusa</i>	0.01	0.01	0.01	1	<i>Cladonia squamosa</i>	0.7	0.5	1	3
<i>Eupatorium</i>	0.01	0.01	0.01	1	<i>Quercus rubra</i>	0.2	0.01	0.5	3
<i>perfoliatum</i> var.					<i>Cladonia rangiferina</i>	6.0	2	10	2
<i>perfoliatum</i>					<i>Lasallia papulosa</i>	5.0	5	5	2
<i>Hypericum mutilum</i>	0.01	0.01	0.01	1	<i>Leucobryum albidum</i>	3.5	2	5	2
<i>Impatiens capensis</i>	0.01	0.01	0.01	1	<i>Dicranum scoparium</i>	1.0	1	1	2
<i>Juncus effusus</i>	0.01	0.01	0.01	1	<i>Polytrichum</i>	0.8	0.5	1	2
<i>Lilium superbum</i>	0.01	0.01	0.01	1	<i>juniperinum</i>				
<i>Lysimachia ciliata</i>	0.01	0.01	0.01	1	<i>Umbilicaria</i>	0.5	0.5	0.5	2
<i>Lysimachia</i>	0.01	0.01	0.01	1	<i>mammulata</i>				
<i>nummularia</i>					<i>Danthonia spicata</i>	0.3	0.01	0.5	2
<i>Mimulus alatus</i>	0.01	0.01	0.01	1	<i>Fagus grandifolia</i>	0.3	0.01	0.5	2
<i>Prunella vulgaris</i>	0.01	0.01	0.01	1	<i>Schizachyrium</i>	0.3	0.01	0.5	2
<i>Ranunculus hispidus</i>	0.01	0.01	0.01	1	<i>scoparium</i> var.				
<i>var. nitidus</i>					<i>scoparium</i>				
<i>Scirpus polyphyllus</i>	0.01	0.01	0.01	1	<i>Mitchella repens</i>	0.0	0.01	0.01	2
<i>Symphyotrichum</i>	0.01	0.01	0.01	1	<i>Pinus rigida</i>	23.0	23	23	1
<i>Triadenum</i>	0.01	0.01	0.01	1	<i>Flavoparmelia</i>	3.0	3	3	1
					<i>caperata</i>				
					<i>Hypnum imponens</i>	2.0	2	2	1
					<i>Castanea dentata</i>	1.0	1	1	1
					<i>Cladonia</i>	1.0	1	1	1
					<i>Dicranum</i>	1.0	1	1	1
					<i>condensatum</i>				
					<i>Dicranum spurium</i>	1.0	1	1	1
					<i>Lasallia pensylvanica</i>	1.0	1	1	1
					<i>Lycopodium</i>	1.0	1	1	1
					<i>tristachyum</i>				
					<i>Robinia pseudoacacia</i>	1.0	1	1	1
					<i>Thuidium delicatulum</i>	1.0	1	1	1
					<i>Betula alleghaniensis</i>	0.5	0.5	0.5	1
					<i>var. alleghaniensis</i>				
					<i>Carex pensylvanica</i>	0.5	0.5	0.5	1
					<i>Cladonia pyxidata</i>	0.5	0.5	0.5	1
					<i>Danthonia sericea</i>	0.5	0.5	0.5	1
					<i>Dichanthelium</i>	0.5	0.5	0.5	1
					<i>commutatum</i> ssp.				
					<i>ashei</i>				
					<i>Dicranum</i>	0.5	0.5	0.5	1
					<i>Rubus</i>	0.5	0.5	0.5	1
					<i>Solidago hispida</i> var.	0.5	0.5	0.5	1
					<i>hispida</i>				
					<i>Aralia spinosa</i>	0.01	0.01	0.01	1
					<i>Asplenium montanum</i>	0.01	0.01	0.01	1
					<i>Coreopsis major</i>	0.01	0.01	0.01	1
					<i>Danthonia compressa</i>	0.01	0.01	0.01	1

Cliff Top Virginia Pine Forest
(CEGL007119) - 6 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Pinus virginiana</i>	47.5	30	60	6
<i>Kalmia latifolia</i>	7.0	0.5	25	6
<i>Smilax rotundifolia</i>	6.1	0.5	20	6
<i>Oxydendrum</i>	3.7	1	10	6
<i>arborescens</i>				
<i>Quercus coccinea</i> var.	2.8	0.5	7	6
<i>coccinea</i>				
<i>Betula lenta</i>	0.7	0.01	1	6
<i>Vaccinium pallidum</i>	3.6	1	10	5
<i>Acer rubrum</i>	2.9	0.5	7	5
<i>Ilex opaca</i> var. <i>opaca</i>	2.1	0.5	4	5
<i>Tsuga canadensis</i>	2.0	0.01	5	5
<i>Cladonia caroliniana</i>	2.0	1	5	5
<i>Amelanchier arborea</i>	1.2	0.01	2	5
<i>var. arborea</i>				
<i>Gaultheria</i>	1.0	0.5	2	5
<i>procumbens</i>				
<i>Sassafras albidum</i>	0.4	0.01	1	5
<i>Leucobryum glaucum</i>	4.8	1	10	4
<i>Vaccinium stamineum</i>	3.4	0.5	10	4
<i>Quercus prinus</i>	2.9	0.01	6	4
<i>Quercus alba</i>	2.0	0.01	5	4

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<i>Dichanthelium acuminatum</i> ssp. <i>columbianum</i>	0.01	0.01	0.01	1	<i>Lepraria obscura</i>	4.0	3	5	2
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.01	0.01	0.01	1	<i>Lepraria lobificans</i>	3.0	1	5	2
<i>Dichanthelium linearifolium</i>	0.01	0.01	0.01	1	<i>Leucobryum albidum</i>	2.5	0.01	5	2
<i>Hamamelis virginiana</i>	0.01	0.01	0.01	1	<i>Andreaea rothii</i>	1.5	0.01	3	2
<i>Heuchera</i>	0.01	0.01	0.01	1	<i>Phlyctis petraea</i>	1.5	1	2	2
<i>Hieracium venosum</i>	0.01	0.01	0.01	1	<i>Leucobryum glaucum</i>	1.0	0.01	2	2
<i>Hypericum hypericoides</i> ssp. <i>multicaule</i>	0.01	0.01	0.01	1	<i>Acer rubrum</i>	0.3	0.01	0.5	2
<i>Polytrichum</i>	0.01	0.01	0.01	1	<i>Polypodium virginianum</i>	0.01	0.01	0.01	2
<i>Quercus velutina</i>	0.01	0.01	0.01	1	<i>Viola</i>	0.01	0.01	0.01	2
<i>Xanthoparmelia conspersa</i>	0.01	0.01	0.01	1	<i>Cladonia squamosa</i>	20.0	20	20	1
<i>Xanthoparmelia plittii</i>	0.01	0.01	0.01	1	<i>Cladonia rangiferina</i>	10.0	10	10	1
					<i>Lichenothelia</i>	5.0	5	5	1
					<i>Porpidia albocaerulescens</i>	5.0	5	5	1
					<i>Cladonia</i>	1.0	1	1	1
					<i>Lasallia papulosa</i>	1.0	1	1	1
					<i>Lepraria caesiella</i>	1.0	1	1	1
					<i>Leucolejeunea clypeata</i>	1.0	1	1	1
					<i>Bazzania trilobata</i>	0.5	0.5	0.5	1
					<i>Dryopteris intermedia</i>	0.5	0.5	0.5	1
					<i>Fraxinus americana</i>	0.5	0.5	0.5	1
					<i>Lepraria neglecta</i>	0.5	0.5	0.5	1
					<i>Rhus</i>	0.5	0.5	0.5	1
					<i>Rubus phoenicolasius</i>	0.5	0.5	0.5	1
					<i>Tsuga canadensis</i>	0.5	0.5	0.5	1
					<i>Acer pensylvanicum</i>	0.01	0.01	0.01	1
					<i>Agrostis perennans</i>	0.01	0.01	0.01	1
					<i>Amelanchier arborea</i> var. <i>arborea</i>	0.01	0.01	0.01	1
					<i>Amphidium mougeotii</i>	0.01	0.01	0.01	1
					<i>Andropogon gerardii</i>	0.01	0.01	0.01	1
					<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.01	0.01	0.01	1
					<i>Asplenium montanum</i>	0.01	0.01	0.01	1
					<i>Atrichum angustatum</i>	0.01	0.01	0.01	1
					<i>Bryoandersonia illecebra</i>	0.01	0.01	0.01	1
					<i>Carex</i>	0.01	0.01	0.01	1
					<i>Carex communis</i> var. <i>communis</i>	0.01	0.01	0.01	1
					<i>Carex digitalis</i> var. <i>digitalis</i>	0.01	0.01	0.01	1
					<i>Carex swanii</i>	0.01	0.01	0.01	1
					<i>Clethra acuminata</i>	0.01	0.01	0.01	1
					<i>Coreopsis major</i>	0.01	0.01	0.01	1
					<i>Cymophyllus fraserianus</i>	0.01	0.01	0.01	1
					<i>Danthonia compressa</i>	0.01	0.01	0.01	1
					<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.01	0.01	0.01	1
					<i>Dicranum fulvum</i>	0.01	0.01	0.01	1
					<i>Dicranum scoparium</i>	0.01	0.01	0.01	1

Common Rock Tripe Cliff Face
(CEGL004387) - 1 plot.

Species	% Cover			N
	Mean	Min	Max	
<i>Umbilicaria mammulata</i>	20.0	20	20	1
<i>Andreaea rothii</i>	5.0	5	5	1
<i>Rhododendron maximum</i>	2.0	2	2	1
<i>Acer rubrum</i>	1.0	1	1	1
<i>Lepraria neglecta</i>	1.0	1	1	1
<i>Rhabdoweisia crispata</i>	0.5	0.5	0.5	1
<i>Tsuga canadensis</i>	0.5	0.5	0.5	1
<i>Kalmia latifolia</i>	0.01	0.01	0.01	1
<i>Leucobryum albidum</i>	0.01	0.01	0.01	1
<i>Magnolia acuminata</i>	0.01	0.01	0.01	1
<i>Oxydendrum arboreum</i>	0.01	0.01	0.01	1
<i>Rhododendron catawbiense</i>	0.01	0.01	0.01	1
<i>Vaccinium pallidum</i>	0.01	0.01	0.01	1

Dry Cliff Face (CEGL006435) - 6 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Umbilicaria mammulata</i>	1.3	1	2	4
<i>Rhododendron maximum</i>	0.5	0.01	1	4
<i>Betula lenta</i>	0.1	0.01	0.5	4
<i>Eurybia divaricata</i>	0.0	0.01	0.01	4
<i>Chrysothrix insulizans</i>	7.5	5	10	2

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<i>Diplophyllum apiculatum</i>	0.01	0.01	0.01	1	<i>Kalmia latifolia</i>	8.3	2	20	4
<i>Eupatorium godfreyanum</i>	0.01	0.01	0.01	1	<i>Ilex opaca</i> var. <i>opaca</i>	5.4	0.5	15	4
<i>Heuchera americana</i> var. <i>americana</i>	0.01	0.01	0.01	1	<i>Hamamelis virginiana</i>	1.9	0.5	5	4
<i>Heuchera villosa</i> var. <i>villosa</i>	0.01	0.01	0.01	1	<i>Gaultheria procumbens</i>	0.4	0.01	0.5	4
<i>Ilex opaca</i> var. <i>opaca</i>	0.01	0.01	0.01	1	<i>Leucobryum glaucum</i>	0.3	0.01	0.5	4
<i>Juniperus virginiana</i> var. <i>virginiana</i>	0.01	0.01	0.01	1	<i>Quercus coccinea</i> var. <i>coccinea</i>	17.7	3	30	3
<i>Kalmia latifolia</i>	0.01	0.01	0.01	1	<i>Quercus velutina</i>	15.3	10	21	3
<i>Muhlenbergia sylvatica</i>	0.01	0.01	0.01	1	<i>Sassafras albidum</i>	2.5	0.5	5	3
<i>Nyssa sylvatica</i>	0.01	0.01	0.01	1	<i>Nyssa sylvatica</i>	1.5	0.5	3	3
<i>Parthenocissus quinquefolia</i>	0.01	0.01	0.01	1	<i>Hypnum imponens</i>	0.3	0.01	1	3
<i>Phytolacca americana</i> var. <i>americana</i>	0.01	0.01	0.01	1	<i>Pinus virginiana</i>	15.5	1	30	2
<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1	<i>Carya alba</i>	10.5	2	19	2
<i>Polystichum acrostichoides</i>	0.01	0.01	0.01	1	<i>Fagus grandifolia</i>	1.8	0.5	3	2
<i>Polytrichum ohioense</i>	0.01	0.01	0.01	1	<i>Vaccinium pallidum</i>	1.3	0.5	2	2
<i>Quercus prinus</i>	0.01	0.01	0.01	1	<i>Prunus serotina</i> var. <i>serotina</i>	1.0	0.01	2	2
<i>Rubus</i>	0.01	0.01	0.01	1	<i>Ilex montana</i>	0.5	0.01	1	2
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	0.01	0.01	0.01	1	<i>Chimaphila maculata</i>	0.5	0.5	0.5	2
<i>Sedum ternatum</i>	0.01	0.01	0.01	1	<i>Polypodium virginianum</i>	0.5	0.5	0.5	2
<i>Solidago</i>	0.01	0.01	0.01	1	<i>Smilax glauca</i>	0.3	0.01	0.5	2
<i>Thelypteris noveboracensis</i>	0.01	0.01	0.01	1	<i>Thuidium delicatulum</i>	0.0	0.01	0.01	2
<i>Trillium erectum</i>	0.01	0.01	0.01	1	<i>Cornus florida</i>	2.0	2	2	1
<i>Usnea amblyoclada</i>	0.01	0.01	0.01	1	<i>Betula lenta</i>	1.0	1	1	1
<i>Vaccinium pallidum</i>	0.01	0.01	0.01	1	<i>Castanea dentata</i>	1.0	1	1	1
Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) - 5 plots.					<i>Cladonia uncialis</i>	1.0	1	1	1
Species	% Cover			N	<i>Dicranum scoparium</i>	1.0	1	1	1
	Mean	Min	Max		<i>Quercus rubra</i>	1.0	1	1	1
<i>Tsuga canadensis</i>	25.2	5	50	5	<i>Asplenium platyneuron</i>	0.5	0.5	0.5	1
<i>Rhododendron catawbiense</i>	24.4	16	31	5	<i>Dryopteris intermedia</i>	0.5	0.5	0.5	1
<i>Quercus prinus</i>	23.4	12	45	5	<i>Epigaea repens</i>	0.5	0.5	0.5	1
<i>Rhododendron maximum</i>	15.2	5	51	5	<i>Hexastylis virginica</i>	0.5	0.5	0.5	1
<i>Acer rubrum</i>	14.4	2	30	5	<i>Leucobryum</i>	0.5	0.5	0.5	1
<i>Oxydendrum arboreum</i>	11.8	3	23	5	<i>Mitchella repens</i>	0.5	0.5	0.5	1
<i>Smilax rotundifolia</i>	1.7	0.5	4	5	<i>Vaccinium stamineum</i>	0.5	0.5	0.5	1
<i>Amelanchier arborea</i> var. <i>arborea</i>	1.6	0.01	5	5	<i>Viburnum acerifolium</i>	0.5	0.5	0.5	1
<i>Quercus alba</i>	11.8	1	25	4	<i>Bazzania trilobata</i>	0.01	0.01	0.01	1
					<i>Conopholis americana</i>	0.01	0.01	0.01	1
					<i>Cypripedium acaule</i>	0.01	0.01	0.01	1
					<i>Danthonia spicata</i>	0.01	0.01	0.01	1
					<i>Euonymus americana</i>	0.01	0.01	0.01	1
					<i>Goodyera pubescens</i>	0.01	0.01	0.01	1
					<i>Heuchera</i>	0.01	0.01	0.01	1
					<i>Juniperus virginiana</i> var. <i>virginiana</i>	0.01	0.01	0.01	1
					<i>Magnolia acuminata</i>	0.01	0.01	0.01	1
					<i>Polytrichum juniperinum</i>	0.01	0.01	0.01	1
					<i>Umbilicaria mammulata</i>	0.01	0.01	0.01	1

Eastern Hemlock Floodplain Forest (CEGL006620) - 11 plots.									
Species	% Cover			N					
	Mean	Min	Max						
<i>Tsuga canadensis</i>	29.3	1	70	11	<i>Rudbeckia laciniata</i>	0.1	0.01	0.5	4
<i>Rhododendron maximum</i>	18.6	0.5	65	11	var. <i>laciniata</i>				
<i>Acer rubrum</i>	12.3	0.01	35	11	<i>Dicranum scoparium</i>	17.3	0.01	51	3
<i>Hamamelis virginiana</i>	2.2	0.5	6	10	<i>Liquidambar styraciflua</i>	10.7	2	15	3
<i>Liriodendron tulipifera</i>	10.2	0.5	30	9	<i>Pinus rigida</i>	6.3	5	8	3
<i>Quercus rubra</i>	10.9	0.01	30	8	<i>Alnus serrulata</i>	5.2	0.5	10	3
<i>Kalmia latifolia</i>	6.0	0.01	35	8	<i>Betula alleghaniensis</i>	3.3	3	4	3
<i>Nyssa sylvatica</i>	3.6	0.5	10	8	var. <i>alleghaniensis</i>				
<i>Xanthorhiza simplicissima</i>	2.1	0.5	5	8	<i>Magnolia fraseri</i>	3.2	0.5	5	3
<i>Thuidium delicatulum</i>	1.4	0.01	5	8	<i>Chionanthus virginicus</i>	2.8	0.5	7	3
<i>Polystichum acrostichoides</i>	0.7	0.01	3	8	<i>Acer saccharum</i> var. <i>saccharum</i>	1.3	0.01	3	3
<i>Parthenocissus quinquefolia</i>	0.5	0.01	2	8	<i>Deschampsia flexuosa</i> var. <i>flexuosa</i>	0.7	0.01	1	3
<i>Leucobryum glaucum</i>	0.4	0.01	1	8	<i>Maianthemum canadense</i>	0.5	0.01	1	3
<i>Betula lenta</i>	18.6	3	40	7	<i>Bazzania trilobata</i>	0.3	0.01	1	3
<i>Betula nigra</i>	9.8	0.5	30	7	<i>Polygonatum pubescens</i>	0.3	0.01	1	3
<i>Fagus grandifolia</i>	6.1	0.5	20	7	<i>Dichantherium clandestinum</i>	0.3	0.01	0.5	3
<i>Ilex opaca</i> var. <i>opaca</i>	2.4	0.01	10	7	<i>Lysimachia quadrifolia</i>	0.3	0.01	0.5	3
<i>Magnolia tripetala</i>	1.8	0.01	6	7	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.2	0.01	0.5	3
<i>Dryopteris intermedia</i>	0.4	0.01	1	7	<i>Carex plantaginea</i>	0.2	0.01	0.5	3
<i>Mitchella repens</i>	0.2	0.01	0.5	7	<i>Osmunda regalis</i> var. <i>spectabilis</i>	0.2	0.01	0.5	3
<i>Oxydendrum arboreum</i>	8.3	1	20	6	<i>Vaccinium pallidum</i>	0.2	0.01	0.5	3
<i>Eurybia divaricata</i>	0.6	0.01	1	6	<i>Quercus prinus</i>	10.0	0.01	20	2
<i>Euonymus americana</i>	0.4	0.01	1	6	<i>Vaccinium corymbosum</i>	3.0	1	5	2
<i>Viola</i>	0.3	0.01	0.5	6	<i>Viburnum nudum</i> var. <i>cassinoides</i>	2.3	0.5	4	2
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	6.9	0.5	12	5	<i>Prunus serotina</i> var. <i>serotina</i>	1.5	0.01	3	2
<i>Rubus</i>	0.7	0.01	1	5	<i>Erigeron pulchellus</i>	1.0	0.01	2	2
<i>Smilax rotundifolia</i>	0.6	0.5	1	5	<i>Magnolia acuminata</i>	1.0	1	1	2
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.2	0.01	0.5	5	<i>Quercus alba</i>	1.0	1	1	2
<i>Thelypteris noveboracensis</i>	2.8	0.01	5	4	<i>Ipomoea pandurata</i>	0.8	0.5	1	2
<i>Fraxinus pennsylvanica</i>	2.3	0.01	3	4	<i>Quercus</i>	0.8	0.5	1	2
<i>Hypnum imponens</i>	1.9	0.5	3	4	<i>Pedicularis canadensis</i> ssp. <i>canadensis</i>	0.5	0.01	1	2
<i>Amelanchier arborea</i> var. <i>arborea</i>	0.9	0.01	2	4	<i>Rosa multiflora</i>	0.5	0.01	1	2
<i>Cornus florida</i>	0.9	0.5	1	4	<i>Zizia aptera</i>	0.5	0.01	1	2
<i>Carya cordiformis</i>	0.4	0.01	1	4	<i>Acer pensylvanicum</i>	0.5	0.5	0.5	2
<i>Toxicodendron radicans</i>	0.4	0.01	1	4	<i>Brachyelytrum erectum</i>	0.5	0.5	0.5	2
<i>Anemone quinquefolia</i> var. <i>quinquefolia</i>	0.4	0.01	0.5	4	<i>Eupatorium rotundifolium</i> var. <i>ovatum</i>	0.5	0.5	0.5	2
					<i>Smilax glauca</i>	0.5	0.5	0.5	2

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<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i>	0.5	0.5	0.5	2	<i>Arnoglossum</i> <i>atriplicifolium</i>	0.5	0.5	0.5	1
<i>Cardamine diphylla</i>	0.3	0.01	0.5	2	<i>Asimina triloba</i>	0.5	0.5	0.5	1
<i>Dichanthelium</i> <i>polyanthes</i>	0.3	0.01	0.5	2	<i>Baptisia tinctoria</i>	0.5	0.5	0.5	1
<i>Fraxinus americana</i>	0.3	0.01	0.5	2	<i>Bryoandersonia</i> <i>illecebra</i>	0.5	0.5	0.5	1
<i>Hydrangea</i> <i>arborescens</i>	0.3	0.01	0.5	2	<i>Castanea dentata</i>	0.5	0.5	0.5	1
<i>Ilex montana</i>	0.3	0.01	0.5	2	<i>Chrysopsis mariana</i>	0.5	0.5	0.5	1
<i>Packera aurea</i>	0.3	0.01	0.5	2	<i>Cladonia</i>	0.5	0.5	0.5	1
<i>Rosa carolina</i> var. <i>carolina</i>	0.3	0.01	0.5	2	<i>Coreopsis major</i>	0.5	0.5	0.5	1
<i>Smilax ecirrata</i>	0.3	0.01	0.5	2	<i>Coreopsis tripteris</i>	0.5	0.5	0.5	1
<i>Smilax tamnoides</i>	0.3	0.01	0.5	2	<i>Cornus amomum</i>	0.5	0.5	0.5	1
<i>Viola blanda</i> var. <i>blanda</i>	0.3	0.01	0.5	2	<i>Cypripedium acaule</i>	0.5	0.5	0.5	1
<i>Carex</i>	0.01	0.01	0.01	2	<i>Danthonia compressa</i>	0.5	0.5	0.5	1
<i>Crataegus</i>	0.01	0.01	0.01	2	<i>Dichanthelium</i> <i>dichotomum</i>	0.5	0.5	0.5	1
<i>Dichanthelium</i> <i>laxiflorum</i>	0.01	0.01	0.01	2	<i>Dichanthelium</i> <i>dichotomum</i> ssp. <i>microcarpon</i>	0.5	0.5	0.5	1
<i>Goodyera pubescens</i>	0.01	0.01	0.01	2	<i>Dichanthelium ovale</i> ssp. <i>villosissimum</i>	0.5	0.5	0.5	1
<i>Hexastylis virginica</i>	0.01	0.01	0.01	2	<i>Dicranella</i>	0.5	0.5	0.5	1
<i>Monotropa uniflora</i>	0.01	0.01	0.01	2	<i>Dioscorea quaternata</i>	0.5	0.5	0.5	1
<i>Quercus velutina</i>	0.01	0.01	0.01	2	<i>Eupatorium album</i>	0.5	0.5	0.5	1
<i>Sedum ternatum</i>	0.01	0.01	0.01	2	<i>Eupatorium fistulosum</i>	0.5	0.5	0.5	1
<i>Vitis</i>	0.01	0.01	0.01	2	<i>Euphorbia corollata</i>	0.5	0.5	0.5	1
<i>Robinia pseudoacacia</i>	15.0	15	15	1	<i>Fraxinus</i>	0.5	0.5	0.5	1
<i>Hypericum prolificum</i>	8.0	8	8	1	<i>Helianthus strumosus</i>	0.5	0.5	0.5	1
<i>Lycopodium digitatum</i>	5.0	5	5	1	<i>Hypericum</i> <i>hypericoides</i> ssp. <i>multicaule</i>	0.5	0.5	0.5	1
<i>Sassafras albidum</i>	5.0	5	5	1	<i>Hypnum curvifolium</i>	0.5	0.5	0.5	1
<i>Physocarpus</i> <i>opulifolius</i> var. <i>opulifolius</i>	3.0	3	3	1	<i>Hypoxis hirsuta</i>	0.5	0.5	0.5	1
<i>Platanus occidentalis</i>	3.0	3	3	1	<i>Ionactis linariifolius</i>	0.5	0.5	0.5	1
<i>Polygonum</i> <i>cuspidatum</i>	3.0	3	3	1	<i>Linum virginianum</i>	0.5	0.5	0.5	1
<i>Dennstaedtia</i> <i>punctilobula</i>	2.0	2	2	1	<i>Luzula acuminata</i>	0.5	0.5	0.5	1
<i>Dichanthelium</i>	2.0	2	2	1	<i>Lysimachia lanceolata</i>	0.5	0.5	0.5	1
<i>Juniperus virginiana</i> var. <i>virginiana</i>	2.0	2	2	1	<i>Medeola virginiana</i>	0.5	0.5	0.5	1
<i>Pteridium aquilinum</i>	2.0	2	2	1	<i>Podophyllum peltatum</i>	0.5	0.5	0.5	1
<i>Rhododendron</i> <i>periclymenoides</i>	2.0	2	2	1	<i>Polygonatum biflorum</i>	0.5	0.5	0.5	1
<i>Sorghastrum nutans</i>	2.0	2	2	1	<i>Potentilla canadensis</i> var. <i>canadensis</i>	0.5	0.5	0.5	1
<i>Vaccinium stamineum</i>	2.0	2	2	1	<i>Prunella vulgaris</i>	0.5	0.5	0.5	1
<i>Clethra acuminata</i>	1.0	1	1	1	<i>Pyrularia pubera</i>	0.5	0.5	0.5	1
<i>Houstonia serpyllifolia</i>	1.0	1	1	1	<i>Rhododendron</i> <i>arborescens</i>	0.5	0.5	0.5	1
<i>Scapania nemorea</i>	1.0	1	1	1	<i>Sambucus</i>	0.5	0.5	0.5	1
<i>Schizachyrium</i> <i>scoparium</i> var. <i>scoparium</i>	1.0	1	1	1	<i>Smilax herbacea</i>	0.5	0.5	0.5	1
<i>Andropogon gerardii</i>	0.5	0.5	0.5	1	<i>Solidago bicolor</i>	0.5	0.5	0.5	1
<i>Aralia spinosa</i>	0.5	0.5	0.5	1	<i>Solidago rugosa</i>	0.5	0.5	0.5	1
					<i>Symphyotrichum</i>	0.5	0.5	0.5	1
					<i>Symphyotrichum laeve</i>	0.5	0.5	0.5	1
					<i>Symphyotrichum</i> <i>prenanthoides</i>	0.5	0.5	0.5	1
					<i>Tephrosia virginiana</i>	0.5	0.5	0.5	1
					<i>Trillium erectum</i>	0.5	0.5	0.5	1

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<i>Uvularia sessilifolia</i>	0.5	0.5	0.5	1
<i>Viola pedata</i>	0.5	0.5	0.5	1
<i>Aesculus flava</i>	0.01	0.01	0.01	1
<i>Ageratina altissima</i> var. <i>altissima</i>	0.01	0.01	0.01	1
<i>Agrostis</i>	0.01	0.01	0.01	1
<i>Amelanchier</i>	0.01	0.01	0.01	1
<i>Amphicarpaea</i> bracteata	0.01	0.01	0.01	1
<i>Bidens</i>	0.01	0.01	0.01	1
<i>Carex communis</i> var. <i>communis</i>	0.01	0.01	0.01	1
<i>Carex swanii</i>	0.01	0.01	0.01	1
<i>Carya glabra</i>	0.01	0.01	0.01	1
<i>Chimaphila maculata</i>	0.01	0.01	0.01	1
<i>Clematis virginiana</i>	0.01	0.01	0.01	1
<i>Collinsonia</i> canadensis	0.01	0.01	0.01	1
<i>Dichanthelium</i> dichotomum ssp. dichotomum	0.01	0.01	0.01	1
<i>Elaeagnus umbellata</i> var. <i>parvifolia</i>	0.01	0.01	0.01	1
<i>Galium triflorum</i>	0.01	0.01	0.01	1
<i>Iris cristata</i>	0.01	0.01	0.01	1
<i>Leersia virginica</i>	0.01	0.01	0.01	1
<i>Lilium canadense</i>	0.01	0.01	0.01	1
<i>Lilium superbum</i>	0.01	0.01	0.01	1
<i>Lobelia cardinalis</i>	0.01	0.01	0.01	1
<i>Lobelia inflata</i>	0.01	0.01	0.01	1
<i>Lonicera japonica</i>	0.01	0.01	0.01	1
<i>Onoclea sensibilis</i>	0.01	0.01	0.01	1
<i>Osmorhiza claytonii</i>	0.01	0.01	0.01	1
<i>Polypodium</i> virginianum	0.01	0.01	0.01	1
<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	0.01	0.01	0.01	1
<i>Sanguinaria</i> canadensis	0.01	0.01	0.01	1
<i>Smilax</i>	0.01	0.01	0.01	1
<i>Solidago caesia</i>	0.01	0.01	0.01	1
<i>Stellaria pubera</i>	0.01	0.01	0.01	1
<i>Tetraphis pellucida</i>	0.01	0.01	0.01	1
<i>Thalictrum</i>	0.01	0.01	0.01	1
<i>Thalictrum clavatum</i>	0.01	0.01	0.01	1
<i>Viburnum acerifolium</i>	0.01	0.01	0.01	1

Eastern Hemlock - Oak - Sweet Birch /
Great Laurel Forest (CEGL007543) - 24
plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Tsuga canadensis</i>	38.4	5	80	24
<i>Rhododendron</i> maximum	33.5	3	90	24
<i>Acer rubrum</i>	10.9	0.5	40	24
<i>Betula lenta</i>	9.1	0.01	40	22
<i>Oxydendrum</i> arboreum	4.4	0.01	15	18
<i>Leucobryum glaucum</i>	1.2	0.01	6	18
<i>Magnolia fraseri</i>	6.6	0.01	20	16
<i>Liriodendron</i> tulipifera	8.4	0.01	30	15
<i>Thuidium delicatulum</i>	2.3	0.01	7	15
<i>Nyssa sylvatica</i>	6.1	0.01	15	14
<i>Hypnum imponens</i>	1.2	0.01	8	14
<i>Smilax rotundifolia</i>	0.3	0.01	1	14
<i>Quercus rubra</i>	14.3	0.01	34	13
<i>Ilex opaca</i> var. <i>opaca</i>	2.1	0.01	11	13
<i>Quercus prinus</i>	16.7	2	65	12
<i>Mitchella repens</i>	0.2	0.01	1	12
<i>Fagus grandifolia</i>	9.8	0.01	45	11
<i>Polystichum</i> acrostichoides	0.5	0.01	1	11
<i>Dryopteris intermedia</i>	3.3	0.01	15	10
<i>Sassafras albidum</i>	2.3	0.01	15	10
<i>Hamamelis virginiana</i>	0.6	0.01	1	9
<i>Rubus</i>	0.2	0.01	0.5	9
<i>Magnolia acuminata</i>	1.6	0.01	5	8
<i>Dryopteris marginalis</i>	0.5	0.01	2	8
<i>Quercus alba</i>	4.6	0.01	15	7
<i>Bazzania trilobata</i>	1.9	0.01	5	7
<i>Monotropa uniflora</i>	0.1	0.01	0.5	7
<i>Viola blanda</i> var. blanda	0.7	0.01	3	6
<i>Parthenocissus</i> quinquefolia	0.4	0.01	1	6
<i>Polypodium</i> virginianum	0.4	0.01	1	6
<i>Dicranum scoparium</i>	2.5	0.5	7	5
<i>Dicranum fulvum</i>	2.3	0.5	5	5
<i>Quercus velutina</i>	1.6	0.01	5	5
<i>Kalmia latifolia</i>	1.0	0.01	3	5
<i>Hexastylis virginica</i>	0.4	0.01	1	5
<i>Smilax glauca</i>	0.3	0.01	0.5	5
<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.1	0.01	0.5	5
<i>Prunus serotina</i> var. serotina	0.1	0.01	0.5	5
<i>Acer saccharum</i> var. saccharum	3.6	0.01	12	4

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<i>Thelypteris noveboracensis</i>	2.0	0.01	7	4	<i>Leucobryum</i>	0.5	0.5	0.5	1
<i>Cypripedium acaule</i>	0.1	0.01	0.5	4	<i>Loeskeobryum brevirostre</i>	0.5	0.5	0.5	1
<i>Eurybia divaricata</i>	0.1	0.01	0.5	4	<i>Maianthemum canadense</i>	0.5	0.5	0.5	1
<i>Magnolia tripetala</i>	3.5	0.5	5	3	<i>Monotropa hypopithys</i>	0.5	0.5	0.5	1
<i>Brotherella recurvans</i>	1.3	0.01	3	3	<i>Pylaisiadelpha tenuirostris</i>	0.5	0.5	0.5	1
<i>Cornus florida</i>	1.0	0.01	2	3	<i>Robinia pseudoacacia</i>	0.5	0.5	0.5	1
<i>Amelanchier arborea</i> var. <i>arborea</i>	0.7	0.01	1	3	<i>Sambucus nigra</i> ssp. <i>canadensis</i>	0.5	0.5	0.5	1
<i>Viburnum acerifolium</i>	0.5	0.01	1	3	<i>Sambucus racemosa</i> var. <i>racemosa</i>	0.5	0.5	0.5	1
<i>Conopholis americana</i>	0.3	0.01	0.5	3	<i>Vaccinium pallidum</i>	0.5	0.5	0.5	1
<i>Polytrichum</i>	0.3	0.01	0.5	3	<i>Vaccinium stamineum</i>	0.5	0.5	0.5	1
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.2	0.01	0.5	3	<i>Viola hastata</i>	0.5	0.5	0.5	1
<i>Toxicodendron radicans</i>	0.2	0.01	0.5	3	<i>Viola sororia</i>	0.5	0.5	0.5	1
<i>Polygonatum pubescens</i>	0.0	0.01	0.01	3	<i>Adiantum pedatum</i>	0.01	0.01	0.01	1
<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i>	2.8	0.5	5	2	<i>Aristolochia serpentaria</i>	0.01	0.01	0.01	1
<i>Fraxinus americana</i>	1.5	0.01	3	2	<i>Carex</i>	0.01	0.01	0.01	1
<i>Polytrichum pallidisetum</i>	0.8	0.5	1	2	<i>Carex digitalis</i> var. <i>digitalis</i>	0.01	0.01	0.01	1
<i>Viola</i>	0.8	0.5	1	2	<i>Carex pensylvanica</i>	0.01	0.01	0.01	1
<i>Vitis aestivalis</i>	0.8	0.5	1	2	<i>Carya glabra</i>	0.01	0.01	0.01	1
<i>Euonymus americana</i>	0.5	0.01	1	2	<i>Chelone glabra</i>	0.01	0.01	0.01	1
<i>Hydrangea arborescens</i>	0.5	0.01	1	2	<i>Chimaphila maculata</i>	0.01	0.01	0.01	1
<i>Vitis</i>	0.5	0.01	1	2	<i>Cladonia</i>	0.01	0.01	0.01	1
<i>Dicranum</i>	0.5	0.5	0.5	2	<i>Dicranella</i>	0.01	0.01	0.01	1
<i>Asplenium platyneuron</i>	0.3	0.01	0.5	2	<i>Dicranella heteromalla</i>	0.01	0.01	0.01	1
<i>Medeola virginiana</i>	0.3	0.01	0.5	2	<i>Dioscorea quaternata</i>	0.01	0.01	0.01	1
<i>Solidago caesia</i>	0.3	0.01	0.5	2	<i>Ganoderma tsugae</i>	0.01	0.01	0.01	1
<i>Umbilicaria mammulata</i>	0.3	0.01	0.5	2	<i>Gaultheria procumbens</i>	0.01	0.01	0.01	1
<i>Acer pensylvanicum</i>	0.01	0.01	0.01	2	<i>Geranium maculatum</i>	0.01	0.01	0.01	1
<i>Carya</i>	0.01	0.01	0.01	2	<i>Goodyera pubescens</i>	0.01	0.01	0.01	1
<i>Ilex montana</i>	0.01	0.01	0.01	2	<i>Hedwigia ciliata</i>	0.01	0.01	0.01	1
<i>Pinus virginiana</i>	20.0	20	20	1	<i>Heuchera</i>	0.01	0.01	0.01	1
<i>Carya alba</i>	7.0	7	7	1	<i>Impatiens</i>	0.01	0.01	0.01	1
<i>Quercus coccinea</i> var. <i>coccinea</i>	5.0	5	5	1	<i>Lycopus uniflorus</i> var. <i>uniflorus</i>	0.01	0.01	0.01	1
<i>Leucobryum albidum</i>	3.0	3	3	1	<i>Mnium hornum</i>	0.01	0.01	0.01	1
<i>Castanea dentata</i>	2.0	2	2	1	<i>Ostrya virginiana</i> var. <i>virginiana</i>	0.01	0.01	0.01	1
<i>Tilia americana</i>	2.0	2	2	1	<i>Panax quinquefolius</i>	0.01	0.01	0.01	1
<i>Plagiomnium ellipticum</i>	1.0	1	1	1	<i>Poa cuspidata</i>	0.01	0.01	0.01	1
<i>Steerecleus serrulatus</i>	1.0	1	1	1	<i>Rhododendron</i>	0.01	0.01	0.01	1
<i>Aralia spinosa</i>	0.5	0.5	0.5	1	<i>Russula</i>	0.01	0.01	0.01	1
<i>Aristolochia macrophylla</i>	0.5	0.5	0.5	1	<i>Sambucus</i>	0.01	0.01	0.01	1
<i>Aulacomnium heterostichum</i>	0.5	0.5	0.5	1	<i>Solidago</i>	0.01	0.01	0.01	1
<i>Clethra acuminata</i>	0.5	0.5	0.5	1	<i>Solidago hispida</i> var. <i>hispida</i>	0.01	0.01	0.01	1
					<i>Thuidium</i>	0.01	0.01	0.01	1
					<i>Tiarella cordifolia</i>	0.01	0.01	0.01	1
					<i>Viburnum prunifolium</i>	0.01	0.01	0.01	1

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<i>Viola rotundifolia</i>	0.01	0.01	0.01	1	<i>Sassafras albidum</i>	0.01	0.01	0.01	3
<i>Xylaria magnoliae</i>	0.01	0.01	0.01	1	<i>Carya glabra</i>	10.5	1	20	2
					<i>Carya ovalis</i>	1.0	0.01	2	2
					<i>Fraxinus americana</i>	0.5	0.01	1	2
					<i>Dennstaedtia punctilobula</i>	0.5	0.5	0.5	2
					<i>Eurybia divaricata</i>	0.3	0.01	0.5	2
					<i>Geranium maculatum</i>	0.3	0.01	0.5	2
					<i>Prenanthes</i>	0.3	0.01	0.5	2
					<i>Vitis</i>	0.3	0.01	0.5	2
					<i>Brachyelytrum erectum</i>	0.01	0.01	0.01	2
					<i>Carex</i>	0.01	0.01	0.01	2
					<i>Carya cordiformis</i>	0.01	0.01	0.01	2
					<i>Chimaphila maculata</i>	0.01	0.01	0.01	2
					<i>Cornus florida</i>	0.01	0.01	0.01	2
					<i>Galium triflorum</i>	0.01	0.01	0.01	2
					<i>Solidago caesia</i>	0.01	0.01	0.01	2
					<i>Vaccinium pallidum</i>	0.01	0.01	0.01	2
					<i>Carya</i>	10.0	10	10	1
					<i>Dicranum fulvum</i>	1.0	1	1	1
					<i>Leucobryum albidum</i>	1.0	1	1	1
					<i>Ostrya virginiana</i> var. <i>virginiana</i>	1.0	1	1	1
					<i>Oxydendrum arboreum</i>	1.0	1	1	1
					<i>Phegopteris hexagonoptera</i>	1.0	1	1	1
					<i>Stellaria pubera</i>	1.0	1	1	1
					<i>Vitis aestivalis</i>	1.0	1	1	1
					<i>Acer pensylvanicum</i>	0.5	0.5	0.5	1
					<i>Galium lanceolatum</i>	0.5	0.5	0.5	1
					<i>Leucobryum</i>	0.5	0.5	0.5	1
					<i>Packera aurea</i>	0.5	0.5	0.5	1
					<i>Polytrichum</i>	0.5	0.5	0.5	1
					<i>Sedum ternatum</i>	0.5	0.5	0.5	1
					<i>Toxicodendron radicans</i>	0.5	0.5	0.5	1
					<i>Aesculus flava</i>	0.01	0.01	0.01	1
					<i>Ageratina altissima</i> var. <i>altissima</i>	0.01	0.01	0.01	1
					<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.01	0.01	0.01	1
					<i>Aristolochia macrophylla</i>	0.01	0.01	0.01	1
					<i>Asimina triloba</i>	0.01	0.01	0.01	1
					<i>Botrychium virginianum</i>	0.01	0.01	0.01	1
					<i>Carex laxiflora</i>	0.01	0.01	0.01	1
					<i>Carex radiata</i>	0.01	0.01	0.01	1
					<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	0.01	0.01	0.01	1
					<i>Cornus alternifolia</i>	0.01	0.01	0.01	1
					<i>Dichanthelium</i>	0.01	0.01	0.01	1
					<i>Epifagus virginiana</i>	0.01	0.01	0.01	1

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<i>Galium circaeazans</i>	0.01	0.01	0.01	1	<i>Nyssa sylvatica</i>	3.5	0.5	10	5
var. <i>hypomalacum</i>					<i>Quercus rubra</i>	1.6	0.01	7	5
<i>Galium latifolium</i>	0.01	0.01	0.01	1	<i>Rosa multiflora</i>	0.8	0.01	2	5
<i>Hydrangea</i>	0.01	0.01	0.01	1	<i>Euonymus americana</i>	0.2	0.01	0.5	5
arborescens					<i>Mitchella repens</i>	0.2	0.01	0.5	5
<i>Hypnum</i>	0.01	0.01	0.01	1	<i>Rubus</i>	0.2	0.01	0.5	5
<i>Lactarius</i>	0.01	0.01	0.01	1	<i>Carpinus caroliniana</i>	20.3	1	40	4
<i>Laportea canadensis</i>	0.01	0.01	0.01	1	ssp. <i>virginiana</i>				
<i>Packera obovata</i>	0.01	0.01	0.01	1	<i>Acer saccharum</i> var.	10.8	1	23	4
<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1	saccharum				
<i>Polygonatum</i>	0.01	0.01	0.01	1	<i>Hypnum imponens</i>	3.9	0.5	5	4
pubescens					<i>Toxicodendron</i>	1.0	0.01	3	4
<i>Prosartes lanuginosa</i>	0.01	0.01	0.01	1	radicans				
<i>Rhododendron</i>	0.01	0.01	0.01	1	<i>Boehmeria cylindrica</i>	1.0	0.5	2	4
maximum					<i>Leersia virginica</i>	1.0	0.5	2	4
<i>Sanicula canadensis</i>	0.01	0.01	0.01	1	<i>Viola</i>	0.4	0.01	1	4
<i>Scutellaria elliptica</i>	0.01	0.01	0.01	1	<i>Sambucus</i>	0.4	0.01	0.5	4
var. <i>hirsuta</i>					<i>Platanus occidentalis</i>	8.3	5	15	3
<i>Smilax tamnoides</i>	0.01	0.01	0.01	1	<i>Ulmus rubra</i>	5.0	0.01	10	3
<i>Solidago bicolor</i>	0.01	0.01	0.01	1	<i>Carya alba</i>	3.3	1	8	3
<i>Verbesina occidentalis</i>	0.01	0.01	0.01	1	<i>Osmunda cinnamomea</i>	2.7	2	4	3
<i>Viola</i> × <i>palmata</i>	0.01	0.01	0.01	1	<i>Viola blanda</i> var.	2.2	0.5	5	3
<i>Viola blanda</i> var.	0.01	0.01	0.01	1	blanda				
blanda					<i>Asimina triloba</i>	2.0	0.01	5	3
<i>Viola hirsutula</i>	0.01	0.01	0.01	1	<i>Onoclea sensibilis</i>	0.7	0.01	2	3
<i>Viola sororia</i>	0.01	0.01	0.01	1	<i>Lycopus virginicus</i>	0.7	0.01	1	3
<i>Viola striata</i>	0.01	0.01	0.01	1	<i>Polygonum</i>	0.7	0.5	1	3

Forest Seep (CEGL007853) - 9 plots.

Species	% Cover			N					
	Mean	Min	Max						
<i>Acer rubrum</i>	12.2	0.5	30	9	<i>Smilax glauca</i>	0.3	0.01	1	3
<i>Thelypteris</i>	9.0	1	25	9	<i>Stellaria pubera</i>	0.3	0.01	1	3
noveboracensis					<i>Carex debilis</i>	0.3	0.01	0.5	3
<i>Thuidium delicatulum</i>	2.9	0.01	10	9	<i>Circaea lutetiana</i> ssp.	0.3	0.01	0.5	3
<i>Polystichum</i>	2.1	0.01	10	9	canadensis				
acrostichoides					<i>Vitis aestivalis</i>	0.3	0.01	0.5	3
<i>Athyrium filix-femina</i>	1.5	0.01	5	9	<i>Arisaema triphyllum</i>	0.2	0.01	0.5	3
var. <i>angustum</i>					ssp. <i>triphyllum</i>				
<i>Liriodendron</i>	33.4	10	60	8	<i>Carex</i>	0.2	0.01	0.5	3
tulipifera					<i>Carex digitalis</i> var.	0.2	0.01	0.5	3
<i>Betula lenta</i>	6.7	0.5	10	8	digitalis				
<i>Ilex opaca</i> var. <i>opaca</i>	2.8	0.01	13	8	<i>Smilax tamnoides</i>	0.2	0.01	0.5	3
<i>Tsuga canadensis</i>	10.7	1	20	6	<i>Ageratina altissima</i>	0.01	0.01	0.01	3
<i>Fraxinus americana</i>	9.2	0.01	40	6	var. <i>altissima</i>				
<i>Fagus grandifolia</i>	6.2	0.01	30	6	<i>Galium triflorum</i>	0.01	0.01	0.01	3
<i>Packera aurea</i>	4.5	0.01	20	6	<i>Dennstaedtia</i>	15.5	1	30	2
<i>Viola cucullata</i>	2.4	0.5	10	6	punctilobula				
<i>Chelone glabra</i>	0.9	0.01	3	6	<i>Diarrhena americana</i>	15.0	0.01	30	2
<i>Plagiomnium ciliare</i>	0.8	0.5	1	6	<i>Lindera benzoin</i> var.	3.8	0.5	7	2
<i>Parthenocissus</i>	0.3	0.01	1	6	pubescens				
quinquefolia					<i>Magnolia tripetala</i>	3.5	1	6	2
<i>Eurybia divaricata</i>	0.2	0.01	0.5	6	<i>Tiarella cordifolia</i>	2.0	1	3	2
<i>Quercus alba</i>	7.4	0.01	20	5	<i>Hamamelis virginiana</i>	1.0	0.01	2	2

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<i>Amphicarpaea bracteata</i>	1.0	1	1	2	<i>Atrichum undulatum</i>	1.0	1	1	1
<i>Pilea pumila</i> var. <i>pumila</i>	1.0	1	1	2	<i>Carex scabrata</i>	1.0	1	1	1
<i>Sedum ternatum</i>	1.0	1	1	2	<i>Deparia acrostichoides</i>	1.0	1	1	1
<i>Glyceria striata</i>	0.8	0.5	1	2	<i>Dryopteris intermedia</i>	1.0	1	1	1
<i>Osmorhiza claytonii</i>	0.8	0.5	1	2	<i>Impatiens</i>	1.0	1	1	1
<i>Rhododendron maximum</i>	0.8	0.5	1	2	<i>Liquidambar styraciflua</i>	1.0	1	1	1
<i>Verbesina alternifolia</i>	0.8	0.5	1	2	<i>Magnolia acuminata</i>	1.0	1	1	1
<i>Atrichum</i>	0.5	0.01	1	2	<i>Viola rotundifolia</i>	1.0	1	1	1
<i>Hydrophyllum canadense</i>	0.5	0.01	1	2	<i>Vitis</i>	1.0	1	1	1
<i>Ilex verticillata</i>	0.5	0.01	1	2	<i>Atrichum angustatum</i>	0.5	0.5	0.5	1
<i>Lindera benzoin</i>	0.5	0.01	1	2	<i>Carex baileyi</i>	0.5	0.5	0.5	1
<i>Symphyotrichum prenanthoides</i>	0.5	0.01	1	2	<i>Carya</i>	0.5	0.5	0.5	1
<i>Anemone quinquefolia</i> var. <i>quinquefolia</i>	0.3	0.01	0.5	2	<i>Cryptotaenia canadensis</i>	0.5	0.5	0.5	1
<i>Carex blanda</i>	0.3	0.01	0.5	2	<i>Danthonia compressa</i>	0.5	0.5	0.5	1
<i>Carex swanii</i>	0.3	0.01	0.5	2	<i>Dicranum</i>	0.5	0.5	0.5	1
<i>Laportea canadensis</i>	0.3	0.01	0.5	2	<i>Dioscorea quaternata</i>	0.5	0.5	0.5	1
<i>Leucobryum</i>	0.3	0.01	0.5	2	<i>Equisetum arvense</i>	0.5	0.5	0.5	1
<i>Platanthera</i>	0.3	0.01	0.5	2	<i>Festuca subverticillata</i>	0.5	0.5	0.5	1
<i>Botrychium virginianum</i>	0.01	0.01	0.01	2	<i>Juncus effusus</i>	0.5	0.5	0.5	1
<i>Carex debilis</i> var. <i>rudgei</i>	0.01	0.01	0.01	2	<i>Kalmia latifolia</i>	0.5	0.5	0.5	1
<i>Carex laxiflora</i>	0.01	0.01	0.01	2	<i>Leucobryum glaucum</i>	0.5	0.5	0.5	1
<i>Collinsonia canadensis</i>	0.01	0.01	0.01	2	<i>Lindera benzoin</i> var. <i>benzoin</i>	0.5	0.5	0.5	1
<i>Dichanthelium clandestinum</i>	0.01	0.01	0.01	2	<i>Oxydendrum arboreum</i>	0.5	0.5	0.5	1
<i>Eupatorium purpureum</i> var. <i>purpureum</i>	0.01	0.01	0.01	2	<i>Polytrichum juniperinum</i>	0.5	0.5	0.5	1
<i>Geranium maculatum</i>	0.01	0.01	0.01	2	<i>Potentilla simplex</i>	0.5	0.5	0.5	1
<i>Juncus</i>	0.01	0.01	0.01	2	<i>Quercus velutina</i>	0.5	0.5	0.5	1
<i>Medeola virginiana</i>	0.01	0.01	0.01	2	<i>Solidago caesia</i>	0.5	0.5	0.5	1
<i>Prenanthes</i>	0.01	0.01	0.01	2	<i>Sphagnum palustre</i>	0.5	0.5	0.5	1
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	0.01	0.01	0.01	2	<i>Viola hastata</i>	0.5	0.5	0.5	1
<i>Sanicula</i>	0.01	0.01	0.01	2	<i>Viola pubescens</i>	0.5	0.5	0.5	1
<i>Smilax</i>	0.01	0.01	0.01	2	<i>Amelanchier arborea</i> var. <i>arborea</i>	0.01	0.01	0.01	1
<i>Solidago rugosa</i>	0.01	0.01	0.01	2	<i>Aulacomnium palustre</i>	0.01	0.01	0.01	1
<i>Fraxinus</i>	30.0	30	30	1	<i>Betula</i>	0.01	0.01	0.01	1
<i>Osmunda claytoniana</i>	30.0	30	30	1	<i>Boletus</i>	0.01	0.01	0.01	1
<i>Betula nigra</i>	15.0	15	15	1	<i>Carex atlantica</i> ssp. <i>atlantica</i>	0.01	0.01	0.01	1
<i>Rhododendron</i>	7.0	7	7	1	<i>Carex festucacea</i>	0.01	0.01	0.01	1
<i>Carex seorsa</i>	5.0	5	5	1	<i>Carex intumescens</i>	0.01	0.01	0.01	1
<i>Paulownia tomentosa</i>	5.0	5	5	1	<i>Carex laxiculmis</i>	0.01	0.01	0.01	1
<i>Bryoandersonia illecebra</i>	3.0	3	3	1	<i>Carex laxiculmis</i> var. <i>laxiculmis</i>	0.01	0.01	0.01	1
<i>Corylus americana</i>	3.0	3	3	1	<i>Carex leptalea</i> ssp. <i>leptalea</i>	0.01	0.01	0.01	1
<i>Scirpus</i>	3.0	3	3	1	<i>Carex prasina</i>	0.01	0.01	0.01	1
<i>Alnus serrulata</i>	1.0	1	1	1	<i>Carex radiata</i>	0.01	0.01	0.01	1
					<i>Carya cordiformis</i>	0.01	0.01	0.01	1
					<i>Clematis virginiana</i>	0.01	0.01	0.01	1
					<i>Cornus</i>	0.01	0.01	0.01	1
					<i>Dichanthelium</i>	0.01	0.01	0.01	1

<i>Dichanthelium laxiflorum</i>	0.01	0.01	0.01	1
<i>Epifagus virginiana</i>	0.01	0.01	0.01	1
<i>Eupatorium perfoliatum</i> var. <i>perfoliatum</i>	0.01	0.01	0.01	1
<i>Galium lanceolatum</i>	0.01	0.01	0.01	1
<i>Geum</i>	0.01	0.01	0.01	1
<i>Geum canadense</i> var. <i>canadense</i>	0.01	0.01	0.01	1
<i>Goodyera pubescens</i>	0.01	0.01	0.01	1
<i>Helianthus</i>	0.01	0.01	0.01	1
<i>Hieracium paniculatum</i>	0.01	0.01	0.01	1
<i>Hypericum punctatum</i>	0.01	0.01	0.01	1
<i>Luzula</i>	0.01	0.01	0.01	1
<i>Lycopus uniflorus</i> var. <i>uniflorus</i>	0.01	0.01	0.01	1
<i>Lysimachia quadrifolia</i>	0.01	0.01	0.01	1
<i>Magnolia fraseri</i>	0.01	0.01	0.01	1
<i>Maianthemum canadense</i>	0.01	0.01	0.01	1
<i>Monotropa uniflora</i>	0.01	0.01	0.01	1
<i>Osmunda regalis</i> var. <i>spectabilis</i>	0.01	0.01	0.01	1
<i>Oxypolis rigidior</i>	0.01	0.01	0.01	1
<i>Panax quinquefolius</i>	0.01	0.01	0.01	1
<i>Pellia epiphylla</i>	0.01	0.01	0.01	1
<i>Phegopteris hexagonoptera</i>	0.01	0.01	0.01	1
<i>Platanthera clavellata</i>	0.01	0.01	0.01	1
<i>Poa</i>	0.01	0.01	0.01	1
<i>Podophyllum peltatum</i>	0.01	0.01	0.01	1
<i>Polygonatum pubescens</i>	0.01	0.01	0.01	1
<i>Prunus serotina</i> var. <i>serotina</i>	0.01	0.01	0.01	1
<i>Ranunculus</i>	0.01	0.01	0.01	1
<i>Ranunculus hispidus</i> var. <i>nitidus</i>	0.01	0.01	0.01	1
<i>Rubus phoenicolasius</i>	0.01	0.01	0.01	1
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	0.01	0.01	0.01	1
<i>Sassafras albidum</i>	0.01	0.01	0.01	1
<i>Scutellaria lateriflora</i> var. <i>lateriflora</i>	0.01	0.01	0.01	1
<i>Thalictrum</i>	0.01	0.01	0.01	1
<i>Vaccinium pallidum</i>	0.01	0.01	0.01	1

Oak / Ericad Forest (CEGL006271) - 10 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Kalmia latifolia</i>	21.6	0.5	50	10
<i>Acer rubrum</i>	9.7	1	20	10
<i>Oxydendrum arboreum</i>	6.0	0.5	20	10
<i>Quercus velutina</i>	17.1	0.5	41	9
<i>Quercus alba</i>	19.8	0.5	35	8
<i>Quercus coccinea</i> var. <i>coccinea</i>	16.6	0.5	40	8
<i>Carya alba</i>	4.9	0.5	20	8
<i>Sassafras albidum</i>	0.8	0.5	1	8
<i>Smilax glauca</i>	0.4	0.01	1	8
<i>Leucobryum glaucum</i>	0.4	0.01	1	8
<i>Quercus prinus</i>	18.4	3	50	7
<i>Vaccinium pallidum</i>	4.4	1	10	7
<i>Nyssa sylvatica</i>	2.1	0.01	5	7
<i>Hamamelis virginiana</i>	1.2	0.01	5	7
<i>Smilax rotundifolia</i>	1.0	0.5	3	7
<i>Amelanchier arborea</i> var. <i>arborea</i>	0.9	0.01	3	7
<i>Liriodendron tulipifera</i>	2.0	0.01	10	6
<i>Thuidium delicatulum</i>	1.2	0.01	5	6
<i>Gaultheria procumbens</i>	0.3	0.01	1	6
<i>Betula lenta</i>	5.0	1	11	5
<i>Tsuga canadensis</i>	3.8	0.01	10	5
<i>Ilex opaca</i> var. <i>opaca</i>	1.8	0.01	7	5
<i>Cornus florida</i>	1.2	0.5	3	5
<i>Parthenocissus quinquefolia</i>	0.5	0.01	1	5
<i>Magnolia fraseri</i>	12.0	3	20	4
<i>Viburnum acerifolium</i>	1.9	0.01	7	4
<i>Polystichum acrostichoides</i>	0.8	0.01	2	4
<i>Coreopsis major</i>	0.4	0.01	1	4
<i>Polytrichum</i>	0.1	0.01	0.5	4
<i>Solidago caesia</i>	0.1	0.01	0.5	4
<i>Carex digitalis</i> var. <i>digitalis</i>	0.01	0.01	0.01	4
<i>Quercus rubra</i>	4.5	0.5	10	3
<i>Rhododendron maximum</i>	3.0	1	5	3
<i>Magnolia acuminata</i>	1.8	0.5	4	3
<i>Dicranum fulvum</i>	0.8	0.5	1	3
<i>Toxicodendron radicans</i>	0.7	0.5	1	3
<i>Dioscorea quaternata</i>	0.5	0.5	0.5	3
<i>Danthonia spicata</i>	0.3	0.011	0.5	3
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.2	0.01	0.5	3

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<i>Hieracium venosum</i>	0.2	0.01	0.5	3	<i>Acer saccharum</i> var.	1.0	1	1	1
<i>Maianthemum</i>	0.2	0.01	0.5	3	<i>saccharum</i>				
<i>racemosum</i> ssp.					<i>Castanea</i>	1.0	1	1	1
<i>racemosum</i>					<i>Epigaea repens</i>	1.0	1	1	1
<i>Chimaphila maculata</i>	0.0	0.01	0.01	3	<i>Punctelia rudecta</i>	1.0	1	1	1
<i>Lysimachia</i>	0.0	0.01	0.01	3	<i>Vitis</i>	1.0	1	1	1
<i>quadrifolia</i>					<i>Acer pensylvanicum</i>	0.5	0.5	0.5	1
<i>Pinus rigida</i>	11.5	8	15	2	<i>Antennaria</i>	0.5	0.5	0.5	1
<i>Gaylussacia baccata</i>	7.8	0.5	15	2	<i>plantaginifolia</i>				
<i>Robinia pseudoacacia</i>	3.5	0.01	7	2	<i>Antennaria solitaria</i>	0.5	0.5	0.5	1
<i>Pinus virginiana</i>	2.0	0.01	4	2	<i>Cornus alternifolia</i>	0.5	0.5	0.5	1
<i>Fagus grandifolia</i>	2.0	1	3	2	<i>Dichanthelium</i>	0.5	0.5	0.5	1
<i>Hypnum imponens</i>	1.8	0.5	3	2	<i>commutatum</i> ssp.				
<i>Flavoparmelia</i>	1.5	1	2	2	<i>ashei</i>				
<i>baltimorensis</i>					<i>Dryopteris intermedia</i>	0.5	0.5	0.5	1
<i>Cladonia furcata</i>	0.8	0.5	1	2	<i>Eupatorium</i>	0.5	0.5	0.5	1
<i>Hedwigia ciliata</i>	0.8	0.5	1	2	<i>godfreyanum</i>				
<i>Dichanthelium</i>	0.5	0.01	1	2	<i>Eurybia divaricata</i>	0.5	0.5	0.5	1
<i>commutatum</i>					<i>Flavoparmelia</i>	0.5	0.5	0.5	1
<i>Rhododendron</i>	0.5	0.01	1	2	<i>caperata</i>				
<i>calendulaceum</i>					<i>Hieracium</i>	0.5	0.5	0.5	1
<i>Potentilla simplex</i>	0.5	0.5	0.5	2	<i>paniculatum</i>				
<i>Umbilicaria</i>	0.5	0.5	0.5	2	<i>Hypnum</i>	0.5	0.5	0.5	1
<i>mammulata</i>					<i>Lactuca</i>	0.5	0.5	0.5	1
<i>Asplenium</i>	0.3	0.01	0.5	2	<i>Lespedeza frutescens</i>	0.5	0.5	0.5	1
<i>platyneuron</i>					<i>Lobelia inflata</i>	0.5	0.5	0.5	1
<i>Carex communis</i> var.	0.3	0.01	0.5	2	<i>Pinus strobus</i>	0.5	0.5	0.5	1
<i>communis</i>					<i>Polytrichum</i>	0.5	0.5	0.5	1
<i>Helianthus</i>	0.3	0.01	0.5	2	<i>juniperinum</i>				
<i>Hypericum</i>	0.3	0.01	0.5	2	<i>Rhus copallinum</i>	0.5	0.5	0.5	1
<i>hypericoides</i> ssp.					<i>Sambucus racemosa</i>	0.5	0.5	0.5	1
<i>multicaule</i>					<i>var. racemosa</i>				
<i>Ilex montana</i>	0.3	0.01	0.5	2	<i>Symphyotrichum</i>	0.5	0.5	0.5	1
<i>Polytrichum ohioense</i>	0.3	0.01	0.5	2	<i>Ageratina altissima</i>	0.01	0.01	0.01	1
<i>Potentilla canadensis</i>	0.3	0.01	0.5	2	<i>var. altissima</i>				
<i>var. canadensis</i>					<i>Aralia racemosa</i> ssp.	0.01	0.01	0.01	1
<i>Rubus</i>	0.3	0.01	0.5	2	<i>racemosa</i>				
<i>Scutellaria elliptica</i>	0.3	0.01	0.5	2	<i>Arisaema triphyllum</i>	0.01	0.01	0.01	1
<i>var. hirsuta</i>					<i>ssp. triphyllum</i>				
<i>Castanea dentata</i>	0.01	0.01	0.01	2	<i>Aureolaria flava</i>	0.01	0.01	0.01	1
<i>Conopholis americana</i>	0.01	0.01	0.01	2	<i>Aureolaria virginica</i>	0.01	0.01	0.01	1
<i>Cypripedium acaule</i>	0.01	0.01	0.01	2	<i>Carex laxiflora</i>	0.01	0.01	0.01	1
<i>Goodyera pubescens</i>	0.01	0.01	0.01	2	<i>Carex pensylvanica</i>	0.01	0.01	0.01	1
<i>Houstonia longifolia</i>	0.01	0.01	0.01	2	<i>Carex virescens</i>	0.01	0.01	0.01	1
<i>Lespedeza</i>	0.01	0.01	0.01	2	<i>Cunila origanoides</i>	0.01	0.01	0.01	1
<i>Smilax tamnoides</i>	0.01	0.01	0.01	2	<i>Danthonia</i>	0.01	0.01	0.01	1
<i>Solidago</i>	0.01	0.01	0.01	2	<i>Danthonia sericea</i>	0.01	0.01	0.01	1
<i>Viola hastata</i>	0.01	0.01	0.01	2	<i>Desmodium</i>	0.01	0.01	0.01	1
<i>Carya glabra</i>	10.01	10	10	1	<i>nudiflorum</i>				
<i>Vaccinium stamineum</i>	10.0	10	10	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Betula alleghaniensis</i>	5.0	5	5	1	<i>Dichanthelium boscii</i>	0.01	0.01	0.01	1
<i>var. alleghaniensis</i>					<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Leucobryum albidum</i>	3.0	3	3	1	<i>laxiflorum</i>				
<i>Dicranum scoparium</i>	2.0	2	2	1	<i>Dicranum</i>	0.01	0.01	0.01	1
<i>Dryopteris marginalis</i>	2.0	2	2	1	<i>Eupatorium</i>	0.01	0.01	0.01	1
					<i>Eurybia</i>	0.01	0.01	0.01	1

