VASCULAR PLANT INVENTORY AND PLANT COMMUNITY CLASSIFICATION FOR MAMMOTH CAVE NATIONAL PARK



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This report consists of the main report along with a series of appendices with information about the plants and plant communities found at the site. Electronic files have been provided to the National Park Service in addition to hard copies. Current information on all communities described here can be found on NatureServe Explorer at http://www.natureserve.org/explorer/

Cover photo: Mature Interior Low Plateau mesophytic forest above the Green River, Mammoth Cave National Park - Photo by Milo Pyne

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Vascular Plant Inventory and Plant Community Classification for Mammoth Cave National Park

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Summary

The first step in any effort to monitor the "vital signs" or ecological health of a tract of land is to develop a baseline from which to measure and gauge trends. We established a baseline for Mammoth Cave National Park in three ways:

1) Ecologists from NatureServe established 34 permanently marked one-hectare circular plots within the park in a grid system and another 31 permanently marked plots in unique ecological areas that were not covered by the initial grid-based plot layout. The permanently marked plots are available to be used by researchers on studies ranging from bird point counts to individual plant monitoring. Eighty-five additional quickplots (non-permanent) were established to further document unusual or ecologically significant associations.

2) Ecologists collected data on all unique vegetation communities within the park and identified 28 natural and 12 human-modified or successional vegetation associations (unique ecological assemblages of plants) within the park boundary. In addition, we identified 2 natural communities that are currently not in the park but may have historically existed within the park and may return depending upon grassland management practices in the future. Other ecological communities may occur within the park, but we are confident that we have documented at least 90% of the communities from our field work. The most globally rare communities in the park appear to be the Central Limestone Glade (G2G3), the Chinquapin Oak Unglaciated Bluff Woodland (G2G3), the Western Highland Rim Escarpment Post Oak Barrens (G2G3), the Highland Rim Limestone Cliff/Talus Seep (G3), the Shumard Oak - Chinquapin Oak Mesic Limestone Forest (G2G3), and the Southern Red Oak Flatwoods Forest (G2?). The first four of these six communities, which are related to exposures of limestone or other habitats favorable for light-demanding plants, warrant special attention due to their relatively high global rank/rarity and the habitat that they can provide for species ranked globally or locally vulnerable. All of these communities suffer from degradation and loss of species diversity from woody plant encroachment due to lack of fire and other natural process disruptions. The other two forested communities are also globally rare, but their dynamics and management are less well known. In addition, there are several examples of mesophytic forests and oak-hickory forests that are noteworthy for their intactness and/or their maturity. Mammoth Cave National Park is noteworthy for being one of the largest blocks of continuous hardwood forest in the region.

3) Ecologists collected and vouchered 43 species new to the park. These species and 36 other new species/subspecies from unvouchered observations were added to an existing list of 1118 species (1186 species, subspecies and varieties) that included vouchers from projects done by earlier researchers. We now count 1265 documented species, varieties, or subspecies of vascular plants in the park (1185 if only including species and not including separate varieties and subspecies). We estimate that over 90% of the vascular flora of the park is now documented.

Introduction

Effective management of natural resources in our national parks relies upon ready access to comprehensive and scientifically credible information on species and habitats found within park boundaries. National Park Service units are currently compiling the information needed to begin to assess the current state of natural resources at specific parks. A few have begun to track and assess trends over time. With the passage of the National Parks Omnibus Management Act of 1998 by Congress, the National Park Service was given the mandate to "undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on the long-term trends and the condition of National Park system resources." Funding for this initiative was appropriated in fiscal year 2000. In May 2002, NatureServe began work on the vascular plant inventory

and vegetation sampling portions of the project at Mammoth Cave National Park. Vegetation sampling and vascular plant inventory was conducted in July, September, and October of 2002; July and August of 2003; June and October of 2004; and April, June, and July of 2005. Additional vegetation sampling was conducted in May, June, and October of 2007.

Although Mammoth Cave National Park is better known for its subterranean resources, particularly the world's longest cave, the park contains significant above-ground natural resources, including "83 square miles of forest and 32 miles of river", comprising "one of the largest natural areas remaining in the Mississippi Basin" (Wallace 2003). In particular, its hardwood forests span several geologic substrates from sandstone to limestone, and exhibit corresponding vegetative community diversity.

After assessing the past and current state of research in the park, we began to work on accomplishing three primary objectives:

1) Establish a minimum of 44 permanent plots throughout the park for present and future monitoring purposes.
2) Document all ecological communities on the site as defined by the United States National Vegetation Classification (Grossman et al. 1998, Anderson et al. 1998).
3) Collect any species of vascular plants found in plots that were not already documented by previous studies including McKinney et al. (1991).

The ultimate goal of the project is to deliver the information described in this report to all interested parties, to inform land management, conservation priorities, and future research at the park, and to ensure that future generations of visitors will visit a park that is both ecologically and historically intact.

Study Area

Mammoth Cave National Park (MACA) is located in south-central Kentucky, primarily in Edmonson County, with smaller portions inHart and Barren counties. It is about 135 km south of Louisville and northwest of Park City, lying approximately midway between Louisville, Kentucky and Nashville, Tennessee. The National Park comprises 21,380 ha (52,830 ac); 21,046 ha (52,003 ac) of this total are Federal, and 335 ha (827 ac) are non-Federal (NPS 2006). The extended Biosphere Reserve area is 367,979 ha (909,295 ac) (UNEP 2005). Surface elevations vary from 128 to 275 meters (421 to 902 ft) above MSL (NPS 2006).

Mammoth Cave is the world's longest cave, containing more than 550 surveyed kilometers (350 mi) of passageways. It is also among the most faunistically diverse (Culver et al. 2003, UNEP 2005), and its network of caves and underground passageways host an unusual flora and fauna, which includes a large number of rare and unusual cave-dependent species. The Park constitutes one of the greatest protectors of biological diversity in Kentucky. The name "Mammoth Cave" simply arose from the size of the passages, and not, as some have surmised, from the presence of giant fossil bones found in the early days of cave exploration.

Mammoth Cave is now understood to be the world's longest cave system. This record was established in 1972 with the accomplishment of the 'great connection', which linked Mammoth Cave with Flint Ridge Cave. The magnitude of the cave continues to increase with new exploration, and may eventually be shown to encompass an additional 960 km (600 mi) of unexplored passageways.

In 1924, area citizens who were interested in promoting Mammoth Cave as a national park formed the Mammoth Cave National Park Association. The entrapment and death of celebrated pioneer caver Floyd Collins in February 1925 in Sand Cave increased public interest in Mammoth Cave and its conservation

and management. The establishment of a National park at Mammoth Cave was authorized in 1926 under enabling legislation of the US Congress (56 Statute 317). Fifteen years later, on July 1, 1941, the park was fully established by 44 Statute 635. The Commonwealth of Kentucky ceded jurisdiction over the park lands by an act approved in 1930 and accepted in 1944. The Civilian Conservation Corps accomplished many infrastructural improvements (roads and cave trails), as well as natural resource conservation, restoration and stabilization projects (e.g. streambank stabilization and tree plantings) (Goode 1986). In 1960 and 1961, the two remaining inholdings (the 106 ha [262 ac] Floyd Collins Crystal Cave, and the 98 ha [242 ac] Great Onyx Cave) were purchased by the Department of the Interior. In 1965 exclusive jurisdiction over the remainder of the land was accepted. This park was designated a world heritage site on October 27, 1981. In 1988 Kentucky designated Big Woods old-growth forest a state natural area, the Green River a wild and scenic river, and Green River and Mammoth Cave subsurface streams as outstanding resource waters. In 1990, Mammoth Cave was accepted as a Biosphere Reserve, and the extent of the Reserve was greatly increased in 1996 to cover the cave's entire recharge area.

Physiography and Geology of the Study Site

The landscape of the Mammoth Cave area is characterized by rolling hills, plateau areas dissected by steep-sided, winding rivers, and sinkholes. The rocks underlying the area are Mississippian to Pennsylvanian age sedimentary deposits and are almost horizontal. Tilting of the layers towards the northwest ranges between just a few degrees from absolute horizontal. Many of the rocks in the area are rich in limestone and susceptible to dissolution from percolating groundwater (NPS 2006). The park sits upon a feature called the Chester Cuesta, which is dissected by broad and deep karst valleys, and underlain by Mississippian strata. It is adjacent to the Sinkhole Plain of the Pennyroyal Plateau to the south. The park is divided into two nearly equal halves by the deep (100 m, 328 ft) gorge of the Green River (Meiman 2006).

Mammoth Cave is generally located in the Shawnee Hills region (Quarterman and Powell 1978) of the Interior Low Plateau physiographic province (Fenneman 1938). Its more precise location is variously characterized in different systems of ecoregional classification. In a map published by the USDA Forest Service (Keys et al. 1995), it is located on the boundary between the "Southern Dripping Springs" (222Dg) and the "Northern Dripping Springs" (222Dj). In this interpretation, the Pennyroyal Karst Plain (222Eh) lies further to the east and south, the Outer Western Coal Fields (222Dc) lie further to the north and west. The Pennyroyal karst plain lacks any permanent surface streams, because the water disappears into cracks and fissures in the limestone, joining underground streams and rivers (Wallace 2003). The water that flows into these underground channels re-emerges into the Green River, which meanders through the park, flowing generally from east to west.

In contrast, the EPA (Woods et al. 2002) places Mammoth Cave at the interface between the "Crawford-Mammoth Cave Uplands" (71a) and the "Caseyville Hills" (72h). This latter unit is affiliated with the broader unit called the "Interior River Lowlands" (72) which includes the "Shawnee Hills" or "Western Kentucky Coal Fields" (Bryant et al. 1993), however these terms are not used by EPA.

In an unpublished map of Kentucky biogeography, Campbell (2003) follows the general guidance of Quarterman and Powell (1978; cited in Bryant et al. 1993) and places Mammoth Cave in an outer band of a "Shawnee Hills" unit called the "Shawnee Hills Escarpments and Karst" sub-unit (6A). This area is closely bounded on the east and south by the "Eastern Karst Plain and Highland Rim" (5A) and on the north and west by inclusions of "Shawnee Hills Sandstone Ravines" (6Ab). This disparity in nomenclature and differences in ecoregional classification between these two systems points to the variability and diversity of the area.

The dramatic changes in surface geology are reflected in both the terrestrial and subterranean environments. Olson and Noble (2005) characterize this as a "gradient of decreasing maturity in karst development" from the southeast to the northwest. In terms of the surface, this means that the northwestern part of the park is covered by sandstones of the lower Pennsylvanian Caseyville formation and/or the Mississippian Big Clifty sandstone, whose hard cap has not yet eroded away. This part of the park is called the Mammoth Cave Plateau and is where acidic ravines containing eastern hemlock (*Tsuga canadensis*) are found. It is this erosion-resistant caprock whose presence has prevented erosion from totally obliterating the limestone strata in which the caves are found. The sandstones and shales protect the older limestones below, including the Girkin and St. Genevieve, from being eroded away (Wallace 2003). The geologic interpretation of this area is that the underlying rocks have a synclinal structure, with two outfacing scarps. The outer one is the Dripping Springs Escarpment on Mississippian rocks and the inner one is the Pottsville Escarpment on Pennsylvanian sandstones (Bryant et al. 1993, Newell 2001), which is found north of the Green River.

The term Pottsville Escarpment is applied both to the band of resistant Lower Pennsylvanian sandstones found between the Cumberland Plateau on the east and the Mississippian Plateau and the Bluegrass on the west, but also to a similar but less profound escarpment which marks the physiographic boundary between the Western Coal Field and the Mississippian Plateau, in the vicinity of Mammoth Cave (Newell 2001). This name "Pottsville Escarpment" is apparently derived from that of the Pennsylvanian Pottsville Formation. This geologic unit term was apparently originally developed in relation to sandstones of the Ridge and Valley physiographic province from Pennsylvania to Alabama. It is also used in relation to sandstones of Kentucky, despite these being in a different natural region.

The sinkhole plain or "Pennyrile" (Pennyroyal) Plateau, which is found south and east beyond the boundaries of the park and across interstate 65, presents a stark contrast. The pungent and sweetly-scented American pennyroyal (*Hedeoma pulegioides*) gives its name to this landscape, parts of which supported tallgrass prairie patches in the past. This is a landscape from which the sandstone caprock and the cave-forming limestones have worn away, leaving behind fertile soils and gently rolling terrain with interspersed sinkholes. The waters that drain into these sinkholes join the underground rivers of Mammoth Cave, and continue on to drain into the Green River, which divides the park more or less in half. The northern section of the park is more remote and provides extensive surface hiking trails.

In the dissected terrain north and west of Interstate Highway 65, between the sinkhole plain and the caprocks of the Mammoth Cave Plateau, we find harder ridges composed of cherty limestones, sandstones, limestones and shales, alternating and interspersed with the valleys, whose floors are composed of purer limestone. This area, the Chester Upland, is where the entrances to Mammoth Cave are found, and where the Green River cuts through the park, adding to the dissection of the landscape.

These factors of geology and topography strongly affect the vegetation. There are vegetation types (such as eastern hemlock forests) that are primarily found in the northern and western sections of the park, and specific oak forest types (as well as chinquapin oak woodlands and limestone glade vegetation) that are only found only on the limestones which are more abundant in the southeastern part of the park. In between these two extremes are found variable oak-hickory forests containing a mixture of White oak, Black oak, and Chestnut oak.

Previous Vegetation Studies

Characterization of the land cover of the Mammoth Cave area in ancient times is somewhat speculative, but some general trends have been established. A series of great continental glacial advances and retreats within broad topographic and geographic zones took place until about 10,000 years before present (ybp). The Mammoth Cave area was never glaciated, but its vegetation was strongly influenced by these events.

The vegetation is thought to have been relatively stable since the Hypsithermal, a warm dry period that ended approximately 5,000 ybp (Delcourt and Delcourt 1981, Meiman 2006). Prentice (1993) summarized the general sequence for environmental change in the Kentucky region shortly before and during times of human occupation (Meiman 2006). During the peak of the Late Wisconsin Glacial period (18,000 ybp), Kentucky was dominated by jack pine (*Pinus banksiana*) forests with spruce and fir as subordinate species (Delcourt and Delcourt 1981, Meiman 2006). Some 14,000 ybp., a general warming trend led to the retreat of the continental glaciers, causing a general migration of forest communities northward, as Spruce-Jack Pine forests dominated the region. The global warming continued and about 10,000 ybp, Kentucky was dominated by mixed hardwood forests with relict spruce and fir at higher elevations. Between 9,000 and 5,000 ybp (the Hypsithermal Interval), warming continued as the mixed hardwoods changed to Oak-Hickory forests as the region's climate became drier. Following the Hypsithermal, the climate has become somewhat wetter, but the general forest community has changed relatively little. Remnant native grasslands may be a relict of this warmer and drier period. Native American Indians burned extensively in the region, and may have been important drivers in converting the Sinkhole Plain from forest to barrens starting about 3900 years ago. As well, archaeological remains in park caves indicate Indian agriculture (Watson 1969, 1974), and the ecology of plants used for torch materials in the caves indicate either forest openings or oak savanna in prehistoric times (Olson 1998, 2002).

Noteworthy previous studies of the post-settlement vegetation of the Mammoth Cave area include general observations made by Braun (1950) and more specific studies by Ellsworth (1934), Faller (1975) and Badger et al. (1997). There are also comments on natural communities in McKinney et al. (1991) and in Seymour and Campbell (1999). Campbell (1998) in an apparently unpublished report, offered a comparison of current vegetation with earlier data and reports. Olson and Franz (1998) devised a vegetation habitat model to support development of a Fire Management Plan. This model was used to help classify satellite spectral data for creation of a vegetation map also needed for the Fire Management Plan. This map shows ecological succession taking place in old fields within the park (Olson et al. 2000).

Braun (1950) characterizes the park area as being generally in the "Western Mesophytic Forest Region", but most of the later-seral upland forests are dominated by Oaks (*Quercus* species) with Hickories (*Carya* species) and other hardwoods. Beech-dominated and other mesophytic upland forests are confined to ravines and sheltered lower slopes. The floodplain forests along the Green River and its tributaries are typically dominated by species such as Sycamore (*Platanus occidentalis*), Silver maple (*Acer saccharinum*), Sugarberry (*Celtis laevigata*), Box-elder (*Acer negundo*), River birch (*Betula nigra*), and other floodplain species.

Badger et al. (1997) undertook an effort to classify the forest community types of Mammoth Cave using the point-centered quarter method, using tree species importance values to create a community classification. Their methods included the establishment of permanent plots and re resampling of old field succession plots established in 1970 by Faller (1975). These plots were not revisited as part of the NatureServe investigations of 2002-2007. The results of their analysis support the recognition of seven widespread forest communities at Mammoth Cave. These include floodplain forests, mesic slope forests, two oak-hickory types, and three mixed Eastern red-cedar/Pine/hardwood types. In addition, there are two other "distinct forest communities of limited areal extent' that were recognized, an Eastern hemlock-hardwood forest and an "upland wet woods," for a total of nine forest communities. Badger et al. also include a discussion of successional trends at Mammoth Cave, based on a comparison of data in Ellsworth (1934) and Faller (1975) with their results.

Badger et al. (1997) Community types with notes and proposed affiliation to NVC type:

1. CT I ***Liriodendron tulipifera, Acer negundo, Platanus occidentalis, Acer saccharum*** (p. 1-31); Habitat: floodplains of the Green and Nolin Rivers [CEGL008429]; also called "*Acer negundo, Liriodendron tulipifera, Platanus occidentalis, Juglans nigra*" (p. 4-25)
2. CT II ***Acer saccharum, Fagus grandifolia, Quercus alba, Fraxinus americana*** (p. 1-31); Habitat: middle and lower slopes of both sandstone and limestone substrate [CEGL002411] (also p. 4-31);
3. CT III ***Juniperus virginiana, Acer saccharum, Quercus alba, Quercus muehlenbergii*** (p. 1-35); Habitat: middle and upper slopes of limestone substrate [CEGL007124, CEGL005131, CEGL004267 (new woodland)]; (also p. 4-35);
4. CT IV ***Quercus prinus, Quercus alba, Acer rubrum, Oxydendron*** (sic) ***arboreum*** (p. 1-35); Habitat: upper slopes primarily in the northwest corner of the park (e.g. on sandstones) [CEGL005022; CEGL007700] also called "*Quercus prinus, Quercus alba, Acer rubrum, Carya glabra*" (p. 4-36)
5. CT V ***Quercus alba, Carya alba, Liriodendron tulipifera, Quercus velutina*** (p. 1-37); Habitat: flat to modestly steep upper slopes and ridgetops [CEGL007795]; also called "*Quercus alba, Liriodendron tulipifera, Carya alba, Quercus velutina*" (p. 4-40); Oak-Hickory (Bryant et al. 1993); Braun (1968) (p. 4-40)
6. CT VI ***Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra*****;** "*Juniperus virginiana, Cornus florida, Pinus virginiana, Quercus alba, Carya glabra*" (p. 4-45)"" (p. 4-50)CT VIII ***Tsuga canadensis, Fagus grandifolia, Liriodendron tulipifera, Acer saccharum*** (p. 1-45)**;** Habitat: sandstone cliffs and Hydric floodplains [CEGL005043]; (also p. 4-54)
9. CT IX ***Quercus palustrus*** (sic), ***Acer rubrum, Nyssa sylvatica, Liquidambar styraciflua***; (p. 1-45) "upland wet woods" mostly found "on ridges south of the Green River" [CEGL002432]. Olson and Ghitter (2000) mention "upland swamps with stands of pin oak, sweetgum, and red maple" but comment that these are "too small to be mapped."

Methods

The inventory and monitoring project covers two main areas: permanent plot establishment for future research in the park; and a vegetation classification of all the vegetation associations within the park according to the National Vegetation Classification (Grossman et al. 1998). In addition, our team collected any observed vascular plants (which were in good enough condition to voucher) that were not already included on the existing list for this park (see McKinney et al. 1991) and the National Park Service's NPSpecies database prior to 2002).

Permanent plot establishment

NatureServe used GIS layers supplied by the National Park Service's Cumberland Piedmont Network to set up a gridded system of one-hectare circular plots within the park boundaries, as mandated by the *Study Plan for Vertebrate and Vascular Plant Inventories* (Nichols 2000). We manipulated the GIS layers supplied to us with the program ArcView GIS 3.3 (ESRI 2002). Before selecting points to sample, we chose a 56-meter buffer inside the current park boundaries, since each point represents the center of a one-hectare circular plot and we did not wish to sample any private holdings outside of the park. With this buffer in place, an evenly spaced grid system was established for each park unit. (We chose the approximate grid size of 2.2 kilometers by 2.2 kilometers *a priori* based on observations made by a team of park service personnel in 2000 (Nichols 2000).) At each north-south and east-west line intersection, we recorded the coordinates for one grid point (Figures 1 and 2, and Table 1).

Once we had fully laid out the grid using ArcView and recorded all of the GPS coordinates for use onsite, we identified areas of the park that were most likely to hold unique associations not represented by the gridded points. We flagged these areas for visits and later established plots there and in other suitable habitat we found that was not represented by the gridded plots. Among the habitats we sampled off the grid were the limestone glades, small-scale wetland such as seeps and ponds, southern red oak flatwoods forest, bottomlands and unusual successional habitats. A map of all plot numbers and locations is shown in Figure 1.

Once at the park, we met with park personnel and local researchers, described the project's goals, and asked for their collaboration in the project. Through this process, we identified priority areas of the park for additional plot establishment and species inventory. During the field seasons of 2002, 2003, 2004 and 2005 we established 34 plots on the grid system and an additional 31 permanently marked plots off grid. Eighty-four additional quickplots were subsequently established to further document unusual or ecologically significant associations (Figures 1a, b, and c). For gridded plots, using the GPS units (Garmin Corp. 1999), we attempted to position ourselves within at least five meters of the "real" map location (the hypothetical location that we created in the lab prior to visiting the site). Once we were within five meters, we monumented each plot with a one foot piece of aluminum conduit and a small blue anodized aluminum tag with a distinctive number attached to an adjacent distinctive tree. General written directions to each permanent plot exist on the vegetation plot sheets filled out during the course of fieldwork and can also be found in the Access database archive of plot information held by the National Park Service (the PLOTS database). Due to variation in signal strength, accuracy may be more than five meters in some cases. During return visits to each full plot and certain of the "quickplots," we recorded additional data regarding spring ephemerals or other plants not recorded during the initial visit.

Vegetation classification

After the establishment of each permanent one-hectare plot, we visually surveyed the area. We chose a representative and relatively homogenous 20 by 50-meter section of the hectare in which to place our standardized vegetation monitoring plot. Within the plot, we measured environmental characteristics and identified every vascular plant within the plot (see Appendix I for a blank version of the data sheets used). We assigned each species a cover value by strata and an overall cover value for the plot based on a modified Braun-Blanquet cover class scale. In addition, we searched for and identified any species within the full hectare that were not represented in the 20 by 50-meter sample. Finally, we returned in a different season to resample all plots with the potential for spring ephemerals in an attempt to document any species that we had missed during the initial visit, normally due to seasonal variation. Detailed location information for each plot was recorded on the data sheets and is archived to assist with relocation of plots.

Our team of ecologists and data managers proofed the plot sheets, entered the data into the National Park Service PLOTS database (NatureServe 2004), and assigned each plot to an association based on floristic composition and environmental factors using the National Vegetation Classification (Anderson et al. 1998, Grossman et al. 1998). We compared the plots with similar plots in other parks in the Interior Low Plateau and with written descriptions of each related classification unit. These comparisons, combined with a thorough review of all classification possibilities and a review of the literature for some of these association types, allowed us to produce the current park vegetation classification (Appendix IV).

Vascular plant inventory

Ecologists completed the species inventory for the park so that at least 90% of the vascular plant species in the park were documented/vouchered. While gathering plot data, we discovered numerous plant species within our plots that had not already been documented. We collected new specimens encountered within the plots (and sometimes outside of the plots) and recorded the GPS coordinates using a Garmin GPS unit. We pressed and thoroughly dried all specimens, identified any unknowns that could be identified, and then vouchered all new species according to National Park Service standards using the Integrated Taxonomic Information System (ITIS) as the naming standard (USDA 2004).

To assess the success of past and present inventories, we used the program PC-ORD (McCune and Grace 2002, McCune and Mefford 1999) to create a species area curve using the data gathered at each one-hectare plot. In addition, we used a jackknife method within PC-ORD to estimate the total number of species found in the park (Palmer 1990). This method used the formula JACK1= SO + r1[n-1]/n where "SO" is the number of species observed in n quadrats (plots), "r1" is the number of species present in only one quadrat, and "n" is the number of quadrats sampled. First-order jackknife estimates often underestimate number of species (McCune and Grace 2002), so we used both first- and second-order jackknife methods to attempt to find the best estimate of overall species diversity for the park.

Results

During the species inventory work, we encountered or collected 79 plant species that had not been confirmed previously from the park, adding to the list of 1118 species (1186 species if you include subspecies) already documented, for a new park total of 1185 species (1265 documented species, varieties, or subspecies) of vascular plants (Table 2). We created 43 vouchers of new species for the herbarium at Mammoth Cave National Park (Table 3). These specimens supplement the collections and observations of McKinney et al. (1991) and Seymour and Campbell (1999).

In addition to collecting the new plants encountered within the plots and elsewhere, we estimated what percentage of the flora in the park is now documented. The estimates of the number of total species in the park that we generated using PC-ORD based on the plot data taken throughout the park were between 840

and 965 species using just the gridded full plots, and between 847 and 945 species using all full plots in the park (Figure 2, Table 4). Excluding varieties, subspecies, and questionable identifications, we believe that researchers past and present have documented 1185 species for the park. Using this figure, the species area curve jackknife method (using all plots) estimates that we have documented between well over 100% of the species currently within the boundaries of the park (Table 4). Since this is impossible, we will assume that we have, at the least, vouchered at least 90% of the species in the park.

In addition, we calculated alpha (average species richness per plot), beta (measure of the heterogeneity of the data (alpha/gamma)), and gamma (total species overall plots) diversity values for the park based on information gathered from the plot data (Table 4). The alpha value for all plots combined was 92.5, the beta value was 7.1, and the gamma value was 658.

Because exotic invasive plants are a cause for concern in managed areas, we have included a list of the 164 exotic plant species/subspecies/varieties (161 if only counting species) found at Mammoth Cave National Park. Of the exotic species listed, 66 of these species have been deemed to have invasive qualities or to represent a threat to native biodiversity in Kentucky or Tennessee. The severity of each of these threats in Kentucky (or Tennessee, if data was unavailable for KY) has been identified and is presented in Table 5.

Using the information gathered in each plot, we discerned 40 distinct vegetation associations within 10 distinct ecological systems (Table 6) as defined by the United States National Vegetation Classification (NatureServe 2008), and 4 additional communities that are likely in the park but that were not documented during our search effort. The common names of all of the communities are presented as follows (* = human modified/successional; *italics* = not documented in park, but probably present). There are also some types that were mapped in the park, but for which no plots were taken. There are also some types that were documented, but which were not used as mapping units.

FOREST

Evergreen Forest
Shortleaf Pine Early-Successional Forest* (CEGL006327)
Virginia Pine - Red-cedar Successional Forest* (CEGL007121)
Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest (CEGL007119)
Virginia Pine Successional Forest* (CEGL002591)
Eastern Red-cedar Successional Forest* (CEGL007124)

Deciduous Forest
Beech - Maple Unglaciated Forest (CEGL002411)
Central Interior Beech - White Oak Forest (CEGL007881)
Successional Black Walnut Forest (CEGL007879)
Successional Tuliptree Forest (Typic Type) (CEGL007221)
Successional Tuliptree Forest (Rich Type) (CEGL007220)
Southeastern Successional Black Cherry Forest (CEGL004133)
Interior Dry-Mesic White Oak - Hickory Forest (CEGL007795)
White Oak - Mixed Oak Dry-Mesic Alkaline Forest (CEGL002070)
Southern Red Oak - Mixed Oak Forest (CEGL005018)
Southern Red Oak Flatwoods Forest (CEGL004412)
Interior Low Plateau Mesic Sugar Maple - Hickory Forest (CEGL004741)
Nashville Basin Shingle Oak - Shumard Oak - Chinquapin Oak Forest (CEGL003876)
Shumard Oak - Chinquapin Oak Mesic Limestone Forest (CEGL008442)
Interior Low Plateau Chestnut Oak Forest (CEGL005022)
Interior Low Plateau Chestnut Oak - Mixed Oak Forest (CEGL007700)
Rich Appalachian Red Oak - Sugar Maple Forest (CEGL007698)

Successional Sweetgum Floodplain Forest (CEGL007330)
Sycamore - Silver Maple Calcareous Floodplain Forest (CEGL007334)
Rich Levee Mixed Hardwood Bottomland Forest (CEGL008429)
Sycamore - Sweetgum Streambottom Forest (CEGL007340)
Pin Oak Mixed Hardwood Forest (CEGL002432)
Interior Low Plateau Willow Pond Forest (CEGL007703)
Cumberland Forested Acidic Seep (CEGL007443)

Mixed Forest
East-central Hemlock Hardwood Forest (CEGL005043)

WOODLAND
Chinquapin Oak Unglaciated Bluff Woodland (CEGL004267)
Western Highland Rim Escarpment Post Oak Barrens (CEGL004686)

SHRUBLAND
Highland Rim Limestone Cliff/Talus Seep (CEGL004708)
*Blackberry - Greenbrier Successional Shrubland Thicket** (CEGL004732)
Buttonbush Sinkhole Pond Swamp (CEGL004742)

HERBACEOUS
Kentucky Mesic Tallgrass Prairie (CEGL004677)
Little Bluestem - Broomsedge Grassland (CEGL007707)
*Successional Broom-sedge Vegetation** (CEGL004044)
*Cultivated Meadow** (CEGL004048)
Sinkhole Pond Marsh (CEGL002413)
Southern Cattail Marsh (CEGL004150)
Central Limestone Glade (CEGL005131)
Water-willow Rocky Bar and Shore (CEGL004286)

Ecological Systems of Mammoth Cave
Central Interior Calcareous Cliff and Talus (CES202.690)
Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)
Central Interior Highlands Calcareous Glade and Barrens (CES202.691)
Pennyroyal Karst Plain Prairie and Barrens (CES202.355)
South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480)
South-Central Interior Large Floodplain (CES202.705)
South-Central Interior Mesophytic Forest (CES202.887)
South-Central Interior Small Stream and Riparian (CES202.706)
Southern Appalachian Low-Elevation Pine Forest (CES202.332)
Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Vegetation community analysis

The association is the finest level of the vegetation classification and is defined as "a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Grossman et al. 1998). Ecological community information such as that gathered for this project and described in Appendix II can be very useful as a management and monitoring tool for the parks. Once identified to the association level, it is possible for land managers on a local scale to use the ecological community information gathered by researchers throughout the association's range to make more informed decisions about how to manage locally. In addition to the information contained in Appendix II, we have included the "system" or broad ecological unit to which each association belongs, a global and local description for each association, specific information on the status of each association both globally and within the park, possible threats to the association in the park, plants of concern found in the park, and management

concerns where they apply. A brief, non-technical description of the prominent Mammoth Cave associations with some notes follows:

Shortleaf Pine Early-Successional Forest
Identifier: CEGL006327
This is a successional forest dominated by shortleaf pine (*Pinus echinata*). The status of this vegetation type at Mammoth Cave is somewhat ambiguous, in that the dominant/nominal species is reported to have been planted there, but long enough ago that the stand appears more or less "natural." Only one stand of this type was sampled. The Mammoth Cave area is not given as part of the natural range of *Pinus echinata* (Burns and Honkala 1990a).

Virginia Pine - Red-cedar Successional Forest
Identifier: CEGL007121
This vegetation is one of several types that has developed on abandoned agricultural land. Stands are dominated by a variable mixture of eastern red-cedar (*Juniperus virginiana*) and Virginia pine (*Pinus virginiana*). When the park was established, about 30% of the land was in active cultivation or in pasture, and another 15% had only recently been abandoned (Ellsworth 1934 cited in Badger et al. 1997). This is a very infrequent type at Mammoth Cave. According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils." In the Mammoth Cave stands placed here, the *Juniperus* may be a natural successional component, and the *Pinus* a result of these plantings or their offspring. Badger et al. (1997) list a CT VI as "*Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra*"; it would seem to be related to CEGL007121 and CEGL007124 in concept and composition. Stands are primarily composed of native species, but some exotics can be present.

Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest
Identifier: CEGL007119
At Mammoth Cave, this type is dominated by Virginia pine (*Pinus virginiana*),white oak (*Quercus alba*), and chestnut oak (*Quercus prinus*). This association can represent natural vegetation (particularly on dry, rocky, edaphically limited sites) but may also be at least partly of successional origin following fire, particularly on deeper soils. This is a very infrequent type at Mammoth Cave. According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils," but examples of this association should be natural, not planted or ruderal stands. Herbs are generally sparse but assume some abundance in canopy gaps and shallow soils associated with sandstone outcrops

Virginia Pine Successional Forest
Identifier: CEGL002591
Stands of this type are dominated by Virginia pine (*Pinus virginiana*). This association is one of several types of successional origin following fire, particularly on deeper soils, including abandoned agricultural land. When the park was established, about 30% of the land was in active cultivation or in pasture, and another 15% had only recently been abandoned (Ellsworth 1934 cited in Badger et al. 1997). According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils." At Mammoth Cave, these *Pinus virginiana* stands may be a result of these plantings or their offspring.

Red-cedar Successional Forest
Identifier: CEGL007124

There are issues with the use of CEGL007124 for stands dominated by eastern red-cedar (*Juniperus virginiana*). There are generally three different ecological concepts or site types included under this vegetation type and map unit. One would be stands on deeper soils, including lands that have been cleared and/or converted for agriculture and subsequently abandoned. A second one is represented by stands on rocky slopes in sink valleys that do not seem to represent the same habitat. These areas could have been used for some timber production and/or cleared for pasture. In most cases, their particular past land use is uncertain, and they do not appear to have been suitable for row crop agriculture. A third site type is related to Eastern Red-cedar growing on shallow soils over limestone that could resemble "limestone cedar glades" with management. This variation may need to be accommodated in the local description for CEGL007124. This type can accommodate evergreen CEGL007124, with up to 40% coverage of deciduous species, including dogwood (*Cornus florida*), without changing the overall type (M. Whited, pers. comm.). This association (in part) is one of several types of successional origin following fire, particularly on deeper soils, including abandoned agricultural land. When the park was established, about 30% of the land was in active cultivation or in pasture, and another 15% had only recently been abandoned (Ellsworth 1934 cited in Badger et al. 1997).

Beech - Maple Unglaciated Forest

Identifier: CEGL002411

The most mesic forests at Mammoth Cave (e.g. rich slopes, deep sinkholes, coves) which are not co-dominated by oaks (e.g. *Quercus sp.*) are placed in *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest CEGL002411. Stands are codominated by some combination of American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and tuliptree (*Liriodendron tulipifera*). A variety of ferns and spring ephemeral wildflowers are present in stands of this community. The "Mixed mesophytic forests" of Braun (1950; separate examples of which occur on "lower slopes" and "ravine slopes") are presumably accommodated by CEGL002411. American beech and sugar maple / black maple (*Acer nigrum*) typically comprise over 50% of the canopy, while "in others the mixed character is more evident". The use *of Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Magnolia tripetala* Forest CEGL005222 should not be necessary at MACA, despite the fact that the Appalachian yellow buckeye (*Aesculus flava*) (a nominal in CEGL005222) has been unexpectedly collected at the park.

Central Interior Beech - White Oak Forest

Identifier: CEGL007881

Mesic stands that are dominated by white oak (*Quercus alba*) and American beech (*Fagus grandifolia*) are placed in *Fagus grandifolia - Quercus alba / Cornus florida* Forest CEGL007881. Stands also contain sugar maple (*Acer saccharum*), tuliptree (*Liriodendron tulipifera*), and may include hickory (*Carya* spp.), and other oaks (*Quercus* spp.) This is a community that is intermediate between the "matrix" upland oak-hickory stands and the non-oak mesic and richer stands on more concave and deeply dissected terrain. This would be distinguished from CEGL002411 at least in part by the absence or at least a lower percentage of oak in CEGL002411. This same slope position is occupied by CEGL007698 on different aspects (e.g. more northerly ones).

Successional Black Walnut Forest

Identifier: CEGL007879

Stands of this type are dominated by black walnut (*Juglans nigra*). American elm (*Ulmus americana*) may codominate in some examples; additional species may include box-elder (*Acer negundo*), tuliptree (*Liriodendron tulipifera*), sycamore (*Platanus occidentalis*), black cherry (*Prunus serotina var. serotina*), shingle oak (*Quercus imbricaria*), and American basswood (*Tilia americana*). It occurs in a variety of habitats, all associated with disturbance, and frequently associated with rich or circumneutral soils. At Mammoth Cave National Park , it has been sampled primarily from sinkhole bottoms and basins, but also from flat alluvial terraces, at from 155 to 245 m (510-800 feet) elevation. The community has presumably

developed in these areas following the cessation of agriculture. Some stands of black walnut may have originated from plantings (Henry Holman, MACA NPS, pers. comm.). Evidence of abandoned fruit orchards may be present. The invasive exotic Nepalese browntop (*Microstegium vimineum*) can be quite abundant.

Interior Mid- to Late-Successional Tuliptree - Hardwood Upland Forest (Acid Type)
Identifier: CEGL007221
This successional tuliptree-oak forest was sampled at one location in the park. It occurs where the canopy was removed or heavily disturbed in the past. It is more frequently encountered than the other tuliptree-dominated association, Successional Tuliptree Forest (Circumneutral Type) CEGL007220. The canopy is dominated by tuliptree (*Liriodendron tulipifera*), Virginia pine (*Pinus virginiana*), and red maple (*Acer rubrum*), the subcanopy by dogwood (*Cornus florida*), sourwood (*Oxydendrum arboreum*), and eastern red-cedar (*Juniperus virginiana*). The one stand assigned here is unusual in that the subcanopy of old, large dogwood (*Cornus florida*) dominates the stand, being more dense than the canopy.

Successional Tuliptree Forest (Circumneutral Type)
Identifier: CEGL007220
This successional tuliptree forest was sampled at eight locations, primarily in the southern parts of the park. It occurs where the canopy was removed or heavily disturbed in the past. Stands are dominated by tuliptree (*Liriodendron tulipifera*). Other species are present, including ones indicative of nutrient-rich or circumneutral environments. It is more frequently encountered than the other tuliptree (*Liriodendron tulipifera*)-dominated association, the Interior Mid- to Late-Successional Tuliptree - Hardwood Upland Forest (Acid Type) CEGL007221. Sites range from flat sinkholes and basins to moderate to somewhat steep, lower to midslopes and summits with a variety of aspects. There may be some issues of assignment in the case of successional stands co-dominated by tuliptree (*Liriodendron tulipifera*) with Sugar Maple (*Acer saccharum*) and this is accommodated in the key.

Southeastern Successional Black Cherry Forest
Identifier: CEGL004133
Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana Forest
This successional and post-disturbance vegetation is located in the old fields mostly on the plateaus and occasionally in the sink valleys at Mammoth Cave National Park. It seems to occur in conjunction with other successional types as a heterogeneous combination of vegetation that develops following old field succession. Composition is variable, and the canopy may be dominated by various combinations of sugar maple (*Acer saccharum*), tuliptree (*Liriodendron tulipifera*), Virginia pine (*Pinus virginiana*),and/or red maple (*Acer rubrum*), the subcanopy by dogwood (*Cornus florida*), sourwood (*Oxydendrum arboreum*), black cherry (*Prunus serotina var. serotina*), and eastern red-cedar (*Juniperus virginiana*).

Interior Dry-Mesic White Oak - Hickory Forest
Identifier: CEGL007795
Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta) Forest
CEGL007795 represents the majority of the central terrain of the rolling uplands of the park, neither on strongly sandstone nor strongly limestone substrates. Typical stands are composed of white oak (*Quercus alba*), usually with black oak (*Quercus velutina*), these two species composing more than 50% of the oak coverage. Stands may also may include mockernut hickory (*Carya alba*), bitternut hickory (*Carya cordiformis*), pignut hickory (*Carya glabra*), white ash (*Fraxinus americana*), scarlet oak *Quercus coccinea*), southern red oak (*Quercus falcata*), chestnut oak (*Quercus prinus*), and others. Southern red oak (*Quercus falcata*) and red oak (*Quercus rubra*) are typically absent or have low cover value. They could be present in the lower strata but not normally in the canopy. Sites range from gently sloping ridges to gentle to steep, lower to upper slopes of any aspect. Elevations range from 177 to 308 m (580-1010 feet). Soils are dry-mesic to mesic, rapidly drained to moderately and well-drained clay loam, sandy loam,

silt loam, silt and loam. CEGL007795 is related to the "White oak-black oak-tuliptree type of slopes of upland" of Braun (1950, p. 148, Table 27). In Braun's analysis, this type is one in which "the three dominants comprise 72% of the canopy." This is at some variance from our data, in which tuliptree (*Liriodendron tulipifera*) is not so constant or important. Her studies in the "Big Woods" area of Hart County focused on mesophytic types. Braun also makes the comment that the "where valleys cut less deeply into the upland….(t)he oak-tuliptree type…prevails"

White Oak - Mixed Oak Dry-Mesic Alkaline Forest

Identifier: CEGL002070

On limestones in the southeastern portion of the park, there are stands with white oak (*Quercus alba*) and red oak (*Quercus rubra*); these are the "real" *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest CEGL002070. Stands are dominated by white oak; additional species may include sugar maple (*Acer saccharum*), pignut hickory (*Carya glabra*), bitternut hickory (*Carya cordiformis*), white ash (*Fraxinus americana*), and red oak (*Quercus rubra*). The moderate (40-50%) subcanopy (10-35 m) is dominated by sugar maple and may include pignut hickory, eastern red-cedar, white oak, chinquapin oak (*Quercus muehlenbergii*), and sassafras (*Sassafras albidum*). Examples of this association are found on soils derived from base-rich rocks (e.g. limestone). The range of this originally Ozarkian type has been expanded to include much of the unglaciated Interior Low Plateau; there may be substantial differences among examples across this range to warrant subdivision, but this has not been tested through any kind of analysis.

Southern Red Oak - Mixed Oak Forest

Identifier: CEGL005018

Stands that have been assigned to *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest CEGL005018 differ from *Quercus alba – Quercus velutina* ones (CEGL007795) in that they exhibit a variable composition including southern red oak (*Quercus falcata*) (which nears the northern edge of its range here) and post oak (*Quercus stellata*). These stands may be drier than the *Quercus alba – Quercus velutina* ones, or some other factor may lead to their development. This is a type that was developed for southern Indiana, where southern red oak is even more of a novelty. Some stands of CEGL007795 are difficult to distinguish from CEGL005018, as the presence/absence of the various oak (*Quercus*) taxa is very similar, but usually cover values vary sufficiently to make this distinction. This type is scattered across uplands in the central part of the park. It is found neither on pure sandstones nor limestones, but on mixed or intermediate geologies. Soils are dry-mesic, moderately well- to well-drained clay loam, sandy loam, silt loam and loam. Southern red oak may have become more prevalent in these stands following the lessening of the importance of fire in the landscape following park establishment, based on the general assumption that southern red oak is less tolerant of fire than post oak.

Southern Red Oak Flatwoods Forest

Identifier: CEGL004412

This unusual community was only located at one location in the park. Its topography is distinctive, being a flatter landtype on a site near the southern park boundary. It is described as a flat upland bench. Most of this landtype has been converted to agricultural or pasture uses. This example is dominated by southern red oak (*Quercus falcata*) and includes red maple (*Acer rubrum*) and blackgum (*Nyssa sylvatica*).

Interior Low Plateau Mesic Sugar Maple-Hickory Forest

Identifier: CEGL004741

This is a calcareous, non-oak dominated forest, which is ecologically related to CEGL008442 (a calcareous, oak-dominated type). It has been used as a map unit at MACA, but is similar in some respects to CEGL008442. There is only one quickplot at MACA assigned to this type, it was taken very close to a plot of CEGL008442, and may in effect be an ecotonal variant of it (or it could be a rare type that has

been undersampled). It is being retained in the classification, and was used as a mapping unit, but more information about it is needed.

Nashville Basin Shingle Oak - Shumard Oak - Chinquapin Oak Forest
Identifier: CEGL003876
An unusual type of mid-successional forest occurs at MACA and in other areas underlain by limestone. Shingle oak (*Quercus imbricaria*) has a very limited distribution, so its presence in these stands makes them unusual and distinctive. It is found in small to medium-sized patches only in karst valleys and on the Sinkhole Plain in the Diamond Caverns vicinity (Olson and Noble 2005). The soils on which it is found are derived from Mississippian limestones, and may have limestone fragments at the surface.

Shumard Oak - Chinquapin Oak Mesic Limestone Forest
Identifier: CEGL008442
There are also relatively uncommon stands with dominance by chinquapin oak (*Quercus muehlenbergii*) and Shumard oak (*Quercus shumardii*); these are compatible with *Quercus shumardii - Quercus muehlenbergii - Acer (barbatum, leucoderme, saccharum) / Ostrya virginiana* Forest CEGL008442. This (and the use of CEGL007698) should obviate the need for CEGL006017 (a northeastern type) at Mammoth Cave. The ecologically related CEGL004741 (a calcareous, non-oak dominated type) has been used as a map unit at MACA, but is similar in some respects to CEGL008442. Only one quickplot was ever assigned to this type.

Interior Low Plateau Chestnut Oak Forest
Identifier: CEGL005022
The more "xeric" *Quercus prinus* stands to the north in primarily sandstone areas are referred to *Quercus prinus / Smilax spp.* Forest CEGL005022. The mixed oak stands that generally contain a majority (greater than 50% canopy closure) *Quercus prinus* in the central and southern part of the park are referred to *Quercus prinus - Quercus spp. / Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest CEGL007700. Two other associations (CEGL008431 and CEGL0006271) were considered for application at Mammoth Cave but were rejected as inappropriate or unnecessary.

Interior Low Plateau Chestnut Oak - Mixed Oak Forest
Identifier: CEGL007700
The mixed oak stands that generally contain a majority (greater than 50% canopy closure) *Quercus prinus* in the central and southern part of the park are referred to *Quercus prinus - Quercus spp. / Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest CEGL007700. The more "xeric" *Quercus prinus* stands to the north in primarily sandstone areas are referred to *Quercus prinus / Smilax spp.* Forest CEGL005022. Two other associations (CEGL008431 and CEGL0006271) were considered for application at Mammoth Cave but were rejected as inappropriate or unnecessary.

Rich Appalachian Red Oak / Sugar Maple Forest
Identifier: CEGL007698
A community typically dominated by *Quercus rubra* with *Acer saccharum* and/or *Liriodendron tulipifera* is typically found downslope from areas dominated by *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest CEGL007795 (which is somewhat variable but wide-ranging). These stands are referred to *Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest CEGL007698, which was not used at the park in early classifications. This association is intermediate in composition and landscape position between upland Oak-Hickory forests (e.g. CEGL007795) and the non-Oak mesic coves and rich lower slopes, especially on northerly aspects.

Successional Sweetgum Floodplain Forest
Identifier: CEGL007330
This successional community develops along floodplains of major creeks and other temporarily flooded areas following clearcutting, agriculture, or other disturbances. At Mammoth Cave, it is found on an alluvial terrace above the normal floodplain of the Green River. These areas were presumably heavily disturbed, and may be wetland old fields that have been recovering for the past 60-70 years. Stands assigned here are codominated by sweetgum (*Liquidambar styraciflua*), tuliptree (*Liriodendron tulipifera*), and white ash (*Fraxinus americana*).

Sycamore - Silver Maple Calcareous Floodplain Forest
Identifier: CEGL007334
Larger floodplains, typically with *Acer saccharinum*, are assigned to *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest CEGL007334, which is restricted to terraces and floodplains of the Green River and its larger tributaries. Some portions of stands assigned to this type exhibit dominance by *Acer negundo,* so the use of *Acer negundo* Forest CEGL005033 should not be necessary.

Rich Levee Mixed Hardwood Bottomland Forest
Identifier: CEGL008429
Most small streams and "alluviated sinkholes" will fit into *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest CEGL008429, which is also applied to some portions of floodplain terraces.

Sycamore - Sweetgum Streambottom Forest
Identifier: CEGL007340
There are small streams in the sandstone-capped, non-karstic topography of the northwestern part of the park that apparently represent examples of *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340) an association in the *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289). The one location in the park where this was sampled is located near a sandstone rockhouse and covers the streambanks near the head of a drainage. The canopy is dominated by *Liriodendron tulipifera* (tuliptree) and includes *Platanus occidentalis* (American sycamore), *Acer saccharum* (sugar maple), *Carya glabra* (pignut hickory), and *Fraxinus americana* (white ash). This type occurs at small linear scales and was not used as a mapping unit.

Pin Oak Mixed Hardwood Depression Forest
Identifier: CEGL002432
There are several rare, small-scale upland depression ponds on the park, both forested and non-forested. The forested ones are attributable to *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest CEGL002432. The forested wetland vegetation at these sites may only be represented by a narrow band around the depression pond, the center of which is lacking in trees and is of a longer hydroperiod than the forested margin. In some examples, *Nyssa sylvatica* may be present rather than, or in addition to, *Liquidambar styraciflua*.

Interior Low Plateau Willow Pond Forest
Identifier: CEGL007703
This black willow wetland forest was sampled at one location in the park. The site is on the rim of a large depressional pond near "Wondering Woods." The vegetation and presence of fish indicate that it is permanently wet. *Salix nigra* (black willow) dominates the tall- and short-shrub layers, which may also include tall *Platanus occidentalis* (American sycamore) and short *Rubus* (blackberry) sp., *Toxicodendron radicans* (eastern poison-ivy), and exotic *Rosa multiflora* (multiflora rose). Herbs include *Asplenium*

platyneuron (ebony spleenwort), *Carex tribuloides* (blunt broom sedge), *Juncus* (rush) sp., *Scirpus* (bulrush) sp., *Symphyotrichum* (aster), and *Vernonia* (ironweed) sp. No stratum or percent coverage data were collected. The vegetation sampled has more of a shrubland appearance than a forest.

Cumberland Forested Acid Seep
Identifier: CEGL007443
At Mammoth Cave National Park, there are some small scale "seepage" areas, which could be attributed to *Acer rubrum var. trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest CEGL007443. This vegetation is rare and poorly understood at MACA, and in any case is too small in scale to be mappable.

East-central Hemlock Hardwood Forest
Identifier: CEGL005043
This community is restricted to the sandstone-capped, non-karstic topography of the northwestern part of the park. The dense tree canopy is dominated by *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), and *Quercus rubra* (northern red oak) and may include *Acer saccharum* (sugar maple), *Quercus alba* (white oak), and others. It is reminiscent of vegetation found to the east in the Cumberland Plateau region.

Chinquapin Oak Unglaciated Bluff Woodland
Identifier: CEGL004267
On lower steep drier slopes, southerly aspects on limestones exhibit a *Quercus muehlenbergii – Juniperus virginiana* woodland with a distinctive suite of associated grasses, forbs, and low shrubs. This has been recently described as a new community, *Quercus muehlenbergii -Juniperus virginiana var. virginiana)* Unglaciated Bluff Woodland CEGL004267, in the *Quercus muehlenbergii* Woodland Alliance (A.621).

Western Highland Rim Escarpment Post Oak Barrens
Identifier: CEGL004686
Stands assigned to *Quercus stellata / Viburnum rufidulum / Schizachyrium scoparium - (Sorghastrum nutans, Helianthus eggertii)* Woodland CEGL004686 are present in the park, but are a rare community type. These are presumably what Braun (1950) refers to as "more xeric" communities "on flatter uplands with poor soil" containing *Quercus falcata* and *Quercus stellata* in addition to *Quercus velutina* and *Quercus marilandica*. In our data, the latter species is limited, mostly occurring in woodlands (more open stands) with *Quercus stellata*. These are referred to CEGL004686, which seems to be the clearest fit with Braun's concept, but the correspondence is imperfect.

Highland Rim Limestone Cliff/Talus Seep
Identifier: CEGL004708
This unusual association is of local and limited distribution, on limestones not sandstones. The shrub layer is dominated almost exclusively by *Hydrangea arborescens* (wild hydrangea); no other species were reported. The sparse (30%) herbaceous layer includes *Heuchera americana* (American alumroot), *Hydrophyllum* (waterleaf) sp., *Impatiens pallida* (pale touch-me-not), and *Sedum ternatum* (woodland stonecrop). Vines include *Parthenocissus quinquefolia* (Virginia creeper). Only limited floristic data could be collected due to the inaccessibility of the site

Buttonbush Sinkhole Pond Swamp
Identifier: CEGL004742
No local description at this time.

Sinkhole Pond Marsh
Identifier: CEGL002413

No local description at this time.

Southern Cattail Marsh
Identifier: CEGL004150
At Mammoth Cave National Park, some open-canopy depression ponds have vegetated rims which are dominated by a combination of herbaceous (*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation CEGL002413, *Typha latifolia* Southern Herbaceous Vegetation CEGL004150) and shrubby Buttonbush-dominated vegetation (*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland CEGL004742). One plot each has been attributed to CEGL002413 and CEGL004742; CEGL004150 is also present and has been observed at MACA, but no plots were sampled.

Central Limestone Glade
Identifier: CEGL005131
This is an open vegetation type found on exposures of Mississippian limestone, especially in the east and southeast portion of the park where these outcrops are most abundant. One extensive area is located on Dennison Ferry Road. This community presents itself as a mixture of grasses and forbs with scattered shrubs and trees. Many of the plants found in this community are found nowhere else at MACA.
The presence of this community is related to the droughty conditions caused by internal drainage through the limestone (karst hydrology) and the sun-beaten south to southwest aspect of the slopes on which examples are most frequently found. Some of the Eastern red-cedars that are present are very old, and are slow-growing due to the difficult habitat conditions.

Water-willow Rocky Bar and Shore
Identifier: CEGL004286
This distinctive, but small-scale vegetation type is restricted to rocky riffles in the Green River and its tributaries. It is composed of monospecific stands of water-willow (*Justicia americana*).

Blackberry-Greenbrier Successional Shrubland Thicket
Identifier: CEGL004732
This community was not documented at MACA, but would be expected in areas that were plowed or mowed and then left fallow for at least 3-5 years. Vegetation varies greatly, but most examples are dominated by sawtooth blackberry (*Rubus argutus*) with other shrub and herbaceous species present depending upon the exact age, the soil characteristics of the site, and the seed sources that are nearby. Allegheny blackberry (*Rubus allegheniensis*) might also be a component. This community exists throughout the park in areas that were recently plowed and/or heavily mowed and are recovering.

Successional Broomsedge Vegetation
Identifier: CEGL004044
This association is composed of dense stands of Broomsedge (*Andropogon virginicus var. virginicus*). A variety of other forbs are typically mixed in. These may include Small's ragwort (*Packera anonyma*), fescue (*Lolium arundinaceum* [= *Festuca arundinacea*]), Canadian horseweed (*Conyza canadensis*), American pokeweed (*Phytolacca americana*), beaked cornsalad (*Valerianella radiata*), largebracted plantain (*Plantago aristata*), littleleaf sensitive-briar (*Mimosa microphylla*), and several other species. It could be found in utility corridors and old fields.

Cultivated Meadow
Identifier: CEGL004048
These are primarily dominated by meadow fescue (*Lolium pratense*) but also include a wide variety of non-native and native species. Other native grass and herbaceous species that could be found in this type include purpletop (*Tridens flavus*), longspike tridens (*Tridens strictus*), beaked panicgrass (*Panicum*

anceps), Florida paspalum (*Paspalum floridanum*), bottlebrush grass (*Setaria parviflora*), eastern gamagrass (*Tripsacum dactyloides*), smooth paspalum (*Paspalum laeve*). Typical non-native species commonly found here include Johnson grass (*Sorghum halepense*, dallis grass (*Paspalum dilatatum*), crabgrass (*Digitaria sanguinalis*), ox-eye daisy (*Leucanthemum vulgare*) and wild carrot (*Daucus carota*).

Discussion/Conclusions

Species Inventory

The field work from this project added 43 new species to the vouchered specimens at the park. These species and 36 others from unvouchered observations were added to an existing list of 1118 species that included vouchers from projects done by earlier researchers. We now count 1185 species (1265 documented species, varieties, or subspecies) of vascular plants in the park. One goal of the Inventory and Monitoring program of the National Park Service is to document at least 90% of the vascular flora of the park. Using various estimates and assumptions, the estimate for total number of species in the park ranged well above 100%. Although this is obviously an impossible number to attain, it signals that we likely documented at least 90% of the vascular flora of the park.

As would be expected in a relatively large park with extensive forested uplands and a major river system passing through it, Mammoth Cave National Park has a rich diversity of natural ecological community types, ranging from rich forested slopes to very dry/xeric calcareous glades, including forested bottomlands, small-scale ponds, and calcareous seeps. Significant portions of the upland acreage were cultivated or pastured agricultural land at the time of park establishment, and this land is today occupied by various kinds of successional hardwood or evergreen forests. The composition of this vegetation is more related to conditions at time of abandonment rather than to any inherent ecological factors such as topography or soil type. In addition some of the acreage of the park, particularly around buildings and facilities, as well as on the boundary of the park, is successional, mowed, or maintained grassland.

The most globally rare communities in the park appear to be the Central Limestone Glade (G2G3), the Chinquapin Oak Unglaciated Bluff Woodland (G2G3), the Western Highland Rim Escarpment Post Oak Barrens (G2G3), the Shumard Oak - Chinquapin Oak Mesic Limestone Forest (G2G3), and the Highland Rim Limestone Cliff/Talus Seep (G3), and the Southern Red Oak Flatwoods Forest (G2?). The first three of these communities are related to exposures of limestone or other habitats favorable for light-demanding plants. These three associations warrant special attention due to their relatively high global rank/rarity and the habitat that they can provide for species ranked globally or locally vulnerable. These communities should be monitored as it is possible that degradation and loss of species diversity may result from woody plant encroachment due to changes in management or natural disturbance regimes. In addition, there are several examples of mesophytic forests and oak-hickory forests that are noteworthy for their intactness and/or their maturity. Mammoth Cave National Park is noteworthy for being one of the largest blocks of continuous hardwood forest in the region.

About 14% (161) of the 1185 plant species in the park are not native to the region or continent. Many of these species were plantings (included in the cultivated meadows, for instance), or are harmless present day components of the flora that found their way into natural areas from plantings or errant seed mixes. However, at least 44 of the 161 exotic species (164 species/subspecies/varieties) found within the park are considered aggressive invasive species that are severe or significant threats and are actively out-competing and replacing native species in other parts of the Southeast (rated as Severe or Significant threats by KYEPPC 2007 and TNEPPC 2007). Invasive species may be the biggest single threat to the overall ecological health of the park at this point in time. In the interior woods and forests, shrubs and vines such as Japanese honeysuckle (*Lonicera japonica*) and multiflora rose (*Rosa multiflora*) have colonized areas of the understory. Most of the floodplains and lower slopes in the park now have large infestations of garlic mustard (*Alliaria petiolata*), ground-ivy (*Glechoma hederacea*), and Japanese stilt grass/Nepalese browntop (*Microstegium vimineum*). Several other species such as Chinese privet (*Ligustrum sinense*), sweetclover species (*Melilotus* sp.), Sweet Autumn Virgin's-bower (*Clematis*

terniflora), and others listed as “significant threat” in table 5 may need monitoring and attention to assure that they are not spreading. In areas where exotics have become a monoculture, removal should occur in conjunction with planting and seeding of natives to help prevent quick recolonization by the same or new invasive exotic species.

Vegetation community analysis

The association is the finest level of the vegetation classification and is defined as “a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy” (Grossman et al. 1998). Ecological community information such as that gathered for this project and described in Appendix IV can be very useful as a management and monitoring tool for the parks. Once identified to the association level, it is possible for land managers on a local scale to use the ecological community information gathered by researchers throughout the association’s range to make more informed decisions about how to manage locally. In the information contained in Appendix IV, we have included the “system” or broad ecological unit to which each association belongs, a global and local description for each association, specific information on the status of each association both globally and within the park, possible threats to the association in the park, plants of concern found in the park, and management concerns where they apply. See Table 6 for a summary of the assignment of plots to associations.

In considering the vegetation at Mammoth Cave National Park, it is important to keep in mind the extensive human manipulation that has impacted the composition of the forests there. What we see today is not entirely natural forest communities, but regrowth of trees after significant human impact. Certainly most, if not all of the entire surface of the park was logged at least once.

One possible exception to this would be the area known as "Big Woods", which is cited in a variety of sources as an "old-growth" forest (e.g. Davis 1996), or as the "oldest and least disturbed stand of timber within the park's boundaries" (McKinney et al. 1991). Campbell (1998), citing McCune and Henckel (1993), states that Big Woods contained "frequent old trees (ca. 100-150 years)" in age without commenting on its old growth status or disturbance and management history. Natural mortality of trees there has reduced the basal area (Winstead and Stone 1996). Tree age data derived from tree ring counts performed in 1966 and 1985 (NOAA 2010) provide some tree ages in excess of 250 years.

In addition, Significant portions of the upland acreage was cultivated or pastured agricultural land at the time of park establishment, and this land is today occupied by various kinds of successional hardwood or evergreen forests.

Ecological Community Summary and Management Considerations

At Mammoth Cave National Park, ecologists/botanists with this project identified 42 ecological community types or associations (described above). Thirty-two of these are considered "natural" or not modified extensively by human activities. These associations occur in a variety of habitats, including areas that have not been severely disturbed for more than 70 years (e.g. since park establishment), or occur in bottomland areas that recover more quickly from disturbance. When considering priorities for land management, exotic invasive control, preservation, etc., these communities should take higher priority than the successional and exotic-dominated communities.

The most globally rare communities in the park appear to be the Central Limestone Glade (G2G3), the Chinquapin Oak Unglaciated Bluff Woodland (G2G3), the Western Highland Rim Escarpment Post Oak Barrens (G2G3), the Highland Rim Limestone Cliff/Talus Seep (G3), the Shumard Oak - Chinquapin Oak Mesic Limestone Forest (G2G3), and the Southern Red Oak Flatwoods Forest (G2?).

The first four of these six communities are related to exposures of limestone or other habitats favorable for light-demanding plants, ranging from extremely dry (glades) to perennialy set (seeps). They warrant special attention due to their relatively high global rank/rarity and the habitat that they can provide for species ranked globally or locally vulnerable. There are issues with their management and/or restoration, and some examples are subject to degradation and loss of species diversity from woody plant encroachment due to lack of fire or other appropriate management. In particular, examples of the xeric Central Limestone Glade (G2G3) are restricted to unusual geologic conditions (outcrops and shallow soil over limestone) and are widely scattered in central Kentucky. They frequently contain a suite of glade endemic plant species, and are worthy of special management consideration. Similar glades are found in the Nashville Basin of central Tennessee and the Moulton Valley of northern Alabama.

In general, the unusual and characteristic plants of limestone glades are light-demanding and do not thrive under the shade of trees and shrubs. More research is needed on the appropriate management techniques to maintain these communities at the right closure of woody plants. Under certain conditions, Eastern red-cedar can expand into openings and reduce the diversity, vigor, and abundance of the native grasses and other characteristic and unusual plant species. Good research will help determine what native (pre-settlement) fire return intervals were present on the park before any conclusions about the natural extent of these glades can be stated with certainty. Under conditions where fire was a part of the landscape, and where the right fuels are present, these communities would burn and likely maintain a more characteristic open woodland structure, even in examples with deeper soils.

Without fire or some type of management which partly mimics the effects of fire (e.g. mowing or mechanical removal of woody plants), only the glade areas with the shallowest soils will remain open. Some of the better glade areas in the park (as on Dennison Ferry Road) appear to have been managed and the beneficial effects of this activity are evident. Without management, this glade habitat is likely to remain limited to the areas of shallow soil that presently support native grasses and glade endemic plant species. With appropriate and science-based management, the glades are likely to expand beyond their current extent into adjacent areas more densely forested with red-cedar. A careful distinction needs to be made between areas with older red-cedars and areas into which red-cedars have more recently spread.

The Highland Rim Limestone Cliff/Talus Seep (G3) was only found at one location in the park (a side of Cedar Sink), but this unusual small-scale community could be found at other locations. It is distinctive for being a natural shrubland, dominated by *Hydrangea arborescens.*The other two forested communities are also globally rare, but their dynamics and management are less well known.

In addition, there are several examples of mesophytic forests and oak-hickory forests that are noteworthy for their intactness and/or their maturity. Mammoth Cave National Park is noteworthy for being one of the largest blocks of hardwood forest in the region.

Mammoth Cave National Park's natural resources are a great asset to the park system; few parks in the southeast boast such fascinating geological features as the extensive cave system as well as the large and mostly unbroken hardwood forests. Some of the recommendations for this park in terms of sustaining and promoting increased plant biodiversity include:

1) Control invasive exotics in all communities, but especially those in and near the limestone glades.
2) Inventory, assess, and document sites that are related to open canopy vegetation types (existing and potential glades, barrens, and woodlands). Some level of formal assessment is needed to determine with certainty if a particular site (for example one with dominance or prevalence of Eastern red-cedar or Shingle oak) is of recent origin on abandoned pasture or crop land, or is a result of more natural and long-term processes. There is a need for more detailed studies of Eastern red-cedar dominated vegetation, including fire history studies. This kind of study would help establish and test a standard means of making this discernment recently successional Eastern red-cedar dominated vegetation and other stands that are older and deserving of management and protection.
3) Determine the extent of recent encroachment of Eastern red-cedar into glades, barrens, and woodlands. A distinction must be made between recently encroaching woody plants and ones that are long-term members of a stand. Proper management (including mechanical removal of recently successional Eastern red-cedar, use of fire in proper settings) may be needed in some circumstances, as in former barrens communities along Dennison Ferry Road. Maintenance of a sparse woodland condition allows for greater light in the understory and thereby promotes a higher cover of native herbaceous plant species. The same principles apply to Post Oak – Blackjack Oak woodlands found on roadsides at several locations in the park. Their extent could be increased, and quality maintained or enhanced with science-based management.
4) Continue to protect high quality versions of all natural communities within the park. Although some natural communities in the park are globally common, with continued protection and management, they can become some of the best high quality examples of these forests in the immediate area, if not in the region.
5) Evaluate and research opportunities for restoration of Giant Cane Shrublands along wider portions of the Green River floodplain. One possible example of this is at Turnhole Bend, where a larger and wider floodplain is present. Most sections of the Green River floodplain are too narrow to have supported extensive giant cane shrublands.
6) Attempt to monitor any potential development near the Highland Rim Limestone Cliff/Talus Seep to ensure that no unintended impacts occur.
7) Old fields and lawns represent an opportunity for "seeding in" native grassland species using local genotypes to increase the populations of sensitive grassland/glade species. Consider using these existing open areas as native grass restoration areas pending more detailed assessments of where these vegetation types most likely existed in the past.

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Tables and Figures

Figure 1a. Map of western section of Mammoth Cave National Park with plot locations.