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<i>Frullania asagrayana</i>	0.01	0.01	0.01	1	<i>Liriodendron</i>	5.3	0.01	15	4
<i>Galium lanceolatum</i>	0.01	0.01	0.01	1	<i>tulipifera</i>				
<i>Heuchera</i>	0.01	0.01	0.01	1	<i>Rubus</i>	1.5	0.01	5	4
<i>Hydrangea</i>	0.01	0.01	0.01	1	<i>Magnolia fraseri</i>	1.3	0.01	3	4
<i>arborescens</i>					<i>Hamamelis virginiana</i>	1.1	0.01	3	4
<i>Hypoxis hirsuta</i>	0.01	0.01	0.01	1	<i>Ilex opaca</i> var. <i>opaca</i>	1.1	0.01	2	4
<i>Leucobryum</i>	0.01	0.01	0.01	1	<i>Polystichum</i>	1.0	0.01	3	4
<i>Mitchella repens</i>	0.01	0.01	0.01	1	<i>acrostichoides</i>				
<i>Monotropa hypopithys</i>	0.01	0.01	0.01	1	<i>Leucobryum glaucum</i>	0.9	0.01	3	4
<i>Monotropa uniflora</i>	0.01	0.01	0.01	1	<i>Maianthemum</i>	0.1	0.01	0.5	4
<i>Mutinus elegans</i>	0.01	0.01	0.01	1	<i>racemosum</i> ssp.				
<i>Pinus</i>	0.01	0.01	0.01	1	<i>racemosum</i>				
<i>Poa cuspidata</i>	0.01	0.01	0.01	1	<i>Dicranum fulvum</i>	4.2	0.5	10	3
<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1	<i>Carya alba</i>	2.0	0.01	3	3
<i>Porteranthus</i>	0.01	0.01	0.01	1	<i>Dryopteris marginalis</i>	1.2	0.01	3	3
<i>trifoliatus</i>					<i>Dioscorea quaternata</i>	0.3	0.01	0.5	3
<i>Prenanthes</i>	0.01	0.01	0.01	1	<i>Mitchella repens</i>	0.2	0.01	0.5	3
<i>Prunus serotina</i> var.	0.01	0.01	0.01	1	<i>Viburnum acerifolium</i>	0.2	0.01	0.5	3
<i>serotina</i>					<i>Chimaphila maculata</i>	0.01	0.01	0.01	3
<i>Pteridium aquilinum</i>	0.01	0.01	0.01	1	<i>Euonymus americana</i>	0.01	0.01	0.01	3
<i>Ranunculus recurvatus</i>	0.01	0.01	0.01	1	<i>Eurybia divaricata</i>	0.01	0.01	0.01	3
<i>var. recurvatus</i>					<i>Smilax glauca</i>	0.01	0.01	0.01	3
<i>Rhododendron</i>	0.01	0.01	0.01	1	<i>Solidago caesia</i>	0.01	0.01	0.01	3
<i>Sericocarpus</i>	0.01	0.01	0.01	1	<i>Quercus coccinea</i> var.	4.0	1	7	2
<i>asteroides</i>					<i>coccinea</i>				
<i>Solidago bicolor</i>	0.01	0.01	0.01	1	<i>Toxicodendron</i>	3.0	1	5	2
<i>Stellaria pubera</i>	0.01	0.01	0.01	1	<i>radicans</i>				
<i>Viola</i>	0.01	0.01	0.01	1	<i>Vitis</i>	2.0	1	3	2
<i>Viola</i> × <i>palmata</i>	0.01	0.01	0.01	1	<i>Hypnum imponens</i>	1.5	0.01	3	2
					<i>Magnolia tripetala</i>	0.8	0.5	1	2
					<i>Acer pensylvanicum</i>	0.5	0.01	1	2
					<i>Arisaema triphyllum</i>	0.3	0.01	0.5	2
					<i>ssp. triphyllum</i>				
					<i>Carex laxiflora</i>	0.3	0.01	0.5	2
					<i>Conopholis americana</i>	0.3	0.01	0.5	2
					<i>Dryopteris intermedia</i>	0.3	0.01	0.5	2
					<i>Leucobryum albidum</i>	0.3	0.01	0.5	2
					<i>Aralia spinosa</i>	0.01	0.01	0.01	2
					<i>Carex communis</i> var.	0.01	0.01	0.01	2
					<i>communis</i>				
					<i>Dichanthelium</i>	0.01	0.01	0.01	2
					<i>commutatum</i> ssp.				
					<i>commutatum</i>				
					<i>Heuchera americana</i>	0.01	0.01	0.01	2
					<i>var. americana</i>				
					<i>Monotropa uniflora</i>	0.01	0.01	0.01	2
					<i>Viola hastata</i>	0.01	0.01	0.01	2
					<i>Carya ovata</i>	5.0	5	5	1
					<i>Fraxinus</i>	5.0	5	5	1
					<i>pennsylvanica</i>				
					<i>Rubus occidentalis</i>	3.0	3	3	1
					<i>Populus grandidentata</i>	2.0	2	2	1
					<i>Acer saccharum</i> var.	1.0	1	1	1
					<i>saccharum</i>				
					<i>Viola blanda</i> var.	1.0	1	1	1
					<i>blanda</i>				

Oak / Great Laurel Forest (CEGL006286)
- 7 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Rhododendron</i>	30.7	5	90	7
<i>maximum</i>				
<i>Quercus prinus</i>	19.1	5	35	7
<i>Acer rubrum</i>	14.0	3	35	7
<i>Quercus rubra</i>	13.7	0.01	27	6
<i>Betula lenta</i>	10.7	0.01	45	6
<i>Thuidium delicatulum</i>	2.8	0.01	10	6
<i>Smilax rotundifolia</i>	0.5	0.01	1	6
<i>Nyssa sylvatica</i>	6.2	3	10	5
<i>Kalmia latifolia</i>	5.6	1	15	5
<i>Tsuga canadensis</i>	5.3	0.5	10	5
<i>Oxydendrum</i>	3.0	1	8	5
<i>arboreum</i>				
<i>Parthenocissus</i>	2.6	0.01	11	5
<i>quinquefolia</i>				
<i>Sassafras albidum</i>	1.3	0.01	5	5
<i>Fagus grandifolia</i>	9.8	2	20	4
<i>Quercus velutina</i>	9.3	5	15	4
<i>Quercus alba</i>	7.8	0.01	14	4

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<i>Carex</i>	0.5	0.5	0.5	1
<i>Cercis canadensis</i> var. <i>canadensis</i>	0.5	0.5	0.5	1
<i>Cladonia cylindrica</i>	0.5	0.5	0.5	1
<i>Fraxinus americana</i>	0.5	0.5	0.5	1
<i>Leucobryum</i>	0.5	0.5	0.5	1
<i>Ostrya virginiana</i> var. <i>virginiana</i>	0.5	0.5	0.5	1
<i>Polytrichum</i> <i>pallidisetum</i>	0.5	0.5	0.5	1
<i>Ribes</i>	0.5	0.5	0.5	1
<i>Rosa multiflora</i>	0.5	0.5	0.5	1
<i>Rubus odoratus</i> var. <i>odoratus</i>	0.5	0.5	0.5	1
<i>Rubus phoenicolasius</i>	0.5	0.5	0.5	1
<i>Amelanchier arborea</i> var. <i>arborea</i>	0.01	0.01	0.01	1
<i>Asplenium</i> <i>platyneuron</i>	0.01	0.01	0.01	1
<i>Carex blanda</i>	0.01	0.01	0.01	1
<i>Carex willdenowii</i>	0.01	0.01	0.01	1
<i>Carya</i>	0.01	0.01	0.01	1
<i>Dennstaedtia</i> <i>punctilobula</i>	0.01	0.01	0.01	1
<i>Dichanthelium</i> <i>dichotomum</i>	0.01	0.01	0.01	1
<i>Galium circaezans</i>	0.01	0.01	0.01	1
<i>Galium triflorum</i>	0.01	0.01	0.01	1
<i>Gaultheria</i> <i>procumbens</i>	0.01	0.01	0.01	1
<i>Geum canadense</i> var. <i>canadense</i>	0.01	0.01	0.01	1
<i>Helianthus</i>	0.01	0.01	0.01	1
<i>Hexastylis virginica</i>	0.01	0.01	0.01	1
<i>Ilex montana</i>	0.01	0.01	0.01	1
<i>Lysimachia</i> <i>quadrifolia</i>	0.01	0.01	0.01	1
<i>Phryma leptostachya</i>	0.01	0.01	0.01	1
<i>Phytolacca americana</i> var. <i>americana</i>	0.01	0.01	0.01	1
<i>Poa cuspidata</i>	0.01	0.01	0.01	1
<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1
<i>Potentilla simplex</i>	0.01	0.01	0.01	1
<i>Prenanthes</i>	0.01	0.01	0.01	1
<i>Rhododendron</i> <i>catawbiense</i>	0.01	0.01	0.01	1
<i>Solidago arguta</i>	0.01	0.01	0.01	1
<i>Umbilicaria</i> <i>mammulata</i>	0.01	0.01	0.01	1
<i>Viola</i>	0.01	0.01	0.01	1
<i>Viola sagittata</i>	0.01	0.01	0.01	1
<i>Viola sororia</i>	0.01	0.01	0.01	1
<i>Vitis aestivalis</i>	0.01	0.01	0.01	1
<i>Xylaria magnoliae</i>	0.01	0.01	0.01	1

Oak - Hickory Floodplain Forest (CEGL006462) - 1 plot.				
Species	% Cover			N
	Mean	Min	Max	
<i>Thelypteris</i> <i>noveboracensis</i>	40.0	40	40	1
<i>Liriodendron</i> <i>tulipifera</i>	30.0	30	30	1
<i>Quercus alba</i>	30.0	30	30	1
<i>Quercus velutina</i>	25.0	25	25	1
<i>Magnolia tripetala</i>	15.0	15	15	1
<i>Carya alba</i>	12.0	12	12	1
<i>Magnolia acuminata</i>	10.0	10	10	1
<i>Magnolia fraseri</i>	10.0	10	10	1
<i>Sassafras albidum</i>	10.0	10	10	1
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	4.0	4	4	1
<i>Hamamelis virginiana</i>	3.0	3	3	1
<i>Ilex opaca</i> var. <i>opaca</i>	3.0	3	3	1
<i>Chionanthus</i> <i>virginicus</i>	2.0	2	2	1
<i>Hexastylis virginica</i>	2.0	2	2	1
<i>Maianthemum</i> <i>racemosum</i> ssp. <i>racemosum</i>	2.0	2	2	1
<i>Oxydendrum</i> <i>arborescens</i>	2.0	2	2	1
<i>Smilax rotundifolia</i>	2.0	2	2	1
<i>Acer rubrum</i>	1.0	1	1	1
<i>Asimina triloba</i>	1.0	1	1	1
<i>Euonymus americana</i>	1.0	1	1	1
<i>Quercus prinus</i>	1.0	1	1	1
<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.5	0.5	0.5	1
<i>Brachyelytrum</i> <i>erectum</i>	0.5	0.5	0.5	1
<i>Castanea</i>	0.5	0.5	0.5	1
<i>Conopholis americana</i>	0.5	0.5	0.5	1
<i>Crataegus</i>	0.5	0.5	0.5	1
<i>Fraxinus</i>	0.5	0.5	0.5	1
<i>Osmunda cinnamomea</i>	0.5	0.5	0.5	1
<i>Parthenocissus</i> <i>quinquefolia</i>	0.5	0.5	0.5	1
<i>Polygonatum biflorum</i>	0.5	0.5	0.5	1
<i>Rubus</i>	0.5	0.5	0.5	1
<i>Sanguinaria</i> <i>canadensis</i>	0.5	0.5	0.5	1
<i>Vaccinium stamineum</i>	0.5	0.5	0.5	1
<i>Viburnum acerifolium</i>	0.5	0.5	0.5	1
<i>Viola</i>	0.5	0.5	0.5	1
<i>Vitis</i>	0.5	0.5	0.5	1
<i>Xanthorhiza</i> <i>simplicissima</i>	0.5	0.5	0.5	1
<i>Dioscorea quaternata</i>	0.01	0.01	0.01	1
<i>Geranium maculatum</i>	0.01	0.01	0.01	1

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<i>Menispermum canadense</i>	0.01	0.01	0.01	1	<i>Tsuga canadensis</i>	6.0	0.01	10	9
<i>Podophyllum peltatum</i>	0.01	0.01	0.01	1	<i>Fraxinus americana</i>	2.1	0.01	6	9
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	0.01	0.01	0.01	1	<i>Viola hastata</i>	0.2	0.01	1	9
<i>Silene stellata</i>	0.01	0.01	0.01	1	<i>Desmodium nudiflorum</i>	0.2	0.01	0.5	9
<i>Uvularia perfoliata</i>	0.01	0.01	0.01	1	<i>Eurybia divaricata</i>	0.2	0.01	0.5	9
					<i>Potentilla simplex</i>	0.2	0.01	0.5	9
					<i>Carex communis</i> var. <i>communis</i>	0.2	0.01	0.5	9
Oak - Hickory Forest (CEGL007267) - 23 plots.					<i>Quercus coccinea</i> var. <i>coccinea</i>	14.9	5	40	8
					<i>Magnolia fraseri</i>	8.1	0.01	30	8
					<i>Cercis canadensis</i> var. <i>canadensis</i>	1.3	0.01	4	8
					<i>Ageratina altissima</i> var. <i>altissima</i>	0.6	0.01	3	8
					<i>Amelanchier arborea</i> var. <i>arborea</i>	0.2	0.01	0.5	8
					<i>Galium circaeazans</i> var. <i>hypomalacum</i>	0.1	0.01	0.5	8
					<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.1	0.01	0.5	8
					<i>Betula lenta</i>	9.4	0.01	30	7
					<i>Vitis aestivalis</i>	0.9	0.01	3	7
					<i>Phryma leptostachya</i>	0.5	0.01	2	7
					<i>Carex laxiflora</i>	0.3	0.01	0.5	7
					<i>Mitchella repens</i>	0.1	0.01	0.5	7
					<i>Scutellaria elliptica</i> var. <i>hirsuta</i>	0.1	0.01	0.5	7
					<i>Goodyera pubescens</i>	0.01	0.01	0.01	7
					<i>Robinia pseudoacacia</i>	3.1	0.5	5	6
					<i>Dryopteris intermedia</i>	2.7	0.01	10	6
					<i>Euonymus americana</i>	0.4	0.01	1	6
					<i>Viola</i>	0.4	0.01	1	6
					<i>Vitis</i>	0.3	0.01	1	6
					<i>Prenanthes</i>	0.2	0.01	0.5	6
					<i>Carex radiata</i>	0.1	0.01	0.5	6
					<i>Carex swanii</i>	0.1	0.01	0.5	6
					<i>Polygonatum biflorum</i>	0.1	0.01	0.5	6
					<i>Monotropa uniflora</i>	0.01	0.01	0.01	6
					<i>Thelypteris noveboracensis</i>	3.8	0.01	10	5
					<i>Dryopteris marginalis</i>	2.2	0.5	5	5
					<i>Hypnum imponens</i>	1.4	0.5	3	5
					<i>Kalmia latifolia</i>	0.9	0.5	2	5
					<i>Vaccinium stamineum</i>	0.5	0.01	1	5
					<i>Tilia americana</i>	0.4	0.01	2	5
					<i>Carex willdenowii</i>	0.1	0.01	0.5	5
					<i>Chimaphila maculata</i>	0.1	0.01	0.5	5
					<i>Galium triflorum</i>	0.1	0.01	0.5	5
					<i>Carya glabra</i>	10.8	6	20	4
					<i>Rhododendron maximum</i>	4.1	0.5	10	4
					<i>Amphicarpaea bracteata</i>	1.4	0.01	5	4
					<i>Polytrichum ohioense</i>	1.1	0.5	3	4

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<i>Potentilla canadensis</i>	0.6	0.5	1	4	<i>Desmodium</i>	0.8	0.5	1	2
var. <i>canadensis</i>					<i>Phytolacca americana</i>	0.8	0.5	1	2
<i>Brachyelytrum</i>	0.5	0.5	0.5	4	var. <i>americana</i>				
erectum					<i>Actaea</i>	0.5	0.5	0.5	2
<i>Ostrya virginiana</i> var.	0.5	0.5	0.5	4	<i>Antennaria</i>	0.5	0.5	0.5	2
<i>virginiana</i>					plantaginifolia				
<i>Rubus occidentalis</i>	0.5	0.5	0.5	4	<i>Gaultheria</i>	0.5	0.5	0.5	2
<i>Hieracium</i>	0.4	0.01	0.5	4	procumbens				
paniculatum					<i>Viola hirsutula</i>	0.5	0.5	0.5	2
<i>Viola</i> × <i>palmata</i>	0.4	0.01	0.5	4	<i>Ambrosia</i>	0.3	0.01	0.5	2
<i>Dichanthelium</i>	0.3	0.01	0.5	4	artemisiifolia var.				
dichotomum ssp.					elator				
dichotomum					<i>Carex virescens</i>	0.3	0.01	0.5	2
<i>Rosa multiflora</i>	0.3	0.01	0.5	4	<i>Desmodium</i>	0.3	0.01	0.5	2
<i>Viola sagittata</i>	0.3	0.01	0.5	4	paniculatum var.				
<i>Helianthus</i>	0.1	0.01	0.5	4	paniculatum				
<i>Rosa carolina</i> var.	0.1	0.01	0.5	4	<i>Galium circaeans</i>	0.3	0.01	0.5	2
<i>carolina</i>					var. <i>circaeans</i>				
<i>Asplenium</i>	0.01	0.01	0.01	4	<i>Juncus tenuis</i>	0.3	0.01	0.5	2
platyneuron					<i>Laportea canadensis</i>	0.3	0.01	0.5	2
<i>Actaea racemosa</i> var.	2.0	0.01	5	3	<i>Poa</i>	0.3	0.01	0.5	2
<i>racemosa</i>					<i>Poa cuspidata</i>	0.3	0.01	0.5	2
<i>Dicranum fulvum</i>	1.0	0.01	2	3	<i>Polypodium</i>	0.3	0.01	0.5	2
<i>Carpinus caroliniana</i>	0.8	0.5	1	3	virginianum				
ssp. <i>virginiana</i>					<i>Punctelia rudecta</i>	0.3	0.01	0.5	2
<i>Magnolia tripetala</i>	0.7	0.01	1	3	<i>Solidago arguta</i>	0.3	0.01	0.5	2
<i>Danthonia spicata</i>	0.7	0.5	1	3	<i>Solidago curtisii</i>	0.3	0.01	0.5	2
<i>Coreopsis major</i>	0.5	0.5	0.5	3	<i>Viola blanda</i> var.	0.3	0.01	0.5	2
<i>Packera obovata</i>	0.5	0.5	0.5	3	<i>blanda</i>				
<i>Aristolochia</i>	0.3	0.01	1	3	<i>Aristolochia</i>	0.01	0.01	0.01	2
macrophylla					serpentaria				
<i>Acer pensylvanicum</i>	0.3	0.01	0.5	3	<i>Carex</i>	0.01	0.01	0.01	2
<i>Leucobryum albidum</i>	0.3	0.01	0.5	3	<i>Carex blanda</i>	0.01	0.01	0.01	2
<i>Corylus americana</i>	0.2	0.01	0.5	3	<i>Cornus</i>	0.01	0.01	0.01	2
<i>Hieracium venosum</i>	0.2	0.01	0.5	3	<i>Crataegus</i>	0.01	0.01	0.01	2
<i>Hydrangea</i>	0.2	0.01	0.5	3	<i>Dichanthelium</i>	0.01	0.01	0.01	2
arborescens					commutatum ssp.				
<i>Osmorhiza claytonii</i>	0.2	0.01	0.5	3	ashei				
<i>Solidago</i>	0.2	0.01	0.5	3	<i>Dichanthelium</i>	0.01	0.01	0.01	2
<i>Conopholis americana</i>	0.01	0.01	0.01	3	dichotomum				
<i>Cynoglossum</i>	0.01	0.01	0.01	3	<i>Hypericum</i>	0.01	0.01	0.01	2
virginianum var.					hypericoides ssp.				
virginianum					multicaule				
<i>Epifagus virginiana</i>	0.01	0.01	0.01	3	<i>Lysimachia</i>	0.01	0.01	0.01	2
<i>Lobelia inflata</i>	0.01	0.01	0.01	3	quadrifolia				
<i>Paronychia</i>	0.01	0.01	0.01	3	<i>Polygonatum</i>	0.01	0.01	0.01	2
<i>canadensis</i>					pubescens				
<i>Stellaria pubera</i>	0.01	0.01	0.01	3	<i>Porteranthus</i>	0.01	0.01	0.01	2
<i>Flavoparmelia</i>	13.0	1	25	2	trifoliatus				
baltimorensis					<i>Ranunculus recurvatus</i>	0.01	0.01	0.01	2
<i>Rubus odoratus</i> var.	3.0	1	5	2	var. <i>recurvatus</i>				
<i>odoratus</i>					<i>Sedum ternatum</i>	0.01	0.01	0.01	2
<i>Flavoparmelia</i>	2.8	0.5	5	2	<i>Pinus rigida</i>	5.0	5	5	1
caperata					<i>Brachythecium</i>	3.0	3	3	1
<i>Carya ovata</i>	2.5	0.01	5	2	salebrosum				
<i>Aralia spinosa</i>	0.8	0.5	1	2	<i>Carya</i>	3.0	3	3	1

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<i>Dicranum scoparium</i>	3.0	3	3	1	<i>Silene virginica</i> var.	0.5	0.5	0.5	1
<i>Hedwigia ciliata</i>	2.0	2	2	1	<i>virginica</i>				
<i>Juglans nigra</i>	2.0	2	2	1	<i>Solidago arguta</i> var.	0.5	0.5	0.5	1
<i>Rubus flagellaris</i>	2.0	2	2	1	<i>arguta</i>				
<i>Adlumia fungosa</i>	1.0	1	1	1	<i>Solidago flexicaulis</i>	0.5	0.5	0.5	1
<i>Athyrium filix-femina</i>	1.0	1	1	1	<i>Solidago hispida</i> var.	0.5	0.5	0.5	1
var. <i>angustum</i>					<i>hispida</i>				
<i>Castanea dentata</i>	1.0	1	1	1	<i>Ulmus rubra</i>	0.5	0.5	0.5	1
<i>Dennstaedtia</i>	1.0	1	1	1	<i>Ulota hutchinsiae</i>	0.5	0.5	0.5	1
punctilobula					<i>Viola pubescens</i>	0.5	0.5	0.5	1
<i>Elaeagnus umbellata</i>	1.0	1	1	1	<i>Agrimonia striata</i>	0.01	0.01	0.01	1
var. <i>parvifolia</i>					<i>Arabis laevigata</i> var.	0.01	0.01	0.01	1
<i>Packera aurea</i>	1.0	1	1	1	<i>laevigata</i>				
<i>Polymnia canadensis</i>	1.0	1	1	1	<i>Arabis canadensis</i>	0.01	0.01	0.01	1
<i>Umbilicaria</i>	1.0	1	1	1	<i>Arnoglossum</i>	0.01	0.01	0.01	1
mammulata					<i>atriplicifolium</i>				
<i>Agrimonia rotellata</i>	0.5	0.5	0.5	1	<i>Asclepias quadrifolia</i>	0.01	0.01	0.01	1
<i>Agrostis perennans</i>	0.5	0.5	0.5	1	<i>Aureolaria</i>	0.01	0.01	0.01	1
<i>Ailanthus altissima</i>	0.5	0.5	0.5	1	<i>Botrychium dissectum</i>	0.01	0.01	0.01	1
<i>Asclepias tuberosa</i>	0.5	0.5	0.5	1	<i>Botrychium</i>	0.01	0.01	0.01	1
ssp. <i>tuberosa</i>					<i>virginianum</i>				
<i>Betula alleghaniensis</i>	0.5	0.5	0.5	1	<i>Brachythecium</i>	0.01	0.01	0.01	1
var. <i>alleghaniensis</i>					<i>plumosum</i>				
<i>Bromus pubescens</i>	0.5	0.5	0.5	1	<i>Carex laxiculmis</i>	0.01	0.01	0.01	1
<i>Cladonia</i>	0.5	0.5	0.5	1	<i>Carex rosea</i>	0.01	0.01	0.01	1
<i>Cunila origanoides</i>	0.5	0.5	0.5	1	<i>Circaea lutetiana</i> ssp.	0.01	0.01	0.01	1
<i>Dicranum flagellare</i>	0.5	0.5	0.5	1	<i>canadensis</i>				
<i>Dicranum fuscescens</i>	0.5	0.5	0.5	1	<i>Collinsonia</i>	0.01	0.01	0.01	1
<i>Festuca subverticillata</i>	0.5	0.5	0.5	1	<i>canadensis</i>				
<i>Geranium maculatum</i>	0.5	0.5	0.5	1	<i>Crepis pulchra</i>	0.01	0.01	0.01	1
<i>Geum virginianum</i>	0.5	0.5	0.5	1	<i>Desmodium</i>	0.01	0.01	0.01	1
<i>Grimmia pilifera</i>	0.5	0.5	0.5	1	<i>glutinosum</i>				
<i>Helianthus divaricatus</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Hexastylis virginica</i>	0.5	0.5	0.5	1	<i>clandestinum</i>				
<i>Hieracium</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>caespitosum</i>					<i>commutatum</i>				
<i>Impatiens</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Lactuca</i>	0.5	0.5	0.5	1	<i>commutatum</i> ssp.				
<i>Leucobryum</i>	0.5	0.5	0.5	1	<i>commutatum</i>				
<i>Lolium pratense</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Luzula multiflora</i> ssp.	0.5	0.5	0.5	1	<i>latifolium</i>				
<i>multiflora</i> var.					<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>multiflora</i>					<i>laxiflorum</i>				
<i>Medeola virginiana</i>	0.5	0.5	0.5	1	<i>Dichanthelium</i>	0.01	0.01	0.01	1
<i>Monarda clinopodia</i>	0.5	0.5	0.5	1	<i>polyanthes</i>				
<i>Myelochroa aurulenta</i>	0.5	0.5	0.5	1	<i>Dicranella</i>	0.01	0.01	0.01	1
<i>Oxalis grandis</i>	0.5	0.5	0.5	1	<i>Dicranum</i>	0.01	0.01	0.01	1
<i>Poa compressa</i>	0.5	0.5	0.5	1	<i>Eupatorium</i>	0.01	0.01	0.01	1
<i>Prunus pensylvanica</i>	0.5	0.5	0.5	1	<i>godfreyanum</i>				
var. <i>pensylvanica</i>					<i>Eupatorium</i>	0.01	0.01	0.01	1
<i>Rhus copallinum</i>	0.5	0.5	0.5	1	<i>purpureum</i> var.				
<i>Sambucus nigra</i> ssp.	0.5	0.5	0.5	1	<i>purpureum</i>				
<i>canadensis</i>					<i>Galium circaezans</i>	0.01	0.01	0.01	1
<i>Sericocarpus</i>	0.5	0.5	0.5	1	<i>Heuchera americana</i>	0.01	0.01	0.01	1
<i>asteroides</i>					var. <i>americana</i>				
					<i>Houstonia longifolia</i>	0.01	0.01	0.01	1

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<i>Lactuca canadensis</i>	0.01	0.01	0.01	1	Oak - Hickory - Sugar Maple Forest (CEGL007268) - 12 plots.				
<i>Lespedeza procumbens</i>	0.01	0.01	0.01	1					
<i>Luzula</i>	0.01	0.01	0.01	1					
<i>Luzula echinata</i>	0.01	0.01	0.01	1	Species	% Cover			N
<i>Morus rubra</i> var. <i>rubra</i>	0.01	0.01	0.01	1	<i>Acer saccharum</i> var. <i>saccharum</i>	26.6	10	60	12
<i>Oxalis violacea</i>	0.01	0.01	0.01	1	<i>Quercus rubra</i>	17.5	0.5	40	12
<i>Panax quinquefolius</i>	0.01	0.01	0.01	1	<i>Parthenocissus quinquefolia</i>	2.3	0.01	15	12
<i>Pedicularis canadensis</i> ssp. <i>canadensis</i>	0.01	0.01	0.01	1	<i>Dioscorea quaternata</i>	0.4	0.01	0.5	12
<i>Pilea pumila</i> var. <i>pumila</i>	0.01	0.01	0.01	1	<i>Polystichum acrostichoides</i>	3.3	0.5	20	11
<i>Plagiomnium cuspidatum</i>	0.01	0.01	0.01	1	<i>Smilax rotundifolia</i>	0.8	0.01	3	11
<i>Polygonum virginianum</i>	0.01	0.01	0.01	1	<i>Quercus prinus</i>	10.9	0.01	35	10
<i>Polytrichum</i>	0.01	0.01	0.01	1	<i>Eurybia divaricata</i>	0.6	0.01	1	10
<i>Prosartes lanuginosa</i>	0.01	0.01	0.01	1	<i>Toxicodendron radicans</i>	1.7	0.01	6	9
<i>Rhododendron calendulaceum</i>	0.01	0.01	0.01	1	<i>Solidago caesia</i>	0.7	0.01	1	9
<i>Sambucus</i>	0.01	0.01	0.01	1	<i>Galium circaeans</i> var. <i>hypomalacum</i>	0.1	0.01	0.5	9
<i>Sambucus racemosa</i> var. <i>racemosa</i>	0.01	0.01	0.01	1	<i>Quercus alba</i>	15.6	0.01	30	8
<i>Sanicula</i>	0.01	0.01	0.01	1	<i>Fagus grandifolia</i>	7.8	1	15	8
<i>Sanicula canadensis</i>	0.01	0.01	0.01	1	<i>Acer rubrum</i>	6.5	1	11	8
<i>Sanicula canadensis</i> var. <i>grandis</i>	0.01	0.01	0.01	1	<i>Cercis canadensis</i> var. <i>canadensis</i>	2.5	0.5	11	8
<i>Sanicula marilandica</i>	0.01	0.01	0.01	1	<i>Fraxinus americana</i>	2.4	0.01	12	8
<i>Silene</i>	0.01	0.01	0.01	1	<i>Carex laxiflora</i>	0.3	0.01	0.5	8
<i>Smilax tamnoides</i>	0.01	0.01	0.01	1	<i>Nyssa sylvatica</i>	3.0	0.5	10	7
<i>Solidago roanensis</i>	0.01	0.01	0.01	1	<i>Prunus serotina</i> var. <i>serotina</i>	2.7	0.01	10	7
<i>Sphenopholis nitida</i>	0.01	0.01	0.01	1	<i>Ostrya virginiana</i> var. <i>virginiana</i>	1.2	0.01	4	7
<i>Symphyotrichum</i>	0.01	0.01	0.01	1	<i>Cornus florida</i>	1.0	0.01	2	7
<i>Symphyotrichum patens</i> var. <i>patens</i>	0.01	0.01	0.01	1	<i>Viburnum acerifolium</i>	0.6	0.01	2	7
<i>Symphyotrichum undulatum</i>	0.01	0.01	0.01	1	<i>Ageratina altissima</i> var. <i>altissima</i>	0.2	0.01	0.5	7
<i>Verbena urticifolia</i>	0.01	0.01	0.01	1	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.1	0.01	0.5	7
<i>Verbesina alternifolia</i>	0.01	0.01	0.01	1	<i>Carya glabra</i>	20.7	10	30	6
<i>Viola rotundifolia</i>	0.01	0.01	0.01	1	<i>Quercus velutina</i>	17.9	0.01	47	6
<i>Viola sororia</i>	0.01	0.01	0.01	1	<i>Carya alba</i>	9.9	0.5	30	6
<i>Viola triloba</i> var. <i>triloba</i>	0.01	0.01	0.01	1	<i>Sassafras albidum</i>	6.2	0.01	30	6
					<i>Dichanthelium boscii</i>	0.6	0.5	1	6
					<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.4	0.01	1	6
					<i>Brachyelytrum erectum</i>	0.3	0.01	1	6
					<i>Hydrangea arborescens</i>	0.3	0.01	0.5	6
					<i>Smilax glauca</i>	0.3	0.01	0.5	6
					<i>Carex digitalis</i> var. <i>digitalis</i>	0.2	0.01	0.5	6
					<i>Desmodium nudiflorum</i>	0.2	0.01	0.5	6

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<i>Scutellaria elliptica</i> var. <i>hirsuta</i>	0.1	0.01	0.5	6	<i>Aristolochia</i> <i>serpentaria</i>	0.5	0.5	0.5	2
<i>Thuidium delicatulum</i>	3.4	0.5	8	5	<i>Potentilla canadensis</i> var. <i>canadensis</i>	0.5	0.5	0.5	2
<i>Sedum ternatum</i>	2.4	0.01	10	5	<i>Symphyotrichum</i>	0.5	0.5	0.5	2
<i>Tilia americana</i>	1.6	0.01	5	5	<i>Ulmus rubra</i>	0.5	0.5	0.5	2
<i>Vitis aestivalis</i>	0.7	0.01	1	5	<i>Aristolochia</i> <i>macrophylla</i>	0.3	0.01	0.5	2
<i>Tsuga canadensis</i>	0.7	0.5	1	5	<i>Carex communis</i> var. <i>communis</i>	0.3	0.01	0.5	2
<i>Poa cuspidata</i>	0.4	0.01	1	5	<i>Collinsonia</i> <i>canadensis</i>	0.3	0.01	0.5	2
<i>Rubus</i>	0.3	0.01	0.5	5	<i>Conopholis americana</i>	0.3	0.01	0.5	2
<i>Euonymus americana</i>	0.2	0.01	0.5	5	<i>Galium circaeans</i>	0.3	0.01	0.5	2
<i>Geranium maculatum</i>	0.2	0.01	0.5	5	<i>Helianthus</i>	0.3	0.01	0.5	2
<i>Phryma leptostachya</i>	0.1	0.01	0.5	5	<i>Hieracium venosum</i>	0.3	0.01	0.5	2
<i>Prosartes lanuginosa</i>	0.01	0.01	0.01	5	<i>Leucobryum albidum</i>	0.3	0.01	0.5	2
<i>Liriodendron</i> <i>tulipifera</i>	9.4	0.5	15	4	<i>Phytolacca americana</i> var. <i>americana</i>	0.3	0.01	0.5	2
<i>Carya ovata</i>	5.8	3	10	4	<i>Smilax tamnoides</i>	0.3	0.01	0.5	2
<i>Amelanchier arborea</i> var. <i>arborea</i>	1.1	0.01	2	4	<i>Viola</i>	0.3	0.01	0.5	2
<i>Dryopteris marginalis</i>	0.6	0.01	1	4	<i>Viola triloba</i> var. <i>triloba</i>	0.3	0.01	0.5	2
<i>Antennaria</i> <i>plantaginifolia</i>	0.4	0.01	0.5	4	<i>Carex blanda</i>	0.01	0.01	0.01	2
<i>Magnolia acuminata</i>	0.4	0.01	0.5	4	<i>Carya cordiformis</i>	0.01	0.01	0.01	2
<i>Asclepias quadrifolia</i>	0.3	0.01	0.5	4	<i>Chimaphila maculata</i>	0.01	0.01	0.01	2
<i>Asplenium</i> <i>platyneuron</i>	0.1	0.01	0.5	4	<i>Galium triflorum</i>	0.01	0.01	0.01	2
<i>Stellaria pubera</i>	0.1	0.01	0.5	4	<i>Geum</i>	0.01	0.01	0.01	2
<i>Prenanthes</i>	0.01	0.01	0.01	4	<i>Hieracium</i> <i>paniculatum</i>	0.01	0.01	0.01	2
<i>Betula lenta</i>	10.3	1	25	3	<i>Houstonia longifolia</i>	0.01	0.01	0.01	2
<i>Oxydendrum</i> <i>arborescens</i>	3.7	0.01	10	3	<i>Muhlenbergia</i>	0.01	0.01	0.01	2
<i>Ilex opaca</i> var. <i>opaca</i>	3.3	0.01	7	3	<i>Phegopteris</i> <i>hexagonoptera</i>	0.01	0.01	0.01	2
<i>Acer pensylvanicum</i>	2.7	0.01	6	3	<i>Viola sagittata</i>	0.01	0.01	0.01	2
<i>Hamamelis virginiana</i>	1.0	0.01	2	3	<i>Carya ovalis</i>	15.0	15	15	1
<i>Robinia pseudoacacia</i>	0.7	0.01	1	3	<i>Lindera benzoin</i>	13.0	13	13	1
<i>Amphicarpaea</i> <i>bracteata</i>	0.3	0.01	0.5	3	<i>Juglans nigra</i>	5.0	5	5	1
<i>Bromus pubescens</i>	0.3	0.01	0.5	3	<i>Platanus occidentalis</i>	5.0	5	5	1
<i>Cunila origanoides</i>	0.3	0.01	0.5	3	<i>Brachythecium laetum</i>	3.0	3	3	1
<i>Solidago curtisii</i>	0.3	0.01	0.5	3	<i>Viola rotundifolia</i>	3.0	3	3	1
<i>Actaea</i>	0.2	0.01	0.5	3	<i>Dicranum fulvum</i>	2.0	2	2	1
<i>Botrychium</i> <i>virginianum</i>	0.2	0.01	0.5	3	<i>Dicranum scoparium</i>	2.0	2	2	1
<i>Laportea canadensis</i>	0.2	0.01	0.5	3	<i>Aesculus flava</i>	1.0	1	1	1
<i>Rosa carolina</i> var. <i>carolina</i>	0.2	0.01	0.5	3	<i>Castanea dentata</i>	1.0	1	1	1
<i>Galium lanceolatum</i>	0.01	0.01	0.01	3	<i>Elymus hystrix</i> var. <i>hystrix</i>	1.0	1	1	1
<i>Goodyera pubescens</i>	0.01	0.01	0.01	3	<i>Viola rostrata</i>	1.0	1	1	1
<i>Helianthus divaricatus</i>	0.01	0.01	0.01	3	<i>Vitis</i>	1.0	1	1	1
<i>Diarrhena americana</i>	35.5	1	70	2	<i>Actaea racemosa</i> var. <i>racemosa</i>	0.5	0.5	0.5	1
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	8.0	5	11	2	<i>Adiantum pedatum</i>	0.5	0.5	0.5	1
<i>Magnolia fraseri</i>	4.5	3	6	2	<i>Cardamine hirsuta</i>	0.5	0.5	0.5	1
<i>Cornus alternifolia</i>	0.5	0.01	1	2	<i>Carex pensylvanica</i>	0.5	0.5	0.5	1
<i>Dryopteris intermedia</i>	0.5	0.01	1	2	<i>Climacium</i> <i>americanum</i>	0.5	0.5	0.5	1
<i>Packera obovata</i>	0.5	0.01	1	2					

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<i>Desmodium glutinosum</i>	0.5	0.5	0.5	1	<i>Heuchera</i>	0.01	0.01	0.01	1
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.5	0.5	0.5	1	<i>Heuchera americana</i> var. <i>americana</i>	0.01	0.01	0.01	1
<i>Gaultheria procumbens</i>	0.5	0.5	0.5	1	<i>Hydrastis canadensis</i>	0.01	0.01	0.01	1
<i>Hypnum imponens</i>	0.5	0.5	0.5	1	<i>Hypericum punctatum</i>	0.01	0.01	0.01	1
<i>Kalmia latifolia</i>	0.5	0.5	0.5	1	<i>Lactuca</i>	0.01	0.01	0.01	1
<i>Leucobryum glaucum</i>	0.5	0.5	0.5	1	<i>Lindera benzoin</i> var. <i>pubescens</i>	0.01	0.01	0.01	1
<i>Pilea pumila</i> var. <i>pumila</i>	0.5	0.5	0.5	1	<i>Luzula</i>	0.01	0.01	0.01	1
<i>Poa</i>	0.5	0.5	0.5	1	<i>Medeola virginiana</i>	0.01	0.01	0.01	1
<i>Poa compressa</i>	0.5	0.5	0.5	1	<i>Mitchella repens</i>	0.01	0.01	0.01	1
<i>Polygonatum pubescens</i>	0.5	0.5	0.5	1	<i>Monarda</i>	0.01	0.01	0.01	1
<i>Polygonum</i>	0.5	0.5	0.5	1	<i>Morus rubra</i> var. <i>rubra</i>	0.01	0.01	0.01	1
<i>Polygonum scandens</i>	0.5	0.5	0.5	1	<i>Osmorhiza claytonii</i>	0.01	0.01	0.01	1
<i>Polygonum virginianum</i>	0.5	0.5	0.5	1	<i>Oxalis grandis</i>	0.01	0.01	0.01	1
<i>Polymnia canadensis</i>	0.5	0.5	0.5	1	<i>Paronychia canadensis</i>	0.01	0.01	0.01	1
<i>Polytrichum</i>	0.5	0.5	0.5	1	<i>Passiflora lutea</i>	0.01	0.01	0.01	1
<i>Sambucus racemosa</i> var. <i>racemosa</i>	0.5	0.5	0.5	1	<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1
<i>Silene virginica</i> var. <i>virginica</i>	0.5	0.5	0.5	1	<i>Polygonum convolvulus</i> var. <i>convolvulus</i>	0.01	0.01	0.01	1
<i>Solidago hispida</i> var. <i>hispida</i>	0.5	0.5	0.5	1	<i>Pyrularia pubera</i>	0.01	0.01	0.01	1
<i>Solidago roanensis</i>	0.5	0.5	0.5	1	<i>Rhododendron maximum</i>	0.01	0.01	0.01	1
<i>Taenidia integerrima</i>	0.5	0.5	0.5	1	<i>Rosa multiflora</i>	0.01	0.01	0.01	1
<i>Thalictrum thalictroides</i>	0.5	0.5	0.5	1	<i>Sanguinaria canadensis</i>	0.01	0.01	0.01	1
<i>Tiarella cordifolia</i>	0.5	0.5	0.5	1	<i>Sanicula</i>	0.01	0.01	0.01	1
<i>Vaccinium pallidum</i>	0.5	0.5	0.5	1	<i>Silene stellata</i>	0.01	0.01	0.01	1
<i>Vaccinium stamineum</i>	0.5	0.5	0.5	1	<i>Solidago</i>	0.01	0.01	0.01	1
<i>Viola striata</i>	0.5	0.5	0.5	1	<i>Solidago arguta</i>	0.01	0.01	0.01	1
<i>Acalypha virginica</i>	0.01	0.01	0.01	1	<i>Symphyotrichum patens</i> var. <i>patens</i>	0.01	0.01	0.01	1
<i>Adiantum pedatum</i>	0.01	0.01	0.01	1	<i>Symphyotrichum undulatum</i>	0.01	0.01	0.01	1
<i>Agrimonia rostellata</i>	0.01	0.01	0.01	1	<i>Thalictrum</i>	0.01	0.01	0.01	1
<i>Agrostis perennans</i>	0.01	0.01	0.01	1	<i>Thelypteris noveboracensis</i>	0.01	0.01	0.01	1
<i>Arabis canadensis</i>	0.01	0.01	0.01	1					
<i>Arabis laevigata</i> var. <i>laevigata</i>	0.01	0.01	0.01	1					
<i>Athyrium filix-femina</i>	0.01	0.01	0.01	1					
<i>Carex</i>	0.01	0.01	0.01	1					
<i>Carex rosea</i>	0.01	0.01	0.01	1					
<i>Caulophyllum thalictroides</i>	0.01	0.01	0.01	1					
<i>Corylus americana</i>	0.01	0.01	0.01	1					
<i>Dichanthelium</i>	0.01	0.01	0.01	1					
<i>Dichanthelium commutatum</i> ssp. <i>ashei</i>	0.01	0.01	0.01	1					
<i>Dichanthelium dichotomum</i>	0.01	0.01	0.01	1					
<i>Eurybia</i>	0.01	0.01	0.01	1					

Riverscour Shrub Prairie (CEGL006623) - 27 plots.									
Species	% Cover			N					
	Mean	Min	Max						
<i>Betula nigra</i>	6.9	0.01	20	25					
<i>Andropogon gerardii</i>	8.7	0.5	30	24					
<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i>	2.5	0.5	8	23					
<i>Packera paupercula</i>	1.5	0.01	5	22					
<i>Physocarpus</i> <i>opulifolius</i> var. <i>opulifolius</i>	1.5	0.01	10	20					
<i>Symphyotrichum laeve</i> var. <i>concinnum</i>	0.9	0.01	3	20					
<i>Ilex verticillata</i>	1.9	0.01	9	19					
<i>Eupatorium fistulosum</i>	0.6	0.01	1	18					
<i>Platanus occidentalis</i>	2.5	0.01	10	16					
<i>Cornus amomum</i>	2.2	0.01	6	16					
<i>Dichanthelium</i> <i>clandestinum</i>	0.4	0.01	2	15					
<i>Ipomoea pandurata</i>	1.4	0.01	3	14					
<i>Rosa carolina</i> var. <i>carolina</i>	0.8	0.01	2	14					
<i>Sorghastrum nutans</i>	4.4	0.01	15	13					
<i>Schizachyrium</i> <i>scoparium</i> var. <i>scoparium</i>	2.2	0.01	5	13					
<i>Euphorbia corollata</i>	0.6	0.01	1	13					
<i>Clematis virginiana</i>	0.5	0.01	1	13					
<i>Physostegia virginiana</i> ssp. <i>virginiana</i>	3.0	0.01	15	12					
<i>Hypericum prolificum</i>	2.1	0.5	10	12					
<i>Osmunda regalis</i> var. <i>spectabilis</i>	0.8	0.01	2	12					
<i>Viola pedata</i>	0.9	0.01	4	11					
<i>Rubus</i>	0.6	0.01	2	11					
<i>Hypoxis hirsuta</i>	0.5	0.01	1	11					
<i>Viola</i>	0.5	0.01	0.5	11					
<i>Panicum virgatum</i>	3.8	0.5	15	10					
<i>Nyssa sylvatica</i>	2.5	0.5	10	10					
<i>Diospyros virginiana</i>	1.8	0.5	5	10					
<i>Alnus serrulata</i>	1.3	0.01	5	10					
<i>Trautvetteria</i> <i>caroliniensis</i> var. <i>caroliniensis</i>	1.3	0.5	4	10					
<i>Rhododendron</i> <i>arborescens</i>	1.1	0.01	5	10					
<i>Potentilla canadensis</i> var. <i>canadensis</i>	0.8	0.5	2	10					
<i>Lysimachia lanceolata</i>	0.7	0.01	1	10					
<i>Dichanthelium</i> <i>dichotomum</i>	0.5	0.01	1	10					
<i>Deschampsia flexuosa</i> var. <i>flexuosa</i>	0.4	0.01	0.5	10					
<i>Justicia americana</i>	1.7	0.01	8	9					
<i>Cephalanthus</i> <i>occidentalis</i>	1.4	0.01	4	9					
<i>Xanthorhiza</i> <i>simplicissima</i>	0.5	0.01	1	9					
<i>Lobelia cardinalis</i>	0.4	0.01	0.5	9					
<i>Salix caroliniana</i>	1.8	0.01	7	8					
<i>Toxicodendron</i> <i>radicans</i>	0.6	0.01	1	8					
<i>Boehmeria cylindrica</i>	0.5	0.01	1	8					
<i>Helenium autumnale</i> var. <i>autumnale</i>	0.4	0.01	0.5	8					
<i>Houstonia serpyllifolia</i>	0.4	0.01	1	8					
<i>Ionactis linariifolius</i>	0.4	0.01	0.5	8					
<i>Tsuga canadensis</i>	2.9	0.5	7	7					
<i>Chionanthus</i> <i>virginicus</i>	0.8	0.5	1	7					
<i>Acer rubrum</i>	0.7	0.5	2	7					
<i>Linum virginianum</i>	0.6	0.5	1	7					
<i>Tephrosia virginiana</i>	0.5	0.01	1	7					
<i>Hypericum mutilum</i>	0.4	0.01	1	7					
<i>Liatris scariosa</i> var. <i>scariosa</i>	0.4	0.01	0.5	7					
<i>Symphyotrichum</i> <i>prenanthoides</i>	0.3	0.01	0.5	7					
<i>Viburnum nudum</i> var. <i>cassinoides</i>	1.1	0.5	3	6					
<i>Smilax glauca</i>	0.7	0.5	1	6					
<i>Zizia aptera</i>	0.7	0.5	1	6					
<i>Dichanthelium</i> <i>dichotomum</i> ssp. <i>dichotomum</i>	0.6	0.01	1	6					
<i>Dichanthelium</i> <i>polyanthes</i>	0.6	0.5	1	6					
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	0.5	0.01	1	6					
<i>Coreopsis tripteris</i>	0.4	0.01	1	6					
<i>Lespedeza cuneata</i>	0.4	0.01	0.5	6					
<i>Viola cucullata</i>	0.3	0.01	1	6					
<i>Polystichum</i> <i>acrostichoides</i>	0.3	0.01	0.5	6					
<i>Juniperus virginiana</i> var. <i>virginiana</i>	5.5	0.5	20	5					
<i>Hamamelis virginiana</i>	1.6	0.5	5	5					
<i>Vaccinium</i> <i>corymbosum</i>	1.2	0.5	3	5					
<i>Rosa multiflora</i>	0.7	0.01	1	5					
<i>Symphyotrichum</i> <i>lanceolatum</i>	0.6	0.01	1	5					
<i>Houstonia caerulea</i>	0.5	0.5	0.5	5					
<i>Smilax herbacea</i>	0.5	0.5	0.5	5					
<i>Dichanthelium</i> <i>acuminatum</i> ssp. <i>fasciculatum</i>	0.4	0.01	0.5	5					
<i>Marshallia</i> <i>grandiflora</i>	0.4	0.01	0.5	5					

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<i>Rhynchospora capitellata</i>	0.3	0.01	1	5	<i>Liquidambar styraciflua</i>	5.3	0.5	10	2
<i>Potentilla simplex</i>	0.3	0.01	0.5	5	<i>Kalmia latifolia</i>	2.5	0.01	5	2
<i>Baptisia tinctoria</i>	1.4	0.5	3	4	<i>Lolium arundinaceum</i>	2.5	0.01	5	2
<i>Hypericum hypericoides</i> ssp. <i>multicaule</i>	0.8	0.5	1	4	<i>Ilex opaca</i> var. <i>opaca</i>	2.3	0.5	4	2
<i>Iris</i>	0.8	0.5	1	4	<i>Sematophyllum demissum</i>	1.8	0.5	3	2
<i>Dichanthelium</i>	0.6	0.01	1	4	<i>Campylopus tallulensis</i>	1.0	0.01	2	2
<i>Chrysopsis mariana</i>	0.6	0.5	1	4	<i>Onoclea sensibilis</i>	1.0	0.01	2	2
<i>Solidago rugosa</i>	0.4	0.01	1	4	<i>Fagus grandifolia</i>	0.8	0.5	1	2
<i>Carex torta</i>	0.4	0.01	0.5	4	<i>Mimulus ringens</i> var. <i>ringens</i>	0.8	0.5	1	2
<i>Linum striatum</i>	0.4	0.01	0.5	4	<i>Pinus rigida</i>	0.8	0.5	1	2
<i>Smilax rotundifolia</i>	0.4	0.01	0.5	4	<i>Quercus alba</i>	0.8	0.5	1	2
<i>Spiraea virginiana</i>	4.2	0.5	10	3	<i>Rhododendron periclymenoides</i>	0.8	0.5	1	2
<i>Apocynum cannabinum</i>	3.8	0.5	10	3	<i>Salix nigra</i>	0.8	0.5	1	2
<i>Rhododendron maximum</i>	1.2	0.01	3	3	<i>Elaeagnus umbellata</i> var. <i>parvifolia</i>	0.5	0.01	1	2
<i>Porella pinnata</i>	1.2	0.5	2	3	<i>Agrostis</i>	0.5	0.5	0.5	2
<i>Rubus flagellaris</i>	0.7	0.01	1	3	<i>Bryum</i>	0.5	0.5	0.5	2
<i>Carex pensylvanica</i>	0.7	0.5	1	3	<i>Erigeron pulchellus</i>	0.5	0.5	0.5	2
<i>Hedwigia ciliata</i>	0.7	0.5	1	3	<i>Muhlenbergia tenuiflora</i>	0.5	0.5	0.5	2
<i>Lysimachia quadrifolia</i>	0.7	0.5	1	3	<i>Pinus virginiana</i>	0.5	0.5	0.5	2
<i>Symphyotrichum lateriflorum</i>	0.7	0.5	1	3	<i>Quercus</i>	0.5	0.5	0.5	2
<i>Climacium americanum</i>	0.5	0.01	1	3	<i>Solanum carolinense</i> var. <i>carolinense</i>	0.5	0.5	0.5	2
<i>Eurybia divaricata</i>	0.5	0.01	1	3	<i>Ambrosia artemisiifolia</i> var. <i>elator</i>	0.3	0.01	0.5	2
<i>Carex</i>	0.3	0.01	1	3	<i>Grimmia laevigata</i>	0.3	0.01	0.5	2
<i>Agrostis perennans</i>	0.3	0.01	0.5	3	<i>Hypericum densiflorum</i>	0.3	0.01	0.5	2
<i>Coreopsis major</i>	0.3	0.01	0.5	3	<i>Leersia virginica</i>	0.3	0.01	0.5	2
<i>Euthamia graminifolia</i> var. <i>graminifolia</i>	0.3	0.01	0.5	3	<i>Lindernia dubia</i> var. <i>dubia</i>	0.3	0.01	0.5	2
<i>Pedicularis canadensis</i> ssp. <i>canadensis</i>	0.3	0.01	0.5	3	<i>Eleocharis obtusa</i>	0.01	0.01	0.01	2
<i>Phlox maculata</i> ssp. <i>pyramidalis</i>	0.3	0.01	0.5	3	<i>Eleocharis tenuis</i>	0.01	0.01	0.01	2
<i>Ranunculus hispidus</i> var. <i>nitidus</i>	0.3	0.01	0.5	3	<i>Eupatorium perfoliatum</i> var. <i>perfoliatum</i>	0.01	0.01	0.01	2
<i>Thalictrum</i>	0.3	0.01	0.5	3	<i>Fissidens osmundioides</i>	0.01	0.01	0.01	2
<i>Viola ×primulifolia</i>	0.3	0.01	0.5	3	<i>Ludwigia palustris</i>	0.01	0.01	0.01	2
<i>Leersia oryzoides</i>	0.2	0.01	0.5	3	<i>Muhlenbergia sylvatica</i>	0.01	0.01	0.01	2
<i>Lycopus uniflorus</i> var. <i>uniflorus</i>	0.2	0.01	0.5	3	<i>Penthorum sedoides</i>	0.01	0.01	0.01	2
<i>Packera aurea</i>	0.2	0.01	0.5	3	<i>Plantago rugelii</i> var. <i>rugelii</i>	0.01	0.01	0.01	2
<i>Juncus tenuis</i>	0.01	0.01	0.01	2	<i>Scirpus cyperinus</i>	0.01	0.01	0.01	2
<i>Polygonum caespitosum</i> var. <i>longisetum</i>	0.01	0.01	0.01	3	<i>Scirpus polyphyllus</i>	0.01	0.01	0.01	2
<i>Prunella vulgaris</i>	0.01	0.01	0.01	3	<i>Xanthoparmelia conspersa</i>	10.0	10	10	1
<i>Vaccinium pallidum</i>	0.01	0.01	0.01	3	<i>Dicranum</i>	5.0	5	5	1
<i>Prunus pumila</i> var. <i>susquehanae</i>	25.0	25	25	2					

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<i>Campsis radicans</i>	3.0	3	3	1	<i>Panicum</i>	0.5	0.5	0.5	1
<i>Solidago juncea</i> var. <i>juncea</i>	3.0	3	3	1	<i>dichotomiflorum</i>				
<i>Betula lenta</i>	2.0	2	2	1	<i>ssp.</i>				
<i>Asclepias incarnata</i>	1.0	1	1	1	<i>dichotomiflorum</i>				
<i>ssp. pulchra</i>					<i>Polygala senega</i>	0.5	0.5	0.5	1
<i>Aster</i>	1.0	1	1	1	<i>Potentilla</i>	0.5	0.5	0.5	1
<i>Euonymus americana</i>	1.0	1	1	1	<i>Racomitrium aciculare</i>	0.5	0.5	0.5	1
<i>Phlox maculata</i> ssp.	1.0	1	1	1	<i>Rhododendron</i>	0.5	0.5	0.5	1
<i>maculata</i>					<i>calendulaceum</i>				
<i>Pteridium aquilinum</i>	1.0	1	1	1	<i>Robinia pseudoacacia</i>	0.5	0.5	0.5	1
<i>var. latiusculum</i>					<i>Schoenoplectus</i>	0.5	0.5	0.5	1
<i>Salix alba</i>	1.0	1	1	1	<i>tabernaemontani</i>				
<i>Sphagnum lescurii</i>	1.0	1	1	1	<i>Scirpus atrovirens</i>	0.5	0.5	0.5	1
<i>Viburnum acerifolium</i>	1.0	1	1	1	<i>Solidago bicolor</i>	0.5	0.5	0.5	1
<i>Acalypha rhomboidea</i>	0.5	0.5	0.5	1	<i>Thelypteris</i>	0.5	0.5	0.5	1
<i>Amelanchier arborea</i>	0.5	0.5	0.5	1	<i>noveboracensis</i>				
<i>var. arborea</i>					<i>Vernonia</i>	0.5	0.5	0.5	1
<i>Atrichum undulatum</i>	0.5	0.5	0.5	1	<i>Vernonia gigantea</i> ssp.	0.5	0.5	0.5	1
<i>Bidens coronata</i>	0.5	0.5	0.5	1	<i>gigantea</i>				
<i>Bidens frondosa</i>	0.5	0.5	0.5	1	<i>Anthoxanthum</i>	0.01	0.01	0.01	1
<i>Carya alba</i>	0.5	0.5	0.5	1	<i>odoratum</i> ssp.				
<i>Cornus florida</i>	0.5	0.5	0.5	1	<i>odoratum</i>				
<i>Dichanthelium</i>	0.5	0.5	0.5	1	<i>Bidens vulgata</i>	0.01	0.01	0.01	1
<i>acuminatum</i> ssp.					<i>Boykinia aconitifolia</i>	0.01	0.01	0.01	1
<i>implicatum</i>					<i>Brachythecium</i>	0.01	0.01	0.01	1
<i>Dichanthelium</i>	0.5	0.5	0.5	1	<i>rutabulum</i>				
<i>commutatum</i>					<i>Carex lurida</i>	0.01	0.01	0.01	1
<i>Doellingeria</i>	0.5	0.5	0.5	1	<i>Carex swanii</i>	0.01	0.01	0.01	1
<i>umbellata</i> var.					<i>Clethra acuminata</i>	0.01	0.01	0.01	1
<i>umbellata</i>					<i>Cyperus strigosus</i>	0.01	0.01	0.01	1
<i>Entodon seductrix</i>	0.5	0.5	0.5	1	<i>Danthonia compressa</i>	0.01	0.01	0.01	1
<i>Eupatorium</i>	0.5	0.5	0.5	1	<i>Glyceria striata</i>	0.01	0.01	0.01	1
<i>Eupatorium</i>	0.5	0.5	0.5	1	<i>Ipomoea</i>	0.01	0.01	0.01	1
<i>purpureum</i> var.					<i>Juncus acuminatus</i>	0.01	0.01	0.01	1
<i>purpureum</i>					<i>Juncus dudleyi</i>	0.01	0.01	0.01	1
<i>Eurybia</i>	0.5	0.5	0.5	1	<i>Juncus marginatus</i>	0.01	0.01	0.01	1
<i>Fraxinus</i>	0.5	0.5	0.5	1	<i>Krigia biflora</i> var.	0.01	0.01	0.01	1
<i>pennsylvanica</i>					<i>biflora</i>				
<i>Hygrohypnum</i>	0.5	0.5	0.5	1	<i>Lobelia inflata</i>	0.01	0.01	0.01	1
<i>eugyrium</i>					<i>Lyonia ligustrina</i> var.	0.01	0.01	0.01	1
<i>Hypericum perforatum</i>	0.5	0.5	0.5	1	<i>ligustrina</i>				
<i>Hypericum punctatum</i>	0.5	0.5	0.5	1	<i>Lysimachia ciliata</i>	0.01	0.01	0.01	1
<i>Hypnum curvifolium</i>	0.5	0.5	0.5	1	<i>Mimulus alatus</i>	0.01	0.01	0.01	1
<i>Lespedeza</i>	0.5	0.5	0.5	1	<i>Osmunda claytoniana</i>	0.01	0.01	0.01	1
<i>Lonicera morrowii</i>	0.5	0.5	0.5	1	<i>Oxalis stricta</i>	0.01	0.01	0.01	1
<i>Lycopus</i>	0.5	0.5	0.5	1	<i>Oxypolis rigidior</i>	0.01	0.01	0.01	1
<i>Lycopus virginicus</i>	0.5	0.5	0.5	1	<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1
<i>Lysimachia</i>	0.5	0.5	0.5	1	<i>Polygonum</i>	0.01	0.01	0.01	1
<i>nummularia</i>					<i>cuspidatum</i>				
<i>Lysimachia terrestris</i>	0.5	0.5	0.5	1	<i>Prunus</i>	0.01	0.01	0.01	1
<i>Mitchella repens</i>	0.5	0.5	0.5	1	<i>Rorippa palustris</i> ssp.	0.01	0.01	0.01	1
<i>Muhlenbergia</i>	0.5	0.5	0.5	1	<i>palustris</i>				
<i>frondosa</i>					<i>Rumex crispus</i> ssp.	0.01	0.01	0.01	1
<i>Packera obovata</i>	0.5	0.5	0.5	1	<i>crispus</i>				
<i>Panicum</i>	0.5	0.5	0.5	1	<i>Salix sericea</i>	0.01	0.01	0.01	1
					<i>Solidago</i>	0.01	0.01	0.01	1

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<i>Symphyotrichum</i>	0.01	0.01	0.01	1	<i>Thuidium delicatulum</i>	0.01	0.01	0.01	1
<i>Symphyotrichum pilosum</i>	0.01	0.01	0.01	1	<i>Vaccinium pallidum</i>	0.01	0.01	0.01	1
<i>Symphyotrichum racemosum</i>	0.01	0.01	0.01	1	<i>Viburnum acerifolium</i>	0.01	0.01	0.01	1
<i>Thalictrum clavatum</i>	0.01	0.01	0.01	1	<i>Viola hastata</i>	0.01	0.01	0.01	1
<i>Thalictrum revolutum</i>	0.01	0.01	0.01	1	<i>Vitis</i>	0.01	0.01	0.01	1
<i>Tussilago farfara</i>	0.01	0.01	0.01	1					
<i>Vaccinium stamineum</i>	0.01	0.01	0.01	1					
<i>Verbesina alternifolia</i>	0.01	0.01	0.01	1					
Successional Pitch Pine Forest (CEGL006304) - 1 plot.					Successional Tuliptree Forest (CEGL007221) - 8 plots.				
	% Cover					% Cover			
Species	Mean	Min	Max	N	Species	Mean	Min	Max	N
<i>Tsuga canadensis</i>	30.0	30	30	1	<i>Liriodendron tulipifera</i>	47.0	25	85	8
<i>Pinus rigida</i>	23.0	23	23	1	<i>Acer rubrum</i>	12.7	3	30	7
<i>Acer rubrum</i>	12.0	12	12	1	<i>Thuidium delicatulum</i>	3.3	0.01	10	7
<i>Betula lenta</i>	10.0	10	10	1	<i>Quercus rubra</i>	1.8	0.01	10	7
<i>Liriodendron tulipifera</i>	6.0	6	6	1	<i>Parthenocissus quinquefolia</i>	1.0	0.5	3	6
<i>Oxydendrum arboreum</i>	6.0	6	6	1	<i>Polystichum acrostichoides</i>	1.0	0.5	2	6
<i>Quercus coccinea</i> var. <i>coccinea</i>	6.0	6	6	1	<i>Betula lenta</i>	26.8	1	50	5
<i>Quercus alba</i>	4.0	4	4	1	<i>Tsuga canadensis</i>	16.8	0.01	75	5
<i>Cornus florida</i>	2.0	2	2	1	<i>Acer saccharum</i> var. <i>saccharum</i>	9.0	3	14	5
<i>Magnolia acuminata</i>	1.0	1	1	1	<i>Ilex opaca</i> var. <i>opaca</i>	8.7	0.5	35	5
<i>Carya alba</i>	0.5	0.5	0.5	1	<i>Magnolia tripetala</i>	6.4	0.5	25	5
<i>Fagus grandifolia</i>	0.5	0.5	0.5	1	<i>Dryopteris intermedia</i>	4.7	0.01	10	5
<i>Hypnum imponens</i>	0.5	0.5	0.5	1	<i>Tilia americana</i>	1.2	0.01	3	5
<i>Ilex opaca</i> var. <i>opaca</i>	0.5	0.5	0.5	1	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.1	0.01	0.5	5
<i>Leucobryum glaucum</i>	0.5	0.5	0.5	1	<i>Rhododendron maximum</i>	26.0	2	89	4
<i>Magnolia fraseri</i>	0.5	0.5	0.5	1	<i>Oxydendrum arboreum</i>	3.4	0.5	10	4
<i>Smilax glauca</i>	0.5	0.5	0.5	1	<i>Toxicodendron radicans</i>	1.1	0.01	3	4
<i>Smilax rotundifolia</i>	0.5	0.5	0.5	1	<i>Packera aurea</i>	0.8	0.01	1	4
<i>Vaccinium stamineum</i>	0.5	0.5	0.5	1	<i>Prunus serotina</i> var. <i>serotina</i>	0.6	0.01	2	4
<i>Carex digitalis</i> var. <i>digitalis</i>	0.01	0.01	0.01	1	<i>Fagus grandifolia</i>	0.4	0.01	1	4
<i>Carex hirsutella</i>	0.01	0.01	0.01	1	<i>Hamamelis virginiana</i>	0.3	0.01	1	4
<i>Chimaphila maculata</i>	0.01	0.01	0.01	1	<i>Euonymus americana</i>	0.1	0.01	0.5	4
<i>Cypripedium acaule</i>	0.01	0.01	0.01	1	<i>Quercus alba</i>	0.01	0.01	0.01	4
<i>Euonymus americana</i>	0.01	0.01	0.01	1	<i>Lycopodium digitatum</i>	30.2	0.5	50	3
<i>Goodyera pubescens</i>	0.01	0.01	0.01	1	<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	8.3	0.01	15	3
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.01	0.01	0.01	1	<i>Hypnum imponens</i>	2.5	0.5	4	3
<i>Medeola virginiana</i>	0.01	0.01	0.01	1	<i>Cornus florida</i>	2.3	1	5	3
<i>Mitchella repens</i>	0.01	0.01	0.01	1	<i>Carya cordiformis</i>	1.0	0.01	3	3
<i>Monotropa uniflora</i>	0.01	0.01	0.01	1	<i>Vitis aestivalis</i>	0.8	0.5	1	3
<i>Polystichum acrostichoides</i>	0.01	0.01	0.01	1	<i>Fraxinus americana</i>	0.7	0.01	2	3
<i>Prenanthes</i>	0.01	0.01	0.01	1	<i>Amphicarpaea bracteata</i>	0.5	0.01	1	3
<i>Quercus velutina</i>	0.01	0.01	0.01	1	<i>Rosa multiflora</i>	0.5	0.01	1	3
					<i>Smilax rotundifolia</i>	0.5	0.01	1	3

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<i>Thelypteris noveboracensis</i>	0.5	0.01	1	3	<i>Polygonatum pubescens</i>	0.01	0.01	0.01	2
<i>Eurybia divaricata</i>	0.5	0.5	0.5	3	<i>Quercus prinus</i>	0.01	0.01	0.01	2
<i>Quercus velutina</i>	0.3	0.01	1	3	<i>Rubus</i>	0.01	0.01	0.01	2
<i>Amelanchier arborea</i> var. <i>arborea</i>	0.3	0.01	0.5	3	<i>Xanthorhiza simplicissima</i>	0.01	0.01	0.01	2
<i>Impatiens</i>	0.3	0.01	0.5	3	<i>Meehania cordata</i>	40.0	40	40	1
<i>Viola</i>	0.3	0.01	0.5	3	<i>Duchesnea indica</i>	30.0	30	30	1
<i>Mitchella repens</i>	0.2	0.01	0.5	3	<i>Liquidambar styraciflua</i>	20.0	20	20	1
<i>Polypodium virginianum</i>	0.2	0.01	0.5	3	<i>Clethra acuminata</i>	10.0	10	10	1
<i>Sanicula canadensis</i>	0.01	0.01	0.01	3	<i>Populus grandidentata</i>	10.0	10	10	1
<i>Sassafras albidum</i>	11.0	2	20	2	<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i>	5.0	5	5	1
<i>Lindera benzoin</i> var. <i>pubescens</i>	5.5	1	10	2	<i>Anemone quinquefolia</i> var. <i>quinquefolia</i>	3.0	3	3	1
<i>Ilex montana</i>	2.8	0.5	5	2	<i>Umbilicaria</i>	3.0	3	3	1
<i>Ulmus rubra</i>	2.5	0.01	5	2	<i>Bryoandersonia illecebra</i>	2.0	2	2	1
<i>Dicranum fulvum</i>	2.0	1	3	2	<i>Dicranum scoparium</i>	2.0	2	2	1
<i>Dennstaedtia punctilobula</i>	1.8	0.5	3	2	<i>Loeskeobryum brevirostre</i>	2.0	2	2	1
<i>Osmorhiza claytonii</i>	1.8	0.5	3	2	<i>Polygonatum biflorum</i>	2.0	2	2	1
<i>Viola blanda</i> var. <i>blanda</i>	1.8	0.5	3	2	<i>Acer negundo</i> var. <i>negundo</i>	1.0	1	1	1
<i>Tiarella cordifolia</i>	1.5	0.01	3	2	<i>Asimina triloba</i>	1.0	1	1	1
<i>Leucobryum glaucum</i>	1.0	1	1	2	<i>Carex plantaginea</i>	1.0	1	1	1
<i>Viola striata</i>	0.8	0.5	1	2	<i>Geum virginianum</i>	1.0	1	1	1
<i>Laportea canadensis</i>	0.5	0.01	1	2	<i>Ostrya virginiana</i> var. <i>virginiana</i>	1.0	1	1	1
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.5	0.01	1	2	<i>Phegopteris hexagonoptera</i>	1.0	1	1	1
<i>Carex</i>	0.5	0.5	0.5	2	<i>Pinus virginiana</i>	1.0	1	1	1
<i>Carex digitalis</i> var. <i>digitalis</i>	0.5	0.5	0.5	2	<i>Plagiomnium ciliare</i>	1.0	1	1	1
<i>Smilax glauca</i>	0.5	0.5	0.5	2	<i>Podophyllum peltatum</i>	1.0	1	1	1
<i>Viola sororia</i>	0.5	0.5	0.5	2	<i>Potentilla canadensis</i> var. <i>canadensis</i>	1.0	1	1	1
<i>Carex swanii</i>	0.3	0.01	0.5	2	<i>Acer nigrum</i>	0.5	0.5	0.5	1
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	0.3	0.01	0.5	2	<i>Aesculus flava</i>	0.5	0.5	0.5	1
<i>Dryopteris marginalis</i>	0.3	0.01	0.5	2	<i>Anemone lancifolia</i>	0.5	0.5	0.5	1
<i>Galium triflorum</i>	0.3	0.01	0.5	2	<i>Carex amphibola</i>	0.5	0.5	0.5	1
<i>Polygonum virginianum</i>	0.3	0.01	0.5	2	<i>Delphinium tricornes</i>	0.5	0.5	0.5	1
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	0.3	0.01	0.5	2	<i>Deparia acrostichoides</i>	0.5	0.5	0.5	1
<i>Smilax tamnoides</i>	0.3	0.01	0.5	2	<i>Desmodium rotundifolium</i>	0.5	0.5	0.5	1
<i>Vitis</i>	0.3	0.01	0.5	2	<i>Dichanthelium boscii</i>	0.5	0.5	0.5	1
<i>Actaea racemosa</i> var. <i>racemosa</i>	0.01	0.01	0.01	2	<i>Dicranum</i>	0.5	0.5	0.5	1
<i>Ageratina altissima</i> var. <i>altissima</i>	0.01	0.01	0.01	2	<i>Diplazium pycnocarpon</i>	0.5	0.5	0.5	1
<i>Agrimonia</i>	0.01	0.01	0.01	2	<i>Festuca subverticillata</i>	0.5	0.5	0.5	1
<i>Asplenium platyneuron</i>	0.01	0.01	0.01	2	<i>Heuchera villosa</i> var. <i>villosa</i>	0.5	0.5	0.5	1
<i>Goodyera pubescens</i>	0.01	0.01	0.01	2	<i>Hexastylis virginica</i>	0.5	0.5	0.5	1
<i>Pilea pumila</i> var. <i>pumila</i>	0.01	0.01	0.01	2	<i>Kalmia latifolia</i>	0.5	0.5	0.5	1

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<i>Lophocolea heterophylla</i>	0.5	0.5	0.5	1	<i>Geum</i>	0.01	0.01	0.01	1
<i>Luzula multiflora</i> ssp. <i>multiflora</i> var. <i>multiflora</i>	0.5	0.5	0.5	1	<i>Glechoma hederacea</i>	0.01	0.01	0.01	1
<i>Magnolia acuminata</i>	0.5	0.5	0.5	1	<i>Hydrangea arborescens</i>	0.01	0.01	0.01	1
<i>Magnolia fraseri</i>	0.5	0.5	0.5	1	<i>Hydrophyllum canadense</i>	0.01	0.01	0.01	1
<i>Nyssa sylvatica</i>	0.5	0.5	0.5	1	<i>Juniperus virginiana</i> var. <i>virginiana</i>	0.01	0.01	0.01	1
<i>Polytrichum</i>	0.5	0.5	0.5	1	<i>Leucobryum albidum</i>	0.01	0.01	0.01	1
<i>Rubus allegheniensis</i>	0.5	0.5	0.5	1	<i>Lobelia inflata</i>	0.01	0.01	0.01	1
<i>Solidago flexicaulis</i>	0.5	0.5	0.5	1	<i>Lonicera japonica</i>	0.01	0.01	0.01	1
<i>Stellaria pubera</i>	0.5	0.5	0.5	1	<i>Monotropa uniflora</i>	0.01	0.01	0.01	1
<i>Symphytotrichum puniceum</i> var. <i>puniceum</i>	0.5	0.5	0.5	1	<i>Nowellia curvifolia</i>	0.01	0.01	0.01	1
<i>Trillium erectum</i>	0.5	0.5	0.5	1	<i>Phryma leptostachya</i>	0.01	0.01	0.01	1
<i>Viola canadensis</i>	0.5	0.5	0.5	1	<i>Potentilla simplex</i>	0.01	0.01	0.01	1
<i>Viola sagittata</i>	0.5	0.5	0.5	1	<i>Pyrularia pubera</i>	0.01	0.01	0.01	1
<i>Asarum canadense</i>	0.01	0.01	0.01	1	<i>Ranunculus recurvatus</i> var. <i>recurvatus</i>	0.01	0.01	0.01	1
<i>Bazzania trilobata</i>	0.01	0.01	0.01	1	<i>Rubus odoratus</i> var. <i>odoratus</i>	0.01	0.01	0.01	1
<i>Botrychium virginianum</i>	0.01	0.01	0.01	1	<i>Salvia lyrata</i>	0.01	0.01	0.01	1
<i>Brachyelytrum erectum</i>	0.01	0.01	0.01	1	<i>Sambucus nigra</i> ssp. <i>canadensis</i>	0.01	0.01	0.01	1
<i>Campsis radicans</i>	0.01	0.01	0.01	1	<i>Sanguinaria canadensis</i>	0.01	0.01	0.01	1
<i>Cardamine concatenata</i>	0.01	0.01	0.01	1	<i>Smilax ecirrata</i>	0.01	0.01	0.01	1
<i>Cardamine diphylla</i>	0.01	0.01	0.01	1	<i>Solidago</i>	0.01	0.01	0.01	1
<i>Carex blanda</i>	0.01	0.01	0.01	1	<i>Solidago caesia</i>	0.01	0.01	0.01	1
<i>Carex gracillima</i>	0.01	0.01	0.01	1	<i>Stylophorum diphyllum</i>	0.01	0.01	0.01	1
<i>Carex jamesii</i>	0.01	0.01	0.01	1	<i>Symphytotrichum</i>	0.01	0.01	0.01	1
<i>Carex gracilescens</i>	0.01	0.01	0.01	1	<i>Viburnum acerifolium</i>	0.01	0.01	0.01	1
<i>Carya alba</i>	0.01	0.01	0.01	1	Successional Virginia Pine Forest (CEGL002591) - 3 plots.				
<i>Cercis canadensis</i> var. <i>canadensis</i>	0.01	0.01	0.01	1					
<i>Cinna arundinacea</i>	0.01	0.01	0.01	1					
<i>Cladonia</i>	0.01	0.01	0.01	1					
<i>Corylus americana</i>	0.01	0.01	0.01	1					
<i>Cryptotaenia canadensis</i>	0.01	0.01	0.01	1					
<i>Cymophyllum fraserianus</i>	0.01	0.01	0.01	1					
<i>Desmodium paniculatum</i> var. <i>paniculatum</i>	0.01	0.01	0.01	1					
<i>Dicentra canadensis</i>	0.01	0.01	0.01	1					
<i>Dichanthelium clandestinum</i>	0.01	0.01	0.01	1					
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.01	0.01	0.01	1					
<i>Dioscorea</i>	0.01	0.01	0.01	1					
<i>Eurhynchium hians</i>	0.01	0.01	0.01	1					
<i>Fissidens dubius</i>	0.01	0.01	0.01	1					
<i>Galium circaeans</i> var. <i>hypomalacum</i>	0.01	0.01	0.01	1					

Successional Virginia Pine Forest
(CEGL002591) - 3 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Pinus virginiana</i>	53.3	30	95	3
<i>Acer rubrum</i>	2.2	0.5	5	3
<i>Fagus grandifolia</i>	1.0	0.01	3	3
<i>Ilex opaca</i> var. <i>opaca</i>	0.5	0.01	1	3
<i>Smilax glauca</i>	0.01	0.01	0.01	3
<i>Tsuga canadensis</i>	75.0	70	80	2
<i>Liriodendron tulipifera</i>	6.5	3	10	2
<i>Oxydendrum arboreum</i>	4.0	3	5	2
<i>Quercus alba</i>	3.5	0.01	7	2
<i>Betula lenta</i>	2.0	1	3	2
<i>Quercus rubra</i>	1.5	0.01	3	2
<i>Lycopodium digitatum</i>	0.8	0.5	1	2
<i>Leucobryum glaucum</i>	0.5	0.01	1	2
<i>Sassafras albidum</i>	0.3	0.01	0.5	2
<i>Nyssa sylvatica</i>	0.01	0.01	0.01	2

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<i>Smilax rotundifolia</i>	0.01	0.01	0.01	2	<i>Solidago rugosa</i>	0.01	0.01	0.01	1
<i>Dicranum scoparium</i>	40.0	40	40	1	<i>Taraxacum officinale</i>	0.01	0.01	0.01	1
<i>Polytrichum commune</i>	30.0	30	30	1	ssp. <i>officinale</i>				
<i>Prunus serotina</i> var. <i>serotina</i>	5.0	5	5	1	<i>Vaccinium pallidum</i>	0.01	0.01	0.01	1
<i>Cladonia subtenuis</i>	1.0	1	1	1	<i>Veronica chamaedrys</i>	0.01	0.01	0.01	1
<i>Cornus florida</i>	1.0	1	1	1	<i>Viola cucullata</i>	0.01	0.01	0.01	1
<i>Platismatia tuckermanii</i>	1.0	1	1	1					
<i>Sphagnum capillifolium</i> var. <i>capillifolium</i>	1.0	1	1	1	Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) - 17 plots.				
<i>Tuckermannopsis ciliaris</i>	1.0	1	1	1					
<i>Cladonia cristatella</i>	0.5	0.5	0.5	1	% Cover				
<i>Cladonia fimbriata</i>	0.5	0.5	0.5	1	Species	Mean	Min	Max	N
<i>Acer saccharum</i> var. <i>saccharum</i>	0.01	0.01	0.01	1	<i>Acer saccharum</i> var. <i>saccharum</i>	22.1	2	65	17
<i>Achillea millefolium</i> var. <i>occidentalis</i>	0.01	0.01	0.01	1	<i>Polystichum acrostichoides</i>	4.6	0.5	25	17
<i>Amelanchier</i>	0.01	0.01	0.01	1	<i>Quercus rubra</i>	4.3	0.01	15	15
<i>Botrychium virginianum</i>	0.01	0.01	0.01	1	<i>Liriodendron tulipifera</i>	14.1	2	33	14
<i>Chimaphila maculata</i>	0.01	0.01	0.01	1	<i>Laportea canadensis</i>	11.7	0.01	35	14
<i>Cirsium</i>	0.01	0.01	0.01	1	<i>Thuidium delicatulum</i>	10.0	0.5	40	14
<i>Crataegus</i>	0.01	0.01	0.01	1	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.2	0.01	0.5	14
<i>Cypripedium acaule</i>	0.01	0.01	0.01	1	<i>Dryopteris intermedia</i>	10.9	0.01	55	13
<i>Danthonia spicata</i>	0.01	0.01	0.01	1	<i>Dryopteris marginalis</i>	4.7	0.01	40	13
<i>Dichanthelium laxiflorum</i>	0.01	0.01	0.01	1	<i>Acer rubrum</i>	4.0	0.01	12	13
<i>Dichanthelium polyanthes</i>	0.01	0.01	0.01	1	<i>Tilia americana</i>	25.1	0.5	50	12
<i>Euonymus americana</i>	0.01	0.01	0.01	1	<i>Fraxinus americana</i>	2.9	0.01	20	12
<i>Fraxinus americana</i>	0.01	0.01	0.01	1	<i>Parthenocissus quinquefolia</i>	1.2	0.01	8	12
<i>Gaylussacia baccata</i>	0.01	0.01	0.01	1	<i>Tiarella cordifolia</i>	2.1	0.01	10	11
<i>Goodyera pubescens</i>	0.01	0.01	0.01	1	<i>Viola canadensis</i>	0.8	0.01	5	11
<i>Hamamelis virginiana</i>	0.01	0.01	0.01	1	<i>Smilax rotundifolia</i>	0.7	0.01	3	11
<i>Hieracium caespitosum</i>	0.01	0.01	0.01	1	<i>Eurybia divaricata</i>	0.2	0.01	1	11
<i>Hypnum imponens</i>	0.01	0.01	0.01	1	<i>Fagus grandifolia</i>	13.6	2	60	10
<i>Lespedeza cuneata</i>	0.01	0.01	0.01	1	<i>Hamamelis virginiana</i>	1.7	0.5	5	10
<i>Mitchella repens</i>	0.01	0.01	0.01	1	<i>Galium triflorum</i>	0.5	0.01	1	10
<i>Parthenocissus quinquefolia</i>	0.01	0.01	0.01	1	<i>Magnolia acuminata</i>	6.3	0.5	20	9
<i>Polystichum acrostichoides</i>	0.01	0.01	0.01	1	<i>Betula lenta</i>	4.3	0.01	10	9
<i>Potentilla canadensis</i> var. <i>canadensis</i>	0.01	0.01	0.01	1	<i>Asarum canadense</i>	4.1	0.01	15	9
<i>Prunus pensylvanica</i> var. <i>pensylvanica</i>	0.01	0.01	0.01	1	<i>Osmorhiza claytonii</i>	0.5	0.01	1	9
<i>Rosa multiflora</i>	0.01	0.01	0.01	1	<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	0.5	0.01	3	9
<i>Rubus</i>	0.01	0.01	0.01	1	<i>Euonymus americana</i>	0.1	0.01	0.5	9
<i>Rubus flagellaris</i>	0.01	0.01	0.01	1	<i>Tsuga canadensis</i>	6.8	0.5	20	8
<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	0.01	0.01	0.01	1	<i>Carya cordiformis</i>	3.1	0.01	23	8
					<i>Actaea racemosa</i> var. <i>racemosa</i>	1.2	0.01	5	8
					<i>Vitis aestivalis</i>	1.0	0.01	2	8
					<i>Geranium maculatum</i>	0.8	0.01	3	8
					<i>Ageratina altissima</i> var. <i>altissima</i>	0.2	0.01	0.5	8

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<i>Botrychium virginianum</i>	0.1	0.01	0.5	8	<i>Lindera benzoin</i> var. <i>benzoin</i>	1.3	0.5	3	4
<i>Lindera benzoin</i>	3.3	0.01	15	7	<i>Carya alba</i>	1.0	0.01	3	4
<i>Ulmus rubra</i>	2.9	0.01	10	7	<i>Galium circaeans</i>	0.5	0.01	1	4
<i>Toxicodendron radicans</i>	0.6	0.01	2	7	var. <i>hypomalacum</i>				
<i>Smilax tamnoides</i>	0.4	0.01	1	7	<i>Viola sagittata</i>	0.5	0.01	1	4
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	0.4	0.01	1	7	<i>Vitis</i>	0.5	0.01	1	4
<i>Rosa multiflora</i>	0.4	0.01	0.5	7	<i>Dioscorea quaternata</i>	0.4	0.01	1	4
<i>Prosartes lanuginosa</i>	0.1	0.01	0.5	7	<i>Hydrangea arborescens</i>	0.4	0.01	1	4
<i>Sedum ternatum</i>	2.1	0.01	10	6	<i>Viola sororia</i>	0.3	0.01	0.5	4
<i>Carex digitalis</i> var. <i>digitalis</i>	0.4	0.01	2	6	<i>Carex albursina</i>	0.1	0.01	0.5	4
<i>Sanguinaria canadensis</i>	0.3	0.01	1	6	<i>Caulophyllum thalictroides</i>	0.1	0.01	0.5	4
<i>Panax quinquefolius</i>	0.2	0.01	0.5	6	<i>Ranunculus recurvatus</i> var. <i>recurvatus</i>	0.1	0.01	0.5	4
<i>Magnolia fraseri</i>	4.0	1	8	5	<i>Tilia americana</i> var. <i>americana</i>	33.3	30	40	3
<i>Brachythecium laetum</i>	2.7	0.01	5	5	<i>Verbesina alternifolia</i>	3.7	0.01	10	3
<i>Diplazium pycnocarpon</i>	1.2	0.01	5	5	<i>Loeskeobryum brevirostre</i>	3.7	1	5	3
<i>Impatiens</i>	1.0	0.5	2	5	<i>Thelypteris noveboracensis</i>	3.7	0.5	10	3
<i>Pilea pumila</i> var. <i>pumila</i>	0.8	0.01	3	5	<i>Ostrya virginiana</i> var. <i>virginiana</i>	2.2	0.5	5	3
<i>Phegopteris hexagonoptera</i>	0.7	0.01	3	5	<i>Quercus prinus</i>	2.2	0.5	5	3
<i>Acer pensylvanicum</i>	0.7	0.01	1	5	<i>Dicranum fulvum</i>	2.0	0.01	5	3
<i>Stellaria pubera</i>	0.6	0.01	1	5	<i>Viola</i>	1.5	0.5	3	3
<i>Adiantum pedatum</i>	0.5	0.01	2	5	<i>Quercus alba</i>	1.2	0.01	3	3
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	0.5	0.01	1	5	<i>Magnolia tripetala</i>	1.0	0.5	2	3
<i>Brachyelytrum erectum</i>	0.3	0.01	1	5	<i>Carex platyphylla</i>	0.8	0.5	1	3
<i>Solidago flexicaulis</i>	0.3	0.01	1	5	<i>Carex laxiflora</i>	0.7	0.01	1	3
<i>Viburnum acerifolium</i>	0.3	0.01	0.5	5	<i>Prunus serotina</i> var. <i>serotina</i>	0.7	0.01	1	3
<i>Collinsonia canadensis</i>	0.2	0.01	0.5	5	<i>Galium aparine</i>	0.7	0.5	1	3
<i>Aristolochia macrophylla</i>	0.1	0.01	0.5	5	<i>Sambucus racemosa</i> var. <i>racemosa</i>	0.5	0.5	0.5	3
<i>Trillium erectum</i>	0.1	0.01	0.5	5	<i>Hydrophyllum canadense</i>	0.3	0.01	1	3
<i>Polygonatum pubescens</i>	0.01	0.01	0.01	5	<i>Viola striata</i>	0.3	0.01	1	3
<i>Aesculus flava</i>	13.0	0.01	30	4	<i>Deparia acrostichoides</i>	0.3	0.01	0.5	3
<i>Asimina triloba</i>	9.3	0.01	25	4	<i>Mitchella repens</i>	0.3	0.01	0.5	3
<i>Cercis canadensis</i> var. <i>canadensis</i>	6.8	0.5	25	4	<i>Rubus</i>	0.3	0.01	0.5	3
<i>Rhododendron maximum</i>	2.6	0.5	6	4	<i>Asplenium rhizophyllum</i>	0.2	0.01	0.5	3
<i>Amphicarpaea bracteata</i>	2.0	0.01	5	4	<i>Cornus alternifolia</i>	0.2	0.01	0.5	3
<i>Viola hastata</i>	1.5	0.01	5	4	<i>Medeola virginiana</i>	0.2	0.01	0.5	3
<i>Festuca subverticillata</i>	1.5	0.5	3	4	<i>Prenanthes</i>	0.2	0.01	0.5	3
<i>Lindera benzoin</i> var. <i>pubescens</i>	1.5	0.5	4	4	<i>Solidago caesia</i>	0.2	0.01	0.5	3
<i>Anomodon attenuatus</i>	1.4	0.01	3	4	<i>Carex radiata</i>	0.01	0.01	0.01	3
					<i>Scutellaria elliptica</i> var. <i>hirsuta</i>	0.01	0.01	0.01	3
					<i>Hypnum imponens</i>	15.0	0.01	30	2
					<i>Juglans cinerea</i>	3.5	2	5	2

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<i>Aulacomnium heterostichum</i>	3.0	1	5	2	<i>Prunus pensylvanica</i> var. <i>pensylvanica</i>	10.0	10	10	1
<i>Diarrhena americana</i>	3.0	1	5	2	<i>Quercus muehlenbergii</i>	10.0	10	10	1
<i>Viola blanda</i> var. <i>blanda</i>	2.5	0.01	5	2	<i>Staphylea trifolia</i>	6.0	6	6	1
<i>Plagiomnium ciliare</i>	1.5	1	2	2	<i>Carya ovata</i>	5.0	5	5	1
<i>Plagiomnium cuspidatum</i>	1.5	1	2	2	<i>Flavoparmelia baltimorensis</i>	5.0	5	5	1
<i>Climacium americanum</i>	1.0	1	1	2	<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i>	2.0	2	2	1
<i>Rhodobryum ontariense</i>	1.0	1	1	2	<i>Carex amphibola</i>	2.0	2	2	1
<i>Duchesnea indica</i>	0.8	0.5	1	2	<i>Acer nigrum</i>	1.0	1	1	1
<i>Ilex opaca</i> var. <i>opaca</i>	0.5	0.01	1	2	<i>Atrichum undulatum</i>	1.0	1	1	1
<i>Polypodium virginianum</i>	0.5	0.01	1	2	<i>Brachythecium rutabulum</i>	1.0	1	1	1
<i>Sassafras albidum</i>	0.5	0.01	1	2	<i>Hydrastis canadensis</i>	1.0	1	1	1
<i>Cornus florida</i>	0.5	0.5	0.5	2	<i>Platanus occidentalis</i>	1.0	1	1	1
<i>Leucobryum glaucum</i>	0.5	0.5	0.5	2	<i>Polygonum caespitosum</i> var. <i>longisetum</i>	1.0	1	1	1
<i>Podophyllum peltatum</i>	0.5	0.5	0.5	2	<i>Robinia pseudoacacia</i>	1.0	1	1	1
<i>Ranunculus abortivus</i>	0.5	0.5	0.5	2	<i>Rubus occidentalis</i>	1.0	1	1	1
<i>Rubus phoenicolasius</i>	0.5	0.5	0.5	2	<i>Steerecleus serrulatus</i>	1.0	1	1	1
<i>Smilax glauca</i>	0.5	0.5	0.5	2	<i>Stellaria media</i> ssp. <i>pallida</i>	1.0	1	1	1
<i>Arabis laevigata</i> var. <i>laevigata</i>	0.3	0.01	0.5	2	<i>Stylophorum diphyllum</i>	1.0	1	1	1
<i>Cardamine concatenata</i>	0.3	0.01	0.5	2	<i>Trichocolea tomentella</i>	1.0	1	1	1
<i>Carex cumberlandensis</i>	0.3	0.01	0.5	2	<i>Verbesina occidentalis</i>	1.0	1	1	1
<i>Dichanthelium boscii</i>	0.3	0.01	0.5	2	<i>Brachythecium salebrosum</i>	0.5	0.5	0.5	1
<i>Geum virginianum</i>	0.3	0.01	0.5	2	<i>Campanulastrum americanum</i>	0.5	0.5	0.5	1
<i>Microstegium vimineum</i>	0.3	0.01	0.5	2	<i>Cardamine parviflora</i> var. <i>arenicola</i>	0.5	0.5	0.5	1
<i>Phryma leptostachya</i>	0.3	0.01	0.5	2	<i>Carex blanda</i>	0.5	0.5	0.5	1
<i>Poa sylvestris</i>	0.3	0.01	0.5	2	<i>Elymus hystrix</i> var. <i>hystrix</i>	0.5	0.5	0.5	1
<i>Polygonum virginianum</i>	0.3	0.01	0.5	2	<i>Erigeron philadelphicus</i> var. <i>philadelphicus</i>	0.5	0.5	0.5	1
<i>Acer spicatum</i>	0.01	0.01	0.01	2	<i>Geum canadense</i> var. <i>canadense</i>	0.5	0.5	0.5	1
<i>Aplectrum hyemale</i>	0.01	0.01	0.01	2	<i>Hypnum</i>	0.5	0.5	0.5	1
<i>Asplenium platyneuron</i>	0.01	0.01	0.01	2	<i>Mitella diphylla</i>	0.5	0.5	0.5	1
<i>Clematis virginiana</i>	0.01	0.01	0.01	2	<i>Morus rubra</i> var. <i>rubra</i>	0.5	0.5	0.5	1
<i>Conopholis americana</i>	0.01	0.01	0.01	2	<i>Oxalis grandis</i>	0.5	0.5	0.5	1
<i>Epifagus virginiana</i>	0.01	0.01	0.01	2	<i>Polymnia canadensis</i>	0.5	0.5	0.5	1
<i>Hexastylis virginica</i>	0.01	0.01	0.01	2	<i>Rhododendron calendulaceum</i>	0.5	0.5	0.5	1
<i>Menispermum canadense</i>	0.01	0.01	0.01	2	<i>Ribes</i>	0.5	0.5	0.5	1
<i>Mnium</i>	0.01	0.01	0.01	2	<i>Rubus flagellaris</i>	0.5	0.5	0.5	1
<i>Monarda</i>	0.01	0.01	0.01	2	<i>Sanicula</i>	0.5	0.5	0.5	1
<i>Sanicula trifoliata</i>	0.01	0.01	0.01	2	<i>Sanicula canadensis</i>	0.5	0.5	0.5	1
<i>Thalictrum</i>	0.01	0.01	0.01	2					
<i>Viola ×palmata</i>	0.01	0.01	0.01	2					
<i>Tilia americana</i> var. <i>heterophylla</i>	40.0	40	40	1					
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	10.0	10	10	1					

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<i>Smilax herbacea</i>	0.5	0.5	0.5	1
<i>Solidago</i>	0.5	0.5	0.5	1
<i>Ailanthus altissima</i>	0.01	0.01	0.01	1
<i>Athyrium filix-femina</i> var. <i>angustum</i>	0.01	0.01	0.01	1
<i>Brotherella recurvans</i>	0.01	0.01	0.01	1
<i>Cardamine diphylla</i>	0.01	0.01	0.01	1
<i>Cardamine hirsuta</i>	0.01	0.01	0.01	1
<i>Carex</i>	0.01	0.01	0.01	1
<i>Carex aestivalis</i>	0.01	0.01	0.01	1
<i>Carex debilis</i> var. <i>rudgei</i>	0.01	0.01	0.01	1
<i>Carex plantaginea</i>	0.01	0.01	0.01	1
<i>Carex rosea</i>	0.01	0.01	0.01	1
<i>Carex swanii</i>	0.01	0.01	0.01	1
<i>Cryptotaenia</i> <i>canadensis</i>	0.01	0.01	0.01	1
<i>Delphinium tricornis</i>	0.01	0.01	0.01	1
<i>Desmodium</i> <i>glutinosum</i>	0.01	0.01	0.01	1
<i>Desmodium</i> <i>nudiflorum</i>	0.01	0.01	0.01	1
<i>Dicentra</i>	0.01	0.01	0.01	1
<i>Dicentra canadensis</i>	0.01	0.01	0.01	1
<i>Dicranum</i>	0.01	0.01	0.01	1
<i>Dryopteris goldiana</i>	0.01	0.01	0.01	1
<i>Eupatorium</i> <i>purpureum</i> var. <i>purpureum</i>	0.01	0.01	0.01	1
<i>Galium circaeans</i>	0.01	0.01	0.01	1
<i>Galium circaeans</i> var. <i>circaeans</i>	0.01	0.01	0.01	1
<i>Galium lanceolatum</i>	0.01	0.01	0.01	1
<i>Hepatica nobilis</i> var. <i>acuta</i>	0.01	0.01	0.01	1
<i>Hybanthus concolor</i>	0.01	0.01	0.01	1
<i>Impatiens pallida</i>	0.01	0.01	0.01	1
<i>Lamium purpureum</i> var. <i>purpureum</i>	0.01	0.01	0.01	1
<i>Lilium canadense</i>	0.01	0.01	0.01	1
<i>Monotropa uniflora</i>	0.01	0.01	0.01	1
<i>Muhlenbergia</i>	0.01	0.01	0.01	1
<i>Osmunda claytoniana</i>	0.01	0.01	0.01	1
<i>Packera aurea</i>	0.01	0.01	0.01	1
<i>Packera obovata</i>	0.01	0.01	0.01	1
<i>Phytolacca americana</i> var. <i>americana</i>	0.01	0.01	0.01	1
<i>Platanthera</i>	0.01	0.01	0.01	1
<i>Poa alsodes</i>	0.01	0.01	0.01	1
<i>Polygonatum biflorum</i>	0.01	0.01	0.01	1
<i>Ranunculus</i> <i>allegheensis</i>	0.01	0.01	0.01	1
<i>Ribes cynosbati</i>	0.01	0.01	0.01	1
<i>Sanicula canadensis</i> var. <i>grandis</i>	0.01	0.01	0.01	1
<i>Solidago curtisii</i>	0.01	0.01	0.01	1

<i>Streptopus lanceolatus</i>	0.01	0.01	0.01	1
var. <i>roseus</i>				
<i>Thalictrum</i> <i>thalictroides</i>	0.01	0.01	0.01	1
<i>Trillium</i>	0.01	0.01	0.01	1
<i>Xylaria hypoxylon</i>	0.01	0.01	0.01	1

(Virginia, Pitch) Pine Floodplain Forest
(CEGL006624) - 6 plots.

Species	% Cover			N
	Mean	Min	Max	
<i>Nyssa sylvatica</i>	9.9	0.5	45	6
<i>Tsuga canadensis</i>	3.5	0.01	10	6
<i>Ilex opaca</i> var. <i>opaca</i>	3.5	1	6	6
<i>Pinus virginiana</i>	28.2	0.01	45	5
<i>Acer rubrum</i>	10.0	0.5	30	5
<i>Betula nigra</i>	5.4	1	10	5
<i>Liriodendron</i> <i>tulipifera</i>	2.8	0.01	5	5
<i>Quercus alba</i>	1.9	0.01	8	5
<i>Kalmia latifolia</i>	6.6	0.5	12	4
<i>Fagus grandifolia</i>	4.3	1	10	4
<i>Hamamelis virginiana</i>	3.1	0.5	5	4
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	2.5	0.5	6	4
<i>Toxicodendron</i> <i>radicans</i>	1.0	0.01	3	4
<i>Fraxinus</i> <i>pennsylvanica</i>	1.0	0.5	2	4
<i>Xanthorhiza</i> <i>simplicissima</i>	1.0	0.5	2	4
<i>Physocarpus</i> <i>opulifolius</i> var. <i>opulifolius</i>	0.8	0.5	1	4
<i>Euonymus americana</i>	0.6	0.5	1	4
<i>Lysimachia</i> <i>quadrifolia</i>	0.6	0.5	1	4
<i>Potentilla canadensis</i> var. <i>canadensis</i>	0.6	0.5	1	4
<i>Rudbeckia laciniata</i> var. <i>laciniata</i>	0.6	0.5	1	4
<i>Oxydendrum</i> <i>arboreum</i>	10.2	0.5	23	3
<i>Acer saccharum</i> var. <i>saccharum</i>	3.7	0.5	10	3
<i>Juniperus virginiana</i> var. <i>virginiana</i>	3.5	0.5	5	3
<i>Viburnum nudum</i> var. <i>cassinoides</i>	3.0	0.01	5	3
<i>Chionanthus</i> <i>virginicus</i>	2.8	0.5	7	3
<i>Rhododendron</i> <i>maximum</i>	2.0	0.5	5	3

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<i>Vaccinium corymbosum</i>	1.7	1	2	3	<i>Goodyera pubescens</i>	0.5	0.5	0.5	2
<i>Packera paupercula</i>	1.2	0.5	2	3	<i>Iris</i>	0.5	0.5	0.5	2
<i>Ipomoea pandurata</i>	1.0	0.5	2	3	<i>Iris cristata</i>	0.5	0.5	0.5	2
<i>Viburnum acerifolium</i>	1.0	0.5	2	3	<i>Liatris scariosa</i> var.	0.5	0.5	0.5	2
<i>Viola pedata</i>	0.8	0.01	2	3	<i>scariosa</i>				
<i>Vaccinium pallidum</i>	0.8	0.5	1	3	<i>Maianthemum</i>	0.5	0.5	0.5	2
<i>Prunus serotina</i> var.	0.7	0.01	1	3	<i>racemosum</i> ssp.				
<i>serotina</i>					<i>racemosum</i>				
<i>Deschampsia flexuosa</i>	0.7	0.5	1	3	<i>Osmunda regalis</i> var.	0.5	0.5	0.5	2
var. <i>flexuosa</i>					<i>spectabilis</i>				
<i>Elaeagnus umbellata</i>	0.7	0.5	1	3	<i>Quercus</i>	0.5	0.5	0.5	2
var. <i>parvifolia</i>					<i>Smilax glauca</i>	0.5	0.5	0.5	2
<i>Pedicularis</i>	0.7	0.5	1	3	<i>Symphiotrichum</i>	0.5	0.5	0.5	2
<i>canadensis</i> ssp.					<i>lateriflorum</i>				
<i>canadensis</i>					<i>Thalictrum</i>	0.5	0.5	0.5	2
<i>Solidago simplex</i> ssp.	0.7	0.5	1	3	<i>Baptisia tinctoria</i>	0.3	0.01	0.5	2
<i>randii</i> var.					<i>Clematis virginiana</i>	0.3	0.01	0.5	2
<i>racemosa</i>					<i>Cypripedium acaule</i>	0.3	0.01	0.5	2
<i>Vaccinium stamineum</i>	0.7	0.5	1	3	<i>Dichanthelium</i>	0.3	0.01	0.5	2
<i>Mitchella repens</i>	0.5	0.01	1	3	<i>laxiflorum</i>				
<i>Eurybia divaricata</i>	0.5	0.5	0.5	3	<i>Parthenocissus</i>	0.3	0.01	0.5	2
<i>Ilex verticillata</i>	0.5	0.5	0.5	3	<i>quinquefolia</i>				
<i>Euphorbia corollata</i>	0.3	0.01	0.5	3	<i>Zizia aptera</i>	0.3	0.01	0.5	2
<i>Packera aurea</i>	0.3	0.01	0.5	3	<i>Cornus florida</i>	8.0	8	8	1
<i>Quercus rubra</i>	0.2	0.01	0.5	3	<i>Schizachyrium</i>	8.0	8	8	1
<i>Vitis</i>	0.01	0.01	0.01	3	<i>scoparium</i> var.				
<i>Pinus rigida</i>	37.5	35	40	2	<i>scoparium</i>				
<i>Quercus prinus</i>	10.0	5	15	2	<i>Robinia pseudoacacia</i>	6.0	6	6	1
<i>Liquidambar</i>	3.0	1	5	2	<i>Diospyros virginiana</i>	5.0	5	5	1
<i>styraciflua</i>					<i>Alnus serrulata</i>	3.0	3	3	1
<i>Rosa multiflora</i>	2.8	0.5	5	2	<i>Hypnum imponens</i>	3.0	3	3	1
<i>Rhododendron</i>	2.0	1	3	2	<i>Platanus occidentalis</i>	3.0	3	3	1
<i>arborescens</i>					<i>Poa alsodes</i>	3.0	3	3	1
<i>Sorghastrum nutans</i>	2.0	1	3	2	<i>Carya cordiformis</i>	2.0	2	2	1
<i>Carya alba</i>	1.5	0.01	3	2	<i>Leucobryum albidum</i>	2.0	2	2	1
<i>Andropogon gerardii</i>	1.3	0.5	2	2	<i>Lindera benzoin</i>	2.0	2	2	1
<i>Dicranum scoparium</i>	1.3	0.5	2	2	<i>Tephrosia virginiana</i>	2.0	2	2	1
<i>Hypoxis hirsuta</i>	1.3	0.5	2	2	<i>Anemone quinquefolia</i>	1.0	1	1	1
<i>Magnolia tripetala</i>	1.3	0.5	2	2	var. <i>quinquefolia</i>				
<i>Quercus velutina</i>	1.0	0.01	2	2	<i>Anthoxanthum</i>	1.0	1	1	1
<i>Hypericum prolificum</i>	1.0	1	1	2	<i>odoratum</i> ssp.				
<i>Rubus</i>	1.0	1	1	2	<i>odoratum</i>				
<i>Betula lenta</i>	0.8	0.5	1	2	<i>Brachyelytrum</i>	1.0	1	1	1
<i>Cornus amomum</i>	0.8	0.5	1	2	<i>erectum</i>				
<i>Lonicera japonica</i>	0.8	0.5	1	2	<i>Dichanthelium</i>	1.0	1	1	1
<i>Lyonia ligustrina</i> var.	0.8	0.5	1	2	<i>clandestinum</i>				
<i>ligustrina</i>					<i>Gaultheria</i>	1.0	1	1	1
<i>Panicum virgatum</i>	0.8	0.5	1	2	<i>procumbens</i>				
<i>Polystichum</i>	0.8	0.5	1	2	<i>Grimmia pilifera</i>	1.0	1	1	1
<i>acrostichoides</i>					<i>Houstonia serpyllifolia</i>	1.0	1	1	1
<i>Acer pensylvanicum</i>	0.5	0.5	0.5	2	<i>Leucanthemum</i>	1.0	1	1	1
<i>Coreopsis tripteris</i>	0.5	0.5	0.5	2	<i>vulgare</i>				
<i>Erigeron pulchellus</i>	0.5	0.5	0.5	2	<i>Luzula echinata</i>	1.0	1	1	1
<i>Eupatorium fistulosum</i>	0.5	0.5	0.5	2	<i>Rhododendron</i>	1.0	1	1	1
<i>Gaylussacia baccata</i>	0.5	0.5	0.5	2	<i>periclymenoides</i>				
					<i>Salvia lyrata</i>	1.0	1	1	1

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<i>Symphyotrichum patens</i> var. <i>patens</i>	1.0	1	1	1	<i>Solidago bicolor</i>	0.5	0.5	0.5	1
<i>Thalictrum thalictroides</i>	1.0	1	1	1	<i>Solidago curtisii</i>	0.5	0.5	0.5	1
<i>Thelypteris noveboracensis</i>	1.0	1	1	1	<i>Symphyotrichum laeve</i>	0.5	0.5	0.5	1
<i>Viola cucullata</i>	1.0	1	1	1	<i>Trautvetteria caroliniensis</i> var. <i>caroliniensis</i>	0.5	0.5	0.5	1
<i>Ageratina altissima</i> var. <i>altissima</i>	0.5	0.5	0.5	1	<i>Trifolium pratense</i>	0.5	0.5	0.5	1
<i>Agrostis perennans</i>	0.5	0.5	0.5	1	<i>Uvularia puberula</i>	0.5	0.5	0.5	1
<i>Amphicarpaea bracteata</i>	0.5	0.5	0.5	1	<i>Viola</i>	0.5	0.5	0.5	1
<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.5	0.5	0.5	1	<i>Viola sororia</i>	0.5	0.5	0.5	1
<i>Asimina triloba</i>	0.5	0.5	0.5	1	<i>Viola striata</i>	0.5	0.5	0.5	1
<i>Bidens frondosa</i>	0.5	0.5	0.5	1	<i>Zizia trifoliata</i>	0.5	0.5	0.5	1
<i>Bryoandersonia illecebra</i>	0.5	0.5	0.5	1	<i>Achillea millefolium</i> var. <i>occidentalis</i>	0.01	0.01	0.01	1
<i>Carex caroliniana</i>	0.5	0.5	0.5	1	<i>Amelanchier stolonifera</i>	0.01	0.01	0.01	1
<i>Chimaphila maculata</i>	0.5	0.5	0.5	1	<i>Carex</i>	0.01	0.01	0.01	1
<i>Chrysopsis mariana</i>	0.5	0.5	0.5	1	<i>Carex digitalis</i> var. <i>digitalis</i>	0.01	0.01	0.01	1
<i>Cladonia</i>	0.5	0.5	0.5	1	<i>Chelone glabra</i>	0.01	0.01	0.01	1
<i>Dichanthelium dichotomum</i>	0.5	0.5	0.5	1	<i>Collinsonia canadensis</i>	0.01	0.01	0.01	1
<i>Dichanthelium dichotomum</i> ssp. <i>dichotomum</i>	0.5	0.5	0.5	1	<i>Coreopsis major</i>	0.01	0.01	0.01	1
<i>Erigeron</i>	0.5	0.5	0.5	1	<i>Crataegus</i>	0.01	0.01	0.01	1
<i>Erigeron pulchellus</i> var. <i>brauniae</i>	0.5	0.5	0.5	1	<i>Dichanthelium polyanthes</i>	0.01	0.01	0.01	1
<i>Fraxinus</i>	0.5	0.5	0.5	1	<i>Dryopteris marginalis</i>	0.01	0.01	0.01	1
<i>Fraxinus americana</i>	0.5	0.5	0.5	1	<i>Eupatorium rotundifolium</i> var. <i>ovatum</i>	0.01	0.01	0.01	1
<i>Houstonia caerulea</i>	0.5	0.5	0.5	1	<i>Galax urceolata</i>	0.01	0.01	0.01	1
<i>Hypericum hypericoides</i> ssp. <i>multicaule</i>	0.5	0.5	0.5	1	<i>Glechoma hederacea</i>	0.01	0.01	0.01	1
<i>Hypericum mutilum</i>	0.5	0.5	0.5	1	<i>Hexastylis virginica</i>	0.01	0.01	0.01	1
<i>Hypnum</i>	0.5	0.5	0.5	1	<i>Lobelia inflata</i>	0.01	0.01	0.01	1
<i>Ionactis linariifolius</i>	0.5	0.5	0.5	1	<i>Magnolia acuminata</i>	0.01	0.01	0.01	1
<i>Lasallia papulosa</i>	0.5	0.5	0.5	1	<i>Oxalis dillenii</i>	0.01	0.01	0.01	1
<i>Lespedeza cuneata</i>	0.5	0.5	0.5	1	<i>Phlox</i>	0.01	0.01	0.01	1
<i>Leucobryum glaucum</i>	0.5	0.5	0.5	1	<i>Porteranthus trifolius</i>	0.01	0.01	0.01	1
<i>Linum virginianum</i>	0.5	0.5	0.5	1	<i>Scutellaria elliptica</i> var. <i>hirsuta</i>	0.01	0.01	0.01	1
<i>Lonicera morrowii</i>	0.5	0.5	0.5	1	<i>Symphyotrichum</i>	0.01	0.01	0.01	1
<i>Parmotrema hypotropum</i>	0.5	0.5	0.5	1	<i>Symphyotrichum boreale</i>	0.01	0.01	0.01	1
<i>Polygonatum biflorum</i>	0.5	0.5	0.5	1	<i>Symphyotrichum cordifolium</i>	0.01	0.01	0.01	1
<i>Polytrichum</i>	0.5	0.5	0.5	1	<i>Thalictrum clavatum</i>	0.01	0.01	0.01	1
<i>Prenanthes alba</i>	0.5	0.5	0.5	1	<i>Thuidium delicatulum</i>	0.01	0.01	0.01	1
<i>Rubus flagellaris</i>	0.5	0.5	0.5	1	<i>Viola ×primulifolia</i>	0.01	0.01	0.01	1
<i>Rubus phoenicolasius</i>	0.5	0.5	0.5	1	<i>Xanthoparmelia plittii</i>	0.01	0.01	0.01	1
<i>Sericocarpus asteroides</i>	0.5	0.5	0.5	1	<i>Zizia</i>	0.01	0.01	0.01	1
<i>Smilax herbacea</i>	0.5	0.5	0.5	1					
<i>Smilax rotundifolia</i>	0.5	0.5	0.5	1					
<i>Solidago</i>	0.5	0.5	0.5	1					

Yellow Birch Cold Cove Forest (CEGL007861) - 3 plots.								
Species	% Cover			N				
	Mean	Min	Max					
<i>Betula alleghaniensis</i> var. <i>alleghaniensis</i>	44.3	23	60	3	<i>Parthenocissus</i> <i>quinquefolia</i>	1.0	1	1
<i>Tsuga canadensis</i>	13.3	10	15	3	<i>Asarum canadense</i>	0.5	0.5	0.5
<i>Betula lenta</i>	9.7	3	15	3	<i>Athyrium filix-femina</i> ssp. <i>asplenioides</i>	0.5	0.5	0.5
<i>Acer rubrum</i>	5.0	3	7	3	<i>Bazzania trilobata</i>	0.5	0.5	0.5
<i>Hamamelis virginiana</i>	1.2	0.01	3	3	<i>Brachyelytrum</i> <i>septentrionale</i>	0.5	0.5	0.5
<i>Dryopteris intermedia</i>	1.2	0.5	2	3	<i>Cymophyllus</i> <i>fraserianus</i>	0.5	0.5	0.5
<i>Smilax rotundifolia</i>	0.7	0.5	1	3	<i>Geranium maculatum</i>	0.5	0.5	0.5
<i>Eurybia divaricata</i>	0.5	0.01	1	3	<i>Hepatica nobilis</i> var. <i>acuta</i>	0.5	0.5	0.5
<i>Rhododendron</i> <i>maximum</i>	35.0	10	60	2	<i>Hypnum</i>	0.5	0.5	0.5
<i>Liriodendron</i> <i>tulipifera</i>	25.0	10	40	2	<i>Ilex montana</i>	0.5	0.5	0.5
<i>Polystichum</i> <i>acrostichoides</i>	5.3	0.5	10	2	<i>Laportea canadensis</i>	0.5	0.5	0.5
<i>Thuidium delicatulum</i>	3.5	2	5	2	<i>Leucobryum glaucum</i>	0.5	0.5	0.5
<i>Clethra acuminata</i>	3.0	1	5	2	<i>Polytrichum</i>	0.5	0.5	0.5
<i>Hypnum imponens</i>	3.0	1	5	2	<i>Sambucus racemosa</i> var. <i>racemosa</i>	0.5	0.5	0.5
<i>Fraxinus americana</i>	2.0	1	3	2	<i>Viola blanda</i> var. <i>blanda</i>	0.5	0.5	0.5
<i>Vitis</i>	1.0	1	1	2	<i>Arisaema triphyllum</i> ssp. <i>triphyllum</i>	0.01	0.01	0.01
<i>Polypodium</i> <i>virginianum</i>	0.3	0.01	0.5	2	<i>Aulacomnium</i> <i>heterostichum</i>	0.01	0.01	0.01
<i>Anemone quinquefolia</i> var. <i>quinquefolia</i>	0.01	0.01	0.01	2	<i>Carex laxiflora</i>	0.01	0.01	0.01
<i>Ilex opaca</i> var. <i>opaca</i>	10.0	10	10	1	<i>Carya cordiformis</i>	0.01	0.01	0.01
<i>Magnolia fraseri</i>	10.0	10	10	1	<i>Chimaphila maculata</i>	0.01	0.01	0.01
<i>Acer saccharum</i> var. <i>saccharum</i>	5.0	5	5	1	<i>Dichanthelium</i> <i>dichotomum</i>	0.01	0.01	0.01
<i>Tiarella cordifolia</i>	5.0	5	5	1	<i>Fagus grandifolia</i>	0.01	0.01	0.01
<i>Amelanchier arborea</i> var. <i>arborea</i>	3.0	3	3	1	<i>Medeola virginiana</i>	0.01	0.01	0.01
<i>Nyssa sylvatica</i>	3.0	3	3	1	<i>Monotropa uniflora</i>	0.01	0.01	0.01
<i>Bryoandersonia</i> <i>illecebra</i>	1.0	1	1	1	<i>Quercus rubra</i>	0.01	0.01	0.01
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	1.0	1	1	1	<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i>	0.01	0.01	0.01
<i>Mnium hornum</i>	1.0	1	1	1	<i>Symphyotrichum</i> <i>lateriflorum</i>	0.01	0.01	0.01
					<i>Thalictrum</i>	0.01	0.01	0.01

Appendix I. Key to the vegetation associations and map classes of Gauley River National Recreation Area.

The following dichotomous key is designed for field identification of natural and semi-natural vegetation within the Gauley River National Recreation Area (GARI). Natural vegetation is defined as plant communities composed primarily of native species that develop in areas which are not significantly affected by human activities. Semi-natural vegetation is defined as plant communities composed primarily of native species that develop spontaneously (without human intervention) in areas that were significantly altered in the past by human activities. Semi-natural vegetation at GARI is usually characterized by even-aged stands of shade intolerant tree species which, over time, show signs of succession towards natural vegetation types adapted to the area. The key does not include 1) cultural vegetation (residential lawns, farmland, tree plantations, etc...), 2) development features (buildings, parking lots, roads, etc...), 3) areas which have been repeatedly or significantly impacted by human-caused disturbance (recently logged areas, recently abandoned farmland, utility and transportation corridors, etc...), 4) natural unvegetated areas (river-scoured bedrock, boulders, cobble, and sand), or 5) aquatic features (rivers, creeks, ponds).

For each final lead, the GARI community type name (underlined) is listed, followed by the corresponding [USNVC association name and code] (in brackets). **Map classes** (in bold) in which each vegetation type occurs are listed either following the vegetation type name, or in a previous lead if the map class includes all the vegetation types which follow that lead. The following map classes are not included in the key: **Creek, Developed Area, Disturbed Area, Pond, Road, Railroad, and Utility Corridor**. The map classes **Back Channel** and **River** are included in the key because they include small patches of the American Water-willow Cobble Bar community type, but their predominant aquatic communities are not included in the key. The map classes **Cliff Face, Successional (Virginia, Pitch) Pine Forest, and Riparian Zone** are each comprised of multiple vegetation types. The map class **Riparian Zone** also includes areas of unvegetated bedrock, boulder, cobble, sand, and water that are not included in the key.

1. Upland communities not including riparian jurisdictional uplands. Located on plateaus, ridges, gorge slopes and benches, in coves and ravines, on cliffs, and in positions along streams which are never flooded.
 - 1.1. Exposed bedrock cliff faces. Vascular plants, including trees, shrubs, and herbs, have sparse cover and are confined to growing in cracks or may overhang and provide partial shade. Highest cover is provided by nonvascular plants, including lichens and bryophytes. **Map class: Cliff Face**
 - 1.1.1. Cliff faces dominated by the macrolichen *Umbilicaria mammulata* (common rock tripe). Cliffs are usually less than vertical, with their faces exposed to water and light: Common Rock Tripe Cliff Face [*Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387)]
 - 1.1.2. Cliff faces with less than 5% cover of *Umbilicaria mammulata* (common rock tripe), often dominated by sparse to heavy cover of crustose lichens. Cliffs are often vertical or with overhangs that reduce exposure to water and light: Dry Cliff Face [Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)]

- 1.2. Forests and woodlands. Vegetation dominated by trees. May occur on top of cliffs or may include small cliffs or ledges shaded by trees, but these do not provide a significant vertical or horizontal break in the forest canopy.
- 1.2.1. Mixed evergreen-deciduous forests and woodlands with a significant conifer component in the stand. Cover by conifers usually > 15% in the canopy layers. If conifer cover is < 15% in the canopy then conifers have higher cover in the surrounding stand and there is abundant conifer regeneration in the understory.
- 1.2.1.1. Species of *Pinus* (pine) dominant or codominant in the canopy.
- 1.2.1.1.1. Even-aged, successional forests on abandoned farmland, in areas excavated for dam construction, or on other disturbed sites. Evidence of succession may include break up of pine canopy and abundance of shade tolerant tree species, such as *Tsuga canadensis* (eastern hemlock) and *Fagus grandifolia* (American beech), in the subcanopy or shrub layers. **Map class: Successional (Virginia, Pitch) Pine Forest**
- 1.2.1.1.1.1. Stands dominated by *Pinus virginiana* (Virginia pine): Successional Virginia Pine Forest [*Pinus virginiana* Successional Forest (CEGL002591)]
- 1.2.1.1.1.2. Stands dominated by *Pinus rigida* (pitch pine): Successional Pitch Pine Forest [*Liriodendron tulipifera* - *Pinus strobus* - *Tsuga canadensis* - *Quercus (rubra, alba)* / *Polystichum acrostichoides* Forest (CEGL006304)]
- 1.2.1.1.2. Edaphic forests and woodlands on hot, dry, exposed cliff tops and rock outcrops. Canopies are often open and stunted and are dominated by *Pinus virginiana* (Virginia pine). Shrub layers usually have abundant *Vaccinium pallidum* (Blue Ridge blueberry) and/or *Gaylussacia baccata* (black huckleberry): Cliff Top Virginia Pine Forest [*Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119)] **Map class: Cliff Top Virginia Pine Forest**
- 1.2.1.2. Species of *Pinus* (pine) absent or sparse in the canopy. *Tsuga canadensis* (eastern hemlock) is the most abundant conifer in the canopy.
- 1.2.1.2.1. *Rhododendron maximum* (great laurel) with >5% cover in the shrub layers, often forming nearly impenetrable thickets.
- 1.2.1.2.1.1. *Rhododendron catawbiense* (Catawba rosebay) common. Rare, small patch forest type on cliff tops and ledges: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest [*Quercus prinus* / *Rhododendron catawbiense* - *Kalmia latifolia* Forest (CEGL008524)] **Map class: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest**
- 1.2.1.2.1.2. *Rhododendron catawbiense* (Catawba rosebay) absent or sparse. Shrub layer dominated by *Rhododendron maximum* (great laurel).
- 1.2.1.2.1.2.1. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) with > 20% cover in the canopy layers. Rare, small patch type confined to cold positions in gorge bottoms: Yellow Birch Cold Cove Forest [*Betula alleghaniensis* - (*Tsuga*

- canadensis*) / *Rhododendron maximum* / (*Leucothoe fontanesiana*) Forest (CEGL007861)] **Map class: Yellow Birch Cold Cove Forest**
- 1.2.1.2.1.2.2. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) absent or sparse in the canopy layers. Matrix or large patch forest type on gorge and ravine slopes and bottoms, cliff tops, and other landforms: Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest [*Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543)] **Map class: Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest**
- 1.2.1.2.2. *Rhododendron maximum* (great laurel) absent or sparse. Large patch forest on upper slopes and plateaus: Eastern Hemlock Plateau Forest [*Liriodendron tulipifera* - *Pinus strobus* - *Tsuga canadensis* - *Quercus (rubra, alba)* / *Polystichum acrostichoides* Forest (CEGL006304)] **Map class: Eastern Hemlock Plateau Forest**
- 1.2.2. Deciduous forests. Cover by conifers < 15% in the canopy and with little conifer regeneration in the understory.
- 1.2.2.1. Successional deciduous forests dominated by *Liriodendron tulipifera* (tuliptree), on land previously cleared for agriculture or subjected to heavy or repeated logging or other canopy replacing disturbance. Cover by *Liriodendron tulipifera* > 50% of total canopy cover: Successional Tuliptree Forest [*Liriodendron tulipifera* - *Quercus* spp. Forest (CEGL007221)] **Map class: Successional Tuliptree Forest**
- 1.2.2.2. Deciduous forests not dominated by *Liriodendron tulipifera* (tuliptree). If present, *Liriodendron tulipifera* contributes < 50% of total canopy cover.
- 1.2.2.2.1. Deciduous forests with canopies dominated by species of *Quercus* (oaks) and/or *Carya* (hickories). Species of *Quercus* or *Carya*, alone or in combination, comprising > 50% of total canopy cover.
- 1.2.2.2.1.1. Oak forests with well-developed shrub layers composed of species in the Ericaceae (heath family), including *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and species of *Rhododendron* (azalea, laurel, rhododendron, rosebay), and *Vaccinium* (blueberry). Heaths, alone or in combination, comprising > 10% cover.
- 1.2.2.2.1.1.1. *Rhododendron catawbiense* (Catawba rosebay) with greater than 5% cover: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest [*Quercus prinus* / *Rhododendron catawbiense* - *Kalmia latifolia* Forest (CEGL008524)] **Map class: Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest**
- 1.2.2.2.1.1.2. *Rhododendron catawbiense* (Catawba rosebay) absent or sparse.
- 1.2.2.2.1.1.2.1. Shrub layers dominated by *Rhododendron maximum* (great laurel), which often forms nearly impenetrable thickets. Occurs on n moister sites compared to the

- next: Oak / Great Laurel Forest [*Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEGL006286)] **Map class: Oak / Great Laurel Forest**
- 1.2.2.2.1.1.2.2. Shrub layers dominated by *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and/or species of *Vaccinium* (blueberry): Occurs on drier sites compared to the last: Oak / Ericad Forest [*Quercus (pinus, coccinea)* / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271)] **Map class: Oak / Ericad Forest**
- 1.2.2.2.1.2. Oak and oak-hickory forests without well developed shrub layers composed of species in the Ericaceae (heath family). Heaths, alone or in combination, comprising < 10% cover.
- 1.2.2.2.1.2.1. *Acer saccharum* var. *saccharum* (sugar maple) with greater cover than *Acer rubrum* (red maple). On moister or more fertile sites compared to the next: Oak - Hickory - Sugar Maple Forest [*Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268)] **Map class: Oak - Hickory - Sugar Maple Forest**
- 1.2.2.2.1.2.2. *Acer rubrum* (red maple) with greater cover than *Acer saccharum* var. *saccharum* (sugar maple). On dryer or less fertile sites compared to the last: Oak - Hickory Forest [*Quercus prinus* - (*Quercus rubra*) - *Carya spp.* / *Oxydendrum arboreum* - *Cornus florida* Forest (CEGL007267)] **Map class: Oak - Hickory Forest**
- 1.2.2.2.2. Deciduous forests not dominated by species of *Quercus* (oaks) or *Carya* (hickories).
- 1.2.2.2.2.1. Forests with > 20% cover by *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) in the canopy and/or subcanopy. Rare, small patch type confined to cold positions in gorge bottoms: Yellow Birch Cold Cove Forest [*Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / (*Leucothoe fontanesiana*) Forest (CEGL007861)] **Map class: Yellow Birch Cold Cove Forest**
- 1.2.2.2.2.2. *Betula alleghaniensis* var. *alleghaniensis* (yellow birch) absent or sparse. Forests codominated by various mixtures of mesophytic species including *Tilia americana* (American basswood), *Acer saccharum* var. *saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Aesculus flava* (yellow buckeye), and *Fagus grandifolia* (American beech): Sugar Maple - Yellow Buckeye - American Basswood Forest [*Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* / (*Magnolia tripetala*) Forest (CEGL005222)] **Map class: Sugar Maple - Yellow Buckeye - American Basswood Forest**

2. Riparian and wetland communities. Vegetation affected by flooding or seepage. Includes jurisdictional wetlands and other areas which are seasonally, temporarily, or occasionally flooded. Frequency of flooding may range from intervals of decades to semi-permanent. Located in slope bottom and level landscape positions on alluvial landforms.
 - 2.1. Seepage wetlands in the headwaters of small streams on the plateaus. Communities are shaded or partially shaded by trees rooted in the wetland and/or overhanging from adjacent upland forests: Forest Seep [*Acer rubrum* - *Nyssa sylvatica* / *Ilex verticillata* - *Vaccinium fuscatum* / *Osmunda cinnamomea* Forest (CEGL007853)] **Map class: Forest Seep.**
 - 2.2. Floodplain and riparian vegetation along rivers and large tributary streams.
 - 2.2.1. Open communities dominated by shrubs and/or herbs. Cover by trees greater than 6 meters tall < 20%.
 - 2.2.1.1. Small patch herbaceous wetlands with semi-permanently saturated or flooded soils. Vegetation is dominated by the wetland obligates *Sparganium* spp. (bur-reed) or *Justicia americana* (American water-willow).
 - 2.2.1.1.1. Herbaceous marsh dominated by a species of *Sparganium* (bur-reed). Rare, small patch community known from one site in a back channel at Iron Ring Rapids: Bur-reed Marsh [*Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation (CEGL004510)] **Map class: Bur-reed Marsh**
 - 2.2.1.1.2. Cobble bars in shallow water of river main channels and back channels dominated by *Justicia americana* (American water-willow): American Water-willow Cobble Bar [*Justicia americana* Herbaceous Vegetation (CEGL004286)] **Map classes: American Water-willow Cobble Bar, Back Channel, River, Riparian Zone**
 - 2.2.1.2. Small patch and linear zones of diverse shrub-prairie vegetation in frequently flooded positions along the shores of rivers and large tributaries. Common species in the shrub layers include *Ilex verticillata* (common winterberry), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and saplings of *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), and *Packera paupercula* (balsam groundsel): Riverscours Shrub Prairie [(*Betula nigra* - *Ilex verticillata*) / *Andropogon gerardii* - *Solidago simplex* var. *racemosa* Shrub Herbaceous Vegetation (CEGL006623)] **Map class: Riparian Zone.**
 - 2.2.2. Floodplain and riparian forests and woodlands. Cover by trees greater than 6 meters tall > 20%.
 - 2.2.2.1. Evergreen and mixed evergreen-deciduous forests and woodlands. Cover by conifers > 15% in the canopy layers.
 - 2.2.2.1.1. *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine) are dominant in the canopy: (Virginia, Pitch) Pine Floodplain Forest [*Pinus virginiana* - (*Pinus rigida*) - *Nyssa sylvatica* / *Xanthorhiza simplicissima* / *Euphorbia corollata* Forest (CEGL006624)] **Map class: (Virginia, Pitch) Pine Floodplain Forest**
 - 2.2.2.1.2. *Tsuga canadensis* (eastern hemlock) is the most abundant conifer in the canopy: Eastern Hemlock Floodplain Forest [*Tsuga canadensis* -

Quercus rubra - (*Platanus occidentalis*, *Betula nigra*) / *Rhododendron maximum* / *Anemone quinquefolia* Forest (CEGL006620)] **Map class: Eastern Hemlock Floodplain Forest**

2.2.2.2. Deciduous forests and woodlands. Cover by conifers < 15% in the canopy layers.

2.2.2.2.1. Riparian woodlands with total cover by trees < 60%. Canopy is kept somewhat open by frequent, high-energy floods. Dominant trees include *Platanus occidentalis* (American sycamore) and/or *Betula nigra* (river birch): American Sycamore - River Birch Riverscour Woodland [*Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Woodland (CEGL003725)] **Map Classes: American Sycamore - River Birch Riverscour Woodland, Riparian Zone.** Two phases can be recognized:

2.2.2.2.1.1. Herbaceous layer dominated by *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), and other tall herbs. Occurs on relatively fine textured alluvial deposits (sand). river birch / Indian woodoats phase

2.2.2.2.1.2. Herbaceous layer dominated by *Andropogon gerardii* (big bluestem) with *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod) and *Packera paupercula* (balsam groundsel) common. Occurs on relatively coarse textured alluvial deposits (boulders, cobbles, and sand). sycamore - river birch / big bluestem phase

2.2.2.2.2. Floodplain forests with total cover by trees > 60%. Stands subject to less frequent and/or lower-energy floods.