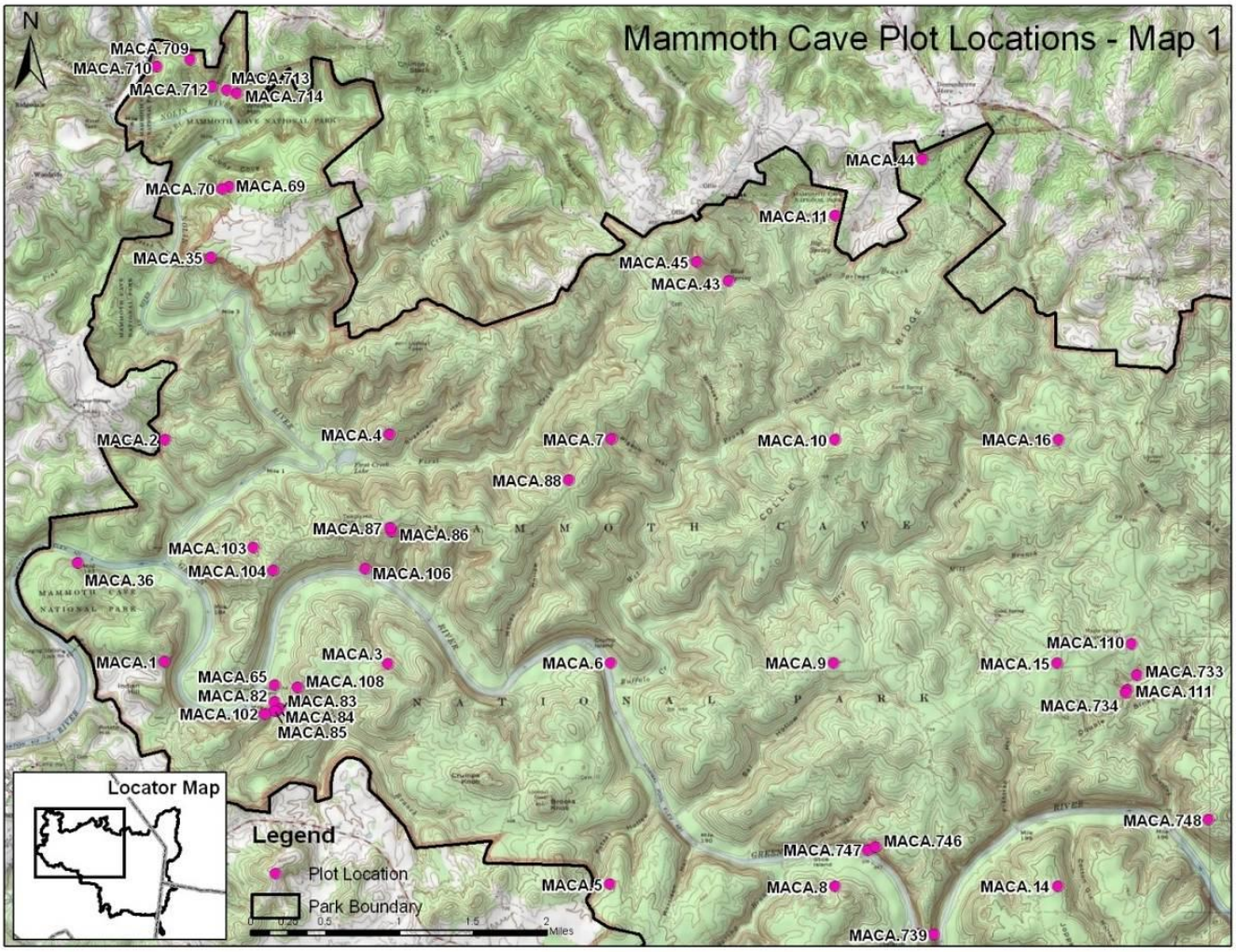


Figure 1b. Map of eastern section of Mammoth Cave National Park with plot locations.

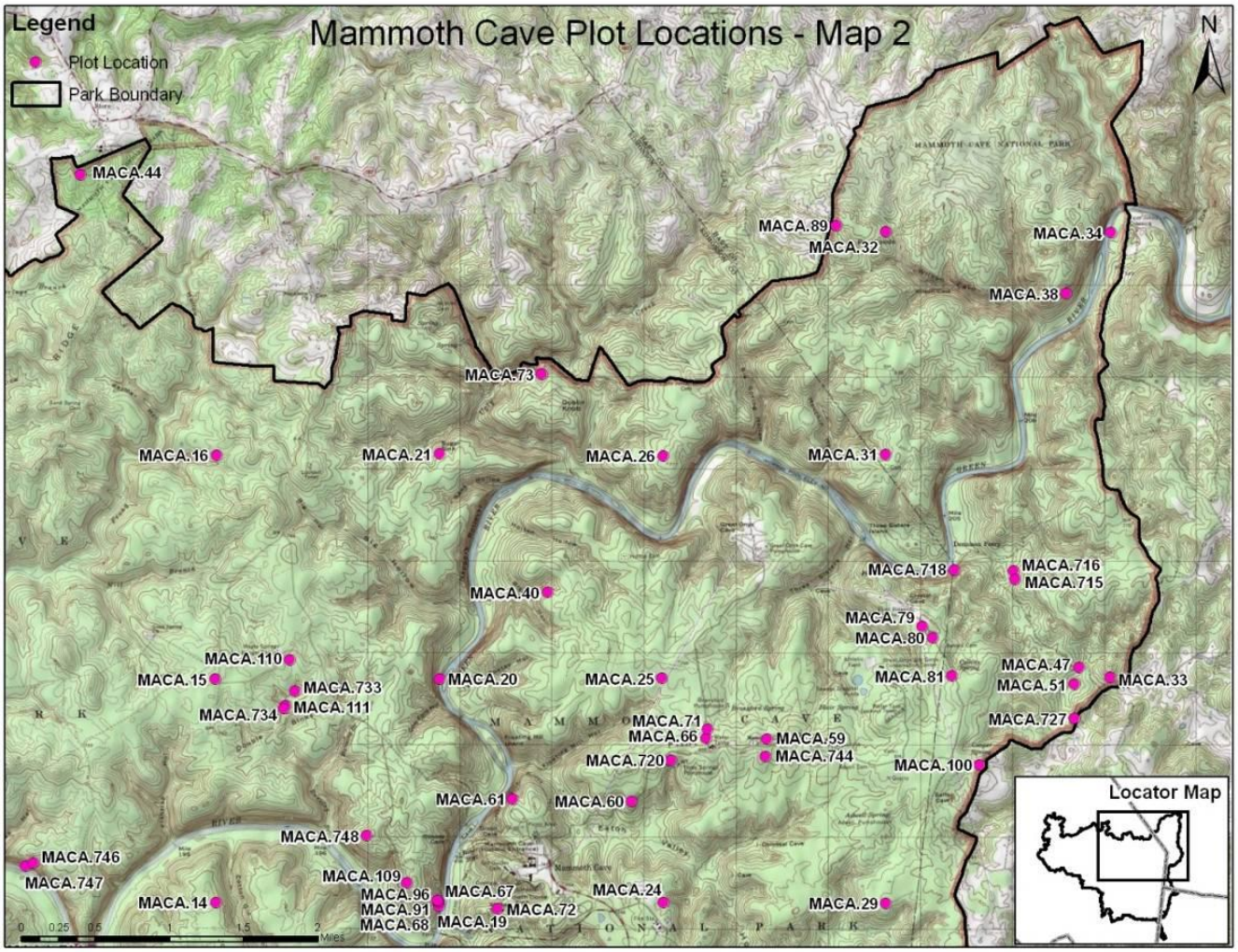


Figure 1c. Map of southern section of Mammoth Cave National Park with plot locations.

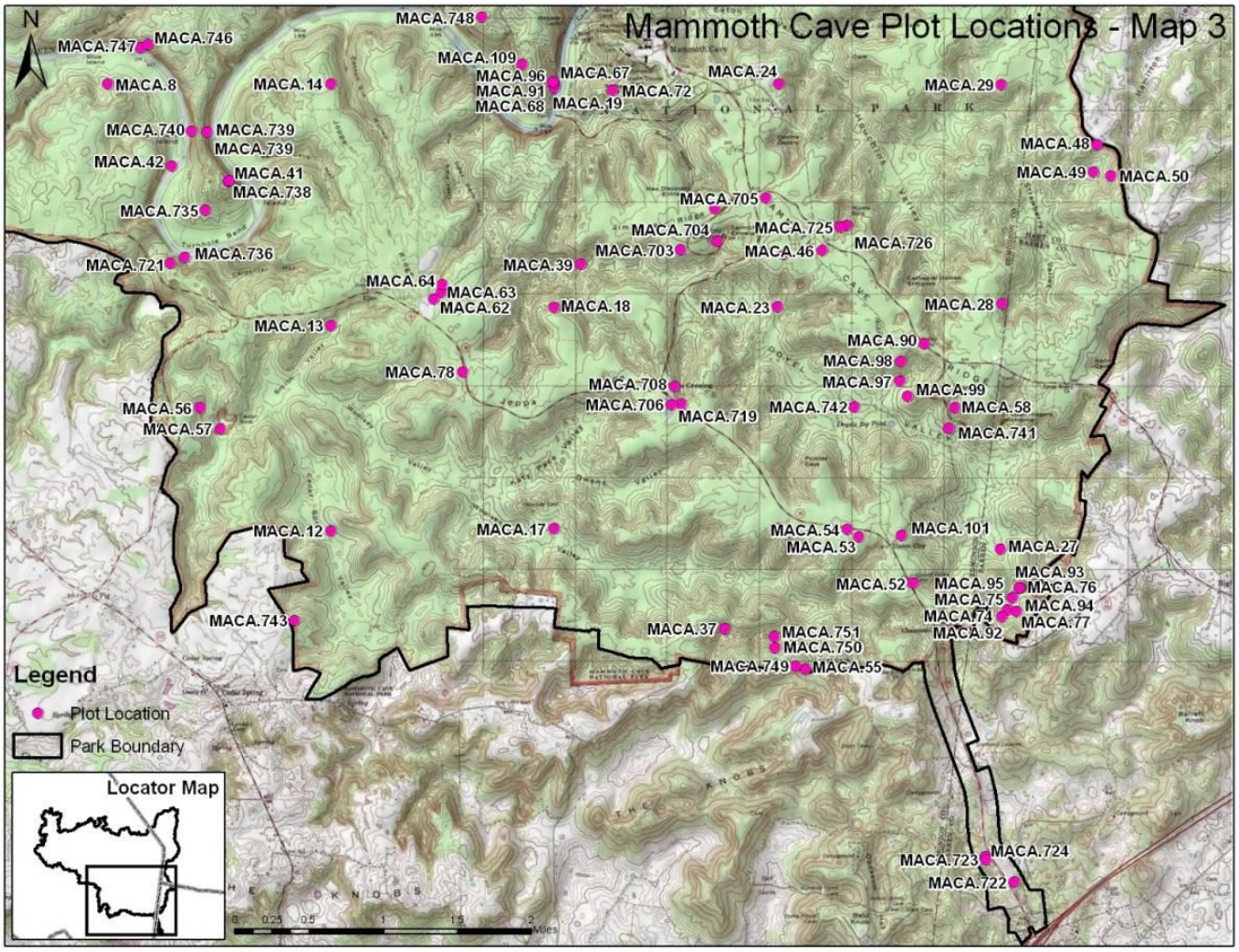
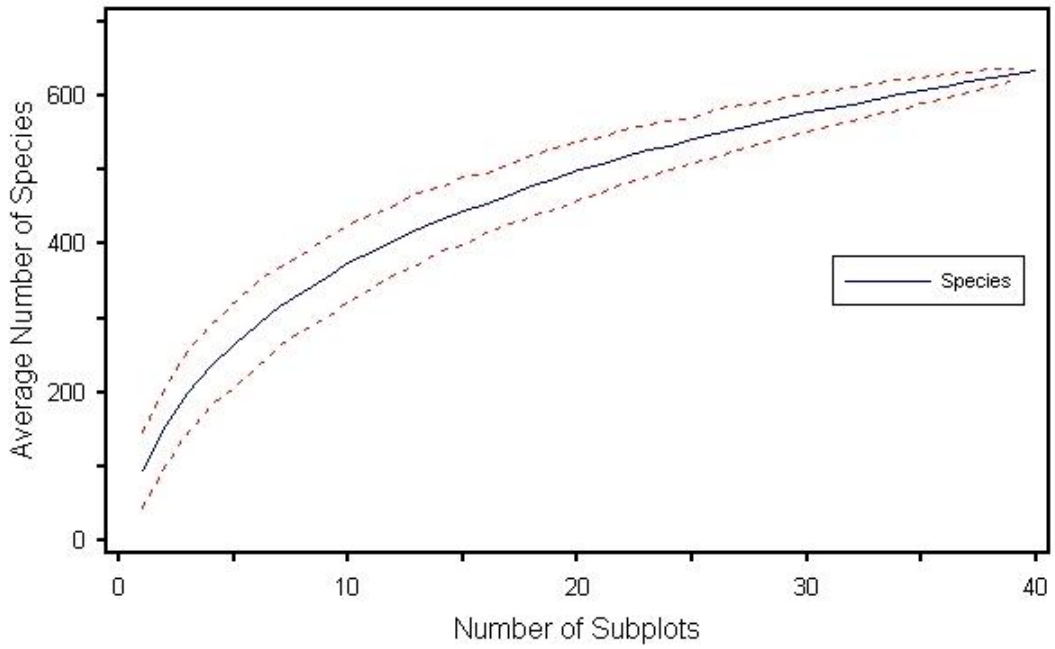


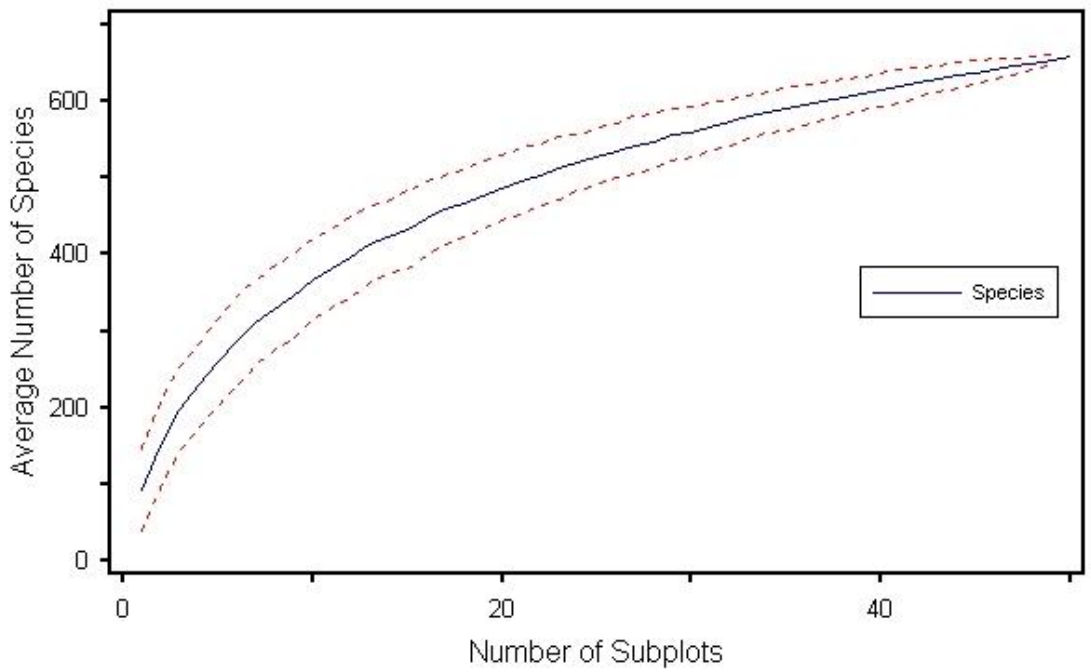
Figure 2. Species area curves for Mammoth Cave National Park a) from only the gridded plots and b) from all full plots.

a)



First-order jackknife estimate of number of species in park = 839.7
Second-order jackknife estimate of number of species in park = 965.2

b)



First-order jackknife estimate of number of species in park = 847.1
Second-order jackknife estimate of number of species in park = 945.0

Table 1. Plots established at Mammoth Cave National Park during our study

Plot Number	Latitude	Longitude	UTM Y Coordinate	UTM X Coordinate	UTM Zone	Datum	Type of Plot
MACA.001	37.205610	-86.249280	4117945.66	566616.34	16	NAD 83	Full
MACA.002	37.227406	-86.248933	4120364.00	566628.00	16	NAD 83	Full
MACA.003	37.205229	-86.221876	4117923.02	569048.46	16	NAD 83	Full
MACA.004	37.227700	-86.221460	4120416.24	569064.89	16	NAD 83	Full
MACA.005	37.183350	-86.194870	4115515.78	571465.57	16	NAD 83	Full
MACA.006	37.205110	-86.194500	4117930.11	571477.89	16	NAD 83	Full
MACA.007	37.227110	-86.194190	4120371.03	571484.64	16	NAD 83	Full
MACA.008	37.182950	-86.167260	4115492.57	573916.74	16	NAD 83	Full
MACA.009	37.204930	-86.167200	4117931.08	573900.64	16	NAD 83	Full
MACA.010	37.226796	-86.166815	4120357.16	573913.45	16	NAD 83	Full
MACA.011	37.248833	-86.166504	4122802.25	573919.54	16	NAD 83	Full
MACA.012	37.138930	-86.140460	4110630.24	576339.90	16	NAD 83	Full
MACA.013	37.159080	-86.140180	4112865.90	576344.51	16	NAD 83	Full
MACA.014	37.182795	-86.139937	4115497.01	576342.23	16	NAD 83	Full
MACA.015	37.204690	-86.139760	4117926.21	576335.89	16	NAD 83	Full
MACA.016	37.226660	-86.139320	4120363.93	576352.79	16	NAD 83	Full
MACA.017	37.138920	-86.113120	4110651.48	578768.16	16	NAD 83	Full
MACA.018	37.160660	-86.112880	4113063.50	578766.93	16	NAD 83	Full
MACA.019	37.182650	-86.112660	4115503.26	578763.63	16	NAD 83	Full
MACA.020	37.204470	-86.112290	4117924.29	578773.80	16	NAD 83	Full
MACA.021	37.226576	-86.111995	4120377.00	578777.00	16	NAD 83	Full
MACA.022	37.138700	-86.085700	4110650.18	581203.76	16	NAD 83	Full
MACA.023	37.160500	-86.085510	4113068.84	581197.32	16	NAD 83	Full
MACA.024	37.182330	-86.085110	4115491.01	581209.47	16	NAD 83	Full
MACA.025	37.204350	-86.085000	4117934.01	581195.65	16	NAD 83	Full
MACA.026	37.226180	-86.084582	4120356.23	581209.29	16	NAD 83	Full
MACA.027	37.136510	-86.058500	4110430.85	583622.00	16	NAD 83	Full
MACA.028	37.160580	-86.058090	4113101.54	583631.91	16	NAD 83	Full
MACA.029	37.182110	-86.057840	4115490.31	583630.37	16	NAD 83	Full
MACA.030	37.204120	-86.057600	4117932.33	583627.39	16	NAD 83	Full
MACA.031	37.226120	-86.057328	4120373.25	583627.24	16	NAD 83	Full
MACA.032	37.247967	-86.057033	4122797.32	583629.31	16	NAD 83	Full
MACA.033	37.204010	-86.030110	4117944.74	586067.01	16	NAD 83	Full
MACA.034	37.247637	-86.029469	4122785.34	586074.25	16	NAD 83	Full
MACA.035	37.245255	-86.243212	4122348.19	567119.69	16	NAD 83	Full
MACA.036	37.215330	-86.259830	4119016.62	565671.73	16	NAD 83	Full
MACA.037	37.128959	-86.092367	4109563.87	580621.97	16	NAD 83	Full
MACA.038	37.241724	-86.035013	4122124.32	585589.25	16	NAD 83	Full
MACA.039	37.164840	-86.109563	4113529.98	579057.12	16	NAD 83	Full
MACA.040	37.212870	-86.098940	4118867.38	579949.62	16	NAD 83	Full

Plot Number	Latitude	Longitude	UTM Y Coordinate	UTM X Coordinate	UTM Zone	Datum	Type of Plot
MACA.041	37.173300	-86.152580	4114433.55	575229.38	16	NAD 83	Full
MACA.042	37.174840	-86.159492	4114598.95	574614.23	16	NAD 83	Full
MACA.043	37.242487	-86.179704	4122088.00	572755.00	16	NAD 83	Full
MACA.044	37.254244	-86.155704	4123411.00	574872.00	16	NAD 83	Full
MACA.045	37.244371	-86.183584	4122294.00	572409.00	16	NAD 83	Full
MACA.046	37.165984	-86.079996	4113682.00	581681.00	16	NAD 83	Full
MACA.047	37.205035	-86.033917	4118055.00	585728.00	16	NAD 83	Full
MACA.048	37.176056	-86.046193	4114829.00	584671.00	16	NAD 83	Quickplot
MACA.049	37.173374	-86.046734	4114531.00	584626.00	16	NAD 83	Quickplot
MACA.050	37.173014	-86.044553	4114493.00	584820.00	16	NAD 83	Quickplot
MACA.051	37.203354	-86.034502	4117868.00	585678.00	16	NAD 83	Quickplot
MACA.052	37.133234	-86.069281	4110058.00	582668.00	16	NAD 83	Quickplot
MACA.053	37.137810	-86.075811	4110560.00	582083.00	16	NAD 83	Quickplot
MACA.054	37.138570	-86.077232	4110643.00	581956.00	16	NAD 83	Quickplot
MACA.055	37.124928	-86.082531	4109125.00	581500.00	16	NAD 83	Quickplot
MACA.056	37.151102	-86.156323	4111968.00	574919.00	16	NAD 83	Quickplot
MACA.057	37.149039	-86.153857	4111741.00	575140.00	16	NAD 83	Quickplot
MACA.058	37.150445	-86.063991	4111972.00	583119.00	16	NAD 83	Quickplot
MACA.059	37.198320	-86.072257	4117276.00	582333.00	16	NAD 83	Quickplot
MACA.060	37.192337	-86.088882	4116598.00	580864.00	16	NAD 83	Quickplot
MACA.061	37.192674	-86.103412	4116623.00	579574.00	16	NAD 83	Quickplot
MACA.062	37.161567	-86.127611	4113152.00	577458.00	16	NAD 83	Quickplot
MACA.063	37.162263	-86.126657	4113230.00	577542.00	16	NAD 83	Quickplot
MACA.064	37.163001	-86.126547	4113312.00	577551.00	16	NAD 83	Quickplot
MACA.065	37.203237	-86.235774	4117692.00	567817.00	16	NAD 83	Quickplot
MACA.066	37.198459	-86.079704	4117285.00	581672.00	16	NAD 83	Quickplot
MACA.067	37.182525	-86.112546	4115489.47	578773.90	16	NAD 83	Quickplot
MACA.068	37.182235	-86.112648	4115457.24	578765.15	16	NAD 83	Quickplot
MACA.069	37.252171	-86.240884	4123117.08	567319.97	16	NAD 83	Full
MACA.070	37.251973	-86.241689	4123094.49	567248.78	16	NAD 83	Full
MACA.071	37.199348	-86.079453	4117383.81	581693.31	16	NAD 83	Quickplot
MACA.072	37.181929	-86.105406	4115429.36	579408.31	16	NAD 83	Quickplot
MACA.073	37.234297	-86.099392	4121244.11	579886.88	16	NAD 83	Quickplot
MACA.074	37.130511	-86.057813	4109765.97	583689.66	16	NAD 83	Quickplot
MACA.075	37.131686	-86.057099	4109896.93	583751.74	16	NAD 83	Quickplot
MACA.076	37.132689	-86.056214	4110009.00	583829.25	16	NAD 83	Quickplot
MACA.077	37.130345	-86.056632	4109748.56	583794.67	16	NAD 83	Quickplot
MACA.078	37.154421	-86.124122	4112362.03	577775.10	16	NAD 83	Quickplot
MACA.079	37.209218	-86.053022	4118501.97	584027.98	16	NAD 83	Quickplot
MACA.080	37.208086	-86.051783	4118377.50	584139.19	16	NAD 83	Quickplot
MACA.081	37.204304	-86.049450	4117960.01	584350.47	16	NAD 83	Quickplot
MACA.082	37.201595	-86.235734	4117509.88	567821.95	16	NAD 83	Quickplot
MACA.083	37.200876	-86.235091	4117430.59	567879.72	16	NAD 83	Quickplot
MACA.084	37.200678	-86.235579	4117408.22	567836.58	16	NAD 83	Quickplot

Plot Number	Latitude	Longitude	UTM Y Coordinate	UTM X Coordinate	UTM Zone	Datum	Type of Plot
MACA.085	37.200646	-86.235745	4117404.53	567821.85	16	NAD 83	Quickplot
MACA.086	37.218150	-86.221261	4119356.90	569091.25	16	NAD 83	Quickplot
MACA.087	37.218536	-86.221438	4119399.62	569075.19	16	NAD 83	Quickplot
MACA.088	37.223069	-86.199439	4119918.77	571022.80	16	NAD 83	Quickplot
MACA.089	37.248614	-86.063145	4122863.73	583086.50	16	NAD 83	Quickplot
MACA.090	37.156743	-86.067571	4112667.59	582794.30	16	NAD 83	Quickplot
MACA.091	37.182650	-86.112660	4115503.26	578763.63	16	NAD 83	Quickplot
MACA.092	37.129846	-86.058467	4109691.60	583632.26	16	NAD 83	Quickplot
MACA.093	37.132689	-86.056214	4110009.00	583829.25	16	NAD 83	Quickplot
MACA.094	37.132689	-86.056214	4110009.00	583829.25	16	NAD 83	Quickplot
MACA.095	37.132689	-86.056214	4110009.00	583829.25	16	NAD 83	Quickplot
MACA.096	37.182766	-86.112790	4115516.00	578752.00	16	NAD 83	Quickplot
MACA.097	37.153093	-86.070682	4112259.87	582522.00	16	NAD 83	Full
MACA.098	37.154997	-86.070523	4112471.27	582534.04	16	NAD 83	Quickplot
MACA.099	37.151570	-86.069766	4112091.71	582605.01	16	NAD 83	Quickplot
MACA.100	37.195584	-86.046211	4116995.41	584647.60	16	NAD 83	Quickplot
MACA.101	37.137930	-86.070645	4110577.77	582541.77	16	NAD 83	Quickplot
MACA.102	37.200379	-86.237042	4117373.95	567707.03	16	NAD 83	Quickplot
MACA.103	37.216713	-86.238238	4119185.23	567586.29	16	NAD 83	Quickplot
MACA.104	37.214477	-86.235823	4118938.88	567802.56	16	NAD 83	Quickplot
MACA.106	37.214554	-86.224507	4118955.57	568806.51	16	NAD 83	Quickplot
MACA.108	37.202995	-86.232950	4117667.13	568067.75	16	NAD 83	Quickplot
MACA.109	37.184577	-86.116503	4115713.84	578420.48	16	NAD 83	Quickplot
MACA.110	37.206516	-86.130621	4118136.14	577145.06	16	NAD 83	Quickplot
MACA.111	37.202020	-86.131196	4117636.90	577098.55	16	NAD 83	Quickplot
MACA.701	37.170178	-86.093090	4114136.00	580514.00	16	NAD 83	Full
MACA.703	37.166171	-86.097294	4113688.00	580145.00	16	NAD 83	Full
MACA.704	37.166994	-86.092869	4113783.00	580537.00	16	NAD 83	Full
MACA.705	37.171184	-86.086849	4114253.00	581067.00	16	NAD 83	Full
MACA.706	37.151011	-86.098634	4112005.00	580042.00	16	NAD 83	Quickplot
MACA.708	37.152793	-86.098241	4112203.00	580075.00	16	NAD 83	Quickplot
MACA.709	37.264666	-86.245461	4124500.00	566903.00	16	NAD 83	Full
MACA.710	37.264025	-86.249607	4124426.00	566536.00	16	NAD 83	Quickplot
MACA.712	37.262035	-86.242860	4124210.00	567136.00	16	NAD 83	Quickplot
MACA.713	37.261609	-86.241082	4124164.00	567294.00	16	NAD 83	Quickplot
MACA.714	37.261304	-86.239856	4124131.00	567403.00	16	NAD 83	Quickplot
MACA.715	37.213760	-86.041616	4119016.00	585035.00	16	NAD 83	Quickplot
MACA.716	37.214536	-86.041775	4119102.00	585020.00	16	NAD 83	Quickplot
MACA.718	37.214694	-86.049065	4119113.00	584373.00	16	NAD 83	Quickplot
MACA.719	37.151020	-86.097440	4112007.00	580148.00	16	NAD 83	Quickplot
MACA.720	37.196338	-86.083989	4117046.00	581294.00	16	NAD 83	Quickplot
MACA.721	37.165324	-86.159792	4113543.00	574597.00	16	NAD 83	Quickplot
MACA.722	37.103826	-86.057284	4106806.00	583766.00	16	NAD 83	Quickplot
MACA.723	37.106044	-86.060723	4107049.00	583458.00	16	NAD 83	Full

Plot Number	Latitude	Longitude	UTM Y Coordinate	UTM X Coordinate	UTM Zone	Datum	Type of Plot
MACA.724	37.106270	-86.060821	4107074.00	583449.00	16	NAD 83	Quickplot
MACA.725	37.168256	-86.077761	4113936.00	581877.00	16	NAD 83	Full
MACA.726	37.168395	-86.076982	4113952.00	581946.00	16	NAD 83	Full
MACA.727	37.200029	-86.034567	4117499.00	585676.00	16	NAD 83	Quickplot
MACA.733	37.203409	-86.129970	4117792.00	577206.00	16	NAD 83	Quickplot
MACA.734	37.201752	-86.131431	4117607.00	577078.00	16	NAD 83	Quickplot
MACA.735	37.170512	-86.155409	4114122.00	574981.00	16	NAD 83	Quickplot
MACA.736	37.165915	-86.158005	4113610.00	574755.00	16	NAD 83	Quickplot
MACA.738	37.173421	-86.152527	4114447.00	575234.00	16	NAD 83	Full
MACA.739	37.178172	-86.155166	4114972.00	574995.00	16	NAD 83	Quickplot
MACA.740	37.178293	-86.157012	4114984.00	574831.00	16	NAD 83	Full
MACA.741	37.148378	-86.064760	4111742.00	583053.00	16	NAD 83	Quickplot
MACA.742	37.150605	-86.076298	4111979.00	582026.00	16	NAD 83	Full
MACA.743	37.130172	-86.144994	4109655.00	575946.00	16	NAD 83	Full
MACA.744	37.196608	-86.072413	4117086.00	582321.00	16	NAD 83	Full
MACA.745	37.165651	-86.084708	4113641.00	581263.00	16	NAD 83	Quickplot
MACA.746	37.186804	-86.162269	4115924.00	574356.00	16	NAD 83	Quickplot
MACA.747	37.186504	-86.163185	4115890.00	574275.00	16	NAD 83	Full
MACA.748	37.189194	-86.121412	4116222.00	577980.00	16	NAD 83	Quickplot
MACA.749	37.125244	-86.083777	4109159.00	581389.00	16	NAD 83	Quickplot
MACA.750	37.127030	-86.086265	4109355.00	581166.00	16	NAD 83	Quickplot
MACA.751	37.128148	-86.086353	4109479.00	581157.00	16	NAD 83	Full

Table 2. List of all plants historically documented at Mammoth Cave National Park

* Vouchered by NatureServe
** First Documented by NatureServe, but not vouchered
^ Probably Present and/or ID questionable, so a voucher needs to be taken.
see note at bottom

Scientific Name (NPSpecies)	Common Name	G-RANK	S-RANK	TSN	Source
Abutilon theophrasti	Velvetleaf	GNR	SNA	21674	Seymour 1999
Acalypha gracilens	Slender Copperleaf	G5	S4S5	28183	NatureServe 2001-2007**
Acalypha rhomboidea	Common Copperleaf	G5	S5	28193	NatureServe 2001-2007
Acalypha virginica	Virginia Copperleaf	G5	S5?	28195	NatureServe 2001-2007
Acer negundo	Box-elder	G5	S5	28749	NatureServe 2001-2007
Acer nigrum	Black Maple	G5	S4	182135	NatureServe 2001-2007
Acer rubrum	Red Maple	G5	S5	28728	NatureServe 2001-2007
Acer rubrum var. trilobum	Carolina Red Maple	G5T5	S4?	182127	NatureServe 2001-2007**
Acer saccharinum	Silver Maple	G5	S5	28757	NatureServe 2001-2007
Acer saccharum	Sugar Maple	G5	S5	28731	NatureServe 2001-2007
Achillea millefolium	Common Yarrow	G5	SNA	35423	NatureServe 2001-2007
Actaea pachypoda	White Baneberry	G5	S5	18722	NatureServe 2001-2007
Actaea racemosa var. racemosa	Black Cohosh	G4T4	SNR	-501896	NatureServe 2001-2007
Adiantum pedatum	Northern Maidenhair	G5	S4	17311	NatureServe 2001-2007
Aesculus flava	Yellow Buckeye	G5	S5	28717	NatureServe 2001-2007
Aesculus glabra var. glabra	Ohio Buckeye	G5T5	S5	28719	NatureServe 2001-2007
Agalinis tenuifolia	Slender False Foxglove	G5	S4	33036	NatureServe 2001-2007
Agastache nepetoides	Yellow Giant-hyssop	G5	S4?	32443	Seymour 1999
Ageratina altissima	White Snakeroot	G5	S5	36466	NatureServe 2001-2007
Ageratina altissima var. altissima	White Snakeroot	G5T5	S5	182398	Imported from ANCS
Ageratina aromatica var. aromatica	Lesser Snakeroot	G5T5	S4	182401	NatureServe 2001-2007
Agrimonia gryposepala	Tall Hairy Groovebur	G5	S1S2	25095	NatureServe 2001-2007
Agrimonia parviflora	Harvest-lice	G5	S5	25098	NatureServe 2001-2007
Agrimonia pubescens	Soft Groovebur	G5	S5	25099	NatureServe 2001-2007
Agrimonia rostellata	Woodland Agrimony	G5	S5	25100	NatureServe 2001-2007
Agrostis elliottiana	Elliott's Bentgrass	G5	SNR	40397	Seymour 1999
Agrostis gigantea	Giant Bentgrass	G4G5	SNA	40414	McKinney, et al. 1991
Agrostis hyemalis	Winter Bentgrass	G5	S4S5	40394	Seymour 1999
Agrostis perennans	Upland Bentgrass	G5	S4S5	40423	NatureServe 2001-2007
Ailanthus altissima	Tree-of-Heaven	GNR	SNA	28827	NatureServe 2001-2007
Albizia julibrissin	Silktree	GNR	SNA	26449	Seymour 1999
Alisma subcordatum	American Water-plantain	G4G5	S4S5	38895	Seymour 1999
Alliaria petiolata	Garlic Mustard	GNR	SNA	184481	NatureServe 2001-2007
Allium canadense	Meadow Garlic	G5	S4	42635	Seymour 1999
Allium cernuum	Nodding Onion	G5	S3S4	42721	Seymour 1999
Allium sativum	Cultivated Garlic	GNR	SNA	42652	Datillo 2006
Allium tricoccum	Ramps	G5	S4	42672	Seymour 1999

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Allium vineale ssp. vineale	Wild Garlic	GNR TNR	SNA	182599	NatureServe 2001-2007
Alnus glutinosa	European Alder	GNR	SNA	19470	McKinney, et al. 1991 ^
Amaranthus albus	Prostrate Pigweed	GNR	S4S5	20719	Medley 1993-1997
Amaranthus retroflexus	Red-root Amaranth	GNR	SNA	20745	Davies 1954
Amaranthus spinosus	Spiny Amaranth	G5	SNA	20748	NatureServe 2001-2007
Ambrosia artemisiifolia	Annual Ragweed	G5	S5	36496	NatureServe 2001-2007
Ambrosia artemisiifolia var. elatior	Annual Ragweed	G5T5	SNR	182420	Seymour 1999
Ambrosia trifida var. trifida	Great Ragweed	G5T5	S5	182422	NatureServe 2001-2007
Amelanchier arborea var. arborea	Common Serviceberry	G5T5	SNR	182037	NatureServe 2001-2007
Amelanchier canadensis	Canada Serviceberry	G5	SNA	25112	McKinney, et al. 1991 ^
Ammannia coccinea	Valley Redstem	G5	S4?	27091	Seymour 1999
Amphicarpaea bracteata	American Hog-peanut	G5	S5	182067	NatureServe 2001-2007
Anagallis arvensis	Scarlet Pimpernel	GNR	SNA	24043	Seymour 1999
Andropogon gerardii	Big Bluestem	G5	S5	40462	NatureServe 2001-2007
Andropogon gyrans var. gyrans	Elliott's Beardgrass	G5T5	S5	182528	NatureServe 2001-2007
Andropogon ternarius	Splitbeard Bluestem	G5	S4	40455	Seymour 1999
Andropogon virginicus var. virginicus	Broomsedge Bluestem	G5T5	S5	182523	NatureServe 2001-2007
Anemone quinquefolia	Nightcaps	G5	S3S4	18448	McKinney, et al. 1991
Anemone virginiana var. virginiana	Tall Thimbleweed	G5T5	S5	181868	NatureServe 2001-2007
Angelica venenosa	Hairy Angelica	G5	S4	29453	NatureServe 2001-2007
Antennaria neglecta	Small Pussytoes	G5 T3T5		185141	NatureServe 2001-2007*
Antennaria plantaginifolia	Pussytoes	G5	S5	36717	NatureServe 2001-2007
Antennaria solitaria	Single-head Pussytoes	G5	S4S5	36756	NatureServe 2001-2007
Anthemis cotula	Stinking Chamomile	G5	SNA	36330	McKinney, et al. 1991
Anthoxanthum odoratum	Sweet Vernal Grass	GNR	SNA	41395	Seymour 1999
Apios americana	Groundnut	G5	S5	25390	NatureServe 2001-2007
Aplectrum hyemale	Adam-and-Eve	G5	S5	43489	NatureServe 2001-2007
Apocynum cannabinum	Indian-hemp	G5	SNA	30157	NatureServe 2001-2007
Aquilegia canadensis	Eastern Columbine	G5	S5	18730	Seymour 1999
Arabidopsis thaliana	Mouse-ear Cress	GNR	SNA	23041	Seymour 1999
Arabis canadensis	Sicklepod	G5	S4	22678	Seymour 1999
Arabis laevigata	Smooth Rockcress	G5	S5	22706	NatureServe 2001-2007
Arabis laevigata var. laevigata	Smooth Rockcress	G5T5	S5	184378	Imported from ANCS
Aralia racemosa ssp. racemosa	American Spikenard	G4G5 T4T5	S4	184743	NatureServe 2001-2007
Aralia spinosa	Devil's Walkingstick	G5	S5	29378	NatureServe 2001-2007
Arctium minus	Lesser Burdock	GNR	SNA	36546	NatureServe 2001-2007
Arisaema dracontium	Green Dragon	G5	S4S5	42529	NatureServe 2001-2007
Arisaema triphyllum	Jack-in-the-Pulpit	G5	S5	42525	NatureServe 2001-2007
Arisaema triphyllum ssp. triphyllum	Jack-in-the-Pulpit	G5T5	SNR	42526	Seymour 1999
Aristida dichotoma	Forktip Three-awn	G5	S4	41415	Seymour 1999
Aristida oligantha	Prairie Three-awn	G5	S4	41405	Seymour 1999

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Aristida purpurascens var. purpurascens	Arrowfeather Three-awn	G5T5	S4S5	185309	Seymour 1999
Aristolochia macrophylla	Pipevine	G5	S4S5	18336	McKinney, et al. 1991
Aristolochia serpentaria	Turpentine-root	G4	S4S5	18342	NatureServe 2001-2007
Aristolochia tomentosa	Woolly Dutchman's Pipe	G5	S4?	18343	Seymour 1999
Arnoglossum atriplicifolium	Pale Indian-plantain	G4G5	S5	36583	Seymour 1999
Arnoglossum muehlenbergii	Great Indian-plantain	G4	S4?	501100	NatureServe 2001-2007
Artemisia annua	Annual Wormwood	GNR	SNA	35448	Seymour 1999
Artemisia ludoviciana ssp. ludoviciana	White Sagebrush	G5T5	SNA	35475	McKinney, et al. 1991
Aruncus dioicus	Bride's-feathers	G5	S4	25130	Seymour 1999
Arundinaria gigantea ssp. gigantea	Giant Cane	G5T5?	SNR	185285	NatureServe 2001-2007
Arundo donax	Giant Reed	G5	SNA	41450	Medley 1993-1997
Asarum canadense	Canadian Wild Ginger	G5	S5	18353	NatureServe 2001-2007
Asclepias amplexicaulis	Clasping Milkweed	G5	S4	30244	Seymour 1999
Asclepias exaltata	Poke Milkweed	G5	S4	30266	McKinney, et al. 1991
Asclepias incarnata	Swamp Milkweed	G5	S5	30241	Seymour 1999
Asclepias purpurascens	Purple Milkweed	G5?	S4	30296	Lix
Asclepias quadrifolia	Fourleaf Milkweed	G5	S4	30297	NatureServe 2001-2007
Asclepias syriaca	Common Milkweed	G5	S5	30310	Seymour 1999
Asclepias tuberosa	Butterfly Milkweed	G5?	S5	30313	NatureServe 2001-2007
Asclepias variegata	Red-ring Milkweed	G5	S4	30319	NatureServe 2001-2007
Asclepias verticillata	Whorled Milkweed	G5	S4?	30320	Seymour 1999
Asclepias viridiflora	Green Comet Milkweed	G5	S4	30322	Seymour 1999
Asimina triloba	Common Pawpaw	G5	S5	18117	NatureServe 2001-2007
Asparagus officinalis	Garden Asparagus	G5?	SNA	42784	Seymour 1999
Asplenium montanum	Mountain Spleenwort	G5	S4S5	17351	NatureServe 2001-2007
Asplenium pinnatifidum	Lobed Spleenwort	G4	S4	17354	Seymour 1999
Asplenium platyneuron	Ebony Spleenwort	G5	S5	17355	NatureServe 2001-2007
Asplenium resiliens	Black-stem Spleenwort	G5	S4	17358	NatureServe 2001-2007
Asplenium rhizophyllum	Walking Fern	G5	S5	17359	NatureServe 2001-2007
Asplenium trichomanes	Maidenhair Spleenwort	G5	S4	17364	NatureServe 2001-2007
Asplenium X trudellii	Spleenwort	GNA	SNR	17367	NatureServe 2001-2007*
Astilbe biternata	Appalachian False Goat's-beard	G4G5	S5	24305	McKinney, et al. 1991
Astranthium integrifolium ssp. integrifolium	Entireleaf Western Daisy	G5TNR	SNR	193411	Seymour 1999
Athyrium filix-femina	Common Ladyfern	G5	S5	17413	NatureServe 2001-2007
Athyrium filix-femina ssp. asplenioides	Southern Ladyfern	G5T5	SNR	17415	NatureServe 2001-2007
Aureolaria flava	Smooth Yellow False Foxglove	G5	S5	33484	NatureServe 2001-2007
Aureolaria patula	Spreading Yellow False Foxglove	G3	S3	33487	McKinney, et al. 1991
Aureolaria virginica	Downy Yellow False Foxglove	G5	S5	33490	NatureServe 2001-2007
Bacopa rotundifolia	Midwestern Water-hyssop	G5	S3S4	33045	Seymour 1999
Barbarea vulgaris	Garden Yellow-rocket	GNR	SNA	22741	Seymour 1999
Bartonia paniculata ssp. paniculata	Twining Screwstem	G5T5	SNR	30021	McKinney, et al. 1991

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Bartonia virginica	Yellow Screwstem	G5	S2	30025	Seymour 1999
Belamcanda chinensis	Blackberry Lily	GNR	SNA	43280	Seymour 1999
Berberis thunbergii	Japanese Barberry	GNR	SNA	18835	Davies 1954
Betula alleghaniensis	Yellow Birch	G5	S5	19481	NatureServe 2001-2007
Betula alleghaniensis var. alleghaniensis	Yellow Birch	G5T5	SNR	183520	McKinney, et al. 1991
Betula lenta	Sweet Birch	G5	S5	19487	McKinney, et al. 1991
Betula nigra	River Birch	G5	S5	19480	McKinney, et al. 1991
Bidens aristosa	Bearded Beggarticks	G5	S5	35713	Seymour 1999
Bidens bipinnata	Spanish-needles	G5	S5	500993	NatureServe 2001-2007
Bidens discoidea	Small Beggarticks	G5	S5?	35719	Seymour 1999
Bidens frondosa	Devil's Pitchfork	G5	S5?	35707	NatureServe 2001-2007
Bidens tripartita	Three-lobe Beggarticks	G5	S5?	35709	Seymour 1999
Bignonia capreolata	Crossvine	G5	S5	34307	NatureServe 2001-2007
Blephilia ciliata	Downy Pagoda Plant	G5	S4	32460	NatureServe 2001-2007
Blephilia hirsuta var. hirsuta	Hairy Pagoda-plant	G5? T5?	SNR	526935	NatureServe 2001-2007
Boehmeria cylindrica	Small-spike False Nettle	G5	S5	19121	NatureServe 2001-2007
Botrychium biternatum	Sparse-lobe Grapefern	G5	S4	17175	NatureServe 2001-2007*
Botrychium dissectum	Cutleaf Grapefern	G5	S5	17171	NatureServe 2001-2007
Botrychium virginianum	Rattlesnake Fern	G5	S5	17173	NatureServe 2001-2007*
Boykinia aconitifolia	Allegheny Brookfoam	G4	S2	24314	Faller 1975
Brachyelytrum erectum	Bearded Shorthusk	G5	S5	41527	NatureServe 2001-2007
Brasenia schreberi	Watershield	G5	S3S4	18370	Seymour 1999
Brassica nigra	Black Mustard	GNR	SNA	23061	Seymour 1999
Brassica rapa	Bird's Rape	GNR	SNA	23063	NatureServe 2001-2007*
Brickellia eupatorioides var. eupatorioides	False Boneset	G5T5	SNR	526976	Seymour 1999
Bromus commutatus	Meadow Brome	GNR	SNA	40497	Seymour 1999
Bromus japonicus	Japanese Brome	GNR	SNA	40479	Seymour 1999
Bromus nottowayanus	Nottoway Valley Brome	G3G5	SNA	40509	NatureServe 2001-2007*
Bromus pubescens	Common Eastern Brome	G5	S5	40514	NatureServe 2001-2007
Bromus racemosus	Bald Brome	GNR	SNA	40516	Seymour 1999
Bromus sterilis	Poverty Brome	GNR	SNA	40522	Seymour 1999
Bromus tectorum	Cheatgrass	GNR	SNA	40524	Seymour 1999
Buchnera americana	Bluehearts	G5?	S3S4	33505	Seymour 1999
Buglossoides arvensis	Corn-gromwell	GNR	SNA	501090	Seymour 1999
Calycanthus floridus var. glaucus	Eastern Sweet-shrub	G5T5	S2	527039	NatureServe 2001-2007
Calystegia sepium	Hedge False Bindweed	G5	SNA	30650	NatureServe 2001-2007
Calystegia sepium ssp. angulata	Hedge False Bindweed	G5T5		30653	Seymour 1999
Calystegia sepium ssp. sepium	Hedge False Bindweed	G5TU	SNA	30651	Lix 1948
Calystegia spithamaea ssp. spithamaea	Low False Bindweed	G4G5 T4T5	SNR	30694	Seymour 1999
Camassia scilloides	Atlantic Camas	G4G5	S4	42892	Seymour 1999
Campanula divaricata	Appalachian Bellflower	G4	S5	34482	NatureServe 2001-2007*
Campanulastrum americanum	American Bellflower	G5	S5	501172	Seymour 1999
Campsis radicans	Trumpetvine	G5	S5	34309	NatureServe 2001-2007
Capsella bursa-pastoris	Common Shepherd's Purse	GNR	SNA	22766	Seymour 1999

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Cardamine angustata	Slender Toothwort	G5	S5	22778	NatureServe 2001-2007
Cardamine bulbosa	Bulbous Bittercress	G5	S4	22769	Seymour 1999
Cardamine concatenata	Cutleaf Toothwort	G5	S5	22787	NatureServe 2001-2007
Cardamine diphylla	Crinkleroot	G5	S5	22792	NatureServe 2001-2007
Cardamine dissecta	Forkleaf Toothwort	G4?	S5	501194	NatureServe 2001-2007
Cardamine douglassii	Limestone Bittercress	G5	S5	22793	NatureServe 2001-2007
Cardamine hirsuta	Hairy Bittercress	GNR	SNA	22797	NatureServe 2001-2007
Cardamine parviflora var. arenicola	Sand Bittercress	G5T5	SNR	527059	Seymour 1999
Cardamine pensylvanica	Quaker Bittercress	G5	S5	22772	Seymour 1999
Cardamine rotundifolia	American Bittercress	G4	S3S4	22810	Seymour 1999
Carduus nutans	Musk Thistle	GNR	SNA	35787	NatureServe 2001-2007
Carex albicans var. albicans	White-tinge Sedge	G5 T4T5	SNR	527064	NatureServe 2001-2007
Carex albicans var. australis	White-tinge Sedge	G5T5	SNR	527065	McKinney, et al. 1991
Carex albicans var. emmonsii	Emmons' Sedge	G5T5	S3?	527066	Seymour 1999
Carex albursina	White Bear Sedge	G5	S5?	39487	NatureServe 2001-2007
Carex amphibola	Eastern Narrowleaf Sedge	G5	S5	39491	NatureServe 2001-2007
Carex blanda	Eastern Sedge	G5?	S5	39379	NatureServe 2001-2007
Carex brevior	Short-beak Sedge	G5?	SNA	39451	Seymour 1999
Carex careyana	Carey's Sedge	G4G5	S4?	39541	Seymour 1999
Carex cephalophora	Oval-leaf Sedge	G5	S5	39383	NatureServe 2001-2007
Carex communis	Fibrous-root Sedge	G5	S5	39550	McKinney, et al. 1991
Carex comosa	Longhair Sedge	G5	SH	39384	NatureServe 2001-2007**
Carex complanata	Hirsute Sedge	G5	S3?	39551	Seymour 1999
Carex crinita	Fringed Sedge	G5	S5	39385	NatureServe 2001-2007
Carex crinita var. crinita	Fringed Sedge	G5T5	SNR	39388	Imported from ANCS
Carex decomposita	Decomposite Sedge	G3	S2	39389	Seymour 1999
Carex digitalis	Slender Wood Sedge	G5	S5	39576	NatureServe 2001-2007
Carex eburnea	Bristleleaf Sedge	G5	S4	39581	McKinney, et al. 1991
Carex flaccosperma	Thin-fruit Sedge	G5	S5	39605	McKinney, et al. 1991
Carex frankii	Frank's Sedge	G5	S5	39393	Seymour 1999
Carex glaucodea	Blue Sedge	G5	SNR	39616	NatureServe 2001-2007
Carex gracilescens	Slender Sedge	G5?	S5	39618	NatureServe 2001-2007
Carex grayi	Gray's Sedge	G4	S5	39622	NatureServe 2001-2007
Carex gynandra	Nodding Sedge	G5	S5	39623	Seymour 1999
Carex hirsutella	Fuzzy-wuzzy Sedge	G5	S5	39636	NatureServe 2001-2007
Carex hirtifolia	Pubescent Sedge	G5	S4	39638	NatureServe 2001-2007
Carex jamesii	James' Sedge	G5	S5	39404	Seymour 1999
Carex laevivaginata	Smooth-sheath Sedge	G5	S5	39410	Seymour 1999
Carex laxiculmis	Spreading Sedge	G5	S3S4	39411	Seymour 1999
Carex laxiflora	Loose-flower Sedge	G5	S5	39662	NatureServe 2001-2007
Carex lupulina	Hop Sedge	G5	S5	39413	Seymour 1999
Carex lurida	Sallow Sedge	G5	S5	39414	NatureServe 2001-2007
Carex meadii	Mead's Sedge	G4G5	S4?	39686	Imported from ANCS
Carex muehlenbergii var. enervis	Muhlenberg's Sedge	G5T5	SNR	527128	Seymour 1999
Carex nigromarginata	Black-edge Sedge	G5	S4?	39719	Seymour 1999
Carex oligocarpa	Richwoods Sedge	G4	S5?	39728	NatureServe 2001-2007
Carex pensylvanica	Pennsylvania Sedge	G5	S5	39749	NatureServe 2001-2007
Carex picta	Painted Sedge	G4G5	S3S4	39755	NatureServe 2001-2007

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Carex plantaginea	Plantainleaf Sedge	G5	S5	39759	Imported from ANCS
Carex platyphylla	Broadleaf Sedge	G5	S5	39761	NatureServe 2001-2007
Carex retroflexa	Reflexed Sedge	G5	S5	39782	NatureServe 2001-2007
Carex rosea	Rosy Sedge	G5	S5	39429	NatureServe 2001-2007
Carex squarrosa	Squarrose Sedge	G4G5	S5	39815	Seymour 1999
Carex striatula	Lined Sedge	G4G5	S3S4	39822	Seymour 1999
Carex stricta	Tussock Sedge	G5	S3?	39435	Seymour 1999
Carex styloflexa	Bent Sedge	G4G5	S3S4	39823	NatureServe 2001-2007*
Carex swanii	Swan's Sedge	G5	S5?	39437	NatureServe 2001-2007
Carex texensis	Texas Sedge	G5	S5?	39842	Seymour 1999
Carex tribuloides	Blunt Broom Sedge	G5	S5	39438	NatureServe 2001-2007
Carex typhina	Cattail Sedge	G5	S5	39439	Seymour 1999
Carex virescens	Ribbed Sedge	G5	S5	39867	NatureServe 2001-2007
Carex vulpinoidea	Fox Sedge	G5	S5	39442	NatureServe 2001-2007*
Carex willdenowii	Willdenow's Sedge	G5	S4S5	39443	McKinney, et al. 1991
Carpinus caroliniana	American Hornbeam	G5	S5	19504	NatureServe 2001-2007
Carpinus caroliniana ssp. virginiana	American Hornbeam	G5T5	SNR	184202	Seymour 1999
Carya alba	Mockernut Hickory	G5	S4	501306	NatureServe 2001-2007
Carya cordiformis	Bitternut Hickory	G5	S5	19227	NatureServe 2001-2007
Carya glabra	Pignut Hickory	G5	S5	19231	NatureServe 2001-2007
Carya illinoinensis	Pecan	G5	S3S4	19234	McKinney, et al. 1991
Carya laciniosa	Shellbark Hickory	G5	S5	19235	McKinney, et al. 1991
Carya ovalis	Red Hickory	G5	S4?	19241	NatureServe 2001-2007
Carya ovata	Shagbark Hickory	G5	S5	19243	NatureServe 2001-2007
Carya pallida	Sand Hickory	G5	S4	19244	NatureServe 2001-2007*
Castanea dentata	American Chestnut	G4	S1?	19454	NatureServe 2001-2007
Caulophyllum thalictroides	Blue Cohosh	G4G5	S4S5	18840	NatureServe 2001-2007
Ceanothus americanus	New Jersey-tea	G5	S5	28454	NatureServe 2001-2007
Celastrus scandens	American Bittersweet	G5	S5	27974	NatureServe 2001-2007
Celtis laevigata	Sugarberry	G5	S5	19042	NatureServe 2001-2007**
Celtis occidentalis	Common Hackberry	G5	S5	19040	NatureServe 2001-2007
Celtis tenuifolia	Georgia Hackberry	G5	S5	19046	NatureServe 2001-2007
Centaurea biebersteinii	Spotted Knapweed	GNR	SNA	501347	Seymour 1999
Centaurium pulchellum	Branched Centaury	GNR	SNA	30036	McKinney, et al. 1991
Cephalanthus occidentalis	Common Buttonbush	G5	S5	34786	NatureServe 2001-2007
Cerastium fontanum ssp. vulgare	Common Mouse-ear Chickweed	GNR TNR	SNA	523831	Seymour 1999
Cerastium glomeratum	Sticky Mouse-ear Chickweed	GNR	SNA	19955	Seymour 1999
Cerastium nutans var. nutans	Nodding Chickweed	G5T5?	SNR	527239	NatureServe 2001-2007**
Cercis canadensis var. canadensis	Eastern Redbud	G5T5	SNR	527241	NatureServe 2001-2007
Chaerophyllum procumbens	Spreading Chervil	G5	S5	29616	Seymour 1999
Chaerophyllum tainturieri var. tainturieri	Hairy-fruit Chervil	G4G5 T4T5	SNR	527258	NatureServe 2001-2007
Chamaecrista fasciculata var. fasciculata	Sleepingplant	G5 T4T5	SNR	566216	NatureServe 2001-2007

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Chamaecrista nictitans ssp. nictitans var. nictitans	Sensitive Partridge-pea	G5T5	SNR	531597	NatureServe 2001-2007
Chamaelirium luteum	Fairywand	G5	S4	42894	NatureServe 2001-2007
Chamaesyce humistrata	Spreading Sandmat	G4G5	S5	501428	Seymour 1999
Chamaesyce maculata	Spotted Sandmat	G5?	S5	565061	NatureServe 2001-2007
Chamaesyce nutans	Eyebane	G5	S5	501442	Imported from ANCS
Chasmanthium latifolium	River-oats	G5	S5	41547	NatureServe 2001-2007
Chasmanthium laxum	Slender Spikegrass	G5	S5	41548	NatureServe 2001-2007**
Cheilanthes lanosa	Hairy Lipfern	G5	S5	17448	Seymour 1999
Chelone glabra	White Turtlehead	G5	S4S5	33182	NatureServe 2001-2007
Chelone obliqua	Red Turtlehead	G4	S3S4	33185	McKinney, et al. 1991
Chenopodium ambrosioides var. ambrosioides	Mexican Tea or Wormseed Goosefoot	GNR TNR	SNA	527311	NatureServe 2001-2007
Chimaphila maculata	Striped Pipsissewa	G5	S5	23767	NatureServe 2001-2007
Chionanthus virginicus	Fringetree	G5	S4	32950	NatureServe 2001-2007**
Cichorium intybus	Chicory	GNR	SNA	36763	Seymour 1999
Cicuta maculata var. maculata	Spotted Water-hemlock	G5T5	SNR	182151	Seymour 1999
Cinna arundinacea	Sweet Woodreed	G5	S5	40583	Seymour 1999
Circaea lutetiana ssp. canadensis	Broadleaf Enchanter's-nightshade	G5T5	SNR	27569	NatureServe 2001-2007
Cirsium altissimum	Tall Thistle	G5	S5	36337	NatureServe 2001-2007
Cirsium carolinianum	Soft Thistle	G5	S3S4	36352	NatureServe 2001-2007
Cirsium discolor	Field Thistle	G5	SNR	36362	NatureServe 2001-2007
Cirsium virginianum	Virginia Thistle	G3	SNA	36427	McKinney, et al. 1991
Cirsium vulgare	Bull Thistle	GNR	SNA	36428	NatureServe 2001-2007
Claytonia virginica	Virginia Springbeauty	G5	S5	20382	NatureServe 2001-2007
Clematis glaucophylla	Whiteleaf Leatherflower	G4?	S3?	18698	NatureServe 2001-2007
Clematis terniflora	Sweet Autumn Virgin's-bower	GNR	SNA	18712	Converted from MACA ANCS by CUPN 2007
Clematis versicolor	Pale Leather Flower	G4?	S4?	18714	Seymour 1999
Clematis viorna	Vasevine	G5	S4S5	18715	McKinney, et al. 1991
Clematis virginiana	Virgin's-bower	G5	S5	18716	NatureServe 2001-2007
Cleome hassleriana	Pink Queen	GNR	SNA	501583	Throne 1956
Clinopodium vulgare	Wild Basil	G5	SNA	501592	Seymour 1999
Clitoria mariana	Atlantic Pigeonwings	G5	S4	26542	Seymour 1999
Collinsonia canadensis	Richweed	G5	S5	32474	NatureServe 2001-2007
Comandra umbellata ssp. umbellata	Bastard Toadflax	G5T5	S4	523880	Seymour 1999
Commelina communis	Asiatic Dayflower	G5	SNA	39127	NatureServe 2001-2007
Commelina virginica	Swamp Dayflower	G5	S5	39128	NatureServe 2001-2007
Conium maculatum	Poison-hemlock	G5	SNA	29473	Seymour 1999
Conoclinium coelestinum	Blue Mistflower	G5	S5	511282	NatureServe 2001-2007
Conopholis americana	American Cancer-root	G5	S5	34274	NatureServe 2001-2007
Convolvulus arvensis	Field Bindweed	GNR	SNA	30705	Seymour 1999
Conyza canadensis	Canada Horseweed	G5	S5	37113	NatureServe 2001-2007
Conyza canadensis var. pusilla	Canada Horseweed	G5T5	SNR	527478	Faller 1975

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Corallorrhiza odontorhiza	Autumn Coralroot	G5	S4S5	43525	NatureServe 2001-2007**
Corallorrhiza wisteriana	Spring Coralroot	G5	S5	43528	Seymour 1999
Coreopsis auriculata	Lobed Tickseed	G5	S5	37124	Seymour 1999
Coreopsis lanceolata	Lanceleaf Tickseed	G5	SNA	37139	Seymour 1999
Coreopsis major	Greater Tickseed	G5	S5	37143	NatureServe 2001-2007
Coreopsis tripteris	Tall Tickseed	G5	S5	37154	NatureServe 2001-2007
Cornus alternifolia	Alternate-leaf Dogwood	G5	SNR	27813	NatureServe 2001-2007**
Cornus amomum	Silky Dogwood	G5	S5	27799	Seymour 1999
Cornus drummondii	Roughleaf Dogwood	G5	S5	27807	Medley 1993-1997
Cornus florida	Flowering Dogwood	G5	S5	27806	NatureServe 2001-2007
Cornus foemina	Stiff Dogwood	G5	S5	27803	NatureServe 2001-2007**
Coronilla varia	Purple Crown-vetch	GNR	SNA	26553	NatureServe 2001-2007
Corydalis flavula	Yellow Fumewort	G5	S5	19005	NatureServe 2001-2007*
Corylus americana	American Hazelnut	G5	S5	19506	NatureServe 2001-2007
Crataegus marshallii	Parsleyleaf Haw	G5	SNA	24584	NatureServe 2001-2007**
Croton capitatus	Hogwort	G5	S4?	28266	Seymour 1999
Croton monanthogynus	Prairie-tea	G5	S5	28283	NatureServe 2001-2007
Croton willdenowii	Broadleaf Rushfoil	G5	S3S4	506921	Seymour 1999
Cryptotaenia canadensis	Canada Honewort	G5	S5	29475	NatureServe 2001-2007
Cuphea viscosissima	Blue Waxweed	G5?	S4?	501842	Seymour 1999
Cuscuta gronovii	Scaldweed	G5	S5	30712	Seymour 1999
Cynanchum laeve	Honeyvine	G5	S5	501893	NatureServe 2001-2007
Cynodon dactylon	Bermuda Grass	GNR	SNA	41619	NatureServe 2001-2007
Cynoglossum virginianum var. virginianum	Wild Comfrey	G5T5	S5	527625	NatureServe 2001-2007
Cyperus echinatus	Globe Flatsedge	G5	S5?	501920	Seymour 1999
Cyperus flavescens	Yellow Flatsedge	G5	S5	39891	Seymour 1999
Cyperus odoratus	Rusty Flatsedge	G5	S5	39894	Seymour 1999
Cyperus pseudovegetus	Marsh Flatsedge	G5	S5?	39896	Seymour 1999
Cyperus retrofractus	Rough Flatsedge	G5	S5?	39961	Seymour 1999
Cyperus retrorsus var. retrorsus	Pine Barren Flat Sedge	G5T5	SNR	527646	Seymour 1999
Cyperus squarrosus	Awned Flatsedge	G5	S4?	501940	Seymour 1999
Cyperus strigosus	Straw-colored Flatsedge	G5	S5	39901	Seymour 1999
Cypripedium parviflorum var. parviflorum	Lesser Yellow Lady's-slipper	G5T3T5	S2	-502207	McKinney, et al. 1991 ^ #
Cypripedium parviflorum var. pubescens	Greater Yellow Lady's-slipper	G5T5	S4	566231	NatureServe 2001-2007
Cystopteris bulbifera	Bulblet Bladderfern	G5	S5	17481	Seymour 1999
Cystopteris fragilis	Fragile Fern	G5	SNA	17482	NatureServe 2001-2007
Cystopteris protrusa	Lowland Bladderfern	G5	S5	17485	NatureServe 2001-2007
Cystopteris tennesseensis	Tennessee Bladderfern	G5	S4?	17486	Imported from ANCS
Cystopteris tenuis	Upland Brittle Bladderfern	G4G5	S2S3	501961	NatureServe 2001-2007
Dactylis glomerata ssp. glomerata	Orchard Grass	GNR TNR	SNA	193447	Seymour 1999
Danthonia compressa	Flattened Oatgrass	G5	S3S4	41637	Seymour 1999
Danthonia spicata	Poverty Oatgrass	G5	S5	41642	NatureServe 2001-2007

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Dasistoma macrophylla	Mullein Foxglove	G4	S4?	33581	Seymour 1999
Datura stramonium	Jimsonweed	GU	SNA	30520	NatureServe 2001-2007
Daucus carota	Queen Anne's-lace	GNR	SNA	29477	NatureServe 2001-2007
Delphinium tricorne	Dwarf Larkspur	G5	S5	18515	NatureServe 2001-2007
Dennstaedtia punctilobula	Eastern Hay-scented Fern	G5	S4?	17491	NatureServe 2001-2007
Deparia acrostichoides	Silver False Spleenwort	G5	S5	501994	Seymour 1996
Desmodium canadense	Showy Tick-trefoil	G5	SNA	25791	McKinney, et al. 1991 ^
Desmodium canescens	Hoary Tick-trefoil	G5	SNR	25792	NatureServe 2001-2007
Desmodium ciliare	Hairy Small-leaf Tick-trefoil	G5	SNR	25793	Seymour 1999
Desmodium cuspidatum	Largebract Tick-trefoil	G5	SNR	25795	Seymour 1999
Desmodium glabellum	Dillenius' Tick-trefoil	G5	SNR	25799	NatureServe 2001-2007
Desmodium glutinosum	Large Tick-trefoil	G5	S5	25800	NatureServe 2001-2007
Desmodium laevigatum	Smooth Tick-trefoil	G5	SNR	25806	NatureServe 2001-2007
Desmodium marilandicum	Maryland Tick-trefoil	G5	S5	25809	Seymour 1999
Desmodium nudiflorum	Naked-flower Tick-trefoil	G5	S5	25812	NatureServe 2001-2007
Desmodium obtusum	Stiff Tick-trefoil	G4G5	SNR	502019	NatureServe 2001-2007
Desmodium paniculatum var. paniculatum	Narrowleaf Tick-trefoil	G5T5	SNR	527679	NatureServe 2001-2007
Desmodium pauciflorum	Few-flower Tick-trefoil	G5	SNR	25816	NatureServe 2001-2007
Desmodium perplexum	Perplexed Tick-trefoil	G5	SNR	25785	Seymour 1999
Desmodium rotundifolium	Prostrate Tick-trefoil	G5	S5	502020	NatureServe 2001-2007
Desmodium sessilifolium	Sessileleaf Tick-trefoil	G5	SNR	25827	Seymour 1999
Desmodium viridiflorum	Velvety Tick-trefoil	G5?	SNR	25833	NatureServe 2001-2007
Dianthus armeria	Deptford-pink	GNR	SNA	20276	NatureServe 2001-2007
Diarrhena americana	American Beakgrain	G4?	S5	41644	NatureServe 2001-2007
Dicentra canadensis	Squirrel-corn	G5	S5	18943	Seymour 1999
Dicentra cucullaria	Dutchman's Breeches	G5	S5	18945	NatureServe 2001-2007
Dichanthelium aciculare	Needleleaf Rosette Grass	G4G5	S3?	41653	NatureServe 2001-2007*
Dichanthelium acuminatum var. acuminatum	Tapered Rosette Grass	G5T5	SNR	527684	NatureServe 2001-2007*
Dichanthelium acuminatum var. fasciculatum	Tapered Rosette Grass	G5T5	SNR	527685	Seymour 1999
Dichanthelium boscii	Bosc's Witchgrass	G5	SNR	41655	NatureServe 2001-2007
Dichanthelium clandestinum	Deer-tongue Witchgrass	G5?	SNR	41656	NatureServe 2001-2007
Dichanthelium commutatum	Variable Rosette Grass	G5	SNR	41647	NatureServe 2001-2007
Dichanthelium depauperatum	Starved Witchgrass	G5	SNR	41658	NatureServe 2001-2007
Dichanthelium dichotomum	Witchgrass	G5	SNR	41659	NatureServe 2001-2007
Dichanthelium dichotomum var. dichotomum	Witchgrass	G5T5	SNR	527691	NatureServe 2001-2007
Dichanthelium dichotomum var. ramulosum	Witchgrass	G5TNR	SNR	-15	NatureServe 2001-2007*
Dichanthelium latifolium	Broadleaf Rosette Grass	G5	SNR	41648	NatureServe 2001-2007
Dichanthelium laxiflorum	Open-flower Rosette Grass	G5	SNR	41661	NatureServe 2001-2007
Dichanthelium oligosanthes var. oligosanthes	Few-flower Witchgrass	G5T5	SNR	527695	Seymour 1999
Dichanthelium oligosanthes var. scribnerianum	Few-flower Witchgrass	G5T5	SNR	527696	McKinney, et al. 1991
Dichanthelium ravenelii	Ravenel's Rosette Grass	G5	SNR	41669	NatureServe 2001-2007
Dichanthelium sphaerocarpon	Roundfruit Witchgrass	G5	SNR	41671	NatureServe 2001-2007