2.2.2.2.2.1. Forests in positions which are rarely flooded. Canopies with a significant component of *Quercus* (oak) species: Oak - Hickory Floodplain Forest [*Quercus (rubra, velutina, alba)* / *Carpinus caroliniana* - (*Halesia tetraptera*) / *Maianthemum racemosum* Forest (CEGL006462)] **Map class: Oak - Hickory Floodplain Forest**

2.2.2.2.2.2. Forests in positions which are more regularly flooded. Canopies without a significant component of *Quercus* (oak) species. Dominant trees include *Platanus occidentalis* (American sycamore) and/or *Liriodendron tulipifera* (tuliptree). *Liquidambar styraciflua* (sweetgum) is common: American Sycamore - Tuliptree - Sweetgum Floodplain Forest [*Liquidambar styraciflua* - *Liriodendron tulipifera* / *Lindera benzoin* / *Arisaema triphyllum* Forest (CEGL004418)] **Map class: American Sycamore - Tuliptree - Sweetgum Floodplain Forest**

Appendix J. Local and global vegetation association descriptions for Gauley River National Recreation Area.

**INTERNATIONAL ECOLOGICAL
CLASSIFICATION STANDARD:**

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Gauley River National Recreation Area

9 April 2010

by

NatureServe

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This subset of the International Ecological Classification Standard covers vegetation associations attributed to Gauley River 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 Sue Gawler, Regional Ecologist, Boston, MA <sue_gawler@natureserve.org>.



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

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

Canada

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

Latin American and Caribbean

Centro de Datos para la Conservacion de Bolivia, La Paz, Bolivia; Centro de Datos para la Conservacion de Colombia, Cali, Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala, Guatemala; Centro de Datos para la Conservacion de Panama, Quarry 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-Departamento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

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COMMON NAME (PARK-SPECIFIC): CLIFF TOP VIRGINIA PINE FOREST

SYNONYMS

USNVC English Name: Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest
USNVC Scientific Name: *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest
USNVC Identifier: CEGL007119

LOCAL INFORMATION

Environmental Description: This association occurs on clifftops, ledges, and rocky slopes weathered from sandstone of the New River formation (Pottsville group). These sites have very high solar exposure and most occurrences have south to west aspects. Slopes in mapped polygons range from 5 to 49 degrees (mean = 33). Elevations in mapped polygons range from 231 to 555 m (mean = 324). Unvegetated ground cover is predominantly litter, bedrock, and large rocks. Soils are typically shallow over bedrock. Soils in plots are described as dry to very dry, well drained to rapidly drained sandy loam and sandy clay loam. Soils test very strongly to extremely acidic (mean pH = 3.95) with relatively high levels of total exchange capacity, estimated N release, Al, and Fe, and relatively low levels of Ca, Cu, Mg, Mn, and Zn compared to average values from all plots in the park. Polygons of this association are usually found adjacent to larger polygons of Oak / Ericad Forest (CEGL006271), Oak - Hickory Forest (CEGL007267), or Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), all of which occur in less xeric positions.

Vegetation Description: Stands of this association are evergreen or mixed evergreen-deciduous woodlands or forests dominated by *Pinus virginiana* (Virginia pine). The canopy is typically short (<20 m), and tree height and cover decrease with increasing severity of the site. *Pinus rigida* (pitch pine) occurs in some stands, and *Tsuga canadensis* (eastern hemlock) is often present with low cover. Associated deciduous trees include *Quercus coccinea* var. *coccinea* (scarlet oak), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Nyssa sylvatica* (blackgum). Shrub layers are usually well-developed and are dominated by species in the Ericaceae (heath family), including *Kalmia latifolia* (mountain laurel), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Rhododendron maximum* (great laurel), *Rhododendron catawbiense* (Catawba rosebay), and *Gaylussacia baccata* (black huckleberry). Additional common shrubs and vines include *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), and *Amelanchier arborea* var. *arborea* (common serviceberry). Tree regeneration in the shrub layers is dominated by deciduous species, but saplings of the conifers *Pinus virginiana* (Virginia pine), *Pinus rigida* (pitch pine), and *Tsuga canadensis* (eastern hemlock) occur in some plots. The ericaceous subshrubs *Gaultheria procumbens* (eastern teaberry) and *Epigaea repens* (trailing arbutus) have high constancy. The herb layer usually has low cover and species diversity. Herbs that occur in more than one plot include *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Mitchella repens* (partridgeberry), and *Danthonia spicata* (poverty oatgrass). State-rare herbs that occur in this association include *Danthonia sericea* (downy danthonia) and *Dichanthelium sabulorum* var. *thinium* (hemlock rosette grass). Additional characteristic herbs include *Dichanthelium linearifolium* (slimleaf panicgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Asplenium montanum* (mountain spleenwort), *Hieracium*

venosum (rattlesnakeweed), *Lycopodium tristachyum* (deeproot clubmoss), and *Carex pensylvanica* (Pennsylvania sedge). Vascular plant species richness in plots ranges from 19 to 32 taxa (mean = 23). Lichens and mosses are usually abundant. Lichens identified in plots include *Cladonia caroliniana* (Carolina cup lichen), *Cladonia squamosa* (cup lichen), *Cladonia rangiferina* (greygreen reindeer lichen), *Cladonia pyxidata* (cup lichen), *Umbilicaria mammulata* (navel lichen), *Lasallia papulosa* (blistered naval lichen), *Lasallia pensylvanica* (Pennsylvania blistered naval lichen), *Xanthoparmelia plittii* (Plitt's rock-shield lichen), *Xanthoparmelia conspersa* (xanthoparmelia lichen), and *Flavoparmelia caperata* (lichen). Mosses identified in plots include *Leucobryum glaucum* (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum scoparium* (dicranum moss), *Dicranum spurium* (dicranum moss), *Dicranum condensatum* (condensed dicranum moss), *Hypnum imponens* (hypnum moss), and *Thuidium delicatulum* (delicate thuidium moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	S2	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered throughout the length of the Meadow and Gauley gorges in the park. Most occurrences are on "river right" (on the right side looking downstream) due to the concentration of south to west aspects on this side of the rivers.

Classification Comments: In a combined analysis with all upland plots from Gauley River National Recreation Area (GARI), New River Gorge National River (NERI), and Bluestone National Scenic River (BLUE), plots of this association from GARI and NERI cluster together as a cohesive group, far away from plots of Virginia Pine - Oak Shale Woodland (CEGL008540) from BLUE. Stands of *Pinus virginiana* (Virginia pine) at GARI which have developed on previously cleared land (abandoned farmland, dam construction sites) are classified as Successional Virginia Pine Forest (CEGL002591). Stands of *Pinus virginiana* (Virginia pine) occurring on floodplains in GARI have much higher diversity in the herb and shrub layers and are classified as (Virginia, Pitch) Pine Floodplain Forest (CEGL006624).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Six plots were sampled: GARI.45, GARI.57, GARI.66, GARI.74, GARI.181, and GARI.162.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	<i>Pinus virginiana</i> Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance
Association	<i>Pinus virginiana</i> - <i>Pinus (rigida, echinata)</i> - (<i>Quercus prinus</i>) / <i>Vaccinium pallidum</i> Forest

Association (English name) Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest

Ecological System(s): Cumberland Sandstone Glade and Barrens (CES202.337).
Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692).
Southern Appalachian Montane Pine Forest and Woodland (CES202.331).
Southern Appalachian Low-Elevation Pine Forest (CES202.332).
Central Appalachian Dry Oak-Pine Forest (CES202.591).
Cumberland Acidic Cliff and Rockhouse (CES202.309).
Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359).
Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This community includes *Pinus virginiana* (Virginia pine)-dominated forests of low-elevation ridges and steep upper slopes, occurring primarily in the Appalachian provinces of the eastern United States, from central Pennsylvania, south and west to northern Georgia and northern Alabama. This community occurs on narrow ridges, steep slopes, and other topographic positions with high solar exposure, over shallow, infertile soils. This mainly evergreen forest is often of low stature, with a somewhat open to closed canopy, sparse to very dense shrub cover dominated by ericaceous species, and a sparse herb stratum. *Pinus virginiana* (Virginia pine) is the canopy dominant throughout the range of the type. In some parts of the range, other *Pinus* (pine) species may be significant canopy associates, as well as dry-site *Quercus* (oak) species (e.g., *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak)). Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Common shrub dominants include *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel). Herbs vary with geography but are typical of infertile, xeric habitats. Some typical herbs in this forest are *Baptisia tinctoria* (horseflyweed), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Epigaea repens* (trailing arbutus), *Euphorbia corollata* (flowering spurge), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Hypoxis hirsuta* (common goldstar), *Iris verna* (dwarf violet iris), *Pityopsis graminifolia* var. *latifolia* (narrowleaf silkgrass), *Pteridium aquilinum* var. *latiusculum* (western brackenfern), and *Schizachyrium scoparium* (little bluestem).

Environmental Description: Stands of this forest occur on narrow ridges and knobs, steep upper slopes, bluff and cliff tops, and other exposed sites throughout the range of the type. The community is found primarily on south-, southeast- or southwest-facing aspects on excessively drained, shallow soils. In the Blue Ridge Escarpment region, the western margin of the Blue Ridge, and west into the Ridge and Valley and Cumberland Mountains, this xeric forest occurs on convex slopes and ridges below 850 m (2800 ft) elevation, over soils classed as Inceptisols, typically Lithic Dystrochrepts originating from sandstone, shale and other noncalcareous parent material. Occurrences in rugged parts of the western Piedmont are also likely. Its environmental situation in the western Alleghenies is not known. In the Interior Low Plateau of Kentucky, Tennessee, and Indiana, this association occurs in edaphically extreme situations, including bluff tops and narrow ridges in thin soils weathered from relatively acidic caprocks with southern and western aspects, as well as other similar slopes, over cherty limestone, siltstones, sandstones, and shales. In particular, in the Knobstone Escarpment Subsection (a few Indiana counties just north of Louisville, Kentucky), it occurs in gladelike situations on steep slopes with thin soils. Along the edges of cliff tops, there is usually a narrow zone of exposed bedrock pavement and patches of very shallow soil, but soils become progressively deeper back from the cliff edge. At least in

West Virginia, portions of the stands along the cliff edge are likely to be edaphic climax communities, but farther back from the edge, they are likely to be successional following fire.

Vegetation Description: This community is a needle-leaved evergreen forest with a usually somewhat open (occasionally closed) canopy. The canopy is typically short (<20 m) with tree height and canopy cover decreasing with increasing severity of the microsite. A deciduous subcanopy may be present. The shrub layers can be sparse but are more often dense to very dense and are composed of tall and short shrubs, predominantly ericaceous species. Herb cover is sparse, and leaf litter often dominates the ground layer. *Pinus virginiana* (Virginia pine) is the canopy dominant throughout the range of the type. In the Southern Appalachians and Southern Ridge and Valley it may occur with mixes of *Pinus rigida* (pitch pine), *Pinus echinata* (shortleaf pine), or *Pinus strobus* (eastern white pine). Within its range, *Pinus pungens* (Table Mountain pine) may be present as a very minor component. Regeneration of *Pinus virginiana* (Virginia pine) is concentrated along cliff edges and tends to drop off inward from the edge. Small stems of *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Oxydendrum arboreum* (sourwood) are common in the subcanopy and sapling strata and may occur in the canopy as well. In the Southern Blue Ridge/Piedmont and Southern Blue Ridge/Ridge and Valley transition regions, *Quercus marilandica* (blackjack oak), *Quercus falcata* (southern red oak), and *Quercus stellata* (post oak) can be deciduous components. Common shrub dominants include *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), and *Kalmia latifolia* (mountain laurel). Other typical shrubs can include *Gaylussacia ursina* (bear huckleberry), *Kalmia latifolia* (mountain laurel), *Sassafras albidum* (sassafras), and *Vaccinium hirsutum* (hairy blueberry) (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* (cat greenbrier) and *Smilax rotundifolia* (roundleaf greenbrier) can be common vines. In the sparse herb layer, characteristic species from the Southern Blue Ridge and Southern Ridge and Valley include *Baptisia tinctoria* (horseflyweed), *Chimaphila maculata* (striped prince's pine), *Dichanthelium commutatum* (variable panicgrass), *Danthonia spicata* (poverty oatgrass), *Epigaea repens* (trailing arbutus), *Euphorbia corollata* (flowering spurge), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Hypoxis hirsuta* (common goldstar), *Iris verna* (dwarf violet iris), *Pityopsis graminifolia* var. *latifolia* (narrowleaf silkgrass), *Pteridium aquilinum* var. *latiusculum* (western brackenfern), and *Schizachyrium scoparium* (little bluestem). Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia* (woman's tobacco), *Antennaria solitaria* (singlehead pussytoes), *Carex albicans* var. *albicans* (whitening sedge), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* (cypress panicgrass), *Lespedeza violacea* (violet lespedeza), *Hieracium gronovii* (queendevil), *Hieracium venosum* (rattlesnakeweed), *Krigia biflora* (twoflower dwarf dandelion), *Solidago erecta*, and *Tephrosia virginiana* (Virginia tephrosia) (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa* (devil's-tongue), *Calamagrostis porteri* ssp. *insperata* (Porter's reedgrass), and *Solidago squarrosa* (stout goldenrod) may occur locally. Nonvascular plants have not been documented rangewide; West Virginia examples have identified lichen species including *Cladonia caroliniana* (Carolina cup lichen), *Cladonia squamosa* (cup lichen), *Cladonia rangiferina* (greygreen reindeer lichen), *Cladonia pyxidata* (cup lichen), *Umbilicaria mammulata* (navel lichen), *Lasallia papulosa* (blistered naval lichen), *Lasallia pensylvanica* (Pennsylvania blistered naval lichen), *Xanthoparmelia plittii* (Plitt's rock-shield lichen), *Xanthoparmelia conspersa* (xanthoparmelia moss), and *Flavoparmelia caperata* (lichen), and moss species including

Leucobryum glaucum (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Dicranum scoparium* (dicranum moss), *Dicranum spurium*, *Dicranum condensatum* (condensed dicranum moss), *Hypnum imponens* (hypnum moss), and *Thuidium delicatulum* (delicate thuidium moss).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus rigida</i> (pitch pine) <i>Pinus virginiana</i> (Virginia pine)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus coccinea</i> var. <i>coccinea</i> (scarlet oak) <i>Quercus prinus</i> (chestnut oak)
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Kalmia latifolia</i> (mountain laurel)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Gaylussacia baccata</i> (black huckleberry) <i>Vaccinium pallidum</i> (Blue Ridge blueberry) <i>Vaccinium stamineum</i> (deerberry)

Characteristic Species: *Cladonia caroliniana* (Carolina cup lichen), *Comptonia peregrina* (sweet fern), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), *Leucobryum glaucum* (leucobryum moss), *Oxydendrum arboreum* (sourwood), *Pinus virginiana* (Virginia pine), *Pteridium aquilinum* (western brackenfern), *Sassafras albidum* (sassafras), *Schizachyrium scoparium* var. *scoparium* (little bluestem).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Buckleya distichophylla</i> (piratebush)	G3	plant	globally imperiled
<i>Calamagrostis porteri</i> ssp. <i>insperata</i> (Porter's reedgrass)	G4T3	plant	
<i>Cleistes bifaria</i> (small spreading pogonia)	-	plant	
<i>Coreopsis pulchra</i> (woodland tickseed)	G2	plant	globally imperiled Cumberland Plateau endemic
<i>Cuscuta harperi</i> (Harper's dodder)	G2G3	plant	
<i>Diervilla rivularis</i> (mountain bush honeysuckle)	G3	plant	
<i>Gaylussacia brachycera</i> (box huckleberry)	G3	plant	
<i>Helianthus longifolius</i> (longleaf sunflower)	G3	plant	rare Cumberland Plateau endemic
<i>Penstemon deamii</i> (Deam's beardtongue)	G1	plant	globally critically imperiled
<i>Rudbeckia heliopsidis</i> (sunfacing coneflower)	G2	plant	globally imperiled
<i>Sabatia capitata</i> (Appalachian rose gentian)	G2	plant	globally imperiled Cumberland Plateau endemic
<i>Talinum mengesii</i> (Menges' fameflower)	G3	plant	
<i>Thermopsis villosa</i> (Aaron's rod)	G3?	plant	
<i>Vaccinium hirsutum</i> (hairy blueberry)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs primarily in the Appalachian region of the United States, ranging from central Pennsylvania, south and west through the Ridge and Valley, Blue Ridge, and Cumberland Plateau to northern Georgia and Alabama, extending westward to scattered areas in the Interior Low Plateau and eastward into the upper Piedmont. It is recorded from the states of Georgia, North Carolina, South Carolina, Tennessee, Kentucky, Pennsylvania, Indiana, Ohio, Maryland, Virginia, and West Virginia.

States/Provinces: AL, GA, IN, KY, MD, NC, OH, PA, SC, TN, VA, WV:S2.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Big South Fork, Blue Ridge Parkway, Chickamauga-Chattanooga, Gauley River, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain?, Little River Canyon, Mammoth Cave, New River Gorge, Obed); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee

(Southern Blue Ridge), Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont), Talladega, Talladega (Oakmulgee), Talladega (Talladega), Wayne).

CONSERVATION STATUS

Rank: G4? (4-Feb-2010).

Reasons: This xeric evergreen forest community will be maintained on sites where local soil conditions and topographic extremes function to retard hardwood invasion. Infestations of southern pine beetle (*Dendroctonus frontalis*) can cause mortality of canopy trees. Examples affected by southern pine beetle in the Great Smoky Mountains can have up to 80–90% standing dead pine.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Some vegetation formerly placed (at least conceptually) in the *Pinus virginiana* - *Quercus (coccinea, prinus)* Forest Alliance (A.408) has been transferred here, with this association (CEGL007119) becoming more geographically inclusive. In Indiana examples, the substrate is primarily a matrix of acidic siltstone, shale, and sandstone. Rarely are cliffs formed; instead the setting is mostly very steep slopes with high hills and deep ravines. This association also includes vegetation from the transition between the Cumberland Plateau / Southern Ridge and Valley and the Upper East Gulf Coastal Plain in Alabama. Though located in the Coastal Plain, these occurrences are physiographically and floristically similar to this montane association.

Early-successional vegetation associated with old fields, old pastures, clearcuts, and burned or eroded areas and dominated by *Pinus virginiana* (Virginia pine) is classified as *Pinus virginiana* (Virginia pine) Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy, are classed in *Quercus (pinus, coccinea)* / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271).

Appalachian shale forests and woodlands with *Pinus virginiana* (Virginia pine) occur on steep, shaly slopes and have stunted canopies and sparse herb and shrub strata, characterized by species adapted to shaly substrates. These shale communities are classed in *Pinus virginiana* - *Quercus (coccinea, prinus)* Forest Alliance (A.408) and *Pinus (rigida, pungens, virginiana)* - *Quercus prinus* Woodland Alliance (A.677). In 13 plots from the Southern Blue Ridge, species with $\geq 54\%$ constancy and at least 10% mean cover are *Pinus virginiana* (Virginia pine), *Vaccinium pallidum* (Blue Ridge blueberry), *Quercus prinus* (chestnut oak), *Oxydendrum arboreum* (sourwood), *Acer rubrum* (red maple), *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Pinus rigida* (pitch pine), *Gaylussacia baccata* (black huckleberry), and *Gaylussacia ursina* (bear huckleberry).

Similar Associations:

- *Pinus (rigida, echinata)* - *Quercus coccinea* / *Ilex opaca* Woodland (CEGL006115).
- *Pinus echinata* Early-Successional Forest (CEGL006327).
- *Pinus pungens* - *Pinus rigida* - (*Quercus prinus*) / *Kalmia latifolia* - *Vaccinium pallidum* Woodland (CEGL007097).
- *Pinus virginiana* - (*Pinus rigida*) - *Nyssa sylvatica* / *Xanthorhiza simplicissima* / *Euphorbia corollata* Forest (CEGL006624).
- *Pinus virginiana* - (*Pinus rigida*, *Pinus pungens*) / *Schizachyrium scoparium* Forest (CEGL008500)--has a more open structure with relatively well-developed herbaceous stratum, often graminoid-dominated.

- *Pinus virginiana* - *Quercus falcata* - *Carya pallida* Forest (CEGL006354).
- *Pinus virginiana* / *Quercus marilandica* Serpentine Forest (CEGL006266).
- *Pinus virginiana* Successional Forest (CEGL002591)--is distinguished from this community by differences in land-use history; CEGL002591 exists in flat to moderately sloping land that was heavily plowed in the recent past (10–60 years), whereas this community is generally a product of less disturbed soils and more historic disturbance by fire or logging without plowing.
- *Quercus (prinus, coccinea)* / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271).
- *Quercus prinus* - *Quercus (alba, coccinea, velutina)* / *Viburnum acerifolium* - (*Kalmia latifolia*) Forest (CEGL005023).

Related Concepts:

- *Pinus virginiana* - (*Quercus* spp.) / *Nyssa sylvatica* / *Gaultheria procumbens* forest (Vanderhorst 2002b) =
- *Pinus virginiana* - *Quercus prinus* - *Nyssa sylvatica* Forest (Walton et al. 1997) ?
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Low Mountain Pine Forest (Montane Pine Subtype) (Schafale 1998b) ?
- Oligotrophic Forest (Rawinski 1992) B
- Virginia Pine - Mixed Oaks, HR (Pyne 1994) B
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine Type (Schmalzer and DeSelm 1982) B
- Virginia Pine, BR, R&V, CUPL (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine forest (CAP pers. comm. 1998) ?
- Xeric Pine Forest, Pine - Heath Ridge Forest (Ambrose 1990a) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, Ambrose 1990a, Barden 1977, Burns and Honkala 1990a, CAP pers. comm. 1998, Cooper 1963, Core 1966, Evans 1991, Eyre 1980, Faller 1975, Fike 1999, Fleming and Patterson 2009a, Gettman 1974, Harrison 2004, Homoya pers. comm., Malter 1977, Maxwell 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Patterson et al. 1999, Peet et al. unpubl. data 2002, Pyne 1994, Racine 1966, Rawinski 1992, Schafale 1998b, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2002b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton et al. 1997, Whittaker 1956.



Plot GARI.66. Cliff Top Virginia Pine Forest.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL VIRGINIA PINE FOREST

SYNONYMS

USNVC English Name: Virginia Pine Successional Forest
USNVC Scientific Name: *Pinus virginiana* Successional Forest
USNVC Identifier: CEGLO02591

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches in areas subjected to clearing and ground disturbance in the past, including abandoned farmland and dam excavation sites. Most stands are on gentle topography on plateaus. Sites usually have convex topography or warm aspects and have high solar exposure. Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Slopes in mapped polygons range from 0 to 32 degrees (mean = 6). Elevations in mapped polygons range from 297 to 540 m (mean = 468). Unvegetated ground cover is mostly litter (pine needles) with some downed woody debris. Higher accumulations of woody debris in older stands can make foot travel difficult. Soils in plots on abandoned farmland are described as dry to somewhat moist, well-drained sandy loam and sandy clay. Soils on the dam excavation sites were stripped away and the substrate is essentially unweathered bedrock; soil from a plot was described as somewhat moist, moderately-drained silty clay loam. Soils test very strongly to extremely acidic (mean pH = 4.6) with relatively high levels of total exchange capacity, S, Al, and P and relatively low levels of organic matter, estimated N release, Cu, Mg, Mn, Na, and Zn compared to average values from all plots in the park. Adjacent vegetation often includes Successional Tuliptree Forest (CEGL007221), which develops in more mesic positions on abandoned farmland, and Eastern Hemlock Plateau Forest (CEGL006304), the natural climax vegetation which persists in areas that were not cleared. Adjacent vegetation at two sites is Successional Pitch Pine Forest which is classified as CEGLO06304. Ecological reasons for the establishment of *Pinus virginiana* (Virginia pine) vs. *Pinus rigida* (pitch pine) on similar adjacent sites is obscure but may be related to fire regime, proximity of seed sources, and timing of farm abandonment.

Vegetation Description: This successional forest represents even-aged stands of *Pinus virginiana* (Virginia pine) which developed in areas following canopy removal and ground disturbance. Older stands on abandoned farmland have tall canopies (>20 m) of decadent *Pinus virginiana* (Virginia pine) overtopping the shade-tolerant *Tsuga canadensis* (eastern hemlock), which often dominates the subcanopy and shrub layers. Scattered *Pinus rigida* (pitch pine) may be mixed in these stands. Associated deciduous trees which occur in the canopy layers include *Liriodendron tulipifera* (tuliptree), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), and *Prunus serotina* var. *serotina* (black cherry). Except for regeneration of *Tsuga canadensis* (eastern hemlock), the shrub and herb layers are usually sparse. These stands appear to be succeeding towards Eastern Hemlock Plateau Forest (CEGL006304), a local natural forest type. Stands which occur on dam excavation sites have somewhat different structure and composition. Their canopies are short (<15 m) and apparently stunted, and there is little evidence of succession towards a local natural vegetation type. Shrub, herb, and bryophyte diversity is higher than in stands on farmland, probably due to higher light levels in the understory. Shrubs in these stands include *Ilex opaca* (American holly), *Gaylussacia baccata* (black huckleberry), and

Vaccinium pallidum (Blue Ridge blueberry), and the herb layer is characterized by weedy natives and exotics such as *Lycopodium digitatum* (fan clubmoss), *Achillea millefolium* var. *occidentalis* (western yarrow), *Hieracium caespitosum* (meadow hawkweed), and *Lespedeza cuneata* (Chinese lespedeza). The bryophyte layer in these stands may have high cover by *Dicranum scoparium* (dicranum moss), *Polytrichum commune* (polytrichum moss), and other mosses. There are a couple wetland indicators in the herb and bryophyte layers, and ruderal wetlands occur as small inclusions within these stands. Vascular plant species richness in all plots ranges from 13 to 33 (mean = 22.2).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNA	=	1	[gname]	WVNHP unpubl. data b

Local Range: Stands of this association are confined to areas on the plateaus which were disturbed by past human activities.

Classification Comments: In a cluster analysis, the one plot from a dam excavation site (GARI.50) grouped as an outlier with plots of the Cliff Top Virginia Pine Forest (CEGL007119), probably due to presence of trace amounts of shrubs of the Ericaceae (heath family). However, these stands are placed in CEGL002591 because they occur on land which was severely impacted by human activities and they are not considered natural vegetation.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Three plots were sampled: GARI.50, GARI.59, and GARI.61.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b.)
Alliance	<i>Pinus virginiana</i> Forest Alliance (A.131)
Alliance (English name)	Virginia Pine Forest Alliance
Association	<i>Pinus virginiana</i> Successional Forest
Association (English name)	Virginia Pine Successional Forest
Ecological System(s):	Southern Appalachian Low-Elevation Pine Forest (CES202.332). Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This successional Virginia pine forest of the southeastern states occurs in areas where canopy removal has created dry, open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These habitats include old fields, old pastures, clearcuts, and eroded areas; soils are typically dry, acidic, and infertile. It is common on abandoned farmland. This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. The dense canopy may also include admixtures of other *Pinus* (pine) species (e.g., *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), *Pinus*

strobis (eastern white pine)) or other early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum)). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. Shrub and herb layers are frequently very sparse. Stands are short-lived, generally less than 75 years.

Environmental Description: This community occurs in areas where canopy removal has created open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana* (Virginia pine). These conditions can include old fields, old pastures, clearcuts, and eroded areas. In the Ridge and Valley of Tennessee, northeastern Monroe County, early successional forests with *Pinus virginiana* (Virginia pine) dominance were found on low slopes in areas that were cleared for agriculture prior to the 1970s, when Tellico Lake was created (Andreu and Tukman 1995). In the Central Appalachians, this vegetation occurs where soft shales have been farmed (in valleys or on plateaus), resulting in stands with nothing but successional species in the understory. Soils underlying these communities are of two general types, i.e., those derived in residuum from calcareous shale and calcareous sandstone of the Middle Ordovician and those of some other origin. Series of the former type include Dandridge (Lithic Ruptic-Alfic Eutrochrepts), Tellico (Typic Rhododults), and Steekee (Ruptic-Ultic Dystrochrepts). Other soil series that this forest type may occur on include Litz, Dewey, Alcoa, Bland, Etowah, Lobdell and Neubert. All of these soils are well-drained and range in pH from moderate acidic to very strongly acidic.

Vegetation Description: This forest typically has a very dense canopy of *Pinus virginiana* (Virginia pine) and little understory vegetation. *Pinus taeda* (loblolly pine), *Pinus echinata* (shortleaf pine), or *Pinus strobus* (eastern white pine) may co-occur with *Pinus virginiana* (Virginia pine) in the canopy. The canopy can also have significant admixtures of early-successional deciduous trees (e.g., *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Oxydendrum arboreum* (sourwood), *Betula lenta* (sweet birch), *Nyssa sylvatica* (blackgum)). Older stands on abandoned farmland may have tall canopies (>20 m) of decadent *Pinus virginiana* (Virginia pine) overtopping the shade-tolerant *Tsuga canadensis* (eastern hemlock), which often dominates the subcanopy and shrub layers. Scattered *Pinus rigida* (pitch pine) may be mixed in these stands. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species; *Lonicera japonica* (Japanese honeysuckle) and *Rosa multiflora* (multiflora rose) are common. The herb layer is characterized by weedy natives and exotics such as *Lycopodium digitatum* (fan clubmoss), *Achillea millefolium* var. *occidentalis* (western yarrow), *Hieracium caespitosum* (meadow hawkweed), and *Lespedeza cuneata* (Chinese lespedeza). Shrub and herb strata, where present at all, are usually sparse in coverage. In eastern Tennessee, the subcanopy may contain *Acer saccharum* (sugar maple) and *Cornus florida* (flowering dogwood); other associated species may include *Cercis canadensis* (eastern redbud), *Parthenocissus quinquefolia* (Virginia creeper), *Lonicera japonica* (Japanese honeysuckle), and *Microstegium vimineum* (Nepalese browntop) (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus strobus* (eastern white pine), *Pinus echinata* (shortleaf pine), and *Pinus rigida* (pitch pine). Some stands may have a dense ericaceous shrub stratum containing *Vaccinium* (blueberry) spp., *Gaylussacia* (huckleberry) spp., *Kalmia latifolia* (mountain laurel), and *Rhododendron* (rhododendron) spp.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus virginiana</i> (Virginia pine)
Tree subcanopy	Needle-leaved tree	<i>Juniperus virginiana</i> (eastern red-cedar)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
		<i>Cornus florida</i> (flowering dogwood)
		<i>Nyssa sylvatica</i> (blackgum)
		<i>Oxydendrum arboreum</i> (sourwood)
Tall shrub/sapling	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)
		<i>Nyssa sylvatica</i> (blackgum)
		<i>Oxydendrum arboreum</i> (sourwood)
Tall shrub/sapling	Broad-leaved evergreen tree	<i>Vaccinium arboreum</i> (farkleberry)
Tall shrub/sapling	Needle-leaved shrub	<i>Tsuga canadensis</i> (eastern hemlock)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium stamineum</i> (deerberry)
Short shrub/sapling	Broad-leaved deciduous tree	<i>Cercis canadensis</i> (eastern redbud)
		<i>Cornus florida</i> (flowering dogwood)
		<i>Oxydendrum arboreum</i> (sourwood)
		<i>Quercus alba</i> (white oak)
		<i>Sassafras albidum</i> (sassafras)
Herb (field)	Vine/Liana	<i>Lonicera japonica</i> (Japanese honeysuckle)
		<i>Smilax glauca</i> (cat greenbrier)
		<i>Toxicodendron radicans</i> (eastern poison ivy)

Characteristic Species: *Pinus virginiana* (Virginia pine), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Albizia julibrissin</i> (silktree)	-	plant	exotic
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	exotic
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	exotic
<i>Pueraria montana</i> var. <i>lobata</i> (kudzu)	-	plant	exotic
<i>Rosa multiflora</i> (multiflora rose)	-	plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This successional community is possible in the Piedmont from Pennsylvania south to Alabama and ranges west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and in scattered locales of the Interior Low Plateau.

States/Provinces: AL, DC?, DE, GA, IN, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Appomattox Court House, Big South Fork, Blue Ridge Parkway?, Bluestone, Booker T. Washington, C&O Canal, Cumberland Gap, Fredericksburg-Spotsylvania, Gauley River, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Little River Canyon, Mammoth Cave, Manassas?, Natchez Trace, National Capital-East?, New River Gorge, Obed, Prince William?, Shenandoah, Shiloh, Thomas Stone, Wolf Trap); TVA (Tellico); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, George Washington, Jefferson, Monongahela, Sumter, Sumter (Mountains), Sumter (Piedmont), Uwharrie?).

CONSERVATION STATUS

Rank: GNA (ruderal) (13-Jun-2000).

Reasons: This forest represents early-successional vegetation and is thus not of high conservation concern.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Early-successional *Pinus virginiana* (Virginia pine) vegetation occurring over calcareous substrates is classed in *Pinus virginiana* - *Juniperus virginiana* var. *virginiana* - *Ulmus alata* Forest (CEGL007121) and has species indicative of calcareous substrates.

Similar Associations:

- *Pinus echinata* Early-Successional Forest (CEGL006327)--occurs in similar environments but is dominated (>50% of canopy) by *Pinus echinata* instead of *Pinus virginiana*.
- *Pinus taeda* - *Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is commonly found in the same area as CEGL002591 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL002591 is mostly *Pinus virginiana*.
- *Pinus taeda* / *Liquidambar styraciflua* - *Acer rubrum* var. *rubrum* / *Vaccinium stamineum* Forest (CEGL006011)--occurs in similar environments with similar disturbance histories but is dominated by (>50% of canopy) *Pinus taeda* instead of *Pinus virginiana*.
- *Pinus virginiana* - *Juniperus virginiana* var. *virginiana* - *Ulmus alata* Forest (CEGL007121)--on more calcareous or circumneutral substrates.
- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119)--can have a very similar canopy in the Piedmont and Blue Ridge ecoregions, but CEGL007119 is generally created and maintained by fire and/or logging but not heavy plowing and/or erosion. CEGL002591 generally has signs of heavy agricultural use such as sparse herbaceous or shrub layers, large percentage of invasive exotics such as *Lonicera japonica* in the herbaceous layer, old plowlines, human debris, and extremely even-aged canopy, whereas CEGL007119 generally has a more intact herbaceous/shrub layer (especially *Vaccinium pallidum*) and less signs of severe human disturbance.

Related Concepts:

- *Pinus virginiana* forest (Vanderhorst 2001b) =
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) B
- Pine-Oak Association of the Western Shore District (Shreve et al. 1910) B
- Successional / Modified Terrestrial Forest (Fleming et al. 2006) B
- Unclassified Old-Field Successional Forest (Fleming and Moorhead 2000) ?
- Virginia Pine - Oak: 78 (Eyre 1980) B
- Virginia Pine Type (Schmalzer and DeSelm 1982) B
- Virginia Pine, RV (Pyne 1994) B
- Virginia Pine: 79 (Eyre 1980) B
- Virginia pine successional forest (Collins and Anderson 1994) =
- Xeric Pine Forest (Ambrose 1990a) B

SOURCES

Description Authors: M. Andreu and M. Tukman, mod. J. P Vanderhorst, K. D. Patterson and S. C. Gawler.

References: Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Burns and Honkala 1990a, Collins and Anderson 1994, Coxe 2009, Eyre 1980, Faller 1975, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming et al. 2006, Hall and Mathews 1974, Nelson 1986, Patterson et al. 1999, Pyne 1994, Schmalzer and DeSelm 1982, Schotz pers. comm., Shreve et al. 1910, Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC 1998c, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Young et al. 2006.



Plot GARI.61. Successional Virginia Pine Forest.

COMMON NAME (PARK-SPECIFIC): (VIRGINIA, PITCH) PINE FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: Virginia Pine - (Pitch Pine) - Blackgum / Yellowroot / Flowering Spurge Forest
USNVC Scientific Name: *Pinus virginiana* - (*Pinus rigida*) - *Nyssa sylvatica* / *Xanthorhiza simplicissima* / *Euphorbia corollata* Forest
USNVC Identifier: CEGL006624

LOCAL INFORMATION

Environmental Description: This association occurs in well-drained positions on floodplains that are hypothesized to be subject to occasional high-energy, stand-replacing floods. Sites are located at knickpoints, or constrictions, which are associated with rapids and bends in the river. Solar exposure of sites is relatively high, especially compared to other gorge bottom communities; most sites occur on river right in positions with southerly exposures. Slopes in mapped polygons range from 0.7 to 18 degrees (mean = 12). Elevations in mapped polygons range from 214 to 401 m (mean = 264). Some sites do not appear to flood regularly but others have evidence (flotsam, sediment accumulation) of frequent flooding. Stands occur on bedrock, boulder, cobble, and sand substrates. Bedrock and boulders provide structure and microsites which facilitate establishment and survival of xerophytic trees and shrubs in frequently flooded sites. In plots that are infrequently flooded, unvegetated ground cover is dominated by litter; in plots that are more frequently flooded, it is dominated by rock, sand, and flotsam. Soils in plots are described as temporarily flooded, well-drained sand and sandy loam. Soils test strongly to slightly acidic (mean pH = 5.3) with relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, Ca, K, and P compared to average values from all plots in the park. Adjacent vegetation includes Riverscour Shrub Prairie (CEGL006623) and American Sycamore - River Birch Riverscour Woodland (CEGL003725), which occupy more frequently flooded positions, and American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418), Eastern Hemlock Floodplain Forest (CEGL006620), and Oak - Hickory Floodplain Forest (CEGL006462), which occupy positions that are less prone to catastrophic floods.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine). Floristic composition of stands is an unusual mix of xerophytic and flood-tolerant species. Tree canopies are tall or somewhat stunted and canopy cover in plots ranges from 30 to 70%. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Subcanopy cover in plots ranges from 0 to 60%. Additional trees which are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species in plots include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus*

virginiana (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs in plots include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Potentilla canadensis* var. *canadensis* (dwarf cinquefoil), *Pedicularis canadensis* ssp. *canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* var. *flexuosa* (wavy hairgrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass). Vascular plant species diversity in plots ranges from 32 to 70 taxa (mean = 56.2). Bryophytes identified in plots include *Dicranum scoparium* (dicranum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Grimmia pilifera* (grimmia dry rock moss), *Hypnum imponens* (hypnum moss), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Thuidium delicatulum* (delicate thuidium moss). Lichens identified in plots include *Xanthoparmelia plittii* (Plitt's rock-shield lichen) and *Parmotrema hypotropum* (parmotrema lichen).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: A few stands of this association are widely scattered along the length of the Gauley River in the park. Most stands are on river right (on the right looking downstream) and occur in the western third of the park.

Classification Comments: Recognition of this new association is supported by data from 11 plots along four rivers in West Virginia. Canopy dominance of this association is similar to Cliff Top Virginia Pine Forest (CEGL007119), but it differs by its occurrence on floodplains and by having much higher diversity in the shrub and herb layers, including many species tolerant of flood disturbance. A single plot from New River Gorge at Sandstone Falls (NERI.92) that was previously classified (Vanderhorst et al. 2007) as a variant of *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Woodland (CEGL003725) is probably better classified as this association.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Six plots were sampled: GARI.6, GARI.18, GARI.88, GARI.127, GARI.129, and GARI.217.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)

Formation	Temporarily flooded temperate or subpolar needle-leaved evergreen forest (I.A.8.N.e.)
Alliance	<i>Tsuga canadensis</i> - (<i>Pinus strobus</i>) Temporarily Flooded Forest Alliance (A.171)
Alliance (English name)	Eastern Hemlock - (Eastern White Pine) Temporarily Flooded Forest Alliance
Association	<i>Pinus virginiana</i> - (<i>Pinus rigida</i>) - <i>Nyssa sylvatica</i> / <i>Xanthorhiza simplicissima</i> / <i>Euphorbia corollata</i> Forest
Association (English name)	Virginia Pine - (Pitch Pine) - Blackgum / Yellowroot / Flowering Spurge Forest
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This association occurs in narrow bands along high-energy floodplain gorges of a few rivers in West Virginia. Sites are located at constrictions associated with rapids and bends in the river. Solar exposure is relatively high for the gorge setting; most known sites occur in positions with southerly exposures. Substrates include bedrock, boulder, cobble, and sand. Soils are acidic, well-drained sand to sandy loam. Vegetation is a mixed evergreen-deciduous forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine), with associated species forming an unusual mix of xerophytic and flood-tolerant species. The canopy varies from tall to somewhat stunted, with 30 to 70% cover. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Other trees that are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus virginiana* (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs in plots include *Rudbeckia laciniata* (cutleaf coneflower), *Potentilla canadensis* (dwarf cinquefoil), *Pedicularis canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass).

Environmental Description: This association occurs in well-drained positions on floodplains that are hypothesized to be subject to occasional high-energy, stand-replacing floods. Sites are located at knickpoints, or constrictions, which are associated with rapids and bends in the river. Solar exposure of sites is relatively high, especially compared to other gorge bottom communities; most sites occur in positions with southerly exposures. Slopes at Gauley River occurrences range from 0.7 to 18 degrees (mean = 12) and elevations range from 214 to 401 m (mean = 264). Some sites do not appear to flood regularly but others have evidence (flotsam, sediment accumulation) of frequent flooding. Stands occur on bedrock, boulder, cobble, and sand substrates. Bedrock and boulders provide structure and microsites which facilitate establishment and survival of xerophytic trees and shrubs in frequently flooded sites. In areas that are infrequently flooded, unvegetated ground cover is dominated by litter; in areas that are more

frequently flooded, it is dominated by rock, sand, and flotsam. Soils are temporarily flooded, well-drained sand and sandy loam. Soils test strongly to slightly acidic (mean pH = 5.3) with relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, Ca, K, and P.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland dominated by *Pinus virginiana* (Virginia pine) and/or *Pinus rigida* (pitch pine). Floristic composition is an unusual mix of xerophytic and flood-tolerant species. Tree canopies are tall or somewhat stunted and canopy cover ranges from 30 to 70%. Canopy trees, in addition to the dominant pines, include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Liriodendron tulipifera* (tuliptree), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), and *Platanus occidentalis* (American sycamore). Subcanopy cover ranges from 0 to 60%. Additional trees that are common in the subcanopy include *Tsuga canadensis* (eastern hemlock), *Ilex opaca* var. *opaca* (American holly), *Oxydendrum arboreum* (sourwood), *Chionanthus virginicus* (white fringetree), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Betula nigra* (river birch). Shrub species include *Hamamelis virginiana* (American witchhazel), *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), and *Xanthorhiza simplicissima* (yellowroot). There is often regeneration of *Pinus virginiana* (Virginia pine) in the shrub layers. The herb layer is usually diverse, in sharp contrast to xeric upland associations dominated by *Pinus virginiana* (Virginia pine) or *Pinus rigida* (pitch pine). Common herbs include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Potentilla canadensis* var. *canadensis* (dwarf cinquefoil), *Pedicularis canadensis* ssp. *canadensis* (Canadian lousewort), *Packera aurea* (golden ragwort), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Zizia aptera* (meadow zizia), *Viola pedata* (birdfoot violet), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Hypoxis hirsuta* (common goldstar), *Euphorbia corollata* (flowering spurge), *Deschampsia flexuosa* var. *flexuosa* (wavy hairgrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Sorghastrum nutans* (Indiangrass). Vascular plant species diversity in six plots sampled along the Gauley River range from 32 to 70 taxa (mean = 56.2). Bryophytes identified in the Gauley River plots include *Dicranum scoparium* (dicranum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Grimmia pilifera* (grimmia dry rock moss), *Hypnum imponens* (hypnum moss), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Thuidium delicatulum* (delicate thuidium moss); lichens include *Xanthoparmelia plittii* (Plitt's rock-shield lichen) and *Parmotrema hypotropum* (parmotrema lichen).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Pinus rigida</i> (pitch pine) <i>Pinus virginiana</i> (Virginia pine)
Herb (field)	Forb	<i>Lysimachia quadrifolia</i> (whorled yellow loosestrife)
Herb (field)	Graminoid	<i>Schizachyrium scoparium</i> (little bluestem)

Characteristic Species: *Andropogon gerardii* (big bluestem), *Carpinus caroliniana* (American hornbeam), *Deschampsia flexuosa* (wavy hairgrass), *Hamamelis virginiana* (American witchhazel), *Hypoxis hirsuta* (common goldstar), *Kalmia latifolia* (mountain laurel), *Liriodendron tulipifera* (tuliptree), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Nyssa sylvatica* (blackgum), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Pedicularis canadensis* (Canadian lousewort), *Physocarpus opulifolius* (common ninebark),

Pinus rigida (pitch pine), *Pinus virginiana* (Virginia pine), *Platanus occidentalis* (American sycamore), *Quercus alba* (white oak), *Rhododendron maximum* (great laurel), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Schizachyrium scoparium* (little bluestem), *Viola pedata* (birdfoot violet), *Zizia aptera* (meadow zizia).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently known from the Gauley, Greenbrier, New, and Tygart's Valley rivers, on the west slope of the Eastern Continental Divide in West Virginia.

States/Provinces: WV.

Federal Lands: NPS (Gauley River).

CONSERVATION STATUS

Rank: GNR (4-Feb-2010).

Reasons: More information on the distribution of this association is needed to assign a global rank.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Recognition of this new association (February 2010) is supported by data from eleven plots along four rivers in West Virginia. Canopy dominance of this association is similar to *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119), but it differs by its occurrence on floodplains and by having much higher diversity in the shrub and herb layers, including many species tolerant of flood disturbance. A single plot from New River Gorge at Sandstone Falls (NERI.92) that was previously classified (Vanderhorst et al. 2007) as a variant of *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Woodland (CEGL003725) is probably better classified as this association.

Similar Associations:

- *Pinus virginiana* - *Pinus (rigida, echinata)* - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEGL007119).

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.217. (Virginia, Pitch) Pine Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: Eastern Hemlock - Northern Red Oak - (American Sycamore, River Birch) / Great Laurel / Nightcaps Forest

USNVC Scientific Name: *Tsuga canadensis* - *Quercus rubra* - (*Platanus occidentalis*, *Betula nigra*) / *Rhododendron maximum* / *Anemone quinquefolia* Forest

USNVC Identifier: CEGLO06620

LOCAL INFORMATION

Environmental Description: This association occurs in small patches on higher floodplains which are infrequently flooded or which are subjected to more frequent low-energy floods. In the steep-sided gorges of the Meadow and Gauley rivers, these are usually very narrow zones, but a few larger patches occur on islands and point bars. Solar exposure of these sites is relatively low. Slopes in mapped polygons range from 0 to 30 degrees (mean = 12). Elevations in mapped polygons range from 207 to 502 m (mean = 304). Fluvial features which help identify this as a floodplain community include alluvial substrate, levees, swales, flotsam (including tires), and scoured tree bases. Unvegetated ground cover in most plots is dominated by litter with lesser amounts of wood, rocks, and sand, but one more frequently (or more recently) flooded plot has 60% exposed sand and only 10% litter. There may be a gradient of increasing litter depth from the river to the upland side of this community related to flooding frequency and energy. Soils in plots are described as temporarily flooded or somewhat moist, deep sand, loamy sand, and sandy loam. Soils test medium to extremely acidic (mean pH = 4.57) with relatively high levels of Fe and relatively low levels of organic matter, Al, Ca, K, Mg, Mn, and P compared to average values from all plots in the park. Adjacent riparian associations which occur in more frequently flooded positions include (Virginia, Pitch) Pine Floodplain Forest (CEGL006624), American Sycamore - River Birch Riverscour Woodland (CEGL003725), and Riverscour Shrub Prairie (CEGL006623). Adjacent upland vegetation is usually Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222).

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest or woodland codominated by *Tsuga canadensis* (eastern hemlock) in the canopy or subcanopy. Associated deciduous trees with high constancy in plots include *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Betula nigra* (river birch), *Oxydendrum arboreum* (sourwood), and *Nyssa sylvatica* (blackgum). Decadent *Pinus rigida* (pitch pine) occurs in a few plots and may indicate succession from (Virginia, Pitch) Pine Floodplain Forest (CEGL006624). There is usually a well-developed tall-shrub layer dominated by *Rhododendron maximum* (great laurel). Additional common tall shrubs include *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), *Kalmia latifolia* (mountain laurel), and *Carpinus caroliniana* ssp. *virginiana* (American hornbeam). The short, rhizomatous shrub *Xanthorhiza simplicissima* (yellowroot) is often abundant, especially closer to the river's edge. The herb layer has sparse to moderate cover and is composed of a mixture of typically upland and riparian species. Herbs with high constancy in plots include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Dryopteris intermedia* (intermediate woodfern), *Eurybia divaricata* (white wood aster),

Maianthemum racemosum ssp. *racemosum* (feathery false lily of the valley), *Anemone quinquefolia* var. *quinquefolia* (nightcaps), *Thelypteris noveboracensis* (New York fern), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), and *Osmunda regalis* var. *spectabilis* (royal fern). Vascular plant species richness in plots ranges from 20 to 70 taxa (mean = 48). The bryophyte layer has sparse to heavy cover. Bryophytes identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata* (common bazzania liverwort), *Dicranum scoparium* (dicranum moss), *Hypnum curvifolium* (curveleaf hypnum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Scapania nemorea*, and *Tetraphis pellucida* (tetraphis moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered along the Gauley and Meadow rivers throughout their lengths in the park but is less common along the highest gradient reaches of the Upper Gauley.

Classification Comments: Walton and Anderson (1997) described a *Tsuga canadensis* - *Betula nigra* / *Rhododendron* woodland from GARI which overlaps with the concept of this association. Their type has woodland physiognomy and many species that are more typical of American Sycamore - River Birch Riverscours Woodland (CEGL003725) and Riverscours Shrub Prairie (CEGL006623) as presented in this classification. Recognizing CEGL006620 as a floodplain forest association distinct from the riverscours types appears to be the most parsimonious solution based on patterns observed along multiple rivers in West Virginia.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Eleven plots were sampled: GARI.7, GARI.14, GARI.41, GARI.48, GARI.68, GARI.119, GARI.122, GARI.149, GARI.154, GARI.171, and GARI.213.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Temporarily flooded temperate or subpolar needle-leaved evergreen forest (I.A.8.N.e.)
Alliance	<i>Tsuga canadensis</i> - (<i>Pinus strobus</i>) Temporarily Flooded Forest Alliance (A.171)
Alliance (English name)	Eastern Hemlock - (Eastern White Pine) Temporarily Flooded Forest Alliance
Association	<i>Tsuga canadensis</i> - <i>Quercus rubra</i> - (<i>Platanus occidentalis</i> , <i>Betula nigra</i>) / <i>Rhododendron maximum</i> / <i>Anemone quinquefolia</i> Forest
Association (English name)	Eastern Hemlock - Northern Red Oak - (American Sycamore, River Birch) / Great Laurel / Nightcaps Forest
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705).

GLOBAL DESCRIPTION

Concept Summary: This association is a mixed evergreen-deciduous floodplain forest, usually with a somewhat open canopy, with *Tsuga canadensis* (eastern hemlock) prominent in the canopy and/or subcanopy. It occurs in small patches on higher floodplains of medium-sized streams which are infrequently flooded. Along smaller streams, stands may occur in positions subject to more frequent, low-energy floods. Mature stands along rivers may represent late-successional vegetation on stabilized terraces, but succession may be reversed by renewed scouring and bank erosion as rivers migrate across their floodplains. Microtopography is characterized by fluvial features including levees and swales. Codominant trees include *Tsuga canadensis* (eastern hemlock), *Acer rubrum* var. *rubrum* (red maple), and *Quercus rubra* (northern red oak). Mature stands have *Tsuga canadensis* (eastern hemlock) codominant in the canopy layer, but younger stands may have dominance by this shade-tolerant species in the lower strata. Additional trees include *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Robinia pseudoacacia* (black locust), and *Sassafras albidum* (sassafras). Tree species that characterize this association as a floodplain forest, including *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch), usually occur at low cover. Shrub layers may have moderate to dense cover and are dominated by *Rhododendron maximum* (great laurel). Herb layers are sparse and species-poor but usually include a few species more typical of floodplains than of upland hemlock forests, such as *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cryptotaenia canadensis* (Canadian honewort), and *Rudbeckia laciniata* (cutleaf coneflower).

Environmental Description: This association occurs in small patches on higher floodplains of medium-sized streams which are infrequently flooded. Along smaller streams, stands may occur in positions subject to more frequent, low-energy floods. Mature stands along rivers may represent late-successional vegetation on stabilized terraces, but succession may be reversed by renewed scouring and bank erosion as rivers migrate across their floodplains. Microtopography is characterized by fluvial features including levees and swales. In West Virginia, plot sampled stands of this association occur at elevations ranging from 207 to 632 m (675–2073 ft). Unvegetated ground cover is typically dominated by litter but may also include coarse woody debris (flotsam) and exposed sand and rock in more recently flooded examples. Soils are temporarily flooded, well-drained, deep, stone-free sand with a thin surficial duff layer, and test medium to extremely acidic.

Vegetation Description: This association is a mixed evergreen-deciduous floodplain forest, usually with a somewhat open canopy, codominated by *Tsuga canadensis* (eastern hemlock) in the canopy and/or subcanopy. Trees along the river's edge often lean towards and eventually topple into the river as the banks are undercut. Codominant trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* var. *rubrum* (red maple), and *Quercus rubra* (northern red oak). Mature stands have *Tsuga canadensis* (eastern hemlock) codominant in the canopy layer, but younger stands may have dominance by this shade-tolerant species in the lower strata. Additional trees include *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Oxydendrum arboreum* (sourwood), and *Nyssa sylvatica* (blackgum). Tree species that characterize this association as a floodplain forest, including *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and *Liquidambar styraciflua* (sweetgum), usually occur at low cover. Shrub layers may have moderate to dense cover. In some areas, the shrub layer is dominated by *Rhododendron maximum* (great laurel) and in some areas the short,

rhizomatous shrub *Xanthorhiza simplicissima* (yellowroot) may be abundant. Herb layers are sparse and species-poor but usually include a few species more typical of floodplains than of upland hemlock forests. Herbs include *Anemone quinquefolia* (nightcaps), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Aristolochia macrophylla* (pipevine), *Carex plantaginea* (plantainleaf sedge), *Conopholis americana* (American squawroot), *Cryptotaenia canadensis* (Canadian honewort), *Dryopteris intermedia* (intermediate woodfern), *Eurybia divaricata* (white wood aster), *Galium triflorum* (fragrant bedstraw), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Osmorhiza claytonii* (Clayton's sweetroot), *Osmunda regalis* var. *spectabilis* (royal fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum pubescens* (hairy Solomon's seal), *Polystichum acrostichoides* (Christmas fern), and *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
		<i>Betula lenta</i> (sweet birch)
		<i>Liriodendron tulipifera</i> (tuliptree)
		<i>Quercus rubra</i> (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	<i>Rhododendron maximum</i> (great laurel)
Herb (field)	Vine/Liana	<i>Aristolochia macrophylla</i> (pipevine)
Herb (field)	Forb	<i>Arisaema triphyllum</i> (Jack in the pulpit)

Characteristic Species: *Anemone quinquefolia* (nightcaps), *Betula nigra* (river birch), *Carex plantaginea* (plantainleaf sedge), *Liquidambar styraciflua* (sweetgum), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Osmunda regalis* var. *spectabilis* (royal fern), *Platanus occidentalis* (American sycamore), *Thuidium delicatulum* (delicate thuidium moss), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently known from floodplains of medium-sized streams west of the Eastern Continental Divide in West Virginia, including the Bluestone, Gauley, Greenbrier, and Shavers Fork rivers and their tributaries.

States/Provinces: WV.

Federal Lands: NPS (Bluestone, Gauley River); USFS (Monongahela).

CONSERVATION STATUS

Rank: GNR (14-Nov-2007).

Reasons: The area occupied by this association has probably been greatly decreased by conversion of upper floodplains for agriculture and other human uses from the late 1700s through the mid-1900s. *Tsuga canadensis* (eastern hemlock) is currently threatened by the exotic insect hemlock woolly adelgid (*Adelges tsugae*). Many hemlocks are already dead in floodplains along the Greenbrier River, and this insect pest is known from the Bluestone River, while trees along the Shavers Fork still appear healthy. Along the Gauley River, occurrences of this association are impacted by camping associated with whitewater rafting. There are currently insufficient data to assign a numeric rank.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This association is classified based on data from 14 plots from the Bluestone, Gauley, and Shavers Fork rivers in West Virginia. It has also been observed along the Greenbrier River and some of its tributaries (e.g., Anthony Creek) and from tributaries of the Shavers Fork River (e.g., Pheasant Run). It is floristically similar to upland mixed deciduous-hemlock forests (e.g., *Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543)), but the presence of floodplain species and contrasting disturbance and successional dynamics support its recognition as a distinct association. Its potential range is larger than currently described, and data from other areas would help increase confidence in the type.

Similar Associations:

- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143).

Related Concepts:

- *Tsuga canadensis* - *Betula nigra* / *Rhododendron* woodland (Walton and Anderson 1997) I

SOURCES

Description Authors: S. C. Gawler, mod. J. Vanderhorst.

References: Eastern Ecology Working Group n.d., Perez pers. comm., Vanderhorst et al. 2008, Vanderhorst et al. 2010, Walton and Anderson 1997.



Plot GARI.171. Eastern Hemlock Floodplain Forest.

**COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE - YELLOW BUCKEYE -
AMERICAN BASSWOOD FOREST**

SYNONYMS

USNVC English Name: Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple / (Umbrella-tree) Forest
USNVC Scientific Name: *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* / (*Magnolia tripetala*) Forest
USNVC Identifier: CEGL005222

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches on gorge slopes with relatively cool aspects and moist, fertile soils. Solar exposure of these sites is low, slopes are mostly steep, and aspects are mostly northwest to north to east. Slopes in mapped polygons range from 0 to 49 degrees (mean = 25). Elevations in mapped polygons range from 212 to 596 m (mean = 400). Bedrock geology is mapped as sandstones and shales of the Kanawha and New River formations of the Pottsville group. This association is more abundant on gorge slopes of the lower Gauley River (downstream from Wood's Ferry), reflecting greater exposure of the Kanawha formation. Unvegetated ground cover is dominated by litter and large rocks with lesser amounts of downed woody debris. Soils in plots are described as well-drained, somewhat moist to moist loam, sandy loam, silt loam, and sandy clay loam. Soil in one plot may be classified as a folist, characterized by a deep organic horizon (duff) over bouldery colluvium. Soils test slightly to extremely acidic (mean pH = 4.76) with relatively high levels of total exchange capacity, estimated N release, Ca, K, Mg, and Zn, and relatively low levels of Fe compared to average values from all plots in the park. Adjacent associations include Oak - Hickory Forest (CEGL007267) and Oak - Hickory - Sugar Maple Forest (CEGL007268) which occur in somewhat warmer, drier slope positions, and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) which is the matrix forest on gorge slopes of the middle to upper Gauley and Meadow rivers in the park.

Vegetation Description: This association is a mostly deciduous forest composed of a diverse mixture of tree species adapted to mesic conditions. Canopies are tall (>20 m). Canopy cover in plots ranges from 50 to 80% and subcanopy cover ranges from 20 to 70%. Codominant trees include (in decreasing order of constancy in plots) *Acer saccharum* var. *saccharum* (sugar maple), *Quercus rubra* (northern red oak), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Tilia americana* (American basswood), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Ulmus rubra* (slippery elm), and *Aesculus flava* (yellow buckeye). Vines, which may reach into the canopy, include *Vitis aestivalis* (summer grape) and *Aristolochia macrophylla* (pipevine). Common shrubs include *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Rhododendron maximum* (great laurel), *Asimina triloba* (pawpaw), and *Cercis canadensis* var. *canadensis* (eastern redbud). Cover in the herb layer of plots ranges from 20 to 80%. Common herbs include (in decreasing order of constancy in plots) *Polystichum acrostichoides* (Christmas fern), *Laportea canadensis* (Canadian woodnettle), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Viola canadensis* (Canadian white violet), *Tiarella cordifolia* (heartleaf foamflower), *Eurybia divaricata* (white wood aster), *Galium*

triflorum (fragrant bedstraw), *Osmorhiza claytonii* (Clayton's sweetroot), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Asarum canadense* (Canadian wildginger), *Ageratina altissima* var. *altissima* (white snakeroot), *Geranium maculatum* (spotted geranium), *Actaea racemosa* var. *racemosa* (black bugbane), and *Botrychium virginianum* (rattlesnake fern). Vascular plant species richness in plots ranges from 28 to 68 taxa (mean = 46.8). Nonvascular cover in plots ranges from 0 to 80%, generally dominated by bryophytes. Bryophytes identified in more than one plot include *Thuidium delicatulum* (delicate thuidium moss), *Brachythecium oxycladon* (brachythecium moss), *Anomodon attenuatus* (anomodon moss), *Loeskeobryum brevirostre* (loeskeobryum moss), *Dicranum fulvum* (dicranum moss), *Aulacomnium heterostichum* (aulacomnium moss), *Rhodobryum ontariense*, *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Climacium americanum* (American climacium moss), *Plagiomnium ciliare* (plagiomnium moss), *Leucobryum glaucum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs on gorge slopes throughout the length of the Meadow and Gauley rivers in the park. It is more abundant on river left (on the left looking downstream) and in the west end of the park.