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Dichanthelium sphaerocarpon var. isophyllum	Round-seed Rosette Grass	G5T5	SNR	527701	NatureServe 2001-2007
Dichanthelium sphaerocarpon var. sphaerocarpon	Roundfruit Witchgrass	G5T5	SNR	527702	NatureServe 2001-2007**
Dichanthelium villosissimum var. villosissimum	White-hair Witchgrass	G5T5	S3S4	527707	NatureServe 2001-2007*
Digitaria filiformis	Slender Crabgrass	G5	S4?	40608	Seymour 1999
Digitaria ischaemum	Smooth Crabgrass	GNR	SNA	40637	McKinney, et al. 1991
Digitaria sanguinalis	Hairy Crabgrass	G5	SNA	40604	Seymour 1999
Diodia teres var. teres	Poorjoe or Rough Buttonweed	G5T5	SNR	527722	Seymour 1999
Diodia virginiana	Virginia Buttonweed	G5	S5	34790	NatureServe 2001-2007
Dioscorea oppositifolia	Chinese Yam	GNR	SNA	502075	Seymour 1999
Dioscorea quaternata	Fourleaf Yam	G5	S5	43371	NatureServe 2001-2007
Dioscorea villosa	Wild Yam	G4G5	S5	43367	NatureServe 2001-2007**
Diospyros virginiana	Eastern Persimmon	G5	S5	23855	NatureServe 2001-2007
Diplazium pycnocarpon	Glade Fern	G5	S4?	502095	Seymour 1999
Diplotaxis tenuifolia	Perennial Wallrocket	GNR	SNA	502098	NatureServe 2001-2007*
Dipsacus fullonum	Fuller's Teasel	GNR	SNA	35404	McKinney, et al. 1991
Dipsacus fullonum ssp. sylvestris	Fuller's Teasel	GNA	SNA	524924	Seymour 1999
Dirca palustris	Leatherwood	G4	S4	27129	Seymour 1999
Dodecatheon frenchii	French's Shootingstar	G3	S3	502108	Seymour 1996
Dodecatheon meadia	Pride-of-Ohio	G5	S5	23969	Seymour 1999
Doellingeria infirma	Cornel-leaf Whitetop	G5	S4S5	508087	Seymour 1999
Doellingeria umbellata var. umbellata	Parasol Whitetop	G5T5	SNR	566233	Seymour 1999
Draba brachycarpa	Shortpod Draba	G4G5	S4?	22865	McKinney, et al. 1991
Draba verna	Spring Whitlow-grass	GNR	SNA	22923	Seymour 1999
Dryopteris carthusiana	Spinulose Woodfern	G5	S3	502157	Lix 1947
Dryopteris goldiana	Goldie's Woodfern	G4	S4	17537	Imported from ANCS
Dryopteris intermedia	Intermediate Woodfern	G5	S5	17538	NatureServe 2001-2007
Dryopteris marginalis	Marginal Woodfern	G5	S5	17541	NatureServe 2001-2007
Duchesnea indica	Indian-strawberry	G5	SNA	25163	NatureServe 2001-2007
Dulichium arundinaceum	Threeway Sedge	G5	S3S4	40009	NatureServe 2001-2007
Echinacea pallida	Pale Purple Coneflower	G4	SNA	37279	NatureServe 2001-2007
Echinacea purpurea	Eastern Purple Coneflower	G4	S4	37281	McKinney, et al. 1991
Echinochloa crus-galli	Large Barnyard Grass	GNR	SNA	502210	Seymour 1999
Echinochloa muricata	Rough Barnyard Grass	G5	S5	40672	McKinney, et al. 1991
Echinochloa muricata var. microstachya	Rough Barnyard Grass	G5T5	SNR	527841	Seymour 1999
Eclipta prostrata	False Daisy	G5	S4S5	196226	Seymour 1999
Elaeagnus umbellata var. parvifolia	Autumn Olive	GNR TNR	SNA	527844	NatureServe 2001-2007
Eleocharis engelmannii	Engelmann's Spikerush	G4G5Q	S5	502237	Seymour 1999
Eleocharis erythropoda	Bald Spikerush	G5	S5?	40043	Seymour 1999
Eleocharis obtusa	Blunt Spikerush	G5	S5	40017	Seymour 1996
Eleocharis ovata	Ovate Spikerush	G5	S4?	40061	McKinney 1988

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Eleocharis palustris	Marsh Spikerush	G5	S4?	40019	McKinney, et al. 1991
Eleocharis quadrangulata	Squarestem Spikerush	G4	S5	40021	McKinney, et al. 1991
Eleocharis tenuis	Slender Spikerush	G5	S5	40070	NatureServe 2001-2007
Elephantopus carolinianus	Carolina Elephant's-foot	G5	S5	37297	NatureServe 2001-2007
Eleusine indica	India Goosegrass	GNR	SNA	41692	Seymour 1999
Elymus hystrix	Bottlebrush Grass	G5	S5	40698	NatureServe 2001-2007
Elymus hystrix var. hystrix	Bottlebrush Grass	G5T5	SNR	527866	NatureServe 2001-2007**
Elymus villosus	Hairy Wild Rye	G5	S5	40714	NatureServe 2001-2007
Elymus virginicus var. virginicus	Virginia Wild Rye	G5T5	SNR	527870	Seymour 1999
Enemion biternatum	Eastern False Rue-anemone	G5	S5	18769	NatureServe 2001-2007
Epifagus virginiana	Beechdrops	G5	S5	34276	NatureServe 2001-2007
Equisetum arvense	Field Horsetail	G5	S5	17152	McKinney, et al. 1991
Equisetum hyemale var. affine	Common Scouring-rush	G5T5	SNR	527892	Converted from MACA ANCS by CUPN 2007
Eragrostis cilianensis	Stinkgrass	GNR	SNA	40719	Seymour 1999
Eragrostis frankii	Sandbar Lovegrass	G5	S5	40741	Seymour 1999
Eragrostis hypnoides	Creeping Lovegrass	G5	S5	40721	Seymour 1999
Eragrostis pectinacea var. pectinacea	Purple Lovegrass	G5T5	SNR	527900	Seymour 1999
Eragrostis spectabilis	Purple Lovegrass	G5	S5?	40717	NatureServe 2001-2007
Erechtites hieraciifolia var. hieraciifolia	American Burnweed	G5T5	SNR	196276	NatureServe 2001-2007
Erigenia bulbosa	Harbinger-of-Spring	G5	S5	29661	Seymour 1999
Erigeron annuus	Eastern Daisy Fleabane	G5	S5	35804	NatureServe 2001-2007
Erigeron philadelphicus	Philadelphia Fleabane	G5	S5	35809	NatureServe 2001-2007
Erigeron pulchellus	Robin's-plantain	G5	S5	35808	NatureServe 2001-2007
Erigeron strigosus	Prairie Fleabane	G5	S5	35951	NatureServe 2001-2007
Eryngium yuccifolium	Rattlesnake-master	G5	S4?	29506	NatureServe 2001-2007
Erythronium albidum	Small White Fawn-lily	G5	S5	42927	NatureServe 2001-2007
Erythronium americanum ssp. americanum	Yellow Trout-lily	G5T5	SNR	196366	NatureServe 2001-2007
Euonymus americana	American Strawberry-bush	G5	S5	502577	NatureServe 2001-2007
Euonymus atropurpurea	Eastern Wahoo	G5	S5	502579	NatureServe 2001-2007
Eupatorium album var. album	WhteThoroughwort	G5T5	SNA	528105	NatureServe 2001-2007
Eupatorium album var. glandulosum	White Thoroughwort	G5 T3T5Q	SNR	528106	Seymour 1999
Eupatorium altissimum	Tall Thoroughwort	G5	S5	502498	Seymour 1999
Eupatorium dubium	Coastal Plain Joe-pyeweed	G5		502508	Seymour 1999
Eupatorium fistulosum	Trumpetweed	G5?	S5	502509	NatureServe 2001-2007
Eupatorium hyssopifolium	Hyssopleaf Thoroughwort	G5	S5	35979	Seymour 1999
Eupatorium hyssopifolium var. laciniatum	Hyssopleaf Thoroughwort	G5 T4T5	S4?	528110	Seymour 1999
Eupatorium perfoliatum var. perfoliatum	Common Boneset	G5T5	SNR	528117	Seymour 1999
Eupatorium pilosum	Rough Boneset	G5	S5?	35997	McKinney, et al. 1991
Eupatorium purpureum var. purpureum	Purple Joe-pyeweed	G5T5?	S5	528118	NatureServe 2001-2007

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Eupatorium rotundifolium	Roundleaf Thoroughwort	G5	S5	36001	NatureServe 2001-2007
Eupatorium rotundifolium var. ovatum	Roundleaf Thoroughwort	G5T5	S5	528120	Seymour 1999
Eupatorium rotundifolium var. rotundifolium	Roundleaf Thoroughwort	G5T5	S5	528121	NatureServe 2001-2007**
Eupatorium serotinum	Late Thoroughwort	G5	S5	35981	NatureServe 2001-2007
Eupatorium sessilifolium	Upland Boneset	G5	S5	36004	NatureServe 2001-2007
Eupatorium X truncatum	Thoroughwort	GNA	SNR	502529	Seymour 1999
Euphorbia commutata	Tinted Woodland Spurge	G5	S4	28054	NatureServe 2001-2007
Euphorbia corollata	Flowering Spurge	G5	S5	28057	NatureServe 2001-2007
Euphorbia dentata var. dentata	Toothed Spurge	G5T5?	SNR	566240	Seymour 1999
Euphorbia heterophylla	Mexican-Fireplant	G5	SNA	28079	Seymour 1999
Eurybia divaricata	White Wood-aster	G5	S5	513440	NatureServe 2001-2007
Eurybia macrophylla	Largeleaf Wood-aster	G5	S5	513449	Seymour 1999
Euthamia graminifolia var. graminifolia	Flat-top Goldentop	G5T5	SNA	528138	Seymour 1996
Fagus grandifolia	American Beech	G5	S5	19462	NatureServe 2001-2007
Festuca rubra	Red Fescue	G5	SNR	40796	Seymour 1999
Festuca subverticillata	Nodding Fescue	G5	SNA	502612	NatureServe 2001-2007
Fimbristylis autumnalis	Slender Fimbry	G5	S5	40111	Seymour 1999
Fragaria virginiana	Virginia Strawberry	G5	S5	24639	NatureServe 2001-2007
Fragaria virginiana ssp. grayana	Virginia Strawberry	G5 T4T5	SNR	24642	Seymour 1999
Frangula caroliniana	Carolina Buckthorn	G5	SNR	506986	NatureServe 2001-2007
Frasera caroliniensis	American Columbo	G5	S5	502651	NatureServe 2001-2007
Fraxinus americana	White Ash	G5	S5	32931	NatureServe 2001-2007
Fraxinus nigra	Black Ash	G5	SNA	32945	McKinney, et al. 1991
Fraxinus pennsylvanica	Green Ash	G5	S5	32929	NatureServe 2001-2007
Fraxinus quadrangulata	Blue Ash	G5	S5	32947	NatureServe 2001-2007
Galactia volubilis	Downy Milkpea	G5	S5	26703	NatureServe 2001-2007
Galearis spectabilis	Showy Orchid	G5	S5	43591	NatureServe 2001-2007
Galinsoga quadriradiata	Fringed Quickweed	GNR	SNA	37415	Seymour 1999
Galium aparine	Sticky Willy	G5	S5	34797	NatureServe 2001-2007
Galium asprellum	Rough Bedstraw	G5	SNA	34798	McKinney, et al. 1991 ^
Galium circaezans	Licorice Bedstraw	G5	SNA	34800	NatureServe 2001-2007
Galium concinnum	Shining Bedstraw	G5	S5	34848	Seymour 1999
Galium obtusum ssp. obtusum	Bluntleaf Bedstraw	G5T4	S4S5	524097	McKinney, et al. 1991
Galium pilosum	Hairy Bedstraw	G5	S5	34907	NatureServe 2001-2007
Galium tinctorium	Stiff Marsh Bedstraw	G5	S5	34803	Seymour 1999
Galium triflorum	Sweet-scent Bedstraw	G5	S5	34933	NatureServe 2001-2007
Gamochaeta purpurea	Spoonleaf Purple Everlasting	G5	SNA	37421	Seymour 1999
Gaultheria procumbens	Wintergreen	G5	SNA	23657	NatureServe 2001-2007
Gaura filipes	Slender-stalk Beeblossom	G5	S5	27649	Seymour 1999
Gaylussacia baccata	Black Huckleberry	G5	S5	23660	McKinney, et al. 1991
Gentiana andrewsii	Closed Bottle Gentian	G5?	SH	29967	McKinney, et al. 1991
Gentiana puberulenta	Downy Gentian	G4G5	S1	29984	Converted from MACA ANCS by CUPN 2007

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Gentiana saponaria var. saponaria	Harvestbells	G5T5	SNR	566244	McKinney, et al. 1991
Gentiana villosa	Striped Gentian	G4	S4?	29990	NatureServe 2001-2007
Geranium carolinianum var. carolinianum	Carolina Geranium	G5T5	S5	528236	NatureServe 2001-2007
Geranium dissectum	Cutleaf Crane's-bill	GNR	SNA	29135	McKinney, et al. 1991
Geranium maculatum	Spotted Geranium	G5	S5	29107	NatureServe 2001-2007
Geranium molle	Dovefoot Crane's-bill	GNR	SNA	29110	McKinney, et al. 1991
Geum canadense var. canadense	White Avens	G5T5	SNR	195814	NatureServe 2001-2007
Geum vernum	Spring Avens	G5	S5	24664	NatureServe 2001-2007
Geum virginianum	Cream Avens	G5	S5	24665	NatureServe 2001-2007
Glandularia canadensis	Rose Mock Vervain	G5	SH	502784	McKinney, et al. 1991
Glechoma hederacea	Ground-ivy	GNR	SNA	502801	NatureServe 2001-2007
Gleditsia triacanthos	Honey-locust	G5	S5	26714	NatureServe 2001-2007
Glyceria acutiflora	Creeping Mannagrass	G5	S1S2	40834	Seymour 1999
Glyceria striata	Fowl Mannagrass	G5	S5	40833	NatureServe 2001-2007
Goodyera pubescens	Downy Rattlesnake-plantain	G5	S5	43594	NatureServe 2001-2007
Gratiola neglecta	Clammy Hedgehyssop	G5	S5	33197	Seymour 1999
Gratiola virginiana var. virginiana	Roundfruit Hedge-hyssop	G5T5	SNR	528269	Seymour 1999
Gymnocladus dioicus	Kentucky Coffeetree	G5	S5	502851	Seymour 1999
Gymnopogon ambiguus	Bearded Skeleton Grass	G4	S2S3	41749	Seymour 1999
Hackelia virginiana	Virginia Stickseed	G5	S5	31921	NatureServe 2001-2007
Hamamelis virginiana	American Witch-hazel	G5	S5	19033	NatureServe 2001-2007
Hasteola suaveolens	False Indian-plantain	G4	SNR	37587	McKinney, et al. 1991
Hedeoma pulegioides	American False Pennyroyal	G5	SNA	32520	McKinney, et al. 1991
Hedera helix	English Ivy	GNR	SNA	29393	Seymour 1999
Helenium autumnale var. autumnale	Common Sneezeweed	G5T5	SNR	528347	Seymour 1999
Helenium flexuosum	Purple-head Sneezeweed	G5	S5	36016	Seymour 1999
Helianthus divaricatus	Spreading Sunflower	G5	S5	36636	NatureServe 2001-2007
Helianthus eggertii	Eggert's Sunflower	G3	S2	36639	Seymour 1999
Helianthus hirsutus	Whiskered Sunflower	G5	S5	36646	NatureServe 2001-2007
Helianthus maximiliani	Michaelmas-daisy	G5	SNA	36653	Converted from MACA ANCS by CUPN 2007
Helianthus microcephalus	Small Woodland Sunflower	G5	S5	36654	NatureServe 2001-2007
Helianthus mollis	Ashy Sunflower	G4G5	S5	36655	Seymour 1999
Helianthus occidentalis ssp. occidentalis	Fewleaf Sunflower	G5T5	SNR	36667	NatureServe 2001-2007
Helianthus strumosus	Paleleaf Woodland Sunflower	G5	S4?	36690	Seymour 1996
Helianthus tuberosus	Jerusalem Artichoke	G5	S5	36691	Seymour 1999
Heliopsis helianthoides	Smooth Oxeye	G5	S5	37605	NatureServe 2001-2007
Heliopsis helianthoides var. scabra	Smooth Oxeye	G5T5	S4S5	528369	Seymour 1999
Heliotropium tenellum	Pasture Heliotrope	G5	S5	31652	Seymour 1999
Hemerocallis fulva	Orange Daylily	GNA	SNA	42943	Seymour 1999
Hepatica nobilis var. acuta	Sharp-lobe Liverleaf	G5T5	S5	528378	NatureServe 2001-2007

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Hepatica nobilis var. obtusa	Round-lobe Liverleaf	G5T5	S5	528379	NatureServe 2001-2007
Heterotheca camporum var. glandulissimum	Lemon-yellow False Goldenaster	G5TNR	SNA	528386	Seymour 1999
Heuchera americana var. americana	American Alumroot	G5T5	SNR	528400	NatureServe 2001-2007
Heuchera americana var. hirsuticaulis	Midwestern Alumroot	G5T5	SNA	528401	Lix 1948
Heuchera parviflora	Cave Alumroot	G4	S5	24365	NatureServe 2001-2007
Heuchera parviflora var. parviflora	Cave Alumroot	G4T4	SNR	528417	Seymour 1999
Heuchera parviflora var. puberula	Ozark Alumroot	G4 T3T4	SNR	528418	Seymour 1999
Heuchera villosa var. villosa	Rock Alumroot	G5T5	SNR	528436	NatureServe 2001-2007
Hexalectris spicata	Spiked Crested Coralroot	G5	S4	43608	Seymour 1999
Hibiscus laevis	Halberd-leaf Rosemallow	G5	S5	21632	NatureServe 2001-2007
Hibiscus moscheutos	Eastern Rosemallow	G5	S5	21612	Seymour 1999
Hieracium aurantiacum	Devil's Paintbrush	GNR	SNA	37697	McKinney, et al. 1991
Hieracium gronovii	Queendevil	G5	S5	37710	NatureServe 2001-2007
Hieracium marianum	Maryland Hawkweed	G5?	SNA	-502436	Seymour 1999
Hieracium pilosella	Mouse-ear hawkweed	GNR	SNA	37720	McKinney, et al. 1991
Hieracium scabrum	Rough Hawkweed	G5	S4	37727	NatureServe 2001-2007
Hieracium venosum	Rattlesnake-weed	G5	S4	37734	NatureServe 2001-2007
Holcus lanatus	Common Velvetgrass	GNR	SNA	41773	Seymour 1999
Holosteum umbellatum	Jagged Chickweed	GNR	SNA	503057	Seymour 1999
Hordeum pusillum	Little Barley	G5	SNA	40866	Seymour 1999
Houstonia caerulea	Quaker-ladies	G5	S5	35038	NatureServe 2001-2007
Houstonia canadensis	Canadian Summer Bluet	G4G5	S5	35039	NatureServe 2001-2007
Houstonia longifolia	Longleaf Summer Bluet	G4G5	S5	35045	NatureServe 2001-2007
Houstonia purpurea	Venus' Pride	G5	S5	35051	NatureServe 2001-2007
Houstonia purpurea var. calycosa	Venus' Pride	G5T5	S4S5	196212	Seymour 1999
Houstonia purpurea var. purpurea	Venus' Pride	G5T5	SNR	196210	Imported from ANCS
Houstonia pusilla	Tiny Bluet	G5	S4?	35052	NatureServe 2001-2007
Huperzia lucidula	Shining Clubmoss	G5	S5	503079	NatureServe 2001-2007
Huperzia porophila	Rock Clubmoss	G4	S5	503084	Seymour 1999
Hybanthus concolor	Green Violet	G5	S5	22026	NatureServe 2001-2007
Hydrangea arborescens	Smooth Hydrangea	G5	S5	24195	NatureServe 2001-2007
Hydrastis canadensis	Goldenseal	G4	S4	18781	NatureServe 2001-2007
Hydrophyllum appendiculatum	Great Waterleaf	G5	S5	31389	Seymour 1999
Hydrophyllum canadense	Mapleleaf Waterleaf	G5	S5	31390	NatureServe 2001-2007
Hydrophyllum macrophyllum	Largeleaf Waterleaf	G5	S5	31393	NatureServe 2001-2007*
Hymenocallis caroliniana	Carolina Spiderlily	G4	S4?	503104	NatureServe 2001-2007
Hypericum denticulatum	Coppery St. John's-wort	G5	S5	21434	Seymour 1999
Hypericum dolabriforme	Straggling St. John's-wort	G4	S4	21435	NatureServe 2001-2007
Hypericum drummondii	Nits-and-lice	G5	S5	21436	Seymour 1999
Hypericum formosum	St. Johnswort	GNA	SNA	21439	McKinney 1988
Hypericum frondosum	Golden St. John's-wort	G4	S5	21440	McKinney, et al. 1991
Hypericum gentianoides	Pineweed	G5	S5	21420	Seymour 1999

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Hypericum hypericoides	St. Andrew's-cross	G5	SU	503138	Seymour and Campbell 1991-99
Hypericum hypericoides ssp. hypericoides	St. Andrew's-cross	G5T5	SNR	524169	NatureServe 2001-2007
Hypericum hypericoides ssp. multicaule	St. Andrew's-cross	G5T4	SNR	524170	NatureServe 2001-2007*
Hypericum lobocarpum	Five-lobe St. John's-wort	G4Q	S4?	503140	Medley 1993-1997
Hypericum mutilum	Dwarf St. John's-wort	G5	SNR	21421	Seymour 1999
Hypericum perforatum	Common St. John's-wort	GNR	SNA	21454	Seymour 1999
Hypericum prolificum	Shrubby St. John's-wort	G5	S5	21455	NatureServe 2001-2007
Hypericum punctatum	Spotted St. John's-wort	G5	S5	21422	NatureServe 2001-2007
Hypericum sphaerocarpum	Roundfruit St. John's-wort	G5	S4	21460	NatureServe 2001-2007*
Hypoxis hirsuta	Eastern Yellow Star-grass	G5	S5	503146	NatureServe 2001-2007
Ilex decidua	Possum-haw	G5	S5	27998	Medley 1993-1997
Ilex opaca var. opaca	American Holly	G5T5	S5	27983	NatureServe 2001-2007
Impatiens capensis	Orange Jewelweed	G5	S5	29182	NatureServe 2001-2007
Impatiens pallida	Yellow Jewelweed	G5	S5	29189	NatureServe 2001-2007
Iodanthus pinnatifidus	Purple-rocket	G5	S5	23149	NatureServe 2001-2007
Ionactis linariifolius	Stiff Aster	G5	SNA	507245	Seymour 1999
Ipomoea coccinea	Redstar	GNR	SNA	30770	NatureServe 2001-2007
Ipomoea hederacea	Ivyleaf Morning-glory	G5	SNA	503177	Seymour 1999
Ipomoea lacunosa	Whitestar	G5?	SNA	30776	Seymour 1999
Ipomoea pandurata	Man-of-the-Earth	G5	S5	30786	NatureServe 2001-2007
Ipomoea purpurea	Common Morning-glory	GNR	SNA	30789	Seymour 1999
Iresine rhizomatosa	Juda's-bush	G5	S5	20819	Seymour 1999
Iris cristata	Crested Dwarf Iris	G5	S4	43204	NatureServe 2001-2007
Iris verna var. smalliana	Upland Dwarf Iris	G5 T4T5	SNR	528565	NatureServe 2001-2007**
Isanthus brachiatus	Fluxweed	G5	SNR	515269	NatureServe 2001-2007
Jeffersonia diphylla	Twinleaf	G5	S5	18844	NatureServe 2001-2007
Juglans cinerea	Butternut	G4	S3	19250	NatureServe 2001-2007
Juglans nigra	Black Walnut	G5	S5	19254	NatureServe 2001-2007
Juncus acuminatus	Sharp-fruit Rush	G5	S5	39221	Seymour 1999
Juncus brachycarpus	Short-fruit Rush	G4G5	S4S5	39226	Seymour 1999
Juncus coriaceus	Tough Rush	G5	S3S4	39230	Seymour 1999
Juncus effusus	Soft Rush	G5	S5	39232	NatureServe 2001-2007 ^
Juncus effusus var. solutus	Soft Rush	G5T5	SNR	528617	Seymour 1999
Juncus secundus	Lopsided Rush	G5?	S4?	39313	Seymour 1999
Juncus tenuis	Poverty Rush	G5	S5	39243	Seymour 1999
Juniperus virginiana var. virginiana	Eastern Red-cedar	G5T5	SNR	194806	NatureServe 2001-2007
Justicia americana	American Water-willow	G5	S5	34352	NatureServe 2001-2007
Kalmia latifolia	Mountain Laurel	G5	S5	23677	NatureServe 2001-2007
Krigia biflora	Two-flower Dwarf-dandelion	G5	S5	37810	NatureServe 2001-2007
Krigia caespitosa	Common Dwarf-dandelion	G5	S5	565260	McKinney, et al. 1991
Krigia dandelion	Potato Dwarf-dandelion	G5	S5	37812	Seymour 1999
Krigia occidentalis	Western Dwarf-dandelion	G5	S1?	37815	Seymour 1999
Krigia virginica	Virginia Dwarf-dandelion	G5	S4?	37816	Seymour 1999
Kummerowia stipulacea	Korean-clover	GNR	SNA	503293	Seymour 1999
Kummerowia striata	Japanese-clover	GNR	SNA	503294	Seymour 1999

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Lactuca canadensis	Florida Blue Lettuce	G5	S4S5	36596	NatureServe 2001-2007
Lactuca floridana	Woodland Lettuce	G5	S5	36599	NatureServe 2001-2007
Lactuca saligna	Willowleaf Lettuce	GNR	SNA	36606	Lix 1949
Lamium amplexicaule	Common Deadnettle	GNR	SNA	32539	NatureServe 2001-2007
Lamium purpureum	Purple Deadnettle	GNR	SNA	32543	Seymour 1999
Laportea canadensis	Canadian Wood-nettle	G5	S5	19127	NatureServe 2001-2007
Lechea racemulosa	Oblong-fruit Pinweed	G5	S5	22295	Seymour 1999
Leersia oryzoides	Rice Cutgrass	G5	S5	40886	NatureServe 2001-2007
Leersia virginica	White Cutgrass	G5	S5	40890	NatureServe 2001-2007
Lemna minor	Lesser Duckweed	G5	S4?	42590	NatureServe 2001-2007*
Lepidium campestre	Cream-anther Field Pepperwort	GNR	SNA	22954	Seymour 1999
Lepidium densiflorum	Miner's Pepperwort	G5	SNA	22960	Seymour 1999
Lepidium ruderale	Roadside Pepperweed	GNR	SNA	22977	McKinney, et al. 1991
Lepidium virginicum var. virginicum	Virginia Pepperweed	G5T5	SNR	528742	Seymour 1999
Leptochloa panicea ssp. brachiata	Needle Sprangletop	G5T5?		566048	McKinney, et al. 1991
Leptochloa panicea ssp. mucronata	Needle Sprangletop	G5T5	SNR	566049	Lix 1949
Lespedeza capitata	Roundhead Bushclover	G5	S3	25897	Seymour 1999
Lespedeza cuneata	Chinese Bushclover	GNR	SNA	25898	NatureServe 2001-2007
Lespedeza hirta ssp. hirta	Hairy Lespedeza	G5T5?	SNR	25901	NatureServe 2001-2007
Lespedeza procumbens	Trailing Bushclover	G5	S4S5	25907	NatureServe 2001-2007
Lespedeza stuevei	Tall Bushclover	G4?	S3?	25911	Seymour 1999
Lespedeza violacea	Violet Bushclover	G5	S4S5	25914	NatureServe 2001-2007
Lespedeza virginica	Wand Lespedeza	G5	S5	25915	NatureServe 2001-2007
Lesquerella globosa	Globe Bladderpod	G2	S1	23184	McKinney, et al. 1991
Leucanthemum vulgare	Oxeye Daisy	GNR	SNA	37903	NatureServe 2001-2007
Leucospora multifida	Narrowleaf Paleseed	G5	S4S5	33632	Seymour 1999
Leucothoe recurva	Red-twig Doghobble	G4G5	S1	23554	Faller 1975
Liatris aspera	Rough Blazingstar	G4G5	S3S4	37909	Seymour 1999
Liatris scariosa	Devil's-bite	G5?	SNA	37941	Seymour 1996 ^
Liatris spicata	Bog Blazingstar	G5	S4	37944	Seymour 1999
Liatris squarrosa	Scaly Blazingstar	G5	S4?	37945	NatureServe 2001-2007
Liatris squarrulosa	Appalachian Gayfeather	G4G5	S4	503447	Seymour 1999
Ligusticum canadense	Canadian Wild Lovage	G4	S4	29528	NatureServe 2001-2007*
Ligustrum sinense	Chinese Privet	GNR	SNA	32979	NatureServe 2001-2007
Lilium canadense	Canada Lily	G5	S4?	42732	McKinney, et al. 1991
Lilium michiganense	Michigan Lily	G5	S4?	503458	Seymour 1999
Lilium philadelphicum	Wood Lily	G5	S2S3	503459	McKinney, et al. 1991
Linaria vulgaris	Butter-and-eggs	GNR	SNA	33216	Davies 1954
Lindera benzoin	Northern Spicebush	G5	S5	18147	NatureServe 2001-2007
Lindera benzoin var. pubescens	Northern Spicebush	G5TNR	SNR	194909	Seymour 1999
Lindernia dubia	Yellowseed False Pimpernel	G5	S5	33221	Seymour 1999
Lindernia dubia var. anagallidea	Yellowseed False Pimpernel	G5T4	SNR	528804	Seymour 1999
Linum medium var. texanum	Stiff Yellow Flax	G5T5	SNR	528821	Seymour 1999
Linum striatum	Ridged Yellow Flax	G5	S4	29223	NatureServe 2001-2007

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Linum virginianum	Woodland Flax	G4G5	S4S5	29202	Seymour 1999
Liparis liliifolia	Brown Wide-lip Orchid	G5	S4	43622	NatureServe 2001-2007
Liquidambar styraciflua	Sweetgum	G5	S5	19027	NatureServe 2001-2007
Liriodendron tulipifera	Tuliptree	G5	S5	18086	NatureServe 2001-2007
Lithospermum canescens	Hoary Puccoon	G5	S4	31945	NatureServe 2001-2007
Lithospermum latifolium	American Gromwell	G4	S4?	31949	NatureServe 2001-2007
Lithospermum officinale	European Stoneseed	GNR	SNA	31952	Lix 1949
Lobelia cardinalis	Cardinal-flower	G5	S5	34505	NatureServe 2001-2007
Lobelia inflata	Indian-tobacco	G5	S5	34524	NatureServe 2001-2007
Lobelia puberula	Downy Lobelia	G5	S4	34529	NatureServe 2001-2007
Lobelia siphilitica var. siphilitica	Great Blue Lobelia	G5T5	SNR	528854	NatureServe 2001-2007
Lobelia spicata	Pale-spike Lobelia	G5	S4S5	34532	NatureServe 2001-2007
Lolium arundinaceum	Tall Fescue	GNR	SNA	507979	NatureServe 2001-2007**
Lolium perenne	Perennial Ryegrass	GNR	SNA	40893	Datillo 2006
Lolium pratense	Meadow Ryegrass	G5	SNA	507983	Seymour 1999
Lonicera japonica	Japanese Honeysuckle	GNR	SNA	35283	NatureServe 2001-2007
Lonicera sempervirens	Trumpet Honeysuckle	G5	S4	35303	Seymour 1999
Ludwigia alternifolia	Bushy Seedbox	G5	S5	27335	Seymour 1999
Ludwigia decurrens	Wingleaf Primrose-willow	G5	S5	27343	Seymour 1999
Ludwigia palustris	Marsh Seedbox	G5	S5	27336	NatureServe 2001-2007
Luzula echinata	Hedgehog Woodrush	G5	S4?	39342	NatureServe 2001-2007
Luzula multiflora	Common Woodrush	G5	S4?	39333	NatureServe 2001-2007*
Lycopodium digitatum	Fan Clubmoss	G5	S5	17028	NatureServe 2001-2007
Lycopus americanus	American Water-horehound	G5	S5	32254	NatureServe 2001-2007
Lycopus rubellus	Stalked Water-horehound	G5	S4	32261	NatureServe 2001-2007
Lycopus uniflorus	Northern Bugleweed	G5	S1S3	32257	McKinney, et al. 1991
Lycopus virginicus	Virginia Water-horehound	G5	S5	32255	NatureServe 2001-2007
Lysimachia ciliata	Fringed Loosestrife	G5	S5	23984	NatureServe 2001-2007
Lysimachia lanceolata	Lanceleaf Loosestrife	G5	S5	23991	NatureServe 2001-2007
Lysimachia nummularia	Creeping Jenny	GNR	SNA	23993	McKinney, et al. 1991
Lysimachia quadrifolia	Whorled Yellow Loosestrife	G5	S5	23997	NatureServe 2001-2007
Maclura pomifera	Osage-orange	G4G5	SNA	19102	NatureServe 2001-2007
Magnolia acuminata	Cucumber-tree	G5	S5	18071	Seymour 1999
Magnolia macrophylla	Bigleaf Magnolia	G5	S5	18075	Seymour 1999
Magnolia tripetala	Umbrella Magnolia	G5	S5	18077	NatureServe 2001-2007
Maianthemum racemosum ssp. racemosum	Feathery False Lily-of-the-valley	G5T5	SNR	524297	NatureServe 2001-2007
Maianthemum stellatum	Starflower False Solomon's-seal	G5	S1	503656	Faller 1975
Manfreda virginica	Eastern Agave	G5	S4	503687	NatureServe 2001-2007
Matelea carolinensis	Maroon Carolina Milkvine	G4	S1?	30369	NatureServe 2001-2007*
Matelea gonocarpos	Angular-fruit Milkvine	G5	S5?	503702	NatureServe 2001-2007
Matelea obliqua	Climbing Milkvine	G4?	S4?	30375	Seymour 1999
Medeola virginiana	Indian Cucumber-root	G5	SNR	42963	NatureServe 2001-2007
Medicago lupulina	Black Medic	GNR	SNA	503721	Seymour 1999
Medicago sativa ssp. sativa	Alfalfa	GNR TNR	SNA	524303	Seymour 1999

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Melanthium woodii	Wood's Bunchflower	G5	S2	42968	NatureServe 2001-2007
Melica mutica	Two-flower Melicgrass	G5	S4?	41858	NatureServe 2001-2007
Melilotus albus	Sweetclover	GNR	SNA	516979	NatureServe 2001-2007
Melilotus officinalis	Sweetclover	GNR	SNA	26150	Seymour 1999
Melissa officinalis	Common Balm	GNR	SNA	32565	Seymour 1999
Menispermum canadense	Common Moonseed	G5	S5	18871	NatureServe 2001-2007
Mentha X piperita	Peppermint	GNA	SNA	32275	McKinney, et al. 1991
Mertensia virginica	Virginia Bluebells	G5	S5	31673	NatureServe 2001-2007
Microstegium vimineum	Japanese Stiltgrass	GNR	SNA	503829	NatureServe 2001-2007
Mimulus alatus	Sharp-wing Monkeyflower	G5	S5	33234	Seymour 1999
Minuartia patula	Pitcher's Stitchwort	G4	S3S4	20009	NatureServe 2001-2007
Mitchella repens	Partridgeberry	G5	S5	35063	NatureServe 2001-2007
Mitella diphylla	Twoleaf Miterwort	G5	S5	24407	NatureServe 2001-2007
Mollugo verticillata	Green Carpetweed	GNR	SNA	19899	NatureServe 2001-2007
Monarda clinopodia	White Bergamot	G5	S5	32288	NatureServe 2001-2007
Monarda fistulosa	Wild Bergamot	G5	S5	565311	NatureServe 2001-2007
Monarda russeliana	Red-purple Beebalm	G4G5	SNA	32286	Seymour 1999
Monotropa hypopithys	American Pinesap	G5	SNR	503871	NatureServe 2001-2007
Monotropa uniflora	Indian-pipe	G5	S5?	23778	NatureServe 2001-2007
Morus rubra var. rubra	Red Mulberry	G5T5	SNR	529232	NatureServe 2001-2007
Mosla dianthera	Miniature Beefsteakplant	GNR	SNA	32621	Seymour 1999
Muhlenbergia capillaris	Hair-awn Muhly	G5	S3S4	41902	Seymour 1999
Muhlenbergia frondosa	Wirestem Muhly	G5	S4S5	41915	Seymour 1999
Muhlenbergia mexicana	Mexican Muhly	G5	SNA	41925	McKinney, et al. 1991
Muhlenbergia schreberi	Nimblewill	G5	S5	41939	Seymour 1999
Muhlenbergia sobolifera	Rock Muhly	G5	S5	41941	NatureServe 2001-2007
Muhlenbergia tenuiflora	Slender Muhly	G5	S5	41943	NatureServe 2001-2007
Muscari botryoides	Common Grape Hyacinth	GNR	SNA	42977	Seymour 1999
Myosotis arvensis	Rough Forget-me-not	GNR	SNA	31692	NatureServe 2001-2007**
Myosotis macrosperma	Large-seed Forget-me-not	G5	S4S5	31695	NatureServe 2001-2007*
Myosotis verna	Spring Forget-me-not	G5	S5	31699	Seymour 1999
Narcissus poeticus	Poet's Narcissus	GNR	SNA	503929	Seymour 1999
Narcissus pseudonarcissus	Common Daffodil	GNR	SNA	503930	Seymour 1999
Nothoscordum bivalve	Grace-garlic	G4	S5	503966	Seymour 1999
Nyssa sylvatica	Blackgum	G5	S5	27821	NatureServe 2001-2007
Obolaria virginica	Virginia Pennywort	G5	S5	30104	NatureServe 2001-2007
Oenothera biennis	King's-cureall	G5	S5	27368	Seymour 1999
Oenothera clelandii	Cleland's Evening-primrose	G3G5	SNR	503996	McKinney, et al. 1991
Oenothera fruticosa	Narrowleaf Evening-primrose	G5	S4?	27369	Seymour 1999
Oenothera fruticosa ssp. glauca	Narrowleaf Evening-primrose	G5T5	SNR	524358	McKinney, et al. 1991
Oenothera perennis	Small Evening-primrose	G5	S1S2	27372	Seymour 1999
Oligoneuron rigidum	Bold Goldenrod	G5	S4	508151	NatureServe 2001-2007*
Oligoneuron rigidum var. glabratum	Bold Goldenrod	G5T4	S4	531226	Seymour 1999
Oligoneuron rigidum var. rigidum	Bold Goldenrod	G5T5	S3S4	531228	Seymour 1999
Onoclea sensibilis	Sensitive Fern	G5	S5	17637	NatureServe 2001-2007

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Ophioglossum engelmannii	Limestone Adder's-tongue	G5	S3S4	504032	McKinney, et al. 1991
Ophioglossum vulgatum	Southern Adder's-tongue	G5	SNR	565333	Seymour 1999
Opuntia humifusa	Eastern Prickly-pear	G5	SNR	19710	NatureServe 2001-2007
Opuntia humifusa var. humifusa	Eastern Prickly-pear	G5T5	SNR	531092	Imported from ANCS
Orbexilum pedunculatum	Sampson's Snakeroot	G5	S4?	504048	NatureServe 2001-2007
Orbexilum pedunculatum var. pedunculatum	Sampson’s Snakeroot	G5T5?	S4S5	529302	Seymour 1999
Orbexilum pedunculatum var. psoralioides	Sampson’s Snakeroot	G5T4?	SNR	529303	Seymour 1999
Ornithogalum umbellatum	Sleepydick	G3G5	SNA	42754	Seymour 1999
Osmorhiza claytonii	Blank Sweet-cicely	G5	S5	29789	NatureServe 2001-2007
Osmorhiza longistylis	Aniseroot	G5	S5	29791	NatureServe 2001-2007
Osmunda cinnamomea var. cinnamomea	Cinnamon Fern	G5T5	SNR	529311	NatureServe 2001-2007
Osmunda claytoniana	Interrupted Fern	G5	S4?	17220	Seymour 1999
Osmunda regalis var. spectabilis	Royal Fern	G5T5	SNR	529314	NatureServe 2001-2007**
Ostrya virginiana	Eastern Hop-hornbeam	G5	S5	19511	NatureServe 2001-2007
Oxalis grandis	Great Yellow Wood Sorrel	G4G5	S5	29083	McKinney, et al. 1991
Oxalis stricta	Common Yellow Wood Sorrel	G5	S5	29095	NatureServe 2001-2007
Oxalis violacea	Violet Wood Sorrel	G5	S5	29098	NatureServe 2001-2007
Oxydendrum arboreum	Sourwood	G5	S5	23690	NatureServe 2001-2007
Oxypolis rigidior	Common Water-dropwort	G5	S4	29544	Seymour 1999
Packera anonyma	Small's Groundsel	G5	S4S5	518137	NatureServe 2001-2007
Packera aurea	Golden Groundsel	G5	S4S5	518139	NatureServe 2001-2007
Packera glabella	Butterweed	G5	S5	565358	NatureServe 2001-2007
Packera obovata	Roundleaf Groundsel	G5	S5	565368	NatureServe 2001-2007
Packera paupercula	Balsam Ragwort	G5	S2?	518155	McKinney, et al. 1991
Panax quinquefolius	American Ginseng	G3G4	S3S4	29399	NatureServe 2001-2007
Panicum anceps	Beaked Panicgrass	G5	S4	40904	NatureServe 2001-2007
Panicum capillare	Common Panicgrass	G5	S5	40914	Seymour 1999
Panicum dichotomiflorum var. dichotomiflorum	Fall Panicgrass	G5T5	SNR	529361	McKinney, et al. 1991
Panicum flexile	Wiry Panicgrass	G5	S5	40918	NatureServe 2001-2007
Panicum gattingeri	Gattinger's Panicgrass	G4	SNR	40933	Seymour 1999
Panicum rigidulum	Redtop Panicgrass	G5	S5	40956	Seymour 1999
Panicum rigidulum var. elongatum	Tall Flat Panicgrass	G5 T4T5	SNR	529367	Seymour 1999
Panicum rigidulum var. rigidulum	Redtop Panicgrass	G5T5?	SNR	529369	Imported from ANCS
Panicum verrucosum	Warty Panicgrass	G4	S5	40961	Seymour 1999
Panicum virgatum var. virgatum	Switchgrass	G5T5	SNR	529371	Seymour 1999
Parietaria pensylvanica	Pennsylvania Pellitory	G5	S4?	19169	NatureServe 2001-2007
Paronychia canadensis	Smooth Forked Nailwort	G5	S4?	20325	Seymour 1999
Paronychia fastigiata	Hairy Forked Nailwort	G5	SNR	20334	McKinney, et al. 1991
Parthenium integrifolium var. integrifolium	Wild Quinine	G5T5	SNR	529405	NatureServe 2001-2007
Parthenocissus quinquefolia	Virginia Creeper	G5	S5	28602	NatureServe 2001-2007

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Paspalum dilatatum	Golden Crown Grass	GNR	SNA	40997	Seymour 1999
Paspalum fluitans	Horsetail Crowngrass	G5	S4S5	40998	Seymour 1999
Paspalum laeve	Field Crowngrass	G4G5	SNR	41024	Seymour 1999
Paspalum pubiflorum	Hairy-seed Crowngrass	G5	S4?	40994	NatureServe 2001-2007
Paspalum setaceum	Slender Crowngrass	G5	SNR	41042	Seymour 1999
Passiflora incarnata	Purple Passionflower	G5	S4S5	504139	Seymour 1999
Passiflora lutea	Yellow Passionflower	G5	S5	22226	NatureServe 2001-2007
Pastinaca sativa	Wild Parsnip	GNR	SNA	29795	Seymour 1996
Paulownia tomentosa	Princess-tree	GNR	SNA	33460	NatureServe 2001-2007
Pedicularis canadensis ssp. canadensis	Canadian Lousewort	G5T5	SNR	524407	NatureServe 2001-2007
Pellaea atropurpurea	Purple Cliffbrake	G5	S4S5	17641	NatureServe 2001-2007
Pennisetum glaucum	Pearl-millet	GNA	SNA	565385	Seymour 1999
Penstemon calycosus	Long-sepal Beardtongue	G5	S4S5	33845	Seymour 1999
Penstemon canescens	Gray Beardtongue	G4	S5	33846	Seymour 1999
Penstemon digitalis	Foxglove Beardtongue	G5	S5	33881	Seymour 1999
Penstemon hirsutus	Hairy Beardtongue	G4	S5	33924	NatureServe 2001-2007
Penstemon pallidus	Pale Beardtongue	G5	S5	33967	NatureServe 2001-2007
Penstemon tenuiflorus	White-flower Beardtongue	G4?	S4?	33780	Seymour 1999
Penthorum sedoides	Ditch-stonecrop	G5	S5	504241	Seymour 1999
Perilla frutescens	Beefsteak Plant	GNR	SNA	32634	NatureServe 2001-2007
Perilla frutescens var. crispa	Beefsteak Plant	GNR TNR	SNA	529520	Seymour 1999
Phacelia bipinnatifida	Fernleaf Scorpionweed	G5	S5	31459	NatureServe 2001-2007
Phacelia purshii	Miami-mist	G5	S5	504279	Seymour 1999
Phaseolus polystachios	Thicket Bean	G5	S4S5	504291	Seymour 1999
Phegopteris hexagonoptera	Broad Beech Fern	G5	S5	504296	NatureServe 2001-2007
Phleum pratense	Timothy	GNR	SNA	41062	Seymour 1999
Phlox amoena ssp. amoena	Hairy Phlox	G4TNR	SNR	524465	McKinney, et al. 1991
Phlox bifida	Cleft Phlox	G5?	S2	30918	McKinney, et al. 1991
Phlox carolina	Thickleaf Phlox	G5?	SNA	30921	McKinney, et al. 1991
Phlox divaricata	Wild Blue Phlox	G5	S5	30934	NatureServe 2001-2007
Phlox glaberrima	Smooth Phlox	G5	S5	30940	Imported from ANCS
Phlox glaberrima ssp. triflora	Smooth Phlox	G5TNR	SNR	524477	Seymour 1999
Phlox maculata	Wild Sweet-william	G5	S5	30961	McKinney, et al. 1991
Phlox paniculata	Fall Phlox	G5	S5	30973	NatureServe 2001-2007
Phlox subulata	Moss Phlox	G5	S4?	30989	Seymour 1999
Phoradendron leucarpum	Oak Mistletoe	G5	S5	504341	McKinney, et al. 1991
Photinia melanocarpa	Black Chokeberry	G5	S4S5	565397	Seymour 1999
Photinia pyrifolia	Red Chokeberry	G5	S4S5	565398	NatureServe 2001-2007
Phryma leptostachya	American Lopseed	G5	S5	504348	NatureServe 2001-2007
Phyla lanceolata	Common Frogfruit	G5	S5	32196	NatureServe 2001-2007
Physalis cordata	Heartleaf Ground-cherry	G5	SNA	30595	NatureServe 2001-2007*
Physalis heterophylla var. heterophylla	Clammy Ground-cherry	G5T5	SNR	531099	Seymour 1999
Physalis longifolia	Longleaf Ground-cherry	G5	S5	30603	McKinney, et al. 1991
Physalis longifolia var. subglabrata	Longleaf Ground-cherry	G5 T4T5	SNR	529629	Seymour 1999
Physalis virginiana var. virginiana	Virginia Ground-cherry	G5T5	SNR	529641	NatureServe 2001-2007

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Physocarpus opulifolius var. opulifolius	Eastern Ninebark	G5T5	SNR	529660	McKinney, et al. 1991
Physostegia virginiana	Obedient Plant	G5	S5	32391	NatureServe 2001-2007
Physostegia virginiana ssp. praemorsa	Obedient Plant	G5 T4T5Q	SNR	196103	Seymour 1999
Physostegia virginiana ssp. virginiana	Obedient Plant	G5T5	SNR	196102	Seymour 1999
Phytolacca americana var. americana	American Pokeweed	G5T5	SNR	531101	NatureServe 2001-2007
Pilea pumila	Canadian Clearweed	G5	S5	19130	NatureServe 2001-2007
Pinus echinata	Shortleaf Pine	G5	S4	183335	NatureServe 2001-2007
Pinus strobus	Eastern White Pine	G5	S3	183385	NatureServe 2001-2007
Pinus taeda	Loblolly Pine	G5	SNA	18037	NatureServe 2001-2007
Pinus virginiana	Virginia Pine	G5	S5	183394	NatureServe 2001-2007
Planera aquatica	Planertree	G5	S3S4	19061	McKinney, et al. 1991
Plantago aristata	Large-bract Plantain	G5	S5	32875	Seymour 1999
Plantago lanceolata	Narrowleaf Plantain	G5	SNA	32874	Seymour 1999
Plantago rugelii	Black-seed Plantain	G5	S5	504439	Seymour 1999
Plantago virginica	Pale-seed Plantain	G5	S5	32895	McKinney, et al. 1991
Platanthera clavellata	Small Green Wood Orchid	G5	S4	43423	Seymour 1999
Platanthera lacera	Green Fringed Orchid	G5	S4?	43430	NatureServe 2001-2007
Platanus occidentalis	Sycamore	G5	S5	19020	NatureServe 2001-2007
Pleopeltis polypodioides ssp. michauxiana	Resurrection Fern	G5T5	SNR	524533	NatureServe 2001-2007
Pluchea camphorata	Marsh-fleabane	G5	S5	36061	NatureServe 2001-2007
Poa annua	Annual Bluegrass	GNR	SNA	41107	NatureServe 2001-2007**
Poa autumnalis	Autumn Bluegrass	G5	S5	41111	NatureServe 2001-2007
Poa chapmaniana	Chapman's Bluegrass	G5	S5	41118	Seymour 1999
Poa compressa	Canada Bluegrass	GNR	SNA	41082	NatureServe 2001-2007
Poa cuspidata	Early Bluegrass	G5	S5	41122	Seymour 1999
Poa pratensis	Kentucky Bluegrass	G5	SNA	41088	NatureServe 2001-2007
Poa sylvestris	Woodland Bluegrass	G5	S5	41162	NatureServe 2001-2007
Podophyllum peltatum	Mayapple	G5	S5	18850	NatureServe 2001-2007
Polemonium reptans	Greek Valerian	G5	S5	31003	NatureServe 2001-2007
Polygala ambigua	Whorled Milkwort	G5?	SNR	519324	Seymour 1999
Polygala incarnata	Procession-Flower	G5	S4?	29341	Seymour 1999
Polygala sanguinea	Purple Milkwort	G5	S5	29314	Seymour 1999
Polygala verticillata	Whorled Milkwort	G5	S5	29320	NatureServe 2001-2007
Polygonatum biflorum var. commutatum	King Solomon’s-seal	G5T5	SNR	529769	NatureServe 2001-2007
Polygonatum pubescens	Hairy Solomon's-seal	G5	S5	43007	Imported from ANCS
Polygonum amphibium	Water Smartweed	G5	S5	20865	Seymour 1999
Polygonum arifolium	Halberd-leaf Tearthumb	G5	S4?	20849	Seymour 1996
Polygonum caespitosum var. longisetum	Oriental Lady’s-thumb	GNR TNR	SNA	566299	NatureServe 2001-2007
Polygonum convolvulus	Black Bindweed	GNR	SNA	20853	McKinney, et al. 1991
Polygonum hydropiperoides	Swamp Smartweed	G5	S5	20857	NatureServe 2001-2007
Polygonum pensylvanicum	Pennsylvania Smartweed	G5	S5	20861	Seymour 1999
Polygonum persicaria	Spotted Lady's-thumb	G3G5	SNA	20915	NatureServe 2001-2007
Polygonum punctatum	Dotted Smartweed	G5	S5	20862	Seymour 1999

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Polygonum sagittatum	Arrowleaf Tearthumb	G5	S5	20863	NatureServe 2001-2007
Polygonum scandens	Climbing False Buckwheat	G5	S5	20924	NatureServe 2001-2007
Polygonum scandens var. cristatum	Climbing False Buckwheat	G5T5	SNA	529790	Seymour 1999
Polygonum virginianum	Jumpseed	G5	S5	20931	NatureServe 2001-2007
Polymnia canadensis	Canada Leafcup	G5	S5	36438	Seymour 1999
Polypodium virginianum	Rock Polypody	G5	S5	17242	Seymour 1999
Polystichum acrostichoides var. acrostichoides	Christmas Fern	G5T5	SNR	529799	NatureServe 2001-2007
Populus alba	White Poplar	G5	SNA	22451	Seymour 1999
Populus deltoides ssp. deltoides	Eastern Cottonwood	G5T5	SNR	22446	Seymour 1999
Porteranthus stipulatus	Indian-physic	G5	S5	25284	NatureServe 2001-2007
Portulaca oleracea	Little Hogweed	GU	SNA	20422	McKinney, et al. 1991
Potamogeton diversifolius	Waterthread	G5	S5	39026	Seymour 1999
Potamogeton pulcher	Spotted Pondweed	G5	S1S2	39016	McKinney, et al. 1991
Potentilla recta	Sulphur Cinquefoil	GNR	SNA	24742	NatureServe 2001-2007
Potentilla simplex	Common Cinquefoil	G5	S5	24751	NatureServe 2001-2007
Prenanthes altissima	Tall Rattlesnake-root	G5?	S5	38273	NatureServe 2001-2007
Prenanthes racemosa	Purple Rattlesnake-root	G5	SNA	38281	Seymour 1999
Prenanthes serpentaria	Cankerweed	G5	S5	38286	NatureServe 2001-2007**
Prenanthes trifoliolata	Gall-of-the-Earth	G5	SNA	504596	NatureServe 2001-2007
Proserpinaca palustris	Marsh Mermaidweed	G5	S5	27049	McKinney, et al. 1991
Proserpinaca palustris var. crebra	Marsh Mermaidweed	G5T5	SNR	529859	Seymour 1999
Prunella vulgaris	Common Self-heal	G5	SNA	32381	NatureServe 2001-2007
Prunus americana	American Plum	G5	S5	24763	Seymour 1999
Prunus angustifolia var. angustifolia	Chickasaw Plum	G5 T4T5	SNR	529868	Seymour 1999
Prunus avium	Sweet Cherry	GNR	SNA	24770	Converted from MACA ANCS by CUPN 2007
Prunus persica	Peach	G5	SNA	24765	McKinney, et al. 1991
Prunus serotina var. serotina	Black Cherry	G5T5	SNR	529886	NatureServe 2001-2007
Prunus virginiana	Choke Cherry	G5	S3S4	24806	NatureServe 2001-2007**
Pseudognaphalium obtusifolium ssp. obtusifolium	Bluntleaf Rabbit-tobacco	G5T5	S5	525057	Seymour 1999
Ptelea trifoliata	Hoptree	G5	S5	28992	McKinney, et al. 1991
Pteridium aquilinum	Bracken Fern	G5	S5	17224	NatureServe 2001-2007
Pteridium aquilinum var. latiusculum	Northern Bracken	G5T5	SNR	529920	Seymour 1999
Pueraria montana var. lobata	Kudzu	GNR TNR	SNA	529930	McKinney, et al. 1991
Pycnanthemum incanum var. incanum	Hoary Mountainmint	G5T5	SNR	529931	NatureServe 2001-2007
Pycnanthemum loomisii	Loomis' Mountainmint	G4?	S5?	32663	Seymour 1999
Pycnanthemum pycnanthemoides var. pycnanthemoides	Southern Mountainmint	G5TNR	SNR	529933	Seymour 1999
Pycnanthemum tenuifolium	Narrowleaf Mountainmint	G5	S5	32668	NatureServe 2001-2007*

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Pycnanthemum verticillatum var. pilosum	Whorled Mountainmint	G5T5	SNR	529935	Seymour 1999
Pyrrhopappus carolinianus	Carolina False-dandelion	G5	S5	38324	Seymour 1999
Quercus alba	White Oak	G5	S5	19290	NatureServe 2001-2007
Quercus bicolor	Swamp White Oak	G5	S5	19300	NatureServe 2001-2007
Quercus coccinea var. coccinea	Scarlet Oak	G5T5	S5	195062	NatureServe 2001-2007
Quercus falcata	Southern Red Oak	G5	S5	19277	NatureServe 2001-2007*
Quercus imbricaria	Shingle Oak	G5	S5	19359	NatureServe 2001-2007
Quercus macrocarpa	Bur Oak	G5	S5	19287	McKinney, et al. 1991
Quercus marilandica	Blackjack Oak	G5	S5	19374	NatureServe 2001-2007
Quercus michauxii	Swamp Chestnut Oak	G5	S5	19279	NatureServe 2001-2007*
Quercus muehlenbergii	Chinquapin Oak	G5	S5	504714	NatureServe 2001-2007
Quercus nigra	Water Oak	G5	S2?	19280	Seymour 1999
Quercus pagoda	Cherrybark Oak	G5	S4S5	195195	NatureServe 2001-2007**
Quercus palustris	Pin Oak	G5	S5	19281	NatureServe 2001-2007
Quercus phellos	Willow Oak	G5	S5	19282	Seymour 1999
Quercus prinus	Chestnut Oak	G5	S5	19398	NatureServe 2001-2007*
Quercus rubra var. rubra	Northern Red Oak	G5T5	S5	195130	NatureServe 2001-2007
Quercus shumardii	Shumard Oak	G5	S5	19417	NatureServe 2001-2007*
Quercus stellata	Post Oak	G5	S5	19422	NatureServe 2001-2007
Quercus velutina	Black Oak	G5	S5	19447	NatureServe 2001-2007
Ranunculus abortivus	Kidneyleaf Buttercup	G5	S5	18559	NatureServe 2001-2007
Ranunculus bulbosus	Bulbous Buttercup	GNR	SNA	18594	NatureServe 2001-2007**
Ranunculus fascicularis	Thickroot Buttercup	G5	S5	18602	McKinney, et al. 1991
Ranunculus hispidus	Bristly Buttercup	G5	S5	18613	NatureServe 2001-2007
Ranunculus hispidus var. nitidus	Bristly Buttercup	G5T5	SNR	194960	McKinney, et al. 1991
Ranunculus micranthus	Rock Buttercup	G5	S4S5	18628	NatureServe 2001-2007
Ranunculus recurvatus	Blisterwort	G5	SNA	18641	NatureServe 2001-2007
Ranunculus sardous	Hairy Buttercup	GNR	SNA	18645	McKinney, et al. 1991
Ratibida pinnata	Gray-head Prairie Coneflower	G5	S4	38343	NatureServe 2001-2007
Rhexia mariana	Maryland Meadowbeauty	G5	S4?	27685	Seymour 1999
Rhexia virginica	Virginia Meadowbeauty	G5	S4	27686	Seymour 1999
Rhus aromatica var. aromatica	Fragrant Sumac	G5T5	SNR	530004	McKinney, et al. 1991
Rhus copallinum var. latifolia	Winged Sumac	G5T5	SNR	530007	NatureServe 2001-2007
Rhus glabra	Smooth Sumac	G5	S5	28782	Seymour 1999
Rhus hirta	Staghorn Sumac	G5	S4?	504755	McKinney, et al. 1991
Rhynchosia tomentosa	Twining Snoutbean	G5	S1S2	504773	NatureServe 2001-2007**
Rhynchospora capitellata	Northern Beaksedge	G5	S5	40145	Seymour 1999
Rhynchospora corniculata	Short-bristle Horned Beaksedge	G5	S4S5	40146	Seymour 1999
Ribes missouriense	Missouri Gooseberry	G5	S4S5	24485	NatureServe 2001-2007*
Robinia hispida	Bristly Locust	G4	SU	26191	McKinney, et al. 1991
Robinia pseudoacacia	Black Locust	G5	S5	504804	NatureServe 2001-2007

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Rorippa palustris ssp. fernaldiana	Fernald's Yellowcress	G5T5	SNR	524631	Seymour 1999
Rorippa sylvestris	Creeping Yellowcress	G5	SNA	23017	Seymour 1999
Rosa carolina var. carolina	Carolina Rose	G5T5	SNR	530107	NatureServe 2001-2007
Rosa multiflora	Multiflora Rose	GNR	SNA	24833	NatureServe 2001-2007
Rosa palustris	Swamp Rose	G5	S5	24809	Seymour 1999
Rosa setigera	Climbing Rose	G5	S5	24839	NatureServe 2001-2007
Rosa virginiana	Virginia Rose	G5	SNA	24810	McKinney, et al. 1991
Rotala ramosior	Lowland Toothcup	G5	S4	27115	Seymour 1999
Rubus allegheniensis	Allegheny Blackberry	G5	SNR	24866	NatureServe 2001-2007*
Rubus argutus	Southern Blackberry	G5	S5	24877	NatureServe 2001-2007
Rubus bifrons	Himalayan Berry	G5	SNA	24891	NatureServe 2001-2007*
Rubus flagellaris	Northern Dewberry	G5	S5	24921	NatureServe 2001-2007
Rubus frondosus	Yankee Blackberry	G5	S4?	24928	Seymour 1999
Rubus occidentalis	Black Raspberry	G5	S5	24854	NatureServe 2001-2007
Rubus pensilvanicus	Pennsylvania Blackberry	G5	SNR	504874	McKinney, et al. 1991
Rubus trivialis	Southern Dewberry	G5	S3S4	25067	NatureServe 2001-2007*
Rudbeckia fulgida	Orange Coneflower	G5	S4	36770	Seymour 1999
Rudbeckia fulgida var. fulgida	Orange Coneflower	G5T4?	S4	530161	Imported from ANCS
Rudbeckia fulgida var. spathulata	Orange Coneflower	G5 T4T5	SNR	530163	Davies 1954
Rudbeckia fulgida var. umbrosa	Orange Coneflower	G5 T4T5	SNR	530166	Seymour 1999
Rudbeckia hirta	Black-eyed-Susan	G5	S5	36765	NatureServe 2001-2007
Rudbeckia laciniata	Greenhead Coneflower	G5	S5	36775	NatureServe 2001-2007
Rudbeckia triloba	Brown-eyed-Susan	G5	S5	36784	Seymour 1999
Ruellia caroliniensis ssp. caroliniensis var. caroliniensis	Carolina Wild Petunia	G5T5	SNR	531772	NatureServe 2001-2007
Ruellia humilis	Low Wild Petunia	G5	S5	565466	Seymour 1999
Ruellia strepens	Limestone Wild Petunia	G4G5	S5	34390	NatureServe 2001-2007
Rumex acetosella	Common Sheep Sorrel	GNR	SNA	20934	Seymour 1999
Rumex crispus	Curly Dock	GNR	SNA	20937	Seymour 1999
Rumex obtusifolius	Bitter Dock	GNR	SNA	20939	Seymour 1999
Rumex pulcher	Fiddle Dock	GNR	SNA	20942	McKinney, et al. 1991
Rumex salicifolius	Willow Dock	G5	SNR	20974	NatureServe 2001-2007*
Sabatia angularis	Squarestem Sabatia	G5	S5	30005	NatureServe 2001-2007
Saccharum alopecuroidum	Silver Plumegrass	G5	SNR	504929	NatureServe 2001-2007
Sagittaria brevirostra	Shortbeak Arrowhead	G5	S4	38914	Seymour 1999
Sagittaria graminea var. graminea	Grassleaf Arrowhead	G5T5	S1S2	182445	McKinney, et al. 1991
Sagittaria platyphylla	Delta Arrowhead	G5	S2?	38927	Seymour 1999
Sagittaria rigida	Sessile-fruit Arrowhead	G5	S1	38928	McKinney, et al. 1991
Salix exigua	Coyote Willow	G5	S4?	22529	Seymour 1999
Salix humilis	Prairie Willow	G5	S4	22546	Seymour 1999
Salix humilis var. tristis	Prairie Willow	G5 T4T5	SNR	530214	Imported from ANCS
Salix interior	Sandbar Willow	G5	S4?	520829	McKinney, et al. 1991
Salix nigra	Black Willow	G5	S5	22484	NatureServe 2001-2007
Salix sericea	Silky Willow	G5	S5	22496	McKinney, et al. 1991
Salix X sepulcralis	Weeping Willow	GNA	SNA	504981	Seymour 1999

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Salvia lyrata	Lyreleaf Sage	G5	S5	32690	NatureServe 2001-2007
Sambucus nigra ssp. canadensis	Common Elderberry	G5T5	S5	525079	NatureServe 2001-2007
Samolus valerandi ssp. parviflorus	Seaside Brookweed	G5T5	SNR	524659	Seymour 1999
Sanguinaria canadensis	Bloodroot	G5	S5	18990	NatureServe 2001-2007
Sanicula canadensis	Canadian Black Snakeroot	G5	S5	29850	NatureServe 2001-2007
Sanicula canadensis var. canadensis	Canadian Black Snakeroot	G5T5	SNR	530236	NatureServe 2001-2007**
Sanicula marilandica	Maryland Black Snakeroot	G5	S2S3	29856	NatureServe 2001-2007
Sanicula odorata	Clustered Black Snakeroot	G5	S4?	505004	NatureServe 2001-2007
Sanicula smallii	Small's Black Snakeroot	G5	S5	29860	NatureServe 2001-2007
Sanicula trifoliata	Large-fruit Black Snakeroot	G4	S4?	29862	NatureServe 2001-2007*
Saponaria officinalis	Bouncing-bet	GNR	SNA	20039	Seymour 1996
Sassafras albidum	Sassafras	G5	S5	18158	NatureServe 2001-2007
Saururus cernuus	Lizard's-tail	G5	S5	18221	NatureServe 2001-2007
Saxifraga virginiensis	Early Saxifrage	G5	S5	24303	NatureServe 2001-2007
Schizachyrium scoparium	Little Bluestem	G5	S5	42076	NatureServe 2001-2007
Schizachyrium scoparium var. scoparium	Little Bluestem	G5T5	SNR	530264	NatureServe 2001-2007
Schoenoplectus tabernaemontani	Softstem Bulrush	G5	S4?	507797	Seymour 1999
Scirpus atrovirens	Green Bulrush	G5?	S5	40227	McKinney, et al. 1991
Scirpus cyperinus	Woolgrass Bulrush	G5	S5	40228	Seymour 1999
Scirpus georgianus	Georgia Bulrush	G5	S4S5	40259	Seymour 1999
Scirpus pendulus	Rufous Bulrush	G5	S5	40273	Seymour 1999
Scirpus polyphyllus	Leafy Bulrush	G5	S4S5	40274	Seymour 1999
Scleria ciliata	Fringed Nutrush	G5	S2	40305	Seymour 1999
Scleria triglomerata	Whip Nutrush	G5	S4S5	40318	NatureServe 2001-2007*
Scrophularia marilandica	Carpenter's-square	G5	S5?	34037	NatureServe 2001-2007
Scutellaria elliptica	Hairy Skullcap	G5	S5	32796	NatureServe 2001-2007
Scutellaria incana	Hoary Skullcap	G5	S5?	32770	NatureServe 2001-2007
Scutellaria lateriflora	Blue Skullcap	G5	S5	32765	Seymour 1999
Scutellaria nervosa	Veiny Skullcap	G5	S3S4	32808	Seymour 1999
Scutellaria ovata	Heartleaf Skullcap	G5	S5?	32772	NatureServe 2001-2007
Scutellaria parvula	Small Skullcap	G4	S4?	32776	NatureServe 2001-2007
Scutellaria parvula var. missouriensis	Leonard's Skullcap	G4T4	S3S4	566308	Seymour 1999
Secale cereale	Rye	GNR	SNA	42090	Seymour 1999
Sedum pulchellum	Widow's-cross	G5	S5	24157	Seymour 1999
Sedum ternatum	Woodland Stonecrop	G5	S5	24184	NatureServe 2001-2007
Senna hebecarpa	Wild Senna	G5	S4?	505155	NatureServe 2001-2007**
Senna marilandica	Maryland Wild Sensitive Plant	G5	S5	505160	NatureServe 2001-2007
Sericocarpus linifolius	Narrowleaf Whitetop Aster	G5	S5	508090	NatureServe 2001-2007
Setaria faberi	Japanese Bristlegrass	GNR	SNA	41244	Seymour 1999
Setaria parviflora	Yellow Foxtail Grass	G5	SNR	505191	Seymour 1999
Sherardia arvensis	Silver Buffalo-berry	GNR	SNA	35237	Converted from MACA ANCS by CUPN 2007