Classification Comments: Occurrences of this association at Gauley River tend to have somewhat different composition compared to occurrences at New River and Bluestone, probably reflecting less fertile soils due to the preponderance of acidic sandstones at Gauley River vs. more prevalent shales at New River and Bluestone. Important species in this association at Gauley River which are not as important in the other parks include *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Rhododendron maximum* (great laurel), *Euonymus americanus* (strawberry bush), and *Dryopteris intermedia* (intermediate woodfern). These species are also important components of Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) which is the matrix forest at Gauley River. Species less common at Gauley River include *Aesculus flava* (yellow buckeye), *Caulophyllum thalictroides* (blue cohosh), and *Actaea racemosa* var. *racemosa* (black bugbane). The parenthetical nominal *Magnolia tripetala* (umbrella-tree) occurs with low cover in three plots but is not an important species in this association at Gauley River or elsewhere in West Virginia. In West Virginia, the varieties of *Tilia americana* (American basswood) are sympatric and intergrade and are not very useful for circumscribing vegetation types.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Seventeen plots were sampled: GARI.37, GARI.42, GARI.49, GARI.58, GARI.79, GARI.86, GARI.98, GARI.99, GARI.107, GARI.110, GARI.123, GARI.130, GARI.145, GARI.146, GARI.175, GARI.184, and GARI.193.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Liriodendron tulipifera</i> - <i>Tilia americana</i> var. <i>heterophylla</i> - <i>Aesculus flava</i> - <i>Acer saccharum</i> Forest Alliance (A.235)
Alliance (English name)	Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Tilia americana</i> var. <i>heterophylla</i> - <i>Aesculus flava</i> - <i>Acer saccharum</i> / (<i>Magnolia tripetala</i>) Forest
Association (English name)	Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple / (Umbrella-tree) Forest
Ecological System(s):	South-Central Interior Mesophytic Forest (CES202.887).

GLOBAL DESCRIPTION

Concept Summary: This mixed mesophytic forest is found primarily in the Central Appalachians, Western Allegheny Plateau, and Cumberland Plateau ecoregions of the United States. Stands occur on cool, moist slopes and steep ravines or bottoms. The tree canopy is often tall, closed and contains a variety of tree species, including *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (American basswood). *Magnolia acuminata* (cucumber-tree) occurs locally. *Acer rubrum* (red maple) and *Betula lenta* (sweet birch) may be common in areas with a more recent harvest history. Frequent vines and shrubs include *Aristolochia macrophylla* (pipevine), *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Parthenocissus quinquefolia* (Virginia creeper), *Staphylea trifolia* (American bladder nut), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* var. *bicolor* (summer grape), and more locally *Magnolia tripetala* (umbrella-tree), *Cercis canadensis* (eastern redbud), and *Rhododendron maximum* (great laurel). The herbaceous layer is extremely rich, including *Actaea racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Botrychium virginianum* (rattlesnake fern), *Caulophyllum thalictroides* (blue cohosh), *Claytonia virginica* (Virginia springbeauty), *Cryptotaenia canadensis* (Canadian honewort), *Dicentra canadensis* (squirrel corn), *Dryopteris marginalis* (marginal woodfern), *Erythronium americanum* (dogtooth violet), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Hydrophyllum virginianum* (Shawnee salad), *Osmorhiza* (sweetroot) spp., *Laportea canadensis* (Canadian woodnettle), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Tiarella cordifolia* (heartleaf foamflower), *Trillium erectum* (red trillium), *Trillium grandiflorum* (snow trillium), *Viola canadensis* (Canadian white violet), and many others. Spring ephemeral herbs which bloom before tree leaf-out may be abundant.

Environmental Description: Stands occur on cool, moist slopes and steep ravines or bottoms, often on colluvium. They occur from lower to upper slopes on northerly aspects but are confined to lower slopes and concave positions on more southerly aspects or may be absent on the warmest aspects. They may also occur on alluvial terraces along streams and on abandoned river terraces. Soils are derived from sandstones or shales, sometimes calcareous. Soils in plots from Bluestone National Scenic River, West Virginia, are described as somewhat moist to moist, well-drained sandy loams, silt loams, and clay loams, and tested strongly to slightly acidic (mean pH = 5.5) with relatively high levels of organic matter, estimated N release, B, Ca, K, Mg, Mn, Na, and P, and relatively low levels of S, Al, Cu, and Zn compared to average values in the park.

Vegetation Description: The tree canopy is often tall, closed and contains a variety of tree species, including *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (American basswood). *Magnolia acuminata* (cucumber-tree) occurs locally, and *Tsuga canadensis* (eastern hemlock) and *Carya cordiformis* (bitternut hickory) may also be present. *Acer rubrum* (red maple) and *Betula lenta* (sweet birch) may be common in areas with a more recent harvest history. Frequent vines include *Aristolochia macrophylla* (pipevine), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis aestivalis* var. *bicolor* (summer grape); shrubs include *Asimina triloba* (pawpaw), *Carpinus caroliniana* (American hornbeam), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Staphylea trifolia* (American bladdernut), and more locally *Magnolia tripetala* (umbrella-tree), *Halesia tetraptera* (mountain silverbell), *Hydrangea arborescens* (wild hydrangea), *Cercis canadensis* (eastern redbud), and *Rhododendron maximum* (great laurel). The herbaceous layer is extremely rich and dominated by shade-tolerant, nutrient-demanding species, including *Actaea racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Botrychium virginianum* (rattlesnake fern), *Caulophyllum thalictroides* (blue cohosh), *Claytonia virginica* (Virginia springbeauty), *Cryptotaenia canadensis* (Canadian honewort), *Dicentra canadensis* (squirrel corn), *Dryopteris marginalis* (marginal woodfern), *Erythronium americanum* (dogtooth violet), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Hydrophyllum virginianum* (Shawnee salad), *Osmorhiza* (sweetroot) spp., *Laportea canadensis* (Canadian woodnettle), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Tiarella cordifolia* (heartleaf foamflower), *Trillium erectum* (red trillium), *Trillium grandiflorum* (snow trillium), *Viola canadensis* (Canadian white violet), and many others. Spring ephemeral herbs which bloom before tree leaf-out may be abundant. Vascular plant richness in West Virginia ranges from 13 to 68 species per 400-square-meter plot. Bryophytes identified in West Virginia include *Thuidium delicatulum* (delicate thuidium moss), *Brachythecium oxycladon* (brachythecium moss), *Brachythecium plumosum* (brachythecium moss), *Anomodon attenuatus* (anomodon moss), *Anomodon rostratus* (anomodon moss), *Loeskeobryum brevirostre* (loeskeobryum moss), *Dicranum fulvum* (dicranum moss), *Dicranodontium denudatum*, *Aulacomnium heterostichum* (aulacomnium moss), *Rhodobryum ontariense*, *Plagiomnium cuspidatum* (toothed plagiomnium moss), *Climacium americanum* (American climacium moss), *Plagiomnium ciliare* (plagiomnium moss), *Hedwigia ciliata* (ciliate

hedwigia moss), *Leucobryum glaucum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Liriodendron tulipifera</i> (tuliptree) <i>Quercus rubra</i> (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Forb	<i>Asarum canadense</i> (Canadian wildginger) <i>Caulophyllum thalictroides</i> (blue cohosh) <i>Hydrophyllum canadense</i> (bluntleaf waterleaf)

Characteristic Species: *Acer saccharum* (sugar maple), *Actaea racemosa* (black bugbane), *Aesculus flava* (yellow buckeye), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrophyllum canadense* (bluntleaf waterleaf), *Laportea canadensis* (Canadian woodnettle), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Magnolia acuminata* (cucumber-tree), *Osmorhiza longistylis* (longstyle sweetroot), *Sedum ternatum* (woodland stonecrop), *Stellaria pubera* (star chickweed), *Tiarella cordifolia* (heartleaf foamflower), *Tilia americana* var. *heterophylla* (American basswood).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Ailanthus altissima</i> (tree of heaven)	-	plant	invasive exotic
<i>Alliaria petiolata</i> (garlic mustard)	-	plant	invasive exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This type is found primarily in the Central Appalachian, Western Allegheny Plateau, and Cumberland Plateau regions of the United States, ranging from southern Pennsylvania and eastern Ohio south to West Virginia and Tennessee, with outliers in Indiana.

States/Provinces: IN, KY, OH, PA:S1S2, TN, WV.

Federal Lands: NPS (Bluestone, Cumberland Gap, Gauley River, New River Gorge); USFS (Daniel Boone, Monongahela, Wayne).

CONSERVATION STATUS

Rank: G4? (30-Sep-2004).

Reasons: There are still issues with the precise geographic limits of this type and its relationship to similar types in adjacent regions. It represents the typical mesic cove forest of a fairly large area of the central interior eastern United States (from southern Pennsylvania and eastern Ohio south to West Virginia and Tennessee, with outliers in Indiana). Within this range, it only occurs in protected concave topographic positions. Although relatively secure and not highly threatened today, many stands have recovered from past episodes of timber removal and remain threatened by future timber harvests because of excellent site productivity. Much of the remaining acreage which is not formally protected is not of high quality. There are some protected stands on Federal lands (national parks, national forests) in the region. Forests of the region are vulnerable to decline from: (1) aluminum toxicity, related to acidification (from sulfates, exceeding 30 pounds per year per acre); (2) nitrogen deposition, which reduces the capacity of trees on the northern slopes to resist fungal infections; and (3) ozone deposition, which diminishes the photosynthetic capacity of trees, which in turn diminishes their roots. Invasive exotics, especially *Alliaria petiolata* (garlic mustard) (a shade-tolerant herb) and *Ailanthus altissima* (tree of

heaven) (a tree which can become established in canopy gaps, mimicking the niche of *Liriodendron* (tuliptree)), pose a serious threat to the integrity of this community's flora.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Trees indicative of the type include *Aesculus flava* (yellow buckeye) and *Tilia americana* var. *heterophylla* (although the latter intergrades with the nominal variety in some areas, reducing its diagnostic value). In Ohio, however, these are restricted to the more southern parts of Ohio, which, depending on the definition of the type, may restrict its concept. Stands strongly dominated by beech and maple go with the Beech - Maple Unglaciated Forest, *Fagus grandifolia* - *Acer saccharum* - *Liriodendron tulipifera* Unglaciated Forest (CEGL002411); by beech and white oak with the White Oak - Beech Western Allegheny Forest, *Quercus alba* - *Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144); and by at least 25% hemlock with the East-Central Hemlock Hardwood Forest, *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043). In Indiana this type occurs in the southeastern part of the Bluegrass Region, where it is found on calcareous substrates, though further review is needed to determine whether these Indiana stands could be placed in CEGL002411. Mike Homoya of the Indiana Heritage Program has species lists, and stand information should be compiled for review. More information is needed to distinguish these more northern (Central Appalachian) mixed mesophytic forests from similar forests in the Southern Appalachians. Further division may be warranted.

Similar Associations:

- *Fagus grandifolia* - *Acer saccharum* - *Liriodendron tulipifera* Unglaciated Forest (CEGL002411)--lacks *Aesculus flava* (generally out of range), but otherwise many similarities.
- *Fraxinus americana* - *Carya ovata* / *Frangula caroliniana* / *Helianthus hirsutus* Woodland (CEGL008458)--also does not generally have high cover of either *Aesculus flava* or *Tilia americana*, and it tends to be on drier mid- to upper slopes instead of ravine areas.
- *Liriodendron tulipifera* - *Fraxinus americana* - (*Tilia americana*, *Aesculus flava*) / *Actaea racemosa* - *Laportea canadensis* Forest (CEGL007710).
- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - (*Aesculus flava*) / *Actaea racemosa* Forest (CEGL007291).
- *Quercus alba* - *Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144).
- *Quercus alba* - *Quercus rubra* - *Quercus prinus* / *Collinsonia canadensis* - *Podophyllum peltatum* - *Amphicarpaea bracteata* Forest (CEGL007692)--does not have any *Aesculus flava* or *Tilia americana* in it.
- *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268).
- *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* / *Cystopteris bulbifera* - *Asarum canadense* Forest (CEGL006472)--is a very rich, bouldery forest of limestone/dolomite coves, gorges and valleys in southwestern Virginia; very similar, lacks some of the characteristic species of CEGL005222 and contains other obligate, low-elevation calciphiles.
- *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043)--contains substantial hemlock.

Related Concepts:

- *Acer saccharum* - *Aesculus flava* / *Laportea canadensis* forest (Vanderhorst 2001b) =
- IA5d. Typic Mesophytic Forest (Allard 1990) ?
- Mixed Mesophytic Forest (Braun 1950) B
- White Ash - Basswood - Northern Red Oak (Rentch et al. 2005) ?

SOURCES

Description Authors: D. Faber-Langendoen, L. Sneddon, M. Pyne, mod. R. White and S. C. Gawler.

References: Allard 1990, Anderson 1982, Braun 1950, Evans 1991, Fike 1999, Midwestern Ecology Working Group n.d., Rentch et al. 2005, TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.



Plot GARI.130. Sugar Maple - Yellow Buckeye - American Basswood Forest.

COMMON NAME (PARK-SPECIFIC): SUCCESSIONAL TULIPTREE FOREST

SYNONYMS

USNVC English Name: Tuliptree - Oak species Forest

USNVC Scientific Name: *Liriodendron tulipifera* - *Quercus* spp. Forest

USNVC Identifier: CEGLO07221

LOCAL INFORMATION

Environmental Description: This association occurs in relatively mesic sites on plateaus, gorge slopes, and floodplains, in areas that were cleared in the past or that have been affected by repeated cycles of logging or other disturbance. It occurs on various aspects, but average solar exposure is relatively low. Slope shape is often concave in one or more directions. Slopes in mapped polygons range from 0.7 to 56 degrees (mean = 21.3). Elevations in mapped polygons range from 210 to 570 m (mean = 414). Unvegetated ground cover in plots is usually dominated by litter, but some plots have significant cover by large rocks. Soils in plots are described as well-drained, dry to moist sand, sandy loam, sandy clay loam, and silt loam. Soils test strongly to very strongly acidic (mean pH = 4.4) with relatively low levels of organic matter and Na compared to average values from all plots in the park. Adjacent vegetation includes Successional Virginia Pine Forest (CEGL002591) in drier positions on abandoned farmland and various natural types in less disturbed areas depending on landform, aspect, and flooding regime.

Vegetation Description: This association represents successional deciduous forests dominated by *Liriodendron tulipifera* (tuliptree). Canopies of mature stands are tall (>20 m) and closed. Common associated trees include (in decreasing order of constancy in plots) *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Oxydendrum arboreum* (sourwood), *Acer saccharum* var. *saccharum* (sugar maple), *Magnolia tripetala* (umbrella-tree), *Liquidambar styraciflua* (sweetgum), *Populus grandidentata* (bigtooth aspen), and *Sassafras albidum* (sassafras). The vines *Vitis aestivalis* (summer grape) and *Parthenocissus quinquefolia* (Virginia creeper) commonly reach the subcanopy. The conifer *Tsuga canadensis* (eastern hemlock) is abundant in the understories of many stands, indicating successional direction towards this shade-tolerant climax species. The evergreen shrubs *Rhododendron maximum* (great laurel) and *Ilex opaca* var. *opaca* (American holly) may have high cover. Additional common shrubs in plots include *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Amelanchier arborea* var. *arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), and *Lindera benzoin* (northern spicebush). There is usually moderate to high cover in the herb layer, which is usually dominated by species adapted to relatively mesic conditions. Herbs with high constancy or cover in plots include *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Packera aurea* (golden ragwort), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris noveboracensis* (New York fern), *Lycopodium digitatum* (fan clubmoss), *Duchesnea indica* (Indian strawberry), and *Meehania cordata* (Meehan's mint). Vascular plant species richness in 400-square-meter plots ranges from 17 to 79 taxa (mean = 39.4).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNA	.	.	[not crosswalked]	.

Local Range: Information not available.

Classification Comments: This association represents all successional stands dominated by *Liriodendron tulipifera* (tuliptree) at Gauley River. These include upland stands that are clearly succeeding towards hemlock dominance, as well as stands on disturbed upper floodplains that grade towards American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418). Most stands do not have a significant oak component, but they are placed in CEGL007221 rather than creating additional successional tuliptree associations. Most sites supporting this type at Gauley River are probably more mesic than typical for CEGL007221 but lack the higher soil pH and fertility represented by CEGL007220.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Eight plots were sampled: GARI.33, GARI.62, GARI.63, GARI.72, GARI.126, GARI.141, GARI.172, and GARI.179.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Liriodendron tulipifera</i> Forest Alliance (A.236)
Alliance (English name)	Tuliptree Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Quercus</i> spp. Forest
Association (English name)	Tuliptree - Oak species Forest
Ecological System(s):	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898). Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This broadly defined semi-natural or successional community is one of several described upland associations dominated by *Liriodendron tulipifera* (tuliptree). It ranges from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. north to the northern Piedmont of New Jersey. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. They are typically acidic and well-drained, dry to moist sand, sandy loam, sandy clay loam, or silt loam. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces. Species found in stands attributable to this type may include a fairly diverse and varied composition. *Acer rubrum* (red maple), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Oxydendrum arboreum* (sourwood), *Acer saccharum* (sugar maple), and occasionally *Liquidambar styraciflua* (sweetgum), *Ilex opaca* (American holly), or *Robinia pseudoacacia* (black locust) may be common in stands of this type. Where oaks are present, they are frequently multi-stemmed, resulting from coppicing.

The conifer *Tsuga canadensis* (eastern hemlock) is abundant in the understories of some stands. Shrub composition is variable but may include *Sambucus canadensis* (common elderberry), *Rhododendron maximum* (great laurel), *Hamamelis virginiana* (American witchhazel), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs are likewise variable; West Virginia samples feature *Dioscorea quaternata* (fourleaf yam), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum racemosum* (feathery false lily of the valley), *Solidago curtisii*, *Symphotrichum prenanthoides* (crookedstem aster), *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Packera aurea* (golden ragwort), *Amphicarpaea bracteata* (American hogpeanut), *Thelypteris noveboracensis* (New York fern), *Lycopodium digitatum* (fan clubmoss), and *Geranium maculatum* (spotted geranium).

Environmental Description: These semi-natural upland deciduous forests are found primarily in areas which were once clearcuts, old fields, or were cleared by fire or other natural disturbances. These successional forests often follow cropping, clearcut logging, or other severe disturbance, and are successional to mixed oak-hickory forests. Examples are common across large areas of the upland landscape which have previously been disturbed. Soils usually exhibit evidence of disturbance and may have little to no organic horizon development. Environmental setting is variable, ranging from level to gently sloping uplands to well-drained floodplains and stream terraces.

Vegetation Description: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera* (tuliptree). *Quercus* (oak) species (*Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Quercus nigra* (water oak), *Quercus velutina* (black oak)) are often present; additional associates may include *Acer barbatum* (southern sugar maple), *Acer rubrum* (red maple), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Nyssa sylvatica* (blackgum), *Cornus florida* (flowering dogwood), and *Robinia pseudoacacia* (black locust). *Betula lenta* (sweet birch) is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush) (in small amounts), and *Vaccinium pallidum* (Blue Ridge blueberry). Herbs vary across the range but may include *Actaea racemosa* (black bugbane), *Dichanthelium clandestinum* (deertongue), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Medeola virginiana* (Indian cucumber), *Potentilla simplex* (common cinquefoil), *Scutellaria serrata* (showy skullcap), *Thelypteris noveboracensis* (New York fern), and *Uvularia perfoliata* (perfoliate bellwort). *Lycopodium digitatum* (fan clubmoss) may be abundant in some stands.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Cornus florida</i> (flowering dogwood)
Herb (field)	Fern or fern ally	<i>Lycopodium digitatum</i> (fan clubmoss)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Actaea racemosa* (black bugbane), *Amelanchier arborea* (common serviceberry), *Carya glabra* (pignut hickory), *Dichanthelium clandestinum* (deertongue), *Fagus grandifolia* (American beech), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Goodyera pubescens* (downy rattlesnake plantain), *Hamamelis virginiana* (American witchhazel), *Lycopodium digitatum* (fan clubmoss), *Medeola virginiana* (Indian cucumber), *Nyssa sylvatica*

(blackgum), *Quercus falcata* (southern red oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Robinia pseudoacacia* (black locust), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Hexastylis naniflora</i> (dwarfflower heartleaf)	G3	plant	Federally listed threatened
<i>Trillium rugelii</i> (illscented wakerobin)	G3	plant	
<i>Trillium simile</i> (jeweled wakerobin)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is known from the southern Cumberland Plateau, Piedmont, and Interior Low Plateau of the southeastern U.S. and may also occur in the Upper East Gulf Coastal Plain. It ranges north to the northern Piedmont of New Jersey and adjacent Pennsylvania. It is also known from Alabama, Georgia, Kentucky, Maryland, North Carolina, South Carolina, Tennessee, West Virginia, and possibly Virginia and Delaware.

States/Provinces: AL, DC?, DE?, GA, KY, MD, NC, NJ, PA, SC, TN, VA, WV.

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort Benning); NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway, Booker T. Washington, C&O Canal, Catoclin Mountain?, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Fredericksburg-Spotsylvania, Gauley River, George Washington Parkway, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Monocacy?, Morristown, Natchez Trace, National Capital-East?, New River Gorge, Ninety Six, Obed, Petersburg, Prince William, Richmond, Shiloh, Valley Forge, Wolf Trap); USFS (Bankhead, Daniel Boone, Oconee?, Talladega, Talladega (Oakmulgee)?, Talladega (Talladega)).

CONSERVATION STATUS

Rank: GNA (ruderal) (19-Aug-2002).

Reasons: This forest represents early-successional vegetation and is thus not a priority for conservation. This is a successional vegetation type composed of native species. Its conservation value is limited, but mature examples could provide buffer for communities of greater conservation value. It may also support rare animal and plant species.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: It differs from other described types within its range based on the lack of a significant pine component [see *Liriodendron tulipifera* - *Pinus taeda* Forest (CEGL007521)] and the absence of species affiliated with circumneutral conditions [see *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220)]; it is later successional and more diverse than *Liriodendron tulipifera* Forest (CEGL007218) and tends to be found on more stable soil substrates and less steep slopes than *Liriodendron tulipifera* - *Acer rubrum* - *Robinia pseudoacacia* Forest (CEGL007219).

Similar Associations:

- *Liriodendron tulipifera* - *Acer negundo* Forest (CEGL007184)--a bottomland type.
- *Liriodendron tulipifera* - *Acer rubrum* - *Robinia pseudoacacia* Forest (CEGL007219)--is generally found on steeper slopes and/or shallow soils and with a more intense history of disturbance.
- *Liriodendron tulipifera* / (*Cercis canadensis*) / (*Lindera benzoin*) Forest (CEGL007220)--is generally found on calcareous or at least pH neutral soils.
- *Liriodendron tulipifera* Forest (CEGL007218)--more early-successional.
- *Prunus serotina* - *Liriodendron tulipifera* - *Acer rubrum* - *Fraxinus americana* - (*Robinia pseudoacacia*) Forest (CEGL006599).
- *Prunus serotina* - *Sassafras albidum* - (*Fraxinus americana*) / *Juniperus virginiana* Forest (CEGL004133).

Related Concepts:

- Successional forest of low-elevation plateaus (Vanderhorst 2001a) B
- Tulip Poplar Type (Schmalzer and DeSelm 1982) B
- Yellow Poplar community (Ehrenfeld 1977) =

SOURCES

Description Authors: R. E. Evans and M. Pyne, mod. L. A. Sneddon, R. White, S. C. Gawler.

References: Ehrenfeld 1977, Gallyoun et al. 1996, Keever 1973, NatureServe Ecology - Southeastern U.S. unpubl. data, Overlease 1987, Russell and Schuyler 1988, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst and Streets 2006, Vanderhorst et al. 2010.



Plot GARI.172. Successional Tuliptree Forest.

COMMON NAME (PARK-SPECIFIC): OAK / ERICAD FOREST

SYNONYMS

USNVC English Name: (Chestnut Oak, Scarlet Oak) / Mountain Laurel / (Beetleweed, Wintergreen) Forest

USNVC Scientific Name: *Quercus (prinus, coccinea)* / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest

USNVC Identifier: CEGL006271

LOCAL INFORMATION

Environmental Description: This association occurs in small to medium-sized patches in warm, dry topographic positions of gorge slopes. Most occurrences are on steep upper slopes with southerly aspects. Average solar exposure is very high. Slopes in mapped polygons range from 2 to 46 degrees (mean = 25.5). Elevations in mapped polygons range from 224 to 603 m (mean = 365.2). Bedrock geology is predominantly sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover in plots is dominated by litter and large rocks. Soils in plots are described as well- to rapidly-drained, dry to very dry sandy loam, sandy clay loam, and clay loam. Soils test strongly to extremely acidic (mean pH = 4.44) with relatively high levels of estimated N release and relatively low levels of organic matter, Ca, Cu, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Adjacent vegetation often includes Cliff Top Virginia Pine Forest (CEGL007110) in more xeric positions and Oak - Hickory Forest (CEGL007267) and Oak / Great Laurel Forest (CEGL006286) in more mesic positions.

Vegetation Description: This association is a mostly deciduous forest dominated by oaks over a shrub layer dominated by species in the Ericaceae (heath family) adapted to xeric site conditions. Canopies are tall (>20 m) or somewhat stunted (10–20 m) and tend to be somewhat more open compared to other deciduous forests in the park. Dominant canopy trees in plots include (in decreasing order of constancy) *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Quercus coccinea* var. *coccinea* (scarlet oak), and *Quercus alba* (white oak). Important canopy trees with lower cover and constancy in plots include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Pinus rigida* (pitch pine), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), and *Carya glabra* (pignut hickory). *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood) are often abundant in the subcanopy. The evergreen shrub *Kalmia latifolia* (mountain laurel) is constant in plots and typically dominates the shrub layers. Additional common shrubs include *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), *Vaccinium pallidum* (Blue Ridge blueberry), *Smilax rotundifolia* (roundleaf greenbrier), *Amelanchier arborea* var. *arborea* (common serviceberry), *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), *Viburnum acerifolium* (mapleleaf viburnum), and *Gaylussacia baccata* (black huckleberry). The subshrub *Gaultheria procumbens* (eastern teaberry) has high constancy. Herb cover is usually sparse. Characteristic herbs include *Solidago caesia* (wreath goldenrod), *Coreopsis major* (greater tickseed), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Hieracium venosum* (rattlesnakeweed), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Danthonia spicata* (poverty oatgrass), and *Chimaphila maculata* (striped prince's pine). Vascular plant species richness in 400-square-meter plots ranges from 22 to 60 taxa (mean = 32.8). Common mosses include

Leucobryum glaucum (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), and *Dicranum fulvum* (dicranum moss). Common lichens include *Umbilicaria mammulata* (navel lichen), *Flavoparmelia baltimorensis*, and *Cladonia furcata* (cup lichen).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs in small patches scattered on upper gorge slopes above the Gauley and Meadow rivers throughout their lengths in the park. It is more abundant on river right (on the right looking downstream) and above the lower Gauley at the west end of the park.

Classification Comments: Some examples of this association at Gauley River grade toward Oak - Hickory Forest (CEGL007267); abundance of *Kalmia latifolia* (mountain laurel) is the best indicator to distinguish these types. Oak forests in somewhat less xeric sites with shrub layers dominated by *Rhododendron maximum* (great laurel) are classified as Oak / Great Laurel Forest (CEGL006286).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Ten plots were sampled: GARI.35, GARI.54, GARI.77, GARI.104, GARI.116, GARI.134, GARI.135, GARI.138, GARI.163, and GARI.191.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - (<i>Quercus coccinea</i> , <i>Quercus velutina</i>) Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	<i>Quercus (pinus, coccinea)</i> / <i>Kalmia latifolia</i> / (<i>Galax urceolata</i> , <i>Gaultheria procumbens</i>) Forest
Association (English name)	(Chestnut Oak, Scarlet Oak) / Mountain Laurel / (Beetleweed, Wintergreen) Forest
Ecological System(s):	Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This community includes xeric ridgetop and exposed slope forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont, north into the Central Appalachians, and north and west into the Ridge and Valley. This community occurs over shallow soils, primarily on south- to west-facing slopes and ridgetops where solar exposure is high. Soils are rocky, infertile, dry, acidic sandy loams typically derived from sandstone. The community includes forests with canopies strongly dominated by *Quercus prinus* (chestnut oak) and/or *Quercus coccinea* (scarlet oak), with lesser amounts of *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus falcata* (southern red oak), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Pinus virginiana* (Virginia pine), and *Acer rubrum* (red maple), occurring over a typically dense shrub stratum dominated by ericaceous species. The

shrub layer may vary between evergreen and deciduous dominance. Typical shrub species include *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and (in the more southern portions of the range) *Leucothoe recurva* (redtwig doghobble). *Castanea dentata* (American chestnut) may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* (trailing arbutus) and *Gaultheria procumbens* (eastern teaberry). Other common species include *Chamaelirium luteum* (fairywand), *Chimaphila maculata* (striped prince's pine), *Galax urceolata* (beetleweed), *Magnolia fraseri* (mountain magnolia), *Sassafras albidum* (sassafras), *Symplocos tinctoria* (common sweetleaf), *Smilax rotundifolia* (roundleaf greenbrier), and *Smilax glauca* (cat greenbrier). This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acidic soils.

Environmental Description: This community occurs on upper slopes, ridges and spurs, usually convex, primarily on south- to west-facing slopes and ridgetops where solar exposure is high. This community includes xeric ridgetop forests in the Southern Blue Ridge, ranging south and east into the upper Piedmont and north into the Central Appalachians, and west into the Ridge and Valley. Soils are rocky, infertile, dry to very dry, acidic sandy loams to clay loams often derived from sandstone. These forests occur on moderate to very steep slopes or on flat to gently sloping interfluvies. Sites supporting this association are typically below 1067 m elevation (3500 ft), but range up to 1280 m (4200 ft). The average elevation of 55 plots classified as this association in the Appalachian Trail project (Fleming and Patterson 2009a) is 845 m (2771 ft), ranging from 262 m (860 ft) to 1305 m (4281 ft).

Vegetation Description: Stands of this association are forests with canopies strongly dominated by *Quercus prinus* (chestnut oak) and *Quercus coccinea* (scarlet oak) alone or in mixture. *Quercus velutina* (black oak) is an important associate in some stands. Other trees, usually in lesser amounts, include *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus falcata* (southern red oak), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Pinus virginiana* (Virginia pine), *Pinus rigida* (pitch pine), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Magnolia acuminata* (cucumber-tree), and *Magnolia fraseri* (mountain magnolia) are present in some areas. The trees grow over a typically dense shrub stratum dominated by ericaceous species, which may display either evergreen or deciduous dominance. Typical shrub species include *Kalmia latifolia* (mountain laurel), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia ursina* (bear huckleberry), and *Gaylussacia baccata* (black huckleberry). Some areas may feature *Rhododendron maximum* (great laurel), *Rhododendron calendulaceum* (flame azalea), *Rhododendron catawbiense* (Catawba rosebay), and *Leucothoe recurva* (redtwig doghobble). *Castanea dentata* (American chestnut) may occur abundantly as root sprouts. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* (trailing arbutus) and *Gaultheria procumbens* (eastern teaberry). Other common species include *Carex digitalis* var. *digitalis* (slender woodland sedge), *Chamaelirium luteum* (fairywand), *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Galax urceolata* (beetleweed), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Dioscorea quaternata* (fourleaf yam), *Hieracium venosum* (rattlesnakeweed), *Houstonia longifolia* (longleaf summer bluet), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Solidago caesia* (wreath goldenrod), *Symplocos tinctoria* (common

sweetleaf), and *Potentilla simplex* (common cinquefoil). Mosses include *Dicranum fulvum* (dicranum moss), *Dicranum scoparium* (dicranum moss), *Thuidium delicatulum* (delicate thuidium moss), and *Leucobryum glaucum* (leucobryum moss). Macrolichens include *Flavoparmelia baltimorensis*, *Cladonia furcata* (cup lichen), *Lasallia* (blistered navel lichen) *papulosa* and *Umbilicaria mammulata* (navel lichen). This community is distinguished by its overall floristic composition, with a high abundance of acid-loving ericaceous species, which are indicative of this community's extremely infertile, acid soils. In the Great Smoky Mountains *Acer rubrum* (red maple) is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 853 m (2800 ft) elevation, where this community is often associated with *Pinus rigida* (pitch pine) forests and woodlands, *Quercus falcata* (southern red oak) may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum* (Blue Ridge blueberry).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak) <i>Quercus coccinea</i> (scarlet oak) <i>Quercus prinus</i> (chestnut oak) <i>Quercus velutina</i> (black oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium stamineum</i> (deerberry)
Tall shrub/sapling	Broad-leaved evergreen shrub	<i>Kalmia latifolia</i> (mountain laurel)
Herb (field)	Dwarf-shrub	<i>Epigaea repens</i> (trailing arbutus) <i>Galax urceolata</i> (beetleweed) <i>Gaultheria procumbens</i> (eastern teaberry)

Characteristic Species: *Acer rubrum* (red maple), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Castanea dentata* (American chestnut), *Chimaphila maculata* (striped prince's pine), *Coreopsis major* (greater tickseed), *Danthonia spicata* (poverty oatgrass), *Dichanthelium dichotomum* var. *dichotomum* (cypress panicgrass), *Galax urceolata* (beetleweed), *Gaylussacia baccata* (black huckleberry), *Hieracium venosum* (rattlesnakeweed), *Kalmia latifolia* (mountain laurel), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Nyssa sylvatica* (blackgum), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak), *Rhododendron periclymenoides* (pink azalea), *Sassafras albidum* (sassafras), *Solidago caesia* (wreath goldenrod), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Canoparmelia amabilis</i> (worthy shield lichen)	G1	plant	globally critically imperiled
<i>Hexastylis contracta</i> (mountain heartleaf)	G3	plant	
<i>Monotropsis odorata</i> (pygmypipes)	G3	plant	
<i>Robinia hispida</i> var. <i>rosea</i> (bristly locust)	G4T3?	plant	
<i>Smilax biltmoreana</i> (Biltmore's carrionflower)	-	plant	
<i>Thermopsis fraxinifolia</i> (ashleaf goldenbanner)	G3?	plant	
<i>Thermopsis mollis</i> (Allegheny Mountain goldenbanner)	G3G4	plant	
<i>Vaccinium hirsutum</i> (hairy blueberry)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The center of distribution for this community is the Southern Blue Ridge of southwestern Virginia, western North Carolina, eastern Tennessee, northeastern Georgia, and northwestern South Carolina. It ranges south and east into the upper Piedmont and north into the

Central Appalachians. This type is common in the Southern Ridge and Valley and Cumberland Mountains of southwestern Virginia and presumably Kentucky.

States/Provinces: GA, KY, NC, SC, TN, VA:S4S5, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)?).

CONSERVATION STATUS

Rank: G5 (31-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: A similar association defined for the southern Cumberland Plateau, *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* - *Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acidic as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia* (mountain laurel), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and *Gaultheria procumbens* (eastern teaberry).

In the Great Smoky Mountains, *Acer rubrum* (red maple) is often dominant or codominant in these forests, presumably on former American chestnut (*Castanea dentata*) sites. In the Blue Ridge-Piedmont transition, below 853 m (2800 ft) elevation, where this community is often associated with *Pinus rigida* (pitch pine) forests and woodlands, *Quercus falcata* (southern red oak) may be a component of the canopy, and the shrub stratum is strongly dominated by *Vaccinium pallidum* (Blue Ridge blueberry). A similar association defined for the southern Cumberland Plateau, *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* - *Vaccinium pallidum* Forest (CEGL008431), occurs over sandstone or other geologies not as acid as the Blue Ridge type and lacks species indicative of the Blue Ridge association, such as *Kalmia latifolia* (mountain laurel), *Gaylussacia ursina* (bear huckleberry), *Gaylussacia baccata* (black huckleberry), and *Gaultheria procumbens* (eastern teaberry).

In 55 plots classified as this association (homoteneity = 0.60) in the Appalachian Trail analysis (Fleming and Patterson 2009a), the most constant species, in order of descending constancy are *Acer rubrum* (red maple), *Kalmia latifolia* (mountain laurel), *Quercus prinus* (chestnut oak), *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Vaccinium pallidum* (Blue Ridge blueberry), *Oxydendrum arboreum* (sourwood), *Galax urceolata* (beetleweed), *Smilax rotundifolia* (roundleaf greenbrier), *Castanea dentata* (American chestnut), *Sassafras albidum* (sassafras), and *Smilax glauca* (cat greenbrier). Species richness ranges from 13–52 species and averages 30 species per 400-m² plot sample. In this same analysis, a group of 11 plots from the Great Smoky and Nantahala mountains segregated as a distinct group in cluster analysis. While the composition of this group fits within the broad concept of this association (CEGL006271), this "southern variant" is distinguished by the dominance of *Gaylussacia ursina* (bear huckleberry) and the greater importance of *Quercus rubra* (northern red oak), *Pyrularia pubera* (buffalo nut), *Tsuga canadensis* (eastern hemlock), and *Magnolia fraseri* (mountain magnolia).

than in the "typic" expression of CEG006271. Further, species that are common in the "typic" expression of CEG006271, *Quercus coccinea* (scarlet oak), *Nyssa sylvatica* (blackgum), *Vaccinium pallidum* (Blue Ridge blueberry), *Gaylussacia baccata* (black huckleberry), and *Leucothoe recurva* (redtwig doghobble), are absent or inconstant in the "southern variant." Based on available plot data, environmental and geographic distinctions could not be made between the two groups, but further study may be warranted.

Similar Associations:

- *Acer rubrum* var. *rubrum* - *Betula* (*alleghaniensis*, *lenta*) - *Magnolia fraseri* / (*Rhododendron maximum*, *Kalmia latifolia*) Forest (CEG008558)--is an acidic mixed hardwood forest of the Southern Blue Ridge, resulting after severe fire, logging, or loss of chestnut; a modified type originally defined from the Great Smoky Mountains.
- *Pinus virginiana* - *Pinus* (*rigida*, *echinata*) - (*Quercus prinus*) / *Vaccinium pallidum* Forest (CEG007119).
- *Quercus alba* - *Quercus* (*coccinea*, *velutina*, *pinus*) / *Gaylussacia baccata* Forest (CEG008521).
- *Quercus prinus* - (*Quercus coccinea*) / *Carya pallida* / *Vaccinium arboreum* - *Vaccinium pallidum* Forest (CEG008431)--defined for the southern Cumberland Plateau and western fringe of the southern Blue Ridge, with more diverse shrubs.
- *Quercus prinus* - (*Quercus coccinea*, *Quercus rubra*) / *Kalmia latifolia* / *Vaccinium pallidum* Forest (CEG006299)--is the Central Appalachian analogue of CEG006271; compositionally similar but generally lacking Southern Appalachian species such as *Galax*, *Oxydendrum*, and *Leucothoe recurva*.
- *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest (CEG007267).
- *Quercus prinus* - *Carya* spp. - *Quercus velutina* / *Vaccinium arboreum* / *Iris verna* var. *smalliana* Forest (CEG007261)--is defined for the lower Piedmont of Alabama and has Coastal Plain affinities.
- *Quercus prinus* - *Quercus* (*alba*, *coccinea*, *velutina*) / *Viburnum acerifolium* - (*Kalmia latifolia*) Forest (CEG005023)--is a broadly defined type for the Appalachian Plateau and Interior Low Plateau.
- *Quercus prinus* - *Quercus* (*rubra*, *velutina*) / *Vaccinium angustifolium* Forest (CEG006282)--is defined for the Northern Piedmont, Central Appalachians; occurs on granite monadnocks.
- *Quercus prinus* - *Quercus alba* / *Oxydendrum arboreum* / *Vitis rotundifolia* Forest (CEG006281).
- *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEG006286)--is more mesic and has a higher component of *Rhododendron maximum* and relatively little *Kalmia latifolia*.

Related Concepts:

- *Quercus alba* - *Quercus velutina* - (*Quercus prinus*) / *Vaccinium pallidum* - (*Kalmia latifolia*) forest (Vanderhorst 2001b) =
- *Quercus montana* - *Quercus coccinea* / *Vaccinium pallidum* Forest (Fleming and Moorhead 2000) ?
- *Quercus montana* / *Kalmia latifolia* / *Vaccinium pallidum* Association, *pro parte* (Rawinski et al. 1996) ?
- *Quercus prinus* - *Quercus coccinea* / *Kalmia latifolia* / *Vaccinium pallidum* Forest (Fleming and Coulling 2001) =
- Chestnut Oak Forest (Dry Heath Subtype) (Schafale 1998b) ?
- Chestnut Oak Forests (McLeod 1988) ?
- Chestnut Oak type (Golden 1974) ?
- Chestnut Oak, BR, CUPL (Pyne 1994) ?
- Chestnut Oak-Chestnut Heath (Whittaker 1956) ?
- Chestnut Oak: 44 (Eyre 1980) B
- Chestnut oak-scarlet oak/ericad forest: (matrix) xeric, S- & SW-facing slopes (CAP pers. comm. 1998) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, CAP pers. comm. 1998, Evans 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming and Patterson 2009a, Fleming et al. 2001, Golden 1974, Major et al. 1999, McLeod 1988, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Pyne 1994, Rawinski et al. 1996, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., TDNH

unpubl. data, VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Whittaker 1956.



Plot GARI.116. Oak / Ericad Forest.

(*common bazzania liverwort*), and *Polytrichum juniperinum* (juniper polytrichum moss). Lichens in plots include *Umbilicaria mammulata* (navel lichen) and *Cladonia uncialis* (cup lichen).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	S2	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in a few scattered patches on gorge slopes above the middle Gauley and the Meadow rivers in the park.

Classification Comments: Occurrences of this association at Gauley River are very small and grade towards adjacent types including Cliff Top Virginia Pine Forest (CEGL007119), Oak / Great Laurel Forest (CEGL006286), Oak - Hickory Forest (CEGL007267), and Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Because of this, there is greater representation of *Tsuga canadensis* (eastern hemlock), *Pinus virginiana* (Virginia pine), *Rhododendron maximum* (great laurel), and *Quercus* (oak) spp. rather than *Quercus prinus* (chestnut oak) compared to the global description. *Tsuga canadensis* (eastern hemlock) is also an important component in stands at New River Gorge but is lacking in most Virginia stands. GARI occurrences represent geographical outliers at the limits of the range of *Rhododendron catawbiense* (Catawba rosebay) in a landscape dominated by *Tsuga canadensis* (eastern hemlock) and *Rhododendron maximum* (great laurel).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Five plots were sampled: GARI.31, GARI.65, GARI.75, GARI.115, and GARI.139.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - (<i>Quercus coccinea</i> , <i>Quercus velutina</i>) Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	<i>Quercus prinus</i> / <i>Rhododendron catawbiense</i> - <i>Kalmia latifolia</i> Forest
Association (English name)	Chestnut Oak / Catawba Rosebay - Mountain Laurel Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: The documented range of this community is confined to the northern Virginia Blue Ridge, scattered locations in the Ridge and Valley province of west-central and southwestern Virginia, and in the gorges of the New and Gauley rivers of southern West Virginia. In addition, there are a few local outliers on sheltered, north-facing bluffs along the James River in the western Piedmont. In the main part of this association's range, stands are associated with strongly convex, upper slopes and spur crests at elevations from 325 m to over 975 m (1050–3200 ft). North or northwest aspects are common, but the type has been documented from other aspects as well, generally with high solar exposure. The vegetation is a

species-poor, open to closed-canopy forest of stunted (often <20 m tall, sometimes <10 m tall), gnarled trees over a dense, evergreen tall-shrub layer. *Quercus prinus* (chestnut oak) is the usual canopy dominant, with occasional associates of *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Pinus virginiana* (Virginia pine), and/or *Pinus strobus* (eastern white pine). *Rhododendron catawbiense* (Catawba rosebay), *Kalmia latifolia* (mountain laurel), and/or *Rhododendron maximum* (great laurel) (the latter primarily in West Virginia occurrences) dominate the shrub layer. Additional shrubs present at low cover include *Hamamelis virginiana* (American witchhazel), *Ilex montana* (mountain holly), and *Amelanchier arborea* (common serviceberry). Deciduous ericads such as *Gaylussacia baccata* (black huckleberry) and *Vaccinium pallidum* (Blue Ridge blueberry) may be present but rarely contribute more than 10% cover. Herbs and subshrubs are exceedingly sparse in the densely shaded, forest-floor environment; most likely to be encountered are the evergreen species *Gaultheria procumbens* (eastern teaberry), *Epigaea repens* (trailing arbutus), *Galax urceolata* (beetleweed), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), and *Chimaphila maculata* (striped prince's pine), sometimes present at low cover.

Environmental Description: This type is generally associated with strongly convex, upper slopes, cliff tops, and spur crests at elevations from 325 m to over 975 m (1050–3200 ft). Plot-sampled stands have various aspects, with north or northwest aspects most common. Slopes are mostly steep, generally >20 degrees but sometimes as low as 10 degrees. Piedmont occurrences of this vegetation type differ somewhat from the main part of the range: they are confined to steep, sheltered bluffs subtending the James River at <200 m (650 ft) elevation. Site moisture potential appears to be in the subxeric to submesic range, with soils in plots described as well- to rapidly-drained, dry sandy loam and silty clay. Surface cover of rocks varies from low to high, and soils have thick, poorly decomposed duff layers. Soils are extremely acidic (mean pH = 4.1) and infertile, with low levels of most nutrients (Ca, Cu, K, Mg, Mn, P, Zn).

Vegetation Description: The vegetation is an exceptionally species-poor, open to closed-canopy forest of somewhat stunted (<20 m tall) to very stunted (<10 m tall), gnarled deciduous or mixed evergreen-deciduous trees over a dense, evergreen tall-shrub layer. *Quercus prinus* (chestnut oak) is the canopy dominant, with occasional associates of *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Nyssa sylvatica* (blackgum), *Acer rubrum* (red maple), *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Betula alleghaniensis* (yellow birch), *Pinus virginiana* (Virginia pine), and/or *Pinus strobus* (eastern white pine). *Acer rubrum* (red maple) and *Oxydendrum arboreum* (sourwood) may be abundant subcanopy trees. *Rhododendron catawbiense* (Catawba rosebay) and *Kalmia latifolia* (mountain laurel), each with mean cover of 25–50% in plots, dominate the shrub layer; *Rhododendron maximum* (great laurel) may be locally important in West Virginia occurrences. Additional shrubs present at low cover include *Acer pensylvanicum* (striped maple), *Gaylussacia baccata* (black huckleberry), *Hamamelis virginiana* (American witchhazel), *Ilex montana* (mountain holly), *Ilex opaca* (American holly), *Amelanchier arborea* (common serviceberry), *Smilax rotundifolia* (roundleaf greenbrier), *Vaccinium pallidum* (Blue Ridge blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). Although not documented in plots, *Pieris floribunda* (mountain fetterbush) is reported to be a characteristic shrub of this community in the Thunder Ridge - Apple Orchard Mountain area of Virginia's Bedford and Botetourt counties (Rawinski et al. 1996). Herbs and subshrubs are

exceedingly sparse in the densely shaded forest floor environment, but the evergreen species *Gaultheria procumbens* (eastern teaberry), *Epigaea repens* (trailing arbutus), *Galax urceolata* (beetleweed), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), and *Chimaphila maculata* (striped prince's pine) are sometimes present at low cover. Occasional herbs include *Aralia nudicaulis* (wild sarsaparilla), *Conopholis americana* (American squawroot), *Cypripedium acaule* (moccasin flower), *Dryopteris intermedia* (intermediate woodfern), *Hexastylis virginica* (Virginia heartleaf), and *Polypodium virginianum* (rock polypody). The bryophyte layer may have significant cover by *Leucobryum glaucum* (leucobryum moss); other bryophytes identified in plots include *Hypnum imponens* (hypnum moss), *Thuidium delicatulum* (delicate thuidium moss), *Dicranum scoparium* (dicranum moss), *Bazzania trilobata* (common bazzania liverwort), and *Polytrichum juniperinum* (juniper polytrichum moss). Lichens collected from this community include *Cladonia caroliniana* (Carolina cup lichen), *Cladonia uncialis* (cup lichen), *Flavoparmelia baltimorensis*, and *Umbilicaria mammulata* (navel lichen). Vascular plant species richness (per 400 square meters) of Virginia plot-sampled stands ranges from 9 to 16 taxa (mean = 12); in the nine WV sampled plots it ranges from 13 to 33 taxa (mean = 22.4).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus prinus</i> (chestnut oak)
Shrub/sapling (tall & short)	Broad-leaved evergreen tree	<i>Rhododendron catawbiense</i> (Catawba rosebay)

Characteristic Species: *Aralia nudicaulis* (wild sarsaparilla), *Cypripedium acaule* (moccasin flower), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hamamelis virginiana* (American witchhazel), *Kalmia latifolia* (mountain laurel), *Quercus prinus* (chestnut oak), *Rhododendron catawbiense* (Catawba rosebay), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The documented range of this community includes the southern part of the Central Appalachians and adjacent areas of the Southern Blue Ridge, Southern Ridge and Valley, and Cumberland Mountains in Virginia and West Virginia. In addition, there are a few local outliers on sheltered, north-facing bluffs along the James River in the western Virginia Piedmont.

States/Provinces: VA:S3, WV:S2.

Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, New River Gorge); USFS (Jefferson).

CONSERVATION STATUS

Rank: G3? (25-Feb-2004).

Reasons: This association appears to be a geographically-limited, environmentally-restricted, and mostly small-patch vegetation type of oligotrophic, somewhat exposed habitats.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: The geographic distribution of this community and the extent to which it recurs throughout the Northern Blue Ridge and Ridge and Valley are somewhat uncertain and need further investigation. Although documented by plot data only on the Blue Ridge of Virginia and at New River Gorge and the Gauley River in West Virginia, similar vegetation is reported to be

frequent on xeric, rocky upper slopes and summits throughout the west-central and southwestern Virginia Ridge and Valley region (T.F. Wieboldt pers. comm.). These putative Ridge and Valley occurrences sometimes contain mixtures of *Rhododendron catawbiense* (Catawba rosebay) and *Rhododendron maximum* (great laurel), as do the Gauley River occurrences. For the most part, however, this community appears to reach optimal development in geographic areas (i.e., the Northern Blue Ridge) and drier habitats where *Rhododendron maximum* (great laurel) is spotty or absent. *Tsuga canadensis* (eastern hemlock) is prominent in this association at New River Gorge and the Gauley River, another contrast to Virginia stands. This association (CEGL008524) is not likely to be found in the Southern Blue Ridge, where *Rhododendron catawbiense* (Catawba rosebay) is more restricted to high elevations and exposed habitats, above the elevational limits of *Quercus prinus* (chestnut oak) (Newell 1997, A.S. Weakley pers. comm.). Although stands of this type can be rather difficult to plot-sample, the collection of additional quantitative data from well developed occurrences would be desirable. This community type is similar to and sometimes co-occurs with *Tsuga caroliniana* / *Kalmia latifolia* - *Rhododendron catawbiense* Forest (CEGL007139) on the Northern Blue Ridge. The degree to which periodic fires have influenced the structure and composition of this community type needs investigation.

Similar Associations:

- *Fagus grandifolia* - *Quercus alba* / *Kalmia latifolia* - (*Symplocos tinctoria*, *Rhododendron catawbiense*) / *Galax urceolata* Forest (CEGL004539).
- *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEGL006286)--is a more mesophytic forest of protected slopes, with substantial *Quercus rubra* and a *Rhododendron maximum* understory.
- *Tsuga caroliniana* / *Kalmia latifolia* - *Rhododendron catawbiense* Forest (CEGL007139).

Related Concepts:

- *Quercus montana* - *Pinus strobus* / *Kalmia latifolia* / *Gaylussacia baccata* Forest (Coulling and Rawinski 1999) ?
- *Quercus montana* / *Kalmia latifolia* / *Vaccinium pallidum* Association: *Rhododendron catawbiense* / *Galax urceolata* Subassociation (Rawinski et al. 1996) ?
- *Quercus montana* / *Rhododendron catawbiense* - *Kalmia latifolia* Forest (Fleming et al. 2006) =
- *Quercus prinus* / *Rhododendron catawbiense* - *Kalmia latifolia* Forest (Fleming and Coulling 2001) =
- *Quercus rubra* - *Tsuga canadensis* / *Rhododendron catawbiense* Association, *pro parte* (Rawinski et al. 1996) ?
- Chestnut Oak: 44 (Eyre 1980) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler.

References: Coulling and Rawinski 1999, Eyre 1980, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2004, Fleming et al. 2006, Newell 1997, Rawinski et al. 1996, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Wieboldt pers. comm.



Plot GARI.139. Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest.

COMMON NAME (PARK-SPECIFIC): OAK - HICKORY - SUGAR MAPLE FOREST

SYNONYMS

USNVC English Name: Chestnut Oak - Shagbark Hickory - Northern Red Oak / Sugar Maple Forest

USNVC Scientific Name: *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest

USNVC Identifier: CEGLO07268

LOCAL INFORMATION

Environmental Description: This association occurs on gorge slopes and plateaus on soils with intermediate moisture regimes (dry-mesic) and relatively high fertility. Most environmental and topographic variables have intermediate means and broad ranges, suggesting that its niche is defined by an interaction of compensatory factors. It occurs on all aspects and average solar exposure of mapped polygons is intermediate. Slopes in mapped polygons range from 0.7 to 48 degrees (mean = 22.5). Elevations in mapped polygons range from 209 to 597 m (mean = 400.9). Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Occurrences are more abundant and cover larger areas in the west end of the park where the Kanawha formation becomes more prevalent. Unvegetated ground cover is dominated by litter and rock. Soils in plots are described as well-drained, dry to somewhat moist sandy loam, sandy clay loam, silt loam, and loam. Soils test slightly to extremely acidic (mean pH = 4.70) with relatively high levels of estimated N release, Al, and K, and relatively low levels of organic matter compared to average values from all plots in the park. In the western part of the park where deciduous forests predominate, adjacent vegetation includes Oak - Hickory Forest (CEGL007268) on drier, less fertile soils and Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) on moister, more fertile soils. In the east end of the park, occurrences are mostly small patches imbedded within the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).

Vegetation Description: This association is a deciduous forest with a canopy dominated by species of *Quercus* (oak) and *Carya* (hickory) with an abundance of *Acer saccharum* var. *saccharum* (sugar maple) in the subcanopy. Canopies are tall (>20 m) with cover ranging from 50 to 90%. Important canopy trees in plots include (in decreasing order of constancy) *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Acer saccharum* var. *saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). Cover in the subcanopy of plots ranges from 20 to 60% and is usually dominated by *Acer saccharum* var. *saccharum* (sugar maple). *Acer rubrum* (red maple) may also be common in the subcanopy with lower cover. The vines *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), and *Parthenocissus quinquefolia* (Virginia creeper) may reach the subcanopy. Common species in the tall-shrub layer include *Cercis canadensis* var. *canadensis* (eastern redbud), *Ostrya virginiana* (hophornbeam), *Cornus florida* (flowering dogwood), and *Amelanchier arborea* var. *arborea* (common serviceberry). Species with high constancy in the short-shrub layer include *Smilax rotundifolia* (roundleaf greenbrier), *Viburnum acerifolium* (mapleleaf viburnum), *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), and *Hydrangea arborescens* (wild hydrangea). There is sparse to moderately high cover in the herb layer. Common herbs in plots include (in decreasing order of constancy) *Dioscorea quaternata* (fourleaf yam), *Polystichum*

acrostichoides (Christmas fern), *Eurybia divaricata* (white wood aster), *Solidago caesia* (wreath goldenrod), *Galium circaezans* (licorice bedstraw), *Carex laxiflora* (broad looseflower sedge), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Ageratina altissima* var. *altissima* (white snakeroot), *Dichanthelium boscii* (Bosc's panicgrass), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Brachyelytrum erectum* (bearded shorthusk), and *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit). Vascular plant species richness in plots ranges from 35 to 61 taxa (mean = 47.4). Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum albidum* (leucobryum moss), *Brachythecium oxycladon* (brachythecium moss), *Dicranum fulvum* (dicranum moss), *Dicranum scoparium* (dicranum moss), *Hypnum imponens* (hypnum moss), *Climacium americanum* (American climacium moss), and *Leucobryum glaucum* (leucobryum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association is found throughout the park where environmental conditions are appropriate, patchier in the eastern portion.

Classification Comments: This association is floristically and environmentally intermediate between Oak - Hickory Forest (CEGL007267) and Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222). In cluster analysis, plots of this association form two main groups that mix with plots of these two related types. Recognition of this association is based on dominance of *Quercus* (oak) spp. in the canopy with abundance of *Acer saccharum* var. *saccharum* (sugar maple) in the lower strata.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twelve plots were sampled: GARI.39, GARI.53, GARI.157, GARI.170, GARI.174, GARI.178, GARI.183, GARI.185, GARI.187, GARI.190, GARI.197, and GARI.202.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - <i>Quercus</i> (<i>alba</i> , <i>falcata</i> , <i>rubra</i> , <i>velutina</i>) Forest Alliance (A.249)
Alliance (English name)	Chestnut Oak - (White Oak, Southern Red Oak, Northern Red Oak, Black Oak) Forest Alliance
Association	<i>Quercus prinus</i> - <i>Carya ovata</i> - <i>Quercus rubra</i> / <i>Acer saccharum</i> Forest
Association (English name)	Chestnut Oak - Shagbark Hickory - Northern Red Oak / Sugar Maple Forest
Ecological System(s):	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898). Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: These dry-mesic forests of the Ridge and Valley and adjacent sedimentary ecoregions (Cumberlands, Interior Low Plateau) occur on ridges, gorge slopes, spurs, and knobs. Elevations range from 250 to 1000 m (800–3250 ft). Soils are very well-drained, acidic to circumneutral, and derived from sandstone and shales. The canopy is dominated by *Quercus prinus* (chestnut oak) with other oaks and hickories, typically with *Acer saccharum* (sugar maple) as a canopy associate and/or subcanopy dominant. Some examples are strongly dominated by *Quercus prinus* (chestnut oak). Other examples with more diverse canopies include *Quercus rubra* (northern red oak), *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Quercus velutina* (black oak). The canopy is generally closed (greater than 75% cover). The subcanopy may be dominated by *Acer saccharum* (sugar maple) in some examples. Other subcanopy species may include *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Quercus rubra* (northern red oak), *Quercus muehlenbergii* (chinkapin oak), *Aesculus flava* (yellow buckeye), and *Juniperus virginiana* (eastern red-cedar). The subcanopy is relatively sparse with cover less than 25%. The shrub and herbaceous layers are sparse with small stems of canopy and subcanopy species along with herbaceous species such as *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Bromus pubescens* (hairy woodland brome), *Carex albursina* (white bear sedge), *Carex cumberlandensis* (Cumberland sedge), *Carex laxiflora* (broad looseflower sedge), *Campanulastrum americanum* (American bellflower), *Chimaphila maculata* (striped prince's pine), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Houstonia longifolia* (longleaf summer bluet), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Vicia caroliniana* (Carolina vetch), *Viola* (violet) spp., and *Zizia trifoliata* (meadow alexanders).

Environmental Description: In the Ridge and Valley of Tennessee, these forests occur near the tops of calcareous ridges and knobs with northerly aspects that range from 250 to 1000 m (800–3250 ft) elevation, on very well-drained, gravelly, sandy soils and exposed topographical positions (Andreu and Tukman 1995). On the Tellico Pilot Project study site, many stands were found on the Dandridge, Tellico, and Steekee soil series. The Tellico series is an Ultisol, while the others are Inceptisols; all can be described as well- to excessively well-drained soils. The Tellico and Steekee soils are strongly or very strongly acidic. The Dandridge soils are slightly acidic neutral or mildly alkaline. At New River Gorge and the nearby Bluestone River, as well as parts of the Gauley River in West Virginia, this association is the predominant upland forest type on lower to upper colluvial gorge slopes of intermediate soil moisture and fertility with relatively warm, dry aspects. It also occurs in smaller patches on plateaus, ridge spurs and convex upper slopes, often north-facing. Stands occur both on sandstones of the Pottsville group and on shales of the Mauch Chunk group. Elevations of mapped stands range from 209 to 985 m. Slopes range from flat to very steep (0 to 51 degrees, mean = 24 degrees). Soils are mostly well-drained, dry to somewhat moist, sandy to clay loams mapped in the Calvin, Dekalb, and Gilpin series. Soil chemistry analyzed from 10 plots indicates extremely acidic to slightly acidic soils (mean pH = 4.92) with intermediate levels of most nutrients and somewhat higher levels of some nutrients (Al, K, Mg, Mn, P) compared to other nearby community types.

Vegetation Description: This association is a closed-canopy (or occasionally somewhat open-canopy) deciduous forest dominated by species of *Quercus* (oak), often with *Carya* (hickory) spp., and characteristically with an abundance of *Acer saccharum* (sugar maple) in the canopy and/or shrub layers. *Quercus prinus* (chestnut oak) is the most typical canopy dominant; other dominants can include *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Fraxinus americana* (white ash), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), and *Carya ovata* (shagbark hickory). *Liriodendron tulipifera* (tuliptree) may be a canopy associate. Subcanopy species include *Carya ovata* (shagbark hickory), *Carya glabra* (pignut hickory), *Quercus rubra* (northern red oak), *Quercus muehlenbergii* (chinkapin oak), *Acer saccharum* (sugar maple), *Aesculus flava* (yellow buckeye), *Tilia americana* (American basswood), *Acer rubrum* (red maple), and *Juniperus virginiana* (eastern red-cedar). The subcanopy may be dominated by *Acer saccharum* (sugar maple) in some examples. Vines, which may occur in the understory or reach into the canopy, include *Aristolochia macrophylla* (pipevine), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis aestivalis* var. *bicolor* (summer grape). Common tall shrubs or short trees include *Amelanchier arborea* var. *arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Halesia tetraptera* (mountain silverbell), *Hamamelis virginiana* (American witchhazel), *Ostrya virginiana* (hophornbeam), and *Viburnum rafinesquianum* (downy arrow-wood). The shrub and herbaceous layers include small stems of canopy and subcanopy species along with herbaceous species. The most common shrubs are *Viburnum acerifolium* (mapleleaf viburnum) and *Smilax rotundifolia* (roundleaf greenbrier); *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras), and/or *Hydrangea arborescens* (wild hydrangea) may also be present. Common herbs include *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Brachyelytrum erectum* (bearded shorthusk), *Bromus pubescens* (hairy woodland brome), *Carex albursina* (white bear sedge), *Carex cumberlandensis* (Cumberland sedge), *Carex digitalis* (slender woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Campanulastrum americanum* (American bellflower), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium boscii* (Bosc's panicgrass), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaeazans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Houstonia longifolia* (longleaf summer bluet), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Vicia* (vetch) *caroliniana*, *Viola* (violet) spp., and *Zizia trifoliata* (meadow alexanders). Vascular plant species richness in 38 400-square-meter sampled plots at New and Gauley rivers, West Virginia, range from 27 to 61 taxa (mean = 43.7).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Carya glabra</i> (pignut hickory)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak) <i>Quercus prinus</i> (chestnut oak) <i>Quercus rubra</i> (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Shrub/sapling (tall & short)	Vine/Liana	<i>Smilax rotundifolia</i> (roundleaf greenbrier)

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Short shrub/sapling	Broad-leaved deciduous tree	<i>Quercus prinus</i> (chestnut oak)
Herb (field)	Fern or fern ally	<i>Pleopeltis polypodioides</i> ssp. <i>polypodioides</i> (resurrection fern)

Characteristic Species: *Actaea racemosa* (black bugbane), *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Carex albursina* (white bear sedge), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaeazans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Geranium maculatum* (spotted geranium), *Maianthemum racemosum* (feathery false lily of the valley), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Prosartes lanuginosa* (yellow fairybells), *Quercus rubra* (northern red oak), *Sanicula canadensis* (Canadian blacksnakeroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Viburnum acerifolium* (mapleleaf viburnum).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Berberis canadensis</i> (American barberry)	G3	plant	globally vulnerable
<i>Monarda fistulosa</i> ssp. <i>brevis</i> (smoke hole bergamot)	G5T1	plant	critically imperiled

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: These dry-mesic forests are found in the Ridge and Valley and adjacent sedimentary ecoregions (Cumberlands, Interior Low Plateau) of the southeastern United States, ranging from Kentucky and Tennessee to West Virginia and perhaps Virginia.