Scientific Name (NPSpecies)	Common Name	G-RANK	S-RANK	TSN	Source
Sibara virginica	Virginia Winged Rockcress	G5	S4?	23307	Seymour 1999
Sicyos angulatus	Bur-cucumber	G5	S5	22402	NatureServe 2001-2007
Sida spinosa	Prickly Fanpetals	G5?	SNA	21732	McKinney, et al. 1991
Sideroxylon lycioides	Buckthorn Bumelia	G5	S4?	505220	NatureServe 2001-2007
Silene rotundifolia	Sandstone Fire-pink	G4	S5	20114	Seymour 1999
Silene stellata	Widow's Frill	G5	S4S5	20127	Seymour 1999
Silene virginica	Fire-pink	G5	S5	20141	NatureServe 2001-2007
Silphium integrifolium	Prairie Rosinweed	G5	S4?	38400	Seymour 1999
Silphium perfoliatum var. perfoliatum	Cup Plant	G5T5?	SNR	38404	Seymour 1999
Silphium pinnatifidum	Tansy Rosinweed	G3Q	S3	38406	Seymour 1999
Silphium terebinthinaceum	Prairie-dock	G4G5	S4?	565520	NatureServe 2001-2007 ^
Silphium trifoliatum	Threeleaf Rosinweed	G4?	S5	505235	NatureServe 2001-2007
Sisymbrium officinale	Hairy-pod Hedge-mustard	GNR	SNA	23316	Seymour 1999
Sisyrinchium albidum	White Blue-eyed-grass	G5?	S5	43241	Seymour 1999
Sisyrinchium angustifolium	Narrowleaf Blue-eyed-grass	G5	S5	43240	NatureServe 2001-2007
Smallanthus uvedalius	Bear's-foot	G4G5	S5	505252	NatureServe 2001-2007
Smilax bona-nox	Fringed Greenbrier	G5	S5	43341	NatureServe 2001-2007
Smilax ecirrata	Upright Greenbrier	G5?	S5	43351	NatureServe 2001-2007
Smilax glauca	Whiteleaf Greenbrier	G5	S5	43342	NatureServe 2001-2007
Smilax herbacea	Smooth Carrion-flower	G5	S5	43356	NatureServe 2001-2007
Smilax hugeri	Huger's Carrion-flower	G4	S4S5	505254	NatureServe 2001-2007
Smilax rotundifolia	Roundleaf Greenbrier	G5	S5	43346	NatureServe 2001-2007
Smilax tamnoides	Chinaroot	G5	S5	43348	NatureServe 2001-2007
Solanum carolinense var. carolinense	Carolina Horsenettle	G5T5	S5?	530413	NatureServe 2001-2007
Solanum ptychanthum	Eastern Black Nightshade	G5	SNA	505270	Seymour 1999
Solidago arguta	Atlantic Goldenrod	G5	S3S4	36230	NatureServe 2001-2007
Solidago arguta var. caroliniana	Atlantic Goldenrod	G5T4	SU	530438	NatureServe 2001-2007*
Solidago bicolor	White Goldenrod	G5	S5?	36234	Seymour 1999
Solidago caesia	Wreath Goldenrod	G5	SNR	36238	NatureServe 2001-2007**
Solidago canadensis	Canada Goldenrod	G5	SNR	36224	NatureServe 2001-2007
Solidago canadensis var. scabra	Canada Goldenrod	G5	SNR	530448	Seymour 1999
Solidago flexicaulis	Zigzag Goldenrod	G5	S5	36257	NatureServe 2001-2007
Solidago gigantea	Giant Goldenrod	G5	S5	36259	Seymour 1999
Solidago hispida	Hairy Goldenrod	G5	S4S5	36266	NatureServe 2001-2007
Solidago juncea	Early Goldenrod	G5	S4S5	36270	Seymour 1999
Solidago missouriensis var. fasciculata	Missouri Goldenrod	G5T5	SNR	530454	Seymour 1999
Solidago nemoralis var. nemoralis	Gray Goldenrod	G5T5	SNR	530465	NatureServe 2001-2007
Solidago odora var. odora	Anise-scented Goldenrod	G5T5	SNR	530467	NatureServe 2001-2007
Solidago patula var. patula	Roundleaf Goldenrod	G5T5	SNR	530468	Seymour 1999
Solidago puberula var. puberula	Downy Goldenrod	G5 T4T5	S2	530471	McKinney, et al. 1991
Solidago rugosa	Wrinkleleaf Goldenrod	G5	S4S5	36299	Seymour 1999
Solidago rugosa ssp. aspera	Wrinkleleaf Goldenrod	G5T5	SNA	36301	NatureServe 2001-2007*

Scientific Name (NPSpecies)	Common Name	G-RANK	S-RANK	TSN	Source
Solidago rugosa ssp. rugosa	Wrinkleleaf Goldenrod	G5T5	SNR	36300	Lix 1950
Solidago speciosa	Showy Goldenrod	G5	S4?	36310	NatureServe 2001-2007
Solidago speciosa var. erecta	Showy Goldenrod	G5T5	S5?	530478	Seymour 1999
Solidago speciosa var. rigidiuscula	Showy Goldenrod	G5T4	SU	530481	NatureServe 2001-2007
Solidago sphacelata	Limestone Goldenrod	G4G5	S4	36312	Seymour 1999
Solidago ulmifolia var. ulmifolia	Elmleaf Goldenrod	G5T5	S5	530489	NatureServe 2001-2007
Sonchus asper	Spiny-leaf Sowthistle	GNR	SNA	38424	Seymour 1999
Sorghastrum nutans	Yellow Indiangrass	G5	S5	42102	NatureServe 2001-2007
Sorghum halepense	Johnson Grass	GNR	SNA	42111	Seymour 1999
Sparganium androcladum	Branched Bur-reed	G4G5	S4?	42320	Seymour 1999
Sphenopholis intermedia	Slender Wedgescale	G5	S5?	505324	Seymour 1999
Sphenopholis nitida	Shiny Wedgescale	G5	S4S5	41281	NatureServe 2001-2007
Sphenopholis obtusata	Prairie Wedgescale	G5	S5?	41279	Seymour 1999
Spiraea tomentosa	Steeplebush	G5	S4S5	25342	Seymour 1996
Spiraea tomentosa var. rosea	Steeplebush	G5T5	SNR	530522	Seymour 1999
Spiraea tomentosa var. tomentosa	Steeplebush	G5T5?	SNA	530523	Seymour 1999
Spiranthes cernua	Nodding Ladies'-tresses	G5	S5	43444	NatureServe 2001-2007
Spiranthes lacera var. gracilis	Southern Slender Ladies'-tresses	G5 T4T5	SNR	530529	Seymour 1999
Spiranthes ovalis	October Ladies'-tresses	G5?	S4S5	43451	NatureServe 2001-2007
Spiranthes tuberosa	Little Ladies'-tresses	G5	S4S5	505346	Seymour 1999
Spiranthes vernalis	Spring Ladies'-tresses	G5	S5	43453	Seymour 1999
Spirodela polyrrhiza	Common Duckmeat	G5	S5	505347	McKinney, et al. 1991
Sporobolus clandestinus	Secret Dropseed	G5	S2S3	42117	NatureServe 2001-2007*
Sporobolus compositus var. compositus	Tall Dropseed	G5T5	SNR	531124	McKinney, et al. 1991
Sporobolus neglectus	Barrens Dropseed	G5	S5	42145	Seymour 1999
Sporobolus vaginiflorus	Poverty Dropseed	G5	S5	42126	NatureServe 2001-2007
Stachys tenuifolia	Smooth Hedge-nettle	G5	SNR	32323	Seymour 1999
Staphylea trifolia	American Bladdernut	G5	S5	28646	Seymour 1999
Stellaria media	Common Chickweed	GNR	SNA	20169	NatureServe 2001-2007
Stellaria pubera	Great Chickweed	G5	S5	20193	NatureServe 2001-2007
Strophostyles helvula	Trailing Wild Bean	G5	S5	505392	Seymour 1999
Strophostyles umbellata	Pink Fuzzy-bean	G5	S5	26201	NatureServe 2001-2007
Stylophorum diphyllum	Celandine Poppy	G5	S5	18994	NatureServe 2001-2007
Stylosanthes biflora	Side-beak Pencil-flower	G5	S5	26973	NatureServe 2001-2007
Symphoricarpos orbiculatus	Coralberry	G5	S5	35337	NatureServe 2001-2007
Symphyotrichum cordifolium	Common Blue American-aster	G5	S5	522193	NatureServe 2001-2007
Symphyotrichum dumosum	Rice Button American-aster	G5	S5	522200	NatureServe 2001-2007
Symphyotrichum dumosum var. dumosum	Rice Button American-aster	G5T3T5	SNR	566329	Seymour 1999
Symphyotrichum laeve var. laeve	Smooth Blue American-aster	G5T5	S4	566333	Seymour 1999

Scientific Name (NPSpecies)	Common Name	G-RANK	S-RANK	TSN	Source
Symphyotrichum lanceolatum ssp. lanceolatum var. lanceolatum	Swamp Aster	G5T5	SNR	566356	Seymour 1999
Symphyotrichum lateriflorum	Calico Aster	G5	S5	522220	NatureServe 2001-2007
Symphyotrichum lateriflorum var. lateriflorum	Calico Aster	G5T5	S5	566334	Seymour 1999
Symphyotrichum lowrieanum	Lowrie's Blue Wood-aster	G3G5Q	SNR	522224	NatureServe 2001-2007
Symphyotrichum novae-angliae	New England Aster	G5	S5	522226	Seymour 1999
Symphyotrichum ontarione	Bottomland Aster	G5	S5	522229	Seymour 1999
Symphyotrichum patens var. patens	Late Purple American-aster	G5T5	SNR	566339	NatureServe 2001-2007**
Symphyotrichum patens var. patentissimum	Western Clasping Aster	G5TNR	SNR	541109	NatureServe 2001-2007*
Symphyotrichum pilosum var. pilosum	White Heath Aster	G5T5	SNR	566340	Seymour 1999
Symphyotrichum prenanthoides	Crooked-stem Aster	G4G5	S5	522239	Seymour 1999
Symphyotrichum racemosum	Small-head Aster	G4G5	S5	522242	Seymour 1999
Symphyotrichum sericeum	Silky Aster	G5	SNA	522245	Seymour 1999
Symphyotrichum shortii	Short's American-aster	G5	S5	522246	NatureServe 2001-2007
Symphyotrichum undulatum	Wavyleaf American-aster	G5	SNR	522257	NatureServe 2001-2007
Synandra hispidula	Guyandotte Beauty	G4	S4	32819	Seymour 1999
Taenidia integerrima	Yellow Pimpernel	G5	S5	29875	McKinney, et al. 1991
Taraxacum laevigatum	Redseed Dandelion	GNR	SNA	36210	Seymour and Campbell 1991-99
Taraxacum officinale ssp. officinale	Common Dandelion	G5T5	SNA	524742	NatureServe 2001-2007
Tephrosia virginiana	Goat's-rue	G5	S5	26998	NatureServe 2001-2007
Teucrium canadense var. canadense	Canada Germander	G5T5	SNA	530630	NatureServe 2001-2007
Thalictrum clavatum	Mountain Meadowrue	G4	SNR	18663	McKinney, et al. 1991
Thalictrum dioicum	Early Meadowrue	G5	S5	18669	NatureServe 2001-2007
Thalictrum pubescens	King-of-the-Meadow	G5	S5	18678	Seymour 1999
Thalictrum revolutum	Skunk Meadowrue	G5	SNR	18660	Seymour 1999
Thalictrum thalictroides	Rue-anemone	G5	S5	18683	NatureServe 2001-2007
Thaspium barbinode	Hairy-joint Meadow-parsnip	G5	S5	29888	NatureServe 2001-2007**
Thaspium pinnatifidum	Cutleaf Meadow-parsnip	G2G3	S2S3	29889	Seymour 1999
Thaspium trifoliatum	Purple Meadow-parsnip	G5	SNR	29890	Seymour 1999
Thelypteris noveboracensis	New York Fern	G5	S5	17261	NatureServe 2001-2007
Thlaspi arvense	Field Pennycress	GNR	SNA	23422	Seymour 1999
Tiarella cordifolia	Heartleaf Foamflower	G5	S5	24530	NatureServe 2001-2007
Tilia americana	American Basswood	G5	S5	21536	NatureServe 2001-2007
Tipularia discolor	Crippled Cranefly	G4G5	S5	43703	NatureServe 2001-2007
Toxicodendron radicans	Eastern Poison-ivy	G5	S5	28821	NatureServe 2001-2007
Trachelospermum difforme	Climbing Dogbane	G4G5	SNR	30230	NatureServe 2001-2007**

Scientific Name (NPSpecies)	Common Name	G-RANK	S-RANK	TSN	Source
Tradescantia subaspera	Zigzag Spiderwort	G5	S5?	39176	NatureServe 2001-2007
Tradescantia virginiana	Virginia Spiderwort	G5	S5	39178	NatureServe 2001-2007
Tragia cordata	Heartleaf Noseburn	G4	S3S4	28428	NatureServe 2001-2007
Tragopogon dubius	Meadow Goat's-beard	GNR	SNA	38564	McKinney, et al. 1991
Trichomanes boschianum	Appalachian Bristle Fern	G4	S3S4	17928	McKinney, et al. 1991
Trichostema dichotomum	Forked Bluecurls	G5	SNR	32364	Seymour 1999
Trichostema setaceum	Narrowleaf Bluecurls	G5	S1	32362	McKinney, et al. 1991
Tridens flavus var. flavus	Tall Redtop	G5T5?	S5	530720	NatureServe 2001-2007
Trifolium arvense	Rabbit-foot Clover	GNR	SNA	26221	McKinney, et al. 1991
Trifolium aureum	Golden Clover	GNR	SNA	26223	McKinney, et al. 1991
Trifolium campestre	Low Hop Clover	GNR	SNA	26231	Seymour 1999
Trifolium hybridum	Alsike Clover	GNR	SNA	26261	Seymour 1999
Trifolium pratense	Red Clover	GNR	SNA	26313	Seymour 1999
Trifolium reflexum	Buffalo Clover	G3G4	S1S2	26280	Seymour 1999
Trifolium repens	White Clover	GNR	SNA	26206	Seymour 1999
Trillium flexipes	Nodding Wakerobin	G5	SNR	43071	NatureServe 2001-2007
Trillium sessile	Toadshade	G4G5	S5	43088	NatureServe 2001-2007
Triodanis perfoliata	Claspingleaf Venus'-looking-glass	G5	S5	34615	Imported from ANCS
Triodanis perfoliata var. perfoliata	Claspingleaf Venus'-looking-glass	G5T5	SNR	530743	Seymour 1999
Triosteum angustifolium	Yellow-fruit Horse-gentian	G5	S5	35344	NatureServe 2001-2007
Triosteum aurantiacum	Orange-fruit Horse-gentian	G5	S5?	505596	Seymour 1999
Triosteum perfoliatum	Feverwort	G5	S3S4	35345	McKinney, et al. 1991
Triphora trianthophora	Threebirds	G3G4	SNR	43709	Seymour 1999
Tsuga canadensis	Eastern Hemlock	G4G5	SNA	183397	NatureServe 2001-2007
Typha angustifolia	Narrowleaf Cattail	G5	SNR	42325	Seymour 1999
Typha latifolia	Broadleaf Cattail	G5	S5	42326	Seymour 1999
Ulmus alata	Winged Elm	G5	S5	19051	NatureServe 2001-2007
Ulmus americana	American Elm	G5?	S5	19049	NatureServe 2001-2007
Ulmus rubra	Slippery Elm	G5	S5	19050	NatureServe 2001-2007
Ulmus serotina	September Elm	G4	S3	19058	Seymour 1999
Ulmus thomasii	Rock Elm	G5	S4?	19059	McKinney, et al. 1991
Utricularia gibba	Humped Bladderwort	G5	S4	34452	Seymour 1999
Uvularia grandiflora	Large-flower Bellwort	G5	SNR	43109	NatureServe 2001-2007
Uvularia perfoliata	Perfoliate Bellwort	G5	S5	43110	NatureServe 2001-2007
Uvularia sessilifolia	Sessile-leaf Bellwort	G5	S5	43112	NatureServe 2001-2007
Vaccinium arboreum	Farkleberry	G5	S5	23580	NatureServe 2001-2007
Vaccinium corymbosum	Highbush Blueberry	G5	S5	23573	NatureServe 2001-2007
Vaccinium pallidum	Hillside Blueberry	G5	S5	23610	NatureServe 2001-2007
Vaccinium stamineum	Deerberry	G5	S5	23615	NatureServe 2001-2007
Valeriana pauciflora	Large-flower Valerian	G4	S5	35364	Seymour 1999
Verbascum blattaria	Moth Mullein	GNR	SNA	33389	Seymour 1999
Verbascum thapsus	Great Mullein	GNR	SNA	33394	NatureServe 2001-2007
Verbena hastata var. hastata	Swamp Verbena	G5T5	SNR	530779	Seymour 1999
Verbena simplex	Narrowleaf Vervain	G5	S5	32123	NatureServe 2001-2007
Verbena stricta	Hoary Verbena	G5	SNA	32078	Seymour 1999
Verbena urticifolia	White Vervain	G5	S5	32127	NatureServe 2001-2007
Verbesina alternifolia	Wingstem	G5	S5	38597	NatureServe 2001-2007
Verbesina helianthoides	Gravelweed	G5	S5	38604	Seymour 1999

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Verbesina occidentalis	Yellow Crownbeard	G5	S5	38610	NatureServe 2001-2007**
Verbesina virginica var. virginica	Common Frostweed	G5?T5?	SNR	530792	Seymour 1999
Vernonia gigantea ssp. gigantea	Giant Ironweed	G5T5	SNR	38635	NatureServe 2001-2007
Veronica arvensis	Corn Speedwell	GNR	SNA	33411	Seymour 1999
Veronica peregrina	Neckweed	G5	S5	33421	Seymour 1999
Veronica serpyllifolia ssp. serpyllifolia	Thymeleaf Speedwell	G5TNR	SNA	33424	Seymour 1999
Veronicastrum virginicum	Culver's-root	G4	S4?	34073	Seymour 1999
Viburnum acerifolium	Mapleleaf Viburnum	G5	S5	35255	NatureServe 2001-2007
Viburnum prunifolium	Smooth Blackhaw	G5	S5?	35253	NatureServe 2001-2007
Viburnum rufidulum	Rusty Blackhaw	G5	S5	35274	NatureServe 2001-2007
Vicia caroliniana	Carolina Wood Vetch	G5	S5	26334	Seymour 1999
Vicia sativa	Spring Vetch	GNR	SNA	26355	McKinney, et al. 1991
Vinca minor	Lesser Periwinkle	GNR	SNA	30238	Seymour 1999
Viola affinis	Sand Violet	G5	SNR	22035	NatureServe 2001-2007*
Viola bicolor	Field Pansy	G5	SNR	22047	Seymour 1999
Viola blanda	Sweet White Violet	G4G5	S5	22050	NatureServe 2001-2007
Viola canadensis var. canadensis	Canada Violet	G5T5	SNR	530825	NatureServe 2001-2007
Viola conspersa	American Bog Violet	G5	S5	22060	McKinney, et al. 1991
Viola cucullata	Marsh Blue Violet	G4G5	S5	505709	Seymour 1999
Viola hirsutula	Southern Woodland Violet	G4	S5	22087	NatureServe 2001-2007
Viola lanceolata ssp. lanceolata	Bog White Violet	G5T5	SNR	22095	Seymour 1999
Viola palmata var. palmata	Early Blue Violet	G5T5?	SNR	531142	NatureServe 2001-2007
Viola pedata	Bird's-foot Violet	G5	S5?	22130	NatureServe 2001-2007
Viola pedatifida	Crowfoot Violet	G5	SNA	22131	NatureServe 2001-2007*
Viola pubescens	Downy Yellow Violet	G5	S5	22144	NatureServe 2001-2007
Viola pubescens var. pubescens	Downy Yellow Violet	G5T5	SNR	530837	Seymour 1999
Viola pubescens var. scabriuscula	Downy Yellow Violet	G5TNR	SNR	531467	NatureServe 2001-2007
Viola rostrata	Longspur Violet	G5	S5	22158	Seymour 1999
Viola rotundifolia	Roundleaf Violet	G5	S3S4	22159	NatureServe 2001-2007**
Viola sagittata	Arrowleaf Violet	G5	S3?	22162	Seymour 1999
Viola sororia	Common Blue Violet	G5	S5	22169	NatureServe 2001-2007
Viola striata	Striped Violet	G5	SNR	22171	NatureServe 2001-2007
Viola walteri	Prostrate Blue Violet	G4G5	S2	22183	Medley 1993-1997
Viola X primulifolia	Primrose-leaf Violet	GNA	SNR	22143	NatureServe 2001-2007
Vitis aestivalis	Summer Grape	G5	S5	28607	NatureServe 2001-2007
Vitis cinerea	Gray-bark Grape	G4G5	S4?	28615	NatureServe 2001-2007
Vitis labrusca	Fox Grape	G5	S2S3	28608	NatureServe 2001-2007**
Vitis palmata	Catbird Grape	G4	S5?	28623	NatureServe 2001-2007*
Vitis rotundifolia	Muscadine	G5	S5	28609	NatureServe 2001-2007**
Vitis vulpina	Frost Grape	G5	S5	28610	NatureServe 2001-2007

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Vulpia octoflora	Eight-flower Six-weeks Grass	G5	S5?	42264	Seymour 1999
Waldsteinia fragarioides	Barren Strawberry	G5	S3S4	505735	Seymour 1999
Waldsteinia fragarioides ssp. doniana	Appalachian Barren Strawberry	G5T3T5	SNR	524828	McKinney 1990
Wisteria frutescens	American Wisteria	G5	S5	27021	McKinney, et al. 1991
Wisteria sinensis	Chinese Wisteria	GNR	SNA	27023	Seymour 1999
Woodsia obtusa	Common Cliff Fern	G5	SNR	17744	NatureServe 2001-2007
Woodwardia areolata	Netted Chainfern	G5	S4?	17749	NatureServe 2001-2007
Xanthium strumarium	Rough Cocklebur	G5	S5?	38692	NatureServe 2001-2007
Xanthium strumarium var. canadense	Cocklebur	G5T5	SNR	530872	Seymour 1999
Yucca filamentosa	Adam's-needle	G5	SNR	43140	NatureServe 2001-2007
Zizia aptera	Heartleaf Alexanders	G5	S5	29905	NatureServe 2001-2007
Zizia aurea	Golden Alexanders	G5	S5	29906	Seymour 1999

Note: There are 2 recognized varieties of Yellow Lady's-slipper in Kentucky, and both have been attributed to MACA, but only one is thought to be actually present. Ironically, the one that is confirmed at MACA is not the 'nominate' variety, the one whose specific name is carried by both varieties. So, *Cypripedium parviflorum* in the broad sense is present, but the only variety which is confirmed is *Cypripedium parviflorum var. pubescens*, the "greater Yellow Lady's-slipper". *Cypripedium parviflorum var. parviflorum* is unconfirmed art MACA, as far as can be determined at present.

Table 3. List of all vouchers collected by NatureServe at Mammoth Cave National Park

Documented Latin Name	Common Name	TSN	Catalog	Collector	Habitat
Aesculus flava	yellow buckeye	28717	MACA 47151	M. Pyne, M. Whited	Mesic lower slope in beech/sugar maple/tulip poplar forest
Antennaria neglecta	small pussytoes	185141	MACA 47102	R. White, W. Weldon	Box-elder/sycamore floodplain forest
Asplenium x trudellii	Trudell's spleenwort	17367	MACA 47103	R. White, K. Feeman	Northern mixed mesophytic forest
Botrychium biternatum	sparselobe grapefern	17175	MACA 47104	R. White, W. Hawkins	Oak-hickory dry mesic forest
Botrychium virginianum	rattlesnake fern	17173	MACA 47105	C. Nordman, R. White	Cedar glade
Brassica rapa	field mustard	23063	MACA 47106	R. White, E. Lunsford	Red cedar successional forest
Bromus nottowayanus	Nottoway Valley brome	40509	MACA 47107	R. White E. Lunsford	Virginia pine successional forest
Campanula divaricata - (2 sheets)	small bonny bellflower	34482	MACA 47108	R. White, W. Weldon	Box-elder/sycamore floodplain forest
Carex styloflexa	bent sedge	39823	MACA 47109	R. White, E. Lunsford, J. Hewitt	Northern mixed mesophytic forest
Carex vulpinoidea	common fox sedge	39442	MACA 47110	R. White, W. Hawkins	Oak-hickory dry mesic forest
Carya pallida	sand hickory	19244	MACA 47111	C. Nordman, B. Bacon	Virginia pine-cedar successional forest
Corydalis flavula	yellow fumewort	19005	MACA 47113	R. White, E. Lunsford, J. Hewitt	Oak-hickory dry mesic forest
Dichanthelium aciculare	needleleaf rosette grass	41653	MACA 47114	C. Nordman & R. White	Successional hickory/ degraded glade complex
Dichanthelium acuminatum var. acuminatum	tapered rosette grass	527684	MACA 47115	M. Webber	Virginia pine successional forest
Dichanthelium commutatum ssp ashei	Ashe's variable panic grass	534431	MACA 47116	R. White, E. Lunsford, J. Hewitt	Northern mixed mesophytic forest
Dichanthelium dichotomum var. ramulosum			MACA 47117	C. Nordman	Tulip poplar successional forest
Dichanthelium villosissimum var. villosissimum	whitehair rosette grass	527707	MACA 47118	C. Nordman?	Virginia pine successional forest
Diplotaxis tenuifolia	perennial wallrocket	502098	MACA 47119	M. Webber	Water-willow Rocky Bar and Shore
Hydrophyllum macrophyllum	largeleaf waterleaf	31393	MACA 47120	E. Lunsford, A. Datillo	NE-facing hemlock/beech/maple slope above alluvial terrace
Hypericum hypericoides ssp. multicaule	St. Andrew's cross	524170	MACA 47121	C. Nordman, R. White	Virginia pine successional forest
Hypericum sphaerocarpum	roundseed St. Johnswort	21460	MACA 47122	C. Nordman	Successional hickory/ degraded glade complex
Lemna minor	common duckweed	42590	MACA 47123	C. Nordman, R. White	Red maple / Pin oak depression forest
Ligusticum canadense	Canadian licorice-root	29528	MACA 47124	E. Lunsford, A. Datillo	Mature oak-hickory forest

Documented Latin Name	Common Name	TSN	Catalog	Collector	Habitat
Luzula multiflora	common woodrush	39333	MACA 47125	E. Lunsford, J. Hewitt, T. Cummins	Red cedar successional forest
Matelea carolinensis?	maroon Carolina milkvine	30369	MACA 47126	R. Evans, T. Hogan	White oak dry-mesic creekside forest
Myosotis macrosperma	southern forget me not	31695	MACA 47127	R. White, Jenny Hewitt	Northern mixed mesophytic forest
Oligoneuron rigidum	stiff goldenrod	508151	MACA 47128	E. Lunsford	Limestone glade
Phyla lanceolata	common frogfruit	182435	MACA 47101	C. Nordman	Box-elder floodplain forest
Physalis cordata	heartleaf groundcherry	30595	MACA 47129	C. Nordman?	Box-elder floodplain forest
Pycnanthemum tenuifolium	narrowleaf mountainmint	32668	MACA 47130	M. Webber	Virginia pine successional forest
Quercus falcata	southern red oak	19277	MACA 47131	M. Webber	Virginia pine successional forest
Quercus michauxii - (2 sheets)	swamp chestnut oak	19279	MACA 47132	M. Pyne	Understory tree on upper end of lower mesic oak slope, below limestone bench with Chinquapin oak, and rocky sandstone bench with Chestnut oak.
Quercus prinus	chestnut oak	19398	MACA 47133	C. Nordman, B. Bacon	Virginia pine-cedar successional forest
Quercus shumardii	Shumard's oak	19417	MACA 47134	E. Lunsford, N. Talley, E. Wenk	High slope over Green river, in patch of Giant cane
Ribes missouriense?	Missouri gooseberry	24485	MACA 47135	C. Nordman	Tulip poplar successional forest
Rubus allegheniensis	Allegheny blackberry	24866	MACA 47136	R. White, E. Lunsford, J. Hewitt	Oak-hickory dry mesic forest
Rubus bifrons	Himalayan berry	24891	MACA 47137	C. Nordman	Tulip poplar successional forest
Rubus trivialis	southern dewberry	25067	MACA 47138	R. White, E. Lunsford, J. Hewitt	Northern mixed mesophytic forest
Rumex salicifolius	willow dock	20974	MACA 47139	M. Webber	Water-willow Rocky Bar and Shore
Sanicula trifoliata	largefruit blacksnakeroot	29862	MACA 47140	E. Lunsford, A. Datillo	Rich cove
Scleria triglomerata	whip nutrush	40318	MACA 47141	R. White	
Solidago arguta var. caroliniana	Atlantic goldenrod	530438	MACA 47142	R. Evans, T. Hogan	White oak forest
Solidago rugosa ssp. aspera	wrinkleleaf goldenrod	36301	MACA 47144	R. Evans, T. Hogan	Interior Low Plateau Chestnut Oak – Mixed Oak Forest

Table 4. Tables of vascular plant diversity measures and species total estimates for Mammoth Cave National Park

	Diversity Measures			
	N	alpha	beta	Gamma
Gridded plots only	40	94.7	6.7	635
Plots off grid only	10	84.1	3.9	324
All plots	50	92.5	7.1	658

alpha = average species richness per plot
beta = measure of the heterogeneity of the data (gamma/alpha)
gamma = total # of species

	Estimate of # of species in park	If estimate is correct, % of species confirmed for park (based on 1265 species documented)
First-order jackknife estimate (all plots)	847	150%
Second-order jackknife estimate (all plots)	945	134%
First-order jackknife estimate (gridded plots)	840	151%
Second-order jackknife estimate (gridded plots)	965	132%

Table 5. List of exotic species documented from Mammoth Cave National Park

Scientific Name	Common name	TSN	Threat?	Source
Abutilon theophrasti	Velvetleaf	21674		
Achillea millefolium	Common Yarrow	35423		
Agrosits giantea	Giant Bentrass	40414		
Ailanthus altissima	Tree-of-Heaven	28827	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Albizia julibrissin	Silktree	26449	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Alliaria petiolata	Garlic Mustard	184481	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Allium sativum	Cultivated Garlic	42652		
Allium vineale ssp. Vineale	Wild Garlic	182599		
Alnus glutinosa	European Alder	19470	Watch List - 2	Tennessee Exotic Pest Plant Council, 2009
Anagallis arvensis	Scarlet Pimpernel	24043		
Anthemis cotula	Stinking Chamomile	36330		
Anthoxanthum odoratum	Sweet Vernal Grass	41395		
Arabidopsis thaliana	Mouse-ear Cress	23041		
Arctium minus	Lesser Burdock	36546	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Artemisia annua	Annual Wormwood	35448		
Aruncus dioicus	Bride's-feathers	25130		
Arundo donax	Giant Reed	41450		
Asparagus officinale	Garden Asparagus	42784		
Barbarea vulgaris	Garden Yellow-rocket	22741	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Belamcanda chinensis	Blackberry Lily	43280		
Berberis thunbergii	Japanese Barberry	18835	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Brassica nigra	Black Mustard	23061		
Brassica rapa	Bird's Rape	23063		
Bromus commutatus	Meadow Brome	40497		
Bromus japonicus	Japanese Brome	40479	Significant Threat	Tennessee Exotic Pest Plant Council, 2009
Bromus racemosus	Bald Brome	40516		
Bromus sterilis	Poverty Brome	40522		
Bromus tectorum	Cheatgrass	40524		
Buglossoides arvensis	Corn-gromwell	501090	Lesser Threat	Kentucky Exotic Pest Plant Council, 2009
Calystegia sepium	Hedge False Bindweed	30650		
Calystegia sepium ssp. sepium	Hedge False Bindweed	30651		
Capsella bursa-pastoris	Common Shepherd's-purse	22766		
Cardamine hirsute	Hairy Bitercress	22797		
Carduus nutans	Musk Thistle	35787	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Centaurea biebersteinii	Spotted Knapweed	501347	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Centaurium pulchellum	Branched Centaury	30036		
Cerastium fontanum ssp. Vulgare	Common Mouse-ear Chickweed	523831		
Cerastium glomeratum	Sticky Mouse-ear Chickweed	19955		
Chenopodium ambrosioides var. ambrosioides	Mexican Tea, Wormseed Goosefoot	527311	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Cichorium intybus	Chicory	36763	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Cirsium vulgare	Bull Thistle	36428		

Scientific Name	Common name	TSN	Threat?	Source
Clematis terniflora	Sweet Autumn Virgin's-bower	18712	Significant Threat	Tennessee Exotic Pest Plant Council, 2009
Cleome hassleriana	Pink Queen	501583		
Commelina communis	Asiatic Dayflower	39127	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Conium maculatum	Poison-hemlock	29473	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Convolvulus arvensis	Field Bindweed	30705	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Coronilla varia	Purple Crown-vetch	26553	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Cynodon dactylon	Bermuda Grass	41619		
Dactylis glomerata ssp. Glomerata	Orchard Grass	193447		
Datura stramonium	Jimsonweed	30520		
Daucus carota	Queen Anne's-lace	29477	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Dianthus armeria	Deptford-pink	20276	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Digitaria ischaemum	Smooth Crabgrass	40637		
Dioscorea oppositifolia	Chinese Yam	502075	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Diplotaxis tenuifolia	Perennial Wallrocket	502098		
Dipsacus fullonum	Fuller's Teasel	35404	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Dipsacus fullonum ssp. sylvestris	Fuller's Teasel	524924	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Draba verna	Spring Whitlow-grass	22923		
Duchesnea indica	Indian-strawberry	25163	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Echinochloa crus-galli	Large Barnyard Grass	502210	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Elaeagnus umbellata var. parvifolia	Autumn Olive	527844	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Eleusine indica	India Goosegrass	41692	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Eragrostis cilianensis	Stinkgrass	40719	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Galinsoga quadriradiata	Fringed Quickweed	37415		
Geranium dissectum	Cutleaf Crane’s-bill	29135		
Geranium molle	Dovefoot Crane’s-bill	29110		
Glechoma hederacea	Ground-ivy	502801	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Hedera helix	English Ivy	29393	Threat	NatureServe Iranks, 2009
Hemerocallis fulva	Orange Daylily	42943	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Hieracium aurantiacum	Devil’s Paintbrush	37697		
Hieracium pilosella	Mouse-ear Hawkweed	37720		
Holcus lanatus	Common Velvetgrass	41773		
Holosteum umbellatum	Jagged Chickweed	503057		
Hypericum formosum	St. Johnswort	21439		
Hypericum perforatum	Common St. John's-wort	21454	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Ipomoea coccinea	Redstar	30770		
Ipomoea hederacea	Ivyleaf Morning-glory	503177		
Ipomoea purpurea	Common Morning-glory	30789		
Kummerowia stipulacea	Korean-clover	503293		
Kummerowia striata	Japanese-clover	503294	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Lactuca saligna	Willowleaf Lettuce	36606	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Lamium amplexicaule	Common Deadnettle	32539	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Lamium purpureum	Purple Deadnettle	32543		
Lepidium campestre	Cream-anther Field Pepperwort	22954		
Lepidium ruderale	Roadside Pepperweed	22977		
Lespedeza cuneata	Chinese Bushclover	25898	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Leucanthemum vulgare	Oxeye Daisy	37903	Significant Threat	Kentucky Exotic Pest Plant Council, 2008

Scientific Name	Common name	TSN	Threat?	Source
Ligustrum sinense	Chinese Privet	32979	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Linaria vulgaris	Butter-and-eggs	33216		
Lithospermum officinale	European Stoneseed	31952		
Lolium arundinaceum (= Festuca a.)	Tall Fescue	507979	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Lolium perenne	Perennial Ryegrass	40893		
Lolium pratense (= Festuca p.)	Meadow Ryegrass	507983	Significant Threat	Tennessee Exotic Pest Plant Council, 2009
Lonicera japonica	Japanese Honeysuckle	35283	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Lysimachia nummularia	Creeping Jenny	23993	Significant Threat	Tennessee Exotic Pest Plant Council, 2009
Medicago lupulina	Black Medic	503721	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Medicago sativa ssp. sativa	Alfalfa	524303		
Melilotus albus	White sweetclover	516979	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Melilotus officinalis	Yellow sweetclover	26150	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Melissa officnalis	Common Balm	32565		
Mentha X piperita	Peppermint	32275	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Microstegium vimineum	Japanese Stiltgrass	503829	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Mosla dianthera	Miniature Beefsteakplant	32621	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Muscari botryoides	Common Grape Hyacinth	42977		
Myosotis arvensis	Rough Forget-me-not	31692		
Narcissus poeticus	Poet's Narcissus	503929		
Narcissus pseudonarcissus	Common Daffodil	503930		
Ornithogalum umbellatum	Sleepydick, Star-of-Bethlehem	42754	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Paspalum dilatatum	Golden Crown GRAss	40997		
Pastinaca sativa	Wild Parsnip	29795		
Paulownia tomentosa	Princess-tree	33460	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Pennisetum glaucum	Pearl-millet	565385		
Perilla frutescens	Beefsteak Plant	32634		
Perilla frutescens var. crispa	Beefsteack Plant	529520		
Phleum pretense	Timothy	41062		
Plantago lanceolata	Narrowleaf Plantain	32874		
Poa annua	Annual Bluegrass	41107	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Poa compressa	Canada Bluegrass	41082	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Poa pratensis	Kentucky Bluegrass	41088		
Polygonum caespitosum var. longisetum	Oriental Lady's-thumb	566299	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Polygonum convolvulus	Black Bindweed	20853		
Polygonum persicaria	Spotted Lady's-thumb	20915	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Populus alba	White Poplar	22451	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Portulaca oleracea	Little Hogweed	20422		
Potentilla recta	Sulphur Cinquefoil	24742	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Prunus avium	Sweet Cherry	24770		
Prunus persica	Peach	24765		
Pueraria montana var. lobata	Kudzu	529930	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Ranunculus bulbosus	Bulbous Buttercup	18594	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Ranunculus sardous	Hairy Buttercup	18645		
Rorippa sylvestris	Creeping Yellowcress	23017		

Scientific Name	Common name	TSN	Threat?	Source
Rosa multiflora	Multiflora Rose	24833	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Rubus bifrons	Himalayan Berry	24891		
Rumex acetosella	Common Sheep Sorrel	20934	Lesser Threat	Kentucky Exotic Pest Plant Council, 2008
Rumex crispus	Curly Dock	20937		
Rumex obtusifolius	Bitter Dock	20939		
Rumex pulcher	Fiddle Dock	20942		
Salix x sepulcralis	Weeping Willow	504981		
Saponaria officinalis	Bouncing-bet	20039		
Secale cereal	Rye	42090		
Setaria faberi	Japanese Bristlegrass	41244	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Sherardia arvensis	Silver Buffalo-berry	35237		
Sisymbrium officinale	Hairy-pod Hedge-mustard	23316		
Sonchus asper	Spiny-leaf Sowthistle	38424		
Sorghum halepense	Johnson Grass	42111	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Stellaria media	Common Chickweed	20169	Severe Threat	Kentucky Exotic Pest Plant Council, 2008
Taraxacum laevigatum	Redseed Dandelion	36210		
Taraxacum officinale ssp. officinale	Common Dandelion	524742		
Thlaspi arvense	Field Pennycress	23422		
Tragopogon dubius	Meadow Goat's-beard	38564		
Trifolium arvense	Rabbit-foot Clover	26221		
Trifolium aureum	Golden Clover	26223		
Trifolium campestre	Low Hop Clover	26231		
Trifolium hybridum	Alsike Clover	26261		
Trifolium pretense	Red Clover	26313		
Trifolium repens	White Clover	26206		
Typha angustifolia	Narrowleaf Cattail	42325		
Verbascum blattaria	Moth Mullein	33389		
Verbascum thapsus	Great Mullein	33394		
Veronica arvensis	Corn Speedwell	33411		
Veronica serpyllifolia ssp. serpyllifolia	Thymeleaf Speedwell	33424		
Vicia sativa	Spring Vetch	26355		
Vinca minor	Lesser Periwinkle	30238	Significant Threat	Kentucky Exotic Pest Plant Council, 2008
Wisteria sinensis	Chinese Wisteria	27023	Significant Threat	Tennessee Exotic Pest Plant Council, 2009

Kentucky Exotic Pest Plant Council - http://www.se-eppc.org/ky/list.htm Accessed September 14, 2009
Tennessee Exotic Pest Plant Council - http://www.tneppc.org/invasive_plants Accessed September 14, 2009

Table 6. Ecological Associations and affiliated plots at MACA

Codes, names, global ranks, and plots affiliated with all ecological associations identified or potentially occurring at Mammoth Cave National Park.

To be Indexed to Vegetation Classification descriptions in final report.

CODE #	Ecological Association Translated Name	Scientific Name	*Common Name*	Ecological System	Plots	Global Rank	Page #
Forest							
CEGL002591	Virginia Pine Successional Forest	*Pinus virginiana* Successional Forest	*Virginia Pine Successional Forest*	Southern Appalachian Low-Elevation Pine Forest (CES202.332)	MACA 9, 24, 30	GNA	131
CEGL006327	Shortleaf Pine Early-Successional Forest	*Pinus echinata* Early-Successional Forest	*Shortleaf Pine Early-Successional Forest*	Southern Appalachian Low-Elevation Pine Forest (CES202.332)	MACA 71	GNA	121
CEGL007119	Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest	*Pinus virginiana - Pinus (rigida, echinata) - (Quercus prinus) / Vaccinium pallidum* Forest	*Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest*	Southern Appalachian Low-Elevation Pine Forest (CES202.332)	MACA 35	G4?	127
CEGL007121	Virginia Pine - Eastern Red-cedar - Winged Elm Forest	*Pinus virginiana - Juniperus virginiana var. virginiana - Ulmus alata* Forest	*Virginia Pine - Red-cedar Successional Forest*	(none - Successional - Human-modified)	MACA 29	GNA	125
CEGL002411	American Beech - Sugar Maple - Tuliptree Unglaciated Forest	*Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest	*Beech - Maple Unglaciated Forest*	South-Central Interior Mesophytic Forest (CES202.887)	MACA 7, 23, 26, 31, 36, 67, 73, 102, 108, 718, 725, 751	G4?	141
CEGL005043	Eastern Hemlock - American Beech - Sugar Maple / (American Witch-hazel, Mountain Laurel) Forest	*Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest	*East-central Hemlock Hardwood Forest*	South-Central Interior Mesophytic Forest (CES202.887)	MACA 45, 70, 710	G3?	235
CEGL007698	Northern Red Oak - Sugar Maple - Appalachian Basswood - Yellow Buckeye - (Yellow-wood) Forest	*Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest	*Rich Appalachian Red Oak - Sugar Maple Forest*	South-Central Interior Mesophytic Forest (CES202.887)	MACA 2, 18, 21, 38, 41, 76, 91, 106, 704, 708, 712, 726, 738, 750	G3	204

CODE #	Ecological Association Translated Name	Scientific Name	*Common Name*	Ecological System	Plots	Global Rank	Page #
CEGL004741	Sugar Maple - Shagbark Hickory - Black Walnut / Coralberry / Licorice Bedstraw Forest	*Acer saccharum - Carya ovata - Juglans nigra / Symphoricarpos orbiculatus / Galium circaezans* Forest	*Interior Low Plateau Mesic Sugar Maple - Hickory Forest*	South-Central Interior Mesophytic Forest (CES202.887)	MACA 84	G3G4	186
CEGL007881	American Beech - White Oak / Flowering Dogwood Forest	*Fagus grandifolia - Quercus alba / Cornus florida* Forest	*Central Interior Beech - White Oak Forest*	South-Central Interior Mesophytic Forest (CES202.887)	MACA 3, 5, 56, 72, 714, 721	G4	147
CEGL004133	Black Cherry - Sassafras - (White Ash) / Eastern Red-cedar Forest	*Prunus serotina - Sassafras albidum* - (*Fraxinus americana*) / *Juniperus virginiana* Forest	*Southeastern Successional Black Cherry Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 62, 78	GNA	163
CEGL007124	Eastern Red-cedar - (Oak species) Forest	*Juniperus virginiana var. virginiana - (Quercus spp.)* Forest	*Eastern Red-cedar Successional Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 8, 12, 17, 33, 39, 716	GNA	136
CEGL003876	Shingle Oak - Shumard Oak - Chinquapin Oak / Common Hackberry / Dwarf Stinging Nettle Forest	*Quercus imbricaria - Quercus shumardii - Quercus muehlenbergii / Celtis occidentalis / Urtica chamaedryoides* Forest	*Nashville Basin Shingle Oak - Shumard Oak - Chinquapin Oak Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 27, 94	G3?	188
CEGL005018	Southern Red Oak - White Oak - Post Oak - Black Oak Forest	*Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest	*Southern Red Oak - Mixed Oak Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 25, 28, 48, 59, 60, 64, 79, 80, 99, 100, 705, 722, 740, 744	G3G5	176
CEGL002070	White Oak - Northern Red Oak - Chinquapin Oak / Eastern Redbud Forest	*Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest	*White Oak - Mixed Oak Dry-Mesic Alkaline Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 13, 14, 37, 40, 727	G4G5	170
CEGL005022	Chestnut Oak / Greenbrier species Forest	*Quercus prinus / Smilax spp.* Forest	*Interior Low Plateau Chestnut Oak Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 4, 709	G3G5	194
CEGL007220	Tuliptree / (Eastern Redbud) / (Northern Spicebush) Forest	*Liriodendron tulipifera / (Cercis canadensis) / (Lindera benzoin)* Forest	*Successional Tuliptree Forest (Circumneutral Type)*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 10, 52, 54, 58, 101, 723, 724	GNA	158

CODE #	Ecological Association Translated Name	Scientific Name	*Common Name*	Ecological System	Plots	Global Rank	Page #
CEGL007221	Tuliptree - Oak species Forest	*Liriodendron tulipifera - Quercus* spp. Forest	*Successional Tuliptree - Oak Forest (Acidic Type)*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 81	GNA	155
CEGL007700	Chestnut Oak - Oak species / Farkleberry (Mountain Laurel, Bigleaf Snowbell) Forest	*Quercus prinus - Quercus spp. / Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest	*Interior Low Plateau Chestnut Oak - Mixed Oak Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 1, 61, 86	G4	199
CEGL008442	Shumard Oak - Chinquapin Oak - (Southern Sugar Maple, Chalk Maple, Sugar Maple) / Eastern Hop-hornbeam Forest	*Quercus shumardii - Quercus muehlenbergii - Acer (barbatum, leucoderme, saccharum) / Ostrya virginiana* Forest	*Shumard Oak - Chinquapin Oak Mesic Limestone Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 68, 85, 735, 739	G2G3	190
CEGL007795	White Oak - Mockernut Hickory - (Black Oak) / Naked-flower Tick-trefoil - (Painted Sedge) Forest	*Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest	*Interior Dry-Mesic White Oak - Hickory Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 11, 15, 16, 19, 22, 32, 50, 87, 98, 104, 109, 701, 703, 715, 720, 741, 746, 748	G4	167
CEGL002432	Pin Oak - Swamp White Oak - (Sweetgum) Mixed Hardwood Forest	*Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest	*Pin Oak Mixed Hardwood Forest*	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)	MACA 46, 89, 745	G3G4	224
CEGL004412	Southern Red Oak Flatwoods Forest	*Quercus falcata* Flatwoods Forest	*Southern Red Oak Flatwoods Forest*	South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480)	MACA 743	G2?	181
CEGL007330	Sweetgum - (Tuliptree) Temporarily Flooded Forest	*Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest	*Successional Sweetgum Floodplain Forest*	South-Central Interior Small Stream and Riparian (CES202.706)	MACA 65	GNA	208
CEGL007334	Sycamore - Silver Maple - Black Walnut - Slippery Elm Forest	*Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest	*Sycamore - Silver Maple Calcareous Floodplain Forest*	South-Central Interior Large Floodplain (CES202.705)	MACA 6, 20, 34, 82, 83, 736	G4	212

CODE #	Ecological Association Translated Name	Scientific Name	*Common Name*	Ecological System	Plots	Global Rank	Page #
CEGL007340	Sycamore - Sweetgum / American Hornbeam - Common Pawpaw Forest	*Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest	*Sycamore - Sweetgum Streambottom Forest*	South-Central Interior Small Stream and Riparian (CES202.706)	MACA 69	G5	219
CEGL007443	Carolina Red Maple - Blackgum / Cinnamon Fern - Slender Spikegrass - Greater Bladder Sedge / Yellow Peatmoss Forest	*Acer rubrum var. trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest	*Cumberland Forested Acidic Seep*	South-Central Interior Small Stream and Riparian (CES202.706)	MACA 110	G3?	231
CEGL007703	Black Willow - (Red Maple, Silver Maple) / Smooth Alder - Common Buttonbush Forest	*Salix nigra - Acer (rubrum, saccharinum) / Alnus serrulata - Cephalanthus occidentalis* Forest	*Interior Low Plateau Willow Pond Forest*	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)	MACA 74	G5	228
CEGL007879	Black Walnut / Wingstem Forest	*Juglans nigra / Verbesina alternifolia* Forest	*Successional Black Walnut Forest*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 49, 51, 75, 95, 742	GNA	151
CEGL008429	Sycamore - Sugarberry - Tuliptree / Northern Spicebush - Giant Cane / American Hog-peanut Forest	*Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest	*Rich Levee Mixed Hardwood Bottomland Forest*	South-Central Interior Small Stream and Riparian (CES202.706)	MACA 43, 63, 97, 103, 111, 713, 719, 733, 734	G4?	215
Woodland							
CEGL004267	Chinquapin Oak – (Eastern Red-cedar) Unglaciated Bluff Woodland	*Quercus muehlenbergii - (Juniperus virginiana var. virginiana)* Unglaciated Bluff Woodland	*Chinquapin Oak Unglaciated Bluff Woodland*	Central Interior Calcareous Cliff and Talus (CES202.690)	MACA 747	G2G3	239
CEGL004686	Post Oak / Rusty Blackhaw / Little Bluestem - (Yellow Indiangrass, Eggert's Sunflower) Woodland	*Quercus stellata / Viburnum rufidulum / Schizachyrium scoparium - (Sorghastrum nutans, Helianthus eggertii)* Woodland	*Western Highland Rim Escarpment Post Oak Barrens*	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)	MACA 44, 55, 749	G2G3	244

Shrubland

CEGL004732	(Southern Blackberry, Southern Dewberry) - (Whiteleaf Greenbrier, Common Greenbrier) Shrubland	*Rubus (argutus, trivialis)* - *Smilax (glauca, rotundifolia)* Shrubland	*Blackberry - Greenbrier Successional Shrubland Thicket*	(none - Successional - Human-modified)	(none)	GNA	250
CEGL004708	Smooth Hydrangea / (Orange Jewelweed, Yellow Jewelweed) - Rock Alumroot Shrubland	*Hydrangea arborescens / Impatiens (capensis, pallida)* - *Heuchera villosa* Shrubland	*Highland Rim Limestone Cliff/Talus Seep*	Central Interior Calcareous Cliff and Talus (CES202.690)	MACA 57	G3	248
CEGL004742	Common Buttonbush / Eastern Rosemallow Depression Pond Shrubland	*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland	*Buttonbush Sinkhole Pond Swamp*	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)	MACA 53	G3?	253

Herbaceous Vegetation

CEGL005131	Chinquapin Oak - Eastern Red-cedar / Little Bluestem - Eastern Agave Wooded Herbaceous Vegetation	*Quercus muehlenbergii* - *Juniperus virginiana / Schizachyrium scoparium* - *Manfreda virginica* Wooded Herbaceous Vegetation	*Central Limestone Glade*	Central Interior Highlands Calcareous Glade and Barrens (CES202.691)	MACA.47	G2G3	279
CEGL004044	Broomsedge Bluestem Herbaceous Vegetation	*Andropogon virginicus var. virginicus* Herbaceous Vegetation	*Successional Broom-sedge Vegetation*	(none - Successional - Human-modified)	MACA 77, 92	GNA	265
CEGL004048	(Tall Fescue, Meadow Fescue) Herbaceous Vegetation	*Lolium (arundinaceum, pratense)* Herbaceous Vegetation	*Cultivated Meadow*	(none - Successional - Human-modified)	(none)	GNA	268
CEGL002413	Longhair Sedge - Decomposite Sedge - Threeway Sedge - Stalked Water-horehound Herbaceous Vegetation	*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation	*Sinkhole Pond Marsh*	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)	MACA 706	G3G4	271

CEGL004150	Broadleaf Cattail Southern Herbaceous Vegetation	*Typha latifolia* Southern Herbaceous Vegetation	*Southern Cattail Marsh*	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)	(none)	G5	276
CEGL004286	American Water-willow Herbaceous Vegetation	*Justicia americana* Herbaceous Vegetation	*Water-willow Rocky Bar and Shore*	South-Central Interior Small Stream and Riparian (CES202.706) & South-Central Interior Large Floodplain (CES202.705)	MACA 42	G4G5	285

Herbaceous Vegetation – additional types not mapped at MACA

CEGL007707	Little Bluestem - (Elliott's Beardgrass, Splitbeard Bluestem, Common Broomsedge) Herbaceous Vegetation	*Schizachyrium scoparium - Andropogon (gyrans, ternarius, virginicus)* Herbaceous Vegetation	*Little Bluestem - Broomsedge Grassland*	Pennyroyal Karst Plain Prairie and Barrens (CES202.355), if found at MACA	(none)	G3?	262
CEGL004677	Big Bluestem - (Yellow Indiangrass) Kentucky Herbaceous Vegetation	*Andropogon gerardii - (Sorghastrum nutans)* Kentucky Herbaceous Vegetation	*Kentucky Mesic Tallgrass Prairie*	Pennyroyal Karst Plain Prairie and Barrens (CES202.355)	(none)	G1G2	258

Global rank

G1 = Critically imperiled globally
G2 = Imperiled globally
G3 = Rare or uncommon
G4 = Widespread, abundant, and apparently secure, but with cause for long-term concern
G5 = Demonstrably widespread, abundant and secure
G? = Unranked
GNA = Not ranked (usually because it is a human modified or exotic type)

Qualifiers:

? = Inexact numeric rank
Q = Questionable taxonomy

Table 7. Index of Plot photo names and photo descriptions for Mammoth Cave National Park

Photo file name	Date taken	Photographer	Description of photo
MACA01N_21.JPG	10/9/2002	Rickie White	MACA plot 01N
MACA01NE_22.JPG	10/9/2002	Rickie White	MACA plot 01NE
MACA01SE_23.JPG	10/9/2002	Rickie White	MACA plot 01SE
MACA01SW_24.JPG	10/9/2002	Rickie White	MACA plot 01SW
MACA01NW_25.JPG	10/9/2002	Rickie White	MACA plot 01NW
Scenic-lichen-near-MACA01_26.JPG	10/9/2002	Rickie White	MACA plot 01; scenic lichens
MACA02N_10.JPG	8/11/2003	Carl Nordman/Rickie White	MACA plot 02N
MACA02E_13.JPG	8/11/2003	Carl Nordman/Rickie White	MACA plot 02E
MACA02S_12.JPG	8/11/2003	Carl Nordman/Rickie White	MACA plot 02S
MACA02W_11.JPG	8/11/2003	Carl Nordman/Rickie White	MACA plot 02W
MACA03N_57.JPG	7/31/2003	Carl Nordman	MACA plot 03N
MACA03E_58.JPG	7/31/2003	Carl Nordman	MACA plot 03E
MACA03S_59.JPG	7/31/2003	Carl Nordman	MACA plot 03S
MACA03W_60.JPG	7/31/2003	Carl Nordman	MACA plot 03W
MACA05N_17.JPG	10/9/2002	Rickie White	MACA plot 05N
MACA05E_18.JPG	10/9/2002	Rickie White	MACA plot 05E
MACA05S_19.JPG	10/9/2002	Rickie White	MACA plot 05S
MACA05W_20.JPG	10/9/2002	Rickie White	MACA plot 05W
MACA07NNE_37.JPG	10/11/2002	Rickie White	MACA plot 07NNE
MACA07ESE_38.JPG	10/11/2002	Rickie White	MACA plot 07ESE
MACA07WSW_39.JPG	10/11/2002	Rickie White	MACA plot 07WSW
MACA07W_40.JPG	10/11/2002	Rickie White	MACA plot 07W
MACA07WNW_36.JPG	10/11/2002	Rickie White	MACA plot 07WNW
MACA07_Lipa-lil_42.JPG	10/11/2002	Rickie White	MACA plot 07; *Liparis liliifolia*
MACA08N_66.JPG	7/19/2002	Rickie White	MACA plot 08N
MACA08E_67.JPG	7/19/2002	Rickie White	MACA plot 08E
MACA08S_68.JPG	7/19/2002	Rickie White	MACA plot 08S
MACA08W_65.JPG	7/19/2002	Rickie White	MACA plot 08W
MACA09N_26.JPG	9/25/2002	Carl Nordman	MACA plot 09N
MACA09E_28.JPG	9/25/2002	Carl Nordman	MACA plot 09E
MACA09S_27.JPG	9/25/2002	Carl Nordman	MACA plot 09S
MACA09W_29.JPG	9/25/2002	Carl Nordman	MACA plot 09W
MACA10N_26.JPG	7/29/2003	Carl Nordman	MACA plot 10N
MACA10E_27.JPG	7/29/2003	Carl Nordman	MACA plot 10E
MACA10S_28.JPG	7/29/2003	Carl Nordman	MACA plot 10S
MACA10W_29.JPG	7/29/2003	Carl Nordman	MACA plot 10W
MACA11N_67.JPG	8/1/2003	Carl Nordman	MACA plot 11N
MACA11E_68.JPG	8/1/2003	Carl Nordman	MACA plot 11E
MACA11S_69.JPG	8/1/2003	Carl Nordman	MACA plot 11S
MACA11W_70.JPG	8/1/2003	Carl Nordman	MACA plot 11W
MACA14N_53.JPG	7/31/2003	Carl Nordman	MACA plot 14N

Photo file name	Date taken	Photographer	Description of photo
MACA14E_54.JPG	7/31/2003	Carl Nordman	MACA plot 14E
MACA14S_55.JPG	7/31/2003	Carl Nordman	MACA plot 14S
MACA14W_56.JPG	7/31/2003	Carl Nordman	MACA plot 14W
MACA15NE_60.JPG	7/18/2002	Rickie White	MACA plot 15NE
MACA15NW_58.JPG	7/18/2002	Rickie White	MACA plot 15NW
MACA15SW_57.JPG	7/18/2002	Rickie White	MACA plot 15SW
MACA15SW_59.JPG	7/18/2002	Rickie White	MACA plot 15SW
MACA15A-tag_401.JPG	5/18/2007	Milo Pyne	MACA plot 15; tree tag - plot 15A
MACA15A_402.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_403.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_404.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_405.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_406.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_407.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_408.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA15A_409.JPG	5/18/2007	Milo Pyne	MACA plot 15; view, taken in 2007
MACA16SE_61.JPG	7/18/2002	Rickie White	MACA plot 16SE
MACA16SW_62.JPG	7/18/2002	Rickie White	MACA plot 16SW
MACA16NW_63.JPG	7/18/2002	Rickie White	MACA plot 16NW
MACA16NE_64.JPG	7/18/2002	Rickie White	MACA plot 16NE
MACA17NW_04.JPG	10/7/2002	Rickie White	MACA plot 17NW
MACA17NW_05.JPG	10/7/2002	Rickie White	MACA plot 17NW
MACA17N_06.JPG	10/7/2002	Rickie White	MACA plot 17N
MACA18N_09.JPG	9/23/2002	Carl Nordman	MACA plot 18N
MACA18E_10.JPG	9/23/2002	Carl Nordman	MACA plot 18E
MACA18S_11.JPG	9/23/2002	Carl Nordman	MACA plot 18S
MACA18W_12.JPG	9/23/2002	Carl Nordman	MACA plot 18W
MACA20NNE_52.JPG	7/18/2002	Rickie White	MACA plot 20NNE
MACA20ESE_53.JPG	7/18/2002	Rickie White	MACA plot 20ESE
MACA20SSW_54.JPG	7/18/2002	Rickie White	MACA plot 20SSW
MACA20WNW_55.JPG	7/18/2002	Rickie White	MACA plot 20WNW
MACA20NNE_56.JPG	7/18/2002	Rickie White	MACA plot 20NNE
MACA21NW_01.JPG	8/11/2003	Rickie White	MACA plot 21NW
MACA21SW_02.JPG	8/11/2003	Rickie White	MACA plot 21SW
MACA21SE_03.JPG	8/11/2003	Rickie White	MACA plot 21SE
MACA21NE_04.JPG	8/11/2003	Rickie White	MACA plot 21NE
MACA23N_43.JPG	7/17/2002	Rickie White	MACA plot 23N
MACA23E_44.JPG	7/17/2002	Rickie White	MACA plot 23E
MACA23SE_47.JPG	7/17/2002	Rickie White	MACA plot 23SE
MACA23S_45.JPG	7/17/2002	Rickie White	MACA plot 23S

Photo file name	Date taken	Photographer	Description of photo
MACA23SW_48.JPG	7/17/2002	Rickie White	MACA plot 23SW
MACA23W_46.JPG	7/17/2002	Rickie White	MACA plot 23W
MACA24N_38.JPG	7/17/2002	Rickie White	MACA plot 24N
MACA24E_39.JPG	7/17/2002	Rickie White	MACA plot 24E
MACA24S_40.JPG	7/17/2002	Rickie White	MACA plot 24S
MACA24W_41.JPG	7/17/2002	Rickie White	MACA plot 24W
MACA24_42.JPG	7/17/2002	Rickie White	MACA plot 24, general view
MACA25N_05.JPG	9/23/2002	Carl Nordman	MACA plot 25N
MACA25E_06.JPG	9/23/2002	Carl Nordman	MACA plot 25E
MACA25S_07.JPG	9/23/2002	Carl Nordman	MACA plot 25S
MACA25W_08.JPG	9/23/2002	Carl Nordman	MACA plot 25W
MACA26N_34.JPG	7/29/2003	Carl Nordman	MACA plot 26N
MACA26E_35.JPG	7/29/2003	Carl Nordman	MACA plot 26E
MACA26S_36.JPG	7/29/2003	Carl Nordman	MACA plot 26S
MACA26W_37.JPG	7/29/2003	Carl Nordman	MACA plot 26W
MACA27NNE_01.JPG	10/7/2002	Rickie White	MACA plot 27NNE
MACA27NE_02.JPG	10/7/2002	Rickie White	MACA plot 27NE
MACA27ESE_03.JPG	10/7/2002	Rickie White	MACA plot 27ESE
MACA29N_17.JPG	9/24/2002	Carl Nordman	MACA plot 29N
MACA29E_20.JPG	9/24/2002	Carl Nordman	MACA plot 29E
MACA29S_19.JPG	9/24/2002	Carl Nordman	MACA plot 29S
MACA29W_18.JPG	9/24/2002	Carl Nordman	MACA plot 29W
MACA30N_30.JPG	9/24/2002	Carl Nordman	MACA plot 30N
MACA30E_31.JPG	9/24/2002	Carl Nordman	MACA plot 30E
MACA30S_32.JPG	9/24/2002	Carl Nordman	MACA plot 30S
MACA30W_33.JPG	9/24/2002	Carl Nordman	MACA plot 30W
MACA31N_18.JPG	7/28/2003	Carl Nordman	MACA plot 31N
MACA31E_19.JPG	7/28/2003	Carl Nordman	MACA plot 31E
MACA31S_20.JPG	7/28/2003	Carl Nordman	MACA plot 31S
MACA31W_21.JPG	7/28/2003	Carl Nordman	MACA plot 31W
MACA32N_22.JPG	7/28/2003	Carl Nordman	MACA plot 32N
MACA32E_23.JPG	7/28/2003	Carl Nordman	MACA plot 32E
MACA32S_24.JPG	7/28/2003	Carl Nordman	MACA plot 32S
MACA32W_25.JPG	7/28/2003	Carl Nordman	MACA plot 32W
MACA33N_13.JPG	9/24/2002	Carl Nordman	MACA plot 33N
MACA33E_14.JPG	9/24/2002	Carl Nordman	MACA plot 33E
MACA33S_15.JPG	9/24/2002	Carl Nordman	MACA plot 33S
MACA33W_16.JPG	9/24/2002	Carl Nordman	MACA plot 33W
MACA34N_43.JPG	7/30/2003	Carl Nordman	MACA plot 34N
MACA34E_44.JPG	7/30/2003	Carl Nordman	MACA plot 34E
MACA34S_45.JPG	7/30/2003	Carl Nordman	MACA plot 34S
MACA34W_46.JPG	7/30/2003	Carl Nordman	MACA plot 34W
MACA35N_63.JPG	8/1/2003	Carl Nordman	MACA plot 35N
MACA35E_64.JPG	8/1/2003	Carl Nordman	MACA plot 35E
MACA35S_65.JPG	8/1/2003	Carl Nordman	MACA plot 35S
MACA35W_66.JPG	8/1/2003	Carl Nordman	MACA plot 35W
MACA36N_33.JPG	10/9/2002	Rickie White	MACA plot 36N

Photo file name	Date taken	Photographer	Description of photo
MACA36E_30.JPG	10/9/2002	Rickie White	MACA plot 36E
MACA36S_31.JPG	10/9/2002	Rickie White	MACA plot 36S
MACA36W_32.JPG	10/9/2002	Rickie White	MACA plot 36W
MACA38N_42.JPG	7/30/2003	Carl Nordman	MACA plot 38N
MACA38E_39.JPG	7/30/2003	Carl Nordman	MACA plot 38E
MACA38S_40.JPG	7/30/2003	Carl Nordman	MACA plot 38S
MACA38W_41.JPG	7/30/2003	Carl Nordman	MACA plot 38W
MACA39N_47.JPG	7/30/2003	Carl Nordman	MACA plot 39N
MACA39E_48.JPG	7/30/2003	Carl Nordman	MACA plot 39E
MACA39S_49.JPG	7/30/2003	Carl Nordman	MACA plot 39S
MACA39W_50.JPG	7/30/2003	Carl Nordman	MACA plot 39W
MACA40N_01.JPG	9/23/2002	Carl Nordman	MACA plot 40N
MACA40E_02.JPG	9/23/2002	Carl Nordman	MACA plot 40E
MACA40S_03.JPG	9/23/2002	Carl Nordman	MACA plot 40S
MACA40W_04.JPG	9/23/2002	Carl Nordman	MACA plot 40W
MACA41N_21.JPG	9/25/2002	Carl Nordman	MACA plot 41N
MACA41E_23.JPG	9/25/2002	Carl Nordman	MACA plot 41E
MACA41SE_25.JPG	9/25/2002	Carl Nordman	MACA plot 41SE
MACA41S_22.JPG	9/25/2002	Carl Nordman	MACA plot 41S
MACA41W_24.JPG	9/25/2002	Carl Nordman	MACA plot 41W
MACA43_BlueSpg_24.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43; Blue Spring
MACA43E_25.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43E
MACA43E_26.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43E
MACA43S_27.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43S
MACA43W_28.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43W
MACA43N_29.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 43N
MACA44S_30.JPG	8/12/2003	Rickie White	MACA plot 44S
MACA44W_31.JPG	8/12/2003	Rickie White	MACA plot 44W
MACA44N_32.JPG	8/12/2003	Rickie White	MACA plot 44N
MACA44E_33.JPG	8/12/2003	Rickie White	MACA plot 44E
MACA45NE_15.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45NE
MACA45NE_16.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45NE
MACA45NW_17.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45NW
MACA45NW_18.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45NW
MACA45SE_14.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45SE
MACA45SW_19.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45SW
MACA45SE_Rockhouse_20.JPG	8/12/2003	Carl Nordman/Rickie White	MACA plot 45SE; Rockhouse, MACA.45