States/Provinces: AL:S1, KY?, TN, VA?, WV.

Federal Lands: DOE (Oak Ridge); NPS (Bluestone, Gauley River, New River Gorge, Russell Cave); TVA (Tellico); USFS (Cherokee?).

CONSERVATION STATUS

Rank: G4? (9-Oct-2001).

Reasons: This community is believed to be relatively common and secure, although good mature examples of large size may be uncommon. Additional information is needed relative to its distribution and relation to other similar communities. The rank was formerly G3G5, and changing it to G4? (which is equivalent) makes it clear that this is not to be considered a rare community type.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Two variants of this association (14 stands sampled; 19 stands sampled) were described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeast Monroe County). It has also been sampled at New River Gorge, Bluestone River, and Gauley River in West Virginia. This may be similar to vegetation reported from limestone in the Ridge and Valley of Virginia.

Similar Associations:

- *Liriodendron tulipifera* - *Tilia americana* var. *heterophylla* - *Aesculus flava* - *Acer saccharum* / (*Magnolia tripetala*) Forest (CEGL005222).
- *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest (CEGL007267).
- *Quercus prinus* - *Quercus rubra* - *Carya* (*ovata*, *glabra*) - *Pinus virginiana* Forest (CEGL007269).
- *Quercus prinus* - *Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia*, *Styrax grandifolius*) Forest (CEGL007700).

Related Concepts:

- *Quercus prinus* - *Quercus rubra* - (*Quercus alba*) - *Liriodendron tulipifera* - *Acer rubrum* / *Parthenocissus quinquefolia* forest (Vanderhorst 2001b) B
- Chestnut Oak Forest (Oberholster 1993) B
- Chestnut Oak, RV (Pyne 1994) B
- Chestnut Oak: 44 (Eyre 1980) B
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) ?
- White Oak - Northern Red Oak - Black Oak (Rentch et al. 2005) ?

SOURCES

Description Authors: M. Andreu and M. Tukman, mod. S. C. Gawler.

References: Allard 1990, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Oberholster 1993, Pyne 1994, Rentch et al. 2005, Schotz pers. comm., Southeastern Ecology Working Group n.d., Sponaugle et al. 1984, TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.



Plot GARI.202. Oak - Hickory - Sugar Maple Forest.

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

SYNONYMS

USNVC English Name: Chestnut Oak - (Northern Red Oak) - Hickory species /
Sourwood - Flowering Dogwood Forest

USNVC Scientific Name: *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum*
arboreum - *Cornus florida* Forest

USNVC Identifier: CEGL007267

LOCAL INFORMATION

Environmental Description: This association occurs in small to large patches in relatively warm, dry sites with relatively low soil fertility. It occurs in small patches, mostly on upper slopes, in the east end of the park and becomes the matrix community in all slope positions on warm aspects in the west end of the park. It occurs on plateaus, ridges, and gorge slopes. Mean solar exposure of mapped polygons is relatively high and aspects are mostly southeast to southwest to northwest. Slopes in mapped polygons range from 0.4–48 degrees (mean = 19.5). Elevations in mapped polygons range from 220–612 m (mean = 397.8). Bedrock geology is mapped as sandstones and shales of the New River and Kanawha formations of the Pottsville group. Surficial geology in plots is mostly sandstone. Unvegetated groundcover is dominated by litter and rock. Soils in plots are described as well to rapidly drained, dry to somewhat moist sandy loam, sandy clay loam, sandy silt loam, silt loam, and clay loam. Soils test slightly to extremely acidic (mean pH = 4.59) with relatively high levels of estimated N release and Al, and relatively low levels of Ca, Fe, Mg, and Zn compared to average values from all plots in the park. This association is often adjacent to and grades towards Oak - Hickory - Sugar Maple Forest (CEGL007268), which occurs in more mesic or more fertile sites, and Oak / Ericad Forest (CEGL006271), which occurs in more xeric sites. In the east end of the park, it is often embedded in the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).

Vegetation Description: This association is a mostly deciduous forest dominated by species of *Quercus* (oak) and *Carya* (hickory). Canopies are usually tall (>20 m) with cover in plots ranging from 30–80%. Codominant canopy trees include (in decreasing order of constancy in plots) *Carya alba* (mockernut hickory), *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus coccinea* var. *coccinea* (scarlet oak), and *Fagus grandifolia* (American beech). The conifer *Tsuga canadensis* (eastern hemlock) sometimes occurs with low cover. Cover in the subcanopy of plots ranges from 10–70% with species of *Quercus* (oak) less well-represented than in the canopy. Important subcanopy trees include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Oxydendrum arboreum* (sourwood), *Quercus alba* (white oak), *Fagus grandifolia* (American beech), *Acer saccharum* var. *saccharum* (sugar maple), and *Nyssa sylvatica* (blackgum). Cover in the tall-shrub layer of plots ranges from 1–40% with high representation by saplings of the shade-tolerant canopy trees. Additional small trees and shrubs in this layer include *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (American witchhazel), *Ilex opaca* var. *opaca* (American holly), and *Rhododendron maximum* (great laurel) (with low cover). Cover in the short-shrub layer of plots ranges from 1–20%; common species include *Smilax rotundifolia* (roundleaf greenbrier), *Rubus* (blackberry) spp., *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), *Sassafras albidum* (sassafras),

Toxicodendron radicans (eastern poison ivy), *Viburnum acerifolium* (mapleleaf viburnum), and *Vaccinium pallidum* (Blue Ridge blueberry). Cover in the herb layer of plots ranges from 1 to 40%. Herbs with high constancy include *Polystichum acrostichoides* (Christmas fern), *Carex digitalis* var. *digitalis* (slender woodland sedge), *Dioscorea quaternata* (fourleaf yam), *Solidago caesia* (wreath goldenrod), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Dichanthelium boscii* (Bosc's panicgrass), *Viola hastata* (halberdleaf yellow violet), *Potentilla simplex* (common cinquefoil), *Eurybia divaricata* (white wood aster), *Desmodium nudiflorum* (nakedflower ticktrefoil), and *Carex communis* var. *communis*. Vascular plant species richness in plots ranges from 28–78 taxa (mean = 43.2). Nonvascular cover in plots ranges from 0 to 40% and is dominated by mosses. Common mosses include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Polytrichum ohioense* (Ohio polytrichum moss), *Leucobryum albidum* (leucobryum moss), and *Dicranum fulvum* (dicranum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: Occurrences are scattered on gorge slopes and plateaus throughout the park. It is more abundant on river right (on the right looking downstream) and in the west end of the park.

Classification Comments: This association is floristically and environmentally intermediate between Oak - Hickory - Sugar Maple Forest (CEGL007268) and Oak / Ericad Forest (CEGL006271). In cluster analysis, plots of this association form two main groups which mix with plots of these two related types. Generally low cover of *Acer saccharum* var. *saccharum* (sugar maple) and *Kalmia latifolia* (mountain laurel) helps distinguish this association from these two types, respectively.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-three plots were sampled: GARI.34, GARI.44, GARI.64, GARI.85, GARI.93, GARI.111, GARI.114, GARI.120, GARI.133, GARI.142, GARI.144, GARI.147, GARI.151, GARI.153, GARI.160, GARI.161, GARI.168, GARI.182, GARI.188, GARI.198, GARI.199, GARI.206, and GARI.212.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - <i>Quercus rubra</i> Forest Alliance (A.250)
Alliance (English name)	Chestnut Oak - Northern Red Oak Forest Alliance
Association	<i>Quercus prinus</i> - (<i>Quercus rubra</i>) - <i>Carya</i> spp. / <i>Oxydendrum arboreum</i> - <i>Cornus florida</i> Forest
Association (English name)	Chestnut Oak - (Northern Red Oak) - Hickory species / Sourwood - Flowering Dogwood Forest

Ecological System(s): Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This community is known from low to intermediate elevations of the Southern Blue Ridge escarpment, the Great Smoky Mountains, Piedmont transition areas, into the Southern Ridge and Valley, and in the Cumberlands in southern West Virginia. It occurs on relatively exposed landforms below 1000 m (3280 ft) elevation (220–1000 m [700–3280 ft]), on nearly level to steep, convex, middle to upper slopes, ridges, and plateaus, with mostly northwestern to southeastern aspects. These are forests characterized by canopies dominated by *Quercus* (oak) and *Carya* (hickory) species that do not have a well-developed heath shrub layer. *Acer rubrum* (red maple) and *Liriodendron tulipifera* (tuliptree) may have significant coverage, apparently related to logging history. The predominant oaks and hickories in the canopy are *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Additional canopy and subcanopy species can include *Nyssa sylvatica* (blackgum), *Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* var. *monticola* (mountain silverbell), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Oxydendrum arboreum* (sourwood). *Cornus florida* (flowering dogwood) is characteristic and may be dominant in the subcanopy and tall-shrub layers; other tall-shrub species include *Magnolia fraseri* (mountain magnolia), *Hamamelis virginiana* (American witchhazel), and *Sassafras albidum* (sassafras). *Kalmia latifolia* (mountain laurel) or *Rhododendron maximum* (great laurel) may be present but only at very low cover. The short-shrub stratum is sparse (up to 20% cover), with no clear dominant. Some typical shrub species include *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), and (in the central and southern portions of the type's range) *Gaylussacia ursina* (bear huckleberry), *Hydrangea arborescens* (wild hydrangea), and *Hydrangea radiata* (silverleaf hydrangea). Common vines are *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), *Vitis rotundifolia* (muscadine), and *Vitis vulpina* (frost grape). Herb cover is sparse to moderate; diversity and species composition vary among occurrences. Some of the more typical herb species include *Eurybia divaricata* (white wood aster), *Dioscorea quaternata* (fourleaf yam), *Maianthemum racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Solidago caesia* (wreath goldenrod), *Uvularia perfoliata* (perfoliate bellwort), and *Uvularia puberula* (mountain bellwort).

Environmental Description: This community is known from plateaus, ridges, and gorge slopes at low to intermediate elevations, on relatively exposed landforms from 220 to 1000 m (700–3250 ft) elevation. Slopes are moderately steep to steep where it occurs on convex, middle to upper slopes, grading to gentle on ridges and plateaus; aspects are mostly northern to southwestern. Unvegetated ground cover is dominated by litter and rock. In Virginia, the type occurs on sites underlain by colluvial and alluvial fan material, sandstone, quartzite, and rocks of the Northern Blue Ridge granitic complex. Farther south, soils are weathered from sandstones and, less commonly, shales and are strongly acidic, relatively nutrient-poor and sandy to loamy in texture. Soils in West Virginia plots are well- to rapidly-drained, dry to somewhat moist sandy loam, sandy clay loam, sandy silt loam, silt loam, and clay loam, and test slightly to extremely acidic (mean pH = 4.59). Soil chemistry data from 25 plot samples from throughout the range indicate that mean conditions are extremely acidic, with low levels of calcium, magnesium, and

total base saturation, along with moderately high iron and aluminum (Fleming and Patterson 2009a).

Vegetation Description: These are forests dominated by species of *Quercus* (oak) and *Carya* (hickory) and without a well-developed heath shrub layer. *Acer rubrum* (red maple) and *Liriodendron tulipifera* (tuliptree) may have significant coverage, apparently related to logging history. The predominant oaks and hickories in the canopy are *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak). Additional canopy and subcanopy species can include *Nyssa sylvatica* (blackgum), *Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* var. *monticola* (mountain silverbell), *Fagus grandifolia* (American beech), *Ilex opaca* (American holly), and *Oxydendrum arboreum* (sourwood). *Cornus florida* (flowering dogwood) is characteristic and may be dominant in the subcanopy and tall-shrub layers; other tall-shrub species include *Magnolia fraseri* (mountain magnolia), *Hamamelis virginiana* (American witchhazel), and *Sassafras albidum* (sassafras). *Kalmia latifolia* (mountain laurel) or *Rhododendron maximum* (great laurel) may be present but only at very low cover. The short-shrub stratum is sparse (up to 20% cover), with no clear dominant. Some typical shrub species include *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum), and (in the central and southern portions of the type's range) *Gaylussacia ursina* (bear huckleberry), *Hydrangea arborescens* (wild hydrangea), and *Hydrangea radiata* (silverleaf hydrangea). Common vines are *Smilax rotundifolia* (roundleaf greenbrier), *Smilax glauca* (cat greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy), *Vitis aestivalis* (summer grape), *Vitis rotundifolia* (muscadine), and *Vitis vulpina* (frost grape). Herb cover is sparse to moderate; diversity and species composition vary among occurrences. Some of the more typical species include *Ageratina altissima* (white snakeroot), *Eurybia divaricata* (white wood aster), *Carex communis* var. *communis*, *Carex digitalis* var. *digitalis* (slender woodland sedge), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dichanthelium* (rosette grass) spp. (e.g., *Dichanthelium boscii* (Bosc's panicgrass), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium dichotomum* (cypress panicgrass)), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Galium latifolium* (purple bedstraw), *Goodyera pubescens* (downy rattlesnake plantain), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Houstonia purpurea* (Venus' pride), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Polystichum acrostichoides* (Christmas fern), *Prenanthes* (rattlesnakeroot) spp., *Solidago caesia* (wreath goldenrod), *Thalictrum thalictroides* (rue-anemone), *Thelypteris noveboracensis* (New York fern), *Uvularia perfoliata* (perfoliate bellwort), *Uvularia puberula* (mountain bellwort), *Uvularia sessilifolia* (sessileleaf bellwort), and *Viola* (violet) spp. (e.g., *Viola blanda* (sweet white violet), *Viola hastata* (halberdleaf yellow violet), *Viola X palmata* (early blue violet), *Viola tripartita* (threepart violet)). Common mosses from West Virginia plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Hypnum imponens* (hypnum moss), *Polytrichum ohioense* (Ohio polytrichum moss), *Leucobryum albidum* (leucobryum moss), and *Dicranum fulvum* (dicranum moss).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple) <i>Carya alba</i> (mockernut hickory) <i>Carya glabra</i> (pignut hickory) <i>Carya ovata</i> (shagbark hickory) <i>Liriodendron tulipifera</i> (tuliptree) <i>Quercus alba</i> (white oak) <i>Quercus velutina</i> (black oak)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus prinus</i> (chestnut oak) <i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Ageratina altissima* (white snakeroot), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Castanea dentata* (American chestnut), *Cornus florida* (flowering dogwood), *Dioscorea quaternata* (fourleaf yam), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Goodyera pubescens* (downy rattlesnake plantain), *Liriodendron tulipifera* (tuliptree), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Nyssa sylvatica* (blackgum), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Solidago caesia* (wreath goldenrod), *Thelypteris noveboracensis* (New York fern), *Toxicodendron radicans* (eastern poison ivy), *Uvularia perfoliata* (perfoliate bellwort), *Uvularia puberula* (mountain bellwort).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Ageratina altissima</i> var. <i>roanensis</i> (white snakeroot)	G5T3T4	plant	
<i>Carex lucorum</i> var. <i>australucorum</i> (Blue Ridge sedge)	G4T3T4	plant	
<i>Isotria medeoloides</i> (green fiveleaf orchid)	G2	plant	Federally listed threatened; globally imperiled
<i>Monotropsis odorata</i> (pygmypipes)	G3	plant	
<i>Solidago glomerata</i> (clustered goldenrod)	G3	plant	
<i>Tsuga caroliniana</i> (Carolina hemlock)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge, the Great Smoky Mountains, and Piedmont transition areas of western North Carolina, eastern Tennessee, northwestern South Carolina, and northeastern Georgia, extending north into the Cumberlands in southern West Virginia and the border area between Virginia, Kentucky, and Tennessee. It also extends north in the Virginia Ridge and Valley and Blue Ridge to Allegheny, Botetourt, and Bedford counties.

States/Provinces: GA, KY, NC, SC, TN, VA:S3S4, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, George Washington, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G4G5 (15-Aug-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This forest lacks the dense ericaceous shrub layer typical of other *Quercus prinus* (chestnut oak)-dominated forests in the Blue Ridge escarpment region and commonly has diverse herbaceous composition. It is distinguished from similar forests in the Ridge and Valley by lacking *Acer saccharum* (sugar maple) and from Piedmont forests by the lack of *Quercus falcata* (southern red oak) and *Quercus stellata* (post oak), and by the presence of species more typical of the Southern Appalachians (*Magnolia fraseri* (mountain magnolia), *Halesia tetraptera* (mountain silverbell), and *Castanea dentata* (American chestnut)). This association was originally defined from the Chattooga Basin Project (S. Simon pers. comm.) and later refined with information from the Great Smoky Mountains. The North Carolina Piedmont examples of this association are only montane transition areas, such as the Sauratown Mountains and Hanging Rock. In West Virginia, this association is floristically intermediate between *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268) and the more xeric *Quercus* (*pinus*, *coccinea*) / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271), and some stands are difficult to distinguish. It lacks the abundance of *Acer saccharum* (sugar maple) of the former and the abundance of ericaceous shrubs of the latter and has higher abundance of *Liriodendron tulipifera* (tuliptree) than either.

Similar Associations:

- *Acer rubrum* var. *rubrum* - *Betula* (*alleghaniensis*, *lenta*) - *Magnolia fraseri* / (*Rhododendron maximum*, *Kalmia latifolia*) Forest (CEGL008558).
- *Quercus* (*pinus*, *coccinea*) / *Kalmia latifolia* / (*Galax urceolata*, *Gaultheria procumbens*) Forest (CEGL006271)--is similar but features a well-developed ericaceous shrub layer.
- *Quercus alba* - *Quercus* (*rubra*, *pinus*) / *Rhododendron calendulaceum* - *Kalmia latifolia* - (*Gaylussacia ursina*) Forest (CEGL007230)--occurs at higher elevations and has a stronger white oak component.
- *Quercus prinus* - *Carya ovata* - *Quercus rubra* / *Acer saccharum* Forest (CEGL007268)--is similar but characterized by *Acer saccharum* as an important subcanopy (or canopy) tree.
- *Quercus prinus* - *Quercus rubra* / *Hamamelis virginiana* Forest (CEGL006057).
- *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEGL006286).
- *Quercus rubra* - *Quercus prinus* - *Magnolia* (*acuminata*, *fraseri*) / *Acer pensylvanicum* Forest [Provisional] (CEGL004817).

Related Concepts:

- *Quercus montana* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest (Fleming et al. 2006) =
- *Quercus prinus* - *Quercus rubra* - (*Quercus alba*) - *Liriodendron tulipifera* - *Acer rubrum* / *Parthenocissus quinquefolia* forest (Vanderhorst 2001b) B
- Chestnut Oak Forest (Herb Subtype) (Schafale 1998b) ?
- IA6h. Montane Oak - Hickory Forest (Allard 1990) B
- Montane Mixed Oak / Oak - Hickory Forest (Fleming and Coulling 2001) B
- Oak - Chestnut - Hickory Forest (Ambrose 1990a) B

SOURCES

Description Authors: K. D. Patterson, mod. T. Govus, R. White, S. C. Gawler, G. P. Fleming.

References: Allard 1990, Ambrose 1990a, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming and Patterson 2009a, Fleming et al. 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Simon pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.44. Oak - Hickory Forest.

COMMON NAME (PARK-SPECIFIC): OAK / GREAT LAUREL FOREST

SYNONYMS

USNVC English Name: Chestnut Oak - Northern Red Oak / Great Laurel / Beetleweed Forest

USNVC Scientific Name: *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest

USNVC Identifier: CEGLO06286

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone colluvium on gorge slopes with relatively warm aspects. Mean solar exposure in mapped polygons is relatively high but with a high standard deviation. It can occur on any aspect but most sites have southerly to westerly aspects. Slopes in mapped polygons range from 2 to 50 degrees (mean = 25.1). Elevations in mapped polygons range from 214 to 596 m (mean = 426.8). Bedrock geology is mapped as sandstones of the New River formation of the Pottsville group, and surficial geology noted in plots is exclusively sandstone. Unvegetated ground cover in plots is dominated by litter and large rocks. Soils in plots are described as well- to rapidly-drained, dry to somewhat moist sandy loam and sandy clay loam. Soils of some sites may be classified as folists, characterized by deep organic horizons (duff) over bouldery colluvium. Soils test very strongly to extremely acidic (mean pH = 4.20) with relatively high levels of estimated N release and Al, and relatively low levels of B, Ca, Cu, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Most stands of this association are imbedded in the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Adjacent patches of deciduous forest which lack high cover by *Rhododendron maximum* (great laurel) include Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) and Oak - Hickory Forest (CEGL007267).

Vegetation Description: This association represents forests with mostly deciduous canopies dominated by oaks growing over a dense tall-shrub layer dominated by *Rhododendron maximum* (great laurel). Canopies are relatively tall (>20 m) with cover in plots ranging from 40 to 80%. Codominant trees in the canopy include *Quercus prinus* (chestnut oak) (constant in plots), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). Cover in the tall-shrub layer of plots ranges from 20 to 70%, dominated by the evergreen *Rhododendron maximum* (great laurel). Additional shrubs and vines include *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), *Hamamelis virginiana* (American witchhazel), and *Kalmia latifolia* (mountain laurel). The herb layer has low cover (5% or less in plots) and diversity. The most common herbs are *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), *Dioscorea quaternata* (fourleaf yam), and *Chimaphila maculata* (striped prince's pine). Vascular plant species richness in plots ranges from 12 to 49 taxa (mean = 30.1). Nonvascular cover in plots ranges from 0 to 30%, dominated by mosses. Common mosses include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Dicranum fulvum*

(dicranum moss), *Leucobryum albidum* (leucobryum moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association is scattered on gorge slopes throughout the park. It is most abundant on river right (on the right looking downstream) in the eastern two-thirds of the park.

Classification Comments: The nominal evergreen herb *Galax urceolata* (beetleweed) was not found in this community at Gauley River although habitat seems appropriate. The park is close to the northern limits of this species' range; it is present but not common in the park. Stands similar to this association but with significant cover by *Tsuga canadensis* (eastern hemlock) in the canopy layers are classified as Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Seven plots were sampled: GARI.43, GARI.55, GARI.80, GARI.105, GARI.121, GARI.152, and GARI.201.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - <i>Quercus rubra</i> Forest Alliance (A.250)
Alliance (English name)	Chestnut Oak - Northern Red Oak Forest Alliance
Association	<i>Quercus prinus</i> - <i>Quercus rubra</i> / <i>Rhododendron maximum</i> / <i>Galax urceolata</i> Forest
Association (English name)	Chestnut Oak - Northern Red Oak / Great Laurel / Beetleweed Forest
Ecological System(s):	Southern Appalachian Oak Forest (CES202.886).

GLOBAL DESCRIPTION

Concept Summary: This forest is known from protected, usually steep slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont to the east and the Cumberlands and Southern Ridge and Valley to the west. In the southern portion of its range (Southern Blue Ridge), it usually occurs on north-facing slopes, while in the northern part of its range (the Cumberlands in West Virginia), most sites have southerly to westerly aspects. This is typically a midslope to lower slope type, but it can be found on upper slopes in a more sheltered position. This forest is found at elevations between 760 and 1220 m (2500–4000 ft) in the Southern Blue Ridge and at somewhat lower elevations (200–600 m) in the Cumberland Plateau. Canopies in these forests are dominated by *Quercus prinus* (chestnut oak), usually with lesser amounts of *Quercus rubra* (northern red oak) and/or *Acer rubrum* (red maple), and always occurring over a dense, very tall shrub stratum (2–6 m) of *Rhododendron maximum* (great laurel). In some examples, this community may also be codominated or dominated by *Quercus velutina* (black

oak), *Quercus alba* (white oak), or *Betula lenta* (sweet birch). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). On some sites, *Tsuga canadensis* (eastern hemlock) may have dense understory regeneration. In some areas of the Southern Blue Ridge, *Rhododendron minus* (piedmont rhododendron) may dominate the shrub layer. Other common shrubs can include *Gaylussacia ursina* (bear huckleberry) (in the Southern Blue Ridge), *Kalmia latifolia* (mountain laurel), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), and/or *Hamamelis virginiana* (American witchhazel). Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* (beetleweed) is found in most occurrences except at the northern limit of this type's range in West Virginia. Other herb species that can be typical include *Chimaphila maculata* (striped prince's pine), *Goodyera pubescens* (downy rattlesnake plantain), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), and *Dioscorea quaternata* (fourleaf yam). Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. Vascular plant species richness in seven 400-square-meter West Virginia plots ranges from 12 to 49 taxa (mean = 30.1).

Environmental Description: This forest is known from protected, usually steep slopes in the Southern Blue Ridge and ranges into adjacent areas of the upper Piedmont to the east and the Cumberlands and Southern Ridge and Valley to the west. In the southern portion of its range (Southern Blue Ridge), it usually occurs on north-facing slopes, while in the northern part of its range (the Cumberlands in WV), most sites have southerly to westerly aspects. This is typically a midslope to lower slope type, but it can be found on upper slopes in a more sheltered position. This forest is found at elevations between 760 and 1220 m (2500–4000 ft) in the Southern Blue Ridge and at somewhat lower elevations (200–600 m) in the Cumberland Plateau. Soils in WV plots are described as well- to rapidly-drained, dry to somewhat moist sandy loam and sandy clay loam that test very strongly to extremely acidic (mean pH = 4.20). Soils of some sites may be classified as folists, characterized by deep organic horizons (duff) over bouldery colluvium.

Vegetation Description: Canopies in these forests are dominated by *Quercus prinus* (chestnut oak), usually with lesser amounts of *Quercus rubra* (northern red oak) and/or *Acer rubrum* (red maple), and always occurring over a dense, very tall shrub stratum (2–6 m) of *Rhododendron maximum* (great laurel). In some examples, this community may also be codominated or dominated by *Quercus velutina* (black oak), *Quercus alba* (white oak), or *Betula lenta* (sweet birch). Additional trees with lower constancy and cover in the canopy and subcanopy include *Tsuga canadensis* (eastern hemlock), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), and *Nyssa sylvatica* (blackgum). On some sites, *Tsuga canadensis* (eastern hemlock) may have dense understory regeneration. In some areas of the Southern Blue Ridge, *Rhododendron minus* (piedmont rhododendron) may dominate the shrub layer. Other common shrubs can include *Gaylussacia ursina* (bear huckleberry) (in the Southern Blue Ridge), *Kalmia latifolia* (mountain laurel), *Smilax rotundifolia* (roundleaf greenbrier), *Ilex opaca* var. *opaca* (American holly), and/or *Hamamelis virginiana* (American witchhazel). Herbs are sparse. The ground cover is dominated by leaf litter, but *Galax urceolata* (beetleweed) is found in most occurrences except at the northern limit of this type's range in West Virginia. Other herb species that can be typical include *Chimaphila maculata* (striped prince's pine), *Goodyera pubescens* (downy rattlesnake plantain), *Polystichum acrostichoides* (Christmas fern), *Maianthemum*

racemosum (feathery false lily of the valley), *Solidago caesia* (wreath goldenrod), *Mitchella repens* (partridgeberry), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), and *Dioscorea quaternata* (fourleaf yam). Some examples may have sparse (woodland-like) canopies and occur in association with rock outcroppings. Vascular plant species richness in seven 400-square-meter WV plots ranges from 12 to 49 taxa (mean = 30.1).

In the Great Smoky Mountains, this community is found consistently as a transitional band of vegetation, downslope from drier *Quercus prinus* (chestnut oak) ridgetop forests, *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), and grading into acidic cove forests, *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543), on the steep ravines below. At Cumberland Gap National Historical Park and the Gauley River National Recreation Area, it can grade into mixed mesophytic forests (CEGL005222) as well.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Quercus prinus</i> (chestnut oak), <i>Quercus rubra</i> (northern red oak)
Tall shrub/sapling	Broad-leaved evergreen tree	<i>Rhododendron maximum</i> (great laurel)

Characteristic Species: *Chimaphila maculata* (striped prince's pine), *Galax urceolata* (beetleweed), *Polystichum acrostichoides* (Christmas fern), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Rhododendron maximum* (great laurel).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Trillium rugelii</i> (illscented wakerobin)	G3	plant	
<i>Tsuga caroliniana</i> (Carolina hemlock)	G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge of northeastern Georgia, northwestern South Carolina, north through eastern Tennessee, western North Carolina, and southwestern Virginia. It extends into the Cumberlands and Southern Ridge and Valley of Kentucky, Virginia and West Virginia. Its range also extends into the upper Piedmont of North Carolina.

States/Provinces: GA, KY, NC, SC, TN, VA:S3?, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Carl Sandburg Home, Cumberland Gap, Gauley River, Great Smoky Mountains); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Jefferson, Nantahala, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G4 (22-Feb-2010).

Reasons: This community is uncommon, but not rare, throughout most of its range. As currently defined, it is a regional endemic, found only in the Southern Blue Ridge and adjacent regions of the upper Piedmont and Cumberlands and Southern Ridge and Valley. This community is often overlooked or not distinguished separately in inventories; thus, it is more common than the number of documented occurrences suggests.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is more protected and more mesic than *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). It occurs at lower elevations and on more protected topographic positions than *Quercus rubra / (Kalmia latifolia, Rhododendron catawbiense (Catawba rosebay), Rhododendron maximum) / Galax urceolata* Forest (CEGL007299). It is much less diverse than *Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida* Forest (CEGL007267), lacking the diverse herbaceous and woody components found in that association. Stands similar to this association but with significant cover by *Tsuga canadensis* (eastern hemlock) in the canopy layers are classified as *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543).

Similar Associations:

- *Acer rubrum* var. *rubrum* - *Betula (alleghaniensis, lenta) - Magnolia fraseri / (Rhododendron maximum, Kalmia latifolia)* Forest (CEGL008558).
- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543).
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271).
- *Quercus prinus - (Quercus rubra) - Carya spp. / Oxydendrum arboreum - Cornus florida* Forest (CEGL007267).
- *Quercus prinus / Rhododendron catawbiense - Kalmia latifolia* Forest (CEGL008524)--is mostly of the Central Appalachians and only peripherally in the northern portion of the Southern Blue Ridge; occupies drier sites and is characterized by a dense *Rhododendron catawbiense* shrub layer.
- *Quercus rubra / (Kalmia latifolia, Rhododendron catawbiense, Rhododendron maximum) / Galax urceolata* Forest (CEGL007299).

Related Concepts:

- *Quercus montana - Quercus rubra / Rhododendron maximum / Galax urceolata* Forest (Fleming et al. 2006) =
- Chestnut Oak Forest (*Rhododendron* Subtype) (Schafale 1998b) ?
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) B
- Oak / Heath Forest (Fleming and Coulling 2001) B

SOURCES

Description Authors: K. D. Patterson, mod. R. White and S. C. Gawler.

References: Allard 1990, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2006, NatureServe Ecology - Southeastern U.S. unpubl. data, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale and Weakley 1990, Schafale pers. comm., Simon pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2010.



Plot GARI.201. Oak / Great Laurel Forest.

COMMON NAME (PARK-SPECIFIC): OAK - HICKORY FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: (Northern Red Oak, Black Oak, White Oak) / American hornbeam - (Mountain Silverbell) / Feathery False Lily-of-the-valley Forest

USNVC Scientific Name: *Quercus (rubra, velutina, alba)* / *Carpinus caroliniana* - (*Halesia tetraptera*) / *Maianthemum racemosum* Forest

USNVC Identifier: CEGLO06462

LOCAL INFORMATION

Environmental Description: This association occurs in a few small patches on upper floodplains subject to infrequent, low-energy flooding. Historical extent of this community has probably been reduced by construction of railroads along the river and by reduction of peak flows since construction of Summersville Dam. Slopes in mapped polygons range from 3 to 26 degrees (mean = 22.5). Elevations in mapped polygons range from 241 to 351 m (mean = 271.2). Sites have fluvial microtopography of levees and swales formed from sandy alluvium.

Unvegetated ground cover in the one plot sampled is dominated by litter. Soil in the plot is described as well-drained, somewhat moist sand with some evidence of A horizon development. Soil from one plot tested extremely acidic (pH = 4.1) with relatively high levels of S, Fe, and P, and relatively low levels of total exchange capacity, organic matter, estimated N release, Al, B, Ca, Cu, K, Mg, Mn, Na, and Zn compared to average values from all plots in the park. Adjacent vegetation on floodplains includes Eastern Hemlock Floodplain Forest (CEGL006620), (Virginia, Pitch) Pine Floodplain Forest (CEGL006624), American Sycamore - River Birch Riverscours Woodland (CEGL003725), and Riverscours Shrub Prairie (CEGL006623).

Vegetation Description: This association is a deciduous floodplain forest dominated by species of *Quercus* (oak) and *Carya* (hickory). The canopy of the one plot sampled is tall (30 m) with 70% cover. Canopy trees in the plot include (in decreasing order of cover) *Quercus velutina* (black oak), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), and *Sassafras albidum* (sassafras). Cover in the subcanopy of the plot is 60%. In addition to the canopy species, the subcanopy includes *Magnolia acuminata* (cucumber-tree), *Magnolia fraseri* (mountain magnolia), *Magnolia tripetala* (umbrella-tree), and *Oxydendrum arboreum* (sourwood). The tall-shrub layer has 40% cover and includes *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), and *Ilex opaca* var. *opaca* (American holly). The short-shrub layer has 10% cover and includes *Xanthorrhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). The herb layer has 40% cover, which is dominated by the rhizomatous fern *Thelypteris noveboracensis* (New York fern). Additional herbs in the plot include *Hexastylis virginica* (Virginia heartleaf), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Brachyelytrum erectum* (bearded shorthusk), *Conopholis americana* (American squawroot), *Osmunda cinnamomea* (cinnamon fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonatum biflorum* (smooth Solomon's seal), and *Sanguinaria canadensis* (bloodroot). Vascular plant species richness in the plot is 44 taxa.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in a few small patches along the middle section of the Gauley River in the park.

Classification Comments: This association occurs in very small patches and is not well-developed at Gauley River, but is recognized based on experience with similar vegetation along other West Virginia rivers. The parenthetical nominal *Halesia tetraptera* (mountain silverbell) and the herb *Hydrastis canadensis* (goldenseal), which characterize stands of this association at New River, do not occur in stands at Gauley River. This association differs from upland occurrences of Oak - Hickory Forest (CEGL007267) by the presence of species which are characteristic of floodplains; at Gauley River, these include *Carpinus caroliniana* ssp. *virginiana* (American hornbeam) and *Xanthorhiza simplicissima* (yellowroot).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: One plot was sampled: GARI.89.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	<i>Acer saccharum</i> - <i>Carya cordiformis</i> Temporarily Flooded Forest Alliance (A.302)
Alliance (English name)	Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance
Association	<i>Quercus (rubra, velutina, alba)</i> / <i>Carpinus caroliniana</i> - (<i>Halesia tetraptera</i>) / <i>Maianthemum racemosum</i> Forest
Association (English name)	(Northern Red Oak, Black Oak, White Oak) / American hornbeam - (Mountain Silverbell) / Feathery False Lily-of-the-valley Forest
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705).

GLOBAL DESCRIPTION

Concept Summary: This association is a closed-canopy to somewhat open-canopy deciduous floodplain forest on the highest positions of river floodplains. These alluvial terraces are infrequently flooded and some are possibly no longer flooded. Low frequency and low energy of flooding is evidenced by the development of litter layers and organic-enriched soil horizons. Soils are well-drained sands and sandy loams, and soil moisture regime may be somewhat dry. The soils are slightly to moderately acidic and have relatively high cation levels. Slopes range from level to steep. The canopy is frequently composed of very large-diameter, tall trees, with species more typical of uplands. Dominant trees in the canopy include *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Acer saccharum* (sugar maple). Additional trees which may occur in the canopy and subcanopy include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Magnolia acuminata*

(cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Prunus serotina* var. *serotina* (black cherry), and *Ulmus americana* (American elm). The small tree *Halesia tetraptera* (mountain silverbell) is dominant in some areas as a well-developed tall-shrub layer and may extend into the tree subcanopy; *Sassafras albidum* (sassafras) may also occur as a small tree. Additional shrubs include *Carpinus caroliniana* (American hornbeam), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Smilax rotundifolia* (roundleaf greenbrier), *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), and *Viburnum prunifolium* (blackhaw). Low shrubs may be present, though typically sparse, and include *Xanthorhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Characteristic herbs include *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Eurybia divaricata* (white wood aster), *Galium circaeazans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Hexastylis virginica* (Virginia heartleaf), *Hydrastis canadensis* (goldenseal), *Maianthemum racemosum* (feathery false lily of the valley), *Packera aurea* (golden ragwort), *Polygonatum biflorum* (smooth Solomon's seal), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Thelypteris noveboracensis* (New York fern), and *Verbesina alternifolia* (wingstem).

Environmental Description: This association occurs in small patches on the highest positions of river floodplains which are infrequently flooded and possibly on alluvial terraces which are no longer flooded. The largest patches occur on large point bars which have developed along inside bends of large meanders. Evidence of flooding includes fluvial topography, accumulations of rocks on the upstream side of tree bases, and some flotsam. Sites have fluvial microtopography of levees and swales formed from sandy alluvium. Low frequency and low energy of flooding is evidenced by the development of litter layers and organic-enriched soil horizons. Soils are stone-free or somewhat stony, moderately well- to well-drained sands and sandy loams derived from alluvium, and soil moisture regime may be somewhat dry. Soil chemistry analyzed from six plots indicates slightly acidic soils (mean pH = 5.8 at New River and 5.0 at Bluestone) and relatively high levels of some nutrients (Ca, Mg, Zn) and relatively low levels of organic matter compared to soils of most upland forests in the area. Soil from the one sampled plot at Gauley River is considerably more acidic (pH=4.1). Slopes range from level to steep. Elevations of mapped stands range from 247 to 506 m.

Vegetation Description: This association is a closed-canopy to somewhat open-canopy deciduous floodplain forest dominated by tree species more typical of uplands. Many of the stands are composed of very large-diameter, tall trees. Dominant trees in the canopy include *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Quercus alba* (white oak), *Liriodendron tulipifera* (tuliptree), and *Acer saccharum* (sugar maple). Additional trees which may occur in the canopy and subcanopy include *Acer rubrum* (red maple), *Carya alba* (mockernut hickory), *Carya cordiformis* (bitternut hickory), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Magnolia acuminata* (cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Nyssa sylvatica* (blackgum), *Platanus occidentalis* (American sycamore), *Prunus serotina* var. *serotina* (black cherry), and *Ulmus americana* (American elm). The small tree *Halesia tetraptera* (mountain silverbell) is dominant in some areas as a well-developed tall-shrub layer and may

extend into the tree subcanopy; *Sassafras albidum* (sassafras) may also occur as a small tree. Additional shrubs include *Carpinus caroliniana* (American hornbeam), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witchhazel), *Lindera benzoin* (northern spicebush), *Smilax rotundifolia* (roundleaf greenbrier), *Magnolia tripetala* (umbrella-tree), *Asimina triloba* (pawpaw), and *Viburnum prunifolium* (blackhaw). Low shrubs may be present, though typically sparse, and include *Xanthorhiza simplicissima* (yellowroot), *Chionanthus virginicus* (white fringetree), *Euonymus americanus* (strawberry bush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Characteristic herbs include *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Arisaema triphyllum* (Jack in the pulpit), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Eurybia divaricata* (white wood aster), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Hexastylis virginica* (Virginia heartleaf), *Hydrastis canadensis* (goldenseal), *Maianthemum racemosum* (feathery false lily of the valley), *Packera aurea* (golden ragwort), *Polygonatum biflorum* (smooth Solomon's seal), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Thelypteris noveboracensis* (New York fern), and *Verbesina alternifolia* (wingstem). Vascular plant species richness in the eight 400-square-meter sampled plots ranges from 16 to 79 (mean at New River = 32; mean at Bluestone = 69; Gauley = 44).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple) <i>Liriodendron tulipifera</i> (tuliptree) <i>Quercus alba</i> (white oak) <i>Quercus rubra</i> (northern red oak) <i>Quercus velutina</i> (black oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Halesia tetraptera</i> (mountain silverbell)
Herb (field)	Fern or fern ally	<i>Thelypteris noveboracensis</i> (New York fern)

Characteristic Species: *Ageratina altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Carpinus caroliniana* (American hornbeam), *Carya ovata* (shagbark hickory), *Cynoglossum virginianum* (wild comfrey), *Dichanthelium boscii* (Bosc's panicgrass), *Dirca palustris* (eastern leatherwood), *Fagus grandifolia* (American beech), *Galium circaezans* (licorice bedstraw), *Galium triflorum* (fragrant bedstraw), *Halesia tetraptera* (mountain silverbell), *Hamamelis virginiana* (American witchhazel), *Hydrastis canadensis* (goldenseal), *Lindera benzoin* (northern spicebush), *Magnolia acuminata* (cucumber-tree), *Magnolia tripetala* (umbrella-tree), *Maianthemum racemosum* (feathery false lily of the valley), *Nyssa sylvatica* (blackgum), *Packera aurea* (golden ragwort), *Parthenocissus quinquefolia* (Virginia creeper), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is currently known only from West Virginia along the New, Bluestone, and Gauley rivers.

States/Provinces: WV.

Federal Lands: NPS (Bluestone, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (5-Jun-2006).

Reasons: More information is needed to determine a global rank. This association is likely to have been reduced from its original extent by clearing for agriculture, transportation, or houses. At Gauley River, the historical extent of this community has probably been reduced by construction of railroads along the river and by reduction of peak flows since construction of Summersville Dam.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This association has canopy composition similar to *Quercus prinus* - (*Quercus rubra*) - *Carya* spp. / *Oxydendrum arboreum* - *Cornus florida* Forest (CEGL007267), but it is differentiated by its occurrence on floodplains and by the abundance of *Halesia tetraptera* (mountain silverbell) and other mesophytic species in the understory.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: J. P. Vanderhorst, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010.



Plot GARI.89. Oak - Hickory Floodplain Forest.

**COMMON NAME (PARK-SPECIFIC): AMERICAN SYCAMORE - TULIPTREE -
SWEETGUM FLOODPLAIN FOREST**

SYNONYMS

USNVC English Name: Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest

USNVC Scientific Name: *Liquidambar styraciflua* - *Liriodendron tulipifera* / *Lindera benzoin* / *Arisaema triphyllum* Forest

USNVC Identifier: CEGL004418

LOCAL INFORMATION

Environmental Description: This association occurs in a few small patches on river floodplains. Most patches are along slower reaches of the lower Gauley River in the park where broader floodplains occur on point bars, alluvial fans, and islands. Slopes in mapped polygons range from 0.6 to 31.4 degrees (mean = 6.9). Elevations in mapped polygons range from 208 to 319 m (mean = 215.6). Evidence of infrequent flooding includes fluvial topography, mixed exposed sand, light flotsam and leaf litter accumulations, and lack of soil horizon development. Soils in plots are described as temporarily flooded, well-drained sand. Soils test slightly to strongly acidic (mean pH = 5.85) with relatively high levels of Cu and Mg, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, K, and P compared to average values from all plots in the park. Adjacent vegetation on floodplains includes Eastern Hemlock Floodplain Forest (CEGL006620), in less frequently flooded positions, and American Sycamore - River Birch Riverscour Woodland (CEGL003725) and Riverscour Shrub Prairie (CEGL006623) in more frequently flooded positions.

Vegetation Description: This association is a deciduous floodplain forest with tall (>20 m), mostly closed canopies. The typical codominant canopy trees are *Platanus occidentalis* (American sycamore) and *Liriodendron tulipifera* (tuliptree); *Liquidambar styraciflua* (sweetgum) is a characteristic associate. Additional trees include *Betula nigra* (river birch), *Carya cordiformis* (bitternut hickory), *Acer rubrum* (red maple), and *Ulmus* (elm) spp. *Carpinus caroliniana* ssp. *virginiana* (American hornbeam) usually dominates the subcanopy and tall-shrub layers. Additional shrubs and vines in plots include *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Xanthorhiza simplicissima* (yellowroot), *Parthenocissus quinquefolia* (Virginia creeper), and *Toxicodendron radicans* (eastern poison ivy). The herb layer has moderate cover and diversity. Common native herbs include *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Packera aurea* (golden ragwort), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum prenanthoides* (crookedstem aster), *Eurybia divaricata* (white wood aster), *Collinsonia canadensis* (richweed), *Viola striata* (striped cream violet), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Polystichum acrostichoides* (Christmas fern), *Polygonatum pubescens* (hairy Solomon's seal), *Deparia acrostichoides* (silver false spleenwort), and *Poa alsodes* (grove bluegrass). The exotics *Rosa multiflora* (multiflora rose), *Microstegium vimineum* (Nepalese browntop), and *Glechoma hederacea* (ground ivy) often invade this community. Vascular plant species richness in plots ranges from 38 to 55 taxa (mean = 45.25). Cover by nonvascular species is usually sparse.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs in a few small patches along the Gauley River, mostly towards the western end of the park.

Classification Comments: This association is distinguished from other floodplain forest associations in West Virginia by having an abundance of *Liquidambar styraciflua* (sweetgum) in the canopy or subcanopy. In West Virginia, this tree is confined to the low to middle elevations of the Ohio River drainage in the southwestern part of the state and is lacking from similar floodplain forests at higher elevations and in the Ridge and Valley in the eastern part of the state.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Four plots were sampled: GARI.124, GARI.125, GARI.207, and GARI.214.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	<i>Liquidambar styraciflua</i> - (<i>Liriodendron tulipifera</i> , <i>Acer rubrum</i>) Temporarily Flooded Forest Alliance (A.287)
Alliance (English name)	Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance
Association	<i>Liquidambar styraciflua</i> - <i>Liriodendron tulipifera</i> / <i>Lindera benzoin</i> / <i>Arisaema triphyllum</i> Forest
Association (English name)	Sweetgum - Tuliptree / Northern Spicebush / Jack-in-the-Pulpit Forest
Ecological System(s):	Northern Atlantic Coastal Plain Stream and River (CES203.070). Southern Piedmont Small Floodplain and Riparian Forest (CES202.323).

GLOBAL DESCRIPTION

Concept Summary: These low-elevation forests develop along relatively acidic soils on small streams in the Coastal Plain of Maryland and Virginia, extending west across the Virginia and North Carolina Piedmont to the Cumberland Plateau and Ridge and Valley. The topographic features of floodplains can heavily influence the makeup of individual examples of this association. The canopy, subcanopy, shrub, and herbaceous layers often are well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (in the eastern part of the range), *Platanus occidentalis* (American sycamore), and *Acer rubrum* var. *rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy, but in many examples, both are equally dominant. Common species in the canopy and understory include *Ilex opaca* var. *opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Betula nigra* (river birch), *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Carya cordiformis* (bitternut hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), *Juglans nigra* (black walnut), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Morus rubra* var. *rubra* (red mulberry),

Nyssa sylvatica (blackgum), *Ostrya virginiana* var. *virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* var. *rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), and *Ulmus alata* (winged elm). *Euonymus americanus* (strawberry bush), *Asimina triloba* (pawpaw), *Lindera benzoin* var. *benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common in the shrub layer. The herbaceous layer is species-rich and often has good sedge development. The exotics *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Rosa multiflora* (multiflora rose), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community.

Environmental Description: These forests develop along small streams or in small patches on river floodplains. Soils are relatively acidic and relatively well-drained. Topographic differences from one floodplain to another, such as gradient and height above the creek, as well as floodplain microtopography (i.e., depositional landforms such as natural levees and sloughs) may influence the variation of vegetation within this association. However, in most floodplains supporting this type, the distinct alluvial landforms are poorly developed or occur at very small scales. At some sites, evidence of infrequent flooding includes fluvial topography, mixed exposed sand, light flotsam and leaf litter accumulations, and lack of soil horizon development.

Vegetation Description: The canopy, subcanopy, shrub, and herbaceous layers of stands of this association are often well-developed. Dominant canopy species always include *Liquidambar styraciflua* (sweetgum) and *Liriodendron tulipifera* (tuliptree), while *Acer barbatum* (southern sugar maple) (in the southern part of the range), *Platanus occidentalis* (American sycamore), and *Acer rubrum* var. *rubrum* (red maple) may also make up significant amounts of the canopy. This community type exists as a continuum between two subtypes, i.e., the tuliptree subtype and the sweetgum subtype. In some examples, only one or the other dominates the canopy. However, in many examples, both are equally dominant. Other common species in the canopy and understory include *Ilex opaca* var. *opaca* (American holly), *Aesculus sylvatica* (painted buckeye), *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Cornus florida* (flowering dogwood), *Fagus grandifolia* (American beech), *Juglans nigra* (black walnut), *Betula nigra* (river birch), *Morus rubra* var. *rubra* (red mulberry), *Ostrya virginiana* var. *virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), *Prunus serotina* var. *serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* var. *rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), *Ulmus alata* (winged elm), *Juniperus virginiana* var. *virginiana* (eastern red-cedar), *Nyssa sylvatica* (blackgum), *Fraxinus americana* (white ash), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), *Arundinaria gigantea* ssp. *gigantea* (giant cane), and *Fraxinus pennsylvanica* (green ash). *Euonymus americanus* (strawberry bush), *Lindera benzoin* var. *benzoin* (northern spicebush), and *Corylus americana* (American hazelnut) are common and dominant in the shrub layer. Other shrub species that may be present include *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum nudum* var. *nudum* (possumhaw), *Viburnum prunifolium* (blackhaw), *Viburnum rufidulum* (rusty blackhaw), *Hamamelis virginiana* (American witchhazel), *Asimina triloba* (pawpaw), and *Ilex decidua* (possumhaw), among others. On the most acidic sites of the Maryland Coastal Plain, *Clethra alnifolia* (coastal sweetpepperbush), *Vaccinium corymbosum* (highbush blueberry), and *Magnolia virginiana* (sweetbay) may be present. Vines are prominent and include *Vitis rotundifolia* (muscadine), *Apios americana* (groundnut), *Campsis radicans* (trumpet creeper), *Aristolochia macrophylla*

(pipevine), *Bignonia capreolata* (crossvine), *Dioscorea quaternata* (fourleaf yam), *Gelsemium sempervirens* (evening trumpetflower), *Parthenocissus quinquefolia* (Virginia creeper), *Passiflora lutea* (yellow passionflower), *Smilax bona-nox* (saw greenbrier), *Smilax glauca* (cat greenbrier), *Smilax hugeri* (Huger's carrionflower), *Smilax rotundifolia* (roundleaf greenbrier), and *Toxicodendron radicans* ssp. *radicans* (eastern poison ivy). The herbaceous layer is species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides* (rue-anemone), *Trillium cuneatum* (little sweet Betsy), *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* var. *platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Carex* (sedge) spp., *Carex impressinervia* (ravine sedge), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Collinsonia canadensis* (richweed), *Deparia acrostichoides* (silver false spleenwort), *Dichanthelium clandestinum* (deertongue), *Elymus virginicus* (Virginia wildrye), *Eurybia divaricata* (white wood aster), *Galium circaeazans* (licorice bedstraw), *Geum canadense* (white avens), *Medeola virginiana* (Indian cucumber), *Packera aurea* (golden ragwort), *Poa alsodes* (grove bluegrass), *Polygonatum pubescens* (hairy Solomon's seal), *Polystichum acrostichoides* (Christmas fern), *Rudbeckia laciniata* (cutleaf coneflower), *Scutellaria integrifolia* (helmet flower), *Symphotrichum prenanthoides* (crookedstem aster), and *Viola striata* (striped cream violet). *Thelypteris noveboracensis* (New York fern) is a common patch-dominant in the northern part of the range and the Uwharrie Mountains of North Carolina. The exotics *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Rosa multiflora* (multiflora rose), *Ligustrum sinense* (Chinese privet), and *Lonicera japonica* (Japanese honeysuckle) are common in this community. Other exotics that colonize quickly in disturbed and fragmented versions of this association include *Wisteria sinensis* (Chinese wisteria), *Clematis* (leather flower) *terniflora*, *Hedera helix* (English ivy), and *Elaeagnus* (elaeanus) sp.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Liquidambar styraciflua</i> (sweetgum) <i>Liriodendron tulipifera</i> (tuliptree)

Characteristic Species: *Arisaema triphyllum* (Jack in the pulpit), *Asplenium platyneuron* (ebony spleenwort), *Botrychium virginianum* (rattlesnake fern), *Campsis radicans* (trumpet creeper), *Carex striatula* (lined sedge), *Cinna arundinacea* (sweet woodreed), *Corylus americana* (American hazelnut), *Elymus virginicus* (Virginia wildrye), *Euonymus americanus* (strawberry bush), *Galium circaeazans* (licorice bedstraw), *Geum canadense* (white avens), *Lindera benzoin* (northern spicebush), *Liquidambar styraciflua* (sweetgum), *Liriodendron tulipifera* (tuliptree), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Scutellaria integrifolia* (helmet flower), *Smilax rotundifolia* (roundleaf greenbrier), *Thalictrum thalictroides* (rue-anemone), *Toxicodendron radicans* (eastern poison ivy), *Trillium cuneatum* (little sweet Betsy).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Carex impressinervia</i> (ravine sedge)	G2	plant	globally imperiled
<i>Carex kraliana</i> (Kral's sedge)	-	plant	is evidently near the northern limit of its (primarily southeastern United States) range and is presently known from only two Maryland sites, has been found in this vegetation type at Thomas Stone NHS.

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Clematis terniflora</i> (sweet autumn virginsbower)	-	plant	invasive exotic
<i>Glechoma hederacea</i> (ground ivy)	-	plant	invasive exotic
<i>Hedera helix</i> (English ivy)	-	plant	invasive exotic
<i>Ligustrum sinense</i> (Chinese privet)	-	plant	invasive exotic
<i>Lonicera japonica</i> (Japanese honeysuckle)	-	plant	invasive exotic
<i>Microstegium vimineum</i> (Nepalese browntop)	-	plant	invasive exotic
<i>Rosa multiflora</i> (multiflora rose)	-	plant	invasive exotic
<i>Wisteria sinensis</i> (Chinese wisteria)	-	plant	invasive exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is found in the Chesapeake Bay Lowlands, the Piedmont, and other low-elevation interior ecoregions (e.g., parts of the Cumberland Plateau and Ridge and Valley). It is defined as being absent from the Mid-Atlantic Coastal Plain of southeastern Virginia, the Carolinas, and Georgia. Its status in the Upper East Gulf Coastal Plain is unknown.

States/Provinces: DC, GA, MD, NC, SC?, TN, VA:S4, WV.

Federal Lands: DOD (Fort Belvoir); NPS (Chickamauga-Chattanooga, Colonial, Cowpens, Fredericksburg-Spotsylvania, Gauley River, Guilford Courthouse, Kennesaw Mountain, Kings Mountain, National Capital-East, Petersburg, Prince William, Richmond, Thomas Stone); USFS (Uwharrie).

CONSERVATION STATUS

Rank: G4 (15-Feb-2007).

Reasons: This community is widespread from the Coastal Plain of Maryland and Virginia through the Piedmont of Virginia and North Carolina to the Cumberland Plateau. Very few streams supporting this type have impoundments or diversions, and most are protected by wetland regulations. However, few, if any, pristine examples remain, and all are highly threatened by invasive exotic species that have colonized most of the remaining examples of this association.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Low-quality occurrences of this type may look very similar to some occurrences of *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330). The presence of higher quality patches of native herbs and stands of native shrubs such as *Lindera benzoin* (northern spicebush) is the best way to distinguish these two types. In addition, stands of CEGL007330 will generally be more even-aged and single species-dominated than this association (CEGL004418).

Similar Associations:

- *Betula nigra* - *Acer rubrum* - (*Liquidambar styraciflua*, *Platanus occidentalis*) Successional Forest (CEGL006976).
- *Liquidambar styraciflua* - (*Liriodendron tulipifera*) Temporarily Flooded Forest (CEGL007330)--occurs in the same habitat but is a highly impacted version of this forest that occurs on old farm fields and other second-growth areas.
- *Liquidambar styraciflua* Forest (CEGL007216).
- *Liriodendron tulipifera* - *Acer (rubrum, negundo)* - (*Platanus occidentalis*) / *Carpinus caroliniana* / *Polygonum virginianum* Forest (CEGL006492).

Related Concepts:

- *Liquidambar styraciflua* - *Liriodendron tulipifera* / *Lindera benzoin* / *Arisaema triphyllum* Forest (Fleming et al. 2006) =
- *Liquidambar styraciflua* - *Quercus palustris* / *Carpinus caroliniana* / *Carex intumescens* Forest (Meininger and McCarthy 1998) ?
- Coastal Plain / Piedmont Floodplain Forest (Fleming et al. 2006) B
- Maple-Gum Association of the Western Shore District (Shreve et al. 1910) B

SOURCES

Description Authors: R. K. Peet, mod. R. White, M. Pyne, G. P. Fleming, S. C. Gawler.

References: Fleming et al. 2001, Fleming et al. 2006, Meininger and McCarthy 1998, Naczi et al. 2002, Peet et al. unpubl. data 2002, Schafale and Weakley 1990, Shreve et al. 1910, Southeastern Ecology Working Group n.d., Vanderhorst et al. 2010.



Plot GARI.125. American Sycamore - Tuliptree - Sweetgum Floodplain Forest.

COMMON NAME (PARK-SPECIFIC): FOREST SEEP

SYNONYMS

USNVC English Name: Red Maple - Blackgum / Common Winterberry - Black
Highbush Blueberry / Cinnamon Fern Forest
USNVC Scientific Name: *Acer rubrum* - *Nyssa sylvatica* / *Ilex verticillata* - *Vaccinium*
fuscatum / *Osmunda cinnamomea* Forest
USNVC Identifier: CEGL007853

LOCAL INFORMATION

Environmental Description: This association occurs in small patches in headwater drainages on the plateaus. Presence of this community was often accurately predicted by the "wet flat" ecological land unit (ELU) derived from a topographic analysis of a digital elevation model for the park; wet flat is one of the rarest ELU types in the park. These sites are jurisdictional wetlands fed by seepage and possibly by occasional overbank flooding of small streams. There is often a small ephemeral stream channel running through or adjacent to the community. Slopes in mapped polygons range from 1 to 17 degrees (mean = 7.7). Elevations in mapped polygons range from 365 to 563 m (mean = 464). Bedrock geology is mapped as sandstone of the New River and Kanawha formations in the Pottsville group. Evidence of wetland hydrology includes crayfish chimneys, oxidized root channels, low soil chroma, and high water tables. Unvegetated ground cover is dominated by litter with significant exposed sand in some plots. Soils in plots are described as moderately well-drained to very poorly-drained, moist to semipermanently flooded loamy sand, sandy loam, silt loam, and sandy clay loam. Soils test very strongly to extremely acidic (mean pH = 4.27) with relatively low levels of total exchange capacity, organic matter, estimated N release, B, Ca, K, and Zn compared to average values from all plots in the park. These forest seeps are embedded in upland forest types, including Eastern Hemlock Plateau Forest (CEGL006304), Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222), and Successional Tuliptree Forest (CEGL007221).

Vegetation Description: This association represents wetland vegetation that has deciduous or mixed evergreen-deciduous forest or woodland physiognomy. Trees are usually rooted around the edges of the wetland or on hummocks, and there may be a canopy gap in the center of the stand. Tree canopies are tall (>20 m) with cover in plots ranging from 40 to 90%. Canopy trees include (in decreasing order of constancy in plots) *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Quercus alba* (white oak), *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore). Additional tree species which are common in the subcanopy and shrub layers include *Tsuga canadensis* (eastern hemlock) and *Nyssa sylvatica* (blackgum). Cover in the shrub layers of plots ranges from 4 to 60%. Common shrub species include *Ilex opaca* var. *opaca* (American holly), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Asimina triloba* (pawpaw), *Lindera benzoin* (northern spicebush), *Euonymus americanus* (strawberry bush), and *Rosa multiflora* (multiflora rose). Cover in the herb layer of plots ranges from 10 to 90%. Common herbs include (in decreasing order of constancy) *Thelypteris noveboracensis* (New York fern), *Athyrium filix-femina* ssp. *angustum* (subarctic ladyfern), *Polystichum acrostichoides* (Christmas fern), *Eurybia divaricata* (white wood aster), *Viola cucullata* (marsh blue violet), *Mitchella repens* (partridgeberry), and *Chelone glabra* (white turtlehead). Additional herbs that indicate wetland conditions include *Onoclea sensibilis* (sensitive fern), *Leersia virginica* (whitegrass), *Boehmeria*

cylindrica (small-spike false nettle), *Osmunda cinnamomea* (cinnamon fern), *Lycopus virginicus* (Virginia water horehound), and *Glyceria striata* (fowl mannagrass). Vascular plant species richness in plots ranges from 18 to 72 taxa (mean = 42). Nonvascular cover in plots ranges from 0 to 20% and is dominated by mosses. Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Plagiomnium ciliare* (plagiomnium moss), *Plagiomnium ciliare* (plagiomnium moss), *Atrichum angustatum* (atrichum moss), *Aulacomnium palustre* (aulacomnium moss), *Leucobryum glaucum* (leucobryum moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Polytrichum juniperinum* (juniper polytrichum moss), and *Sphagnum palustre* (prairie sphagnum).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	Byers et al. 2007

Local Range: Information not available.

Classification Comments: Occurrences of this association at GARI are very small and have fewer wetland obligates compared to better developed examples at New River Gorge National River. West Virginia examples in general lack many of the southern species listed in the global description. At GARI, *Tsuga canadensis* (eastern hemlock) is often an important species in the subcanopy, reflecting the dominance of this species in the surrounding uplands.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Eight plots were sampled: GARI.46, GARI.96, GARI.136, GARI.169, GARI.189, GARI.195, GARI.200, and GARI.215.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	<i>Acer rubrum</i> - <i>Nyssa sylvatica</i> Saturated Forest Alliance (A.348)
Alliance (English name)	Red Maple - Blackgum Saturated Forest Alliance
Association	<i>Acer rubrum</i> - <i>Nyssa sylvatica</i> / <i>Ilex verticillata</i> - <i>Vaccinium fuscum</i> / <i>Osmunda cinnamomea</i> Forest
Association (English name)	Red Maple - Blackgum / Common Winterberry - Black Highbush Blueberry / Cinnamon Fern Forest
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This community occurs on groundwater-saturated flats and low slopes along streams in the Ridge and Valley, northern Cumberland Plateau, northern Blue Ridge, and western Piedmont at elevations of 200–900 m (700–2900 ft). Habitats are usually more-or-less narrow and elongate, with hummock-and-hollow microtopography, and frequently with a small ephemeral stream channel running through or adjacent to the community. Substrates are poorly drained mineral soils with numerous hydric indicators. The ground surface is slightly sloping,

and drainage is usually via small, intricately braided channels with interspersed hummocks. The canopy is usually closed and consists of *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Liriodendron tulipifera* (tuliptree). *Quercus alba* (white oak) is an important associate in some areas, and *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore) are present in some stands. Minor or local tree species include *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Pinus rigida* (pitch pine), and *Pinus strobus* (eastern white pine). The shrub stratum may be well-developed and includes *Ilex verticillata* (common winterberry), *Ilex opaca* (American holly), *Vaccinium* (blueberry) *corymbosum*, *Kalmia latifolia* (mountain laurel), *Alnus serrulata* (hazel alder), *Viburnum nudum* var. *cassinoides* (withe-rod), *Viburnum dentatum* (southern arrow-wood), *Smilax* (greenbrier) spp., and, less consistently, *Carpinus caroliniana* (American hornbeam), *Asimina triloba* (pawpaw), *Euonymus americanus* (strawberry bush), *Lindera benzoin* (northern spicebush), *Gaylussacia frondosa* (blue huckleberry), *Gaylussacia baccata* (black huckleberry), *Menziesia pilosa* (minniebush), *Vaccinium fuscum* (black highbush blueberry), *Chionanthus virginicus* (white fringetree), *Viburnum nudum* var. *nudum* (possumhaw), *Rhododendron viscosum* (swamp azalea), and *Toxicodendron vernix* (poison-sumac). *Rubus hispidus* (bristly dewberry) is an abundant creeping vine in many stands. Typical herbaceous plants include *Osmunda cinnamomea* (cinnamon fern), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex atlantica* (prickly bog sedge), *Carex debilis* (white edge sedge), *Thelypteris noveboracensis* (New York fern), *Platanthera clavellata* (small green wood orchid), *Chelone glabra* (white turtlehead), *Medeola virginiana* (Indian cucumber), *Dioscorea quaternata* (fourleaf yam), *Juncus effusus* (common rush), *Lycopus uniflorus* (northern bugleweed), *Lycopodium obscurum* (rare clubmoss), *Osmunda regalis* var. *spectabilis* (royal fern), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Viola hastata* (halberdleaf yellow violet), and *Viola cucullata* (marsh blue violet).