Photo file name	Date taken	Photographer	Description of photo
Rockhouse_021.JPG	8/12/2003	Carl Nordman/Rickie White	Rockhouse, MACA.45
Rockhouse_022.JPG	8/12/2003	Carl Nordman/Rickie White	Rockhouse, MACA.45
Rockhouse_023.JPG	8/12/2003	Carl Nordman/Rickie White	Rockhouse, MACA.45
MACA46S_34.JPG	8/13/2003	Rickie White	MACA plot 46S
MACA46W_35.JPG	8/13/2003	Rickie White	MACA plot 46W
MACA46N_36.JPG	8/13/2003	Rickie White	MACA plot 46N
MACA46E_37.JPG	8/13/2003	Rickie White	MACA plot 46E
MACA47NE_40.JPG	8/13/2003	Rickie White	MACA plot 47NE
MACA47SE_41.JPG	8/13/2003	Rickie White	MACA plot 47SE
MACA47SW_42.JPG	8/13/2003	Rickie White	MACA plot 47SW
MACA47NW_43.JPG	8/13/2003	Rickie White	MACA plot 47NW
MACA47_Saba-ang_45.JPG	8/13/2003	Rickie White	MACA plot 47; *Sabatia angularis*
MACA47_Glade-spp_46.JPG	8/13/2003	Rickie White	MACA plot 47; Glade plant species
MACA47_Glade-spp_47.JPG	8/13/2003	Rickie White	MACA plot 47; Glade plant species
MACA47_Core_trip_48.JPG	8/13/2003	Rickie White	MACA plot 47; *Coreopsis tripteris*
MACA47_Ruellia_50.JPG	8/13/2003	Rickie White	MACA plot 47; *Ruellia* sp.
MACA47_CedarGlade_51.JPG	8/13/2003	Rickie White	MACA plot 47; Cedar Glade
MACA47_vic-glade_416.JPG	8/9/2007	Milo Pyne	MACA plot 47; view of glade
MACA47_vic-glade_417.JPG	8/9/2007	Milo Pyne	MACA plot 47; view of glade
MACA47_vic-glade_418.JPG	8/9/2007	Milo Pyne	MACA plot 47; view of glade
MACA55_14.JPG	6/23/2004	Rickie White	MACA plot 55
MACA55_15.JPG	6/23/2004	Rickie White	MACA plot 55
MACA55_16.JPG	6/23/2004	Rickie White	MACA plot 55
MACA57_Heuch-ame_20.JPG	7/2/2005	Erin Lunsford	MACA plot 57; *Heuchera americana*
MACA57_Cedar-Sink-rpt_21.JPG	7/2/2005	Erin Lunsford	MACA plot 57; Cedar Sink rpt
MACA57_Cedar-Sink-rpt_22.JPG	7/2/2005	Erin Lunsford	MACA plot 57; Cedar Sink rpt
MACA69N_02.JPG	4/12/2005	Erin Lunsford	MACA plot 69N
MACA69E_03.JPG	4/12/2005	Erin Lunsford	MACA plot 69E
MACA69S_04.JPG	4/12/2005	Erin Lunsford	MACA plot 69S
MACA69W_05.JPG	4/12/2005	Erin Lunsford	MACA plot 69W
MACA70N_06.JPG	4/12/2005	Erin Lunsford	MACA plot 70N
MACA70E_07.JPG	4/12/2005	Erin Lunsford	MACA plot 70E
MACA70S_08.JPG	4/12/2005	Erin Lunsford	MACA plot 70S
MACA70W_09.JPG	4/12/2005	Erin Lunsford	MACA plot 70W
MACA73_Melan-wood_21.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Melanthium woodii*
MACA73_Melan-wood_22.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Melanthium woodii*
MACA73_Melan-wood_23.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Melanthium woodii*
MACA73_Smil-ecir_26.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Smilax ecirrata*
MACA73_Smil-ecir_27.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Smilax ecirrata*

Photo file name	Date taken	Photographer	Description of photo
MACA73_44.JPG	6/28/2005	Erin Lunsford	MACA plot 73
MACA73_below_45.JPG	6/28/2005	Erin Lunsford	MACA plot 73; below
MACA73_Hydrangea-rept_48.JPG	6/28/2005	Erin Lunsford	MACA plot 73; *Hydrangea* rept
MACA73_below-cove-rept_50.JPG	6/28/2005	Erin Lunsford	MACA plot 73; below cove rept
MACA73_Hydran_51.JPG	6/28/2005	Erin Lunsford	MACA plot 73; Hydrangea rept
MACA74N_11.JPG	7/2/2005	Erin Lunsford	MACA plot 74N
MACA74E_12.JPG	7/2/2005	Erin Lunsford	MACA plot 74E
MACA74S_13.JPG	7/2/2005	Erin Lunsford	MACA plot 74S
MACA74_Junc-scirp_14.JPG	7/2/2005	Erin Lunsford	MACA plot 74; *Juncus scirpoides*
MACA77_downslope320deg_15.JPG	7/2/2005	Erin Lunsford	MACA plot 77; downslope 320deg plot 77
MACA77_upslope-3androp_16.JPG	7/2/2005	Erin Lunsford	MACA plot 77; upslope 3 andropogons, plot 77
MACA77_Oligoneuron-rigidum-vouch_17.JPG	7/2/2005	Erin Lunsford	MACA plot 77; *Oligoneuron rigidum* voucher, plot 77
MACA77_Liatris_18.JPG	7/2/2005	Erin Lunsford	MACA plot 77; *Liatris* sp. in plot 77
MACA81_Cornus-flo-woodland_24.JPG	7/3/2005	Erin Lunsford	MACA plot 81; *Cornus florida* woodland
MACA81_Cornus-flo-woodland_25.JPG	7/3/2005	Erin Lunsford	MACA plot 81; *Cornus florida* woodland
MACA82_baby-raccoon_26.JPG	7/3/2005	Erin Lunsford	MACA plot 82; baby raccoon
MACA82SE_Acer-saccharinum_31.JPG	7/3/2005	Erin Lunsford	MACA plot 82SE; *Acer saccharinum*
MACA89_Wetland_40.JPG	6/28/2005	Erin Lunsford	MACA plot 89; Wetland
MACA89_Wetland_41.JPG	6/28/2005	Erin Lunsford	MACA plot 89; Wetland
MACA89_Wetland_43.JPG	6/28/2005	Erin Lunsford	MACA plot 89; Wetland
MACA97N_269.JPG	5/15/2007	Milo Pyne	MACA plot 97N
MACA97E_270.JPG	5/15/2007	Milo Pyne	MACA plot 97E
MACA97S_271.JPG	5/15/2007	Milo Pyne	MACA plot 97S
MACA97W_272.JPG	5/15/2007	Milo Pyne	MACA plot 97W
MACA102_ridge_316.JPG	5/16/2007	Milo Pyne	MACA plot 102; ridge
MACA102_ridge_317.JPG	5/16/2007	Milo Pyne	MACA plot 102; ridge
MACA102_ridge_318.JPG	5/16/2007	Milo Pyne	MACA plot 102; ridge
MACA102_slope_319.JPG	5/16/2007	Milo Pyne	MACA plot 102; slope
MACA102_slope_320.JPG	5/16/2007	Milo Pyne	MACA plot 102; slope
MACA102_Dryo-mar_322.JPG	5/16/2007	Milo Pyne	MACA plot 102; *Dryopteris marginalis*
MACA102_Adia-ped_327.JPG	5/16/2007	Milo Pyne	MACA plot 102; *Adiantium pedatum*
MACA102_ferns_328.JPG	5/16/2007	Milo Pyne	MACA plot 102; ferns
MACA102_boulder_329.JPG	5/16/2007	Milo Pyne	MACA plot 102; boulder
MACA102_boulder_330.JPG	5/16/2007	Milo Pyne	MACA plot 102; boulder
MACA103_331.JPG	5/16/2007	Milo Pyne	MACA plot 103; general view
MACA103_333.JPG	5/16/2007	Milo Pyne	MACA plot 103; general view
MACA103_334.JPG	5/16/2007	Milo Pyne	MACA plot 103; general view

Photo file name	Date taken	Photographer	Description of photo
MACA103_335.JPG	5/16/2007	Milo Pyne	MACA plot 103; general view
MACA103_336.JPG	5/16/2007	Milo Pyne	MACA plot 103; general view
MACA106_385.JPG	5/17/2007	Milo Pyne	MACA plot 106; general view
MACA106_386.JPG	5/17/2007	Milo Pyne	MACA plot 106; general view
MACA106_387.JPG	5/17/2007	Milo Pyne	MACA plot 106; general view
MACA109N_389.JPG	5/18/2007	Milo Pyne	MACA plot 109N
MACA109E_390.JPG	5/18/2007	Milo Pyne	MACA plot 109E
MACA109S_391.JPG	5/18/2007	Milo Pyne	MACA plot 109S
MACA109W_392.JPG	5/18/2007	Milo Pyne	MACA plot 109W
MACA109_393.JPG	5/18/2007	Milo Pyne	MACA plot 109
MACA110_seep_399.JPG	5/18/2007	Milo Pyne	MACA plot 110; seep
MACA111_410.JPG	5/18/2007	Milo Pyne	MACA plot 111; general view
MACA111_412.JPG	5/18/2007	Milo Pyne	MACA plot 111; general view
MACA111_413.JPG	5/18/2007	Milo Pyne	MACA plot 111; general view
MACA111_414.JPG	5/18/2007	Milo Pyne	MACA plot 111; general view
MACA111_415.JPG	5/18/2007	Milo Pyne	MACA plot 111; general view
MACA111_Oxal-gra_416.JPG	5/18/2007	Milo Pyne	MACA plot 111; *Oxalis grandis*
MACA111_vic_419.JPG	5/18/2007	Milo Pyne	MACA plot 111; vicinity
MACA111_vic_420.JPG	5/18/2007	Milo Pyne	MACA plot 111; ferns in vicinity
MACA111_vic_421.JPG	5/18/2007	Milo Pyne	MACA plot 111; ferns in vicinity
MACA111_vic_422.JPG	5/18/2007	Milo Pyne	MACA plot 111; ferns in vicinity
MACA703N_217.JPG	8/6/2007	Milo Pyne	MACA plot 703N
MACA703E_218.JPG	8/6/2007	Milo Pyne	MACA plot 703E
MACA703S_219.JPG	8/6/2007	Milo Pyne	MACA plot 703S
MACA703W_220.JPG	8/6/2007	Milo Pyne	MACA plot 703W
MACA704N_223.JPG	8/6/2007	Milo Pyne	MACA plot 704N
MACA704E_224.JPG	8/6/2007	Milo Pyne	MACA plot 704E
MACA704S_225.JPG	8/6/2007	Milo Pyne	MACA plot 704S
MACA704W_226.JPG	8/6/2007	Milo Pyne	MACA plot 704W
MACA705N_229.JPG	8/6/2007	Milo Pyne	MACA plot 705N
MACA705E_230.JPG	8/6/2007	Milo Pyne	MACA plot 705E
MACA705S_231.JPG	8/6/2007	Milo Pyne	MACA plot 705S
MACA705W_232.JPG	8/6/2007	Milo Pyne	MACA plot 705W
MACA706_233.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA706_234.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA706_235.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA706_236.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA706_237.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA706_238.JPG	8/6/2007	Milo Pyne	MACA plot 706; general view from boardwalk
MACA708N_239.JPG	8/6/2007	Milo Pyne	MACA plot 708N

Photo file name	Date taken	Photographer	Description of photo
MACA708E_240.JPG	8/6/2007	Milo Pyne	MACA plot 708E
MACA708S_241.JPG	8/6/2007	Milo Pyne	MACA plot 708S
MACA708W_242.JPG	8/6/2007	Milo Pyne	MACA plot 708W
MACA709N_248.JPG	8/7/2007	Milo Pyne	MACA plot 709N
MACA709E_249.JPG	8/7/2007	Milo Pyne	MACA plot 709E
MACA709S_250.JPG	8/7/2007	Milo Pyne	MACA plot 709S
MACA709W_251.JPG	8/7/2007	Milo Pyne	MACA plot 709W
MACA709_Carex-picta_252.JPG	8/7/2007	Milo Pyne	MACA plot 709; *Carex picta*
MACA709_Carex-picta_253.JPG	8/7/2007	Milo Pyne	MACA plot 709; *Carex picta*
MACA709_Carex-picta_254.JPG	8/7/2007	Milo Pyne	MACA plot 709; *Carex picta*
MACA710N_255.JPG	8/7/2007	Milo Pyne	MACA plot 710N
MACA710E_256.JPG	8/7/2007	Milo Pyne	MACA plot 710E
MACA710S_257.JPG	8/7/2007	Milo Pyne	MACA plot 710S
MACA710W_258.JPG	8/7/2007	Milo Pyne	MACA plot 710W
MACA710_259.JPG	8/7/2007	Milo Pyne	MACA plot 710
MACA710_rocks_262.JPG	8/7/2007	Milo Pyne	MACA plot 710; rocks
MACA710_vicinity_263.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_266.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_267.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_268.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_269.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_270.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_271.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA710_vicinity_272.JPG	8/7/2007	Milo Pyne	MACA plot 710; general view
MACA711N_274.JPG	8/7/2007	Milo Pyne	MACA obs. point "711N" (no plot taken)
MACA711E_275.JPG	8/7/2007	Milo Pyne	MACA obs. point "711E" (no plot taken)
MACA711S_276.JPG	8/7/2007	Milo Pyne	MACA obs. point "711S" (no plot taken)
MACA711W_277.JPG	8/7/2007	Milo Pyne	MACA obs. point "711W" (no plot taken)
MACA712N_279.JPG	8/7/2007	Milo Pyne	MACA plot 712N
MACA712E_280.JPG	8/7/2007	Milo Pyne	MACA plot 712E
MACA712S_281.JPG	8/7/2007	Milo Pyne	MACA plot 712S
MACA712W_282.JPG	8/7/2007	Milo Pyne	MACA plot 712W
MACA713N_283.JPG	8/7/2007	Milo Pyne	MACA plot 713N
MACA713E_285.JPG	8/7/2007	Milo Pyne	MACA plot 713E
MACA713S_286.JPG	8/7/2007	Milo Pyne	MACA plot 713S
MACA713W_287.JPG	8/7/2007	Milo Pyne	MACA plot 713W
MACA714N_289.JPG	8/7/2007	Milo Pyne	MACA plot 714N
MACA714E_290.JPG	8/7/2007	Milo Pyne	MACA plot 714E
MACA714S_291.JPG	8/7/2007	Milo Pyne	MACA plot 714S
MACA714W_292.JPG	8/7/2007	Milo Pyne	MACA plot 714W
MACA715N_304.JPG	8/8/2007	Milo Pyne	MACA plot 715N
MACA715E_305.JPG	8/8/2007	Milo Pyne	MACA plot 715E
MACA715S_306.JPG	8/8/2007	Milo Pyne	MACA plot 715S
MACA715W_307.JPG	8/8/2007	Milo Pyne	MACA plot 715W

Photo file name	Date taken	Photographer	Description of photo
MACA715_308.JPG	8/8/2007	Milo Pyne	MACA plot 715
MACA716N_310.JPG	8/8/2007	Milo Pyne	MACA plot 716N
MACA716E_311.JPG	8/8/2007	Milo Pyne	MACA plot 716E
MACA716S_312.JPG	8/8/2007	Milo Pyne	MACA plot 716S
MACA716W_313.JPG	8/8/2007	Milo Pyne	MACA plot 716W
MACA718N_315.JPG	8/8/2007	Milo Pyne	MACA plot 718N
MACA718E_316.JPG	8/8/2007	Milo Pyne	MACA plot 718E
MACA718S_317.JPG	8/8/2007	Milo Pyne	MACA plot 718S
MACA718W_318.JPG	8/8/2007	Milo Pyne	MACA plot 718W
MACA718_322.JPG	8/8/2007	Milo Pyne	MACA plot 718; general view
MACA718_326.JPG	8/8/2007	Milo Pyne	MACA plot 718; general view
MACA_Aesc-fla_428.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Aesculus flava*
MACA718_Aspl-rhiz_321.JPG	8/8/2007	Milo Pyne	MACA plot 718; *Asplenium rhizophilum*
MACA718_Aspl-rhiz_324.JPG	8/8/2007	Milo Pyne	MACA plot 718; *Asplenium rhizophilum*
MACA_fern_424.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Diplazium pycnocarpon*
MACA_fern_434.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Diplazium pycnocarpon*
MACA_Fagu-gra_419.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Fagus grandifolia*
MACA_Fagu-gra_421.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Fagus grandifolia*
MACA_Lapo-can_432.JPG	8/10/2007	Milo Pyne	MACA plot 718; *Laportea canadensis*
MACA719_ferns_243.JPG	8/6/2007	Milo Pyne	MACA plot 719; *Diplazium pycnocarpon*
MACA719_ferns_246.JPG	8/6/2007	Milo Pyne	MACA plot 719; *Diplazium pycnocarpon*
MACA720N_328.JPG	8/8/2007	Milo Pyne	MACA plot 720N
MACA720E_329.JPG	8/8/2007	Milo Pyne	MACA plot 720E
MACA720S_330.JPG	8/8/2007	Milo Pyne	MACA plot 720S
MACA720W_331.JPG	8/8/2007	Milo Pyne	MACA plot 720W
MACA721N_334.JPG	8/8/2007	Milo Pyne	MACA plot 721N
MACA721E_335.JPG	8/8/2007	Milo Pyne	MACA plot 721E
MACA721S_336.JPG	8/8/2007	Milo Pyne	MACA plot 721S
MACA721W_337.JPG	8/8/2007	Milo Pyne	MACA plot 721W
MACA722N_345.JPG	8/9/2007	Milo Pyne	MACA plot 722N
MACA722E_346.JPG	8/9/2007	Milo Pyne	MACA plot 722E
MACA722S_347.JPG	8/9/2007	Milo Pyne	MACA plot 722S
MACA722W_348.JPG	8/9/2007	Milo Pyne	MACA plot 722W
MACA724N_349.JPG	8/9/2007	Milo Pyne	MACA plot 724N
MACA724E_350.JPG	8/9/2007	Milo Pyne	MACA plot 724E
MACA724S_351.JPG	8/9/2007	Milo Pyne	MACA plot 724S
MACA724W_352.JPG	8/9/2007	Milo Pyne	MACA plot 724W
MACA725N_355.JPG	8/9/2007	Milo Pyne	MACA plot 725N
MACA725E_356.JPG	8/9/2007	Milo Pyne	MACA plot 725E
MACA725S_357.JPG	8/9/2007	Milo Pyne	MACA plot 725S

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MACA725W_358.JPG	8/9/2007	Milo Pyne	MACA plot 725W
MACA725_Cave_365.JPG	8/9/2007	Milo Pyne	MACA plot 725; Cave
MACA725_Acta-rac_379.JPG	8/9/2007	Milo Pyne	MACA plot 725; *Actaea racemosa*
MACA725_Acta-rac_380.JPG	8/9/2007	Milo Pyne	MACA plot 725; *Actaea racemosa*
MACA725_Acta-rac_383.JPG	8/9/2007	Milo Pyne	MACA plot 725; *Actaea racemosa*
MACA725_Cave_384.JPG	8/9/2007	Milo Pyne	MACA plot 725; Cave
MACA726N_386.JPG	8/9/2007	Milo Pyne	MACA plot 726N
MACA726E_387.JPG	8/9/2007	Milo Pyne	MACA plot 726E
MACA726S_388.JPG	8/9/2007	Milo Pyne	MACA plot 726S
MACA726W_389.JPG	8/9/2007	Milo Pyne	MACA plot 726W
MACA727N_397.JPG	8/9/2007	Milo Pyne	MACA plot 727N
MACA727E_398.JPG	8/9/2007	Milo Pyne	MACA plot 727E
MACA727S_399.JPG	8/9/2007	Milo Pyne	MACA plot 727S
MACA727W_400.JPG	8/9/2007	Milo Pyne	MACA plot 727W
MACA727_rocks_401.JPG	8/9/2007	Milo Pyne	MACA plot 727; rocks
MACA727_rocks_402.JPG	8/9/2007	Milo Pyne	MACA plot 727; rocks
MACA727_vic-Hexa-spic_405.JPG	8/9/2007	Milo Pyne	MACA plot 727; *Hexalectris spicata*
MACA727_vic-Hexa-spic_411.JPG	8/9/2007	Milo Pyne	MACA plot 727; *Hexalectris spicata*
MACA735E_572.JPG	10/2/2007	Milo Pyne	MACA plot 735E
MACA735N_573.JPG	10/2/2007	Milo Pyne	MACA plot 735N
MACA735S_575.JPG	10/2/2007	Milo Pyne	MACA plot 735S
MACA735W_574.JPG	10/2/2007	Milo Pyne	MACA plot 735W
MACA736NE_570.JPG	10/2/2007	Milo Pyne	MACA plot 736NE
MACA736NE_571.JPG	10/2/2007	Milo Pyne	MACA plot 736NE
MACA736NW_568.JPG	10/2/2007	Milo Pyne	MACA plot 736NW
MACA736N_569.JPG	10/2/2007	Milo Pyne	MACA plot 736N
MACA738-41.2_577.JPG	10/2/2007	Milo Pyne	MACA plot 738-41.2
MACA738NE_578.JPG	10/2/2007	Milo Pyne	MACA plot 738NE
MACA738NE_583.JPG	10/2/2007	Milo Pyne	MACA plot 738NE
MACA738NW1_581.JPG	10/2/2007	Milo Pyne	MACA plot 738NW1
MACA738NW2_582.JPG	10/2/2007	Milo Pyne	MACA plot 738NW2
MACA738NW_586.JPG	10/2/2007	Milo Pyne	MACA plot 738NW
MACA738SE_579.JPG	10/2/2007	Milo Pyne	MACA plot 738SE
MACA738SE_584.JPG	10/2/2007	Milo Pyne	MACA plot 738SE
MACA738SW_580.JPG	10/2/2007	Milo Pyne	MACA plot 738SW
MACA738SW_585.JPG	10/2/2007	Milo Pyne	MACA plot 738SW
MACA738x_587.JPG	10/2/2007	Milo Pyne	MACA plot 738x
MACA738x_588.JPG	10/2/2007	Milo Pyne	MACA plot 738x
MACA740N_589.JPG	10/2/2007	Milo Pyne	MACA plot 740N
MACA740E_590.JPG	10/2/2007	Milo Pyne	MACA plot 740E
MACA740S_591.JPG	10/2/2007	Milo Pyne	MACA plot 740S
MACA740W_592.JPG	10/2/2007	Milo Pyne	MACA plot 740W
MACA742E_560.JPG	10/3/2007	Milo Pyne	MACA plot 742E
MACA742N_559.JPG	10/3/2007	Milo Pyne	MACA plot 742N

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MACA742S_561.JPG	10/3/2007	Milo Pyne	MACA plot 742S
MACA742W_562.JPG	10/3/2007	Milo Pyne	MACA plot 742W
MACA742x1_563.JPG	10/3/2007	Milo Pyne	MACA plot 742
MACA742x2_564.JPG	10/3/2007	Milo Pyne	MACA plot 742
MACA743ESE_577.JPG	10/3/2007	Milo Pyne	MACA plot 743ESE
MACA743ESE_578.JPG	10/3/2007	Milo Pyne	MACA plot 743ESE
MACA743ESE_579.JPG	10/3/2007	Milo Pyne	MACA plot 743ESE
MACA743N_573.JPG	10/3/2007	Milo Pyne	MACA plot 743N
MACA743E_574.JPG	10/3/2007	Milo Pyne	MACA plot 743E
MACA743SSE_580.JPG	10/3/2007	Milo Pyne	MACA plot 743SSE
MACA743S_575.JPG	10/3/2007	Milo Pyne	MACA plot 743S
MACA743W_576.JPG	10/3/2007	Milo Pyne	MACA plot 743W
MACA743_571.JPG	10/3/2007	Milo Pyne	MACA plot 743
MACA743_572.JPG	10/3/2007	Milo Pyne	MACA plot 743
MACA744N_572.JPG	10/4/2007	Milo Pyne	MACA plot 744N
MACA744E_573.JPG	10/4/2007	Milo Pyne	MACA plot 744E
MACA744S_574.JPG	10/4/2007	Milo Pyne	MACA plot 744S
MACA744W_575.JPG	10/4/2007	Milo Pyne	MACA plot 744W
MACA744x1_576.JPG	10/4/2007	Milo Pyne	MACA plot 744
MACA744x2_577.JPG	10/4/2007	Milo Pyne	MACA plot 744
MACA744x3_578.JPG	10/4/2007	Milo Pyne	MACA plot 744
MACA745N1_580.JPG	10/4/2007	Milo Pyne	MACA plot 745N1
MACA745N2_581.JPG	10/4/2007	Milo Pyne	MACA plot 745N2
MACA745E_582.JPG	10/4/2007	Milo Pyne	MACA plot 745E
MACA745S_583.JPG	10/4/2007	Milo Pyne	MACA plot 745S
MACA745W_584.JPG	10/4/2007	Milo Pyne	MACA plot 745W
MACA745x1_585.JPG	10/4/2007	Milo Pyne	MACA plot 745x1
MACA745x2_586.JPG	10/4/2007	Milo Pyne	MACA plot 745x2
MACA746N_588.JPG	10/4/2007	Milo Pyne	MACA plot 746N
MACA746E_589.JPG	10/4/2007	Milo Pyne	MACA plot 746E
MACA746S_590.JPG	10/4/2007	Milo Pyne	MACA plot 746S
MACA746W_591.JPG	10/4/2007	Milo Pyne	MACA plot 746W
MACA747N_598.JPG	10/4/2007	Milo Pyne	MACA plot 747N
MACA747E_599.JPG	10/4/2007	Milo Pyne	MACA plot 747E
MACA747S_600.JPG	10/4/2007	Milo Pyne	MACA plot 747S
MACA747W_601.JPG	10/4/2007	Milo Pyne	MACA plot 747W
MACA747_610.JPG	10/4/2007	Milo Pyne	MACA plot 747
MACA747_611.JPG	10/4/2007	Milo Pyne	MACA plot 747
MACA747_612.JPG	10/4/2007	Milo Pyne	MACA plot 747
MACA747_613.JPG	10/4/2007	Milo Pyne	MACA plot 747
MACA748N_619.JPG	10/4/2007	Milo Pyne	MACA plot 748N
MACA748E_620.JPG	10/4/2007	Milo Pyne	MACA plot 748E
MACA748S_621.JPG	10/4/2007	Milo Pyne	MACA plot 748S
MACA748W_622.JPG	10/4/2007	Milo Pyne	MACA plot 748W
MACA749N_572.JPG	10/5/2007	Milo Pyne	MACA plot 749N
MACA749E_573.JPG	10/5/2007	Milo Pyne	MACA plot 749E
MACA749S_574.JPG	10/5/2007	Milo Pyne	MACA plot 749S

Photo file name	Date taken	Photographer	Description of photo
MACA749W_575.JPG	10/5/2007	Milo Pyne	MACA plot 749W
MACA749_576.JPG	10/5/2007	Milo Pyne	MACA plot 749
MACA749_577.JPG	10/5/2007	Milo Pyne	MACA plot 749
MACA749_578.JPG	10/5/2007	Milo Pyne	MACA plot 749
MACA750N_579.JPG	10/5/2007	Milo Pyne	MACA plot 750N
MACA750E_580.JPG	10/5/2007	Milo Pyne	MACA plot 750E
MACA750S_581.JPG	10/5/2007	Milo Pyne	MACA plot 750S
MACA750W_582.JPG	10/5/2007	Milo Pyne	MACA plot 750W
MACA751E_588.JPG	10/5/2007	Milo Pyne	MACA plot 751E
MACA751S_589.JPG	10/5/2007	Milo Pyne	MACA plot 751S
MACA751S_590.JPG	10/5/2007	Milo Pyne	MACA plot 751S
MACA751W_591.JPG	10/5/2007	Milo Pyne	MACA plot 751W
MACA751_Dryo-gol_584.JPG	10/5/2007	Milo Pyne	MACA plot 751; *Dryopteris goldiana*
MACA751_Dryo-gol_585.JPG	10/5/2007	Milo Pyne	MACA plot 751; *Dryopteris goldiana*
MACA751_Dryo-gol_586.JPG	10/5/2007	Milo Pyne	MACA plot 751; *Dryopteris goldiana*
MACA751_Dryo-gol_587.JPG	10/5/2007	Milo Pyne	MACA plot 751; *Dryopteris goldiana*
MACA751x_592.JPG	10/5/2007	Milo Pyne	MACA plot 751
Rock_038.JPG	8/13/2003	Carl Nordman/Rickie White	MACA; Rock
Rock_039.JPG	8/13/2003	Carl Nordman/Rickie White	MACA; Rock
Liparis_lilifolia.JPG	5/20/2003	??	MACA; *Liparis liliifolia*
Sloans_Pond.JPG	5/20/2003	??	MACA; MACA; Sloans Pond
Hexalectris-spicata_52.JPG	8/5/2003	Carl Nordman	MACA; *Hexalectris spicata*
Panax_Partheno_61.JPG	8/6/2003	Carl Nordman	MACA; Ginseng with Virginia creeper
Rattler_50.JPG	7/17/2002	Rickie White	MACA; Rattlesnake
Panax_Partheno_62.JPG	8/6/2003	Carl Nordman	MACA; Ginseng with Virginia creeper
Rattler_51.JPG	7/17/2002	Rickie White	MACA; Rattlesnake
Caterpillar009.JPG	8/11/2003	Carl Nordman/Rickie White	MACA; Caterpillar
Echinaea_02.JPG	6/22/2004	Rickie White	MACA; *Echinaea purpurea*
Echinaea_03.JPG	6/22/2004	Rickie White	MACA; *Echinaea purpurea*
Ratibida_04.JPG	6/22/2004	Rickie White	MACA; *Ratibida pinnata*
Ratibida_05.JPG	6/22/2004	Rickie White	MACA; *Ratibida pinnata*
Ratibida_06.JPG	6/22/2004	Rickie White	MACA; *Ratibida pinnata*
Ipom-pan_07.JPG	6/22/2004	Rickie White	MACA; *Ipomoea pandurata*
Ipom-pan_08.JPG	6/22/2004	Rickie White	MACA; *Ipomoea pandurata*
Juniperus_09.JPG	6/22/2004	Rickie White	MACA; *Juniperus virginiana*
Mona-fis_11.JPG	6/22/2004	Rickie White	MACA; *Monarda fistulosa*
Mona-fis_12.JPG	6/22/2004	Rickie White	MACA; *Monarda fistulosa*
Hills_17.JPG	6/23/2004	Rickie White	MACA; Hills
Box-turtle_22.JPG	6/24/2004	Rickie White	MACA; Box turtle
Box-turtle_23.JPG	6/24/2004	Rickie White	MACA; Box turtle

Photo file name	Date taken	Photographer	Description of photo
MACA_BigWoods-Ltl-Jord-rd-rpt_52.JPG	6/28/2005	Erin Lunsford	MACA Big Woods; Little Jordan rd rpt
MACA_Coreop_246.JPG	5/14/2007	Milo Pyne	MACA; *Coreopsis* sp.
MACA_Coreop_248.JPG	5/14/2007	Milo Pyne	MACA; *Coreopsis* sp.
MACA_Packera_252.JPG	5/14/2007	Milo Pyne	MACA; *Packera anonyma*
MACA_253.JPG	5/15/2007	Milo Pyne	MACA; slope
MACA_254.JPG	5/15/2007	Milo Pyne	MACA; slope
MACA_Oxal-str_255.JPG	5/15/2007	Milo Pyne	MACA; *Oxalis stricta*
MACA_Oxal-str_257.JPG	5/15/2007	Milo Pyne	MACA; *Oxalis stricta*
MACA_Cora-odo_260.JPG	5/15/2007	Milo Pyne	MACA; *Corallorhiza odontohiza*
MACA_Ioda-pin_263.JPG	5/15/2007	Milo Pyne	MACA; *Iodanthus pinnatifidus*
MACA_Sampling_274.JPG	5/15/2007	Milo Pyne	MACA; Sampling
MACA_Sampling_275.JPG	5/15/2007	Milo Pyne	MACA; Sampling
MACA_277.JPG	5/15/2007	Milo Pyne	MACA; slump; nascent sinkhole?
MACA_Lipa-lil_281.JPG	5/15/2007	Milo Pyne	MACA; *Liparis liliifolia*
MACA_Lipa-lil_288.JPG	5/15/2007	Milo Pyne	MACA; *Liparis liliifolia*
MACA_successional_289.JPG	5/15/2007	Milo Pyne	MACA; successional veg.
MACA_successional_290.JPG	5/15/2007	Milo Pyne	MACA; successional veg.
MACA_successional_291.JPG	5/15/2007	Milo Pyne	MACA; successional veg.
MACA_Cyp-reg_303.JPG	5/16/2007	Milo Pyne	MACA; *Cypripedium reginae*
MACA_Cyp-reg_311.JPG	5/16/2007	Milo Pyne	MACA; *Cypripedium reginae*
MACA_Cyp-reg_312.JPG	5/16/2007	Milo Pyne	MACA; *Cypripedium reginae*
MACA_Hydr-can_337.JPG	5/16/2007	Milo Pyne	MACA; *Hydrastis canadensis*
MACA_Hydr-can_339.JPG	5/16/2007	Milo Pyne	MACA; *Hydrastis canadensis*
MACA_Mona-brad_362.JPG	5/17/2007	Milo Pyne	MACA; *Monarda bradburiana*
MACA_Mona-brad_368.JPG	5/17/2007	Milo Pyne	MACA; *Monarda bradburiana*
MACA_Mona-brad_371.JPG	5/17/2007	Milo Pyne	MACA; *Monarda bradburiana*
MACA_Poly-acr_376.JPG	5/17/2007	Milo Pyne	MACA; *Polystichum acrostichoides*
MACA_Bleph-cil_380.JPG	5/17/2007	Milo Pyne	MACA*; Blephilia ciliata*
MACA_Bleph-cil_381.JPG	5/17/2007	Milo Pyne	MACA; *Blephilia ciliata*
MACA_rocks_293.JPG	8/7/2007	Milo Pyne	MACA; rocks
MACA_rocks_294.JPG	8/7/2007	Milo Pyne	MACA; rocks
MACA_rock-skull_295.JPG	8/7/2007	Milo Pyne	MACA; skull rock
MACA_rock-skull_296.JPG	8/7/2007	Milo Pyne	MACA; skull rock
MACA_rocks.ferns_297.JPG	8/7/2007	Milo Pyne	MACA; rocks and ferns
MACA_rocks.ferns_298.JPG	8/7/2007	Milo Pyne	MACA; rocks and ferns
MACA_Heuchera_301.JPG	8/7/2007	Milo Pyne	MACA; *Heuchera* sp.
MACA_Heuchera_302.JPG	8/7/2007	Milo Pyne	MACA; *Heuchera* sp.
MACA_river_339.JPG	8/8/2007	Milo Pyne	MACA; river at MACA
MACA_river_340.JPG	8/8/2007	Milo Pyne	MACA; river at MACA
MACA_rocks_342.JPG	8/8/2007	Milo Pyne	MACA; rocks at MACA
MACA_rocks_343.JPG	8/8/2007	Milo Pyne	MACA; rocks at MACA
MACA_592.JPG	10/4/2007	Milo Pyne	MACA; rocks at MACA
MACA_593.JPG	10/4/2007	Milo Pyne	MACA; rocks at MACA
MACA_596.JPG	10/4/2007	Milo Pyne	MACA; roots of long-dead tree

Photo file name	Date taken	Photographer	Description of photo
MACA_Symp-sho_602.JPG	10/4/2007	Milo Pyne	MACA; *Symphyotrichum shortii*
MACA_Symp-sho_607.JPG	10/4/2007	Milo Pyne	MACA; *Symphyotrichum shortii*
MACA_Symp-sho_608.JPG	10/4/2007	Milo Pyne	MACA; *Symphyotrichum shortii*
MACA_Symp-sho_609.JPG	10/4/2007	Milo Pyne	MACA; *Symphyotrichum shortii*
MACA_sandstone_614.JPG	10/4/2007	Milo Pyne	MACA; sandstone
MACA_sandstone_615.JPG	10/4/2007	Milo Pyne	MACA; sandstone
MACA_sandstone_616.JPG	10/4/2007	Milo Pyne	MACA; sandstone
MACA_sandstone_617.JPG	10/4/2007	Milo Pyne	MACA; sandstone

Appendix I. FIELD KEY

Key to the National Vegetation Classification (NVC) Associations which occur at Mammoth Cave National Park

Associations documented from Mammoth Cave are highlighted in yellow. Those which are likely to occur but are undocumented for Mammoth Cave are unhighlighted. For each association, the common name is given, with the Element Code in parentheses (CEGL00####), and the Alliance Code in brackets [A.###]. The Alliances are broader units (groups of associations) based on dominant species.

KEY TO KEYS

1a. Vegetation dominated by trees, either closed forests or open woodlands **2**

1b. Vegetation not dominated by trees, trees are absent or very sparse **4**

2a. Upland forests and woodlands, not prone to flooding or saturation **3**

2b. Forests of bottomlands, swamps, seeps or other areas prone to flooding or saturation..... ***KEY C – WETLAND FORESTS***

3a. Upland deciduous forests or woodlands, if evergreen trees are present they are a minor canopy component..... ***KEY B – UPLAND DECIDUOUS FORESTS***

3b. Upland forests dominated or co-dominated by evergreen trees such as Pine (*Pinus spp.)*, Eastern Red-cedar (*Juniperus virginiana*), or Eastern Hemlock (*Tsuga canadensis*)..... ***KEY A – UPLAND EVERGREEN FORESTS***

4a. Shrub-dominated and vine-dominated areas (with few or no tall trees; may include scattered individuals or areas of low-stature or young trees)..... ***KEY D – SHRUBLANDS***

4b. Vegetation dominated by herbaceous plants..... **5**

5a. Vegetation dominated or characterized by grasses or grass-like plants (perennial or annual) ..... ***KEY E – GRAMINOID VEGETATION (and sparse woodlands)***

5b. Vegetation dominated by forbs (broadleaf plants)..... ***KEY F – FORB (BROADLEAF HERB) VEGETATION***

KEY A – UPLAND EVERGREEN FORESTS

1a. Evergreen forest dominated or codominated by Pine (*Pinus spp.*) or Eastern Hemlock (*Tsuga canadensis*), possibly with Eastern red-cedar (*Juniperus virginiana*) as a component **2**

1b. Evergreen or mixed forest, woodland or sparse woodland, characterized by Eastern red-cedar (*Juniperus virginiana*), with pines (*Pinus* spp.) absent or as a minor component (less than 25%) **8**

2a. Evergreen forest (natural stands) dominated or codominated by Eastern Hemlock (*Tsuga canadensis)*, this species having at least 25% cover in the plot or stand ..... ***East-central Hemlock Hardwood Forest* (CEGL005043) [A.413]**

2b. Evergreen forest (natural or successional stands) dominated by Virginia Pine (*Pinus virginiana*), Loblolly Pine (*Pinus taeda*), or Shortleaf Pine (*Pinus echinata)* **3**

3a. Natural evergreen forest (including young stands) on dry sites (especially S to SW slopes) dominated by Virginia Pine (*Pinus virginiana*) or Shortleaf Pine (*Pinus echinata)*, understory with Blueberries (*Vaccinium* spp.) ..... ***Appalachian Low-Elevation Mixed Pine / Hillside Blueberry Forest* (CEGL007119))[A.131]**

3b. Successional (on old fields or clearcut sites) or planted evergreen forest dominated by Virginia Pine (*Pinus virginiana*), Loblolly Pine (*Pinus taeda),* or Shortleaf Pine (*Pinus echinata*), possibly with Eastern red-cedar (*Juniperus virginiana*) as a component **4**

4a. Dominated by Loblolly Pine (*Pinus taeda*) **5**

4b. Dominated by Virginia Pine (*Pinus virginiana*), Loblolly Pine (*Pinus taeda*), or Shortleaf Pine (*Pinus echinata*), possibly with Eastern red-cedar (*Juniperus virginiana*) as a component **6**

5a. Monospecific stands of (generally young) planted Loblolly Pine (*Pinus taeda*), with little understory ..... ***Loblolly Pine Plantation* (CEGL007179) [A.99]**

5b. Successional stands of Loblolly Pine (*Pinus taeda*) possibly mixed with successional hardwoods (*Liriodendron tulipifera, Liquidambar styraciflua*)..... ??

6a. Successional stands (their origin unclear) dominated by Shortleaf Pine (*Pinus echinata*)..... ***Shortleaf Pine Early-Successional Forest* (CEGL006327) [A.119]**

6b. Successional stands dominated by Virginia Pine (*Pinus virginiana*) **7**

7a. Successional stands dominated by Virginia Pine (*Pinus virginiana*), without Eastern red-cedar ..... ***Virginia Pine Successional Forest* (CEGL002591) [A.131]**

7b. Successional stands dominated by Virginia Pine (*Pinus virginiana*), with Eastern red-cedar ..... ***Virginia Pine - Red-cedar Successional Forest* CEGL007121**

8a. Evergreen or mixed woodland or sparse woodland, characterized by Eastern red-cedar (*Juniperus virginiana*) and Chinquapin Oak (*Quercus muehlenbergii*), with native warm-season grasses and calciphilic forbs (of limited extent).....***Central Limestone Glade*** **(CEGL005131) [A.1919]**

8b. Evergreen or mixed forest, dominated or codominated by Eastern red-cedar (*Juniperus virginiana*)... **9**

9a. Evergreen or mixed forest, dominated (>50% cover) by Eastern red-cedar (*Juniperus virginiana*) .... ***Red-cedar Successional Forest*** **(CEGL007124) [A.137]**

9b. Mixed forest, codominated by Eastern red-cedar (*Juniperus virginiana*), Flowering Dogwood (*Cornus florida*), White Ash (*Fraxinus americana),* or Blue Ash (*Fraxinus quadrangulata)*, an understory of Flowering Dogwood (*Cornus florida*) may be present..... ....***Southeastern Successional Black Cherry Forest*** **(CEGL004133) mixed variant**

KEY B – UPLAND DECIDUOUS FORESTS

1a. Forest dominated by the exotic (not native) Tree-of-Heaven (*Ailanthus altissima*)..... .....***Successional Tree-of-Heaven Forest*** **(CEGL007191) [A.221]**

1b. Forest or open grassy woodland dominated by native trees **2**

2a. Dry to mesic forests or woodlands dominated by Oaks (*Quercus spp.)* and neither dominated nor codominated by American Beech (*Fagus grandifolia*), Black Walnut (*Juglans nigra*), Tuliptree (*Liriodendron tulipifera*), Sweetgum (*Liquidambar styraciflua*), Sugar Maple (*Acer saccharum*) ....**Ecological System (CES202.898) Southern Interior Low Plateau Dry-Mesic Oak Forest**.... **13**

2b. Forests, including mesic and non-oak dominated ones, not as described above **3**

3a. Forest codominated by American Beech *(Fagus grandifolia),* often with Tuliptree (*Liriodendron tulipifera*), possibly with White Oak (*Quercus alba*) and White Ash (*Fraxinus americana*) **4**

3b. Forests neither dominated nor codominated by American Beech (*Fagus grandifolia*)..... **5**

4a. Forests of ravines, coves, or sinkholes dominated by American Beech (*Fagus grandifolia),* Sugar Maple *(Acer saccharum),* Tuliptree (*Liriodendron tulipifera),* White Ash (*Fraxinus americana),* Red Oak (*Quercus rubra),* and/or White Oak (*Quercus alba)* .... ***Beech - Maple Unglaciated Forest*** **(CEGL002411) [A.227]**

4b. Forest with canopy dominated by American Beech (*Fagus grandifolia*) typically at 15-60% and White Oak (*Quercus alba*), along with Red Oak (*Quercus rubra*), White Ash (*Fraxinus americana*), and Tuliptree (*Liriodendron tulipifera*), but with low cover of Sugar Maple (*Acer saccharum*); typically found on mid-slopes..... ***Central Interior Beech – White Oak Forest*** **(CEGL007881) [A.229]**

5a. Early to-mid-successional forest dominated by some combination of species whose seeds are wind-borne or easily transported by birds and mammals onto post-cultivation lands, including but not limited to Black Cherry (*Prunus serotina var. serotina*), Sugar Maple (*Acer saccharum*), Tuliptree (*Liriodendron tulipifera*), Virginia Pine (*Pinus virginiana*), Red Maple (*Acer rubrum*), Dogwood (*Cornus florida*), Sourwood (*Oxydendrum arboreum*), and Eastern Red-cedar (*Juniperus virginiana*). Frequently found near old home sites, near roads, or in other situations where lands were taken out of cultivation at the time of the establishment of the park (including in sinkhole bottoms near old house sites)..... **6**

5b. Other non-oak (*Quercus spp.*) dominated forest, dominated by other species, in particular Tuliptree (*Liriodendron tulipifera*) and or Sweetgum (*Liquidambar styraciflua*), as well as Sugar Maple (*Acer saccharum*)..... **7**

6a. Forest dominated by Black Walnut (*Juglans nigra)*; other canopy species can include Tuliptree (*Liriodendron tulipifera),* Black Cherry (*Prunus serotina),* Shingle Oak (*Quercus imbricaria)*, and American Elm (*Ulmus americana)*..... ***Successional Black Walnut Forest*** **(CEGL007879) [A.1932]**

6b. Other early to-mid-successional forest, dominated by a variable combination of species including Black Cherry (*Prunus serotina var. serotina*), Sugar Maple (*Acer saccharum*), Tuliptree (*Liriodendron tulipifera*), Virginia Pine (*Pinus virginiana*),and/or Red Maple (*Acer rubrum*), the subcanopy by Dogwood (*Cornus florida*), Sourwood (*Oxydendrum arboreum*), and Eastern Red-cedar (*Juniperus virginiana*). In some examples, the tall-shrub layer of old, large Dogwood (*Cornus florida*) is more dense

(70% cover) than the canopy. Some stands may be dominated by Red Maple (*Acer rubrum*) or by Sugar Maple (*Acer saccharum*), and these are recognized as map variants..... .....***Southeastern Successional Black Cherry Forest*** **(CEGL004133)**

7a. Forest (early Successional or not) dominated or codominated by Sweetgum (*Liquidambar styraciflua*) and/or Tuliptree (*Liriodendron tulipifera*)..... **8**

7b. Forest dominated or codominated by Sugar Maple (*Acer saccharum*), usually not dominated nor codominated by Sweetgum (*Liquidambar styraciflua*) nor Tuliptree (*Liriodendron tulipifera*), but some stands dominated by a combination of Sugar Maple and Tuliptree will key here as well..... **11**

8a. Early to mid-successional Forest dominated or codominated by Sweetgum (*Liquidambar styraciflua*) . .....**9 [A.234]**

8b. Forest dominated or codominated by Tuliptree (*Liriodendron tulipifera*) .....**10 [A.236]**

9a. Early successional forest nearly completely dominated by Sweetgum (*Liquidambar styraciflua*) on disturbed or formerly cut over sites ..... ***Successional Sweetgum Forest*** **(CEGL007216) [A.234]**

9b. Mid to late successional forest dominated by Sweetgum (*Liquidambar styraciflua*) with White Oak (*Quercus alba*), Tuliptree (*Liriodendron tulipifera)*, and/or Southern Red Oak (*Quercus falcata*) in the overstory ..... ***Interior Mid- to Late-Successional Sweetgum - Oak Forest*** **(CEGL007217) [A.234]**

10a. Forest with Tuliptree *(Liriodendron tulipifera)* and a hardwood component indicative of acidic conditions (i.e. with Red Maple (*Acer rubrum),* White Oak (*Quercus alba*), or Southern Red Oak (*Quercus falcata*) ..... ***Successional Tuliptree Forest (Typic Type)*** **(CEGL007221) [A.236]**

10b. Forest with Tuliptree *(Liriodendron tulipifera)* and a hardwood component indicative of basic or circumneutral conditions (i.e. with Black Walnut (*Juglans nigra),* White Ash (*Fraxinus americana),* Slippery Elm (*Ulmus rubra),* Chinquapin Oak (*Quercus muehlenbergii)*, and Shagbark Hickory (*Carya ovata)*. Canopy may be codominated by Sugar Maple (*Acer saccharum)*. Species often found in the subcanopy include Sugar Maple (*Acer saccharum),* Redbud *(Cercis canadensis),*and Spicebush (*Lindera benzoin)*..... ***Successional Tuliptree Forest (Rich Type)*** **(CEGL007220) [A.236]**

11a. Earlier Successional forest dominated by Sugar Maple (*Acer saccharum*), often found on old home sites ***Southeastern Successional Black Cherry Forest*** **(CEGL004133) Sugar maple-dominated variant**

11b. Mid- to later-successional forest with a more diverse canopy, dominated by some combination of Sugar Maple (*Acer saccharum*), Hickory (*Carya spp.*), sometimes with Ash (*Fraxinus spp.),* Black Cherry *(Prunus serotina),* and/or Black Walnut (*Juglans nigra)* **12**

12a. Forest codominated by Sugar Maple (*Acer saccharum*) and Tuliptree *(Liriodendron tulipifera)*, sometimes with Ash (*Fraxinus spp.)* or Black Cherry *(Prunus serotina).* Generally found on toe slopes or riparian terraces (this keys in two places to accommodate stand variation) .... ***Successional Tuliptree Forest (Rich Type)*** **(CEGL007220) [A.236]**

12b. Forest with canopy dominated by Sugar Maple (*Acer saccharum*), Mockernut Hickory (*Carya alba*), Shagbark Hickory (*Carya ovata*), sometimes with Black Walnut (*Juglans nigra)* ....***Nashville Basin Mesic Sugar Maple – Hickory Forest*** **(CEGL004741) [A.1912]**

13a. Open-canopied grassy woodland with Post Oak (*Quercus stellata*), Blackjack Oak (*Quercus marilandica*), Pignut Hickory (*Carya* glabra), and Little Bluestem (*Schizachyrium scoparium*) ..... ***Western Highland Rim Escarpment Post Oak Barrens* (CEGL004686) [A.625]**

13b. Generally closed-canopy forests, primarily oak-dominated, not as described above (including stands dominated by various combinations of Chestnut Oak (*Quercus prinus*), Southern Red Oak (*Quercus falcata*), White Oak (*Quercus alba*), and others)..... **14**

14a. Dry oak forest dominated or codominated by Chestnut Oak (*Quercus prinus*)..... **15**

14b. Dry to mesic oak forest not dominated nor codominated by Chestnut Oak (*Quercus prinus*)..... **16**

15a. Canopy strongly dominated by Chestnut Oak (*Quercus prinus)*, without Mountain Laurel (*Kalmia latifolia*) ..... ***Interior Low Plateau Chestnut Oak Forest* (CEGL005022) [A.248]**

15b. Canopy strongly dominated by Chestnut Oak (*Quercus prinus)*, with Mountain Laurel (*Kalmia latifolia*) as an important shrub ..... ***Interior Low Plateau Chestnut Oak - Mixed Oak Forest* (CEGL007700) [A.249]**

16a. Dry oak forest dominated or codominated by Southern Red Oak (*Quercus falcata*)..... **17**

16b. Dry to mesic oak forest not dominated nor codominated by Southern Red Oak (*Quercus falcata*), nor by Chestnut Oak (*Quercus prinus)* **18**

17a. Dry oak forest typically dominated or codominated by a combination of Southern Red Oak (*Quercus falcata*) and/or Post Oak (*Quercus stellata*), also possibly containing White Oak (*Quercus alba*) and Scarlet Oak (*Quercus coccinea*) ..... ***Southern Red Oak - Mixed Oak Forest* (CEGL005018) [A.241]**

17b. Dry oak forest, dominated solely or primarily by Southern Red Oak (*Quercus falcata*) ..... ***Southeastern Interior Southern Red Oak - Scarlet Oak Forest* (CEGL007247)[A.243]**

18a. Forest on basic or circumneutral substrates dominated or codominated by Chinquapin Oak (*Quercus muehlenbergii),* and/or Shumard Oak (*Quercus shumardii*), and/or Shingle Oak (*Quercus imbricaria*) ..... **19 [A.1912]**

18b. Forest (on basic or circumneutral substrates) not dominated nor codominated by Chinquapin Oak (*Quercus muehlenbergii),* nor Shumard Oak (*Quercus shumardii*), nor Shingle Oak (*Quercus imbricaria*). These forests are generally dominated or codominated by some combination of White Oak *(Quercus alba),* Red Oak (*Quercus rubra*), Post Oak (*Quercus stellata*) and/or Black Oak (*Quercus velutina*), often with Hickories (*Carya* spp.)..... **20**

19a. Forest on basic or circumneutral substrates dominated or codominated by Shingle Oak (*Quercus imbricaria*), usually with Red Hickory (*Carya ovalis*), and White Ash (*Fraxinus americana*)..... ***Nashville Basin Shingle Oak – Shumard Oak – Chinquapin Oak Forest* (CEGL003876) [A.1912]**

19b. Forest on basic or circumneutral substrates dominated by Chinquapin Oak (*Quercus muehlenbergii),* Pignut Hickory (*Carya glabra),* Shagbark Hickory *(Carya ovata),* Eastern Red-cedar *(Juniperus virginiana),* Black Cherry (*Prunus serotina*), and/or Shumard Oak (*Quercus shumardii)* ..... ***Shumard Oak – Chinquapin Oak Mesic Limestone Forest* (CEGL008442) [A.1912]**

20a. Forest dominated by a variable mixture of White Oak (*Quercus alba*) and Black Oak (*Quercus velutina*), perhaps with a minor component of Southern Red Oak (*Quercus falcata*) and Post Oak (*Quercus stellata*); a common, widespread and somewhat variable community at MACA. .... ***Interior Dry-Mesic White Oak - Hickory Forest* (CEGL007795) [A.239]**

20b. Other forests (mesic or dry-mesic) dominated by White Oak *(Quercus alba)* and/or Red Oak *(Quercus rubra)* **21**

21a. Dry-mesic forest dominated by White Oak *(Quercus alba)*, with Red Oak *(Quercus rubra)* and/or Shumard Oak *(Quercus shumardii)* with plants indicative of basic or circumneutral conditions (such as Sugar Maple (*Acer saccharum*), Hop hornbeam (*Ostrya virginiana),* Redbud (*Cercis canadensis*), Bitternut Hickory (*Carya cordiformis*), Buck Brush (*Symphoricarpos orbiculatus*), Eastern Red-cedar (*Juniperus virginiana*) ..... ***White Oak - Mixed Oak Dry-Mesic Alkaline Forest* (CEGL002070) [A.239]**

21b. Mesic forest dominated by Red Oak *(Quercus rubra*) and Sugar Maple *(Acer saccharum)*, with plants indicative of mesic conditions, such as Solomon's Plume (*Maianthemum racemosum*) and May-apple (*Podophyllum peltatum*), found on lower concave slopes .... ***Rich Appalachian Red Oak / Sugar Maple Forest* (CEGL007698) [A.251]**

KEY C – WETLAND FORESTS

1a. Forested acid seep in streamhead swales on broad ridges on sandy, saturated soils. Canopy composition is highly variable, but Carolina Red Maple (*Acer rubrum var. trilobum),* Black Gum (*Nyssa sylvatica),* Tuliptree (*Liriodendron tulipifera)*, and Sweetgum (*Liquidambar styraciflua)* are common. A community of small-scale, limited areas at MACA. ***Cumberland Forested Acid Seep* (CEGL007443) [A.348]**

1b. Other forest or woodland associated with ponds, lakes, riparian areas, bottomlands or swamps **2**

2a. Swamp in pond, seasonally or semi-permanently (long duration) flooded..... **3**

2b. Bottomland or riparian area, temporarily (short duration) flooded **4**

3a. Swamp forest in pond, dominated by Pin Oak (*Quercus palustris)* and Red Maple (*Acer rubrum*), also possibly containing Black Gum (*Nyssa sylvatica*), Cherrybark Oak (*Quercus pagoda*) and/or Shagbark Hickory (*Carya ovata)*..... ***Pin Oak Mixed Hardwood Forest* (CEGL002432) [A.329]**

3b. Swamp forest in pond, dominated or codominated by Black Willow (*Salix nigra)*..... ..... ***Interior Low Plateau Willow Pond Forest* (CEGL007703) [A.334]**

4a. Forest on levee, terrace, or edge of river, canopy dominated by Silver Maple (*Acer saccharinum*) and Sycamore (*Platanus occidentalis)*, with Black Walnut (*Juglans nigra*), but typically without Sweetgum (*Liquidambar styraciflua*). Some portions of stands may be dominated by Box-elder (*Acer negundo*), with Silver Maple (*Acer saccharinum*) and/or Sycamore (*Platanus occidentalis*)..... ..... ***Sycamore - Silver Maple Calcareous Floodplain Forest* (CEGL007334) [A.288]**

4b. Successional forest dominated by Sweetgum (*Liquidambar styraciflua)* and/or Tuliptree (*Liriodendron tulipifera)* without codominant Oaks (*Quercus spp.)*..... **5**

5a. Forest on upper terrace canopy dominated by Sweetgum (*Liquidambar styraciflua*), also with Tuliptree (*Liriodendron tulipifera*) and White Ash (*Fraxinus americana*) Red Maple (*Acer rubrum*) may also be a component. Found on a terrace above the normal floodplain of the Green River; sampled at only this one location, but could be found at others as well .... ***Successional Sweetgum Floodplain Forest* (CEGL007330) [A.287]**

5b. Forest on bottomland terrace or at toe slope, canopy dominated by Tuliptree (*Liriodendron tulipifera),* typically with Sugar Maple (*Acer saccharum*) in the understory and sometimes with Ash (*Fraxinus spp.)* or Black Cherry *(Prunus serotina)* in one or both of these strata; diverse and variable successional forest.. ..... ***Successional Tuliptree Forest (Circumneutral Type)* (CEGL007220) [A.236]**

KEY D – SHRUBLANDS (includes some stands dominated by young or low-stature trees)

1a. Evergreen needle-leaved shrubland, may have open grassy areas and scattered trees **2**

1b. Deciduous shrubland **3**

2a. Vegetation dominated (>50% cover) by Eastern red-cedar (*Juniperus virginiana*) ..... ***Red-cedar Successional Forest* (CEGL007124) [A.137]**

2b. Evergreen or mixed shrubland, woodland or sparse woodland, characterized by Eastern red-cedar (*Juniperus virginiana*) and Chinquapin Oak (*Quercus muehlenbergii)* ..... ***Central Limestone Glade* (CEGL005131) [A.1919]**

3a. Deciduous shrubland in wetland (pond, lake or floodplain area near river or creek) ..... **4 (3 choices)**

3b. Upland deciduous shrubland (generally not subject to flooding), may include groundcovering vine areas **5**

4a. Pond dominated by Buttonbush (*Cephalanthus occidentalis*) ..... ***Buttonbush Sinkhole Pond Swamp* (CEGL004742) [A.988]**

4b. Shrubland dominated by Smooth Alder (*Alnus serrulata*) ..... ***Southeastern Smooth Alder Swamp* (CEGL008474) [A.994]**

4c. Swamp in pond, dominated or codominated by Black Willow (*Salix nigra)* ..... ***Interior Low Plateau Willow Pond Forest* (CEGL007703) [A.334]**

5a. Vegetation dominated by Kudzu (*Pueraria montana* var. *lobata*), with few or no trees ..... ***Kudzu Vineland* (CEGL003882) [A.904]**

5b. Vegetation not dominated by Kudzu (*Pueraria montana* var. *lobata*) **6**

6a. Upland deciduous shrubland dominated by greenbrier species (*Smilax glauca, Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus, Rubus trivialis*), may include grasses and small trees, occurring on disturbed or successional sites ..... ***Blackberry - Greenbrier Successional Shrubland Thicket* (CEGL004732) [A.908]**

6b. Vegetation of walls and openings of limestone sinks dominated by *Hydrangea arborescens*, the herbaceous layer including *Hydrophyllum sp., Impatiens pallida, Parthenocissus quinquefolia, Sedum ternatum, and Heuchera americana* ***Highland Rim Limestone Cliff/Talus Seep* (CEGL004708) [A.1905]**

KEY E – GRAMINOID VEGETATION (See alternate key)

1a. Vegetation mainly non-native perennial grasses (or grasses mixed with forbs), may be kept open by mowing or bushhogging **2**

1b. Vegetation not with the above combination of characteristics, mainly dominated by native plants **3**

2a. Grassland pastures and hayfields, more-or-less cultural, but may no longer be actively maintained, dominated by European Tall Fescue or Meadow Fescue (*Lolium arundinaceum, L. pratense*)..... ..... ***Cultivated Meadow* (CEGL004048) [A.1213]**

2b. Grass areas dominated by Johnson grass (*Sorghum halepense*)..... ..... ***Johnson Grass vegetation* (CEGL004108*)* [A.2020]**

3a. Vegetation dominated by Common Broomsedge (*Andropogon virginicus* var. *virginicus*), a blond colored grass about 1 m tall ..... ***Successional Broomsedge Vegetation* (CEGL004044) [A.1208]**

3b. Vegetation not dominated by Common Broomsedge (*Andropogon virginicus* var. *virginicus*) **4**

4a. Vegetation dominated or codominated by Little Bluestem (*Schizachyrium scoparium*)..... **5**

4b. Wetland graminoid vegetation (and not characterized, dominated or codominated by Little Bluestem (*Schizachyrium scoparium*)) **8**

5a. Native perennial grassland dominated by Little Bluestem (*Schizachyrium scoparium*) with some mixture of Elliott's Beardgrass (*Andropogon gyrans**)***, Splitbeard Bluestem (*Andropogon ternarius)*, and/or Common Broomsedge (*Andropogon virginicus*)..... ..... ***Little Bluestem - Broomsedge Grassland* (CEGL007707) [A.1198]**

5b. Herbaceous vegetation including Little Bluestem *(Schizachyrium scoparium)*, not codominated by Elliott's Beardgrass (*Andropogon gyrans**)***, Splitbeard Bluestem (*Andropogon ternarius)*, and/or Common Broomsedge (*Andropogon virginicus*)..... **6**

6a. Vegetation with scattered trees of Chinquapin Oak (*Quercus muehlenbergii*) and Eastern Red-cedar (*Juniperus virginiana*); of limited extent..... ***Central Limestone Glade* (CEGL005131) [A.1919]**

6b. Scattered trees may be present, but of species other than Chinquapin Oak (*Quercus muehlenbergii*) and Eastern Red-cedar (*Juniperus virginiana*) **7**

7a. Open-canopied grassy woodland with Post Oak (*Quercus stellata*), Blackjack Oak (*Quercus marilandica*), Pignut Hickory (*Carya* glabra), and Little Bluestem (*Schizachyrium scoparium*) .... ***Western Highland Rim Escarpment Post Oak Barrens* (CEGL004686) [A.625]**

7b. Grassland lacking trees, dominant herbaceous plants are Little Bluestem (*Schizachyrium scoparium*) and Big Bluestem (*Andropogon gerardii)* ..... ***Kentucky Mesic Tallgrass Prairie* (CEGL004677) [A.1192]**

8a. Dominated by Soft Rush (*Juncus effusus),* includes marsh ..... ***Rush Marsh* (CEGL004112) [A.1375]**

8b. Pond edge dominated by a mix of graminoids ..... ***Sinkhole Pond Marsh* (CEGL002413) [A.1439]**

Alternate KEY E –GRAMINOID VEGETATION

1a. Graminoid vegetation made up largely of cultivated (or formerly cultivated), very common non-native or weedy native species (lawns, rights-of-way, fields) **2**

1b. Wetland and natural upland graminoid communities, some of them rare in the general landscape **4**

2a. Grass lawns or frequently mowed areas with perennial grasses and forbs (weedy lawns) ..... ***Lawns***

2b. Pastures and agricultural fields, actively maintained or abandoned, or powerline rights-of-way **3**

3a. Powerline right-of-way. Linear feature, maintained in an early successional condition by infrequent mowing or herbicide treatment. (May have native or non-native species) ..... ***ROW***

3b. Pastures and agricultural fields, actively maintained or abandoned ..... ***Fields***

Note: for mapping purposes, no distinction was made between the following types of fields:

- A field actively maintained for agriculture; grassland pastures and hayfields dominated by European tall fescue or Meadow fescue (*Lolium arundinaceum, Lolium pratense*), Bermuda grass (*Cynodon dactylon*), White clover (*Trifolium repens*), and other exotic or weedy herbs. ..... ***Cultivated Meadow* (CEGL004048) [A.1213]**
- Grass areas dominated by Johnson grass (*Sorghum halepense*) ..... ***Johnson Grass vegetation* (CEGL004108*)* [A.2020]**
- An old field or clearing giving way to Broomsedge bluestem (*Andropogon virginicus*) and other native grasses and eventually woody species. ..... ***Successional Broom-sedge Vegetation* (CEGL004044) [A.1208]**

  (Note: With long neglect, succession to woods is evident in emerging shrubs and saplings [often Eastern red-cedar (*Juniperus Virginiana*) or Virginia pine (*Pinus virginiana*) – See **KEY A – EVERGREEN FORESTS AND WOODLANDS**]).
- An old field or clearing giving way to native perennial grassland dominated by Little Bluestem (*Schizachyrium scoparium*) with some mixture of Elliott's Beardgrass (*Andropogon gyrans)*, Splitbeard Bluestem (*Andropogon ternarius)*, and/or Common Broomsedge (*Andropogon virginicus*) ..... ***Little Bluestem - Broomsedge Grassland* (CEGL007707) [A.1198]**
- An old field giving way to other weedy exotic and native forbs such as Queen Anne's lace (*Daucus carota*), Wingstem (*Verbesina alternifolia*), thistles (*Cirsium* spp.), Teasel (*Dipsacus fullonum*), briars (*Rubus* spp.), Japanese honeysuckle (*Lonicera japonica*), and various non-native or native grasses. ..... ***Old field***

4a. Upland prairie/glade/barrens vegetation mainly dominated or codominated by Little Bluestem (*Schizachyrium scoparium*) or Big Bluestem (*Andropogon gerardii*). [This may need to be the mapping unit??] ..... **5 (3 choices)**

4b. Wetland graminoid vegetation **6**

5a. Limestone glade or barrens: Dry grassland or sparse open woodland on limestone slopes (shallow soil and outcrops maintain open condition); vegetation dominated by native perennial grasses such as Little Bluestem (*Schizachyrium scoparium*), with other limestone glade associates such as straggling St. John's-wort (*Hypericum dolabriforme*), Pale purple coneflower (*Echinacea pallida*), Prickly pear cactus (*Opuntia humifusa*) and scattered trees of Chinquapin Oak (*Quercus muehlenbergii*) and Eastern Red-cedar (*Juniperus virginiana*); of limited extent ..... ***Central Limestone Glade* (CEGL005131) [A.1919]**

5b. Open-canopied grassy woodland with Post Oak (*Quercus stellata*), Eastern Red-cedar (*Juniperus virginiana*), and sometimes Blackjack Oak (*Quercus marilandica*) and Pignut Hickory (*Carya* glabra). Little Bluestem (*Schizachyrium scoparium*) characterizes the herbaceous layer. With fire suppression, all but the most droughty sites are likely to revert to forest. ..... ***Western Highland Rim Post Oak Barrens*** **(CEGL004686) [A.625]**

5c. Submesic grassland of Little Bluestem (*Schizachyrium scoparium*) and Big Bluestem (*Andropogon gerardii)*, and sometimes Plume Grass (Saccharum spp.), with scattered trees or shrubs possible [Red Maple (*Acer rubrum*) and others] This vegetation has only been found in limited areas of the former "Wondering Woods", and its origin is unclear. It is not used as a mapping unit..... ..... ***Kentucky Mesic Tallgrass Prairie*** **(CEGL004677) [A.1192]**

6a. Areas dominated by Soft Rush (*Juncus effusus)*, including marshes..... ..... ***Rush Marsh*** **(CEGL004112) [A.1375]**

6b. Pond edge dominated by a mix of graminoids, including Three-way Sedge (*Dulichium arundinaceum*) and Sedges (*Carex spp*.) ..... ***Sinkhole Pond Marsh*** **(CEGL002413) [A.1439]**

KEY F – FORB (BROADLEAF) VEGETATION

1a. Vegetation of walls and openings of limestone sinks dominated by *Hydrangea arborescens*, the herbaceous layer includes *Hydrophyllum sp., Impatiens pallida, Parthenocissus quinquefolia, Sedum ternatum, and Heuchera americana* ***Highland Rim Limestone Cliff/Talus Seep*** **(CEGL004708) [A.1905]**

1b. Rocky bar or shore of river or creek dominated by Common Water-willow (*Justicia americana*) .... ***Water-willow Rocky Bar and Shore*** **(CEGL004286) [A.1657]**

Appendix II. USNVC Classification of Plant Associations at Mammoth Cave National Park

INTERNATIONAL ECOLOGICAL CLASSIFICATION STANDARD:

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Mammoth Cave National Park

18 November 2009

by

NatureServe

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Arlington, VA 22209

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Durham, NC 27713

This subset of the International Ecological Classification Standard covers associations and alliances attributed to Mammoth Cave National Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Erin Lunsford Jones, Ecologist/Data Manager, Durham, NC <erin_jones@natureserve.org>.