Environmental Description: This community occurs on groundwater-saturated flats along low- to middle-elevation streams and headwaters seeps in areas underlain by acidic sedimentary and metamorphic rocks. It is a small-patch type that is particularly frequent and well-developed in the large alluvial fans along the western foot of the northern Blue Ridge and in small-stream valleys and low-gradient plateau drainages of the Ridge and Valley province and parts of the Cumberland Plateau. Outliers occur throughout the western Piedmont, particularly in districts underlain by acidic metasedimentary rocks. Habitats are usually more-or-less narrow and elongate, with hummock-and-hollow microtopography, and frequently with a small ephemeral stream channel running through or adjacent to the community. Substrates are poorly drained mineral soils with numerous hydric indicators, including saturated horizons, oxidized root channels, low chroma, gley, and mottles. Local areas of organic muck sometimes accumulate in depressions. The ground surface is slightly sloping, and drainage is usually via small, intricately braided channels with interspersed hummocks. Moss mats, predominantly of *Sphagnum* (sphagnum) spp., are usually abundant and provide a rooting medium for herbaceous species. Soils collected from plot samples are very strongly acidic with moderately low to very low base status. Patches of this community are mostly shaded by overhanging trees, but sunny spots may be created by canopy gaps, and larger patches may have small open centers.

Vegetation Description: This forest association has an open to closed canopy of *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Liriodendron tulipifera* (tuliptree). *Quercus alba* is an important associate in some areas, and *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and *Platanus occidentalis* (American sycamore) are present in some stands. *Pinus*

rigida (pitch pine) is a frequent overstory associate in some Ridge and Valley and Blue Ridge stands, although its numbers have been recently reduced by southern pine beetle outbreaks. Minor tree species, especially at the higher elevations, include *Magnolia acuminata* (cucumber-tree), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), and *Pinus strobus* (eastern white pine). A single, anomalous stand in Augusta County, Virginia, contains an abundance of the disjunct Coastal Plain tree *Magnolia virginiana* (sweetbay) (Carr 1939). *Amelanchier arborea* (common serviceberry) is usually common in the understory, along with reproduction of *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum). The shrub stratum is often well-developed and includes *Ilex verticillata* (common winterberry), *Ilex opaca* (American holly), *Kalmia latifolia* (mountain laurel), *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), *Photinia pyrifolia* (red chokeberry), *Vaccinium corymbosum* (highbush blueberry), and *Smilax* (greenbrier) spp. Less frequent, but locally important, shrubs include *Asimina triloba* (pawpaw), *Vaccinium fuscum* (black highbush blueberry), *Euonymus americanus* (strawberry bush), *Toxicodendron vernix* (poison-sumac), *Viburnum nudum* var. *nudum* (possumhaw), *Viburnum nudum* var. *cassinoides* (withe-rod), *Menziesia pilosa* (minniebush), *Carpinus caroliniana* (American hornbeam), *Chionanthus virginicus* (white fringetree), *Lindera benzoin* (northern spicebush), *Gaylussacia frondosa* (blue huckleberry), *Rhododendron catawbiense* (Catawba rosebay), *Rhododendron periclymenoides* (pink azalea), and *Rhododendron viscosum* (swamp azalea). *Rubus hispidus* (bristly dewberry) is an abundant creeping vine in many stands; *Smilax rotundifolia* (roundleaf greenbrier) may also be present. The most characteristic herbaceous plants are *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Platanthera clavellata* (small green wood orchid), *Chelone glabra* (white turtlehead), *Rubus hispidus* (bristly dewberry), *Viola cucullata* (marsh blue violet), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex atlantica* (prickly bog sedge), *Carex debilis* (white edge sedge), *Oxypolis rigidior* (stiff cowbane), *Thelypteris noveboracensis* (New York fern), *Athyrium filix-femina* (common ladyfern), *Dioscorea quaternata* (fourleaf yam), *Juncus effusus* (common rush), *Lycopus uniflorus* (northern bugleweed), *Medeola virginiana* (Indian cucumber), *Polystichum acrostichoides* (Christmas fern), *Potentilla simplex* (common cinquefoil), and *Viola hastata* (halberdleaf yellow violet). Where shrubs are sparse, as in most of the West Virginia occurrences, fern cover is typically extensive. Less frequent but typical herbs include *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Carex intumescens* (greater bladder sedge), *Carex leptalea* (bristlystalked sedge), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Maianthemum canadense* (Canada mayflower), *Lycopodium obscurum*, *Onoclea sensibilis* (sensitive fern), *Leersia virginica* (whitegrass), *Boehmeria cylindrica* (small-spike false nettle), *Lycopus virginicus* (Virginia water horehound), *Glyceria striata* (fowl mannagrass), and *Dryopteris* (woodfern) *crinata*. Many additional herbaceous species, including several more typical of uplands, occur at low constancy and cover. The bryophyte layer may also be diverse; species of mosses and liverworts identified from plots include *Atrichum undulatum* (undulate atrichum moss), *Aulacomnium palustre* (aulacomnium moss), *Bryhnia novae-angliae* (New England bryhnia moss), *Callicladium haldanianum* (callicladium moss), *Campylium radicale* (campylium moss), *Dicranum scoparium* (dicranum moss), *Hypnum imponens* (hypnum moss), *Jungermannia gracillima*, *Leucobryum albidum* (leucobryum moss), *Mnium hornum* (horn calcareous moss), *Pellia epiphylla*, *Plagiomnium ciliare* (plagiomnium moss), *Platygyrium repens*, *Steerecleus serrulatus* (steerecleus moss), and *Thuidium delicatulum* (delicate thuidium moss). Mean vascular plant

species richness of 37 plot-sampled stands in Virginia and West Virginia is 47 taxa per 400 square meters.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple) <i>Liriodendron tulipifera</i> (tuliptree) <i>Nyssa sylvatica</i> (blackgum) <i>Quercus alba</i> (white oak)
Herb (field)	Fern or fern ally	<i>Thelypteris noveboracensis</i> (New York fern)

Characteristic Species: *Acer rubrum* (red maple), *Alnus serrulata* (hazel alder), *Aulacomnium palustre* (aulacomnium moss), *Bryhnia novae-angliae* (New England bryhnia moss), *Callicladium haldanianum* (callicladium moss), *Campylium radicale* (campylium moss), *Carex baileyi* (Bailey's sedge), *Carex debilis* (white edge sedge), *Carex folliculata* (northern long sedge), *Carex intumescens* (greater bladder sedge), *Carex prasina* (drooping sedge), *Chelone glabra* (white turtlehead), *Cinna arundinacea* (sweet woodreed), *Dichanthelium dichotomum* (cypress panicgrass), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Ilex verticillata* (common winterberry), *Juncus effusus* (common rush), *Liriodendron tulipifera* (tuliptree), *Lycopus uniflorus* (northern bugleweed), *Mnium hornum* (horn calcareous moss), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Oxypolis rigidior* (stiff cowbane), *Pellia epiphylla* (common peltia), *Plagiomnium ciliare* (plagiomnium moss), *Platanthera clavellata* (small green wood orchid), *Rubus hispidus* (bristly dewberry), *Thelypteris noveboracensis* (New York fern), *Viola cucullata* (marsh blue violet).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Eriocaulon decangulare</i> (tenangle pipewort)	-	plant	VA state-imperiled
<i>Helonias bullata</i> (swamppink)	G3	plant	Federally listed threatened

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: The documented range of this community type encompasses the Central Appalachians of Maryland and Virginia, and the Cumberland Mountains in West Virginia. In Virginia, it is scattered throughout the mountains and, more locally, the western Piedmont (Allard and Leonard 1943).

States/Provinces: MD, NC, PA?, VA:S2S3, WV.

Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, New River Gorge, Shenandoah); USFS (George Washington).

CONSERVATION STATUS

Rank: G3G4 (1-Oct-2001).

Reasons: This association has a narrow geographic range and is further limited by its requirement for special, localized wetlands. The type is confined to groundwater-saturated, nutrient-poor habitats that are large enough to support forest vegetation.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Examples occur near the Maple Flats pond complex (Augusta County, Virginia). This community is also known from Massanutten Mountain (Lee District, George Washington National Forest), elsewhere along the foot of the Blue Ridge (north of Maple Flats), a site on the northern Blue Ridge in Loudoun County, Virginia (owned by The Appalachian Trail Club), and

in the Bull Run Mountains of Virginia, an isolated Piedmont foothill in Fauquier and Prince William counties, Virginia; occurrences in the latter two areas do not have *Pinus rigida* (pitch pine) (or much of it) but are otherwise very similar (Fleming 1998). Quantitative analysis of a 1300-plot regional dataset for the National Capital Region Parks Vegetation Mapping Project Phase I indicate that a portion of Gould and Berdine's (1998) "circumneutral" seepage swamp community from Catoctin Mountain, Maryland, also corresponds to this type. It has also been sampled in West Virginia, where occurrences generally lack a dense shrub layer and are characterized by heavy fern cover.

There are unresolved issues regarding conceptual overlap between this type and *Acer rubrum* - *Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132). The latter type is a broadly defined community type that encompasses both seepage wetlands and poorly drained depressions. The community classified and described here for Virginia is limited conceptually to flow-through, groundwater-seepage wetlands. Communities with similar *Acer* - *Nyssa* canopies but occurring in saturated to seasonally flooded depression wetlands without apparent seepage inputs have been documented in Virginia but are not treated due to insufficient data. Nevertheless, they appear to warrant segregation from the seepage wetland communities because of their hydrologic regime, distinctly different herbaceous composition, and much lower species richness.

This type is currently under-represented by plot data, but observations suggest that it is relatively consistent in its composition and environmental affiliations. However, community characterization and nomenclature are subject to change pending further data collection and analysis, ideally based on wider geographic sampling. The recognition of segregate associations, subassociations, or variants may also be warranted following additional assessment. Lower-elevation sites are characterized by *Amianthium muscitoxicum* (flypoison), *Brachyelytrum erectum* (bearded shorthusk), *Carex debilis* (white edge sedge), *Carex intumescens* (greater bladder sedge), *Cypripedium acaule* (moccasin flower), *Gaylussacia frondosa* (blue huckleberry), *Lindera benzoin* (northern spicebush), *Platanthera ciliaris* (yellow fringed orchid), *Platanthera clavellata* (small green wood orchid), *Uvularia sessilifolia* (sessileleaf bellwort), *Viburnum nudum* var. *nudum* (possumhaw), and *Viola X primulifolia* (primroseleaf violet). Middle-elevation sites are characterized by *Oclemea acuminata* (whorled wood aster), *Betula lenta* (sweet birch), *Magnolia acuminata* (cucumber-tree), *Pinus strobus* (eastern white pine), *Rhododendron catawbiense* (Catawba rosebay), and *Rhododendron viscosum* (swamp azalea). A single site (Magnolia Swamp), possibly with boggier or more organic soils, is characterized by *Magnolia virginiana* (sweetbay), *Arethusa bulbosa* (dragon's mouth), *Dulichium arundinaceum* (threeway sedge), *Juncus effusus* (common rush), *Parthenocissus quinquefolia* (Virginia creeper), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Woodwardia areolata* (netted chainfern).

This type is similar in many respects to, and intergrades with, Montane Basic Seepage Swamps that are situated on calcareous soils derived from metabasalt (greenstone) and carbonate rock substrates [see *Acer rubrum* - *Fraxinus americana* - *Fraxinus nigra* - *Betula alleghaniensis* / *Veratrum viride* - *Carex bromoides* Forest (CEGL008416)]. These environmentally disparate swamps share a surprising number of prominent species including *Acer rubrum* (red maple), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (green false hellebore), *Osmunda*

cinnamomea (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Carex leptalea* (bristlystalked sedge), etc. Acidic seepage swamps, however, have lower species richness and mostly lack distinctly base-loving species such as *Fraxinus americana* (white ash), *Fraxinus nigra* (black ash), *Caltha palustris* (yellow marsh-marigold), *Carex bromoides* (bromelike sedge), *Saxifraga pensylvanica* (eastern swamp saxifrage), etc. *Sphagnum* (sphagnum) mosses, as well as many vascular plants that characterize Acidic Seepage Swamps, are absent or unimportant in the calcareous swamps. Examples include *Pinus rigida* (pitch pine), *Nyssa sylvatica* (blackgum), *Viburnum nudum* (possumhaw), *Parnassia asarifolia* (kidneyleaf grass of Parnassus), *Platanthera ciliaris* (yellow fringed orchid), *Platanthera clavellata* (small green wood orchid), *Rubus hispidus* (bristly dewberry), *Lycopodium obscurum* (rare clubmoss), *Carex debilis* (white edge sedge), and *Carex folliculata* (northern long sedge) (Fleming and Van Alstine 1999).

Formerly a common canopy tree of this community type in certain localities (e.g., Maple Flats, Augusta County), *Pinus rigida* (pitch pine) has been nearly eliminated from many stands by a recent outbreak of southern pine beetles (*Dendroctonus frontalis*).

Similar Associations:

- *Acer rubrum* - *Fraxinus americana* - *Fraxinus nigra* - *Betula alleghaniensis* / *Veratrum viride* - *Carex bromoides* Forest (CEGL008416).
- *Acer rubrum* - *Nyssa sylvatica* - *Magnolia virginiana* / *Viburnum nudum* var. *nudum* / *Osmunda cinnamomea* - *Woodwardia areolata* Forest (CEGL006238).
- *Acer rubrum* - *Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest (CEGL006132).

Related Concepts:

- *Acer rubrum* - *Fraxinus pennsylvanica* - *Betula (alleghaniensis, lenta)* / *Ilex verticillata* / *Symplocarpus foetidus* Forest (Gould and Berdine 1998) I
- *Acer rubrum* - *Liriodendron tulipifera* / *Ilex verticillata* - *Vaccinium fuscatum* / *Osmunda cinnamomea* - *Symplocarpus foetidus* Forest (Fleming 2002a) =
- *Acer rubrum* - *Nyssa sylvatica* - *Pinus rigida* / *Ilex verticillata* / *Osmunda cinnamomea* community (Fleming and Van Alstine 1999) ?
- *Acer rubrum* - *Nyssa sylvatica* / *Vaccinium fuscatum* - *Ilex verticillata* / *Osmunda cinnamomea* Forest (Fleming and Coulling 2001) =
- *Acer rubrum* / *Thelypteris noveboracensis* forest seep (Vanderhorst 2001b) =
- Mountain / Piedmont Acidic Seepage Swamp (Fleming and Coulling 2001) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler.

References: Allard and Leonard 1943, Byers et al. 2007, Carr 1939, Fleming 1998, Fleming 2002a, Fleming and Coulling 2001, Fleming and Van Alstine 1999, Fleming et al. 2001, Fleming pers. comm., Gould and Berdine 1998, Southeastern Ecology Working Group n.d., VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Young et al. 2006.



Plot GARI.195. Forest Seep.

COMMON NAME (PARK-SPECIFIC): **EASTERN HEMLOCK PLATEAU FOREST AND
SUCCESIONAL PITCH PINE FORES.**

SYNONYMS

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

LOCAL INFORMATION

Environmental Description: This association occurs in large patches on residual soils of upper slopes, ridgetops, and rolling plateaus. Sites have relatively high solar exposure. Dominance by *Tsuga canadensis* (eastern hemlock) in these exposed landscape positions is somewhat unusual and can be attributed to the general landscape dominance of the species in the eastern two-thirds of the park. Landscape dominance of *Tsuga canadensis* (eastern hemlock) in GARI is a reflection of the area's temperate climate with relatively high rainfall combined with the preponderance of well-drained coarse-textured acidic soils derived primarily from sandstone. Slopes in mapped polygons range from 0.3 to 48 degrees (mean = 10.7). Elevations in mapped polygons range from 295 to 611 m (mean = 458). Bedrock geology is primarily sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover is strongly dominated by litter with significant accumulations of woody debris in some areas, especially where successional pines are dying and breaking up. Soils in plots are described as well-drained, dry to moist sandy loam, sandy clay loam, silt loam, loam, and silty clay. Soils test strongly to extremely acidic (mean pH = 4.39) with relatively high levels of total exchange capacity, estimated N release, S, and Al, and relatively low levels of B, Cu, Fe, Mg, and Zn compared to average values from all plots in the park. This association is often uphill from Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), which occurs in more mesic gorge slope positions. Adjacent associations on the plateaus include Oak - Hickory Forest (CEGL007267), Successional Tuliptree Forest (CEGL007221), and Successional Virginia Pine Forest (CEGL002591).

Vegetation Description: This association is a mixed evergreen-deciduous forest codominated by *Tsuga canadensis* (eastern hemlock) and lacking significant cover by the evergreen shrub *Rhododendron maximum* (great laurel). Canopies are tall (>20 m) with cover in plots ranging from 40 to 80%. *Tsuga canadensis* (eastern hemlock) is a canopy tree in mature stands but may be overtopped by deciduous trees or *Pinus rigida* (pitch pine) in younger stands. Codominant deciduous trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Fagus grandifolia* (American beech). Additional characteristic trees in the canopy and subcanopy include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), and *Carya glabra* (pignut hickory). The shrub layers are typically dominated by saplings of *Tsuga canadensis* (eastern hemlock). *Smilax rotundifolia* (roundleaf greenbrier) and *Ilex opaca* var. *opaca* (American holly) have high constancy in the shrub layers. The herb layer usually has sparse cover and low diversity. Common herbs include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Viola hastata* (halberdleaf yellow violet), *Monotropa uniflora* (Indianpipe), *Medeola virginiana* (Indian cucumber), and *Dryopteris*

intermedia (intermediate woodfern). Vascular plant species richness in plots ranges from 21 to 47 taxa (mean = 28.5). Nonvascular cover is usually sparse. Mosses identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Leucobryum glaucum* (leucobryum moss), *Leucobryum albidum* (leucobryum moss), *Hypnum imponens* (hypnum moss), and *Dicranum fulvum* (dicranum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: This association occurs on the plateaus in the eastern two-thirds of the park.

Classification Comments: Stands of this association at GARI differ from the global description by completely lacking *Pinus strobus* (eastern white pine) and by occurring in upper slope and plateau positions. These differences may be related to relatively high rainfall and acidic sandstone bedrock geology in this area which does not promote *Pinus strobus* (eastern white pine) and which allows *Tsuga canadensis* (eastern hemlock) to dominate in all topographic positions. At GARI, this association grades towards Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543), which usually occurs downhill on colluvial gorge slopes and is best distinguished by having high cover by *Rhododendron maximum* (great laurel). A few stands mapped as Successional Pitch Pine Forest are included in this association because there is no existing USNVC association for successional stands dominated by *Pinus rigida* (pitch pine), and at GARI these stands are succeeding towards dominance by *Tsuga canadensis* (eastern hemlock).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Seven plots were sampled: GARI.38, GARI.56, GARI.73, GARI.94, GARI.102, GARI.194, and GARI.216.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Pinus strobus</i> - <i>Quercus</i> (<i>alba</i> , <i>rubra</i> , <i>velutina</i>) Forest Alliance (A.401)
Alliance (English name)	Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Pinus strobus</i> - <i>Tsuga canadensis</i> - <i>Quercus</i> (<i>rubra</i> , <i>alba</i>) / <i>Polystichum acrostichoides</i> Forest
Association (English name)	Tuliptree - Eastern White Pine - Eastern Hemlock - (Northern Red Oak, White Oak) / Christmas Fern Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592).

GLOBAL DESCRIPTION

Concept Summary: mixed hardwood - white pine - hemlock cove forest is widely but locally distributed in the southern part of the Central Appalachians in Virginia, West Virginia, and

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

Environmental Description: This community occurs at lower elevations, generally below 915 m (3000 ft), on the lower slopes and bottoms of ravines and coves, extending to upper slopes, ridgetops, and rolling plateaus on parts of the Cumberland Plateau. Sites may be underlain by bedrock or colluvial and alluvial deposits of various metasedimentary rocks, granitic rocks, or metabasalt. Habitats are generally mesic with acidic soils of moderate or intermediate fertility. Soils are mostly well-drained, dry to moist sandy loam, sandy clay loam, silt loam, loam, and silty clay.

Vegetation Description: The overstory is codominated by variable mixtures of *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus alba* (white oak). This forest generally has a moderate to strong evergreen component, but *Pinus strobus* (eastern white pine) varies from absent to widely scattered to codominant, and *Tsuga canadensis* (eastern hemlock) has been greatly reduced in many areas by recent outbreaks of the hemlock woolly adelgid and may be restricted to the understory. Less frequent overstory associates include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya* (hickory) *alba*, *Carya glabra* (pignut hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Quercus prinus* (chestnut oak). The subcanopy is of variable cover and may include *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Nyssa*

sylvatica (blackgum), *Pinus strobus* (eastern white pine), and *Tsuga canadensis* (eastern hemlock). The shrub layer is typically patchy or open and characterized by *Viburnum acerifolium* (mapleleaf viburnum), *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Hamamelis virginiana* (American witchhazel), *Hydrangea arborescens* (wild hydrangea), *Ilex opaca* (American holly), and *Lindera benzoin* (northern spicebush). The herb layer is usually patchy to moderately dense. Frequent patch-dominants include *Amphicarpaea bracteata* (American hogpeanut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), and *Polystichum acrostichoides* (Christmas fern). Other constant but low-cover herbs include *Botrychium virginianum* (rattlesnake fern), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Stellaria pubera* (star chickweed), *Viola hastata* (halberdleaf yellow violet), and *Dryopteris intermedia* (intermediate woodfern). Many additional herbs occur at low constancy. Species richness of 34 Virginia and West Virginia plot samples ranges from 21 to 98 taxa per 400 square meters (mean = 57), with the WV plots decidedly less species-rich (WV mean=28.5 spp.; VA mean = 64 spp.).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the southern portion of the Central Appalachians of Maryland, West Virginia, and Virginia, extending to the adjacent Cumberland Plateau in West Virginia. It is rare in the western Piedmont foothills of Virginia, adjacent to the Blue Ridge.

States/Provinces: MD, OH, VA:S4, WV.

Federal Lands: NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, Shenandoah); USFS (George Washington, Jefferson, Wayne).

CONSERVATION STATUS

Rank: G4? (25-Jan-2008).

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

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This association is represented by 35 Virginia plots, all of which have been analyzed in a statewide classification (>1300 plots) of montane upland forests and woodlands (Fleming and Patterson 2009b). Ten plots from the southern part of the Central Appalachians were classified as this association in the Appalachian Trail classification project (Fleming and Patterson 2009a).

Similar Associations:

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

Related Concepts:

- Acidic Cove Forest (Fleming et al. 2001) B
- White pine-oak-tuliptree dry forest (CAP pers. comm. 1998) B

SOURCES

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

References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fleming and Patterson 2009a, Fleming and Patterson 2009b, Fleming et al. 2001, Harrison 2004, Vanderhorst et al. 2010, Young et al. 2006.



Plot GARI.216. Eastern Hemlock Plateau Forest.



Plot GARI.143. Successional Pitch Pine Forest.

COMMON NAME (PARK-SPECIFIC): YELLOW BIRCH COLD COVE FOREST

SYNONYMS

USNVC English Name: Yellow Birch - (Eastern Hemlock) / Great Laurel / (Mountain Doghobble) Forest

USNVC Scientific Name: *Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / (*Leucothoe fontanesiana*) Forest

USNVC Identifier: C EGL007861

LOCAL INFORMATION

Environmental Description: This association is confined to a few locations on lower gorge slopes that have northeasterly aspects with extremely low solar exposure. Slopes are steep and substrates are bouldery colluvium. Slopes in mapped polygons range from 14 to 38 degrees (mean = 25). Elevations in mapped polygons range from 348 to 501 m (mean = 421). Bedrock geology is mapped as sandstone of the New River formation in the Pottsville group. Soils in plots are described as well-drained, somewhat-moist to moist sandy loam. Soils test strongly to extremely acidic (mean pH = 4.33) with relatively high levels of organic matter, estimated N release, and Na, and relatively low levels of S, Al, Cu, Mn, P, and Zn compared to average values from all plots in the park. This association is embedded within the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Stands are truncated by a railroad grade uphill. Downhill from this association are floodplain and riparian communities.

Vegetation Description: This association represents deciduous and mixed deciduous-conifer forests having a large component of *Betula alleghaniensis* var. *alleghaniensis* (yellow birch). Canopies are tall (>20 m) with cover in plots ranging from 30 to 70%. Associated canopy trees include *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock), and *Magnolia fraseri* (mountain magnolia). Cover in the subcanopy of plots ranges from 20 to 80%. Additional tree species in the subcanopy include *Amelanchier arborea* var. *arborea* (common serviceberry), *Ilex opaca* var. *opaca* (American holly), and *Nyssa sylvatica* (blackgum). Shrub layers are well-developed and include *Rhododendron maximum* (great laurel), *Clethra acuminata* (mountain sweetpepperbush), *Hamamelis virginiana* (American witchhazel), and *Smilax rotundifolia* (roundleaf greenbrier). Cover by herbs is sparse to moderate. Common herbs include *Eurybia divaricata* (white wood aster), *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), *Polypodium virginianum* (rock polypody), *Anemone quinquefolia* var. *quinquefolia* (nightcaps), and *Tiarella cordifolia* (heartleaf foamflower). The West Virginia state-rare sedge *Cymophyllus fraserianus* (Fraser's cymophyllus) occurs in one stand. Vascular plant species richness in plots ranges from 20 to 27 taxa (mean = 23). Bryophytes identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Aulacomnium heterostichum* (aulacomnium moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Bazzania trilobata* (common Bazzania liverwort), *Leucobryum glaucum* (leucobryum moss), and *Mnium hornum* (horn calcareous moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: There are two stands in the eastern half of GARI, one on river left along the Meadow River, and one on river left on the Gauley River near Iron Ring Rapids.

Classification Comments: Stands at GARI are very small and are embedded within the related Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543). Stands of this association can be differentiated from all other types at GARI by having a large component of *Betula alleghaniensis* var. *alleghaniensis* (yellow birch).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Three plots were sampled: GARI.159, GARI.209, and GARI.210.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Betula alleghaniensis</i> Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	<i>Betula alleghaniensis</i> - (<i>Tsuga canadensis</i>) / <i>Rhododendron maximum</i> / (<i>Leucothoe fontanesiana</i>) Forest
Association (English name)	Yellow Birch - (Eastern Hemlock) / Great Laurel / (Mountain Doghobble) Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593). Southern Appalachian Northern Hardwood Forest (CES202.029).

GLOBAL DESCRIPTION

Concept Summary: This association occurs in the Great Smoky Mountains and high mountain areas of southwestern Virginia, and at lower elevations in protected mountain settings in West Virginia. This community is found on steep, mostly north-facing slopes, and on slopes and flats along and above streams. These forests occur on midslope or toeslope positions, protected by higher landforms, where solar exposure is very low. The elevations of samples range from as low as 320 m in West Virginia (1040 ft) to around 1350 m (4400 ft), but the community can probably occur as high as 1524 m (5000 ft) or until *Picea rubens* (red spruce) begins to dominate. Sites are rocky, often with many large boulders and talus. Soils are stony with heavy litter layers and pockets of colluvium. This forest is affected by occasional disturbance by ice, wind and landslides. This mixed forest type has an open to closed canopy dominated by *Betula alleghaniensis* (yellow birch) and/or *Tsuga canadensis* (eastern hemlock), although either of these species may be locally dominant at a small scale. In some stands, *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree) (at lower elevations), *Tilia americana* var. *heterophylla* (American basswood), *Picea rubens* (red spruce), or *Quercus rubra* (northern red oak) can be important in the canopy or occur as minor associates. Other minor canopy and subcanopy species may include *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), and *Magnolia acuminata* (cucumber-tree). The tall-shrub stratum is over 2 m in height, very dense (50–100% coverage) and dominated by *Rhododendron maximum*.

(great laurel). Other minor shrubs commonly include *Acer pensylvanicum* (striped maple), *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Clethra acuminata* (mountain sweetpepperbush), *Hamamelis virginiana* (American witchhazel) (West Virginia), *Ilex montana* (mountain holly), and *Vaccinium erythrocarpum* (southern mountain cranberry). The ground layer is dominated by leaf litter, fallen trees and rocks. Herbaceous cover is sparse to moderate and is composed of scattered plants typical of mid- to high-elevation acidic forests. Composition can be quite variable among stands, but some of the more characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Oclemena acuminata* (whorled wood aster), *Polystichum acrostichoides* (Christmas fern) (West Virginia), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet). The bryophyte layer can be well-developed and diverse. This association grades into forests dominated by *Picea rubens* (red spruce) or *Tsuga canadensis* (eastern hemlock) at higher elevations.

Environmental Description: This community occurs on steep, mostly north-facing mesic slopes, and on toeslopes and flats along streams. It typically occupies mid- to lower slope and valley-bottom topographic positions that are well-protected by higher landforms. These sites have low solar exposure and may be subject to cold-air inversions. Elevations (of plot-sampled stands) range from 320–750 m (1040–2400 ft) in West Virginia, to 915–1450 m (3000–4800 ft) in the Virginia mountains, and to 1030–1450 m (3400–4800 ft) in the Great Smoky Mountains. Lower elevation stands may intergrade with *Betula lenta* (sweet birch)-dominated forest types. Sites are often rocky, with many large boulders and stones and pockets of colluvium. Soils, weathered from sandstone, acidic shale, or metamorphic igneous rocks, have dense, root-rich duff layers. Samples collected from plots are highly acidic (mean pH = 3.7 to 4.8) with low base status and moderately high organic matter content (mean = 20%). On stream-bottom sites, local areas of seepage are not uncommon, and habitats may be somewhat transitional to a saturated hydrologic regime. Sites occupied by this forest are affected by occasional ice, wind, and landslide disturbances.

Vegetation Description: This mixed forest has an open to closed canopy codominated by *Betula alleghaniensis* (yellow birch) and/or *Tsuga canadensis* (eastern hemlock), although either of these species may be solely dominant over small areas. In some stands, *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree) (at lower elevations), *Tilia americana* var. *heterophylla* (American basswood), *Picea rubens* (red spruce), or *Quercus rubra* (northern red oak) can be important in the canopy or occur as minor associates. Other minor canopy and subcanopy species may include *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), and *Magnolia acuminata* (cucumber-tree). The community has a very dense (50–100% cover), evergreen tall-shrub stratum (>2 m tall) dominated by *Rhododendron maximum* (great laurel). In the Great Smoky Mountains, a dense low-shrub stratum dominated by *Leucothoe fontanesiana* (highland doghobble) is typical, but this species is absent from Virginia and West Virginia examples of the type. Other minor shrubs commonly include *Acer pensylvanicum* (striped maple), *Amelanchier laevis* (Allegheny serviceberry), *Hamamelis virginiana* (American witchhazel) (in West Virginia stands), *Ilex montana* (mountain holly), and *Vaccinium erythrocarpum* (southern mountain cranberry). Herbaceous cover is sparse to occasionally moderate and is composed of scattered plants typical of mid- to high-elevation acidic forests. Composition can be quite variable among stands, but some of the more characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Oclemena acuminata* (whorled wood aster), *Polystichum acrostichoides* (Christmas fern) (in West Virginia

stands), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet). Some additional herbaceous species found in this community include *Arisaema triphyllum* (Jack in the pulpit), *Dennstaedtia punctilobula* (eastern hayscented fern), *Huperzia lucidula* (shining clubmoss), and *Medeola virginiana* (Indian cucumber). In Southern Appalachian stands with very dense evergreen shrub layers, species richness can be extraordinarily low (<10 taxa per 1000-square-meter sample), but in stands with somewhat more open shrub layers, richness can exceed 30 taxa per sample. The bryophyte layer can be well-developed and diverse; mosses and liverworts collected from West Virginia plots include *Anomodon attenuatus* (anomodon moss), *Aulacomnium heterostichum* (aulacomnium moss), *Bryhnia graminicolor* (bryhnia moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Campylium chrysophyllum* (goldenleaf campylium moss), *Hypnum curvifolium* (curveleaf hypnum moss), *Hypnum imponens* (hypnum moss), *Loeskeobryum brevirostre*, *Mnium stellare* (stellar calcareous moss), *Plagiothecium denticulatum* (toothed plagiothecium moss), *Platyhypnidium riparioides*, *Thuidium delicatulum* (delicate thuidium moss), *Bazzania trilobata* (common bazzania liverwort), *Leucobryum glaucum* (leucobryum moss), and *Mnium hornum* (horn calcareous moss).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Broad-leaved deciduous tree	<i>Betula alleghaniensis</i> (yellow birch)
Tall shrub/sapling	Broad-leaved evergreen tree	<i>Rhododendron maximum</i> (great laurel)
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> (intermediate woodfern)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Botrychium oneidense* (bluntlobe grapefern), *Magnolia fraseri* (mountain magnolia), *Mitchella repens* (partridgeberry), *Oxalis montana* (mountain woodsorrel), *Picea rubens* (red spruce), *Polypodium appalachianum* (Appalachian polypody), *Polypodium virginianum* (rock polypody), *Polystichum acrostichoides* (Christmas fern), *Rhododendron maximum* (great laurel), *Ribes cynosbati* (eastern prickly gooseberry), *Tiarella cordifolia* (heartleaf foamflower), *Tsuga canadensis* (eastern hemlock), *Viola rotundifolia* (roundleaf yellow violet).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Abies fraseri</i> (Fraser fir)	G2	plant	globally imperiled
<i>Botrychium oneidense</i> (bluntlobe grapefern)	-	plant	
<i>Catharus guttatus</i> (hermit thrush)	-	animal	
<i>Dendroica magnolia</i> (magnolia warbler)	-	animal	
<i>Geum geniculatum</i> (bent avens)	G1G2	plant	globally imperiled
<i>Hypericum mitchellianum</i> (Blue Ridge St. Johnswort)	G3	plant	
<i>Prenanthes roanensis</i> (Roan Mountain rattlesnakeroot)	G3	plant	
<i>Regulus satrapa</i> (golden-crowned kinglet)	-	animal	
<i>Sitta canadensis</i> (red-breasted nuthatch)	-	animal	
<i>Troglodytes troglodytes</i> (winter wren)	-	animal	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been documented in the Great Smoky Mountains of Tennessee; in the Mount Rogers - Whitetop Mountain area of the Virginia Blue Ridge (Grayson, Smyth and Washington counties); on Salt Pond Mountain in the Ridge and Valley of west-central Virginia (Giles County); on Allegheny Mountain in Highland County, Virginia, and adjacent Pocahontas County, West Virginia; and in Fayette County, West Virginia, along and near the New River Gorge, and along Gauley River in West Virginia. This vegetation type may be locally distributed throughout higher elevations of the Southern and Central Appalachians.

States/Provinces: NC, TN, VA:S2, WV.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Gauley River, Great Smoky Mountains, New River Gorge); USFS (Cherokee, George Washington, Jefferson).

CONSERVATION STATUS

Rank: G3G4 (24-Feb-2010).

Reasons: This community type is naturally uncommon within its range due to specific requirements for protected, mesic sites at high elevations. Most remaining examples of this community have been affected by past logging and are currently threatened with the loss of their *Tsuga canadensis* (eastern hemlock) component due to ongoing or potential infestations by the exotic pest hemlock woolly adelgid (*Adelges tsugae*). This community type has a restricted but locally extensive distribution in the highest mountains of southwestern and west-central Virginia. This association was originally described from Great Smoky Mountains National Park.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This association is a high-elevation acidic cove forest and is characterized by species indicative of montane, infertile environments, a dense shrub layer of *Rhododendron maximum* (great laurel), and a mixed deciduous-evergreen to mostly deciduous canopy. Species richness is typically low, ranging from 4 to 38 species per sample with an average of 19 species per 400-square-meter sample. Analysis of plot samples from the Great Smoky and Virginia mountains, and from Fayette and Raleigh counties, West Virginia, shows the most constant species as *Betula alleghaniensis* (yellow birch), *Rhododendron maximum* (great laurel), *Tsuga canadensis* (eastern hemlock), and *Dryopteris intermedia* (intermediate woodfern).

Some stands in West Virginia may be better classified as *Tsuga canadensis* - *Betula alleghaniensis* - *Prunus serotina* / *Rhododendron maximum* Forest (CEGL006206), a seemingly more diverse and lower-elevation type. Forests of high-elevation coves at Salt Pond Mountain in Giles County (e.g., War Spur Branch), where *Picea rubens* (red spruce) is codominant with or subordinate to *Tsuga canadensis* (eastern hemlock) and *Betula alleghaniensis* (yellow birch), are tentatively placed here. Some of these stands, however, may be better classified as wetlands and require additional investigation.

Similar Associations:

- *Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (CEGL007543).
- *Picea rubens* - (*Betula alleghaniensis*, *Aesculus flava*) / *Rhododendron (maximum, catawbiense)* Forest (CEGL004983).
- *Picea rubens* - (*Betula alleghaniensis*, *Aesculus flava*) / *Viburnum lantanoides* / *Oxalis montana* - *Solidago glomerata* Forest (CEGL006256).
- *Picea rubens* / *Betula alleghaniensis* / *Bazzania trilobata* Forest (CEGL008501).
- *Tsuga canadensis* - (*Betula alleghaniensis*, *Quercus rubra*) / *Ilex montana* / *Rhododendron catawbiense* Forest (CEGL008513).
- *Tsuga canadensis* - *Betula alleghaniensis* - *Acer saccharum* / *Dryopteris intermedia* Forest (CEGL006109).
- *Tsuga canadensis* - *Betula alleghaniensis* - *Prunus serotina* / *Rhododendron maximum* Forest (CEGL006206).
- *Tsuga canadensis* - *Halesia tetraptera* - (*Fagus grandifolia*, *Magnolia fraseri*) / *Rhododendron maximum* / *Dryopteris intermedia* Forest (CEGL007693).

Related Concepts:

- *Betula alleghaniensis* - *Tsuga canadensis* - (*Picea rubens*) / *Rhododendron maximum* Forest (Fleming and Coulling 2001) =
- *Betula alleghaniensis* - *Tsuga canadensis* / *Rhododendron maximum* Forest (Fleming et al. 2006) =

- *Betula alleghaniensis* / *Oxalis montana* Association: *Betula alleghaniensis* / *Rhododendron maximum* Variant (Fleming and Moorhead 1996) ?
- *Betula alleghaniensis* / *Rhododendron maximum* forest (Vanderhorst 2001b) =
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- High-Elevation Cove Forest (Fleming and Coulling 2001) B
- Red Spruce Community: Hemlock - Spruce Subtype (Adams and Stephenson 1991) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. Gawler and K. Patterson.

References: Adams and Stephenson 1991, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2006, Grafton and McGraw 1976, Livingston and Mitchell 1976, NatureServe Ecology - Southeastern U.S. unpubl. data, Newell 1997, Newell et al. 1997, Peet et al. unpubl. data 2002, Southeastern Ecology Working Group n.d., TDNH unpubl. data, VDNH 2003, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.159. Yellow Birch Cold Cove Forest.

COMMON NAME (PARK-SPECIFIC): **EASTERN HEMLOCK - OAK - SWEET BIRCH
/ GREAT LAUREL FOREST**

SYNONYMS

USNVC English Name: **Tuliptree - Sweet Birch - Eastern Hemlock / Great Laurel Forest**

USNVC Scientific Name: ***Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest**

USNVC Identifier: **CEGL007543**

LOCAL INFORMATION

Environmental Description: This matrix forest dominates colluvial gorge slopes of all aspects in the eastern two-thirds of the park. Landscape dominance of *Tsuga canadensis* (eastern hemlock) in GARI is a reflection of the area's temperate climate with relatively high rainfall combined with the preponderance of well-drained coarse-textured acidic soils derived primarily from sandstone. Mean solar exposure of mapped stands is relatively low but values have a high standard deviation. Slopes in mapped polygons range from 0 to 55 degrees (mean = 22.7). Elevations in mapped polygons range from 207 to 611 m (mean = 416). Bedrock geology is mapped as primarily sandstones of the New River and Kanawha formations in the Pottsville group. Unvegetated ground cover in plots is dominated by litter, with high cover of large rocks in several plots. Soils in plots are described as well-drained, dry to moist loam, sandy loam, sandy clay loam, and silt loam. Soils test strongly to extremely acidic (mean pH = 4.17) with relatively high levels of total exchange capacity and estimated N release, and relatively low levels of Ca, Cu, Mg, Mn, and Zn compared to average values from all plots in the park. Adjacent vegetation often occurs as smaller patches embedded within a matrix of this association. Adjacent associations include Oak / Great Laurel Forest (CEGL006286), Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222), Oak - Hickory - Sugar Maple Forest (CEGL007268), Yellow Birch Cold Cove Forest (CEGL007861), and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524). Eastern Hemlock Plateau Forest (CEGL006304) often occurs uphill from this association on residual soils of upper slopes and plateaus.

Vegetation Description: This association represents mixed evergreen-deciduous forests codominated by *Tsuga canadensis* (eastern hemlock) with a well-developed shrub layer dominated by *Rhododendron maximum* (great laurel). Canopies are tall (>20 m) with cover in plots ranging from 50 to 100%. Codominant canopy trees include (in decreasing order of constancy in plots) *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), *Quercus rubra* (northern red oak), *Betula lenta* (sweet birch), *Quercus prinus* (chestnut oak), *Liriodendron tulipifera* (tuliptree), *Fagus grandifolia* (American beech), and *Magnolia fraseri* (mountain magnolia). Cover in the subcanopy of plots ranges from 10 to 50%. In addition to the canopy species, the subcanopy also includes *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Ilex opaca* var. *opaca* (American holly), and *Magnolia tripetala* (umbrella-tree). The shrub layers are usually very well-developed and strongly dominated by *Rhododendron maximum* (great laurel). Additional species in the shrub layers of plots include *Ilex opaca* var. *opaca* (American holly), *Hamamelis virginiana* (American witchhazel), *Smilax rotundifolia* (roundleaf greenbrier), *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (cat greenbrier), and *Kalmia latifolia* (mountain laurel). There is low to moderate cover and diversity

in the herb layer. Common herbs include *Polystichum acrostichoides* (Christmas fern), *Mitchella repens* (partridgeberry), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Viola blanda* (sweet white violet), *Polypodium virginianum* (rock polypody), *Monotropa uniflora* (Indianpipe), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), and *Hexastylis virginica* (Virginia heartleaf). Vascular plant species diversity in plots ranges from 7 to 33 taxa (mean = 19.5). Bryophytes identified in plots include *Leucobryum glaucum* (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata* (common bazzania liverwort), *Dicranum scoparium* (dicranum moss), *Dicranum fulvum* (dicranum moss), *Brotherella recurvans* (recurved brotherella moss), and *Polytrichum pallidisetum* (polytrichum moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	S5	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association is the matrix forest on gorge slopes of all aspects in the eastern two-thirds of GARI but becomes restricted to more mesic positions in the western third of the park.

Classification Comments: Stands of this association at GARI often have a larger component of *Quercus* (oak) species compared to stands at New River Gorge National River (NERI). At NERI, this association includes deciduous forests dominated by *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* (red maple), and *Quercus rubra* (northern red oak) with high cover by *Rhododendron maximum* (great laurel) in the shrub layers. However, at GARI, deciduous forests with high *Rhododendron maximum* (great laurel) cover have a larger component of *Quercus prinus* (chestnut oak) and other oaks, and generally lack *Liriodendron tulipifera* (tuliptree); these forests at GARI are classified as Oak / Great Laurel Forest (CEGL006286).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-two plots were sampled: GARI.36, GARI.51, GARI.52, GARI.60, GARI.71, GARI.76, GARI.78, GARI.95, GARI.103, GARI.106, GARI.113, GARI.131, GARI.132, GARI.137, GARI.140, GARI.150, GARI.158, GARI.186, GARI.196, GARI.204, GARI.205, and GARI.208.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	<i>Tsuga canadensis</i> - <i>Liriodendron tulipifera</i> Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	<i>Liriodendron tulipifera</i> - <i>Betula lenta</i> - <i>Tsuga canadensis</i> / <i>Rhododendron maximum</i> Forest

Association (English name) Tuliptree - Sweet Birch - Eastern Hemlock / Great Laurel Forest
Ecological System(s): Southern and Central Appalachian Cove Forest (CES202.373).

GLOBAL DESCRIPTION

Concept Summary: This association includes hemlock-hardwood forests and acidic cove forests of lower to intermediate elevations in the Southern Blue Ridge, upper Piedmont, Cumberlands, and adjacent areas, ranging from southwestern Virginia and southern West Virginia, south and west to northwestern Georgia. The concept for this association is intended to be broad and cover both mixed stands of evergreen and deciduous hardwoods as well as stands dominated exclusively by deciduous trees in mesic, acidic environments. These communities occur at low to middle elevations (200–1060 m [650–3500 ft]), generally in coves, gorges or sheltered slopes, over acidic soils. The canopy is usually dominated by *Liriodendron tulipifera* (tuliptree) or *Betula lenta* (sweet birch) mixed with *Tsuga canadensis* (eastern hemlock), but substantial portions may be comprised mainly of *Tsuga canadensis* (eastern hemlock) and the occasional *Acer rubrum* (red maple), while other sites may have little or no *Tsuga* (hemlock) in the canopy. Other deciduous species more typical of "rich" coves may occur as scattered individuals, including *Tilia americana* var. *heterophylla* (American basswood), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech). Other canopy/subcanopy species often include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Magnolia fraseri* (mountain magnolia), and *Pinus strobus* (eastern white pine). *Rhododendron maximum* (great laurel) is usually dominant in the shrub stratum, often forming impenetrable thickets. South of Virginia, woody associates may also include *Ilex opaca* var. *opaca* (American holly), *Calycanthus floridus* (eastern sweetshrub), *Halesia tetraptera* var. *tetraptera* (mountain silverbell), and *Leucothoe fontanesiana* (highland doghobble). Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Typical herbs include *Polystichum acrostichoides* (Christmas fern), *Dryopteris intermedia* (intermediate woodfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Goodyera pubescens* (downy rattlesnake plantain), *Mitchella repens* (partridgeberry), *Thelypteris noveboracensis* (New York fern), *Galax urceolata* (beetleweed), *Viola rotundifolia* (roundleaf yellow violet), and *Tiarella cordifolia* (heartleaf foamflower).

Environmental Description: This association is typically found at lower to intermediate elevations (200–1060 m [650–3500 ft]) in the Southern Appalachians and adjacent foothills as well as nearby plateau/gorge systems in West Virginia. Habitats are mesic and located on gentle to steep, lower slopes along creeks in ravines, in coves or gorges, and in concave positions on protected slopes with cool aspects and acidic soils. In situations where midslopes are in protected north-facing positions, this community can range very high up straight or even convex slopes. The type often occurs in linear patches along stream bottoms and in steep ravines in complexes with rich cove communities. Although frequently associated with streams, it is not a wetland. Soils collected from plots are extremely acidic (mean pH = 4.0) and infertile, with high iron and aluminum levels and very low total base saturation. Where present, they are usually well-drained sandy loam, silt loam, loam, clay loam, or clay. The degree of soil development is highly variable. Some stands have relatively deep colluvial or residual soils, while others have a substrate of deeply piled boulders with sparse interstitial, organic soils.

Vegetation Description: This association encompasses hemlock-hardwood forests and acidic cove forests with canopies dominated by mixtures of *Tsuga canadensis* (eastern hemlock), *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), and *Acer rubrum* (red maple). The concept for this association is intended to be broad and cover

both mixed stands of evergreen and deciduous hardwoods as well as stands dominated exclusively by deciduous trees. Presumably because of past logging, *Tsuga canadensis* (eastern hemlock) is absent or confined to the understory in some stands, which have mixed canopies of *Liriodendron tulipifera* (tuliptree), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Magnolia acuminata* (cucumber-tree), *Quercus rubra* (northern red oak), and/or *Nyssa sylvatica* (blackgum). Other deciduous species more typical of fertile coves, including *Tilia americana* var. *heterophylla* (American basswood), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech), may occur as scattered individuals. Minor overstory and understory species include *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Magnolia fraseri* (mountain magnolia), *Magnolia tripetala* (umbrella-tree), *Oxydendrum arboreum* (sourwood), *Prunus serotina* (black cherry), and *Pinus strobus* (eastern white pine). *Rhododendron maximum* (great laurel) is scattered to dominant in the shrub stratum often forming nearly impenetrable colonies. *Kalmia latifolia* (mountain laurel) is also a typical, but less abundant, shrub. In the southern portion of this type's range, *Calycanthus floridus* (eastern sweetshrub), *Halesia tetraptera* (mountain silverbell), and *Leucothoe fontanesiana* (highland doghobble) may be common; these are lacking in Virginia and West Virginia occurrences, where *Hamamelis virginiana* (American witchhazel) and *Acer pensylvanicum* (striped maple) may be minor associates. Herbaceous cover is sparse but can be diverse and is composed of acid-loving species. Frequent low-cover species of this layer include *Arisaema triphyllum* (Jack in the pulpit), *Chimaphila maculata* (striped prince's pine), *Dioscorea quaternata* (fourleaf yam), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Eurybia divaricata* (white wood aster), *Galax urceolata* (beetleweed), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hexastylis* (heartleaf) spp., *Luzula echinata* (hedgehog woodrush), *Monotropa uniflora* (Indianpipe), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Polypodium virginianum* (rock polypody), *Polystichum acrostichoides* (Christmas fern), *Thelypteris noveboracensis* (New York fern), *Tiarella cordifolia* (heartleaf foamflower), *Viola blanda* (sweet white violet), and *Waldsteinia fragarioides* (Appalachian barren strawberry). The spectacular sedge *Cymophyllum fraserianus* (Fraser's cymophyllum) is often associated with this forest. Bryophytes identified in West Virginia plots include *Leucobryum glaucum* (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Bazzania trilobata* (common Bazzania liverwort), *Dicranum scoparium* (dicranum moss), *Dicranum fulvum* (dicranum moss), *Brotherella recurvans* (recurved brotherella moss), and *Polytrichum pallidisetum* (polytrichum moss).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
		<i>Betula lenta</i> (sweet birch)
		<i>Liriodendron tulipifera</i> (tuliptree)
Tall shrub/sapling	Broad-leaved evergreen tree	<i>Rhododendron maximum</i> (great laurel)

Characteristic Species: *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Galax urceolata* (beetleweed), *Leucothoe fontanesiana* (highland doghobble), *Liriodendron tulipifera* (tuliptree), *Luzula echinata* (hedgehog woodrush), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), *Quercus rubra* (northern red oak), *Rhododendron maximum* (great laurel), *Thelypteris noveboracensis* (New York fern), *Tiarella cordifolia*

(heartleaf foamflower), *Tsuga canadensis* (eastern hemlock), *Waldsteinia fragarioides* (Appalachian barren strawberry).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Ageratina altissima</i> var. <i>roanensis</i> (white snakeroot)	G5T3T4	plant	
<i>Betula uber</i> (Virginia roundleaf birch)	G1Q	plant	Federally listed threatened; globally critically imperiled
<i>Botrychium jenmanii</i> (Dixie grapefern)	G3G4	plant	
<i>Diervilla rivularis</i> (mountain bush honeysuckle)	G3	plant	
<i>Hexastylis contracta</i> (mountain heartleaf)	G3	plant	
<i>Hexastylis naniflora</i> (dwarfflower heartleaf)	G3	plant	Federally listed threatened globally imperiled
<i>Hexastylis rhombiformis</i> (North Fork heartleaf)	G2	plant	
<i>Isotria medeoloides</i> (green fiveleaf orchid)	G2	plant	Federally listed threatened; globally imperiled
<i>Malaxis bayardii</i> (Bayard's adder's-mouth orchid)	G1G2	plant	globally imperiled
<i>Monotropsis odorata</i> (pygmypipes)	G3	plant	
<i>Shortia galacifolia</i> var. <i>brevistyla</i> (Oconee bells)	G2G3T2	plant	
<i>Shortia galacifolia</i> var. <i>galacifolia</i> (Oconee bells)	G2G3T2T3	plant	
<i>Trillium persistens</i> (persistent wakerobin)	G1	plant	Federally listed endangered; globally critically imperiled globally imperiled
<i>Trillium pusillum</i> var. 1 (interior least trillium)	G3T2Q	plant	
<i>Trillium rugelii</i> (illscented wakerobin)	G3	plant	
<i>Vaccinium hirsutum</i> (hairy blueberry)	G3	plant	
<i>Waldsteinia lobata</i> (Piedmont barren strawberry)	G2G3	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in the Southern Blue Ridge and Cumberlands and peripherally in the upper Piedmont and southern Central Appalachians, ranging from southwestern Virginia and southeastern West Virginia south and west to northwestern Georgia.

States/Provinces: GA, NC, SC, TN, VA:S4S5, WV:S5.

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Appalachian Trail, Blue Ridge Parkway, Bluestone, Carl Sandburg Home, Gauley River, Great Smoky Mountains, New River Gorge, Obed); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains), Sumter (Piedmont)).

CONSERVATION STATUS

Rank: G5 (27-Sep-2004).

Reasons: Within its range, this community type occurs extensively in suitable mesic habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Deciduous trees more typical of "rich" coves, such as *Aesculus flava* (yellow buckeye), *Tilia americana* var. *heterophylla* (American basswood), and *Acer saccharum* (sugar maple), are present in this forest only as minor components, if at all. Likewise, rich-site herbs such as *Actaea racemosa* (black bugbane), *Caulophyllum thalictroides* (blue cohosh), *Actaea pachypoda* (white baneberry), and *Adiantum pedatum* (northern maidenhair) are absent or nearly

so. This forest is distinguished from "northern hardwood forests" by the lack of or near absence of *Fagus grandifolia* (American beech), *Betula alleghaniensis* (yellow birch), and *Aesculus flava* (yellow buckeye), and the presence of low-elevation species such as *Betula lenta* (sweet birch) and *Liriodendron tulipifera* (tuliptree), and generally by a more depauperate herb layer. There is much variability in species composition in the 43 plots classified as this association from the Appalachian Trail region (Fleming and Patterson 2009a), but constancy of the nominal species was quite high ($\geq 84\%$). The most constant species ($\geq 64\%$), in order of descending constancy, are *Rhododendron maximum* (great laurel), *Tsuga canadensis* (eastern hemlock), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak), *Mitchella repens* (partridgeberry), *Polystichum acrostichoides* (Christmas fern), and *Hamamelis virginiana* (American witchhazel). Species richness in 400-m² plots ranges from 11–72 species per plot. This variable richness is probably influenced by somewhat variable soil fertility and the variation in cover/density of evergreen *Rhododendron* (rhododendron) shrub colonies. An interesting example from the Piedmont/Blue Ridge transition of Georgia (Cedar Creek Canyon, Chattahoochee National Forest) has high coverage of *Rhododendron minus* (piedmont rhododendron) and other foothills/Piedmont species such as *Liquidambar styraciflua* (sweetgum) and *Aesculus sylvatica* (painted buckeye).

In the 900- to 1060-m (3000–3500 ft) elevational range, the type becomes transitional to *Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / (*Leucothoe fontanesiana*) Forest (CEGL007861), which lacks lower-elevation species such as *Liriodendron tulipifera* (tuliptree) and *Galax urceolata* (beetleweed), and contains many species characteristic of higher elevations and northern latitudes.

Similar vegetation has been observed in coves of the Cumberland Mountains of southwestern Virginia (e.g., Clinch Ranger District: Dark Hollow, Roaring Branch, Pick Breeches, and Flannery Ridges) but comprehensive data are needed to determine whether these stands are part of this forest type or transitional to *Tsuga canadensis* - (*Fagus grandifolia*, *Tilia americana* var. *heterophylla*) / *Magnolia tripetala* Forest (CEGL008407). The latter unit apparently has an extensive distribution in the Cumberland Plateau of Kentucky and Tennessee, the Southern Ridge and Valley of Tennessee, and the Central Appalachians of West Virginia and southwestern Pennsylvania.

Similar Associations:

- *Acer rubrum* var. *rubrum* - *Betula (alleghaniensis, lenta)* - *Magnolia fraseri* / (*Rhododendron maximum*, *Kalmia latifolia*) Forest (CEGL008558).
- *Betula alleghaniensis* - (*Tsuga canadensis*) / *Rhododendron maximum* / (*Leucothoe fontanesiana*) Forest (CEGL007861).
- *Pinus strobus* - *Tsuga canadensis* / *Rhododendron maximum* - (*Leucothoe fontanesiana*) Forest (CEGL007102).
- *Quercus prinus* - *Quercus rubra* / *Rhododendron maximum* / *Galax urceolata* Forest (CEGL006286).
- *Tsuga canadensis* - (*Fagus grandifolia*, *Tilia americana* var. *heterophylla*) / *Magnolia tripetala* Forest (CEGL008407).
- *Tsuga canadensis* - (*Pinus strobus*) Temporarily Flooded Forest (CEGL007143).
- *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043).
- *Tsuga canadensis* - *Halesia tetraptera* - (*Fagus grandifolia*, *Magnolia fraseri*) / *Rhododendron maximum* / *Dryopteris intermedia* Forest (CEGL007693).
- *Tsuga canadensis* - *Quercus prinus* - *Liriodendron tulipifera* / *Kalmia latifolia* - (*Rhododendron catawbiense*) Forest (CEGL008512).

Related Concepts:

- *Liriodendron tulipifera* - *Betula lenta* - (*Tsuga canadensis*) / *Rhododendron maximum* / *Galax urceolata* Forest (Fleming et al. 2006) =
- *Liriodendron tulipifera* - *Betula lenta* - *Tsuga canadensis* / *Rhododendron maximum* Forest (Fleming and Coulling 2001) ?
- *Tsuga canadensis* - *Betula lenta* / *Rhododendron maximum* forest (Vanderhorst 2001b) =
- Acidic Cove Forest (Fleming et al. 2001) B
- Acidic Cove Forest (Typic Subtype) (Schafale 1998b) ?
- Cove Forest (Patterson et al. 1994) B
- IA5b. Southern Appalachian Hemlock Cove Forest (Allard 1990) B
- Mixed Mesophytic Coves (Gettman 1974) ?
- Sweet Birch - Hemlock Type (Schmalzer and DeSelm 1982) =
- Type 5 (Newell and Peet 1995) ?
- Yellow-Poplar - Eastern Hemlock: 58 (Eyre 1980) B

SOURCES

Description Authors: K. Patterson, mod. G. Fleming and P. Coulling, mod. T. Govus and S. Gawler.

References: Allard 1990, Eyre 1980, Fleming and Coulling 2001, Fleming and Patterson 2009a, Fleming et al. 2001, Fleming et al. 2004, Fleming et al. 2006, Gettman 1974, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1986, Newell and Peet 1995, Patterson 1994, Patterson et al. 1994, Peet et al. unpubl. data 2002, Perez pers. comm., Schafale 1998b, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Wood 1999.



Plot GARI.36. Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest.

**COMMON NAME (PARK-SPECIFIC): AMERICAN SYCAMORE - RIVER BIRCH
RIVERSCOUR WOODLAND**

SYNONYMS

USNVC English Name: American Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland
USNVC Scientific Name: *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Woodland
USNVC Identifier: CEG003725

LOCAL INFORMATION

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to frequent, high-energy flooding. Floods damage and remove trees, maintaining a short, open canopy. Slopes in mapped polygons range from 3 to 39 degrees (mean = 19.6). Elevations in mapped polygons range from 207 to 421 m (mean = 274.6). On depositional landforms, variation in flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free sand in areas subject to less frequent, lower energy floods. In GARI, this association also occurs on flood-scoured bedrock. Unvegetated ground cover in plots is usually dominated by large rock or sand, but significant bedrock and flotsam occur in some plots. There is often a range in soil drainage related to microsites and bank position. Soils in plots are described as temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test very slightly to very strongly acidic (mean pH = 5.29) with relatively high levels of Mn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Ca, Cu, K, Na, and P compared to average values from all plots in the park. Adjacent associations include Riverscour Shrub Prairie (CEGL006623), which occurs in areas subject to more frequent, higher energy flooding, and Oak - Hickory Floodplain Forest (CEGL006462), Eastern Hemlock Floodplain Forest (CEGL006620), and American Sycamore - Tuliptree - Sweetgum Floodplain Forest (CEGL004418), which occur in less frequently flooded positions.

Vegetation Description: This association is a deciduous woodland dominated by *Betula nigra* (river birch) and/or *Platanus occidentalis* (American sycamore). Tree canopies are typically short (<15 m) and open, and trees are often flood-battered and lean downstream. Canopy cover in plots ranges from 10 to 70% and subcanopy cover ranges from 0 to 40%. Distinguishing canopy and shrub strata is often difficult or arbitrary due to short stature and high variability of individual tree heights. At GARI, *Betula nigra* (river birch) is the leading dominant, probably due to acidic soils which are not ideal for *Platanus occidentalis* (American sycamore).

Additional important trees in plots include *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Diospyros virginiana* (common persimmon), and *Tsuga canadensis* (eastern hemlock). There is often a well-developed shrub layer composed of heavily battered trees, tree saplings, and true shrubs. Common shrubs in plots include *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Alnus serrulata* (hazel alder), *Viburnum nudum* var. *cassinoides* (withe-rod), *Kalmia latifolia* (mountain laurel), *Rhododendron arborescens* (smooth azalea), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Vaccinium corymbosum* (highbush blueberry), and *Xanthorhiza simplicissima* (yellowroot). This association is the primary habitat for the threatened shrub *Spiraea virginiana* (Virginia meadowsweet) at GARI. The vine

Toxicodendron radicans (eastern poison ivy) has high constancy in plots. There is usually moderate to high cover and high diversity in the herb layer. Common herbs include (in decreasing order of constancy in plots) *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Dichanthelium clandestinum* (deertongue), *Trautvetteria caroliniensis* var. *caroliniensis* (Carolina bugbane), *Eupatorium fistulosum* (trumpetweed), *Osmunda regalis* var. *spectabilis* (royal fern), *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Deschampsia flexuosa* (wavy hairgrass), *Solidago rugosa* (wrinkleleaf goldenrod), and *Packera paupercula* (balsam groundsel). Stands on sandy alluvium may have high cover by *Chasmanthium latifolium* (Indian woodoats). Vascular plant species richness in plots ranges from 41 to 76 taxa (mean = 53). Nonvascular cover is usually low but may range up to 20%, mostly on rocks. Bryophytes identified in more than one plot include *Schistidium apocarpum*, *Grimmia laevigata* (grimmia dry rock moss), *Climacium americanum* (American climacium moss), *Bryoandersonia illecebra* (bryoandersonia moss), and *Sphagnum lescurii* (Lescur's sphagnum). Lichens identified in plots include *Coccocarpia palmicola* and *Dermatocarpon luridum*.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: This association occurs in small patches scattered throughout the length of the Meadow and Gauley rivers in the park.

Classification Comments: One stand of this association (sampled by plot GARI.90) clusters with and is remarkably similar to stands of this association at Bluestone National Scenic River (BLUE) that were recognized as a river birch / Indian woodoats phase (Vanderhorst et al. 2008). These stands occur on sandy alluvium, are strongly dominated by *Betula nigra* (river birch), and have understories dominated by *Dichanthelium clandestinum* (deertongue), *Chasmanthium latifolium* (Indian woodoats), and tall herbs. Most other plots of this association at GARI cluster as a sister clade to the group of plots representing Riverscour Shrub Prairie (CEGL006623) at GARI, rather than directly with plots of CEGL003725 from BLUE or New River Gorge National River (NERI) (Vanderhorst et al. 2007). This is due to a large number of riparian species that are common at GARI but absent or sparse at BLUE and NERI; these include *Ilex verticillata* (common winterberry), *Rhododendron arborescens* (smooth azalea), *Xanthorhiza simplicissima* (yellowroot), *Packera paupercula* (balsam groundsel), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Osmunda regalis* var. *spectabilis* (royal fern), and others. However, there are also floristic differences, in addition to contrasting physiognomy, which help distinguish CEGL003725 and CEGL006623 at GARI. In a previous study of riparian communities at GARI, Walton and Anderson (1997) described a *Betula nigra* - *Platanus occidentalis* / *Xanthorhiza simplicissima* woodland which is equivalent to this association. Plot data collected for their study were incorporated in this analysis, and plots of their *Liquidambar styraciflua* - *Carpinus caroliniana* woodland (GARI.29, GARI.30) were also attributed to this association.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-three plots were sampled: GARI.1, GARI.2, GARI.10, GARI.13, GARI.17, GARI.21, GARI.22, GARI.23, GARI.24, GARI.29, GARI.30, GARI.32, GARI.40, GARI.47,

GARI.67, GARI.90, GARI.91, GARI.97, GARI.100, GARI.108, GARI.109, GARI.117, and GARI.128.

Gauley River National Recreation Area Inventory Notes: All ten randomly placed accuracy assessment points for the Riparian Zone map class were keyed to Riverscour Shrub Prairie (CEGL006623), therefore American Sycamore - River Birch Riverscour Woodland (CEGL003725) is probably not a large component of this map class.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
Alliance	<i>Platanus occidentalis</i> - (<i>Betula nigra</i> , <i>Salix</i> spp.) Temporarily Flooded Woodland Alliance (A.633)
Alliance (English name)	American Sycamore - (River Birch, Willow species) Temporarily Flooded Woodland Alliance
Association	<i>Platanus occidentalis</i> - <i>Betula nigra</i> / <i>Cornus amomum</i> / (<i>Andropogon gerardii</i> , <i>Chasmanthium latifolium</i>) Woodland
Association (English name)	American Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland
Ecological System(s):	South-Central Interior Large Floodplain (CES202.705). South-Central Interior Small Stream and Riparian (CES202.706).

GLOBAL DESCRIPTION

Concept Summary: These woodlands occur along high-energy Appalachian rivershores, such as along the New, Bluestone, and Gauley rivers in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). The coarse-textured substrates are potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. The usually short, open canopy is composed mostly of flood-battered trees, typically codominated by *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Additional important trees include *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Nyssa sylvatica* (blackgum), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). *Tsuga canadensis* (eastern hemlock) is present in some sites along the Gauley River. Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* (common ninebark), *Salix caroliniana* (coastal plain willow), and *Xanthorhiza simplicissima* (yellowroot). The invasive exotic shrub *Rosa multiflora* (multiflora rose) is sometimes present. There is often a large component of woody vines in the short-shrub layer, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs

include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Symphotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Trautvetteria caroliniensis* (Carolina bugbane), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet). Exotic herbs which are common, usually in small amounts, include *Prunella vulgaris* (common selfheal), *Plantago rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch).

Environmental Description: These woodlands occur along high-energy Appalachian rivershores, such as the New River in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). This association occurs as relatively continuous linear zones (sometimes in small patches), commonly on deposition bars, in positions that are subject to frequent high-energy flooding. These floods damage and remove trees, maintaining an open canopy. Variation in this community related to flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free silty sand in areas subject to less frequent, lower energy floods. There is no soil horizon development. These coarse-textured substrates are potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. Unvegetated ground cover is dominated by various mixtures of boulders, cobbles, and sand, with significant cover by coarse woody debris (flotsam) and standing water in some plots. Soil chemistry analyzed from 27 West Virginia plots indicates low levels of macronutrients (N, P, K) and organic matter, and high levels of several micronutrients (Fe, Mg, Mn, Zn, somewhat variable from site to site). Plots along the New River have soils with relatively high pH (mean = 6.73), while those along the Bluestone and Gauley rivers are more acidic (mean pH = 5.6 and 5.3, respectively). Slopes range from level to steep but are generally gentle. Known elevations range from 207 to 485 m (670–1575 ft).

Vegetation Description: This association is a deciduous woodland with a short, open canopy (10–70% cover) typically codominated by flood-battered *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). Additional important trees include *Acer saccharinum* (silver maple), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Nyssa sylvatica* (blackgum), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). *Tsuga canadensis* (eastern hemlock) is present in some sites along the Gauley River. The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus*

occidentalis (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush), *Physocarpus opulifolius* (common ninebark), *Salix caroliniana* (coastal plain willow), and *Xanthorhiza simplicissima* (yellowroot). This association is the primary habitat for the threatened shrub *Spiraea virginiana* (Virginia meadowsweet) along the Gauley River. Some Gauley River sites have *Kalmia latifolia* (mountain laurel), *Rhododendron arborescens* (smooth azalea), and *Vaccinium corymbosum* (highbush blueberry), but heaths are not typical. The invasive exotic shrub *Rosa multiflora* (multiflora rose) is sometimes present. There is often a large component of woody vines in the short-shrub layer, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera aurea* (golden ragwort), *Packera paupercula* (balsam groundsel), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Symphyotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Trautvetteria caroliniensis* (Carolina bugbane), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet). Exotic herbs which are common in small amounts include *Prunella vulgaris* (common selfheal), *Plantago rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch). Plants tracked as rare in West Virginia by the Natural Heritage Program include *Baptisia australis* (blue wild indigo), *Carex emoryi* (Emory's sedge), *Coreopsis pubescens* var. *robusta* (star tickseed), *Juncus dichotomus* (forked rush), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Spiraea virginiana* (Virginia meadowsweet), *Stachys tenuifolia* (smooth hedgenettle), and *Vitis rupestris* (sand grape). Vascular plant species richness in the 51 sampled plots in West Virginia ranges from 15 to 87 (mean = 49.5). The bryophyte layer is usually poorly developed; crustose lichens may occur on large rocks. Along the Gauley River, mosses in plots include *Schistidium apocarpum*, *Grimmia laevigata* (grimmia dry rock moss), *Climacium americanum* (American climacium moss), *Bryoandersonia illecebra* (bryoandersonia moss), and *Sphagnum lescurii* (Lescur's sphagnum); lichens identified in plots include *Coccocarpia palmicola* and *Dermatocarpon luridum*.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	<i>Betula nigra</i> (river birch)
		<i>Platanus occidentalis</i> (American sycamore)

Characteristic Species: *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Campsis radicans* (trumpet creeper), *Catalpa speciosa* (northern catalpa), *Cephalanthus occidentalis* (common buttonbush),

Chasmanthium latifolium (Indian woodoats), *Chionanthus virginicus* (white fringetree), *Conoclinium coelestinum* (blue mistflower), *Cornus amomum* (silky dogwood), *Deschampsia flexuosa* (wavy hairgrass), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Hypericum prolificum* (shrubby St. Johnswort), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Panicum virgatum* (switchgrass), *Physocarpus opulifolius* (common ninebark), *Robinia pseudoacacia* (black locust), *Salix caroliniana* (coastal plain willow), *Salix nigra* (black willow), *Solidago juncea* (early goldenrod), *Toxicodendron radicans* (eastern poison ivy), *Tripsacum dactyloides* (eastern gamagrass), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Viola cucullata* (marsh blue violet), *Vitis rupestris* (sand grape).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Baptisia australis</i> (blue wild indigo)	-	plant	WV state-rare plant
<i>Carex emoryi</i> (Emory's sedge)	-	plant	WV state-rare plant
<i>Coreopsis pubescens</i> var. <i>robusta</i> (star tickseed)	-	plant	WV state-rare plant
<i>Coronilla varia</i> (purple crownvetch)	-	plant	exotic
<i>Lysimachia nummularia</i> (creeping jenny)	-	plant	exotic
<i>Melilotus officinalis</i> (yellow sweetclover)	-	plant	exotic
<i>Rosa multiflora</i> (multiflora rose)	-	plant	exotic
<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i> (Rand's goldenrod)	G5T3?	plant	WV state-rare plant
<i>Spiraea virginiana</i> (Virginia meadowsweet)	G2	plant	Federally listed threatened; globally imperiled
<i>Trifolium pratense</i> (red clover)	-	plant	exotic
<i>Vitis rupestris</i> (sand grape)	G3	plant	WV state-rare plant

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is currently documented from high-energy Appalachian rivers, such as the New, Bluestone, and Gauley rivers in West Virginia. Its range may include some of western Virginia as well.

States/Provinces: VA, WV.

Federal Lands: NPS (Bluestone, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Along the New River, this association is ecologically and floristically intermediate between *Andropogon gerardii* - *Panicum virgatum* - *Baptisia australis* Herbaceous Vegetation (CEGL006283), which is more open and occurs on sites which are more severely impacted by flooding, and *Platanus occidentalis* - *Fraxinus pennsylvanica* / *Carpinus caroliniana* / *Verbesina alternifolia* Forest (CEGL006458), which has a more closed canopy, usually lacking *Betula nigra* (river birch), and occurs on sites less severely impacted by flooding. It is also similar to *Salix nigra* - *Betula nigra* / *Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463), which occurs on finer textured alluvium in riverside positions

along lower energy reaches. Similar vegetation was described from the New River Gorge by Suiter (1995) as *Platanus occidentalis* - *Betula nigra* forest. Two phases of this association can be recognized along the Bluestone River and its tributaries. Stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, have more open canopies and relatively sparse herb layers with *Andropogon gerardii* (big bluestem) prominent in late season. Stands on sand substrate, which are subject to less frequent, lower energy floods, have taller, more closed canopies, often dominated by *Betula nigra* (river birch), over lush, tall herb layers with abundant *Dichanthelium clandestinum* (deertongue) and *Chasmanthium latifolium* (Indian woodoats). The tough-rooted, flood-tolerant *Carex emoryi* (Emory's sedge) often grows in a line along the riverside edge of this association, sometimes beyond the woodland canopy. These zones are included within the association concept presented here. Recent classification studies in the National Park Service National Capitol Region have shown this association to be distinct from similar vegetation in the Potomac drainage, which is classified as *Platanus occidentalis* - *Betula nigra* - *Salix* (*caroliniana*, *nigra*) Woodland (CEGL003896).

Similar Associations:

- (*Betula nigra*, *Ilex verticillata*) / *Andropogon gerardii* - *Solidago simplex* ssp. *randii* var. *racemosa* Shrub Herbaceous Vegetation (CEGL006623).
- *Betula nigra* - *Platanus occidentalis* Forest (CEGL002086)--with a more-or-less closed canopy.
- *Platanus occidentalis* - *Betula nigra* - *Salix* (*caroliniana*, *nigra*) Woodland (CEGL003896).
- *Quercus bicolor* - *Fraxinus pennsylvanica* - (*Platanus occidentalis*) / *Chasmanthium latifolium* - *Dichanthelium clandestinum* - *Zizia aurea* Woodland (CEGL006218).
- *Salix nigra* - *Betula nigra* / *Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463)--occurs in similar riverside positions along lower energy reaches, often just downstream from rapids.

Related Concepts:

- *Betula nigra* - *Platanus occidentalis* / *Xanthorhiza simplicissima* woodland (Walton and Anderson 1997) =
- *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* riparian woodland (Vanderhorst 2001b) =
- *Platanus occidentalis* - *Betula nigra* forest (Suiter 1995) ?

SOURCES

Description Authors: M. Pyne, mod. S. C. Gawler.

References: Fleming et al. 2001, Mitchem 2004, Southeastern Ecology Working Group n.d., Suiter 1995, Vanderhorst 2000b, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst et al. 2010, Vanderhorst pers. comm., Walton and Anderson 1997.



Plot GARI.97. American Sycamore - River Birch Riverscour Woodland (sycamore - river birch / big bluestem phase).



Plot GARI.90. American Sycamore - River Birch Riverscour Woodland (river birch / Indian woodoats phase).

COMMON NAME (PARK-SPECIFIC): RIVERSCOUR SHRUB PRAIRIE

SYNONYMS

USNVC English Name: (River Birch, Common Winterberry) / Big Bluestem - Sticky Goldenrod Shrub Herbaceous Vegetation
USNVC Scientific Name: (*Betula nigra*, *Ilex verticillata*) / *Andropogon gerardii* - *Solidago simplex* var. *racemosa* Shrub Herbaceous Vegetation
USNVC Identifier: CEGLO06623

LOCAL INFORMATION

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to very frequent, high-energy flooding. Flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. The largest, best developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans, etc.). Slopes in mapped polygons of the Riparian Zone map class, which includes this association as a major component, range from 0 to 34 degrees (mean = 12). Elevations in mapped polygons of the Riparian Zone map class range from 207 to 512 m (mean = 315). Substrates are primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover in most plots is dominated by bedrock and large rocks, but a few plots have higher cover of small rocks and sand. Many plots have some standing water. Soils in plots are described as temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test strongly to very slightly acidic (mean pH = 5.75) with relatively high levels of Mg, Mn, Na, and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, K, and P compared to average values from all plots in the park. Adjacent vegetation in positions that are subject to somewhat less frequent and less high-energy flooding includes American Sycamore - River Birch Riverscour Woodland (CEGL003725) and (Virginia, Pitch) Pine Floodplain Forest (CEGL006624).

Vegetation Description: This association has mixed shrub and herbaceous physiognomy and may include a few taller trees. All trees in plots are less than 10 m tall and canopy cover in plots ranges from 0 to 30%. Common trees include *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Cover in the tall-shrub layer of plots ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common species in the shrub layers include (in decreasing order of constancy in plots) *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) occurs in three plots and the state-rare shrub *Prunus pumila* (sandcherry) occurs in two plots. Cover in the herb layer of plots ranges from 5 to 60% and this stratum usually has the highest cover. Common herbs include (in decreasing order of constancy in plots) *Andropogon gerardii* (big bluestem), *Solidago simplex*

ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in plots ranges from 18 to 70 taxa (mean = 36.4). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock. Bryophytes identified in more than one plot include *Porella pinnata* (aquatic tongue liverwort), *Hedwigia ciliata* (ciliate hedwigia moss), *Climacium americanum* (American climacium moss), *Sematophyllum demissum* (sematophyllum moss), *Grimmia laevigata* (grimmia dry rock moss), *Campylopus tallulensis* (Tallul Campylopus moss), and *Fissidens osmundioides* (osmund fissidens moss). Lichens in plots include *Xanthoparmelia conspersa* (xanthoparmelia lichen) and a distinctive "whitewash" growth on the downstream side of boulders, possibly *Phlyctis petraea* or a related species.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	<i>Betula nigra</i> (river birch)
Herb (field)	Graminoid	<i>Andropogon gerardii</i> (big bluestem) <i>Sorghastrum nutans</i> (Indiangrass)

Characteristic Species: *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Clematis virginiana* (devil's darning needles), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Euphorbia corollata* (flowering spurge), *Hypericum prolificum* (shrubby St. Johnswort), *Hypoxis hirsuta* (common goldstar), *Ilex verticillata* (common winterberry), *Lysimachia lanceolata* (lanceleaf loosestrife), *Nyssa sylvatica* (blackgum), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Rhododendron arborescens* (smooth azalea), *Rosa palustris* (swamp rose), *Salix caroliniana* (coastal plain willow), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Sorghastrum nutans* (Indiangrass), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Viola pedata* (birdfoot violet), *Xanthorrhiza simplicissima* (yellowroot).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Marshallia grandiflora</i> (Monongahela Barbara's buttons)	G2	plant	WV state-rare plant (S2)
<i>Packera paupercula</i> (balsam groundsel)	-	plant	WV state-rare plant (S2)
<i>Prunus pumila</i> (sandcherry)	-	plant	WV state-rare plant (S1)
<i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i> (Rand's goldenrod)	G5T3?	plant	WV state-rare plant (S2)
<i>Spiraea virginiana</i> (Virginia meadowsweet)	G2	plant	Fedreally listed threatened; globally imperiled; WV state-rare plant (S1)

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	S2	.	.	[not crosswalked]	.

Local Range: This association occurs in small patches and linear zones scattered throughout the lengths of the Meadow and Gauley rivers in the park.

Classification Comments: In an analysis of riverscours communities throughout West Virginia, plots of this association at Gauley River clustered strongly together as a group distinct from riverscours prairie plots that are classified as *Andropogon gerardii* - *Panicum virgatum* - *Baptisia australis* Herbaceous Vegetation (CEGL006283) from New River Gorge National River (Vanderhorst et al. 2007) and the Greenbrier River. They clustered together with plots of shrubby prairies from high-energy reaches of the Tygart's Valley, Middle Fork, and Cheat rivers in north-central West Virginia. These river reaches share acidic sandstone bedrock and boulder substrate and extremely high-energy flows. The "prairie-like situation" described by Bush (1976) describes this vegetation at Arden along the Tygart's Valley River. Similar vegetation may also occur along the Youghiogheny in Pennsylvania. A regional review of similar vegetation from the Potomac to western Pennsylvania and south to the Cumberlands would be instructive to clarify the differences and confirm the correct circumscription of associations.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Twenty-seven plots were sampled: GARI.3, GARI.4, GARI.5, GARI.8, GARI.9, GARI.11, GARI.12, GARI.15, GARI.16, GARI.19, GARI.20, GARI.25, GARI.26, GARI.27, GARI.28, GARI.70, GARI.81, GARI.83, GARI.87, GARI.92, GARI.101, GARI.112, GARI.118, GARI.148, GARI.155, GARI.156, and GARI.173.

Gauley River National Recreation Area Inventory Notes: All ten randomly placed accuracy assessment points for the Riparian Zone map class were keyed to Riverscours Shrub Prairie (CEGL006623), therefore this is probably a large component of this map class.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j.)
Alliance	<i>Andropogon gerardii</i> - (<i>Sorghastrum nutans</i>) Temporarily Flooded Herbaceous Alliance (A.1337)
Alliance (English name)	Big Bluestem - (Yellow Indiangrass) Temporarily Flooded Herbaceous Alliance
Association	(<i>Betula nigra</i> , <i>Ilex verticillata</i>) / <i>Andropogon gerardii</i> - <i>Solidago simplex</i> ssp. <i>randii</i> var. <i>racemosa</i> Shrub Herbaceous Vegetation
Association (English name)	(River Birch, Common Winterberry) / Big Bluestem - Sticky Goldenrod Shrub Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This rivershore prairie occurs along the high-energy reaches of the Gauley, Tygart's Valley, Middle Fork, and Cheat rivers in West Virginia, and possibly elsewhere in the region. It occurs in small patches and linear zones subject to very frequent, high-energy flooding. The most well-developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans). Substrates are

primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover in most plots is dominated by bedrock and large rocks, but a few areas have higher cover of small rocks and sand, and some have some standing water. The physiognomy is mixed shrub and herbaceous cover, with herbs dominating the general aspect; in places, it may include a few taller individuals of *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore) (0–30% cover, trees less than 10 m tall). Cover in the tall-shrub layer ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common species in the shrub layers include *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) occurs in a few locations. Cover in the herb layer of plots ranges from 5 to 60%, and this stratum usually has the highest cover. Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in sampled plots ranges from 18 to 70 taxa (mean = 36.4). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock.

Environmental Description: This association occurs in small patches and linear zones in positions along rivershores subject to very frequent, high-energy flooding. Flooding disturbance maintains an open physiognomy by removing or damaging trees before they become large enough to provide significant shade. The largest, best developed occurrences are located along rapids created by constrictions in the river channel (bedrock outcrops, point bars, bends, islands, alluvial fans). Slopes in mapped polygons (Gauley River) range from 0 to 34 degrees (mean = 12). Elevations in mapped polygons (Gauley River) range from 207 to 512 m (mean = 315). Substrates are primarily sandstone bedrock and boulders. There is often an elevation range of a few meters within stands which creates wet and dry microsites and provides elevated rooting substrate. Bedrock and boulders also provide structure which protects vegetation from high-energy flows. Unvegetated ground cover is dominated by bedrock and large rocks, but some areas have higher cover of small rocks and sand, and some areas have patches of standing water. Soils are temporarily flooded, moderately well- to rapidly-drained sand and sandy loam. Soils test strongly to very slightly acidic (mean pH = 5.75) with relatively high levels of Mg, Mn, Na,

and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, K, and P.

Vegetation Description: This association has mixed shrub and herbaceous physiognomy and may include a few taller trees. Trees are less than 10 m tall and canopy cover ranges from 0 to 30%. Common trees include *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore). Cover in the tall-shrub layer ranges from 0 to 30%, and cover in the short-shrub layer ranges from 0 to 60%. Common shrubs include *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore), *Ilex verticillata* (common winterberry), *Cornus amomum* (silky dogwood), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Rhododendron arborescens* (smooth azalea), *Hypericum prolificum* (shrubby St. Johnswort), *Alnus serrulata* (hazel alder), *Diospyros virginiana* (common persimmon), *Nyssa sylvatica* (blackgum), *Xanthorhiza simplicissima* (yellowroot), *Rosa palustris* (swamp rose), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). The federally listed threatened shrub *Spiraea virginiana* (Virginia meadowsweet) and the state-rare shrub *Prunus pumila* (sandcherry) both have been occasionally found in this association. Cover in the herb layer ranges from 5 to 60%, and this stratum usually has the highest cover. Common herbs include *Andropogon gerardii* (big bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Packera paupercula* (balsam groundsel), *Eupatorium fistulosum* (trumpetweed), *Dichanthelium clandestinum* (deertongue), *Symphyotrichum laeve* var. *concinnum* (smooth blue aster), *Sorghastrum nutans* (Indiangrass), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Euphorbia corollata* (flowering spurge), *Clematis virginiana* (devil's darning needles), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Osmunda regalis* var. *spectabilis* (royal fern), *Viola pedata* (birdfoot violet), *Hypoxis hirsuta* (common goldstar), and *Lysimachia lanceolata* (lanceleaf loosestrife). Additional characteristic herbs include *Ionactis linariifolius* (flaxleaf whitetop aster), *Linum virginianum* (woodland flax), *Zizia aptera* (meadow zizia), *Dichanthelium sphaerocarpon* var. *isophyllum* (roundseed panicgrass), *Marshallia grandiflora* (Monongahela Barbara's buttons), *Liatris scariosa* (devil's bite), and *Baptisia tinctoria* (horseflyweed). Vascular plant species richness in sampled plots ranges from 18 to 70 taxa (mean = 36.4, N=27). Nonvascular cover can be high, consisting mostly of bryophytes and lichens on rock. Bryophytes include *Porella pinnata* (aquatic tongue liverwort), *Hedwigia ciliata* (ciliate hedwigia moss), *Climacium americanum* (American climacium moss), *Sematophyllum demissum* (sematophyllum moss), *Grimmia laevigata* (grimmia dry rock moss), *Campylopus tallulensis* (Tallul campylopus moss), and *Fissidens osmundioides* (osmund fissidens moss). Lichens include *Xanthoparmelia conspersa* (xanthoparmelia lichen) and a distinctive "whitewash" growth on the downstream side of boulders, possibly *Phlyctis petraea* or a related species.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	<i>Betula nigra</i> (river birch)
Herb (field)	Graminoid	<i>Andropogon gerardii</i> (big bluestem)
		<i>Sorghastrum nutans</i> (Indiangrass)

Characteristic Species: *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Clematis virginiana* (devil's darning needles), *Cornus amomum* (silky dogwood), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Euphorbia corollata* (flowering spurge), *Hypericum prolificum* (shrubby St. Johnswort), *Hypoxis hirsuta* (common goldstar), *Ilex verticillata* (common winterberry),

Lysimachia lanceolata (lanceleaf loosestrife), *Nyssa sylvatica* (blackgum), *Osmunda regalis* var. *spectabilis* (royal fern), *Packera paupercula* (balsam groundsel), *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Platanus occidentalis* (American sycamore), *Rhododendron arborescens* (smooth azalea), *Rosa palustris* (swamp rose), *Salix caroliniana* (coastal plain willow), *Schizachyrium scoparium* var. *scoparium* (little bluestem), *Solidago simplex* ssp. *randii* var. *racemosa* (Rand's goldenrod), *Sorghastrum nutans* (Indiangrass), *Symphotrichum laeve* var. *concinnum* (smooth blue aster), *Viola pedata* (birdfoot violet), *Xanthorhiza simplicissima* (yellowroot).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Marshallia grandiflora</i> (Monongahela Barbara's buttons)	G2	plant	WV state-rare plant (S2)
<i>Spiraea virginiana</i> (Virginia meadowsweet)	G2	plant	Federally listed threatened; global imperiled

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is known from the Gauley, Tygart's Valley, Middle Fork, and Cheat rivers on the west slope of the Eastern Continental Divide in West Virginia. Whether it extends to other similar rivers in the region has not been conclusively determined.

States/Provinces: WV:S2.

Federal Lands: NPS (Gauley River).

CONSERVATION STATUS

Rank: G2 (3-Feb-2010).

Reasons: This association is only known from four rivers in West Virginia. Each river constitutes a single Element Occurrence.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: In an analysis of riverscours communities throughout West Virginia, plots of this association at Gauley River clustered strongly together as a group distinct from riverscours prairie plots that are classified as *Andropogon gerardii* - *Panicum virgatum* - *Baptisia australis* Herbaceous Vegetation (CEGL006283) from New River Gorge National River (Vanderhorst et al. 2007) and the Greenbrier River. They clustered together with plots of shrubby prairies from high-energy reaches of the Tygart's Valley, Middle Fork, and Cheat rivers in north-central West Virginia. These river reaches share acidic sandstone bedrock and boulder substrate and extremely high-energy flows. The "prairie-like situation" described by Bush (1976) describes this vegetation at Arden along the Tygart's Valley River. Similar vegetation may also occur along the Youghiogheny in Pennsylvania. A regional review of similar vegetation from the Potomac to western Pennsylvania and south to the Cumberlands would be instructive to clarify the differences and confirm the correct circumscription of associations.

Similar Associations:

- (*Salix caroliniana*, *Rhododendron arborescens*) - *Andropogon gerardii* - *Baptisia australis* - (*Solidago simplex* ssp. *randii*) Herbaceous Vegetation (CEGL008471)--is described from somewhat south of here and includes both sandstone and limestone variants.
- *Andropogon gerardii* - *Panicum virgatum* - *Baptisia australis* Herbaceous Vegetation (CEGL006283)--occurs on cobble/boulder bars with higher base status; the present association lacks *Baptisia australis* and high cover by vines such as *Vitis rupestris* and *Campsis radicans*, and includes a large number of cushion-forming herbs such as *Marshallia grandiflora*, *Solidago simplex* ssp. *randii* var. *racemosa*, and *Packera paupercula*.

- *Platanus occidentalis* - *Betula nigra* / *Cornus amomum* / (*Andropogon gerardii*, *Chasmanthium latifolium*) Woodland (CEGL003725)--is woodier overall and differs somewhat floristically.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Bush 1976, Eastern Ecology Working Group n.d., Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton and Anderson 1997.



Plot GARI.101. Riverscour Shrub Prairie.

COMMON NAME (PARK-SPECIFIC): BUR-REED MARSH

SYNONYMS

USNVC English Name: American Bur-reed - (Simple-stem Bur-reed) - Bog
Willowherb Herbaceous Vegetation

USNVC Scientific Name: *Sparganium americanum* - (*Sparganium erectum* ssp. *stoloniferum*) - *Epilobium leptophyllum* Herbaceous Vegetation

USNVC Identifier: CEGL004510

LOCAL INFORMATION

Environmental Description: The one stand of this wetland association at GARI occurs in the floodplain of the Gauley River at Iron Ring Rapids. Elevation of the site is about 354 m. The site is in a back channel which is flooded by overbank flows at high flood stages and which receives and accumulates runoff from uplands throughout the year. Hydrology of the wetland appears to vary from year to year. The herbaceous marsh vegetation occurs on level, poorly drained, sandy alluvium behind riverside sandstone bedrock and huge boulders. Soils usually remain saturated and there may be standing water throughout the growing season. Soil in a plot is described as very poorly drained sandy loam with organic muck. Soil from one plot tested strongly acidic (pH = 4.90) with relatively high levels of estimated N release, S, B, Fe, Mg, and Zn, and relatively low levels of total exchange capacity, organic matter, Al, Ca, Cu, K, Mn, Na, and P compared to average values from all plots in the park. Adjacent vegetation on the floodplain includes American Sycamore - River Birch Riverscour Woodland (CEGL003725) and Riverscour Shrub Prairie (CEGL006623).

Vegetation Description: The single known stand of this association at GARI is in a wetland with temporarily and spatially variable composition. The wetland is partially shaded by overhanging *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch), and there is a shrubby zone with *Spiraea alba* var. *alba* (white meadowsweet) and *Cornus amomum* (silky dogwood) which surrounds an open center with standing water, bare mucky litter, and a patch of herbaceous marsh vegetation. A plot was centered on the herbaceous zone which was dominated by a species of *Sparganium* (bur-reed), tentatively identified as *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). Other prominent herbs in this patch include *Eleocharis acicularis* (needle spikerush), *Leersia oryzoides* (rice cutgrass), *Sagittaria latifolia* (broadleaf arrowhead), *Alisma subcordatum* (American water plantain), *Boehmeria cylindrica* (small-spike false nettle), *Carex crinita* var. *crinita* (fringed sedge), *Galium tinctorium* (stiff marsh bedstraw), *Isoetes engelmannii* (Appalachian quillwort), *Ludwigia palustris* (marsh seedbox), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Penthorum sedoides* (ditch stonecrop), and *Polygonum hydropiperoides* (swamp smartweed). The wetland was revisited in subsequent years after the plot was sampled and dominance by *Sparganium* (bur-reed) was somewhat diminished.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Carex bromoides</i> ssp. <i>bromoides</i> (bromelike sedge)	-	plant	WV state-rare plant

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	S2	=	1	<i>Sparganium (americanum, chlorocarpum)</i> marsh	Byers et al. 2007

Local Range: One occurrence is known in the park along the Gauley River, river left, at Iron Ring Rapids.

Classification Comments: The one stand at GARI is tentatively placed in this association based solely on dominance of *Sparganium* (bur-reed). Specimens of *Sparganium* (bur-reed) collected from this site are immature and are tentatively identified as *Sparganium chlorocarpum* (simplestem bur-reed), which is considered native to West Virginia, although it has been synonymized with *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed), which is often considered exotic and invasive. Taxonomy of *Sparganium* (bur-reed) is difficult and in need of global standardization.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: One plot was sampled: GARI.82.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	<i>Sparganium americanum</i> Seasonally Flooded Herbaceous Alliance (A.1388)
Alliance (English name)	American Bur-reed Seasonally Flooded Herbaceous Alliance
Association	<i>Sparganium americanum</i> - (<i>Sparganium erectum</i> ssp. <i>stoloniferum</i>) - <i>Epilobium leptophyllum</i> Herbaceous Vegetation
Association (English name)	American Bur-reed - (Simple-stem Bur-reed) - Bog Willowherb Herbaceous Vegetation
Ecological System(s):	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018). South-Central Interior Small Stream and Riparian (CES202.706). High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This vegetation occupies marshes and impoundments within small rivers or streams with seasonal flooding, especially in areas currently or formerly flooded by beavers or restricted by natural bedrock or boulder accumulation. Most sites were heavily altered by logging in the late 1800s through the early 1900s, and this disturbance may have altered the distribution, cover, and physiognomy of these wetlands. Soils are variable and may consist of poorly to very poorly drained muck or organic-rich loamy soils of varying texture. *Sparganium americanum* (American bur-reed) strongly dominates the dense herb layer at many sites, although at some locations in the Allegheny Mountains and on the Cumberland Plateau, it is replaced by *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). Common associates vary with geography and include *Agrostis hyemalis* (winter bentgrass), *Callitriche heterophylla* (twoheaded water-starwort), *Carex scoparia* (broom sedge), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt

spikerush), *Epilobium coloratum* (purpleleaf willowherb), *Epilobium leptophyllum* (bog willowherb), *Galium tinctorium* (stiff marsh bedstraw), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Hydrocotyle americana* (American marshpennywort), *Hypericum mutilum* (dwarf St. Johnswort), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum punctatum* (dotted smartweed), *Potamogeton* (pondweed) spp., *Scirpus cyperinus* (woolgrass), *Scirpus hattorianus* (mosquito bulrush), *Scutellaria lateriflora* (blue skullcap), *Solidago rugosa* (wrinkleleaf goldenrod), *Sphenopholis pensylvanica* (swamp wedgescale), and *Symphotrichum prenanthoides* (crookedstem aster). More locally, *Glyceria grandis* (American mannagrass) is an abundant grass. A very sparse shrub layer may be present.

Environmental Description: This vegetation occupies marshes and impoundments within small rivers or streams with seasonal flooding, especially in areas currently or formerly flooded by beavers or restricted by natural bedrock or boulder accumulation. In the Allegheny Mountains area, it occurs within northern hardwood or red spruce forest zones at 600 to 1300 m elevation; in Virginia, it is restricted to gentle, upper-slope streamhead valleys above 1060 m (3500 ft) elevation, where it occurs in patch-mosaics with wet spruce forests, sphagnum seepage bogs, and open to scrubby meadows; it can also occur at lower elevations, for example on the northern Cumberland Plateau where it is found at 350 m elevation. Most sites were heavily altered by logging in the late 1800s through the early 1900s, and this disturbance may have altered the distribution, cover, and physiognomy of these wetlands. Soils are variable and may consist of poorly to very poorly drained muck, or organic-rich loamy soils of varying texture. Average depth of organic soil is 35 cm. Hydric soil indicators include histisol, histic epipedon, hydrogen sulfide, 2 cm muck, sandy gleyed matrix, depleted matrix, redox depressions, and iron/manganese masses. Soil pH averages 4.5 (n=78) and can be as low as 3.9. Soil chemistry is characterized by high B, Fe, S; moderate Al, Ca, Cu, K, Na, Mg, Zn, exchangeable nitrogen, and total exchange capacity; and low Mn, P, and organic matter (n=7).

Vegetation Description: Vegetation of this community type is almost entirely herbaceous, although some stands may have a sparse (<10%) shrub layer. *Sparganium* (bur-reed) spp. strongly dominate the dense herb layer. *Sparganium americanum* (American bur-reed) dominates in Virginia occurrences; in the Allegheny Mountains and Cumberland Plateau, it is sometimes replaced by *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed). *Scirpus expansus* (woodland bulrush) may dominate or codominate with *Sparganium americanum* (American bur-reed) in some areas. Common associates vary with geography and include *Agrostis hyemalis* (winter bentgrass), *Callitriche heterophylla* (twoheaded water-starwort), *Carex scoparia* (broom sedge), *Carex gynandra* (nodding sedge), *Carex lurida* (shallow sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt spikerush), *Epilobium coloratum* (purpleleaf willowherb), *Epilobium leptophyllum* (bog willowherb), *Galium tinctorium* (stiff marsh bedstraw), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Hydrocotyle americana* (American marshpennywort), *Hypericum mutilum* (dwarf St. Johnswort), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Poa palustris* (fowl bluegrass), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum punctatum* (dotted smartweed), *Potamogeton* (pondweed) spp., *Scirpus cyperinus* (woolgrass), *Scirpus hattorianus* (mosquito bulrush),

Scutellaria lateriflora (blue skullcap), *Solidago rugosa* (wrinkleleaf goldenrod), *Sphenopholis pensylvanica* (swamp wedgescale), and *Symphyotrichum prenanthoides* (crookedstem aster). More locally, *Glyceria grandis* (American mannagrass) is an abundant grass.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Sparganium americanum</i> (American bur-reed) <i>Sparganium erectum</i> ssp. <i>stoloniferum</i> (simplestem bur-reed)

Characteristic Species: *Carex gynandra* (nodding sedge), *Carex scoparia* (broom sedge), *Carex stipata* (owlfruit sedge), *Eleocharis obtusa* (blunt spikerush), *Epilobium leptophyllum* (bog willowherb), *Glyceria grandis* (American mannagrass), *Hydrocotyle americana* (American marshpennywort), *Juncus effusus* (common rush), *Leersia oryzoides* (rice cutgrass), *Ludwigia palustris* (marsh seedbox), *Scirpus expansus* (woodland bulrush), *Sparganium americanum* (American bur-reed), *Sparganium erectum* ssp. *stoloniferum* (simplestem bur-reed).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Aeshna canadensis</i> (Canada darner)	-	animal	
<i>Aeshna tuberculifera</i> (black-tipped darner)	-	animal	
<i>Aeshna verticalis</i> (green-striped darner)	-	animal	
<i>Arigomphus furcifer</i> (lilypad clubtail)	-	animal	
<i>Colias interior</i> (pink-edged sulphur)	-	animal	
<i>Cordulegaster diastatops</i> (delta-spotted spiketail)	-	animal	
<i>Cordulia shurtleffii</i> (American emerald)	-	animal	
<i>Enallagma annexum</i> (northern bluet)	-	animal	
<i>Enallagma hageni</i> (Hagen's bluet)	-	animal	
<i>Epitheca canis</i> (beaverpond baskettail)	-	animal	
<i>Gomphus borealis</i> (beaverpond clubtail)	-	animal	
<i>Juncus brevicaudatus</i> (narrowpanicle rush)	-	plant	VA S2
<i>Ladona julia</i> (chalk-fronted corporal)	-	animal	
<i>Lanthus parvulus</i> (northern pygmy clubtail)	-	animal	
<i>Lestes disjunctus</i> (northern spreadwing)	-	animal	
<i>Leucorrhinia frigida</i> (frosted whiteface)	-	animal	
<i>Leucorrhinia hudsonica</i> (Hudsonian whiteface)	-	animal	
<i>Nehalennia irene</i> (sedge sprite)	-	animal	
<i>Nemotaulius hostilis</i> (a limnephilid caddisfly)	-	animal	
<i>Poa palustris</i> (fowl bluegrass)	-	plant	VA S1S2
<i>Rhionaeschna mutata</i> (spatterdock darner)	-	animal	
<i>Somatochlora elongata</i> (ski-tipped emerald)	-	animal	
<i>Somatochlora williamsoni</i> (Williamson's emerald)	-	animal	
<i>Sympetrum obtrusum</i> (white-faced meadowhawk)	-	animal	

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is known from a few high-elevation sites in the Southern Blue Ridge of North Carolina, the Southern Cumberland/ Ridge and Valley of Georgia, and the greater Allegheny Mountains area of Virginia and West Virginia.

States/Provinces: GA, NC, TN, VA:SU, WV:S2.

Federal Lands: NPS (Chickamauga-Chattanooga, Gauley River, New River Gorge); USFS (George Washington, Monongahela, Pisgah); USFWS (Canaan Valley).

CONSERVATION STATUS

Rank: G3? (9-Apr-2010).

Reasons: This association is known from only a small number of sites, each very small. Most sites are dependent on periodic re-establishment by beaver flooding. The rank is questionable because the total range and abundance of this association is not clearly known.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Similar vegetation may occur in the Ridge and Valley of Virginia in abandoned beaver ponds. [See VDNH's Laurel Fork report, *Carex stipata* - *Sparganium americanum* subassociation (Fleming and Moorhead 1996).].

Similar Associations: Information not available.

Related Concepts:

- *Picea rubens* / *Vaccinium angustifolium* - *Epilobium leptophyllum* Association: *Carex stipata* - *Sparganium americanum* Subassociation (Fleming and Moorhead 1996) ?
- *Sparganium americanum* - *Epilobium leptophyllum* Herbaceous Vegetation (Fleming and Coulling 2001) ?
- *Sparganium americanum* - *Scirpus* spp. herbaceous wetland (Vanderhorst 2001b) =
- *Sparganium americanum* herbaceous vegetation (Hall 2005a) =
- Appalachian Bog (Fleming et al. 2001) B
- IID6a. Natural Impoundment Pond (Allard 1990) B
- Piedmont/Mountain Semipermanent Impoundment (Montane Boggy Subtype) (Schafale 1998b) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. C. Gawler and E. A. Byers.

References: Allard 1990, Allard and Leonard 1952, Byers et al. 2007, FNA Editorial Committee 2000, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fleming et al. 2004, Hall 2005a, Peet et al. unpubl. data 2002, Putnam 1995, Schafale 1998b, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Strausbaugh and Core 1978, Suiter 1995, Suiter and Evans 1999, TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.82. Bur-reed Marsh.

COMMON NAME (PARK-SPECIFIC): AMERICAN WATER-WILLOW COBBLE BAR

SYNONYMS

USNVC English Name: American Water-willow Herbaceous Vegetation
USNVC Scientific Name: *Justicia americana* Herbaceous Vegetation
USNVC Identifier: CEGLO04286

LOCAL INFORMATION

Environmental Description: This association occurs on wet cobble and boulder bars within the active river channel. Stands are subject to frequent high-energy floods but appear to be absent from the high-gradient "whitewater" reaches of the Gauley River. Stands are submerged for long periods throughout the year and the substrate rarely dries out. Elevations in mapped polygons range from 207 to 208 m. Rooting substrate is sand in the interstices between cobbles and boulders. Soils test slightly to medium acidic (mean pH = 5.80) with relatively high levels of Fe, Mn, and Zn, and relatively low levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Ca, K, and P compared to average values from all plots in the park. Adjacent vegetation at one site is Riverscour Shrub Prairie (CEGL006623).

Vegetation Description: This association represents herbaceous vegetation strongly dominated by the hydrophyte *Justicia americana* (American water-willow). Woody species that sometimes overhang the edges of this community or are present with low cover in the shrub layers include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Cephalanthus occidentalis* (common buttonbush), and *Salix caroliniana* (coastal plain willow). Cover by *Justicia americana* (American water-willow) ranges from 5 to 40% in plots. Associated herbs which have low cover in plots include the natives *Physostegia virginiana* ssp. *virginiana* (obedient plant), *Boehmeria cylindrica*, *Osmunda regalis* (royal fern) var. *spectabilis*, and *Viola cucullata* (marsh blue violet), and the exotics *Polygonum cuspidatum* (Japanese knotweed) and *Xanthium strumarium* (rough cocklebur).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: Three small polygons are mapped in the park along the lower Gauley River near Swiss and an additional small patch was sampled by a plot about 2 km upstream. Additional small patches are very likely included in the River and Riparian Zone map classes.

Classification Comments: In a previous study of riparian communities at GARI, Walton and Anderson (1997) described a *Justicia americana* - *Andropogon gerardii* herbaceous channel bed based on a single plot (GARI.26). Plot data collected for their study were incorporated in this analysis and GARI.26 was attributed to the Riverscour Shrub Prairie (CEGL006623).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Two plots were sampled: GARI.84 and GARI.211.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	<i>Justicia americana</i> Temporarily Flooded Herbaceous Alliance (A.1657)
Alliance (English name)	American Water-willow Temporarily Flooded Herbaceous Alliance
Association	<i>Justicia americana</i> Herbaceous Vegetation
Association (English name)	American Water-willow Herbaceous Vegetation
Ecological System(s):	Central Appalachian River Floodplain (CES202.608). Central Appalachian Stream and Riparian (CES202.609). South-Central Interior Small Stream and Riparian (CES202.706). Southern Piedmont Small Floodplain and Riparian Forest (CES202.323). Cumberland Riverscour (CES202.036). South-Central Interior Large Floodplain (CES202.705). Ozark-Ouachita Riparian (CES202.703).

GLOBAL DESCRIPTION

Concept Summary: This association is found primarily in the Piedmont, Central Appalachians, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. Slopes range from level to moderate but are typically gentle. The substrate is a variable mixture of sand, gravel and cobbles, often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. *Justicia americana* (American water-willow) is the characteristic dominant. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species that may be present include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); where present, these are sparse. Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. This association provides habitat in some portions of its range for globally rare dragonflies and herbs.

Environmental Description: This association occurs on the shoals or bars of rocky streams and riverbeds, on bedrock, boulders, cobble, gravel, and sands. They are subject to frequent high-energy floods, and are entirely submerged by most flood events. During extreme low water periods, the substrate can be exposed, showing a varied mixture of sand, gravel and cobbles,

often with deposits of silt and muck. Rooting occurs in the interstices between cobbles and boulders. Stands commonly occur on the edge of the river and at the heads and tails of islands and may sometimes occur on deposition bars in the middle of the river. Substrate pH is circumneutral (mean = 6.0) in four samples. Slopes range from level to moderate but are typically gentle. Elevations of West Virginia stands range from 73 to at least 654 m; the type occurs at lower elevations in the Piedmont and Coastal Plain.

Vegetation Description: *Justicia americana* (American water-willow) is the dominant (and sometimes the only) species, forming lawnlike stands in shallow reaches of rivers. Cover by *Justicia americana* (American water-willow) ranges from 40 to 85%. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species may be present but rarely achieve more than 2% cover; they include *Bidens* (beggarticks) spp., *Cyperus* (flatsedge) spp., *Diodia teres* (poorjoe), *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Gratiola brevifolia* (sticky hedgehyssop), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Physostegia virginiana* (obedient plant), *Podostemum ceratophyllum* (hornleaf riverweed), *Polygonum caespitosum* var. *longisetum* (oriental ladythumb), *Scirpus* (bulrush) spp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife); they have not been observed in abundance in this community, possibly due to intolerance of high-energy flooding. In some areas, *Justicia* (water-willow) usually grows in nearly pure patches, so that few other species are associated with it. *Cuscuta gronovii* (scaldweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum* (knotweed) spp., *Rumex* (dock) spp., and *Salix interior* (sandbar willow) can also occur (Anderson 1982). Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). Scattered shrub seedlings of *Salix nigra* (black willow), *Salix caroliniana* (coastal plain willow), *Betula nigra* (river birch), *Cephalanthus occidentalis* (common buttonbush), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. In the Cumberland Plateau of Alabama, *Justicia americana* (American water-willow) is present in dense patches with some interspersions of other species, including *Pilea pumila* (Canadian clearweed), *Boehmeria cylindrica* (small-spike false nettle), *Eclipta prostrata* (false daisy), *Juncus coriaceous* (leathery rush), *Mikania scandens* (climbing hempvine), *Ludwigia palustris* (marsh seedbox), *Leersia* (cutgrass) sp., and *Bidens* (beggarticks) sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* (goldenclub) growing along streambanks or in shallow riffles "along or with" *Justicia americana* (American water-willow) in the Obed River in the Cumberland Plateau of Tennessee. In 29 plots sampled in the Potomac River watershed (Piedmont, Blue Ridge and Ridge and Valley provinces), *Justicia* (water-willow) was overwhelmingly dominant (50–75% mean cover), and no associated species occurred in more than 48% of the plots. Vascular plant species richness in sampled plots is low (typically 6–14 taxa).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Forb	<i>Justicia americana</i> (American water-willow)

Characteristic Species: *Justicia americana* (American water-willow), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Orontium aquaticum* (goldenclub), *Polygonum*

amphibium (water knotweed), *Polygonum caespitosum* var. *longisetum* (oriental ladythumb), *Saururus cernuus* (lizard's-tail), *Schoenoplectus pungens* (common threesquare).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Lysimachia vulgaris</i> (garden yellow loosestrife)	-	plant	exotic
<i>Lythrum salicaria</i> (purple loosestrife)	-	plant	invasive exotic
<i>Marshallia trinervia</i> (broadleaf Barbara's buttons)	G3	plant	
<i>Ptilimnium nodosum</i> (piedmont mock bishopweed)	G2	plant	Federally listed endangered; globally imperiled
<i>Sagittaria secundifolia</i> (Little River arrowhead)	G1	plant	Federally listed threatened; globally critically imperiled

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, Central Appalachians, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, New York, and New Jersey, with possible outliers north to southern Quebec.

States/Provinces: AL, AR, GA, KY, MD, NC, NJ, NY, OH:S4, OK, PA, QC:S1?, SC?, TN, VA:S4, WV.

Federal Lands: NPS (Appalachian Trail, Big South Fork, Buffalo River, C&O Canal, Delaware Water Gap, Gauley River, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Pisgah, Sumter (Mountains)?, Sumter (Piedmont)?, Sumter?, Uwharrie, Wayne).

CONSERVATION STATUS

Rank: G4G5 (12-Sep-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (water-willow) (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

Similar Associations:

- *Hymenocallis coronaria* - *Justicia americana* Herbaceous Vegetation (CEGL004285).
- *Justicia americana* - *Peltandra virginica* Herbaceous Vegetation [Provisional] (CEGL006579)--occurs in freshwater tidal habitats.
- *Peltandra virginica* - *Saururus cernuus* - *Boehmeria cylindrica* / *Climacium americanum* Herbaceous Vegetation (CEGL007696).

Related Concepts:

- *Justicia americana* - *Andropogon gerardii* herbaceous channel bed (Walton and Anderson 1997) =
- *Justicia americana* riparian herbaceous vegetation (Vanderhorst 2001b) =
- Aquatic Types (Schmalzer and DeSelm 1982) B
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Lizard's tail emergent bed (Perles et al. 2004) ?
- Rocky Bar / Shore (Fleming and Coulling 2001) B
- Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) ?
- Water willow emergent bed (Perles et al. 2004) ?

SOURCES

Description Authors: A. S. Weakley, mod. D. Faber-Langendoen and S. C. Gawler.

References: Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming 2007, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Hoagland 1997, Hoagland 2000, Lea 2000, Lea 2004, Major et al. 1999, McCoy 1958, Nelson 1986, ONHD unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Penfound 1953, Perles et al. 2004, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2010, Walton and Anderson 1997.



Plot GARI.84. American Water-willow Cobble Bar.

COMMON NAME (PARK-SPECIFIC): COMMON ROCK TRIPE CLIFF FACE

SYNONYMS

USNVC English Name: Common Rocktripe Nonvascular Vegetation

USNVC Scientific Name: *Umbilicaria mammulata* Nonvascular Vegetation

USNVC Identifier: CEGL004387

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone cliff faces which are less than vertical and are thus exposed to light, rain, and seepage. Cliffs in the park are formed from the Nuttall, Guyandotte, and Raleigh sandstones of the New River formation in the Pottsville group. Slope measured in the one sampled plot is 80 degrees. Elevations in mapped polygons of Cliff Face, which includes patches of this association, range from 250 to 563 m (mean = 407). Soil gathered from crevices in the cliff face from one plot tested extremely acidic (pH = 4.00) with relatively high levels of total exchange capacity, organic matter, estimated N release, S, Al, B, Fe, and K, and relatively low levels of Ca, Cu, Mg, Mn, P, and Zn compared to average values from all plots in the park. Adjacent areas of cliff which have vertical or overhanging faces are classified as Dry Cliff Face (CEGL006435). Cliffs often form a boundary between contrasting forest associations. Typically, the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Oak / Great Laurel Forest (CEGL006286) occur on colluvial slopes below cliffs, while small patches of Cliff Top Virginia Pine Forest (CEGL007119) and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) occur above cliffs. Many cliffs in the park are used for recreational rock climbing.

Vegetation Description: This association represents sandstone cliff faces dominated by the macrolichen *Umbilicaria mammulata* (navel lichen). There is about 20% cover by this species in the one sampled plot. Woody vascular plants which grow in crevices in trace amounts in the plot include *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Rhododendron maximum* (great laurel), and *Rhododendron catawbiense* (Catawba rosebay). Associated lichens include the crustose species *Lepraria neglecta* (dust lichen). Associated mosses include *Andreaea rothii* (Roth's *Andreaea* moss), *Leucobryum albidum* (leucobryum moss), and *Rhabdoweisia crispata* (*Rhabdoweisia* moss).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: Small patches and linear bands of cliffs are scattered throughout the length of the Gauley and Meadow river gorges in the park. They are mostly associated with outcrops of sandstone of the New River formation which are exposed on gorge slopes in the eastern two-thirds of the park.

Classification Comments: Cliffs faces which are vertical or overhanging and are thus protected from light, rain, and seepage are not usually dominated by *Umbilicaria mammulata* (navel lichen) and are classified as Dry Cliff Face (CEGL006435).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: One plot was sampled: GARI.177.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Nonvascular Vegetation (VI)
Physiognomic Subclass	Lichen vegetation (VI.B.)
Physiognomic Group	Temperate or subpolar lichen vegetation (VI.B.1.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar lichen vegetation (VI.B.1.N.)
Formation	Alpine to submontane temperate or subpolar lichen vegetation (VI.B.1.N.b.)
Alliance	<i>Umbilicaria mammulata</i> Nonvascular Alliance (A.1827)
Alliance (English name)	Common Rocktripe Nonvascular Alliance
Association	<i>Umbilicaria mammulata</i> Nonvascular Vegetation
Association (English name)	Common Rocktripe Nonvascular Vegetation
Ecological System(s):	North-Central Appalachian Acidic Cliff and Talus (CES202.601). Southern Appalachian Montane Cliff and Talus (CES202.330).

GLOBAL DESCRIPTION

Concept Summary: Vegetation is strongly dominated by *Umbilicaria mammulata* (navel lichen), on relatively moist, shaded rock outcrops, often on slopes with northerly aspects. This vegetation occurs where periodic seepage occurs on acidic rock outcrops. Individual occurrences can be as large as an acre. Vascular plants are generally sparse or absent, though trees or shrubs of adjacent forest communities often shade the outcrop community for much of the day. Other umbilicate lichens, shade-tolerant foliose lichens such as *Flavoparmelia baltimorensis*, and numerous crustose lichens may also occur. Associates include scattered individuals of *Dryopteris intermedia* (intermediate woodfern) and *Polypodium appalachianum* (Appalachian polypody).

Environmental Description: This lichen-dominated community occurs on relatively moist, shaded, acidic rock outcrops (bedrock cliffs and vertical surfaces of large exfoliated boulders) where periodic seepage occurs. It is often found on slopes with northerly aspects. Individual occurrences can be as large as an acre.

Vegetation Description: The vegetation is strongly dominated by *Umbilicaria mammulata* (navel lichen). Vascular plants are generally sparse or absent, though trees and shrubs of adjacent forest communities often shade the outcrop community for much of the day. Other umbilicate lichens, shade-tolerant foliose lichens such as *Flavoparmelia baltimorensis*, and numerous crustose lichens (e.g., *Lepraria neglecta*) may also occur. Associates include scattered individuals of *Dryopteris intermedia* (intermediate woodfern) and *Polypodium appalachianum* (Appalachian polypody). Associated mosses include *Andreaea rothii*, *Leucobryum albidum* (leucobryum moss), and *Rhabdoweisia crispata*.

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> (intermediate woodfern) <i>Polypodium virginianum</i> (rock polypody)
Nonvascular	Lichen	<i>Umbilicaria mammulata</i> (navel lichen)

Characteristic Species: *Umbilicaria mammulata* (navel lichen).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.

States/Provinces: CT, GA, KY, NC, PA, SC, TN, VA:S3?, WV.

Federal Lands: NPS (Blue Ridge Parkway?, Cumberland Gap, Gauley River, New River Gorge, Shenandoah, Weir Farm); USFS (Cherokee?, George Washington, Jefferson, Monongahela?, Nantahala, Pisgah).

CONSERVATION STATUS

Rank: G4? (15-Aug-1994).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Potentially very widespread in Southeast and beyond.

Similar Associations:

- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)--on drier cliff faces.
- *Lasallia papulosa* - *Umbilicaria caroliniana* Nonvascular Vegetation (CEGL004386).

Related Concepts:

- IE2a. Southern Appalachian Acidic Cliff (Allard 1990) ?
- Lichen / Bryophyte Boulderfield (Fleming and Coulling 2001) B
- Lichen-dominated shaded outcrops (CAP pers. comm. 1998) ?
- Montane Cliff (Carolina Rocktripe Subtype) (Schafale 1998b) ?
- SNE acidic cliff community (Rawinski 1984) ?

SOURCES

Description Authors: A. S. Weakley, mod. G. P. Fleming.

References: Allard 1990, CAP pers. comm. 1998, Fike 1999, Fleming and Coulling 2001, Rawinski 1984, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, TDNH unpubl. data, Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.177. Common Rock Tripe Cliff Face.

COMMON NAME (PARK-SPECIFIC): DRY CLIFF FACE

SYNONYMS

USNVC English Name: Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation

USNVC Scientific Name: Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation

USNVC Identifier: CEGL006435

LOCAL INFORMATION

Environmental Description: This association occurs on sandstone cliff faces that are vertical or overhanging and are thus protected from light, rain, and seepage. Cliffs in the park are formed from the Nuttall, Guyandotte, and Raleigh sandstones of the New River formation in the Pottsville group. Elevations in mapped polygons of Cliff Face, which includes patches of this association, range from 250 to 563 m (mean = 407). Soil collected from the cliff base of one plot tested very strongly acidic (pH = 4.4) with relatively high levels of estimated N release, S, Al, B, and Fe, and relatively low levels of total exchange capacity, organic matter, Ca, Cu, K, Mg, Mn, Na, P and Zn compared to average values from all plots in the park. Adjacent areas of cliff which have less than vertical faces are classified as Common Rock Tripe Cliff Face (CEGL004387).

Cliffs often form a boundary between contrasting forest associations. Typically, the matrix Eastern Hemlock - Oak - Sweet Birch / Great Laurel Forest (CEGL007543) or Oak / Great Laurel Forest (CEGL006286) occur on colluvial slopes below cliffs, while small patches of Cliff Top Virginia Pine Forest (CEGL007119) and Eastern Hemlock - Chestnut Oak / Catawba Rosebay Forest (CEGL008524) occur above cliffs. Massive cliffs in the gorges of the Gauley and Meadow rivers can have dramatic overhangs which create unique dry habitats utilized by Allegheny wood rats (*Neotoma magister*), antlions (larvae of insects in the family Myrmeleontidae), and humans. Many cliffs in the park are used for recreational rock climbing.

Vegetation Description: This association represents sparsely vegetated sandstone cliff faces. Woody vascular plant species that grow in cracks and crevices in trace amounts in plots include *Rhododendron maximum* (great laurel), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple). Herbs in plots include *Eurybia divaricata* (white wood aster) and *Polypodium virginianum* (rock polypody). Diversity and cover are dominated by lichens and bryophytes. Lichens identified in plots include *Chrysothrix insulizans* (lichen), *Cladonia rangiferina* (greygreen reindeer lichen), *Cladonia squamosa* (cup lichen), *Lasallia papulosa* (blistered naval lichen), *Lepraria obscura* (dust lichen), *Lepraria lobificans* (dust lichen), *Lepraria caesiella* (dust lichen), *Lepraria neglecta* (dust lichen), *Phlyctis petraea* (lichen), *Porpidia albocaerulescens* (porpidia lichen), *Usnea amblyoclada* (rock beard lichen), and *Umbilicaria mammulata* (navel lichen) (in trace amounts). Bryophytes identified in plots include *Andreaea rothii* (Roth's andreaea moss), *Bazzania trilobata* (common bazzania liverwort), *Bryoandersonia illecebra* (bryoandersonia moss), *Dicranum scoparium* (dicranum moss), *Diplophyllum apiculatum* (pointed mitten liverwort), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Leucolejeunea clypeata* (white caveleaf liverwort).

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

<u>State</u>	<u>SRank</u>	<u>Rel</u>	<u>Conf</u>	<u>SName</u>	<u>Reference</u>
WV	SNR	.	.	[not crosswalked]	.

Local Range: Small patches and linear bands of cliffs are scattered throughout the length of the Gauley and Meadow river gorges in the park. They are mostly associated with outcrops of sandstone of the New River formation which are exposed on gorge slopes in the eastern two-thirds of the park.

Classification Comments: Cliff faces which are less than vertical and are thus exposed to light, rain, and seepage are usually dominated by the macrolichen *Umbilicaria mammulata* (navel lichen) and are classified as Common Rock Tripe Cliff Face (CEGL004387).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Six plots were sampled: GARI.164, GARI.165, GARI.166, GARI.167, GARI.176, and GARI.180.

Gauley River National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated cliffs (VII.A.1.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
Formation	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
Alliance	Open Cliff Sparsely Vegetated Alliance (A.1836)
Alliance (English name)	Open Cliff Sparsely Vegetated Alliance
Association	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation
Association (English name)	Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation
Ecological System(s):	North-Central Appalachian Acidic Cliff and Talus (CES202.601).

GLOBAL DESCRIPTION

Concept Summary: This dry sandstone cliff community occurs in the Western Allegheny Plateau and central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes. Vascular plants are restricted to shelves, cracks and crevices in the rock, generally averaging less than 20% cover. Mosses and lichens are common, including crustose lichens. The sparse woody species include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Rhododendron maximum* (great laurel), *Rhododendron periclymenoides* (pink azalea), *Kalmia latifolia* (mountain laurel), *Toxicodendron radicans* (eastern poison ivy), and rarely *Hydrangea arborescens* (wild hydrangea). Herbs are sparse but may include the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Eurybia divaricata* (white wood aster), *Mitchella repens* (partridgeberry), *Sedum ternatum* (woodland stonecrop), and *Viola blanda* (sweet white violet). *Silene rotundifolia* (roundleaf catchfly) often occurs at the drip line. Ferns such as *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris tenuis* (upland brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium virginianum* (rock polypody), *Polypodium appalachianum* (Appalachian polypody), *Woodsia*

obtus (bluntlobe cliff fern), and the rare *Asplenium bradleyi* (Bradley's spleewort) also occur. Massive cliffs in the gorges of the Gauley and Meadow rivers (West Virginia) can have dramatic overhangs which create unique dry habitats utilized by Allegheny wood rats (*Neotoma magister*) and antlions (larvae of insects in the family Myrmeleontidae).

Environmental Description: This community occurs on sandstone cliff faces that are vertical or overhanging and are thus protected from light, rain and seepage, across the Western Allegheny Plateau and central Appalachian Mountains of the United States. Stands occur as steep to vertical rock exposures of sandstone bedrock. Aspect is variable, but stands are best developed on south- and west-facing slopes.

Vegetation Description: Vascular plants are restricted to shelves, cracks and crevices in the rock, generally averaging less than 20% cover. Mosses and lichens are common, including crustose lichens. The sparse woody species include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Rhododendron maximum* (great laurel), *Rhododendron periclymenoides* (pink azalea), *Kalmia latifolia* (mountain laurel), *Toxicodendron radicans* (eastern poison ivy), and rarely *Hydrangea arborescens* (wild hydrangea). The herbaceous layer contains the forbs *Agrostis perennans* (upland bentgrass), *Aquilegia canadensis* (red columbine), *Eurybia divaricata* (white wood aster), *Mitchella repens* (partridgeberry), *Sedum ternatum* (woodland stonecrop), and *Viola blanda* (sweet white violet). *Silene rotundifolia* (roundleaf catchfly) often occurs at the drip line. Ferns such as *Asplenium montanum* (mountain spleenwort), *Asplenium pinnatifidum* (lobed spleenwort), *Asplenium rhizophyllum* (walking fern), *Asplenium trichomanes* (maidenhair spleenwort), *Cystopteris tenuis* (upland brittle bladderfern), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polypodium virginianum* (rock polypody), *Polypodium appalachianum* (Appalachian polypody), *Woodsia obtusa* (bluntlobe cliff fern), and the rare *Asplenium bradleyi* (Bradley's spleewort) also occur. Lichens identified in WV plots include *Chrysothrix insulizans* (lichen), *Cladina rangiferina* (greygreen reindeer lichen), *Cladonia squamosa* (cup lichen), *Lasallia papulosa* (blistered naval lichen), *Lepraria obscura* (dust lichen), *Lepraria lobificans* (dust lichen), *Lepraria caesiella* (dust lichen), *Lepraria neglecta* (dust lichen), *Phlyctis petraea* (lichen), *Porpidia albocaerulescens* (porpidia lichen), *Usnea amblyoclada* (rock beard lichen), and *Umbilicaria mammulata* (navel lichen) (in trace amounts); bryophytes in those plots include *Andreaea rothii* (Roth's andreaea moss), *Bazzania trilobata* (common bazzania liverwort), *Bryoandersonia illecebra* (bryoandersonia moss), *Dicranum scoparium* (dicranum moss), *Diplophyllum apiculatum* (pointed mitten liverwort), *Leucobryum albidum* (leucobryum moss), *Leucobryum glaucum* (leucobryum moss), and *Leucolejeunea clypeata* (white caveleaf liverwort).

Most Abundant Species:

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Herb (field)	Semi-shrub	<i>Mitchella repens</i> (partridgeberry)
Herb (field)	Forb	<i>Aquilegia canadensis</i> (red columbine)
Herb (field)	Graminoid	<i>Agrostis perennans</i> (upland bentgrass)
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i> (eastern hayscented fern)

Characteristic Species: *Cystopteris tenuis* (upland brittle bladderfern).

Other Noteworthy Species:

<u>Species</u>	<u>GRank</u>	<u>Type</u>	<u>Note</u>
<i>Neotoma magister</i> (Allegheny woodrat)	G3G4	animal	utilize unique dry habitats of cliff overhangs

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is currently documented from the Western Allegheny Plateau and central Appalachian Mountains of the United States, extending to northern Cumberland Plateau and the New and Gauley rivers in West Virginia.

States/Provinces: OH, PA, VA, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Gauley River, New River Gorge).

CONSERVATION STATUS

Rank: GNR (24-Jan-2003).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: These cliffs are known in some areas as "rockhouses." In Ohio, Anderson (1996) provides several references to lichen composition on sandstone cliffs. Further work is needed to determine whether this association should be classified as lichen-dominated or sparse vegetation, or should be split to recognize dominance of some occurrences by crustose lichens.

Similar Associations:

- *Asplenium montanum* - *Heuchera parviflora* var. *parviflora* - *Silene rotundifolia* Sparse Vegetation (CEGL004392).
- *Juniperus virginiana* - *Corydalis sempervirens* Cliff Sparse Vegetation (CEGL006422).
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045).
- Sandstone Midwest Moist Cliff Sparse Vegetation (CEGL002287).
- *Umbilicaria mammulata* Nonvascular Vegetation (CEGL004387)--occurs on acidic cliffs with more moisture.

Related Concepts:

- Cliff Communities (Anderson 1996) B

SOURCES

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

References: Anderson 1996, Eastern Ecology Working Group n.d., Perles et al. 2007, Sneddon and Menard 2002, Vanderhorst et al. 2007, Vanderhorst et al. 2010.



Plot GARI.176. Dry Cliff Face.

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