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

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

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

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

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I. Forest

I.A.8.N.b. Rounded-crowned temperate or subpolar needle-leaved evergreen forest

A.119 Pinus echinata *Forest Alliance*

Shortleaf Pine Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes forests dominated by *Pinus echinata*, which on very dry sites may be virtually the only tree species present. This is a wide-ranging alliance; it is currently known from wide areas of the eastern United States from the Central Appalachians south through the Southern Blue Ridge and Cumberland Plateau and Mountains, extending into the Piedmont, and in the central United States in the Ouachita Mountains and Ozarks, extending south into the Gulf Coastal Plain. Other pine species may be present in small amounts; these vary with geography and include *Pinus taeda, Pinus virginiana, Pinus pungens*, and *Pinus rigida*. Typical hardwood associates include *Quercus alba, Quercus falcata, Quercus velutina, Quercus coccinea, Quercus marilandica, Nyssa sylvatica, Liquidambar styraciflua, Carya alba*, and *Carya glabra*. Understory species vary across the range of the alliance, but some common components are *Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum, Symplocos tinctoria, Ulmus alata, Diospyros virginiana, Acer rubrum, Cornus florida*, and *Oxydendrum arboreum*. One association in the West Gulf Coastal Plain of Arkansas has *Vaccinium elliottii, Aesculus pavia var. pavia*, and *Chasmanthium laxum*. Common herbaceous species in this Coastal Plain association include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*. Some associations can result from natural or anthropogenic disturbances such as fire or windstorms, while others occur naturally on the landscape, are maintained by edaphic situations, and may even represent "climax" vegetation on these sites. Soils of these forests are acidic and are derived from sandstone, chert or granitic rock situated on ravines, ridges, and steep, often south-facing, slopes; the surface is often rocky. In the Coastal Plain, this alliance is particularly typical of clay soils, on hillsides, ridges, flats, and low hills. In the Ouachita Mountains and Ozarks, forests of this alliance typically occur on south-facing slopes and saddles, and rocky outcrops and bluffs, but may also occur on lower, north-facing slopes and flat uplands, especially in the Piedmont.

Environment: In the more interior provinces, the soils of these forests are acidic and are derived from sandstone, chert or granitic rock situated on ravines, ridges, and steep, often south-facing, slopes; the surface is often rocky. In the Coastal Plain and Piedmont, this alliance is particularly typical of clay soils, on hillsides, ridges, flats, and low hills. These associations typically occur on south-facing slopes and saddles in the Ouachita Mountains and southern Arkansas Ozarks but may also occur on lower, north-facing slopes. In the northern Arkansas Ozarks, *Pinus echinata* forests occur naturally on steep slopes, over cherty residuum of the Boone Formation. Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

Vegetation: Forests are dominated by *Pinus echinata*, which on very dry sites may be virtually the only tree species present. Other pine species may be present in small amounts and include *Pinus taeda, Pinus virginiana, Pinus pungens*, and *Pinus rigida*. Typical hardwood associates include *Quercus alba, Quercus falcata, Quercus velutina, Quercus coccinea, Quercus marilandica, Nyssa sylvatica, Liquidambar styraciflua, Carya alba*, and *Carya glabra*. *Vaccinium arboreum, Vaccinium pallidum, Vaccinium stamineum, Symplocos tinctoria, Ulmus alata, Diospyros virginiana, Acer rubrum, Cornus florida*, and *Oxydendrum arboreum* are common in the understory. One association in the West Gulf Coastal Plain of Arkansas has *Vaccinium elliottii, Aesculus pavia var. pavia*, and *Chasmanthium laxum*. Common herbaceous species include *Smilax glauca, Silphium compositum, Pteridium aquilinum var. latiusculum, Scleria oligantha, Piptochaetium avenaceum*, and *Tephrosia virginiana*.

Dynamics: Some associations can result from natural or anthropogenic disturbances such as fire, windstorms, plowing, or clearcuts, while others occur naturally on the landscape, are maintained by edaphic situations, and may even represent "climax" vegetation on these sites. Stands may have suffered damage from the southern pine beetle (*Dendroctonus frontalis*).

Similar Alliances:

- *Pinus echinata* Woodland Alliance (A.515)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This is a wide-ranging alliance; it is currently known from wide areas of the eastern United States from the Central Appalachians south, through the Southern Blue Ridge and Cumberland Plateau and Mountains, extending into the Piedmont, and in the central United States in the Ouachita Mountains and Ozarks, extending south into the Gulf Coastal Plain. Associations in this alliance are found in southern Missouri, Alabama, Arkansas, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and possibly in West Virginia.

Nations: US
Subnations: AL, AR, DE, GA, KY, LA, MD, MO, MS, NC, NJ, OK, SC, TN, TX, WV?
TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:C, 52:C, 53:C, 58:C, 59:C
USFS Ecoregions: 221Db:CCC, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 221Jc:CCP, 222Ag:CCC, 222Dg:CCC, 222Ej:CPP, 222En:CP?, 222Eo:CPP, 222Hc:CCC, 231Aa:CCC, 231Ab:CCP, 231Ac:CCP, 231Ad:CC?, 231Ae:CCC, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCC, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCC, 231Be:CCP, 231Bg:CC?, 231Bk:CC?, 231Ca:CC?, 231Cc:CCC, 231Da:CP?, 231Dc:CPP, 231Ea:CCC, 231Ef:CCC, 231Ej:CCC, 231Fa:CPP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ba:CCC, 232Bb:CCP, 232Bd:CC?, 232Bj:CC?, 232Bk:CC?, 232Bm:CCC, 232Fe:CCC, 234Ab:CCC, M221A:CC, M221B:C?, M221Ca:CC?, M221Cd:CCP, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC, M222A:CC, M231Aa:CCP, M231Ab:CCC, M231Ac:CCC
Federal Lands: BIA (Eastern Band of Cherokee); DOD (Camp Robinson); NPS (Buffalo River, Cowpens, Fort Donelson, Great Smoky Mountains, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace?, Ozark Riverways, Shiloh); TVA (Tellico); USFS (Angelina, Bienville, Chattahoochee, Cherokee?, Daniel Boone, Davy Crockett, Holly Springs, Mark Twain, Nantahala, Oconee?, Ouachita, Ozark, Sabine, Sam Houston, St. Francis, Sumter, Talladega?, Tombigbee, Tuskegee?)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. R. White
References: Allard 1990, Allred and Mitchell 1955, Bruner 1931, Burns and Honkala 1990a, Cain and Shelton 1994, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Fountain and Sweeney 1987, Frothingham et al. 1926, Hoagland 1998a, Nelson 1986, Pyne 1994, Racine 1966, Southeastern Ecology Working Group n.d.

[CEGL006327] *Pinus echinata* Early-Successional Forest

Translated Name: **Shortleaf Pine Early-Successional Forest**
Common Name: **Early-Successional Shortleaf Pine Forest**
Ecological System(s):
- East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)
- Southern Appalachian Low-Elevation Pine Forest (CES202.332)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): A.S. Weakley and K.D. Patterson, mod. R.E. Evans

ELEMENT CONCEPT

Global Summary: This association represents early-successional *Pinus echinata*-dominated vegetation. This broadly defined type has a wide distribution throughout the native range of *Pinus echinata* where it may develop under a variety of circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or heavily eroded areas, where adjacent *Pinus echinata* are able to seed into the newly disturbed area and colonize before other species such as *Pinus taeda*. These are considered semi-natural forests as they typically result from anthropogenic disturbances that fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil. Vegetation tends to be dense with a moderately to extremely barren understory. While *Pinus echinata* is clearly the single most dominant tree, other "old-field" *Pinus* species (e.g., *Pinus taeda, Pinus virginiana*) and/or other early-successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*) may also be present. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species. As these forests age, mid-successional species such as *Quercus* spp. and *Carya* spp. may begin to replace senescent *Pinus echinata* individuals.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This early-successional shortleaf pine forest was sampled at one location in the park. The site is a flat summit of a gentle hill at 245 m (800 feet) elevation. The unvegetated surface is dominated by leaf litter (95% cover) with some wood (5%). Evidence of disturbance includes the presence of exotic plants. The status of the vegetation at Mammoth Cave is somewhat ambiguous, in that the dominant/nominal species is reported to be planted there, but long enough ago that the stand appears more or less "natural." The vicinity of Mammoth Cave is not given as part of the natural range of *Pinus echinata* (Burns and Honkala 1990a).
Global Environment: This broadly defined type may develop under a variety of circumstances associated with severe natural and/or anthropogenic disturbance. It is most frequently associated with abandoned agricultural land, unmanaged clearcuts, and burned or eroded areas. These are considered semi-natural forests as they typically result from

anthropogenic disturbances which fundamentally alter the vegetation structure, floristic composition, and often the physical and chemical structure of the soil.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: In this successional forest, the moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by *Pinus echinata, Pinus taeda*, and *Pinus virginiana*. The very sparse (10%) subcanopy (15-20 m) includes *Cornus florida* and *Juniperus virginiana*. The very sparse (10%) tall-shrub layer (5-10 m) and sparse (20%) short-shrub layer (1-2 m) include *Acer rubrum, Cornus florida, Fagus grandifolia, Fraxinus* sp., and *Quercus* sp. The very sparse (10%) herbaceous layer is dominated by the invasive exotic *Lonicera japonica*.

Global Vegetation: *Pinus echinata* is clearly the single most dominant tree. In addition, other "old-field" *Pinus* species (e.g., *Pinus taeda, Pinus virginiana*) and/or other early-successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*) may also be present. Forests of 50+ years may begin to become codominated by mid-successional species such as *Quercus* spp. and *Carya* spp. in some instances. Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species.

Global Dynamics: Composition of this community depends more on past disturbance history and adjacent forest composition than on the micro-environment of the site. The community can be found on a variety of upland exposures but is most well-developed in areas that were heavily farmed and then abandoned. Over time, the canopy composition shifts as *Pinus echinata* succumbs to disease, blowdown, or pine beetle damage and other later successional species begin to take advantage of the gaps left by dead and dying pines. At this point, the community can begin to shift to one of a number of community types that are considered "later successional" than this type and possess a canopy that is dominated by hardwoods rather than pines.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus echinata	Tree canopy	Needle-leaved tree	X	X	.
Pinus taeda Tree canopy	Needle-leaved tree	X	.	.	
Pinus virginiana	Tree canopy	Needle-leaved tree	X	.	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Fagus grandifolia	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus echinata	Tree canopy	Needle-leaved tree	X	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (3-Apr-2000). This forest represents a ruderal community resulting from succession following anthropogenic disturbance of an area. It is not of conservation concern and does not receive a conservation status rank. Stands have suffered some damage from the southern pine beetle (*Dendroctonus frontalis*).

RELATED CONCEPTS

Global Similar Associations:

- *Pinus taeda - Liquidambar styraciflua* Semi-natural Forest (CEGL008462)--is commonly found in the same area as CEGL006327 in the Piedmont. CEGL008462 contains at least 50% *Pinus taeda* in the canopy, whereas CEGL006327 is mostly *Pinus echinata*.
- *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 echinata*.
- *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. CEGL006327 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.
- *Pinus virginiana* Successional Forest (CEGL002591)--occurs in similar environments but is dominated (>50% of canopy) by *Pinus virginiana* instead of *Pinus echinata*.

Global Related Concepts:

- IA7a. Xeric Shortleaf Pine - Oak Forest (Allard 1990) [in part] **B**

- T1A9bI1a. *Pinus echinata* (Foti et al. 1994) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: The status of the vegetation at Mammoth Cave is somewhat ambiguous, in that the dominant/nominal species is reported to be planted there, but long enough ago that the stand appears more or less "natural". The vicinity of Mammoth Cave is not given as part of the natural range of *Pinus echinata* (Burns and Honkala 1990a). Its occurrence is too small and limited to be used as a mapping unit at the park.

Mammoth Cave National Park Other Comments:

Global Classification Comments: In Kentucky, this vegetation is known only from the eastern part of the state. A stand at Mammoth Cave National Park which is referred here may have originated with the planting of *Pinus echinata*. In Louisiana, this successional vegetation occurs in the Florida parishes and may have a dense shrub understory. In Arkansas, old fields succeed to *Pinus echinata*. Stands have suffered some damage from southern pine beetle (*Dendroctonus frontalis*).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: The one sampled stand of this association is located along Flint Ridge in the eastern part of the park. This stand may have originated with the planting of *Pinus echinata*. This is too limited to be used as a mapping unit at the park.

Global Range: This community is found throughout the southeastern United States.

Nations: US

States/Provinces: AL, AR, GA, KY, LA, MO, MS, NC, OK, SC, TN, TX, WV?

TNC Ecoregions: 38:C, 39:C, 40:C, 43:C, 44:C, 50:C, 51:C, 52:C, 53:C, 59:C

TNC Ecoregion Comments: ECO52 changed from P to C for CHAT/KEMO (mjr 11-08). ECO51 added for Cherokee Nation (mjr 11-07). ECO40 changed from P to C (REE 4-02). ECO40 added at REE's request and ECO52 added after merger with CEGL007508 (KP 5-00).

USFS Ecoregions: 221J:CC, 222Ag:CCC, 222Dg:CCC, 231A:CC, 231Bd:CCC, 231Cc:CCC, 231E:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bm:CCC, M221A:C?, M221B:C?, M221Dd:CCC, M222A:CC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Buffalo River, Cowpens, Fort Donelson, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace?, Shiloh); TVA (Tellico); USFS (Bienville?, Chattahoochee, Chattahoochee (Piedmont)?, Chattahoochee (Southern Blue Ridge), Daniel Boone, Holly Springs?, Mark Twain, Oconee?, Ouachita, Ouachita (Coastal Plain), Ouachita (Mountains), Ozark, St. Francis, Sumter (Piedmont)?, Sumter?, Talladega?, Tombigbee?, Tuskegee?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.71.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): A.S. Weakley and K.D. Patterson, mod. R.E. Evans

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990	.	X	X	.	.	.	.	.	
Burns and Honkala 1990a	.	.	.	X	.	.	.	.	.
Foti 1994b	X	.	X	.	.	.	.	.	
Foti et al. 1994	.	X	X	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.131 Pinus virginiana *Forest Alliance*

Virginia Pine Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes forests dominated by *Pinus virginiana* occurring in the Piedmont from Pennsylvania south to Alabama, and ranging west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and at scattered locales in the Interior Low Plateau. Forests in this alliance may have admixtures of *Pinus taeda, Pinus echinata, Pinus pungens*, and/or *Pinus rigida*. These other species, if present, can have canopy coverage between 1 and 50%. Other associated species vary with the geographic distribution of the alliance. In many associations, a dense ericaceous shrub

stratum is typical. This alliance includes both early-successional forests resulting from natural or anthropogenic disturbances and natural forests in edaphically extreme situations. Typically, *Pinus virginiana* communities are short-lived as a forest and are more common as woodland communities [see *~Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)]. Associated species vary with the geographic distribution of the alliance.

Environment: This alliance includes both early-successional forests resulting from natural or anthropogenic disturbances and natural forests in edaphically extreme situations.

Vegetation: This alliance includes evergreen forests dominated by *Pinus virginiana*. These forests are usually dense and can contain admixtures of *Pinus taeda, Pinus echinata, Pinus pungens*, and/or *Pinus rigida*, and, particularly in fire-suppressed examples, small stems of deciduous species. Associated species vary with the geographic distribution of the alliance. In many associations, a dense ericaceous shrub stratum is typical. Types resulting from anthropogenic disturbance may have a greater admixture of deciduous species. In the Piedmont common associates include *Liquidambar styraciflua, Pinus taeda, Pinus echinata*, and *Quercus* spp., while on extreme sites in the southern Appalachians, *Pinus pungens* and *Pinus rigida* are more typical. In areas with calcareous geology, *Juniperus virginiana* is a typical associate. In many associations, a dense ericaceous shrub stratum is typical and can include species such as *Vaccinium pallidum, Vaccinium stamineum, Vaccinium arboreum, Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata, Gaylussacia ursina, Kalmia latifolia, Rhododendron catawbiense*, and *Rhododendron maximum*. Dry-mesic successional examples may contain other *Pinus* species (e.g., *Pinus taeda, Pinus echinata*) or other early successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Liriodendron tulipifera*). The subcanopy may contain *Acer saccharum* and *Cornus florida*; other associated species may include *Cercis canadensis, Parthenocissus quinquefolia, Lycopodium digitatum*, as well as the exotics *Lonicera japonica* and *Microstegium vimineum* (Andreu and Tukman 1995).

Dynamics: This alliance includes both early successional forests resulting from natural or anthropogenic disturbance and natural forests in edaphically extreme situations. Typically, *Pinus virginiana* communities are short-lived as a forest and are more common as woodland communities [see *~Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)].

Similar Alliances:

- *Pinus (rigida, pungens, virginiana) - Quercus prinus* Woodland Alliance (A.677)
- *Pinus virginiana* Planted Forest Alliance (A.100)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: Forests in this alliance are possible in the Piedmont from Pennsylvania south to Alabama, and ranging west into the Appalachians, Ridge and Valley, the Cumberland Plateau, and at scattered locales in the Interior Low Plateau.

Nations: US

Subnations: AL, DC?, DE, GA, IN, KY, MD, NC, NH, NJ, OH, PA, SC, TN, VA, WV

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C, 62:C, 63:C

USFS Ecoregions: 221Da:CCC, 221Db:CCC, 221Ea:CC?, 221Eb:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 221Jc:CCC, 222Cg:CCC, 222Da:CCC, 222Dc:CCC, 222Dd:CCC, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Eg:CCC, 222Eh:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fc:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCP, 231Ad:CCC, 231Ae:CCC, 231Af:CCP, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCC, 231Al:CCP, 231Am:CCP, 231An:CCC, 231Ao:CCP, 231Ap:CCP, 231Bc:CCC, 231Be:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Dc:CCC, 232Ab:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CCP, M221Be:CCC, M221Ca:CCP, M221Cb:CCC, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

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?, Chickamauga-Chattanooga, Cumberland Gap, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Kennesaw Mountain, 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 (Land Between the Lakes?, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Jefferson, Monongahela, Nantahala, Pisgah, Sumter, Talladega, Uwharrie?, Wayne); USFWS (Chesapeake Marshlands)

ALLIANCE SOURCES

Author(s): D.J. Allard/K.D. Patterson

References: Allard 1990, Andreu and Tukman 1995, Barden 1977, Burns and Honkala 1990a, Chapman 1957, Cooper 1963, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Frothingham et al. 1926, Gettman 1974, Malter 1977,

Nelson 1986, Pyne 1994, Racine 1966, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Whittaker 1956

[CEGL007121] *Pinus virginiana - Juniperus virginiana var. virginiana - Ulmus alata* Forest

Translated Name: **Virginia Pine - Eastern Red-cedar - Winged Elm Forest**
Common Name: **Virginia Pine - Red-cedar Successional Forest**
Ecological System(s):
Status: Standard
Circumscription Confidence: 3 - Weak
Concept Author(s): M. Andreu and M. Tukman

ELEMENT CONCEPT

Global Summary: This community was originally defined from the Ridge and Valley of Tennessee, where it is found on highly eroded, abandoned agricultural land. The concept may apply to other areas where early successional *Juniperus virginiana* occurs over calcareous substrates. It includes dry-mesic, low- to mid-slope forest vegetation with *Pinus virginiana* and *Juniperus virginiana var. virginiana* making up most of the total canopy cover. Other canopy species may include *Quercus prinus, Quercus stellata, Quercus velutina, Liriodendron tulipifera, Liquidambar styraciflua*, and others. *Ulmus alata* is prominent in the subcanopy, while other subcanopy species include *Cornus florida, Carya ovata*, and *Juniperus virginiana var. virginiana*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This early-successional Virginia pine forest was sampled at one location in the park. The site is a flat summit of a ridge at 273 m (895 feet) elevation with moderately well-drained soil. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes likely past clearing of the site.
Global Environment: This community is found on highly eroded, abandoned, agricultural land (Andreu and Tukman 1995).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is codominated by *Juniperus virginiana* and *Pinus virginiana*; additional species include *Carya alba, Carya ovata, Oxydendrum arboreum, Quercus coccinea, Quercus falcata*, and *Quercus stellata*. The sparse (20%) subcanopy (5-10 m) includes *Cornus florida, Nyssa sylvatica, Oxydendrum arboreum, Prunus serotina var. serotina*, and *Quercus rubra*. The sparse (30%) tall-shrub layer (2-5 m) is dominated by *Acer rubrum*, as is the moderately sparse (40%) short-shrub layer (1-2 m) along with *Fraxinus americana, Quercus* spp., *Rubus argutus, Sassafras albidum*, and *Vaccinium stamineum*. The moderately sparse (20%) herbaceous layer is diverse (a total of 62 species were recorded from one 20x50-m plot) and includes *Acalypha virginica, Ageratina aromatica, Brachyelytrum erectum, Desmodium nudiflorum, Dichanthelium boscii, Dichanthelium laxiflorum, Galium circaezans, Polystichum acrostichoides, Potentilla simplex, Symphoricarpos orbiculatus*, and many others. Vines include *Smilax glauca* and *Vitis rotundifolia*.
Global Vegetation: Stands are dominated by *Pinus virginiana* and *Juniperus virginiana var. virginiana*, which make up most of the total canopy cover. Other canopy species may include *Quercus prinus, Quercus stellata, Quercus velutina, Liriodendron tulipifera, Liquidambar styraciflua*, and others. *Ulmus alata* is prominent in the subcanopy, while other subcanopy species include *Cornus florida, Carya ovata*, and *Juniperus virginiana var. virginiana* (Andreu and Tukman 1995).
Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree canopy	Needle-leaved tree	X	X	.
Pinus virginiana	Tree canopy	Needle-leaved tree	X	X	.
Quercus falcata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus stellata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Acer rubrum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Fraxinus americana	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Dichanthelium boscii	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (25-Mar-2002). This community is an early-successional one, occurring on highly eroded abandoned agricultural land. It is not of conservation concern and is composed primarily of pioneer species that establish themselves following disturbance. Grank was changed from "GW" as the components are native species rather than non-native, exotic ones.

RELATED CONCEPTS

Global Similar Associations:

- *Pinus virginiana / Juniperus virginiana - Chionanthus virginicus* Granitic Flatrock Border Forest (CEGL003993)
- *Pinus virginiana* Successional Forest (CEGL002591)--on less calcareous, more acidic substrates.

Global Related Concepts:

- CT VI *Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra* (Badger et al. 1997) **I**
- Virginia Pine, RV (Pyne 1994) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils." At stands classified here from Mammoth Cave, the *Juniperus* may be a natural successional component, and the *Pinus* a result of these plantings or their offspring. Badger et al. (1997) list a CT VI as *Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra*; it would seem to be related to CEGL007124 (and CEGL007121) in concept and composition. Habitat: ridgetops and upper slopes with both sandstone and limestone substrates, drier aspects [high disturbance, abrupt transition to other communities] [CEGL007124; CEGL007121]; also called "*Juniperus virginiana, Cornus florida, Pinus virginiana, Quercus alba, Carya glabra*" (pp. 4-45).

Mammoth Cave National Park Other Comments:

Global Classification Comments: Originally described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeastern Monroe County; 42 stands sampled), where this type occurs on highly eroded, abandoned agricultural land, at 250 to 300 m (820-1000 feet) elevation (Andreu and Tukman 1995). Early-successional *Pinus virginiana* vegetation occurring over acidic, infertile substrates is classed in ~*Pinus virginiana* Successional Forest (CEGL002591) and lacks species indicative of calcareous substrates.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist. It was sampled at one location in the park but is much more common than this would indicate.

Global Range: This type is documented from Tennessee and Kentucky but is possible anywhere within or proximal to the natural range of *Pinus virginiana*. This centers on the southern Appalachians and includes areas ranging from Long Island, New York, west into Pennsylvania and southern Ohio, and south and west in a band approximately 800 km wide to the Cumberlands of Alabama and parts of western Kentucky and Tennessee.

Nations: US

States/Provinces: KY, TN

TNC Ecoregions: 44:C, 50:C

TNC Ecoregion Comments: ECO44 and 222Dg added for MACA (MP 9-08).

USFS Ecoregions: 221:C, 222Dg:CCC

Federal Lands: NPS (Mammoth Cave); TVA (Tellico); USFS (Cherokee?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.29.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Andreu and Tukman 1995	.	X	.	X	.	.	.	.	.
Badger et al. 1997	.	.	X	X	.	.	.	.	.
Burns and Honkala 1990a	.	.	.	X	.	.	.	.	.
Faller 1975 .	.	.	X	.	.	.	.	.	
Pyne 1994 .	.	X	X	.	.	.	.	.	
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

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

Translated Name: **Virginia Pine - (Pitch Pine, Shortleaf Pine) - (Chestnut Oak) / Hillside Blueberry Forest**

Common Name: **Appalachian Low-Elevation Mixed Pine / 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)

Status: Standard

Circumscription Confidence: 1 - Strong

Concept Author(s): K.D. Patterson

ELEMENT CONCEPT

Global Summary: This community includes *Pinus virginiana*-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 exposed topographic positions, 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* is the canopy dominant throughout the range of the type. In some parts of the range, other *Pinus* species may be significant canopy associates, as well as dry-site *Quercus* species (e.g., *Quercus prinus, Quercus coccinea*). Deciduous species may form a subcanopy or sapling stratum, particularly in areas where fire has been excluded. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum, Gaylussacia baccata*, and *Kalmia latifolia*. Herbs vary with geography but are typical of infertile, xeric habitats. Some typical herbs in this forest are *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Epigaea repens, Euphorbia corollata, Galax urceolata, Gaultheria procumbens, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This Virginia pine - oak forest was sampled at one location in the park. The site is a gentle, southwest-facing slope at 223 m (730 feet) elevation. Soil is a dry-mesic, rapidly drained loam with a thick layer of humus. The unvegetated surface is dominated by leaf litter (90% cover) with some wood (5%) and bare soil (5%). The presence of old fencing suggests that the site may have been used for grazing in the past (over 70 years ago). This implies that the stand may be at least somewhat successional in origin.

Global Environment: 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 feet) 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

Mammoth Cave National Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by *Pinus virginiana, Quercus alba*, and *Quercus prinus*; additional species include *Carya glabra, Quercus rubra*, and *Quercus velutina*. The moderately sparse (40%) subcanopy (10-15 m) includes *Acer saccharum, Quercus alba, Quercus prinus*, and others. The sparse (20%) tall-shrub layer (2-5 m) is dominated by *Acer rubrum, Acer saccharum*, and *Quercus velutina* and the sparse (20%) short-shrub layer (0.5-1 m) by *Vaccinium pallidum*. The very sparse (10%) herbaceous layer is dominated by *Carex* sp. Vines (10%) include *Smilax rotundifolia*.

Global Vegetation: 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, especially in areas where fire has been excluded. 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* 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, Pinus echinata*, or *Pinus strobus*. Within its range, *Pinus pungens* may be present as a very minor component. Regeneration of *Pinus virginiana* is concentrated along cliff edges and tends to drop off inward from the edge. Small stems of *Quercus prinus, Quercus coccinea, Acer rubrum, Nyssa sylvatica*, and *Oxydendrum arboreum* are common in the subcanopy and sapling strata, particularly in areas where fire has been excluded, 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, Quercus falcata*, and *Quercus stellata* can be deciduous components. Common shrub dominants include *Vaccinium pallidum, Vaccinium stamineum, Gaylussacia baccata*, and *Kalmia latifolia*. Other typical shrubs can include *Gaylussacia ursina, Kalmia latifolia, Sassafras albidum*, and *Vaccinium hirsutum* (southwestern North Carolina and southeastern Tennessee only). *Smilax glauca* and *Smilax rotundifolia* can be common vines. In the sparse herb layer, characteristic species from the Southern Blue Ridge and Southern Ridge and Valley include *Baptisia tinctoria, Chimaphila maculata, Dichanthelium commutatum, Danthonia spicata, Epigaea repens, Euphorbia corollata, Galax urceolata, Gaultheria procumbens, Hypoxis hirsuta, Iris verna, Pityopsis graminifolia var. latifolia, Pteridium aquilinum var. latiusculum*, and *Schizachyrium scoparium*. Typical herbs from examples in the western portion of the range (Interior Low Plateau) include *Antennaria plantaginifolia, Antennaria solitaria, Carex albicans var. albicans (= Carex artitecta), Danthonia spicata, Dichanthelium dichotomum, Lespedeza violacea (= Lespedeza intermedia), Hieracium gronovii, Hieracium venosum, Krigia biflora, Solidago erecta*, and *Tephrosia virginiana* (M. Homoya pers. comm. 1999). In some of these examples *Opuntia humifusa, Calamagrostis porteri ssp. insperata*, and *Solidago squarrosa* may occur locally.

Global Dynamics: This xeric, evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire 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. Throughout most of its range, this community occurs as linear features along ridge tops and may be adjacent to or grade into xeric forests dominated by *Quercus coccinea* or *Quercus prinus* or more mesic forests dominated by *Quercus alba, Quercus rubra, Quercus velutina, Carya glabra*, and *Carya alba*. In the Interior Low Plateau, individual stands can be small in size, occurring in a matrix of *Quercus prinus* or *Quercus prinus - Quercus alba* forest (e.g., ~*Quercus prinus / Smilax* spp. Forest (CEGL005022) or ~*Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)), but in more edaphically extreme circumstances.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus prinus	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Pinus virginiana	Tree canopy	Needle-leaved tree	X	X	.
Acer saccharum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer rubrum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium pallidum	Short shrub/sapling	Broad-leaved deciduous shrub	X	X	.
Smilax rotundifolia	Herb (field)	Vine/Liana	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus virginiana	Tree canopy	Needle-leaved tree	X	X	X

Quercus prinus	Tree canopy	Broad-leaved deciduous tree	X	.	.
Sassafras albidum	Shrub/sapling (tall & short)	Broad-leaved deciduous tree	.	X	.
Kalmia latifolia	Tall shrub/sapling	Broad-leaved evergreen shrub	X	.	.
Gaylussacia baccata	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium pallidum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium stamineum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Comptonia peregrina	Herb (field)	Dwarf-shrub	.	X	.
Epigaea repens	Herb (field)	Dwarf-shrub	.	X	.
Gaultheria procumbens	Herb (field)	Dwarf-shrub	.	X	.
Pteridium aquilinum	Herb (field)	Fern or fern ally	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Rosa multiflora	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Buckleya distichophylla	G2	P	
Calamagrostis porteri ssp. *insperata*	G4T3	P	
Cleistes bifaria	-	P	
Coreopsis pulchra	G2	P	imperiled Cumberland Plateau endemic
Helianthus longifolius	G3	P	rare Cumberland Plateau endemic
Penstemon deamii	G1	P	
Sabatia capitata	G2	P	imperiled Cumberland Plateau endemic
Thermopsis villosa	G3?	P	
Vaccinium hirsutum	G3	P	

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (11-Feb-2001). This xeric evergreen forest community will be maintained on sites where local soil conditions, topographic extremes, or occasional fire 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.

RELATED CONCEPTS

Global 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, Pinus pungens) / Schizachyrium scoparium* Forest (CEGL008500)
- *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)

Global 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**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was

planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils," but examples of this association should be natural, not planted stands.

Mammoth Cave National Park Other Comments:

Global Classification 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* is classified as *~Pinus virginiana* Successional Forest (CEGL002591). Appalachian xeric oak forests with similar floristics, but with a mainly deciduous canopy, are classed in *~Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271). Appalachian shale forests and woodlands with *Pinus virginiana* 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).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist. Some of the stands attributed to this type may be more "natural" than others, in terms of the origin of the plant material (e.g., whether it originated from plantings or not).

Global 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.

Nations: US

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

TNC Ecoregions: 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 59:C, 61:P

TNC Ecoregion Comments: ECO61 changed from C to P (SLN 4-03). Present in portions of AL ECO43 as currently mapped (REE 1-03). ECO43 added (JT 6-01). ECO43 deleted and ECO52 added (KP 4-00). ECO61 added (LAS 10-99).

USFS Ecoregions: 221Ea:CC?, 221Eb:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCC, 221Jb:CCC, 222Da:CCC, 222Dc:CCC, 222Dg:CCC, 222Dj:CCC, 222Eg:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 222Eo:CCC, 222Fd:CCC, 222Ff:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Bc:CCC, 231Cc:CCC, 231Cd:CCC, 231Da:CCC, 231Dc:CCC, M221Aa:CCP, M221Ab:CCC, M221Ac:CCC, M221Bb:CCC, M221Bd:CCP, M221Be:CCP, M221Cb:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Big South Fork, Blue Ridge Parkway, Chickamauga-Chattanooga, 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)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.35.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): K.D. Patterson, mod. R. White and S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	X	.	.	.	.	
Ambrose 1990a	.	.	X	X	X	.	.	.	.
Barden 1977	.	.	.	.	X	.	.	.	.

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

[CEGL002591] *Pinus virginiana* Successional Forest

Translated Name: **Virginia Pine Successional Forest**

Common 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)

Status: Standard

Circumscription Confidence: 1 - Strong

Concept Author(s): S. Simon, G. Kauffman, D. Danley

ELEMENT CONCEPT

Global 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*. These habitats include old fields, old pastures, clearcuts, and burned or eroded areas; soils are typically dry, acidic, and infertile. This forest typically has a very dense canopy of *Pinus virginiana* and little understory vegetation. The dense canopy may also include admixtures of other *Pinus* species (e.g., *Pinus taeda, Pinus echinata, Pinus strobus*) or other early-successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Nyssa sylvatica*). 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

USFWS Wetland System:

Mammoth Cave National Park Environment: This upland successional Virginia pine forest was sampled at four locations in the park, from midslope positions up to ridge summits. Sites are gentle southeast-facing slopes and ridges at 226 to 263 m (742-864 feet) elevation. Soils are dry-mesic, somewhat poorly drained sandy loam. The unvegetated surface is dominated by leaf litter (86-90% cover) with some large rocks (0-2%), wood (5-8%) and bare soil (4-5%). Evidence of disturbance includes past logging and clearing, roads and trails, and the presence of exotic plants.

Global Environment: This community occurs in areas where canopy removal has created open conditions and bare mineral soil, allowing for the establishment of *Pinus virginiana*. These conditions can include old fields, old pastures, clearcuts, and burned or eroded areas. In the Ridge and Valley of Tennessee, northeastern Monroe County, early successional forests with *Pinus virginiana* 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

Mammoth Cave National Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by dense *Pinus virginiana* and may include *Acer rubrum, Juniperus virginiana, Liriodendron tulipifera, Quercus falcata*, and others. The moderately sparse (30-50%) subcanopy (10-20 m) includes canopy species as well as *Cornus florida, Nyssa sylvatica*, and *Oxydendrum arboreum*. The sparse (20%) tall-shrub layer (2-5 m) is made up of saplings of tree species, as is the sparse (20%) short-shrub layer (0.5-1 m) which also includes *Carya glabra, Fagus grandifolia, Fraxinus americana, Ilex opaca var. opaca, Prunus serotina var. serotina, Quercus* spp., *Rubus argutus, Symphoricarpos orbiculatus*, and *Ulmus alata*. The moderate (50%) herbaceous layer includes *Brachyelytrum erectum, Cynoglossum virginianum, Dichanthelium boscii, Elephantopus carolinianus, Elymus hystrix, Polystichum acrostichoides, Sanicula canadensis*, and many others. Vines (10%) are dominated by *Smilax glauca* and may include *Smilax bona-nox, Toxicodendron radicans*, and *Vitis* spp. Many exotic species have invaded the community, including *Microstegium vimineum* which dominates the herbaceous layer.

Global Vegetation: This forest typically has a very dense canopy of *Pinus virginiana* and little understory vegetation. *Pinus taeda, Pinus echinata*, or *Pinus strobus* may co-occur with *Pinus virginiana* in the canopy. The canopy can also have significant admixtures of early-successional deciduous trees (e.g., *Acer rubrum, Liquidambar styraciflua, Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Nyssa sylvatica*). Associated woody and herbaceous species vary with geography but are typically ruderal or exotic species; *Lonicera japonica* and *Rosa multiflora* are common. Shrub and herb strata are absent to sparse in coverage. In eastern Tennessee, the subcanopy may contain *Acer saccharum* and *Cornus florida*; other associated species may include *Cercis canadensis, Parthenocissus quinquefolia, Lonicera japonica*, and *Microstegium vimineum* (Andreu and Tukman 1995). In the Central Appalachians, associates include *Pinus strobus, Pinus echinata*, and *Pinus rigida*. Some stands may have a dense ericaceous shrub stratum containing *Vaccinium* spp., *Gaylussacia* spp., *Kalmia latifolia*, and *Rhododendron* spp.

Global Dynamics: This is an early-successional forest type. Damage from ice storms was the main disturbance observed in these stands in the Tellico Pilot Project study area. In addition, fire and insect infestation are likely damaging agents.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree (canopy & subcanopy)	Needle-leaved tree	X	.	.
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Pinus virginiana	Tree canopy	Needle-leaved tree	X	X	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Nyssa sylvatica	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Rubus argutus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Dichanthelium boscii	Herb (field)	Graminoid	X	.	.
Microstegium vimineum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus virginiana	Tree canopy	Needle-leaved tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.

Nyssa sylvatica	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Oxydendrum arboreum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Nyssa sylvatica	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Oxydendrum arboreum	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Vaccinium arboreum	Tall shrub/sapling	Broad-leaved evergreen tree	X	.	.
Vaccinium stamineum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Cercis canadensis	Short shrub/sapling	Broad-leaved deciduous tree	X	.	.
Cornus florida	Short shrub/sapling	Broad-leaved deciduous tree	X	.	.
Oxydendrum arboreum	Short shrub/sapling	Broad-leaved deciduous tree	X	.	.
Quercus alba	Short shrub/sapling	Broad-leaved deciduous tree	X	.	.
Sassafras albidum	Short shrub/sapling	Broad-leaved deciduous tree	X	.	.
Lonicera japonica	Herb (field)	Vine/Liana	X	.	.
Smilax glauca	Herb (field)	Vine/Liana	X	.	.
Toxicodendron radicans	Herb (field)	Vine/Liana	X	.	.

Higher Taxon Name	Note
Cladonia sp.	dominant nonvascular
Lycopodium sp.	dominant fern ally

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic
Daucus carota	-	P	exotic
Glechoma hederacea	-	P	exotic
Lespedeza cuneata	-	P	exotic
Leucanthemum vulgare	-	P	exotic
Lolium arundinaceum	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Pinus strobus	-	P	state-vulnerable
Poa annua -	P	exotic	
Poa compressa	-	P	exotic
Potentilla recta	-	P	exotic
Rosa multiflora	-	P	exotic
Verbascum thapsus	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Albizia julibrissin	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Pueraria montana var. *lobata*	-	P	exotic
Rosa multiflora	-	P	exotic

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (13-Jun-2000). This forest represents early-successional vegetation and is thus not of high conservation concern.

RELATED CONCEPTS

Global 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.

Global Related Concepts:
- *Pinus virginiana* forest (Vanderhorst 2001b) =
- IA7c. Xeric Virginia Pine Ridge Forest (Allard 1990) [in part] **B**
- Pine-Oak Association of the Western Shore District (Shreve et al. 1910) **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**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: According to Burns and Honkala (1990a) Mammoth Cave National Park is on the western edge of the natural range of *Pinus virginiana*. Faller (1975) states that "Virginia pine was planted [at Mammoth Cave] to hasten forest canopy closure and increase protection for the residual soils."

Mammoth Cave National Park Other Comments:

Global Classification Comments: Early successional *Pinus virginiana* 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.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist.

Global 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.

Nations: US

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

TNC Ecoregions: 43:C, 44:C, 49:P, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C, 63:C

TNC Ecoregion Comments: ECO63 added for White Mtn (mjr 10-07). ECO43 added for NATR (mjr 4-07). ECO58 changed from P to C & 232BR added for FRSP (mjr 3-07). ECO44 added for ABLI (ELJ 2-07). ECO49 added (CWN 9-05). ECO52 and ECO61 added (KP 4-00). ECO58 added (LAS 10-99).

USFS Ecoregions: 221Da:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221J:CC, 222Cg:CCC, 222Dg:CCC, 222Eg:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 231Ae:CCC, 231Ak:CCC, 231An:CCC, 231Be:CCC, 231Cc:CCC, 231Cd:CCC, 232Br:CCC, 232Bt:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Be:CCC, M221Ca:CCP, M221Cb:CCC, M221Cc:CCP, M221Cd:CCC, M221Ce:CCP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

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, George Washington Parkway, Gettysburg, Great Smoky Mountains, 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?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.9, MACA.24, MACA.30, MACA.60.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Andreu and M. Tukman, mod. K.D. Patterson and S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
Ambrose 1990a	.	.	X	X	.	.	.	.	.
Andreu and Tukman 1995	.	.	.	X	.	.	.	.	.
Burns and Honkala 1990a	.	.	.	X	.	.	.	.	.
Collins and Anderson 1994	.	X	X	.	.	.	.	.	.
Coxe 2008 .	.	.	X	.	.	.	.	.	

Eyre 1980 .	.	X	X	.	.	.	.	.	
Faller 1975 .	.	.	X	.	.	.	.	.	
Fike 1999 .	X	.	X	.	.	.	.	.	
Fleming and Coulling 2001	.	X	.	X	.	.	.	.	.
Fleming and Moorhead 2000	.	.	X	X	.	.	.	.	.
Hall and Mathews 1974	.	.	.	X	.	.	.	.	.
Nelson 1986	.	.	.	X	.	.	.	.	.
Patterson et al. 1999	.	.	.	X	.	.	.	.	.
Pyne 1994 .	.	X	X	X	.	.	.	.	
Schmalzer and DeSelm 1982	.	.	X	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Shreve et al. 1910	.	X	X	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998 .	X	.	.	.	.	.	.	.	
Vanderhorst 2001b	.	X	X	X	.	.	.	.	.
Vanderhorst et al. 2007	.	X	.	X	.	.	.	.	.
Vanderhorst et al. 2008	.	X	.	X	.	.	.	.	.
Young et al. 2006	.	X	.	X	.	.	.	.	.

I.A.8.N.c. Conical-crowned temperate or subpolar needle-leaved evergreen forest

A.137 Juniperus virginiana *Semi-natural Forest Alliance*

Eastern Red-cedar Forest Alliance

ALLIANCE CONCEPT

Summary: Examples of this semi-natural eastern red-cedar forest alliance are expected to be found in locally disturbed areas. Forests in this alliance are strongly dominated by *Juniperus virginiana var. virginiana* on usually high pH, fire-suppressed sites or old fields. This alliance is most common in old fields and pastures, successional cleared land, and other various disturbed areas, especially on calcareous rocks. The growth of *Juniperus virginiana var. virginiana* may be very dense, and the stature may be rather low. Other species that may occur in the canopy of Tennessee stands include *Carya alba, Carya ovata, Cercis canadensis*, and *Pinus virginiana*. Various oaks (including *Quercus coccinea, Quercus falcata*, and *Quercus phellos*) also may be present. The midstory is typically sparse, with canopy species as well as *Cornus florida, Ilex opaca, Liquidambar styraciflua*, and *Prunus serotina var. serotina*. *Frangula caroliniana* may occur in several strata. Herb distribution is patchy, and typical species include *Asplenium platyneuron, Chasmanthium laxum, Eupatorium* spp., *Polystichum acrostichoides*, and *Carex* spp. In the central and upper midwestern United States, stands of semi-natural vegetation dominated by *Juniperus virginiana var. virginiana* typically occur in old fields and other disturbed places. The vegetation may vary in structure from open-canopy woodland (particularly as it invades herbaceous old fields) to dense, closed-canopy forest. *Rhus typhina* may be an associate.

Environment: Forests in this alliance occur on usually high pH, fire-suppressed sites or old fields. The habitat for this alliance is most commonly old fields and pastures, successional cleared land, and other various locally disturbed areas, especially on calcareous rocks.

Vegetation: Stands are strongly dominated by *Juniperus virginiana var. virginiana*. Other species that may occur in the canopy of Tennessee stands include *Carya alba, Carya ovata, Cercis canadensis*, and *Pinus virginiana*. Various oaks (including *Quercus coccinea, Quercus falcata*, and *Quercus phellos*) also may be present. The midstory is typically sparse, with canopy species as well as *Cornus florida, Ilex opaca, Liquidambar styraciflua*, and *Prunus serotina var. serotina*. *Frangula caroliniana* may occur in several strata. Herb distribution is patchy, and typical species include *Asplenium platyneuron, Chasmanthium laxum, Eupatorium* spp., *Polystichum acrostichoides*, and *Carex* spp. In the central and upper midwestern United States, stands are dominated by *Juniperus virginiana var. virginiana* with *Rhus typhina* as an associate.

Dynamics:

Similar Alliances:

- *Juniperus virginiana* Woodland Alliance (A.545)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in the northeastern U.S. from Massachusetts and New York, adjacent Ontario, Canada, to the southeastern U.S. from Virginia to Oklahoma and Texas, to the midwestern U.S. from Iowa to Missouri, and possibly elsewhere.

Nations: CA, US

Subnations: AL, AR, DE, GA, IA, KY, LA, MA, MD?, MO, MS, NC, NJ, NY, OK, ON, PA, SC, TN, TX, VA, WV
TNC Ecoregions: 32:C, 33:C, 35:P, 36:P, 37:C, 38:C, 39:C, 40:C, 43:C, 44:C, 46:P, 48:P, 50:C, 51:?, 52:C, 53:P, 58:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions: 212Fc:CCC, 221Aa:CCP, 221Ab:CCC, 221Ac:CCP, 221Ad:CCP, 221Ae:CC?, 221Ak:CCC, 221Bd:CCC, 221Hc:CCC, 221Jb:CCC, 221Jc:CCC, 222Ak:CCP, 222Ca:CCC, 222Cb:CCC, 222Cg:CCC, 222Da:CCC, 222Db:CCC, 222Dc:CCC, 222Dg:CCC, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ef:CCC, 222Eg:CCC, 222Ej:CCC, 222Ek:CCC, 222En:CCC, 222Eo:CCC, 222Fc:CCC, 222Fd:CCC, 222Lc:CCP, 222Me:CCP, 231Aa:CC?, 231Ab:CC?, 231Ac:CC?, 231Ad:CC?, 231Ae:CCC, 231Af:CC?, 231Ag:CC?, 231Ah:CC?, 231Ai:CC?, 231Aj:CC?, 231Ak:CCC, 231Al:CC?, 231Am:CCC, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CCC, 231Bb:CCC, 231Bc:CCP, 231Bd:CCC, 231Be:CCC, 231Bf:CC?, 231Bg:CC?, 231Bh:CC?, 231Bi:CC?, 231Bj:CC?, 231Bk:CC?, 231Ca:CC?, 231Cb:CC?, 231Cc:CC?, 231Cd:CCC, 231Ce:CC?, 231Cf:CCC, 231Cg:CC?, 231Da:CCC, 231Db:CC?, 231Dc:CC?, 231Dd:CC?, 231De:CCP, 231Ee:CCP, 231Ej:CC?, 231Ga:CCP, 231Gb:CCP, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Bb:CC?, 232Bc:CCP, 232Bj:CCC, 232Br:CCC, 251Cc:CC?, 251Ch:CCP, 251E:CC, 251F:CC, 255Ad:CCC, 311A:CC, 332E:CC, M221Ab:CCC, M221Be:CCC, M222Aa:CCC, M231Aa:CCP, M231Ab:CCP, M231Ac:CCP, M231Ad:CCP
Federal Lands: COE (J. Percy Priest); DOD (Arnold, Camp Gruber); NPS (Abe Lincoln Birthplace, Antietam?, Appomattox Court House, Big South Fork, Bluestone, Boston Harbor Islands, Buffalo River, C&O Canal?, Cape Cod, Chickamauga-Chattanooga, Chickasaw NRA, Cumberland Gap, Delaware Water Gap, Fire Island, Fort Donelson, Fredericksburg-Spotsylvania, George Washington Birthplace, Harpers Ferry, Kings Mountain, Mammoth Cave, Manassas?, Natchez Trace, Richmond, Russell Cave, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Cherokee?, Daniel Boone, Monongahela, Ouachita, Ozark); USFWS (Cape May, Supawna Meadows)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. M. Pyne
References: Andreu and Tukman 1995, Eyre 1980, Foti et al. 1994, Midwestern Ecology Working Group n.d.

[CEGL007124] *Juniperus virginiana var. virginiana - (Quercus* spp.) Forest

Translated Name: **Eastern Red-cedar - (Oak species) Forest**
Common Name: **Eastern Red-cedar Successional Forest**
Ecological System(s):

- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)
- Southern Coastal Plain Limestone Forest (CES203.502)

Status: Standard
Circumscription Confidence: 3 - Weak
Concept Author(s): K.D. Patterson, mod. R.E. Evans

ELEMENT CONCEPT

Global Summary: This is a successional community dominated by a nearly monospecific *Juniperus virginiana var. virginiana* canopy. Species composition and cover are variable depending upon geographic location and disturbance history. Some examples are densely forested (75-100% total cover) with *Juniperus virginiana var. virginiana* and sparse subcanopy, shrub and herb strata. Other examples, especially those that are somewhat more open-canopied, are more species-rich, and other tree species may enter the canopy in low levels of abundance. Species that may occur in the canopy include *Carya alba, Carya carolinae-septentrionalis, Carya ovata, Cercis canadensis*, and *Pinus virginiana*. Various oaks (including *Quercus coccinea, Quercus falcata, Quercus stellata*, and *Quercus phellos*) may also be present, seeding in from adjacent oak-hardwood forests. The midstory is typically sparse, with canopy species as well as *Cornus florida, Ilex opaca, Liquidambar styraciflua*, and *Prunus serotina var. serotina*. In addition, *Frangula caroliniana* occurs in various strata. Herbs are patchy and typically include *Asplenium platyneuron, Chasmanthium laxum, Eupatorium* spp., *Polystichum acrostichoides*, and *Carex* spp.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This successional red-cedar forest was sampled at six locations in the park. This successional association is primarily found on sites that have been cleared and/or converted for agriculture and subsequently abandoned. Some examples are on rocky slopes where successful row crop agriculture was unlikely. These areas could have been used for some timber production and/or cleared for pasture. In most cases, their particular past land use is uncertain. Sites are gentle to somewhat steep, low to upper slopes with northerly, southerly and westerly aspects at 163 to 233 m(536-765 feet) elevation. Soils range from very dry to mesic, moderately well-drained to rapidly drained loam, clay, sandy loam, and clay loam. The unvegetated surface is dominated by leaf litter (35-100% cover) with some

exposed bedrock (0-30%), large rocks (0-20%), wood (0-15%) and bare soil (0-5%). Evidence of disturbance includes past logging and clearing (likely for grazing livestock), roads and trails, fire suppression, dogwood anthracnose, and the presence of exotic plants.

Global Environment: This community occurs in both coastal plain and interior regions of the southeastern United States in a variety of disturbed areas such as eroded soils on abandoned agricultural land (Andreu and Tukman 1995). In Kentucky, this vegetation occurs throughout the state (Bluegrass region, Highland Rim, East Gulf Coastal Plain) on calcareous substrates or on abandoned agricultural land; acreage of this type has increased since presettlement times. This type also includes the *Juniperus virginiana var. virginiana* woodland from Tellico Lake (Andreu and Tukman 1995) which occurs on drier sites with shallow, rocky soils.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to very dense (50-90% cover) tree canopy, 10-35 m tall, is dominated by *Juniperus virginiana*; additional species may include *Juglans nigra, Quercus alba*, and others. The moderate sparse to dense (40-80%) subcanopy (5-15 m) is also dominated by *Juniperus virginiana* and may include *Cercis canadensis, Cornus florida, Fraxinus americana*, and others. The moderately sparse (30%) tall-shrub layer (1-5 m) is dominated by *Cercis canadensis* and *Fraxinus americana* and may include *Cornus florida, Fagus grandifolia, Juglans nigra, Ostrya virginiana, Quercus muehlenbergii, Ulmus alata*, and others. The moderately sparse (20-30%) short-shrub layer (0.5-1 m) may include tall-shrub species as well as *Acer rubrum, Acer saccharum, Carya cordiformis, Celtis occidentalis, Diospyros virginiana, Frangula caroliniana, Liriodendron tulipifera, Prunus serotina var. serotina, Quercus imbricaria, Rhus copallinum, Rubus argutus, Sassafras albidum, Symphoricarpos orbiculatus*, and *Vaccinium stamineum*. The highly variable (10-100%) herbaceous layer includes *Ageratina altissima, Aristolochia serpentaria, Asplenium platyneuron, Botrychium virginianum, Cynoglossum virginianum, Desmodium nudiflorum, Desmodium rotundifolium, Dichanthelium boscii, Galium circaezans, Geum canadense, Podophyllum peltatum, Salvia lyrata, Sanicula canadensis, Uvularia perfoliata, Viola* spp., and many others; over 270 taxa were recorded from 3 plots. Vines include *Parthenocissus quinquefolia, Smilax glauca, Toxicodendron radicans, Vitis rotundifolia*, and others. This community is heavily infested with exotic plants (18 taxa recorded); however, it also supports state-vulnerable *Sanicula marilandica, Sporobolus clandestinus*, and *Juglans cinerea*.

Global Vegetation: Stands are dominated by *Juniperus virginiana var. virginiana*. A host of other woody species may also be present, some of which may occur in the canopy at low levels of abundance. These species include *Carya alba, Carya ovata, Cercis canadensis, Pinus virginiana, Quercus coccinea, Quercus falcata*, and *Quercus phellos*. The midstory is typically sparse, with canopy species as well as *Cornus florida, Ilex opaca, Liquidambar styraciflua*, and *Prunus serotina var. serotina* (NatureServe Ecology unpubl. data). In addition, *Frangula caroliniana* occurs in various strata. Herbs are patchy and typically include *Asplenium platyneuron, Chasmanthium laxum, Eupatorium* spp., *Polystichum acrostichoides*, and *Carex* spp. The ground layers of some stands may exhibit dominance by native warm-season grasses and other graminoids, including *Schizachyrium scoparium, Andropogon* spp., and *Danthonia* spp. The exotics *Lonicera japonica* and *Microstegium vimineum* may also be present.

Global Dynamics: In most cases, this community only occurs in areas with a recent history of plowing or clearcutting. Examples, such as those at Arnold Air Force Base (Coffee County, Tennessee), may be invaded by pines (*Pinus strobus, Pinus taeda*, and *Pinus virginiana*) from adjacent plantations.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree (canopy & subcanopy)	Needle-leaved tree	X	X	.
Cercis canadensis	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Celtis occidentalis	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Frangula caroliniana	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Fraxinus americana	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Toxicodendron radicans	Herb (field)	Vine/Liana	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana var. *virginiana*	Tree subcanopy	Needle-leaved tree	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic
Brassica rapa	-	P	exotic
Cardamine hirsuta	-	P	exotic

Carduus nutans	-	P	exotic
Cirsium vulgare	-	P	exotic
Daucus carota	-	P	exotic
Duchesnea indica	-	P	exotic
Juglans cinerea	-	P	state-vulnerable
Leucanthemum vulgare	-	P	exotic
Ligustrum sinense	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Poa annua -	P	exotic	
Poa pratensis	-	P	exotic
Rosa multiflora	-	P	exotic
Sanicula marilandica	-	P	state-vulnerable
Sporobolus clandestinus	-	P	state-vulnerable
Stellaria media	-	P	exotic
Taraxacum officinale	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	invasive exotic
Microstegium vimineum	-	P	invasive exotic

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (3-Sep-2002). This forest represents early-successional, modified, or silviculturally managed vegetation and is thus not of conservation concern and does not receive a conservation status rank.

RELATED CONCEPTS

Global Similar Associations:

- *Juniperus virginiana* Midwest Forest (CEGL002593)
- *Juniperus virginiana var. virginiana / Rhus copallinum / Schizachyrium scoparium* Woodland (CEGL007704)

Global Related Concepts:

- CT VI *Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra* (Badger et al. 1997) **I**
- CT VII *Juniperus virginiana, Liriodendron tulipifera, Quercus imbricaria, Quercus velutina* (Badger et al. 1997) **I**
- Eastern Redcedar: 46 (Eyre 1980) **B**
- IB5a. Eastern Red Cedar Woodland (Allard 1990) **?**
- Red cedar, RV (Pyne 1994) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: There are issues with the use of this association (CEGL007124) for classifying stands dominated by *Juniperus virginiana*. Some of these are related to shallow soils over limestone that could resemble "limestone cedar glades" with management, but there are other stands on slopes in sink valleys that do not seem to represent the same habitat. This variation may need to be accommodated in the local description for CEGL007124. This type can accommodate evergreen CEGL007124, up to 40% coverage of deciduous species, including dogwood (*Cornus florida*), without changing the overall type (M. Whited pers. comm.). Badger et al. (1997) list a CT VI as *Juniperus virginiana, Pinus virginiana, Cornus florida, Carya glabra*; it would seem to be related to CEGL007124 (and CEGL007121) in concept and composition. Habitat: ridgetops and upper slopes with both sandstone and limestone substrates, drier aspects [high disturbance, abrupt transition to other communities] [CEGL007124; CEGL007121]; also called "*Juniperus virginiana, Cornus florida, Pinus virginiana, Quercus alba, Carya glabra*" (pp. 4-45). In addition, their CT VII *Juniperus virginiana, Liriodendron tulipifera, Quercus imbricaria, Quercus velutina* is also related (pp. 1-43). Habitat: broad valley bottoms with a limestone substrate (e.g., the Karst valleys) and a drier aspect [CEGL007124, in part?]; also called "*Juniperus virginiana, Liriodendron tulipifera*" (pp. 4-50).

Mammoth Cave National Park Other Comments:

Global Classification Comments: Originally described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeastern Monroe County) based on 10 stands sampled by Andreu and Tukman (1995). This community is very closely related to *Juniperus virginiana* Woodland and to mixed juniper-oak forest types but is distinguished by the closed-canopy evergreen dominance of *Juniperus virginiana*. *Juniperus virginiana* woodlands may be equivalent to this type.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found particularly frequently in sinkhole valleys, where stands of this community cover many hectares, the stands being of largely uniform composition. There are also stands placed here, and areas where this association may be mapped, which are found on shallow limestone soils in the northeastern part of the park (e.g., on Dennison Ferry Road), as well as stands that have developed on cleared forest land or abandoned agricultural land, where these land-use conditions have occurred.

Global Range: This community is widely distributed in both coastal plain and interior regions of the southeastern United States, ranging in the interior to Oklahoma, Kentucky, and West Virginia.
Nations: US
States/Provinces: AL, AR, GA, KY, LA, MS, NC, OK, SC, TN, VA, WV?
TNC Ecoregions: 38:C, 39:P, 43:C, 44:C, 50:C, 51:?, 52:?, 53:P, 59:C
TNC Ecoregion Comments: ECO38 & M222Aa added for BUFF (mjr 6-08). ECO50 changed from P to C and 221Hc added for BISO (mjr 4-05). ECO43 and 222Cg:CCC added to correspond with Shiloh attribution (MP 8-02). ECO44, ECO50, ECO53 added (KP 2-00).
USFS Ecoregions: 221Hc:CCC, 222Ak:CCP, 222Cg:CCC, 222Dg:CCC, 222Eb:CCC, 222Ed:CCC, 222Ef:CCC, 222Eg:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 222Lc:CCP, 222Me:CCP, 231Ba:CCC, 231Bd:CCC, 231Be:CCC, 231Cd:CCC, 251Cc:CC?, 251Ch:CCP, M221Be:CCC, M222Aa:CCC
Federal Lands: DOD (Arnold, Camp Gruber, J. Percy Priest); NPS (Abe Lincoln Birthplace, Big South Fork, Buffalo River, Chickamauga-Chattanooga, Chickasaw NRA, Cumberland Gap, Fort Donelson, Kings Mountain, Mammoth Cave, Natchez Trace, Russell Cave, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Cherokee?, Daniel Boone, Ouachita (Mountains)?, Ouachita?, Ozark)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.8, MACA.12, MACA.17, MACA.33, MACA.39, MACA.716.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): K.D. Patterson, mod. M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990	.	X	X	.	.	.	.	.	
Andreu and Tukman 1995	.	X	.	X	X	.	.	.	.
Badger et al. 1997	.	.	X	.	.	.	.	.	.
Evans 1991	X	.	X	X	.	.	.	.	
Eyre 1980	.	X	X	.	.	.	.	.	
Gallyoun et al. 1996	.	.	.	.	X	.	.	.	.
Hoagland 2000	.	.	.	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Pyne 1994	.	X	X	X	.	.	.	.	
Rice 1960	.	.	X	.	.	.	.	.	
Rosson 1995	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Whited pers. comm.	.	.	.	X	.	.	.	.	.

I.B.2.N.a. Lowland or submontane cold-deciduous forest

A.227 Fagus grandifolia - Acer saccharum - (Liriodendron tulipifera) *Forest Alliance*

American Beech - Sugar Maple - (Tuliptree) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance is composed of rich, mesic forests of the east-central United States and southern Canada. The southern range of this alliance is limited by the distribution of *Acer saccharum* which is largely absent from the Coastal Plain. Stands of this alliance are found on flat, rolling, or, in the south, dissected topography. South of the limit of glaciation there is an increasing tendency for this alliance to be found on north- or east-facing slopes. The soils are fertile well-drained, silt, silt loam, sandy loam, or loam. Those in the north have formed over glacial till almost exclusively, while stands south of the limit of Wisconsin glaciation may form from till, alluvium, sandstone, or shale. The forest canopy and subcanopy are typically dominated by *Acer saccharum* and *Fagus grandifolia*, although *Liriodendron tulipifera* may be an important canopy component in some parts of the range. Other common trees include *Carpinus caroliniana, Carya* spp., *Fraxinus americana, Ostrya virginiana, Quercus rubra, Tilia americana*, and *Ulmus americana*. In the southern part of this alliance's range, additional species may include *Quercus alba, Tilia americana, Liquidambar styraciflua, Aesculus glabra, Nyssa sylvatica*, and *Carya cordiformis*. Shrubs are usually rare in northern stands but

become more abundant in southern stands. *Asimina triloba* and *Lindera benzoin* (in the southern parts of this alliance's range), *Diervilla lonicera, Euonymus obovatus*, and *Sambucus* spp. (in the northern parts), *Morus rubra*, and *Corylus americana* are typical shrubs. The herbaceous layer is well-developed. The most abundant species include *Adiantum pedatum, Arisaema triphyllum, Claytonia virginica, Dicentra canadensis, Dryopteris intermedia, Galium aparine, Maianthemum canadense* (in the north), *Maianthemum racemosum, Menispermum canadense, Osmorhiza claytonii, Phegopteris hexagonoptera* (in the south), *Podophyllum peltatum, Polygonatum biflorum, Sanguinaria canadensis, Trillium grandiflorum*, and *Viola* spp.

Environment: Stands of this alliance are found on flat, rolling, or, in the south, dissected topography (Braun 1950, Pell and Mack 1977). South of the limit of glaciation there is an increasing tendency for this alliance to be found on north- or east-facing slopes (Eyre 1980). The soils are fertile, well-drained silt, silt loam, sandy loam, or loam. Those in the north have formed over glacial till almost exclusively, while stands south of the limit of Wisconsin glaciation may form from till, alluvium, sandstone, or shale (Dodge and Harman 1977, Eyre 1980).

Vegetation: This alliance is composed of rich, mesic forests of the east-central United States and southern Canada. The forest canopy and subcanopy are dominated by *Acer saccharum* and *Fagus grandifolia*. Other common trees include *Carpinus caroliniana, Carya* spp., *Fraxinus americana, Ostrya virginiana, Quercus rubra, Quercus macrocarpa* (in wetter stands), *Tilia americana*, and *Ulmus americana*. In the southern part of this alliance's range, species more typical of mixed mesophytic forests occur. These include *Aesculus glabra, Liquidambar styraciflua, Nyssa sylvatica*, and *Quercus alba* (Braun 1950). Shrubs are less abundant in northern stands than in southern stands. Typical shrubs include *Asimina triloba* (in the southern parts of this alliance's range), *Corylus americana, Diervilla lonicera* (in the north), *Euonymus obovatus, Lindera benzoin* (in the south), *Morus rubra*, and *Sambucus* spp. (in the north). The herbaceous layer is well-developed. The most abundant species include *Adiantum pedatum, Arisaema triphyllum, Claytonia virginica, Dicentra canadensis, Dryopteris intermedia, Galium aparine, Maianthemum canadense* (in the north), *Maianthemum racemosum, Menispermum canadense, Osmorhiza claytonii, Phegopteris hexagonoptera* (in the south), *Podophyllum peltatum, Polygonatum biflorum, Sanguinaria canadensis, Trillium grandiflorum*, and *Viola* spp. At the southern limit of this alliance's distribution (e.g., in the Cumberland Plateau of Alabama), the "sugar maple" in the stands, if present, may be *Acer barbatum* and/or *Acer leucoderme*, not *Acer saccharum*.

Dynamics:

Similar Alliances:

- *Acer saccharum - Betula alleghaniensis - (Fagus grandifolia)* Forest Alliance (A.216)
- *Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance (A.217)
- *Acer saccharum - Tilia americana - (Quercus rubra)* Forest Alliance (A.220)
- *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)
- *Fagus grandifolia - Quercus alba* Forest Alliance (A.228)
- *Fagus grandifolia - Quercus rubra - Quercus alba* Forest Alliance (A.229)
- *Fagus grandifolia - Quercus* spp. *- Acer* spp. Forest Alliance (A.230)
- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)--some conceptual and floristic overlap.
- *Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)

Similar Alliance Comments: Stands of this alliance may be similar to stands in the *~Acer saccharum - Betula alleghaniensis - (Fagus grandifolia)* Forest Alliance (A.216) (northward), *~Fagus grandifolia - Quercus alba* Forest Alliance (A.228), and *~Fagus grandifolia - Quercus* spp. *- Acer* spp. Forest Alliance (A.230). In the northeast this alliance is not clearly differentiated from the *~Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance (A.217), especially on the lakeplain in New York [see Kuchler 1964]. Rogers (1981) also compared stands of this beech-maple alliance with those of the maple-basswood alliance, *~Acer saccharum - Tilia americana - (Quercus rubra)* Forest Alliance (A.220), in Minnesota and Wisconsin. *Tilia americana* was far more dominant in that alliance. Further review of Rogers' discussion of the herbaceous layer of these two alliances is needed. Forests in this alliance are distinguished from forests in the *~Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235) by lacking the suite of Appalachian species characteristic to that alliance.

ALLIANCE DISTRIBUTION

Range: This alliance is found in southern Michigan, Ohio, Indiana, Illinois, eastern Missouri, Kentucky, Tennessee, Alabama, Pennsylvania, New York, New Jersey, West Virginia, Virginia, and possibly Arkansas and Maryland. It is also found in Canada in southern Ontario.

Nations: CA, US

Subnations: AL, AR?, CT, DC, DE, GA, IL, IN, KY, MD, MI, MO, MS, NJ, NY, OH, ON, PA, SC, TN, VA, WV

TNC Ecoregions: 36:C, 38:C, 42:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 52:C, 57:C, 58:C, 59:C, 60:C, 61:C

USFS Ecoregions: 212Fa:CC?, 212Fb:CCP, 212Fc:CCC, 212Ga:CPP, 221Bc:CCC, 221Bd:CCC, 221Db:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC,

221Ha:CCP, 221Hc:CCC, 221He:CCC, 221J:CC, 222Ak:CP?, 222Ao:CPP, 222Aq:CPP, 222Ca:CCP, 222Cb:CCC, 222Cc:CCC, 222Cg:CCC, 222Ch:CCP, 222Da:CCC, 222Db:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCC, 222Dg:CCC, 222Dh:CCP, 222Di:CCC, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Eg:CCC, 222Eh:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Em:CCC, 222En:CCP, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gc:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hd:CCC, 222Hf:CCC, 222Ia:CCC, 222Ib:CCC, 222Ic:CC?, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jd:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 231Ab:CCC, 231Ac:CCP, 231Ae:CCC, 231Af:CCC, 231Ah:CCP, 231Ai:CCP, 231Ak:CCC, 231An:CCC, 231Ap:CCC, 231Ba:CC?, 231Bb:CC?, 231Bc:CCP, 231Bd:CCP, 231Be:CCC, 231Bf:CC?, 231Bh:CCC, 231Bk:CCP, 231Cd:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bx:CCC, 232Ch:CCC, 232Cj:CCC, 234Ab:CCC, 234Ac:CCC, 234An:CCP, 251De:CCC, M221Aa:CC?, M221Ab:CCP, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Cd:CCC, M221Da:CCC

Federal Lands: NPS (Abe Lincoln Birthplace, Allegheny Portage Railroad, Big South Fork, C&O Canal?, Colonial, Delaware Water Gap, Friendship Hill, George Washington Parkway, Horseshoe Bend, Indiana Dunes, Little River Canyon?, Mammoth Cave, Monocacy?, Morristown, Natchez Trace, National Capital-East, Obed, Saratoga, Shiloh, Thomas Stone); TVA (Land Between the Lakes, Tellico); USFS (Allegheny, Bankhead, Chattahoochee?, Cherokee?, Daniel Boone, Finger Lakes, Hoosier, Jefferson?, Shawnee, Talladega, Tuskegee, Wayne); USFWS (Chesapeake Marshlands, Eastern Neck, Erie, Iroquois, Prime Hook)

ALLIANCE SOURCES

Author(s): D. Faber-Langendoen/D.J. Allard

References: Allard 1990, Andreu and Tukman 1995, Braun 1950, Cobbe 1943, Dodge and Harman 1985, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Kuchler 1964, Martin 1975, Midwestern Ecology Working Group n.d., Muller 1982, Pell and Mack 1977, Pyne 1994, Rogers 1981, Schmalzer 1978, Schmalzer and DeSelm 1982, Schmalzer et al. 1978, Smith 1991

[CEGL002411] *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest

Translated Name: **American Beech - Sugar Maple - Tuliptree Unglaciated Forest**

Common Name: **Beech - Maple Unglaciated Forest**

Ecological System(s):

- East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477)
- Ozark-Ouachita Mesic Hardwood Forest (CES202.043)
- South-Central Interior Mesophytic Forest (CES202.887)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Guetersloh, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This beech - maple forest is found in unglaciated areas of the east-central United States. Stands occur on unglaciated terraces and mesic slopes of maturely dissected plateaus and submontane regions. The aspect is neutral on sandy alluvial terraces and is northern to eastern on slopes. Soils are moderately well-drained, moist, rich and deep (100+ cm). The vegetation is dominated by a closed-canopy forest with a well-developed tall-shrub layer. The forest canopy is dominated by *Fagus grandifolia* and *Acer saccharum*. Other canopy species include *Liriodendron tulipifera, Liquidambar styraciflua, Fraxinus americana, Quercus rubra, Carya glabra*, and *Carya cordiformis*. Shrubs commonly found in this community are *Asimina triloba* and *Lindera benzoin*. Herbaceous species are diverse, forming a dense cover. They include *Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Carex blanda, Dicentra canadensis, Dioscorea quaternata, Galium circaezans, Menispermum canadense, Phegopteris hexagonoptera, Polystichum acrostichoides*, and *Sanguinaria canadensis*. The large size of dominant canopy species (over 30 m tall), herbaceous diversity, and accumulated litter emphasize the high degree of mesophytism. Community occurrences have been extensively logged, and the canopy openings favor regeneration of *Acer saccharum*. In the Appalachians of eastern Kentucky, other typical trees include *Aesculus flava* (locally abundant), *Juglans cinerea, Juglans nigra, Magnolia acuminata, Quercus muehlenbergii*, and *Ulmus rubra*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: These are the most mesic and rich upland forests of the park, being restricted to rich slopes, deep sinkholes, and coves. This beech - maple forest was sampled at 12 locations in the park. Sites range from a gently sloping sinkhole to moderate to steep, north-, west-, northwest-, east- and southeast-facing, lower to upper slopes and ravines at 176 to 236 m (577-774 feet) elevation. Soils are moderately well-drained to well-drained silt loam, clay loam, sandy loam and loam. The unvegetated surface is dominated by leaf litter (56-98% cover)

with some exposed bedrock (0-20%), large rocks (0-10%), wood (2-15%) and bare soil (0-20%). Evidence of disturbance includes past logging and clearing (likely for grazing livestock), dogwood anthracnose, and the presence of exotic plants.
Global Environment: Stands occur on unglaciated terraces and mesic slopes of maturely dissected plateaus and submontane regions. The aspect is neutral on sandy alluvial terraces and is northern to eastern on slopes. Soils are moderately well-drained, moist, rich, and deep (100+ cm). In Crowley's Ridge of Missouri, stands occur on moderate slopes of hills and valleys and on knolls or ridges of large alluvial terraces.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately sparse to dense (40-80% cover) tree canopy, 20-50 m tall, is codominated by *Fagus grandifolia, Acer saccharum*, and *Liriodendron tulipifera* and may include *Acer nigrum, Carya glabra, Carya ovalis, Carya ovata, Fraxinus americana, Quercus alba, Quercus rubra*, and others. The moderate (40-60%) subcanopy (10-20 m) is dominated by *Acer saccharum* and may include canopy species (particularly *Fagus grandifolia*) as well as *Aesculus glabra, Carya pallida, Cercis canadensis*, and *Juniperus virginiana*. The sparse (60%) tall-shrub layer (2-10 m) is dominated by *Asimina triloba* and may include canopy species as well as *Corylus americana, Lindera benzoin*, and *Ostrya virginiana*. The sparse to moderate (10-50%) short-shrub layer (0.5-2 m) has a similar composition and may include *Cornus alternifolia, Euonymus americanus, Hydrangea arborescens*, and *Symphoricarpos orbiculatus*. The very sparse to dense (5-80%) herbaceous layer is dominated by *Polystichum acrostichoides* and may include *Adiantum pedatum, Arundinaria gigantea, Asarum canadense, Diplazium pycnocarpon, Dryopteris marginalis, Hydrophyllum canadense, Pilea pumila, Podophyllum peltatum, Solidago flexicaulis, Verbesina alternifolia*, and others. Vines (up to 30%) include *Amphicarpaea bracteata, Parthenocissus quinquefolia, Smilax rotundifolia*, and *Toxicodendron radicans*. This community has been invaded by several exotic species. In addition, this community supports state-imperiled *Calycanthus floridus* and *Melanthium woodii* and state-vulnerable *Juglans cinerea*.
Global Vegetation: The vegetation is dominated by a closed-canopy forest with a well-developed tall-shrub layer. The forest canopy is dominated by *Fagus grandifolia* and *Acer saccharum*. Other canopy species include *Liriodendron tulipifera, Liquidambar styraciflua, Fraxinus americana, Quercus rubra, Carya glabra*, and *Carya cordiformis*. Shrubs commonly found in this community are *Asimina triloba* and *Lindera benzoin*. Herbaceous species are diverse, forming a dense cover. They include *Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Carex blanda, Dicentra canadensis, Dioscorea quaternata, Galium circaezans, Menispermum canadense, Phegopteris hexagonoptera, Polystichum acrostichoides*, and *Sanguinaria canadensis*. The large size of dominant canopy species (over 30 m tall), herbaceous diversity, and accumulated litter emphasize the high degree of mesophytism (TNC 1995a). In the Appalachians of eastern Kentucky, other typical trees include *Aesculus flava* (locally abundant), *Juglans cinerea, Juglans nigra, Magnolia acuminata, Quercus muehlenbergii*, and *Ulmus rubra*. Shrub cover may be low to moderate, and includes *Cornus alternifolia* and *Cornus florida* Ground cover is moderate with frequent (or locally abundant) *Asarum canadense, Eurybia divaricata (= Aster divaricatus), Diplazium pycnocarpon (= Athyrium pycnocarpon), Hepatica nobilis var. acuta (= Hepatica acutiloba), Osmorhiza claytonii, Poa sylvestris, Ranunculus recurvatus, Sedum ternatum*, and *Uvularia grandiflora*, among others (Campbell 2001).
Global Dynamics: This community is a late successional mature community. Canopy closure is 100%, favoring a subcanopy dominated by American beech. Canopy openings are created by wind throws, insect and disease damage, and tree senescence. Sugar maple regeneration is prominent where these openings occur. Forest openings are rapidly colonized by dense stands of herbaceous vegetation. Succession is rapid due to ideal nutrient availability and soil moisture. Seed dispersal is accomplished by wind and seed-eating birds and mammals.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Fagus grandifolia	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Liriodendron tulipifera	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Acer saccharum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Asimina triloba	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carya cordiformis	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carya glabra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree	X	.	.

Fraxinus americana	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liquidambar styraciflua	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus rubra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Lindera benzoin	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Morus rubra	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Parthenocissus quinquefolia	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Galium circaezans	Herb (field)	Semi-shrub	X	.	.
Menispermum canadense	Herb (field)	Vine/Liana	X	.	.
Actaea pachypoda	Herb (field)	Forb	X	.	.
Arisaema triphyllum	Herb (field)	Forb	X	.	.
Asarum canadense	Herb (field)	Forb	X	.	.
Claytonia virginica	Herb (field)	Forb	X	.	.
Dicentra canadensis	Herb (field)	Forb	X	.	.
Dioscorea quaternata	Herb (field)	Forb	X	.	.
Maianthemum racemosum	Herb (field)	Forb	X	.	.
Sanguinaria canadensis	Herb (field)	Forb	X	.	.
Sanicula canadensis	Herb (field)	Forb	X	.	.
Carex blanda	Herb (field)	Graminoid	X	.	.
Adiantum pedatum	Herb (field)	Fern or fern ally	X	.	.
Phegopteris hexagonoptera	Herb (field)	Fern or fern ally	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic
Calycanthus floridus	-	P	state-imperiled
Glechoma hederacea	-	P	exotic
Juglans cinerea	-	P	state-vulnerable
Lonicera japonica	-	P	exotic
Melanthium woodii	-	P	state-imperiled
Microstegium vimineum	-	P	exotic
Poa pratensis	-	P	exotic
Polygonum persicaria	-	P	exotic
Potentilla recta	-	P	exotic
Rosa multiflora	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ambystoma tigrinum	-	A	
Baeolophus bicolor	-	A	
Carphophis amoenus	-	A	
Dryocopus pileatus	-	A	
Empidonax virescens	-	A	
Eurytides marcellus	-	A	
Hylocichla mustelina	-	A	
Meleagris gallopavo	-	A	
Microtus pinetorum	-	A	
Odocoileus virginianus	-	A	
Oporornis formosus	-	A	
Plethodon glutinosus	-	A	
Rana sylvatica	-	A	
Sciurus carolinensis	-	A	
Wilsonia citrina	-	A	

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (15-Mar-2007). This is a fairly wide-ranging and broadly defined community type. Many community occurrences have been extensively logged, and the canopy openings favor regeneration of *Acer saccharum*. In Crowley's Ridge Section of Missouri, this community is rare and confined to protected valleys (Vancil Hollow Natural

Area), but it has been so extensively eliminated that its classification is problematic. It is probably eliminated in the Lowlands Section of the state. Possible occurrences in Arkansas need to be examined further.

RELATED CONCEPTS

Global Similar Associations:

- *Acer saccharum - Carya cordiformis / Asimina triloba* Floodplain Forest (CEGL005035)
- *Acer saccharum - Liriodendron tulipifera - Fraxinus americana / Staphylea trifolia* Forest (CEGL006201)--may overlap with CEGL002411.
- *Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest (CEGL005013)--may be similar to this community.
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296)
- *Fagus grandifolia - Quercus alba / Cornus florida* Forest (CEGL007881)--a beech - white oak type.
- *Fagus grandifolia - Quercus rubra - Tilia americana var. caroliniana / Magnolia tripetala / Podophyllum peltatum* Forest (CEGL007823)
- *Fagus grandifolia - Quercus* spp. *- Acer rubrum - Juglans nigra* Forest (CEGL005014)
- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest (CEGL005222)--has coniferous evergreen species, such as eastern hemlock (*Tsuga canadensis*), as well as species such as white basswood (*Tilia americana var. heterophylla*) and sweet buckeye (*Aesculus flava*), which are not present in CEGL002411 (Braun 1950).
- *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059)

Global Related Concepts:

- *Fagus - Acer saccharum - Liriodendron / Rhus radicans* community (Voigt and Mohlenbrock 1964) =
- *Fagus grandifolia - Acer saccharum* type (Franklin et al. 1993) **?**
- Beech - Maple Forest (Braun 1950) [The "Beech - Maple Forest" community also includes a significant forest community type of the glaciated mesic forests of the northeastern United States.] **I**
- Beech - Sugar Maple: 60 (Eyre 1980) [Beech - Maple Unglaciated Subtype.] **B**
- Beech - Tulip Poplar Type (Schmalzer and DeSelm 1982) =
- Beech-maple-tuliptree forest (matrix, large patch) (CAP pers. comm. 1998) **?**
- CT II *Acer saccharum, Fagus grandifolia, Quercus alba, Fraxinus americana* (Badger et al. 1997) =
- Eastern Broadleaf Forests: 102: Beech-Maple Forest (*Fagus-Acer*) (Kuchler 1964) **B**
- Mesic Forest (Nelson 1985) **I**
- Terrestrial: Forest: Hardwood (TNC 1985) **B**
- UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) **B**
- Western Mesophytic Forest (Braun 1950) [The terms "western mesophytic" and "mesic upland" rely upon moisture and topographic position to establish community boundaries.] **I**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: The most mesic forests (rich slopes, deep sinkholes, coves) which are not codominated by oaks (*Quercus* spp.) should classify as this association (CEGL002411); the use of *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest (CEGL005222) should not be necessary, despite the fact that the Appalachian *Aesculus flava* (a nominal in CEGL005222) has been collected at the park (unexpectedly so). Braun's (1950) "Mixed mesophytic forests" (separate examples of which occur on "lower slopes" and "ravine slopes") are presumably accommodated by CEGL002411. *Fagus* and *Acer saccharum/nigrum* typically comprise over 50% of the canopy, while "in others the mixed character is more evident." Badger et al.'s (1997) CT II *Acer saccharum, Fagus grandifolia, Quercus alba, Fraxinus americana* (pp. 1-31) is equivalent to CEGL002411. Habitat: middle and lower slopes of both sandstone and limestone substrate [CEGL002411] (also pp. 4-31).

Mammoth Cave National Park Other Comments:

Global Classification Comments: Braun (1950, p. 141-150) describes these beech - maple forests in the Hill Section of her Western Mesophytic Forest Region. Dry-mesic forests, in which *Quercus alba, Quercus rubra*, and *Carya ovata* dominate, often have American beech and sugar maple regeneration due to an increased availability of moisture when mature oaks are removed. Where logging is heavy in these oak - hickory stands, second-growth regeneration is often dominated by sugar maple and, to a lesser extent, American beech. Classification under these circumstances can be difficult. Conversely, where sugar maple is selectively removed by logging, American beech can occur in pure stands. Forests from the southern part of Crowley's Ridge (Arkansas) are placed in ~*Fagus grandifolia - Quercus alba - Liriodendron tulipifera / Hydrangea arborescens / Schisandra glabra* Forest (CEGL004663), where *Acer saccharum* is not a big component and *Quercus alba* is more common. This type may apply to other parts of Crowley's Ridge, but more information is needed.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is found primarily in the central and southern parts of the park, including on rich, northeastern- to northwestern-facing slopes along the Green River and its tributaries.

Global Range: This beech - maple forest is found in unglaciated areas of the east-central United States, ranging from Ohio, West Virginia (and possibly western Maryland and Virginia) southwest to southeastern Missouri, Kentucky and Tennessee, and possibly Arkansas. This community occupies mesic slopes of maturely dissected plateaus and submontane regions of the east-central United States. These sites were not covered by Wisconsin era glaciers.
Nations: US
States/Provinces: AR?, IL, IN, KY, MD?, MO, OH, TN, VA?, WV
TNC Ecoregions: 38:C, 42:C, 43:C, 44:C, 45:C, 49:C, 50:C, 59:C
TNC Ecoregion Comments: ECO50 changed from P to C (CWN 9-05). ECO61 removed and placed instead on newly created CEGL006296 of this alliance (LAS 6-05). ECO61 tagged here for PA forests; if PA crosswalk revised to different type, remove ECO61 (SLN 5-03). WAP ecology team attributed appropriate subsections for this type (LAS 1-03). ECO43 added (DFL 1-00). Presumably for the Illinois part of ECO43 (MP 8-02). The ECO43 attribution also presumably applies to limited areas of western KY (REE 10-02).
USFS Ecoregions: 221D:CC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Eg:CCC, 221Ha:CCP, 221Hc:CCC, 221He:CCC, 221J:CP, 222Ak:CP?, 222Ao:CPP, 222Aq:CPP, 222Ca:CPP, 222Ch:CPP, 222Db:CCC, 222Dc:CCC, 222De:CCC, 222Df:CCC, 222Dg:CCC, 222Dh:CCP, 222Di:CCC, 222Dj:CCC, 222Ec:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Em:CCC, 222En:CCP, 222Eo:CCP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Gc:CCC, 222Gd:CCP, 222Hc:CCC, 231Be:CCC, 234Ab:CCC, 234Ac:CCC, 234An:CCP, M221Ab:CCP, M221Ac:CCC, M221Ad:CCP, M221Ba:CCC, M221Bb:CCC, M221Cd:CCC, M221Da:CPP
Federal Lands: NPS (Abe Lincoln Birthplace, Big South Fork, Mammoth Cave, Natchez Trace, Obed); USFS (Daniel Boone?, Jefferson?, Land Between the Lakes, Shawnee, Wayne)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.7, MACA.23, MACA.26, MACA.31, MACA.36, MACA.67, MACA.73, MACA.102, MACA.108, MACA.718, MACA.725, MACA.751.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Guetersloh, mod. D. Faber-Langendoen 04-00
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Badger et al. 1997	.	X	X	.	.	.	.	.	.
Behler 1988.	.	.	X	.	.	.	.	.	
Braun 1950 .	.	X	X	.	.	.	.	.	
Bull and Farrand 1977	.	.	.	X	.	.	.	.	.
CAP pers. comm. 1998	.	.	X	X	.	.	.	.	.
Campbell 2001	.	.	.	X	.	.	.	.	.
Clark and Hutchinson 1994	.	.	.	X	.	.	.	.	.
Craighead 1949	.	.	.	X	.	.	.	.	.
Duncan and Duncan 1988	.	.	.	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Eyre 1980 .	.	X	X	.	.	.	.	.	
Faircloth 1971	.	.	.	X	.	.	.	.	.
Fralish 1987	.	.	.	X	.	.	.	.	.
Fralish 1988b	.	.	.	X	.	.	.	.	.
Franklin et al. 1993	.	.	X	X	.	.	.	.	.
Harrison 2004	.	.	.	.	.	.	.	.	.
Illinois Nature Preserve Commission 1973	.	.	.	X	.	.	.	.	.
Jenkins and Pallardy 1993	.	.	.	X	.	.	.	.	.
Kuchler 1964	.	.	X	X	.	.	.	.	.
Little 1980a.	.	.	X	.	.	.	.	.	
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Mohlenbrock 1986	.	.	.	X	.	.	.	.	.
Nelson 1985	.	.	X	.	.	.	.	.	.
Niering 1979	.	.	.	X	.	.	.	.	.
SAF 1967 .	.	.	X	.	.	.	.	.	
Schafale and Weakley 1985	.	.	.	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	X	.	.	.	.	.
Schwartz and Schwartz 1959	.	.	.	X	.	.	.	.	.

TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1985 .	.	X	X	.	.	.	.	.	
TNC 1995a .	X	.	X	.	.	.	.	.	
UNESCO 1973	.	.	X	X	.	.	.	.	.
Voigt and Mohlenbrock 1964	.	.	X	X	.	.	.	.	.
White and Madany 1978	.	.	.	X	.	.	.	.	.

A.229 Fagus grandifolia - Quercus rubra - Quercus alba *Forest Alliance*

American Beech - Northern Red Oak - White Oak Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance occur in non-montane or low-elevation montane mesic situations. These forests often occur on concave and sheltered landforms, such as north-facing slopes, low slopes, high terraces along streams, and possibly other situations. The core concept of the range of this alliance includes areas inland from the Coastal Plain, as *Quercus rubra* is absent from large areas of the Coastal Plain (as in North Carolina). Forests in this alliance occur in the Cumberlands and Southern Ridge and Valley, Piedmont and Interior Low Plateau, and on protected slopes and ravines in the Ozarks, central Ouachita Mountains, and Arkansas Valley. They are dominated by *Fagus grandifolia* typically with some combination of *Quercus rubra* and/or *Quercus alba*. Associated canopy and subcanopy species can include *Liriodendron tulipifera, Acer saccharum, Magnolia tripetala, Magnolia acuminata* (Ozarks), *Tilia americana var. americana* (Ozarks), *Tilia americana var. heterophylla, Quercus muehlenbergii, Acer rubrum, Cornus florida, Ostrya virginiana, Aesculus sylvatica*, and *Ilex opaca*. Some of these forests, particularly in the Piedmont of South Carolina, the southern Ridge and Valley of Alabama, or in Arkansas, may contain *Acer barbatum* instead of *Acer saccharum*. Shrubs in this alliance include *Vaccinium stamineum, Viburnum rafinesquianum, Euonymus americanus*, and, in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Hexastylis arifolia, Hexastylis minor, Desmodium nudiflorum, Erythronium umbilicatum ssp. umbilicatum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Trillium* spp., *Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others present.

Environment: These forests often occur on concave and sheltered landforms such as north-facing slopes, low slopes, high terraces along streams, and possibly other situations.

Vegetation: Forests in this alliance occur in non-montane or low-elevation montane mesic situations and are dominated by *Fagus grandifolia* typically with some combination of *Quercus rubra* and/or *Quercus alba*. Associated canopy and subcanopy species can include *Liriodendron tulipifera, Acer saccharum, Magnolia tripetala, Magnolia acuminata* (Ozarks), *Tilia americana var. americana* (Ozarks), *Tilia americana var. heterophylla, Quercus muehlenbergii, Acer rubrum, Cornus florida, Ostrya virginiana, Aesculus sylvatica*, and *Ilex opaca*. Some of these forests, especially in the Piedmont of South Carolina, the southern Ridge and Valley of Alabama, or in Arkansas, may contain *Acer barbatum* instead of *Acer saccharum*. Shrubs in this alliance include *Vaccinium stamineum, Viburnum rafinesquianum, Euonymus americanus*, and, in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Hexastylis arifolia, Hexastylis minor, Desmodium nudiflorum, Erythronium umbilicatum ssp. umbilicatum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Trillium* spp., *Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others present.

On Crowley's Ridge, Arkansas (Cross County south through Phillips County), canopies are dominated by *Fagus grandifolia, Quercus alba*, and *Liriodendron tulipifera*, with associates including *Fraxinus americana, Sassafras albidum, Ulmus rubra, Quercus michauxii, Acer saccharum, Magnolia acuminata, Carya illinoinensis*; and *Liquidambar styraciflua, Juglans cinerea, Ilex opaca, Tilia americana, Gymnocladus dioicus, Quercus pagoda*, and *Carya cordiformis* in the deep moist gullies. Understory species include *Asimina triloba, Ostrya virginiana, Hydrangea arborescens, Lindera benzoin, Cornus florida, Carpinus caroliniana, Cercis canadensis, Ilex decidua*, and *Aralia spinosa*; smaller shrubs include *Vaccinium arboreum, Vaccinium stamineum*, and *Vaccinium pallidum*. *Schisandra glabra* often forms a lush sprawling groundcover, sometimes reaching the canopy. Other herbaceous species include *Phegopteris hexagonoptera, Polystichum acrostichoides, Diplazium pycnocarpon, Osmunda cinnamomea, Osmunda regalis, Asarum canadense, Podophyllum peltatum, Arisaema dracontium, Arisaema triphyllum, Actaea pachypoda, Uvularia* spp., *Maianthemum racemosum, Polygonatum* spp., *Trillium* spp., and *Smilax* spp. These stands were formerly assigned to an association in the related (but more southerly) ~*Fagus grandifolia - Quercus alba* Forest Alliance (A.228).

Dynamics:

Similar Alliances:

- *Betula alleghaniensis - Fagus grandifolia - Aesculus flava* Forest Alliance (A.266)
- *Fagus grandifolia - Acer saccharum - (Liriodendron tulipifera)* Forest Alliance (A.227)

• *Fagus grandifolia - Quercus alba* Forest Alliance (A.228)--is an equivalent alliance found in the Coastal Plain and generally outside of the range of *Quercus rubra*.
• *Fagus grandifolia* Temporarily Flooded Forest Alliance (A.284)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: The core concept of the range of this alliance includes areas inland from the Coastal Plain, as *Quercus rubra* is absent from large areas of this region. Forests in this alliance occur in the Cumberlands and Southern Ridge and Valley, Piedmont, and Interior Low Plateau, and on protected slopes and ravines in the Ozarks, central Ouachita Mountains, and Arkansas Valley. This alliance is known from the states of Alabama, Arkansas, Delaware, Georgia, Kentucky, Massachusetts, Maryland, North Carolina, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia. It may possibly occur in southern Indiana and Connecticut.
Nations: US
Subnations: AL, AR, DC, DE, GA, IN?, KY, MA, MD, MS, NC, NJ, NY, OK, PA, RI, SC, TN, VA, WV
TNC Ecoregions: 38:C, 39:C, 42:C, 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions: 212Fc:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCP, 221Am:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Ef:CCP, 221Eg:CCP, 221Ha:CCC, 221Hc:CCC, 221Hd:CCP, 221He:CCC, 221Ja:CCP, 221Jb:CC?, 221Jc:CCP, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Cb:CCC, 222Cc:CCC, 222Cd:CC?, 222Ce:CC?, 222Cf:CC?, 222Cg:CCC, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCC, 222Di:CC?, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CC?, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222Em:CCP, 222En:CCP, 222Eo:CCP, 222F:CC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ai:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCP, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CC?, 231Bb:CC?, 231Bc:CCC, 231Be:CC?, 231Bg:CCC, 231Bh:CCC, 231Bi:CC?, 231Bk:CC?, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCC, 231Db:CCC, 231Dc:CCC, 231Dd:CCC, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, 232Bx:CCP, 232Bz:CCC, 232Ch:CCC, 232Cj:CCC, 234Ab:CCC, M221Cc:CCC, M221Da:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC
Federal Lands: COE (Falls Lake, Jordan Lake, Kerr Reservoir); DOD (Fort A.P. Hill, Fort Belvoir, Fort Benning, Fort Dix, Fort Pickett, Yorktown); NPS (Appomattox Court House, Big South Fork, Buffalo River, C&O Canal, Cape Cod, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cumberland Gap, Fort Donelson, Fredericksburg-Spotsylvania, George Washington Parkway, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Little River Canyon, Mammoth Cave, Morristown, Natchez Trace, National Capital-East, Ninety Six, Petersburg, Prince William, Richmond, Rock Creek, Sagamore Hill, Shenandoah, Shiloh, Thomas Stone, Upper Delaware, Wolf Trap); TVA (Land Between the Lakes, Tellico); USFS (Bankhead, Chattahoochee, Cherokee?, Daniel Boone, Holly Springs, Jefferson?, Oconee?, Ouachita, Ozark, St. Francis, Sumter, Talladega, Uwharrie); USFWS (Great Swamp, James River, Lake Isom, Prime Hook)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. A.S. Weakley/K.D. Patterson/S. Landaal/M. Pyne
References: Allard 1990, Ambrose 1990a, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Golden 1979, Jones 1988a, Jones 1988b, Martin and Smith 1991, Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, USFS 1990

[CEGL007881] *Fagus grandifolia - Quercus alba / Cornus florida* Forest

Translated Name: **American Beech - White Oak / Flowering Dogwood Forest**
Common Name: **Central Interior Beech - White Oak Forest**

Ecological System(s):
• South-Central Interior Mesophytic Forest (CES202.887)
• East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest (CES203.477)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Pyne after S. Franklin

ELEMENT CONCEPT

Global Summary: This beech-white oak forest is found in the Interior Low Plateau and the Southern Ridge and Valley of Kentucky, Tennessee (and possibly adjacent Georgia), the Cumberland region of Kentucky, and adjacent areas of the Upper East Gulf Coastal Plain. Stands occur on mesic mid to lower slopes in moderately dissected terrain. Stand positions vary from north-facing slopes and low slopes to high terraces along streams. The vegetation is generally dominated by

Fagus grandifolia with more or less *Quercus alba* depending on past logging history. Associated canopy and subcanopy species can include *Acer saccharum, Quercus muehlenbergii, Fraxinus americana, Liriodendron tulipifera, Nyssa sylvatica, Sassafras albidum, Acer rubrum, Cornus florida, Ostrya virginiana*, and *Ilex opaca*. Shrubs which may be present include *Vaccinium stamineum, Viburnum acerifolium, Euonymus americanus*, and, in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Desmodium nudiflorum, Erythronium americanum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This beech-white oak forest was sampled at six locations in the park. Sites range from gentle to somewhat steep, north-, northwest- and east-facing lower to midslopes and ridges at 147 to 270 m (482-887 feet) elevation. Soils are dry-mesic to mesic, moderately well- to well-drained clay, clay loam, and silt loam. The unvegetated surface is dominated by leaf litter (90-98% cover) with some exposed bedrock (0-2%), large rocks (0-5%) and wood (2-5%). Evidence of disturbance includes past clearing and old fencing (likely for grazing livestock), dogwood anthracnose, and the presence of exotic plants.

Global Environment: Stands occur on mesic mid to lower slopes in moderately dissected terrain. Stand positions vary from north-facing slopes and low slopes to more rocky stands (Franklin et al. 1993). At Land Between the Lakes, this community is restricted to deep limestone-derived soils of the Baxter Series and silty soils of the Brandon Series, generally on lower slopes with northwest, north, to southeast aspects (Franklin 1990). This association is generally found between oak-hickory forests above and even more mesic and rich stands below in more concave and deeply dissected terrain, if that is available in the landscape.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately dense to dense (70-90% cover) tree canopy, 15-50 m tall, is dominated by *Quercus alba* and *Fagus grandifolia*. Stands also contain *Acer saccharum, Liriodendron tulipifera*, and may include *Carya* spp., and other *Quercus* spp. The sparse to moderate (30-60%) subcanopy (5-20 m) is dominated by *Acer saccharum* and includes other canopy species. The sparse (10-30%) tall-shrub layer (2-5 m) is also dominated by *Acer saccharum* and may include *Asimina triloba, Cornus florida, Fagus grandifolia*, and *Ostrya virginiana*. The sparse (20-40%) short-shrub layer (0.5-2 m) may be dominated by *Asimina triloba, Lindera benzoin*, and/or *Ostrya virginiana*. The sparse (10-40%) herbaceous layer is dominated by *Polystichum acrostichoides* and may include *Asplenium platyneuron, Cynoglossum virginianum, Desmodium nudiflorum, Galium circaezans, Maianthemum racemosum, Phryma leptostachya, Podophyllum peltatum, Thalictrum thalictroides*, and many others. Vines (up to 20%) are dominated by *Parthenocissus quinquefolia*.

Global Vegetation: The vegetation is dominated by at least 40% *Fagus grandifolia* with more or less *Quercus alba* depending on past logging history. Associated canopy and subcanopy species can include *Liriodendron tulipifera, Acer saccharum, Quercus pagoda, Quercus rubra, Quercus coccinea, Cornus florida, Nyssa sylvatica, Sassafras albidum*, and *Ostrya virginiana* (Franklin 1990, NatureServe Ecology unpubl. data). Other potential species include *Quercus muehlenbergii, Acer rubrum*, and *Ilex opaca*. Shrubs which may be present include *Vaccinium stamineum, Viburnum acerifolium, Euonymus americanus*, and in some occurrences, *Kalmia latifolia*. The herb layer can be relatively lush with such species as *Polystichum acrostichoides, Galium circaezans, Desmodium nudiflorum, Erythronium americanum, Hepatica nobilis var. obtusa, Epifagus virginiana, Tiarella cordifolia var. collina, Heuchera americana, Stellaria pubera, Podophyllum peltatum, Botrychium virginianum*, and others. Campbell (2001) provides an extensive list of species for eastern Kentucky; see also NatureServe Ecology unpublished data from Fort Donelson.

Global Dynamics: Stands may be successionally unstable, with an increase in mesophytic dominants over time (Franklin et al. 1993). However, ground layer fires that eliminated the mesophytic regeneration could stabilize the stands.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree	X	X	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus rubra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Acer saccharum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Asimina triloba	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Ostrya virginiana	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Desmodium nudiflorum	Herb (field)	Forb	X	.	.

Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Elaeagnus umbellata	-	P	exotic
Lonicera japonica	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (31-Jan-2007). This is not an inherently rare forest type, and many examples are still believed to be extant. The lack of element occurrences of this type does not reflect its relative abundance. Patch size may be small, but this is a somewhat widespread association (and may be merged with others as classification is resolved); many examples are still extant. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*) and loss of herbaceous species diversity from the disturbance effects of logging. The Grank has been changed from G3G4 to G4 to reflect its true abundance.

RELATED CONCEPTS

Global Similar Associations:

- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)
- *Fagus grandifolia - Liriodendron tulipifera / Euonymus americanus / Athyrium filix-femina ssp. asplenioides* Forest (CEGL007201)
- *Fagus grandifolia* Ridge and Valley Forest (CEGL007200)
- *Quercus alba - (Liriodendron tulipifera, Liquidambar styraciflua) / Calycanthus floridus / Athyrium filix-femina* Forest (CEGL008428)--of the southern Ridge and Valley.
- *Quercus alba - Fagus grandifolia / Hydrangea quercifolia - Viburnum acerifolium / Carex picta - Polystichum acrostichoides* Forest (CEGL007213)
- *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070)
- *Quercus rubra - Tilia americana var. heterophylla - Carya carolinae-septentrionalis / Acer (barbatum, leucoderme) / Hydrangea quercifolia* Forest (CEGL008488)

Global Related Concepts:

- *Acer saccharum - Quercus alba - Fagus grandifolia* type (Franklin et al. 1993) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Mesic stands at Mammoth Cave that are dominated by white oak and beech are classified as this association (CEGL007881). This is a community that is intermediate between the "matrix" upland oak-hickory stands and the non-oak mesic stands on certain slopes and aspects. This would be distinguished from ~*Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411) at least in part by a lower percentage of oak. This same slope position is occupied by ~*Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest (CEGL007698) on different aspects (e.g., more northerly ones).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This association is similar to ~*Quercus alba - Fagus grandifolia / Hydrangea quercifolia - Viburnum acerifolium / Carex picta - Polystichum acrostichoides* Forest (CEGL007213), found in northern Alabama, but is more broadly defined and geographically distinct from it. The associations have been kept separate until more detailed floristic and range information can be obtained for this type (CEGL007881). CEGL007881 is often less species-rich than the current concept of CEGL007213. ~*Fagus grandifolia - Liriodendron tulipifera / Euonymus americanus / Athyrium filix-femina ssp. asplenioides* Forest (CEGL007201) is somewhat similar but lacks codominance by *Quercus* species. Information on species from stands in eastern Kentucky is provided by Campbell (2001), who tentatively crosswalks his 5C3 to this type. Further review is needed before incorporating his description.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is found primarily in the central and southern parts of the park, including on midslopes with various aspects.

Global Range: This association was defined for the Interior Low Plateau of Tennessee. It ranges to the Cumberlands and Interior Low Plateau of Kentucky and Upper East Gulf Coastal Plain in Tennessee, but more information is needed to

determine its full range. Currently the range across USFS Sections 221H, 222E, and 222C covers approximately 58,000 square km.
Nations: US
States/Provinces: AL?, GA?, IN?, KY, TN, VA?
TNC Ecoregions: 43:C, 44:C, 50:C
TNC Ecoregion Comments: ECO43 changed from P to C (CWN 2-04). ECO50 added (MP/DFL 2-01).
USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Cg:CCC, 222Dg:CCC, 222Dj:CCC, 222Eb:CCP, 222Eg:CCC, 222Eh:CCP, 222Ei:CCP, 222Ek:CCP, 222Em:CCP, 222En:CCP, 222Eo:CCP, 231Cc:CCC
Federal Lands: NPS (Big South Fork, Chickamauga-Chattanooga, Cumberland Gap, Fort Donelson, Mammoth Cave, Natchez Trace, Shiloh); USFS (Daniel Boone, Jefferson?, Land Between the Lakes)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.3, MACA.5, MACA.56, MACA.72, MACA.714, MACA.721.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Pyne, mod. C.W. Nordman
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Campbell 2001	.	.	.	X	.	.	.	.	.
Evans 1991 .	X	.	X	.	.	.	.	.	
Franklin et al. 1993	.	.	X	X	.	.	.	.	.
Franklin pers. comm.	.	X	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.1932 Juglans nigra *Forest Alliance*

Black Walnut Forest Alliance

ALLIANCE CONCEPT

Summary: These are successional forests usually dominated or codominated by *Juglans nigra*, often associated with former homesites or other disturbances on fertile alluvial deposits. This alliance is more widespread than the data would suggest due to the lack of attention this successional community attracts in community surveys.
Environment: This alliance occurs on flats or gentle slopes in historically disturbed areas such as old homesites.
Vegetation: Although usually dominated by *Juglans nigra*, the canopy can also contain *Liriodendron tulipifera* and/or *Robinia pseudoacacia* at very high densities. At Mammoth Cave National Park (Kentucky), the subcanopy may include *Acer negundo, Frangula caroliniana, Morus rubra*, and *Nyssa sylvatica*. The tall-shrub layer may include *Corylus americana, Sambucus canadensis*, and *Sassafras albidum*. The short-shrub layer is dominated by *Symphoricarpos orbiculatus*, along with *Rubus occidentalis*. The herb layer is dominated by *Verbesina alternifolia*; other herbs include *Chasmanthium latifolium* and *Polystichum acrostichoides*.
Dynamics: The alliance seems to occur on heavily impacted old homesites. It prefers calcium-rich soils.
Similar Alliances:
• *Juglans nigra - Aesculus glabra - Celtis (laevigata, occidentalis)* Forest Alliance (A.232)--seems to be restricted to the Bluegrass Region of Kentucky and Tennessee and appears to be a much more diverse ecosystem not derived from human disturbance.
Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance has been documented from the Piedmont, Cumberlands, Southern Blue Ridge, and Interior Low Plateau, and ranges from the Carolinas to Tennessee and Kentucky, and north into northern New Jersey, Pennsylvania and possibly into other states in the northeastern U.S.
Nations: US
Subnations: GA, KY, MD?, NC, NJ, NY?, PA, SC, TN, VA, WV
TNC Ecoregions: 44:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C
USFS Ecoregions: 212Fc:CCC, 221Bd:CCC, 221Hc:CCC, 221Ja:C??, 222Dg:CCC, 231Aa:PPP, 231Ae:PPP, M221Bb:CCC, M221Be:CCC, M221Cc:CCC, M221Ce:CCC, M221Dd:CCC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Antietam?, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, C&O Canal?, Chickamauga-Chattanooga, Colonial, Cumberland Gap, Delaware Water Gap,

George Washington Parkway?, Great Smoky Mountains, Harpers Ferry, Kings Mountain, Mammoth Cave, Manassas, Ninety Six, Richmond)

ALLIANCE SOURCES

Author(s): K.D. Patterson, mod. M. Pyne
References: NatureServe Ecology - Southeastern U.S. unpubl. data, Southeastern Ecology Working Group n.d.

[CEGL007879] *Juglans nigra / Verbesina alternifolia* Forest

Translated Name: **Black Walnut / Wingstem Forest**
Common Name: **Successional Black Walnut Forest**
Ecological System(s):

- South-Central Interior Large Floodplain (CES202.705)
- Central Appalachian River Floodplain (CES202.608)
- South-Central Interior Mesophytic Forest (CES202.887)

Status: Standard
Circumscription Confidence: 3 - Weak
Concept Author(s): K.D. Patterson

ELEMENT CONCEPT

Global Summary: This successional black walnut forest of the eastern United States occurs in a variety of habitats, all associated with disturbance, and frequently associated with rich or circumneutral soils, usually having a neutral to basic pH. These habitats include ridgetops, slopes, floodplains, alluvial terraces, and the floors of sinkholes. These are all generally areas that were cleared for agriculture or homesites. It has been documented from various-sized drainages. The community was originally defined from former homesites in Great Smoky Mountains National Park, where this association is an open, successional forest. It has since been found on some old pasture sites, associated with former settlements, from Georgia northeast to Pennsylvania, and is potentially a wide-ranging type. It has also been sampled from the floors of sinkholes and other related areas at Mammoth Cave National Park. The canopy can be closed to somewhat open. *Juglans nigra* forms at least half of the canopy and is often the sole canopy tree. Associated canopy trees vary from site to site and can include *Liriodendron tulipifera, Juglans cinerea, Robinia pseudoacacia, Fraxinus americana, Ulmus americana, Platanus occidentalis, Acer saccharum, Acer nigrum, Morus rubra*, and *Aesculus flava*. Additional tree species in the subcanopy can include *Carya cordiformis* and *Celtis occidentalis*. *Sassafras albidum* and/or *Carpinus caroliniana* may be present as small trees. The shrub layer may or may not be well-developed; common species include *Asimina triloba, Viburnum prunifolium, Lindera benzoin, Corylus americana*, and the exotic invasive *Rosa multiflora*. The herb layer is variable, often with one or a few species providing most of the cover. *Verbesina alternifolia* (within its range) and *Ageratina altissima* are characteristic and may be dominant; other herbs include *Ambrosia trifida, Amphicarpaea bracteata, Agrimonia pubescens, Apios americana, Cryptotaenia canadensis, Galium triflorum, Osmorhiza longistylis, Dichanthelium clandestinum, Packera aurea, Polygonum virginianum, Rudbeckia laciniata, Podophyllum peltatum, Impatiens capensis, Circaea lutetiana ssp. canadensis, Viola striata*, and *Ambrosia trifida*. The invasive exotics *Microstegium vimineum, Alliaria petiolata, Rosa multiflora*, and *Polygonum caespitosum* can be common in this community.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This successional black walnut forest was sampled at five locations in the park. Sites include the floors of sinkholes, as well as other terraces and basins at 155 to 245 m (510-800 feet) elevation. The community has presumably developed in these fertile areas following the cessation of agriculture. The soil at one site is moderately well-drained clay loam; no additional soil information was collected. The unvegetated surface is dominated by leaf litter (10-100% cover) or lichens (0-90%) with some wood (0-10%). Evidence of disturbance includes roads and the presence of exotic plants; one site was formerly part of a resort area (Wondering Woods), and evidence of abandoned fruit orchards may be present.
Global Environment: This successional community occurs in a variety of habitats, all associated with disturbance, and frequently associated with rich or circumneutral soils. These habitats include ridgetops, slopes, floodplains, alluvial terraces, and the floors of sinkholes. These are all generally areas that were cleared for agriculture or homesites. It has been sampled on former homesites along streams at 460-610 m (1500-2000 feet) elevation in the Smokies, as well as on ridgetops, slopes, and stream areas in the Cumberlands, Alleghenies, and Central Appalachians at 430-1070 m (1400-3500 feet). In addition, the association was sampled from the Piedmont of South Carolina in low-lying, poor-drainage areas from approximately 170-200 m (550-650 feet) in elevation. At Mammoth Cave National Park, it was most frequently sampled from terraces in the bottoms of sinkholes. Along the Delaware River and nearby waters, the substrate varies from silt loam to gravelly sandy loams.This community was sampled on former homesites along streams at 460-610 m (1500-

2000 feet) elevation in the Smokies, as well as on ridgetops, slopes, and stream areas in the Cumberlands, Alleghenies, and Central Appalachians at 430-1070 m (1400-3500 feet). In addition, the association was sampled from the Piedmont of South Carolina in low-lying, poor-drainage areas from approximately 170-200 m (550-650 feet) in elevation. At Mammoth Cave National Park, it may occur on terraces in the bottoms of sinkholes. Along the Delaware River and nearby waters, the substrate varies from silt loam to gravelly sandy loams.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 10-35 m tall, is dominated by *Juglans nigra*; additional species may include *Acer negundo, Liriodendron tulipifera, Platanus occidentalis, Prunus serotina var. serotina, Quercus imbricaria, Tilia americana, Ulmus americana* (which may codominate in some examples), and *Ulmus rubra*. The sparse (5-30%) subcanopy (5-20 m) is comprised of canopy species. The sparse (10-30%) tall-shrub layer (1-5 m) may include canopy species as well as *Corylus americana, Frangula caroliniana, Lindera benzoin, Nyssa sylvatica*, and *Sambucus canadensis*. The very sparse to very dense (10-90%) short-shrub layer (1-2 m) is dominated by *Symphoricarpos orbiculatus*. The sparse to dense (30-80%) herbaceous layer may include *Ageratina altissima, Amphicarpaea bracteata, Arisaema dracontium, Boehmeria cylindrica, Bromus pubescens, Menispermum canadense, Pilea pumila, Polystichum acrostichoides, Solidago gigantea, Symphyotrichum ontarionis, Verbesina alternifolia, Verbesina occidentalis*, and others. The invasive exotic *Microstegium vimineum* can be quite abundant. Vines (up to 20%) include *Vitis* spp. This community also supports state-vulnerable *Juglans cinerea*.

Global Vegetation: The canopy can be closed to somewhat open. *Juglans nigra* forms at least half of the canopy and is often the sole canopy tree. Associated canopy trees vary from site to site and can include *Liriodendron tulipifera, Juglans cinerea, Robinia pseudoacacia, Fraxinus americana, Ulmus americana, Platanus occidentalis, Acer saccharum, Acer nigrum, Morus rubra*, and *Aesculus flava*. Additional tree species in the subcanopy can include *Carya cordiformis* and *Celtis occidentalis*. *Sassafras albidum* and/or *Carpinus caroliniana* may be present as small trees. The shrub layer may or may not be well-developed; common species include *Asimina triloba, Viburnum prunifolium, Lindera benzoin, Corylus americana*, and the exotic invasive *Rosa multiflora*. The herb layer is variable, often with one or a few species providing most of the cover. *Verbesina alternifolia* (within its range) and *Ageratina altissima* are characteristic and may be dominant; other herbs include *Amphicarpaea bracteata, Agrimonia pubescens, Apios americana, Cryptotaenia canadensis, Galium triflorum, Osmorhiza longistylis, Dichanthelium clandestinum, Packera aurea, Polygonum virginianum, Rudbeckia laciniata, Podophyllum peltatum, Impatiens capensis, Circaea lutetiana ssp. canadensis, Viola striata*, and *Ambrosia trifida*. The invasive exotics *Microstegium vimineum, Alliaria petiolata*, and *Polygonum caespitosum* can be common in this community.

Global Dynamics: Since this community was the product of an anthropogenic catastrophic disturbance, the canopy is likely to change drastically as new species of trees colonize gaps left by senescent walnuts. *Juglans nigra* may obtain canopy dominance due to its resistance to grazing pressure on young seedlings due to the unpalatable juglone which is present in the leaves and stems. This allelopathic compound also inhibits the growth of *Rubus argutus, Rubus alleghenienesis* and other related species (blackberries), which would help keep the shrub layer open and reduce species diversity.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Ulmus americana	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Juglans nigra	Tree canopy	Broad-leaved deciduous tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Acer negundo	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Amphicarpaea bracteata	Herb (field)	Forb	X	.	.
Arisaema dracontium	Herb (field)	Forb	X	.	.
Boehmeria cylindrica	Herb (field)	Forb	X	.	.
Menispermum canadense	Herb (field)	Forb	X	.	.
Pilea pumila	Herb (field)	Forb	X	.	.
Verbesina alternifolia	Herb (field)	Forb	X	X	.
Verbesina occidentalis	Herb (field)	Forb	X	X	.
Bromus pubescens	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note
Vitis sp.	dominant vine

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juglans nigra	Tree canopy	Broad-leaved deciduous tree	X	X	.

Cercis canadensis	Tree subcanopy	Broad-leaved deciduous tree	.	X	.
Rosa multiflora	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.
Verbesina alternifolia	Herb (field)	Forb	X	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Glechoma hederacea	-	P	exotic
Juglans cinerea	-	P	state-vulnerable
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Alliaria petiolata	-	P	invasive exotic
Microstegium vimineum	-	P	invasive exotic
Polygonum caespitosum	-	P	invasive exotic
Rosa multiflora	-	P	invasive exotic

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (2-Apr-2001). This vegetation represents vegetation created by anthropogenic disturbance and is thus not a conservation priority. Grank changed from GW to GD 2001-04-02 MP.

RELATED CONCEPTS

Global Similar Associations:

• *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest (CEGL006599)--is a modified successional forest that may also have a large component of *Juglans nigra* and occurs on disturbed sites, but it is largely dominated by early-successional trees in the canopy.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments: Some stands of black walnut at MACA may have originated from plantings (Henry Holman, MACA NPS, pers. comm.).

Global Classification Comments: This association was originally described from Great Smoky Mountains National Park where this association can be distinguished with aerial photography.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: Most examples of this type are found in sinkholes, which are more abundant in the central parts of the park.

Global Range: This association is currently known from Georgia and the Carolinas to Tennessee and Kentucky, north to Pennsylvania and New Jersey where *Juglans nigra* is near the northern end of its range. It may range into adjacent states.

Nations: US

States/Provinces: GA, KY, MD?, NC, NJ, NY?, PA, SC, TN, VA, WV

TNC Ecoregions: 44:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C

TNC Ecoregion Comments: ECO44 & 222Dg added for MACA (MP 9-08). ECO60, ECO61, M221Be:CCC, 212Fc:CCC, 221Bd:CCC added and ECO52 changed from P to C when CEGL006449 from the Delaware River was folded into this type. ECO59 & M221Bb:CCC added for Camp Dawson WV (SCG 10-06). ECO50 & 221Hc added for BISO (CWN 4-05). ECO52 added (RW 3-03).

USFS Ecoregions: 212Fc:CCC, 221Bd:CCC, 221Hc:CCC, 221Ja:C??, 222Dg:CCC, 231Aa:PPP, 231Ae:PPP, M221Bb:CCC, M221Be:CCC, M221Cc:CCC, M221Ce:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Antietam?, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, C&O Canal?, Chickamauga-Chattanooga, Colonial, Cumberland Gap, Delaware Water Gap, Great Smoky Mountains, Harpers Ferry, Kings Mountain, Mammoth Cave, Manassas, Ninety Six, Richmond)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.49, MACA.51, MACA.75, MACA.95, MACA.742.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): K.D. Patterson, mod. R. White, S.C. Gawler, M. Pyne

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Lea 2004 .	X	.	X	.	.	.	.	.	

NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Peet et al. unpubl. data 2002	.	.	.	X	.	.	.	.	.
Podniesinski et al. 2006	.	X	.	X	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Vanderhorst et al. 2008	.	X	.	X	.	.	.	.	.

A.236 Liriodendron tulipifera *Forest Alliance*

Tuliptree Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes deciduous forests dominated by *Liriodendron tulipifera*, primarily in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These non-wetland forests are also found along mesic stream terraces and on upland mountain benches. Forests in this alliance are abundant in the central and southern Appalachians, below 915 m (3000 feet) elevation, usually associated with disturbance and on the most productive sites, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau. This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* as well as forests with *Liriodendron tulipifera* associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum, Robinia pseudoacacia, Betula lenta, Acer saccharum*, and *Acer negundo* are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* is a common associate. In the Appalachians, *Halesia tetraptera, Tsuga canadensis, Tilia americana var. heterophylla (= Tilia heterophylla), Prunus serotina var. serotina*, and *Magnolia fraseri* can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra, Magnolia acuminata, Carya alba, Carya glabra, Pinus virginiana, Sassafras albidum, Pinus strobus, Carpinus caroliniana, Asimina triloba*, and *Staphylea trifolia*. Herbaceous strata are not diverse and, in the southern Appalachians, this feature distinguishes these forests from rich cove forests in *~Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). Vines can be abundant including *Vitis* spp., *Smilax* spp., *Aristolochia macrophylla*, and *Parthenocissus quinquefolia*. Forests in this alliance occur on middle to lower slopes, sheltered coves and gentle concave slopes, and river terraces over various soils and geologies. Vegetation of this alliance is uncommon in Louisiana.

Environment: Forests in this alliance are primarily found in areas which were once clearcut, old fields, or cleared by fire or other natural disturbances. These forests are also found along streams in flat bottoms and on upland mountain benches. Forests in this alliance are abundant in the central and southern Appalachians, below 915 m (3000 feet) elevation, usually associated with disturbance and on the most productive sites. They also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.

Vegetation: This alliance includes pure, often even-aged stands of *Liriodendron tulipifera* as well as forests with *Liriodendron tulipifera* associated with other species favored by canopy openings. Associated species vary with geographic location. Throughout most of the range of this alliance, *Acer rubrum, Robinia pseudoacacia, Betula lenta, Acer saccharum*, and *Acer negundo* are common components. In the Piedmont and Coastal Plain, *Liquidambar styraciflua* is a common associate. In the Appalachians, *Halesia tetraptera, Tsuga canadensis, Tilia americana var. heterophylla (= Tilia heterophylla), Prunus serotina var. serotina*, and *Magnolia fraseri* can be additional components. In the Ridge and Valley and Cumberland Plateau, additional species include *Quercus rubra, Magnolia acuminata, Carya alba, Carya glabra, Pinus virginiana, Sassafras albidum, Pinus strobus, Carpinus caroliniana, Asimina triloba*, and *Staphylea trifolia*. Herbaceous strata are not diverse and, in the southern Appalachians, this feature distinguishes these forests from rich cove forests in *~Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). Vines can be abundant including *Vitis* spp., *Smilax* spp., *Aristolochia macrophylla*, and *Parthenocissus quinquefolia*.

Dynamics:

Similar Alliances:

- *Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum)* Temporarily Flooded Forest Alliance (A.287)--temporarily flooded forests dominated or codominated by *Liriodendron tulipifera*.
- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)
- *Pinus taeda - Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434)--temporarily flooded forests dominated or codominated by *Liriodendron tulipifera*.

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Maryland, Pennsylvania, Virginia, and West Virginia. Forests in this alliance are abundant in the central and

southern Appalachians, below 915 m (3000 feet) elevation, but also occur in the Coastal Plain, Piedmont, Ridge and Valley, and Cumberland Plateau.
Nations: US
Subnations: AL, DC, DE, FL?, GA, KY, LA, MD, MS, NC, NJ, PA, SC, TN, VA, WV
TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 53:P, 58:C, 59:C, 61:C
USFS Ecoregions: 221Da:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Jb:CCC, 222Cg:CCC, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ed:CCP, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Ai:CCC, 231Ak:CCC, 231Al:CCC, 231An:CCC, 231Ap:CCC, 231Bc:CCC, 231Bh:CCC, 231Cd:CCC, 231Dc:CCC, 232Ad:CCC, 232Br:CCC, 232D:CP, 234Ab:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Be:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC
Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Abe Lincoln Birthplace, Antietam, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, Booker T. Washington, C&O Canal, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cowpens, Cumberland Gap, Fort Donelson, Fort Necessity, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Harpers Ferry, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Manassas, Monocacy?, Morristown, Natchez Trace, National Capital-East, New River Gorge, Ninety Six, Obed, Petersburg, Prince William, Richmond, Rock Creek, Shenandoah, Shiloh, Thomas Stone, Valley Forge, Vicksburg, Wolf Trap); TVA (Tellico); USFS (Apalachicola?, Bankhead, Bienville?, Chattahoochee, Cherokee, Conecuh?, Daniel Boone, De Soto?, George Washington, Jefferson, Monongahela, Nantahala, Oconee?, Pisgah, Sumter, Talladega, Tombigbee?, Tuskegee?)

ALLIANCE SOURCES

Author(s): D.J. Allard
References: Andreu and Tukman 1995, Eyre 1980, Gallyoun et al. 1996, Golden 1974, Horn 1980, McGee and Hooper 1970, Phillips and Shure 1990, Schmalzer 1978, Southeastern Ecology Working Group n.d., Thomas 1966

[CEGL007221] *Liriodendron tulipifera - Quercus* spp. Forest

Translated Name: **Tuliptree - Oak species Forest**
Common Name: **Successional Tuliptree - Oak Forest**
Ecological System(s):
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): A.S. Weakley and A. Andreu

ELEMENT CONCEPT

Global Summary: This broadly defined semi-natural or successional community is one of several described upland associations dominated by *Liriodendron tulipifera*. 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. 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, Quercus* spp., and occasionally *Liquidambar styraciflua* or *Robinia pseudoacacia* may be common in stands of this type; *Betula lenta* often occurs at the northern end of the range. The oaks in these stands are frequently multi-stemmed, resulting from coppicing. Shrub composition is variable but may include *Sambucus canadensis* and *Vaccinium pallidum*. Herbs are likewise variable; West Virginia samples feature *Dioscorea quaternata, Lysimachia quadrifolia, Maianthemum racemosum, Solidago curtisii, Symphyotrichum prenanthoides*, and *Geranium maculatum*. This association differs from other described types in the alliance 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) or *~Liriodendron tulipifera - Acer rubrum - Robinia pseudoacacia* Forest (CEGL007219).

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This successional tuliptree-oak forest was sampled at one location in the park. The site is a gently sloping, west-facing summit at 293 m (960 feet) elevation. No other environmental data are provided. The site was burned in spring 2005, resulting in the death of most of the tall shrubs.

Global Environment: 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

Mammoth Cave National Park Vegetation: This association has a moderate canopy (40% cover) over a dense subcanopy (90%). The canopy is dominated by *Liriodendron tulipifera, Pinus virginiana*, and *Acer rubrum*, the subcanopy by *Cornus florida, Oxydendrum arboreum*, and *Juniperus virginiana*. This is an unusual stand in which the subcanopy of old, large *Cornus florida* dominates (70% cover). There is also a sparse (20%) canopy layer of *Acer rubrum, Carya alba, Liriodendron tulipifera, Pinus virginiana*, and *Quercus falcata*. The subcanopy also includes *Juniperus virginiana* and *Oxydendrum arboreum*. Shrubs include *Asimina triloba, Fagus grandifolia, Lindera benzoin, Oxydendrum arboreum, Toxicodendron radicans*, and others. The herbaceous layer is dominated by *Polystichum acrostichoides* and includes *Aristolochia serpentaria, Cynoglossum virginianum, Desmodium nudiflorum, Dichanthelium boscii, Passiflora lutea, Potentilla simplex, Sanicula smallii, Uvularia perfoliata*, and *Viola X palmata*. Vines are dominated by *Parthenocissus quinquefolia*.

Global Vegetation: The canopy of this semi-natural upland association is dominated by *Liriodendron tulipifera*. *Quercus* species (*Quercus alba, Quercus rubra, Quercus falcata, Quercus nigra, Quercus velutina*) are often present; additional associates may include *Acer barbatum, Acer rubrum, Carya* spp., *Fagus grandifolia, Nyssa sylvatica, Cornus florida*, and *Robinia pseudoacacia*. *Betula lenta* is a common associate at the northern range limit. Shrub layers may include saplings of the canopy species and *Acer pensylvanicum, Amelanchier arborea, Hamamelis virginiana, Lindera benzoin* (in small amounts), and *Vaccinium pallidum*. Herbs vary across the range but may include *Actaea racemosa, Dichanthelium clandestinum, Dioscorea quaternata, Galium circaezans, Geranium maculatum, Goodyera pubescens, Medeola virginiana, Potentilla simplex, Scutellaria serrata, Thelypteris noveboracensis*, and *Uvularia perfoliata*. *Lycopodium digitatum* may be abundant in some stands.

Global Dynamics: This community is widespread in areas that had stand-initiating disturbance such as heavy logging or plowing in the recent past. In areas that have been protected for more than 80 years, this community is uncommon.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus virginiana	Tree canopy	Needle-leaved tree	X	.	.
Acer rubrum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carya alba Tree canopy	Broad-leaved deciduous tree X		.	.	
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Carya glabra	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Fagus grandifolia	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Liriodendron tulipifera	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	X
Nyssa sylvatica	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Quercus falcata	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Quercus rubra	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Quercus velutina	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Robinia pseudoacacia	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Acer pensylvanicum	Shrub/sapling (tall & short)	Broad-leaved deciduous tree	.	X	.
Amelanchier arborea	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.
Hamamelis virginiana	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.
Vaccinium pallidum	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.

Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Actaea racemosa	Herb (field)	Forb	.	X	.
Galium circaezans	Herb (field)	Forb	.	X	.
Geranium maculatum	Herb (field)	Forb	.	X	.
Goodyera pubescens	Herb (field)	Forb	.	X	.
Medeola virginiana	Herb (field)	Forb	.	X	.
Uvularia perfoliata	Herb (field)	Forb	.	X	.
Dichanthelium clandestinum	Herb (field)	Graminoid	.	X	.
Lycopodium digitatum	Herb (field)	Fern or fern ally	X	X	.
Thelypteris noveboracensis	Herb (field)	Fern or fern ally	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Hexastylis naniflora	G3	P	Federally listed threatened

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (19-Aug-2002). This forest represents early-successional vegetation and is thus not of conservation concern. 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.

RELATED CONCEPTS

Global 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.
- *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest (CEGL006599)
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest (CEGL004133)

Global Related Concepts:

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

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: Within its range, it differs from other described types 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).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found near Crystal Cave Road, off Flint Ridge Road.

Global 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.

Nations: US

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

TNC Ecoregions: 43:P, 44:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C

TNC Ecoregion Comments: ECO51 & M221Dd added for Cherokee Nation (mjr 11-07). ECO58 & 232BR added for FRSP (mjr 3-07). ECO59 & M221Bb:CCC added for Camp Dawson WV (SCG 10-06). ECO61 added for Morristown (mjr 12-04). ECO44 changed from P to C (REE 10-03). ECO58 removed as per Chesapeake Bay Working Group (sln 9-01). ECO58 added (LAS 10-99).

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Cg:CCC, 222Dg:CCC, 222Eb:CCC, 222Eg:CCC, 222En:CCC, 222Eo:CCC, 231Aa:CCP, 231Ab:CCC, 231Ae:CCC, 231Ak:CCC, 231An:CCC, 231Bc:CCC, 231Bh:CCC, 231Cd:CCP, 231Dc:CCC, 232Br:CCC, M221Bb:CCC, M221Cb:CCC, M221Cd:CCC, M221Dd:CCC

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?, Catoctin Mountain?, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Fredericksburg-Spotsylvania, 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))

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.81.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): R.E. Evans and M. Pyne, mod. L.A. Sneddon, R. White, S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Ehrenfeld 1977	.	X	X	X	.	.	.	.	.
Gallyoun et al. 1996	.	X	.	X	.	.	.	.	.
Keever 1973	.	.	.	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Overlease 1987	.	.	.	X	.	.	.	.	.
Russell and Schuyler 1988	.	.	.	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Vanderhorst 2001a	.	X	X	X	.	.	.	.	.
Vanderhorst and Streets 2006	.	X	.	X	.	.	.	.	.

[CEGL007220] *Liriodendron tulipifera / (Cercis canadensis) / (Lindera benzoin)* Forest

Translated Name: **Tuliptree / (Eastern Redbud) / (Northern Spicebush) Forest**

Common Name: **Successional Tuliptree Forest (Rich Type)**

Ecological System(s):

- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)
- Southern Atlantic Coastal Plain Mesic Hardwood Forest (CES203.242)
- South-Central Interior Mesophytic Forest (CES202.887)
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Status: Standard

Circumscription Confidence: 3 - Weak

Concept Author(s): M. Andreu and M. Tukman, mod. R.E. Evans and M. Pyne, mod. G. Fleming and J. Teague

ELEMENT CONCEPT

Global Summary: This semi-natural or successional community dominated by *Liriodendron tulipifera* occurs in the Ridge and Valley of Tennessee and Virginia, the Interior Low Plateau of Kentucky, and the Central Appalachians, Piedmont and inner Coastal Plain regions of Virginia, West Virginia, and Maryland. Plots attributable to this type are also known from the Piedmont of Georgia. It may also occur in similar regions of Pennsylvania and Delaware. It is distinguished from other upland communities dominated by *Liriodendron tulipifera* by the presence of species associated with soils with moderately high base saturation levels (rich soils). Species found in stands attributable to this type may be fairly diverse and result in a varied composition. In addition to *Liriodendron tulipifera*, other canopy species may include *Liquidambar styraciflua, Acer saccharum, Aesculus flava, Platanus occidentalis, Quercus rubra, Acer rubrum, Robinia pseudoacacia, Juglans nigra, Halesia tetraptera, Fraxinus americana, Fagus grandifolia, Magnolia acuminata, Ulmus rubra, Quercus imbricaria, Quercus muehlenbergii*, and *Carya ovata*. Species often found in the subcanopy include *Acer saccharum, Cercis canadensis, Ulmus alata, Fraxinus americana, Morus rubra*, and *Cornus florida*. Shrubs include saplings of the subcanopy and canopy species, as well as *Lindera benzoin, Symphoricarpos orbiculatus, Asimina triloba, Staphylea trifolia, Acer negundo*, and *Juniperus virginiana var. virginiana*. Exotic shrubs, including *Rosa multiflora, Rubus phoenicolasius*, and *Lonicera japonica*, are present at some sites. Herb-layer species include the exotics *Microstegium vimineum, Alliaria petiolata*, and *Veronica hederifolia*, as well as *Toxicodendron radicans, Parthenocissus*

quinquefolia, Smilax tamnoides, Actaea racemosa, Caulophyllum thalictroides, Laportea canadensis, Impatiens pallida, Hydrophyllum canadense, Adiantum pedatum, Polygonatum pubescens, Verbesina alternifolia, Amphicarpaea bracteata, and *Polystichum acrostichoides*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This successional tuliptree forest was sampled at eight locations in the park. Sites range from flat sinkholes and basins to moderate to somewhat steep, lower to midslopes and summits with western, northern or eastern aspects. Elevations range from 223 to 294 m (732-963 feet). Soils are moderately well-drained silt loam and clay loam. The unvegetated surface is dominated by leaf litter (70-98% cover) with some large rocks (0-30%), wood (0-10%) and bare soil (0-10%). Evidence of disturbance includes past logging and the presence of exotic plants.

Global Environment: These forests are found on disturbed mesic areas underlain by rich soils with moderately high base saturation levels. It occurs on abandoned farmland and townsites, old strip mines, old clearcuts, burned areas, and other areas where the canopy was removed or heavily disturbed in the past. Small patches may occur in areas where canopy disturbance has resulted from natural causes such as windfall or landslides. Soils may be underlain by a variety of geologic strata that weather to base-rich soils including limestone, dolomite, calcareous shale, shell deposits, metabasalts and granitic complexes. In Kentucky this association may occur on calcareous substrates in the Dripping Springs Escarpment. At Shenandoah National Park in Virginia, this community is underlain by Catoctin metabasalt or a pyroxene-bearing granitic complex. In West Virginia, parent materials include sandstone, shale, and alluvium. Soils in plots were described as moderately well-drained to well-drained clay, silt loam, and sandy loam with pH ranging from 5.0 to 7.5, with relatively high levels of organic matter, estimated N release, Ca, Cu, K, Mg, and Mn, and relatively low levels of S, Al, B, Fe, P, and Zn compared to average values in the area.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The sparse to dense (20-80% cover) tree canopy, 15-35 m tall, is dominated by *Liriodendron tulipifera*; additional canopy species may include *Carya ovata, Fagus grandifolia, Juglans nigra, Platanus occidentalis*, and *Quercus alba*. The sparse to dense (20-80%) subcanopy (5-20 m) may include *Acer saccharum, Carya cordiformis, Cornus florida, Fagus grandifolia, Fraxinus americana, Juniperus virginiana, Liriodendron tulipifera, Nyssa sylvatica, Quercus alba*, and others. The sparse to dense (30-80%) tall-shrub layer (2-10 m) includes saplings of tree species as well as *Asimina triloba, Cercis canadensis, Corylus americana, Lindera benzoin, Sassafras albidum*, and *Symphoricarpos orbiculatus*. The sparse (20-30%) short-shrub layer (0.5-1 m) is dominated by *Symphoricarpos orbiculatus* and includes other tall-shrub species. The herbaceous layer may be sparse or very dense (30-90%); dominants can include *Amphicarpaea bracteata, Brachyelytrum erectum, Actaea racemosa (= Cimicifuga racemosa), Elephantopus carolinianus, Galium circaezans, Polystichum acrostichoides* (constant), and the invasive exotic *Microstegium vimineum* (up to 90% cover). Dominant vines include *Parthenocissus quinquefolia* and *Smilax bona-nox*.

Global Vegetation: Stands are dominated by *Liriodendron tulipifera* but also include various other species, including ones indicative of nutrient-rich or circumneutral environments. Other species include *Liquidambar styraciflua, Acer saccharum, Aesculus flava, Platanus occidentalis, Quercus rubra, Acer rubrum, Robinia pseudoacacia, Juglans nigra, Halesia tetraptera, Fraxinus americana, Fagus grandifolia, Magnolia acuminata, Ulmus rubra, Quercus imbricaria, Quercus muehlenbergii*, and *Carya ovata* (NatureServe Ecology unpubl. data, VDNH unpubl. data, WVNHP unpubl. data.). Species often found in the subcanopy include *Acer saccharum, Cercis canadensis, Ulmus alata, Morus rubra, Sassafras albidum*, and *Cornus florida*. *Cercis canadensis* is often abundant on soils underlain by carbonate strata. Shrubs include saplings of the subcanopy and canopy species, as well as *Symphoricarpos orbiculatus, Lindera benzoin, Asimina triloba*, and *Juniperus virginiana var. virginiana*. *Lindera benzoin* is often abundant in occurrences of this community in the Central Appalachians, Piedmont and inner Coastal Plain regions of Virginia, West Virginia, and Maryland. Exotic shrubs, including *Rosa multiflora, Rubus phoenicolasius*, and *Lonicera japonica*, are present at some sites. Vines, which may be abundant, include *Aristolochia macrophylla, Toxicodendron radicans, Parthenocissus quinquefolia, Smilax tamnoides*, and *Vitis aestivalis var. bicolor*. Herbaceous species include the exotics *Microstegium vimineum, Alliaria petiolata*, and *Veronica hederifolia*, as well as *Actaea racemosa, Ageratina altissima, Arisaema triphyllum, Asarum canadense, Caulophyllum thalictroides, Cryptotaenia canadensis, Galium triflorum, Laportea canadensis, Impatiens pallida, Hydrophyllum canadense, Osmorhiza longistylis, Adiantum pedatum, Polygonatum pubescens, Polystichum acrostichoides, Verbesina alternifolia, Amphicarpaea bracteata, Solidago caesia*, and *Polystichum acrostichoides*. (Andreu and Tukman 1995, NatureServe Ecology unpubl. data, VDNH unpubl. data, WVNHP unpubl. data). Examples at Fort Donelson that have been very heavily disturbed may have local dominance by *Celtis laevigata* and *Juglans nigra*.

Global Dynamics: This community occurs in successional situations, generally where forest clearing has a taken place in the past. In West Virginia, this type is found in areas that have been logged repeatedly, as well as on abandoned farmland and mines.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree canopy	Needle-leaved tree	X	.	.
Acer saccharum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tree canopy	Broad-leaved deciduous tree	X	.	.
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree	X	.	.
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	X	.
Nyssa sylvatica	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	X	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Smilax bona-nox	Herb (field)	Vine/Liana	X	.	.
Amphicarpaea bracteata	Herb (field)	Forb	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Microstegium vimineum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Aesculus flava	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Carya ovata	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Cercis canadensis	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Liriodendron tulipifera	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	X
Ulmus rubra	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	.	X	.
Aristolochia macrophylla	Tree (canopy & subcanopy)	Vine/Liana	.	X	.
Toxicodendron radicans	Tree (canopy & subcanopy)	Vine/Liana	.	X	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	.	X	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	.	X	.
Ageratina altissima	Herb (field)	Forb	.	X	.
Arisaema triphyllum	Herb (field)	Forb	.	X	.
Asarum canadense	Herb (field)	Forb	.	X	.
Cryptotaenia canadensis	Herb (field)	Forb	.	X	.
Galium triflorum	Herb (field)	Forb	.	X	.
Osmorhiza longistylis	Herb (field)	Forb	.	X	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Alliaria petiolata	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Rosa multiflora	-	P	exotic
Rubus phoenicolasius	-	P	exotic
Veronica hederifolia	-	P	exotic

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (28-Oct-2003). This forest represents successional vegetation and is thus not of high conservation concern. It is composed largely of native species, though exotics may be locally abundant. Its conservation value is limited, but mature examples could provide buffer for communities of greater conservation value.

RELATED CONCEPTS

Global Similar Associations:

• *Liriodendron tulipifera - Pinus taeda* Forest (CEGL007521)--supports a significant pine component.
• *Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata* Forest (CEGL006186)
• *Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221)--on more acidic substrates, lacks species affiliated with circumneutral conditions.
• *Liriodendron tulipifera* Forest (CEGL007218)--is less diverse and earlier successional.

Global Related Concepts:
• *Liriodendron tulipifera / Lindera benzoin* Forest (Lea 2000) **F**
• Oak-Hickory Association of the Western Shore District (Shreve et al. 1910) **B**
• Successional forest of low-elevation plateaus (Vanderhorst 2001a) **B**
• Tulip Poplar Type (Schmalzer and DeSelm 1982) **B**
• Yellow Poplar - Sugar Maple - Cucumber (Rentch et al. 2005) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:
Mammoth Cave National Park Other Comments:
Global Classification Comments: This type was originally described from the work of Andreu and Tukman (1995) but was later modified to emphasize stands with moderately high base saturation levels. It is apparently a widespread successional forest of relatively fertile substrates in all provinces of the Mid-Atlantic states and in parts of the Southeast.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This successional tuliptree forest is found primarily in the southern parts of the park. This association results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist.
Global Range: This type occurs in the Ridge and Valley and Cumberland Plateau of Tennessee, the Interior Low Plateau of Kentucky, the Upper East Gulf Coastal Plain of Mississippi, and the Central Appalachian, Piedmont and Inner Coastal Plain regions of Virginia, West Virginia, Maryland and possibly Pennsylvania and Delaware. Plots attributable to this type are also known from the Georgia Piedmont. Its full range has not been documented.
Nations: US
States/Provinces: DC, DE?, GA, KY, MD, MS, PA?, TN, VA, WV
TNC Ecoregions: 44:C, 50:C, 52:C, 58:C, 59:C
TNC Ecoregion Comments: ECO52:C, ECO58:C, ECO59:C added (JT 8-04). ECO44 changed from ? to C (REE 10-03).
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 221Jb:CCC, 222Dg:CCC, 222Dj:CCC, 222Eg:CCC, 231Ae:CCC, 231Al:CCC, 231Ap:CCC, 232Ad:CCC, M221Ab:CCC, M221Bb:CCC, M221Be:CCC, M221Cb:CCC, M221Da:CCC
Federal Lands: NPS (Abe Lincoln Birthplace, Antietam, Big South Fork, Blue Ridge Parkway, Bluestone, C&O Canal, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Cumberland Gap, Fort Donelson, George Washington Parkway, Harpers Ferry, Mammoth Cave, Monocacy?, Natchez Trace, National Capital-East, New River Gorge, Obed, Rock Creek, Shenandoah, Thomas Stone, Vicksburg, Wolf Trap); TVA (Tellico); USFS (Cherokee?, Monongahela)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.10, MACA.52, MACA.54, MACA.58, MACA.93, MACA.101, MACA.723, MACA.724.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): R.E. Evans, mod. M. Pyne, J. Teague, C.W. Nordman, R. White, S.C. Gawler
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Andreu and Tukman 1995	.	X	.	X	.	.	.	.	.
Hall and Mathews 1974	.	.	.	X	.	.	.	.	.
Lea 2000 .	.	X	X	.	.	.	.	.	
Lea 2003 .	.	.	X	X	.	.	.	.	
Lea 2004 .	X	.	X	.	.	.	.	.	
Martin 1989	.	X	.	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Rentch et al. 2005	.	X	X	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	.	.	.	.	.	.

Shreve et al. 1910	.	X	X	X	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
VDNH unpubl. data	.	.	.	X	.	.	.	.	.
Vanderhorst 2001a	.	X	X	X	.	.	.	.	.
Vanderhorst et al. 2007	.	X	.	X	.	.	.	.	.
Vanderhorst et al. 2008	.	X	.	X	.	.	.	.	.
WVNHP unpubl. data b	.	.	.	X	.	.	.	.	.
Young et al. 2006	.	X	.	X	.	.	.	.	.

A.237 Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus *spp. Forest Alliance*

Black Cherry - Red Maple - Canadian Serviceberry - Oak species Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes temperate deciduous forests and scrub forests comprised of early-successional species. The physiognomy of this vegetation is highly variable and may range from open woodland to stunted forest to dense nearly impenetrable thicket. In maritime settings, individual trees tend to be wind-pruned and multi-stemmed. In inland settings, this vegetation is generally the result of natural or human-caused disturbance such as hurricanes or logging. The canopy may contain *Prunus serotina var. serotina, Amelanchier canadensis, Acer rubrum, Liriodendron tulipifera, Fraxinus americana, Nyssa sylvatica, Photinia pyrifolia (= Aronia arbutifolia)*, and *Sassafras albidum* in varying proportions. *Pinus taeda, Diospyros virginiana*, and *Ilex opaca var. opaca* may occur locally on the Coastal Plain. Some examples support vines in great abundance, such as *Smilax rotundifolia, Smilax glauca, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Herbs are of variable cover, depending on the degree of sunlight penetrating the canopy. Herbaceous composition is widely variable and may include both native and exotic species. The substrate varies from pure sand and loamy sands in coastal regions, or loam in the interior.

Environment: The substrate varies from pure sand and loamy sands in coastal regions, or loam in the interior.

Vegetation: The physiognomy of this vegetation is highly variable and may range from forest to open woodland to stunted forest to dense nearly impenetrable thicket. In maritime settings, individual trees tend to be wind-pruned and multi-stemmed. The canopy may contain *Prunus serotina var. serotina, Amelanchier canadensis, Acer rubrum, Liriodendron tulipifera, Fraxinus americana, Nyssa sylvatica, Photinia pyrifolia (= Aronia arbutifolia)*, and *Sassafras albidum* in varying proportions. *Pinus taeda, Diospyros virginiana*, and *Ilex opaca var. opaca* may occur locally on the Coastal Plain. Some examples support vines in great abundance, such as *Smilax rotundifolia, Smilax glauca, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Herbs are of variable cover, depending on the degree of sunlight penetrating the canopy.

Dynamics:

Similar Alliances:

- *Ilex opaca* Forest Alliance (A.3002)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in the eastern U.S. from southern Maine south to Virginia, Kentucky, and Tennessee, and west to Indiana. The extent of its distribution in central and northern Maine needs clarification.

Nations: US

Subnations: CT, DE, IN, KY, MA, MD, ME, NH, NJ, NY, PA, RI, TN, VA, WV

TNC Ecoregions: 44:C, 48:C, 49:C, 52:?, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C

USFS Ecoregions: 212Cb:CCP, 212Db:CCC, 212Dc:CCP, 212Fc:CCC, 212G:C?, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Fa:CCC, 222Dc:CPP, 222Dj:CPP, 222Ea:CCP, 222Eh:CCP, 222Ei:CCP, 222Ek:CCC, 222Ic:CCC, 222Jj:CCC, 231A:??, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CC?, 232Bb:CC?, 232Bc:CCP, 232Bd:CCP, 232Bz:CCC, 232Ch:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212E:C?, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Da:CCC

Federal Lands: NASA (Wallops); NPS (Abe Lincoln Birthplace, Allegheny Portage Railroad, Assateague Island, Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fire Island, Fort Necessity, Friendship Hill, Gateway, George Washington Parkway?, Gettysburg, Harpers Ferry, Indiana Dunes, Johnstown Flood, Mammoth Cave?, Manassas, Morristown, Sagamore Hill, Saratoga, Saugus Iron Works, Shenandoah, Upper Delaware, Valley Forge, Weir Farm); USFS (George Washington, Monongahela); USFWS (Cape May, Chincoteague, Erie, Great Meadows?, Great Swamp, Montezuma, Nomans Land Island?, Parker River, Prime Hook, Rachel Carson, Supawna Meadows)

ALLIANCE SOURCES

Author(s): Eastern Ecology Group, mod. L.A. Sneddon

References: Bellis 1992, Boule 1979, Dunlop and Crow 1985, Eastern Ecology Working Group n.d., Eyre 1980, Higgins et al. 1971, Hill 1986, Martin 1959b, Sneddon et al. 1994, Stalter 1979, Swain and Kearsley 2001

[CEGL004133] *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest

Translated Name: **Black Cherry - Sassafras - (White Ash) / Eastern Red-cedar Forest**

Common Name: **Southeastern Successional Black Cherry Forest**

Ecological System(s):

- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Nonstandard

Circumscription Confidence: 3 - Weak

Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: This early-successional woody vegetation of the interior southeastern United States (unglaciated Interior Low Plateau) occurs on sites that have generally been formerly cleared for agriculture or heavily impacted by logging or grazing. Environmental setting varies, but generally sites are dry-mesic to mesic. Early-successional woody species dominate the canopy in a widely variable mixture, depending on geographic location. Tree species typically include *Prunus serotina, Sassafras albidum, Robinia pseudoacacia, Liriodendron tulipifera, Fraxinus americana*, and/or *Acer rubrum*. Other associates can include *Juglans nigra, Ulmus americana, Quercus* spp., *Juniperus virginiana, Acer negundo*, and the exotic *Ailanthus altissima*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin, Carpinus caroliniana*, and *Crataegus* spp. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus argutus, Rubus allegheniensis, Rubus flagellaris, Rubus hispidus*, and/or the exotic *Rubus phoenicolasius*. This layer may also be dominated by exotic species such as *Lonicera maackii, Lonicera japonica, Rosa multiflora*, and *Berberis thunbergii*. Vines may be present, including *Smilax* spp., *Vitis* spp., *Toxicodendron radicans*, and *Parthenocissus quinquefolia*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This successional forest was sampled at two locations in the park. The sites range from a flat low level area to gentle slopes, but it could occur in a great variety of landform types depending on disturbance history. The soil at the lowland site is poorly drained. The unvegetated surface is dominated by leaf litter (80-100% cover), with some wood (0-3%), bare soil (0-12%) and bryophytes/lichens (0-5%).

Global Environment: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The composition of stands of this type may vary greatly among one another., being influenced heavily by the species which first came to occupy a patch of severely disturbed ground. The lowland stand has a very dense, almost total (100% cover) canopy 20-35 m tall and moderate (40%) subcanopy (15-20 m). The canopy may be dominated by *Acer saccharum, Acer rubrum, Liriodendron tulipifera, Pinus virginiana*, and/or *Acer rubrum*, the subcanopy by *Cornus florida, Oxydendrum arboreum, Prunus serotina*, *Ulmus alata,* and *Juniperus virginiana*. Short shrubs may include *Vaccinium stamineum.* The herbaceous layer may contain *Asplenium platyneuron, Carex spp.,* and *Amphicarpaea bracteata*. The invasive exotic *Microstegium vimineum* dominates one stand. Vines are dominated by *Parthenocissus quinquefolia*.

Global Vegetation: Early-successional woody species dominate the canopy in a widely variable mixture, depending on geographic location. Tree species typically include *Prunus serotina, Sassafras albidum, Robinia pseudoacacia, Liriodendron tulipifera, Fraxinus americana*, and/or *Acer rubrum*. Other associates can include *Juglans nigra, Ulmus americana, Quercus* spp., *Juniperus virginiana, Acer negundo*, and the exotic *Ailanthus altissima*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin, Carpinus caroliniana*, and *Crataegus* spp. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus argutus, Rubus allegheniensis, Rubus flagellaris, Rubus hispidus*, and/or the exotic *Rubus phoenicolasius*. This layer may also be dominated by exotic species such as *Lonicera maackii, Lonicera japonica, Rosa multiflora*, and *Berberis thunbergii*. Vines may be present, including *Smilax* spp., *Vitis* spp., *Toxicodendron radicans*, and *Parthenocissus quinquefolia*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Pinus virginiana	Tree canopy	Needle-leaved tree	X	.	.
Acer rubrum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Acer saccharum	Tree canopy	Broad-leaved deciduous tree	X	X	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Prunus serotina var. *serotina*	Tree subcanopy	Broad-leaved deciduous tree	X	X	.
Asimina triloba	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Microstegium vimineum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	invasive/exotic
Microstegium vimineum	-	P	invasive/exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (3-Aug-2006). This vegetation is modified, originates from human activity and is not of conservation concern.

RELATED CONCEPTS

Global Similar Associations:

- *Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221)--is more strongly dominated by *Liriodendron* and is generally in a later successional state as evidenced by taller trees and more closed canopy.
- *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest (CEGL006599)--of northeastern states.
- *Robinia pseudoacacia* Forest (CEGL007279)--stands of this type are generally over 75% *Robinia*.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: This successional and post-disturbance vegetation is located in the old fields mostly on the plateaus and occasionally in the sink valleys at Mammoth Cave National Park. It seems to occur in conjunction with other successional types as a heterogeneous combination of vegetation that develops following old field succession. As applied at Mammoth Cave, it also includes pure stands of *Acer saccharum*, as well as old fencerows of non-oak-dominated forest and small-patch forest gaps of early-succession vegetation. Inclusion of an early-successional calcareous type is warranted to incorporate oddball vegetation such as stands with *Cornus florida* dominance in the woody strata with *Fraxinus americana*, as well as *Acer saccharum* forests and other successional combinations. The concept is of a large-scale type that could differ within a polygon, but remain consistent with a concept of an early-successional non-oak deciduous to mixed type.

Mammoth Cave National Park Other Comments:

Global Classification Comments: This vegetation is broadly defined and varies widely in composition across its range.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found near Crystal Cave Road, off Flint Ridge Road, as well as in many other locations in the park. It results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist.

Global Range: This vegetation is currently described from Kentucky and Tennessee but is likely of broader distribution in the upper southeastern U.S. and adjacent lower Midwest (unglaciated Interior Low Plateau).

Nations: US

States/Provinces: IN?, KY, TN

TNC Ecoregions: 44:C

TNC Ecoregion Comments:

USFS Ecoregions: 222:C

Federal Lands: NPS (Abe Lincoln Birthplace, Mammoth Cave)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.62, MACA.78.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Pyne, after L.A. Sneddon
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.

A.239 Quercus alba - (Quercus rubra, Carya *spp.) Forest Alliance*

White Oak - (Northern Red Oak, Hickory species) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance is widely distributed in the eastern United States and portions of adjacent Canada and includes dry mesic to mesic upland oak forests dominated by *Quercus alba* and/or *Quercus rubra*, with or without *Carya* species. Stands are found on gentle to moderately steep lower to upper slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the midwestern United States, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera, Liquidambar styraciflua, Fraxinus americana, Acer rubrum*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire and in areas adjacent to creeks and rivers. Stands are 15-25 m tall, with a closed, deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* usually dominates, either alone or in combination with *Quercus rubra* (especially on moister sites) and sometimes *Quercus velutina* and *Quercus falcata* (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra*, although *Quercus alba* is usually also a canopy component. *Carya* species (particularly *Carya alba, Carya glabra* or *Carya ovata*) are typically common either in the canopy or subcanopy. In the southeastern United States, this alliance covers dry-mesic forests of the Piedmont, low Appalachian Mountains, and the Cumberland and Interior Low Plateau, and mesic oak-hickory forests of the Blue Ridge and the interior highlands of the Ozarks and Ouachita Mountains. Associated species include *Carya glabra, Carya ovata, Carya alba, Fraxinus americana, Acer rubrum, Acer leucoderme, Cornus florida, Nyssa sylvatica, Ostrya virginiana, Calycanthus floridus, Pyrularia pubera, Tilia americana var. caroliniana, Oxydendrum arboreum, Kalmia latifolia*, and others. This alliance is found throughout the midwestern United States on moderately rich, upland sites. Typical associates include *Fraxinus americana, Ulmus americana, Tilia americana, Acer saccharum, Acer rubrum*, and more locally, *Quercus macrocarpa* and *Quercus ellipsoidalis*.

Environment: Stands are found on gentle to moderately steep slopes on uplands and on steep valley sides. The soils are moderately deep to deep and vary from silts to clays and loams. The parent material ranges from glaciated till to limestone, shale, sandstone and other bedrock types. In the Midwest, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the East and Southeast, *Liriodendron tulipifera, Fraxinus americana, Liquidambar styraciflua*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire (Eyre 1980) and in areas adjacent to creeks and rivers.

Vegetation: This alliance is widely distributed in the eastern United States and portions of adjacent Canada and includes dry mesic to mesic upland oak forests dominated by *Quercus alba* and *Quercus rubra*, with or without *Carya* species. Stands are 15-25 m tall, with a closed deciduous canopy. The shrub and herbaceous strata are typically well-developed. *Quercus alba* usually dominates stands, either alone or in combination with *Quercus rubra* (especially on moister sites) and sometimes *Quercus velutina* (especially on drier sites). Some associations in this alliance are dominated by *Quercus rubra*, although *Quercus alba* is usually also a canopy component. *Carya* species (particularly *Carya alba, Carya glabra* or *Carya ovata*) are typically common either in the canopy or subcanopy. In the southeastern United States, this alliance covers dry-mesic forests of the Piedmont, low Appalachian Mountains, and Interior Low Plateau, and mesic oak-hickory forests of Blue Ridge and interior highlands of the Ozarks and Ouachita Mountains. Associated species in the southeastern United States include *Carya glabra, Carya ovata, Carya alba, Fraxinus americana, Acer rubrum, Acer leucoderme, Cornus florida, Nyssa sylvatica, Ostrya virginiana, Calycanthus floridus, Pyrularia pubera, Kalmia latifolia, Tilia americana var. caroliniana, Oxydendrum arboreum*, and others. In the midwestern United States, this alliance is found throughout the region on moderately rich, upland sites. Typical associates include *Fraxinus americana, Ulmus americana, Tilia americana, Acer saccharum, Acer rubrum*, and more locally, *Quercus macrocarpa* and *Quercus ellipsoidalis*.

Dynamics: In the midwestern United States, many stands are succeeding to types dominated by *Acer saccharum, Tilia americana, Acer rubrum*, and other mesic tree associates. This succession may be delayed by fire and grazing. In the eastern and southeastern United States, *Liriodendron tulipifera, Fraxinus americana, Acer rubrum*, and other mesic associates often increase after disturbances, such as clearcutting or windstorms, especially in the absence of fire.

Similar Alliances:

- *Carya (glabra, ovata) - Fraxinus americana - Quercus (alba, rubra)* Forest Alliance (A.258)
- *Quercus alba - (Quercus nigra)* Forest Alliance (A.238)
- *Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241)
- *Quercus alba* Montane Forest Alliance (A.271)--forests dominated by *Quercus alba* in extreme montane landscapes.
- *Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)--mesic forests dominated by *Quercus rubra*.
- *Quercus rubra* Montane Forest Alliance (A.272)--forests dominated by *Quercus rubra* in extreme montane landscapes.
- *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911)--includes floristically and structurally similar stands, typically drier that A.239.

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance ranges from Ontario, Canada, throughout the midwestern and eastern United States, south to the very northern edges of the Western and Eastern Gulf coastal plains.

Nations: CA, US

Subnations: AL, AR, CT, DC, DE, GA, IA, IL, IN, KS, KY, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NY, OH, OK, ON, PA, RI, SC, TN, VA, VT, WI, WV

TNC Ecoregions: 32:P, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:?, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 64:C

USFS Ecoregions: 212Ec:CCC, 212Ed:CCC, 212Fb:CCP, 212Fc:CCC, 212Fd:CC?, 212Ga:CC?, 212Gb:CC?, 212Ht:CPP, 212Hx:CPP, 212Jj:C??, 212Ka:CC?, 212Kb:CCC, 212Mb:C??, 212Na:CCP, 212Nb:CC?, 212Nc:CCC, 212Nd:CC?, 221Aa:CCP, 221Ab:CCC, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Fc:CCC, 221Ha:CCC, 221Hc:CCC, 221Hd:CCC, 221He:CCC, 221Ja:CCP, 221Jb:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Al:CCP, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Ap:CCC, 222Aq:CCC, 222Cb:CCC, 222Cc:CCC, 222Cd:CCC, 222Ce:CCC, 222Cf:CCC, 222Cg:CCC, 222Ch:CCC, 222Da:CCP, 222Db:CCC, 222Dc:CCC, 222Dd:CCP, 222De:CCC, 222Df:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCC, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ei:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCC, 222En:CCC, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fd:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Qb:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCC, 231Be:CCC, 231Bg:CCC, 231Bh:CCP, 231Bk:CCC, 231Ca:CCC, 231Cb:CCC, 231Cc:CCC, 231Cd:CCC, 231Cf:CCC, 231Cg:CCC, 231Da:CCC, 231Dc:CCC, 231Dd:CCC, 231De:CCC, 231E:CC, 231Gb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCP, 232Ad:CCC, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bv:CCC, 232Bx:CCC, 232Ca:CCC, 232Cb:CCC, 232Ch:CCC, 232Cj:CCC, 234Ac:PPP, 251Aa:CCC, 251Ba:CCC, 251Be:CCC, 251Ca:CC?, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cj:CCC, 251Ck:CCC, 251Cn:CC?, 251Co:CC?, 251Cp:CCC, 251Cq:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP, 251Ea:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CC?, M212Eb:CC?, M221Aa:CCC, M221Ac:CCC, M221Bd:C??, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: BIA (Eastern Band of Cherokee); COE (Dale Hollow?, Kerr Reservoir); DOD (Arnold, Fort Benning, Fort Pickett); DOE (Oak Ridge); NPS (Abe Lincoln Birthplace, Appomattox Court House, Big South Fork, Blue Ridge Parkway, Booker T. Washington, Boston Harbor Islands, Buffalo River, C&O Canal, Cape Cod, Carl Sandburg Home, Chattahoochee River, Chickamauga-Chattanooga, Colonial, Cowpens, Cumberland Gap, Delaware Water Gap, Effigy Mounds, Fort Donelson, Fort Necessity, Fredericksburg-Spotsylvania, George Washington Parkway, Gettysburg, Great Smoky Mountains, Guilford Courthouse, Indiana Dunes, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Manassas, Minute Man, Morristown, Natchez Trace, Ninety Six, Obed, Ozark Riverways, Petersburg, Prince William, Richmond, Rock Creek, Russell Cave, Sagamore Hill, Saint Croix, Saratoga, Shenandoah, Shiloh, Upper Delaware, Weir Farm); TVA (Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Chippewa, Daniel Boone, Finger

Lakes, George Washington, Hoosier, Huron-Manistee, Jefferson, Land Between the Lakes, Manistee, Mark Twain, Nantahala, Oconee, Ouachita?, Ozark, Pisgah, Shawnee, St. Francis, Sumter, Uwharrie, Wayne); USFWS (Assabet River, Cape May, Great Meadows)

ALLIANCE SOURCES

Author(s): D.J. Allard/D. Faber-Langendoen, mod. S. Landaal/D. Faber-Langendoen

References: Allard 1990, Ambrose 1990a, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Fountain and Sweeney 1985, Fralish 1988b, Fralish et al. 1991, Golden 1979, Hoagland 1997, Jones 1988a, Jones 1988b, McLeod 1988, Midwestern Ecology Working Group n.d., Monk et al. 1990, Nelson 1986, Oakley et al. 1995, Oosting 1942, Rawinski 1992, Robertson et al. 1984, Schafale and Weakley 1990, Swain and Kearsley 2001, Wharton 1978

[CEGL007795] *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest

Translated Name: **White Oak - Mockernut Hickory - (Black Oak) / Naked-flower Tick-trefoil - (Painted Sedge) Forest**

Common Name: **Interior Dry-Mesic White Oak - Hickory Forest**

Ecological System(s):

- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne and C.S. Major

ELEMENT CONCEPT

Global Summary: This dry-mesic white oak - hickory forest is found in the Interior Low Plateau of Tennessee and adjoining states. Stands occur in dissected landscapes at low to moderate elevations (200-350 m [600-1200 feet]), on upper, middle, and lower slopes of various aspects, as well as toeslopes of gently convex form. Examples vary somewhat in expression on different aspects; however, the canopy is typically dominated by *Quercus alba* and *Carya alba*, with *Carya glabra* and *Quercus velutina*. *Quercus rubra* may be found in the subcanopy of some examples, particularly on north- and east-facing slopes. The subcanopy may also contain *Acer rubrum, Acer saccharum, Amelanchier arborea, Carpinus caroliniana, Nyssa sylvatica*, and *Oxydendrum arboreum*. *Vaccinium pallidum* may be a prominent low shrub in some examples, along with *Vaccinium stamineum* and *Viburnum acerifolium*. The herb dominance may be quite variable depending on aspect. Within its range, extensive carpets of *Carex picta* present a dramatic winter aspect dominance in south- or west-facing examples. In contrast, *Polystichum acrostichoides* may be equally dominant on north- or east-facing slopes. Some other herbs which may be found include *Cardamine angustata, Cynoglossum virginianum var. virginianum, Sanicula smallii*, and the fern *Asplenium platyneuron*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This dry-mesic white oak - hickory forest was sampled at 18 locations in the park. Sites range from gently sloping ridges to gentle to steep, lower to upper slopes of any aspect. Elevations range from 177 to 308 m (580-1010 feet). Soils are dry-mesic to mesic, rapidly drained to moderately and well-drained clay loam, sandy loam, silt loam, silt and loam. The unvegetated surface is dominated by leaf litter (45-98% cover) with some exposed bedrock (0-7%), large rocks (0-5%), small rocks (0-1%), wood (1-15%) and bare soil (0-45%). Evidence of disturbance includes past logging and clearing (likely for grazing livestock), roads and trails, animal grazing/browsing, recent fire, fire suppression, dogwood anthracnose, and the presence of exotic plants.

Global Environment: Stands occur in dissected landscapes at low to moderate elevations (200-350 m [600-1200 feet]), on mid- to lower slopes of various aspects, as well as toeslopes of gently convex form. Aspect may be an important factor in species composition of different stands attributable to this type.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately sparse to dense (20-80%) tree canopy, 15-50 m tall, is dominated by *Quercus alba* and *Quercus velutina* and may include *Carya alba, Carya cordiformis, Carya glabra, Fraxinus americana, Quercus coccinea, Quercus falcata, Quercus prinus*, and others. *Quercus falcata* is typically absent or at low value; similarly *Quercus rubra* could be present in the lower strata but not in the canopy. The sparse to moderately dense (20-70%) subcanopy (5-20 m) is dominated by *Acer saccharum* and may include canopy species as well as *Acer rubrum, Carya ovata, Cornus florida, Fagus grandifolia, Liriodendron tulipifera, Nyssa sylvatica*, and *Sassafras albidum*. The very sparse to moderately dense (10-70%) tall-shrub layer (1-5 m) and very sparse to moderate (10-50%) short-shrub layer (0.5-2 m) are made up of saplings of the tree species and may include *Frangula caroliniana, Lindera*

benzoin, Ostrya virginiana, Prunus serotina, Rhus copallinum, Rubus allegheniensis, Rubus argutus, and *Symphoricarpos orbiculatus*. The very sparse (5-20%) herbaceous layer may include *Brachyelytrum erectum, Chasmanthium latifolium, Danthonia spicata, Desmodium nudiflorum, Dichanthelium boscii, Elymus hystrix, Iris cristata, Polystichum acrostichoides, Salvia lyrata*, and the invasive exotic *Microstegium vimineum*. Vines (up to 20%) include *Bignonia capreolata, Parthenocissus quinquefolia, Smilax rotundifolia*, and *Toxicodendron radicans*. Thirteen species of exotic plants were recorded from 18 sampled plots. In addition, this community supports saplings of state-critically imperiled *Castanea dentata* and herb *Matelea carolinensis* and state-vulnerable *Aralia nudicaulis*.

Global Vegetation: The canopy is typically dominated by *Quercus alba* and *Carya alba*, with *Carya glabra* and *Quercus velutina*. *Quercus rubra* may be found in the subcanopy of some examples, particularly on north- and east-facing slopes. The subcanopy may also contain *Acer rubrum, Acer saccharum, Amelanchier arborea, Carpinus caroliniana, Nyssa sylvatica*, and *Oxydendrum arboreum*. *Vaccinium pallidum* may be a prominent low shrub in some examples, along with *Vaccinium stamineum* and *Viburnum acerifolium*. The herb dominance may be quite variable depending on aspect. Within its range, extensive carpets of *Carex picta* present a dramatic winter-aspect dominant in south- or west-facing examples. In contrast, *Polystichum acrostichoides* may be equally dominant on north- or east-facing slopes. Some other herbs which may be found include *Cardamine angustata, Cynoglossum virginianum var. virginianum, Sanicula smallii*, and the fern *Asplenium platyneuron*. Other species documented in plots include *Asimina triloba, Brachyelytrum erectum, Amphicarpaea bracteata, Cynoglossum virginianum*, and others (NatureServe Ecology unpubl. data).

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Carya alba Tree canopy	Broad-leaved deciduous tree	X	X	.	
Carya glabra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus velutina	Tree canopy	Broad-leaved deciduous tree	X	X	.
Acer saccharum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Nyssa sylvatica	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer saccharum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Nyssa sylvatica	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic
Allium vineale	-	P	exotic
Aralia nudicaulis	-	P	state-vulnerable
Cardamine hirsuta	-	P	exotic
Castanea dentata	-	P	state-critically imperiled
Cirsium vulgare	-	P	exotic
Glechoma hederacea	-	P	exotic
Lespedeza cuneata	-	P	exotic
Lonicera japonica	-	P	exotic
Matelea carolinensis	-	P	state-critically imperiled
Microstegium vimineum	-	P	exotic
Myosotis arvensis	-	P	exotic
Potentilla recta	-	P	exotic
Rosa multiflora	-	P	exotic
Stellaria media	-	P	exotic
Verbascum thapsus	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (31-Jan-2007). This is not an inherently rare forest type, and many examples are still extant. The lack of element occurrences of this type does not reflect its relative abundance. It is an extensive and

widespread forest type within its range. This type is described from the Interior Low Plateau. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba*). There may be some loss of herbaceous species diversity from the disturbance effects of logging.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - (Quercus prinus) / (Hydrangea quercifolia) - Viburnum acerifolium / Carex picta - Piptochaetium avenaceum* Forest (CEGL008430)
- *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011)--is similar but with a more northwesterly distribution.
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067)
- *Quercus alba - Quercus rubra - Carya (ovata, carolinae-septentrionalis) / Cercis canadensis* Forest (CEGL007232)
- *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070)--is a type with a more strongly alkaline character.
- *Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum* Ozark Forest (CEGL004270)--of the Ozarks (e.g., at Buffalo National River).
- *Quercus alba / Cornus florida* Unglaciated Forest (CEGL002066)
- *Quercus rubra / Magnolia tripetala - Cercis canadensis / Actaea racemosa - Tiarella cordifolia* Forest (CEGL003949)
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)

Global Related Concepts:

- CT V *Quercus alba, Carya glabra, Liriodendron tulipifera, Quercus velutina* (Badger et al. 1997) **I**
- Oak-Hickory (Braun 1950) **B**
- Oak-Hickory (Bryant et al. 1993) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: This association (CEGL007795) is related to the "White oak-black oak-tuliptree type of slopes of upland" of Braun (1950, p. 148, Table 27). In Braun's analysis, this type is one in which "the three dominants comprise 72% of the canopy." This is at some variance from our data from Mammoth Cave National Park (Kentucky), in which *Liriodendron* is not so constant or important. Her studies in the "Big Woods" area of Hart County focused on mesophytic types. Braun also makes the comment that "where valleys cut less deeply into the upland....(t)he oak-tuliptree type...prevails." Badger et al.'s (1997) CT V *Quercus alba, Carya alba, Liriodendron tulipifera, Quercus velutina* (Badger et al. 1997 pp. 1-37). Habitat: flat to modestly steep upper slopes and ridgetops [CEGL007795]; also called "*Quercus alba, Liriodendron tulipifera, Carya alba, Quercus velutina*" (pp. 4-40); Oak-Hickory (Bryant et al. 1993); Oak-Hickory Braun (1950) (pp. 4-40).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This type was originally described from the Western Highland Rim of Tennessee, and is reported from Kentucky. It covers much of the upland forests of Mammoth Cave National Park. This type could also be expected in adjacent Alabama, and possibly also from the adjacent Upper East Gulf Coastal Plain. It is also possible in Illinois and Indiana; however, in those two states the type may overlap in concept with ~*Quercus alba / Cornus florida* Unglaciated Forest (CEGL002066), and it may be that those stands should be removed from CEGL002066 and placed with this type. Alternatively, if this type can be white oak- and black oak-dominated, there may be some overlap with unglaciated stands placed in ~*Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076). A similar association defined from the southern Cumberland Plateau, ~*Quercus alba - (Quercus prinus) / (Hydrangea quercifolia) - Viburnum acerifolium / Carex picta - Piptochaetium avenaceum* Forest (CEGL008430), is dominated by *Quercus alba* and *Quercus prinus*, with character species such as *Magnolia macrophylla* and *Hydrangea quercifolia*. A related type, ~*Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum* Ozark Forest (CEGL004270), has been developed to accommodate similar vegetation in the Ozarks (e.g., at Buffalo National River).

This association (CEGL007795) is related to the "White oak-black oak-tuliptree type of slopes of upland" of Braun (1950, p. 148, Table 27). In Braun's analysis, this type is one in which "the three dominants comprise 72% of the canopy." This is at some variance from our data from Mammoth Cave National Park (Kentucky), in which *Liriodendron* is not so constant or important. Her studies in the "Big Woods" area of Hart County focused on mesophytic types. Braun also makes the comment that the "where valleys cut less deeply into the upland....(t)he oak-tuliptree type...prevails."

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association represents the majority of the central terrain of the rolling uplands of the park, neither on strongly sandstone nor strongly limestone substrates.

Global Range: This association is found from Kentucky and Tennessee north to Indiana and Illinois, possibly south to northern Alabama and northeastern Mississippi. It was originally described from the unglaciated Interior Low Plateau.

Nations: US

States/Provinces: AL, IL, IN, KY, MS, TN
TNC Ecoregions: 43:C, 44:C, 50:C
TNC Ecoregion Comments: ECO43 changed from ? to C for NATR (mjr 4-07). ECO50 and Daniel Boone added (MP/DFL 2-01).
USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Cg:CPP, 222Dg:CCC, 222Dj:CCC, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCP, 222En:CCC, 222Eo:CCC, 231Be:CCC, 231Bg:CCC, 231Cd:CCC, M221Cd:CCC
Federal Lands: NPS (Mammoth Cave, Natchez Trace, Shiloh); USFS (Daniel Boone, Land Between the Lakes)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.11, MACA.15, MACA.16, MACA.19, MACA.22, MACA.32, MACA.50, MACA.87, MACA.98, MACA.104, MACA.109, MACA.701, MACA.703, MACA.715, MACA.720, MACA.741, MACA.746, MACA.748.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Pyne, mod. R.E. Evans
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Badger et al. 1997	.	X	X	X	.	.	.	.	.
Braun 1950 .	X	X	.	.	.	.	.	.	
Bryant et al. 1993	.	X	X	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Pyne 1997 .	X	.	X	.	.	.	.	.	
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

[CEGL002070] *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest

Translated Name: **White Oak - Northern Red Oak - Chinkapin Oak / Eastern Redbud Forest**
Common Name: **White Oak - Mixed Oak Dry-Mesic Alkaline Forest**
Ecological System(s):

- Ozark-Ouachita Dry-Mesic Oak Forest (CES202.708)
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This dry-mesic white oak - mixed oak alkaline forest community is found in unglaciated areas of the Interior Highlands of the east-central United States. Stands occur on gentle to steep slopes with moderately to well-drained moist loamy/sandy, relatively neutral to basic soils, which are underlain by bedrock of limestone and less commonly sandstone, siltstone, or shale. Soils may be shallow to somewhat deep (20-100 cm), with rock fragments present. The canopy is dense, yet enough scattered light penetrates to encourage a rich and diverse herbaceous layer, especially in the spring. Typical tree dominants include *Quercus alba, Quercus rubra, Quercus velutina*, and *Quercus muehlenbergii*. Typical associates include *Carya ovata, Carya alba*, and *Liriodendron tulipifera*. Other shade-tolerant tree associates that may dominate the subcanopy include *Acer saccharum* (or possibly *Acer barbatum* to the south), *Ulmus rubra, Juglans nigra, Fraxinus americana, Ostrya virginiana, Carpinus caroliniana*, and *Amelanchier arborea*. *Quercus muehlenbergii* is a key, but perhaps uncommon, indicator of the more neutral to alkaline soil characteristics of this type. Typical shrubs include *Aesculus glabra, Asimina triloba, Cercis canadensis, Cornus florida, Euonymus americanus, Frangula caroliniana*, and *Viburnum rufidulum*. Woody vines include *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Anemone virginiana, Arisaema triphyllum, Botrychium virginianum, Carex jamesii, Actaea racemosa (= Cimicifuga racemosa), Desmodium glutinosum, Desmodium rotundifolium, Dioscorea quaternata, Goodyera pubescens, Hybanthus concolor, Iris cristata, Maianthemum racemosum, Passiflora lutea*, and *Sanicula canadensis*. These forests occur in habitats transitional between mesic to wet riparian and floodplain communities and the drier ridgetop ecosystems.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This mature dry-mesic white oak forest was sampled at five locations in the park. Sites range from moderate to somewhat steep, southeast-, west- and northwest-facing mid to upper slopes, sinkholes and bedrock outcrops at 186 to 297 m (610-975 feet). Soils are moderately well- to well-drained silt loam and loam. The unvegetated surface is dominated by leaf litter (90-95% cover) with some exposed bedrock (0-5%), large rocks (0-5%), small rocks (0-5%) and wood (2-5%). Evidence of disturbance includes past logging and the presence of exotic plants.

Global Environment: Stands occur on gentle to steep slopes with moderately to well-drained moist loamy/sandy, relatively neutral to basic soils, which are underlain by bedrock of limestone and less commonly sandstone, siltstone, or shale. Soils may be shallow to somewhat deep (20-100 cm), with rock fragments present. In Illinois, this community occurs on thin, sandy/loamy soils underlain by sedimentary rock (mostly Pennsylvanian age sandstone). Limestone and shale are commonly found where erosion has removed resistant sandstone layers near the surface (TNC 1995a). In Missouri, non-cherty limestones and dolomites prevail (Nelson 1985). In Alabama, this type occurs on mixed limestone and sandstone substrate, providing a subcalcareous substrate.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to dense (60-80% cover) tree canopy, 20-50 m tall, is dominated by *Quercus alba*; additional species may include *Acer saccharum, Carya alba, Carya cordiformis, Fraxinus americana*, and *Quercus rubra*. The moderate (40-50%) subcanopy (10-35 m) is dominated by *Acer saccharum* and may include *Carya alba, Juniperus virginiana, Quercus alba, Quercus muehlenbergii*, and *Sassafras albidum*. The sparse (20%) tall-shrub layer (2-5 m) includes canopy species as well as *Celtis laevigata* and *Ulmus rubra*. The sparse (10-30%) short-shrub layer (0.5-1 m) includes *Fraxinus americana* and *Symphoricarpos orbiculatus*. The very sparse to moderate (5-40%) herbaceous layer includes *Brachyelytrum erectum, Desmodium nudiflorum, Dichanthelium boscii, Polygonum virginianum, Polymnia canadensis, Sanicula* sp., and *Solidago caesia*. Vines include *Parthenocissus quinquefolia, Smilax rotundifolia*, and *Vitis aestivalis*.

Global Vegetation: The canopy is dense, yet enough scattered light penetrates to encourage a rich and diverse herbaceous layer. Typical tree dominants include *Quercus alba, Quercus rubra, Quercus velutina*, and *Quercus muehlenbergii*. Typical associates include *Carya ovata* and *Carya alba*. Other shade-tolerant tree associates that may dominate the subcanopy include *Acer saccharum* (and/or *Acer barbatum* or *Acer leucoderme* to the south), *Ulmus rubra, Juglans nigra, Fraxinus americana, Ostrya virginiana, Carpinus caroliniana*, and *Amelanchier arborea*. *Quercus muehlenbergii* is a key, but perhaps uncommon, indicator of the more neutral to alkaline soil characteristics of this type. *Juniperus virginiana* may be present. Typical shrubs include *Aesculus glabra, Asimina triloba, Cercis canadensis, Cornus florida, Euonymus americanus, Frangula caroliniana*, and *Viburnum rufidulum*. Woody vines include *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Anemone virginiana, Arisaema triphyllum, Botrychium virginianum, Carex jamesii, Actaea racemosa (= Cimicifuga racemosa), Desmodium glutinosum, Desmodium rotundifolium, Dioscorea quaternata, Goodyera pubescens, Hybanthus concolor, Iris cristata, Maianthemum racemosum, Passiflora lutea*, and *Sanicula canadensis*. These forests occur in habitats transitional between mesic to wet riparian and floodplain communities and the drier ridgetop ecosystems (Nelson 1985, TNC 1995a).

Global Dynamics: Important disturbance factors affecting this community include fire, wind, drought, insect infestation, bacteria, and fungus. Oaks are now the dominant species in this mid-late successional hardwood forest. Seed dispersal is largely accomplished by squirrels, chipmunks, and acorn-eating birds. The sapling layer is dominated by maples and may indicate that this type is being replaced (TNC 1995a).

Fire, drought, wind, and weathering of bedrock are primary biophysical parameters that affect species composition within this community element, promoting a more graminoid understory (e.g., *Bromus pubescens, Chasmanthium latifolium, Carex* spp.). Insects, fungus, and blight can also severely impact dominance within and among occurrences of this forest. Moderate to severe disturbances, such as cutting, catastrophic wind, and/or fire in mesic stands dominated by beech and maple, may allow white and red oak stands to form (Fralish 1988, Fralish et al. 1991). These stands may succeed back to beech - maple stands over time. Fires were more frequent (almost annual) from the early 1900s to 1930, but there is little information on presettlement (prior to 1800) fire frequency (Robertson and Heikens 1994).

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Fraxinus americana	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Celtis laevigata	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.

Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Vitis aestivalis	Herb (field)	Vine/Liana	X	.	.
Desmodium nudiflorum	Herb (field)	Forb	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Dichanthelium boscii	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note
Sanicula sp.	dominant forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Carya ovata	Tree canopy	Broad-leaved deciduous tree	.	.	X
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus muehlenbergii	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus rubra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus velutina	Tree canopy	Broad-leaved deciduous tree	.	.	X
Acer saccharum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Ulmus rubra	Tree subcanopy	Broad-leaved deciduous tree	.	.	X
Parthenocissus quinquefolia	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Smilax bona-nox	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Cercis canadensis	Tall shrub/sapling	Broad-leaved deciduous tree	.	.	X
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous tree	.	.	X
Arisaema dracontium	Herb (field)	Forb	X	.	.
Dioscorea quaternata	Herb (field)	Forb	.	.	X
Hybanthus concolor	Herb (field)	Forb	X	.	.
Passiflora lutea	Herb (field)	Forb	.	.	X
Carex jamesii	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Allium vineale	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Paulownia tomentosa	-	P	exotic
Perilla frutescens	-	P	exotic
Taraxacum officinale	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Agkistrodon contortrix	-	A	
Callirhytis quercuspunctata	-	A	
Caprimulgus vociferus	-	A	
Chionaspis corni	-	A	
Cyanocitta cristata	-	A	
Dendroica cerulea	-	A	
Dryocopus pileatus	-	A	
Eumeces laticeps	-	A	
Eurytides marcellus	-	A	
Glaucomys volans	-	A	
Hylocichla mustelina	-	A	
Isotria medeoloides	G2	P	Federally listed threatened
Juglans cinerea	-	P	
Lynx rufus -	A	State threatened in Illinois (TNC 1995).	
Melanerpes carolinus	-	A	
Melanerpes erythrocephalus	-	A	
Meleagris gallopavo	-	A	
Myotis sodalis	G2	A	State and Federally listed endangered; often utilize shagbark hickory as roost sites (TNC 1995).
Nymphalis antiopa	-	A	
Odocoileus virginianus	-	A	
Piranga olivacea	-	A	
Sayornis phoebe	-	A	

Schizura badia	-	A
Sciurus carolinensis	-	A
Sciurus niger	-	A
Tamias striatus	-	A
Thryothorus ludovicianus	-	A

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

- *Fagus grandifolia - Quercus alba / Cornus florida* Forest (CEGL007881)--contains a high concentration of *Fagus grandifolia* in the canopy.
- *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795)--is not as strongly calcareous in character but with a similar distribution.
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067)--is very similar, but has a more acidic character.
- *Quercus alba - Quercus rubra - Carya ovata / Cercis canadensis - Juniperus virginiana var. virginiana* Forest (CEGL007240)
- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068)
- *Quercus alba - Quercus stellata / Ostrya virginiana - Acer barbatum / Chasmanthium sessiliflorum* Forest (CEGL008443)
- *Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum* Ozark Forest (CEGL004270)
- *Quercus alba / Cornus florida* Unglaciated Forest (CEGL002066)
- *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest (CEGL005018)--occurs on drier sites and contains *Quercus falcata*, which this community does not have in large amounts.
- *Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808)
- *Quercus prinus - Quercus rubra - Carya* spp. *- Fraxinus americana / Cercis canadensis / Solidago sphacelata* Forest (CEGL008549)
- *Quercus rubra / Ostrya virginiana / Ptelea trifoliata - Ribes curvatum / Helianthus divaricatus* Woodland (CEGL007828)
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)--occurs where soils are drier and thick to very thin over bedrock which is often exposed, and on hillsides with clay soils where sand is absent.

Global Related Concepts:

- *Quercus rubra - Quercus alba* mesic lower slope community type (Robertson et al. 1984) =
- Dry-Mesic Limestone/Dolomite Forest (Nelson 1985) [in part] **B**
- Dry-mesic Upland Forest (S) (White and Madany 1978) [(IL) Illinois Natural Areas Inventory (INAI) nomenclature relies on hydrologic variability and topographic position to determine vegetative community composition (White and Madany 1978).] **B**
- Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) **B**
- Northern Red Oak: 55 (Eyre 1980) **B**
- Terrestrial: Forest: Hardwood (TNC 1985) **B**
- UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) **B**
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) **B**
- White Oak: 53 (Eyre 1980) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: The concept of this type relies, in part, on Missouri's "dry-mesic limestone/dolomite forest" (Nelson 1985). Stands in Illinois and Indiana may not have strongly contrasting alkaline and acidic rocks compared to those in the Ozarks. This type may also occur in the south-central glaciated portion of Illinois. Examples from Arkansas may lack *Quercus rubra*. Neither *Quercus muehlenbergii* nor *Cercis canadensis* may be very common in this type. Extensive selective logging of *Quercus alba* and *Quercus rubra* for sawtimber has severely impacted this community. Stands placed in this type in northern Alabama (Bankhead National Forest) and the Nashville Basin of Tennessee are not a perfect match, but seem similar enough to classify here. The range of this originally Ozarkian type has been expanded to include much of the unglaciated Interior Low Plateau; there may be substantial differences among examples across this range to warrant subdivision, but this has not been tested through any kind of analysis.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is found in the eastern and southern parts of the park, where limestone substrates predominate.

Global Range: This white oak - red oak, dry-mesic alkaline forest community is found in calcareous regions of the Interior Highlands of the east-central United States, ranging from Missouri and Arkansas east to Indiana, south to Kentucky, Tennessee and northern Alabama, and possibly in Oklahoma. Moisture availability and geologic characteristics are largely responsible for the distribution of this community.

Nations: US

States/Provinces: AL, AR, IL, IN, KY, MO:S4S5, MS, OK?, TN
TNC Ecoregions: 36:C, 37:C, 38:C, 39:C, 43:C, 44:C, 48:C, 50:C
TNC Ecoregion Comments: ECO43 changed from ? to C for NATR (mjr 4-07). ECO43 changed from P to ?. This is very unlikely in the coastal plains; it should be confined to "hard-rock" substrates (MP 5-06). ECO39 changed from ? to C based on confirmation by D. Zollner KP 3-01. ECO50 added AW 6-00. ECO39 changed to ? per D. Zollner 8-99.
USFS Ecoregions: 221Hc:CCC, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ae:CCP, 222Af:CC?, 222Ag:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Aq:CCC, 222Ch:CCC, 222De:CC?, 222Df:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCC, 222Ec:CCC, 222Ed:CCC, 222Eg:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCP, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fe:CCC, 231Bd:CCC, 231Be:CCC, 231Bk:CCC, 231Cd:CCC, 231Gb:CCC, 251Cd:CCC, 251Ce:CCC, 251Ea:CCC, M222Aa:CCC, M222Ab:CCC
Federal Lands: NPS (Abe Lincoln Birthplace, Buffalo River, Fort Donelson, Mammoth Cave, Natchez Trace, Ozark Riverways, Russell Cave, Shiloh); USFS (Bankhead, Daniel Boone, Mark Twain, Ouachita (Mountains)?, Ouachita?, Ozark, Shawnee)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.13, MACA.14, MACA.37, MACA.40, MACA.727.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Evans 1991 .	X	.	X	.	.	.	.	.	
Eyre 1980 .	.	X	X	.	.	.	.	.	
Fralish 1987	.	.	.	X	.	.	.	.	.
Fralish et al. 1991	.	.	.	X	.	.	.	.	.
Kuchler 1964	.	.	X	X	.	.	.	.	.
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Nelson 1985	.	X	X	X	.	.	.	.	.
Robertson and Heikens 1994	.	.	.	X	.	.	.	.	.
Robertson et al. 1984	.	.	X	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1985 .	.	X	X	.	.	.	.	.	
TNC 1995a .	X	.	X	.	.	.	.	.	
UNESCO 1973	.	.	X	X	.	.	.	.	.
Voigt and Mohlenbrock 1964	.	.	.	X	.	.	.	.	.
White and Madany 1978	.	.	X	X	.	.	.	.	.

A.241 Quercus alba - Quercus (falcata, stellata) *Forest Alliance*

White Oak - (Southern Red Oak, Post Oak) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance contains vegetation that can be described as dry oak and oak-hickory forests. These often are successional forests following logging and/or agricultural cropping (and possibly also chestnut blight in the southern Appalachians). Some examples occur in upland flats and have been called xerohydric because they occasionally will have standing water in the winter due to a perched water table, but are droughty by the end of the growing season. Other occurrences are found on well-drained sandy loam or clay loam soils that are often, although not always, shallow. Karst topography can be found in areas where this alliance occurs. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Forests of this alliance may occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. This alliance is found in the Upper East Gulf Coastal Plain, Piedmont, low mountains (including Cumberlands, Ridge and Valley, and low parts of the Southern Blue Ridge), and Interior Low Plateau. Distribution in the Atlantic Coastal Plain, East Gulf Coastal Plain, and Upper West Gulf Coastal Plain needs assessment. In the Shawnee Hills, Knobs, Coastal Plain, and Appalachian Plateau regions of Kentucky, these forests form a common matrix vegetation over acidic sandstone and shales. These Kentucky forests are dominated by *Quercus alba* with little or no *Quercus falcata* and occupy middle to upper slope positions. In the southern Illinois portion of the range, examples occur on south- to west-facing slopes where increased temperatures favor *Quercus falcata* over

Quercus rubra. These forests are usually dominated by a mixture of *Quercus alba* and *Quercus falcata*; *Quercus stellata* may be dominant or codominant. In addition, *Quercus coccinea, Quercus velutina, Quercus marilandica, Carya alba, Carya glabra, Carya pallida, Carya carolinae-septentrionalis, Carya ovata*, and *Fraxinus americana* often are present. Common subcanopy and shrub species include *Oxydendrum arboreum, Acer rubrum, Ulmus alata, Juniperus virginiana var. virginiana, Vaccinium arboreum, Cornus florida, Sassafras albidum, Gaylussacia frondosa (= var. frondosa), Gaylussacia baccata, Vaccinium pallidum*, and *Vaccinium stamineum*. Herbaceous species that may be present include *Chimaphila maculata, Polystichum acrostichoides, Asplenium platyneuron, Hexastylis arifolia, Coreopsis major, Tephrosia virginiana, Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum*? (= *Aster sagittifolius*?), *Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Hieracium venosum*.

Environment: These often are successional forests following logging and/or agricultural cropping. Some examples occur in upland flats and have been called xerohydric because they occasionally will have standing water in the winter due to a perched water table, but are droughty by the end of the growing season. Other occurrences are found on well-drained sandy loam or clay loam soils that are often, although not always, shallow. Karst topography can be found in areas where this alliance occurs. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Forests of this alliance may occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. In the Shawnee Hills, Knobs, Coastal Plain, and Appalachian Plateau regions of Kentucky, these forests form a common matrix vegetation over acidic sandstone and shales. They are dominated by *Quercus alba* with little or no *Quercus falcata* and occupy middle to upper slope positions. In the southern Illinois portion of the range, examples occur on south- to west-facing slopes where increased temperatures favor *Quercus falcata* over *Quercus rubra*.

Vegetation: This alliance contains vegetation that can be described as dry oak and oak-hickory forests. These are usually dominated by a mixture of *Quercus alba* and *Quercus falcata*; *Quercus stellata* may be dominant or codominant. In addition, *Quercus coccinea, Quercus velutina, Quercus marilandica, Carya alba, Carya glabra, Carya pallida, Carya carolinae-septentrionalis, Carya ovata*, and *Fraxinus americana* often are present. Common subcanopy and shrub species include *Oxydendrum arboreum, Acer rubrum, Ulmus alata, Juniperus virginiana var. virginiana, Vaccinium arboreum, Cornus florida, Sassafras albidum, Gaylussacia frondosa (= var. frondosa), Gaylussacia baccata, Vaccinium pallidum*, and *Vaccinium stamineum*. Herbaceous species that may be present include *Chimaphila maculata, Polystichum acrostichoides, Asplenium platyneuron, Hexastylis arifolia, Coreopsis major, Tephrosia virginiana, Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum*? (= *Aster sagittifolius*?), *Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Hieracium venosum*.

Dynamics:

Similar Alliances:

- *Pinus echinata - Quercus (alba, falcata, stellata, velutina)* Forest Alliance (A.394)
- *Quercus alba - (Quercus nigra)* Forest Alliance (A.238)
- *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)
- *Quercus alba - Quercus stellata - Quercus velutina - (Quercus falcata)* Woodland Alliance (A.613)
- *Quercus falcata* Forest Alliance (A.243)
- *Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911)

Similar Alliance Comments: These forests are drier than those of the ~*Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239) and the ~*Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911) and often occur on poorer soils or on south- and west-facing slopes. Related forests, drier than those of this alliance, are placed in the more southerly ranging ~*Quercus falcata* Forest Alliance (A.243). This alliance could occur in the Ozarks and Ouachita Mountains, but associations are yet to be defined. Distribution of vegetation in this alliance is patchy, occurring on south- to west-facing slopes where *Quercus falcata* is favored over *Quercus rubra*. Stands of this alliance are similar to, and can grade into, stands of other dry-mesic *Quercus* spp.-dominated alliances such as the ~*Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239), the ~*Quercus velutina - Quercus alba - (Quercus coccinea)* Forest Alliance (A.1911), and the ~*Quercus alba - Quercus stellata - Quercus velutina - (Quercus falcata)* Woodland Alliance (A.613). Dominance by *Quercus falcata* typically serves to separate this alliance from others in the Midwest.

ALLIANCE DISTRIBUTION

Range: This alliance is found in the Upper East Gulf Coastal Plain, Piedmont, low mountains, and Interior Low Plateau. Distribution in the Atlantic Coastal Plain, East Gulf Coastal Plain, and Upper West Gulf Coastal Plain needs assessment. In the Shawnee Hills, Knobs, Coastal Plain, and Appalachian Plateau regions of Kentucky, these forests form a common matrix vegetation over acid sandstone and shales.

Nations: US

Subnations: AL, AR, CT, DC?, DE, GA, IL, IN?, KY, LA?, MA, MD, MO?, MS, NC, NJ, NY, OK?, PA, SC, TN, TX?, VA

TNC Ecoregions: 32:P, 40:C, 41:P, 42:C, 43:C, 44:C, 50:C, 51:C, 52:C, 53:P, 56:C, 57:P, 58:C, 59:P, 61:C, 62:C

USFS Ecoregions: 221Ad:CPP, 221Dc:CC?, 221Ha:CCP, 221Hc:CCC, 221Hd:CCP, 221He:CCP, 221Jb:CCC, 222Ca:CCP, 222Cb:CCC, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CC?, 222Cg:CCC, 222Ch:CC?, 222Da:CCC, 222Dc:CCP, 222Dd:CCP, 222De:CCC, 222Df:CCP, 222Dg:CCC, 222Dh:CCC, 222Di:CCP, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Ec:CCP, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ei:CCC, 222Ej:CCC, 222El:CCC, 222En:CCC, 231Aa:CCC, 231Ab:CCC, 231Ac:CCP, 231Ad:CCP, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Ah:CCP, 231Ai:CCC, 231Aj:CCP, 231Ak:CCC, 231Al:CCC, 231Am:CCC, 231An:CCC, 231Ao:CCC, 231Ap:CCC, 231Ba:CCP, 231Bb:CCC, 231Bc:CCP, 231Bd:CCP, 231Be:CC?, 231Bg:CCC, 231Bh:CCC, 231Bj:CCC, 231Bk:CCC, 231Ca:CCP, 231Cb:CCP, 231Cc:CCC, 231Cd:CCC, 231Ce:CCP, 231Cg:CCP, 231Da:CCC, 231Dc:CCC, 231De:CCC, 231Ea:CC?, 231Eb:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bv:CCP, 232Bx:CCC, 232Bz:CCC, 232Ca:CC?, 232Ch:CCC, 232Fa:CP?, 234Aa:CC?, 234Ab:CCC, 234Ac:CCP, 234Ae:CCC, 234Ag:CC?, 234Ah:CCP, M221Aa:CC?, M221Ab:CCC, M221Da:CCC, M221Dd:CCC

Federal Lands: DOD (Arnold, Fort A.P. Hill, Fort Benning, Fort Gordon, Yorktown); DOE (Oak Ridge); NPS (Abe Lincoln Birthplace, Big South Fork, Blue Ridge Parkway, Chattahoochee River, Chickamauga-Chattanooga, Cowpens, Fire Island, Fredericksburg-Spotsylvania, George Washington Parkway, Great Smoky Mountains, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, National Capital-East, Ninety Six, Petersburg, Richmond, Shiloh); TVA (Land Between the Lakes?, Tellico); USFS (Bankhead, Chattahoochee?, Cherokee, Daniel Boone, Holly Springs?, Oconee, Shawnee, St. Francis, Sumter, Talladega, Tombigbee?, Tuskegee?, Uwharrie); USFWS (Blackwater, Cape May, Chesapeake Marshlands, Eufaula, Prime Hook)

ALLIANCE SOURCES

Author(s): M. Pyne/A.S. Weakley, mod. S. Landaal

References: Allard 1990, Andreu and Tukman 1995, Braun 1950, Diamond 1993, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Fralish et al. 1991, Golden 1979, Oosting 1942, Peet and Christensen 1980, Pyne 1994, Robertson and Heikens 1994, Schafale and Weakley 1990, Smith 1991, Sneddon et al. 1996, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, Voigt and Mohlenbrock 1964

[CEGL005018] *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest

Translated Name: **Southern Red Oak - White Oak - Post Oak - Black Oak Forest**

Common Name: **Southern Red Oak - Mixed Oak Forest**

Ecological System(s):

- Ozark-Ouachita Dry Oak Woodland (CES202.707)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Guetersloh, mod. M. Pyne

ELEMENT CONCEPT

Global Summary: This dry-mesic southern red oak - mixed oak forest type is found in the central United States in the unglaciated Interior Low Plateau. Stands occur on the upper slopes and ridgetops of moderately to maturely dissected hills, where they occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Bedrock is predominantly Paleozoic sandstone of Pennsylvanian age and is often exposed; the association may also occur on siltstone, shale, or coal, or over Mississippian limestones, especially in the southern part of its range. Karst topography can be found in areas where this community occurs. The vegetation is dominated by a closed-tree canopy. *Quercus alba, Quercus coccinea, Quercus falcata, Quercus stellata*, and *Quercus velutina* are among the oaks which dominate this dry-mesic forest. *Quercus falcata* reaches the northern extent of its range within this community. Other tree species include *Carya ovata, Carya glabra*, and *Carya alba*. The density and diversity of subcanopy, shrub, and herbaceous species are substantially less than are found in mesic forests due to limited moisture availability during most of the growing season. Typical shrubs and small trees include *Cornus florida* and *Sassafras albidum*. Common herbaceous species include *Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum (= Aster sagittifolius), Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Podophyllum peltatum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This dry-mesic southern red oak - mixed oak forest was sampled at 14 locations in the park. Sites range from flat to gently sloping ridges to gentle to somewhat steep lower to upper slopes of any aspect. Elevations range from 190 to 281 m (623-922 feet). Soils are dry-mesic, moderately well- to well-drained clay loam, sandy loam, silt loam and loam. The unvegetated surface is dominated by leaf litter (55-100% cover) with some

large rocks (0-15%), wood (0-15%) and bare soil (0-40%). Evidence of disturbance includes past logging and clearing, roads and trails, dogwood anthracnose, recent fire, fire suppression, and the presence of exotic plants. It appears to be restricted to, or most prevalent on, the Caseyville Formation (a sandstone unit) which is found on gentle knobs across the park.

Global Environment: Stands occur on the upper slopes and ridgetops of moderately to maturely dissected hills, where they occupy narrow bands of dry-mesic habitat transitional between lower and midslope mesic communities and xeric ridgetops. Soils are most often a well-drained sandy loam, although clay loams are not uncommon. Bedrock is predominantly Paleozoic sandstone of Pennsylvanian age and is often exposed; the association may also occur on siltstone, shale, or coal, or over Mississippian limestones, especially in the southern part of its range (Kentucky). Karst topography can be found in areas where this community occurs.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The sparse to very dense (40-90% cover) tree canopy, 10-50 m tall, is dominated by *Quercus falcata* and likely includes other oaks such as *Quercus alba, Quercus coccinea, Quercus stellata*, and *Quercus velutina*, as well as lesser amounts of *Carya alba, Carya glabra, Liriodendron tulipifera*, and *Nyssa sylvatica* and may include many others. Some examples contain *Quercus marilandica*, particularly in the subcanopy. These stands have more of a mixed oak character, containing more *Quercus falcata* and/or *Quercus stellata* than examples of ~*Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795). The sparse to very dense (30-90%) subcanopy (5-20 m) is dominated by *Cornus florida, Juniperus virginiana, Nyssa sylvatica*, and *Oxydendrum arboreum*. The very sparse to very dense (10-90%) tall-shrub layer (2-5 m) is made up of saplings of the tree species. The very sparse to very dense (20-90%) short-shrub layer (0.5-2 m) may include tree saplings as well as *Acer rubrum, Diospyros virginiana, Frangula caroliniana, Fraxinus americana, Prunus serotina var. serotina, Rubus argutus, Sassafras albidum, Symphoricarpos orbiculatus, Vaccinium stamineum*, and *Viburnum rufidulum*. The very sparse to dense (5-80%) herbaceous layer may include *Agrimonia pubescens, Brachyelytrum erectum, Chimaphila maculata, Desmodium nudiflorum, Dichanthelium boscii, Polystichum acrostichoides*, and many others. Vines (up to 30%) include *Parthenocissus quinquefolia, Smilax glauca, Smilax rotundifolia, Toxicodendron radicans*, and *Lonicera japonica* (exotic). In addition, this community supports state-imperiled *Rhynchosia tomentosa* and state-vulnerable *Vitis labrusca* and *Elephantopus tomentosus*.

Global Vegetation: The vegetation is dominated by a closed-tree canopy. *Quercus alba, Quercus coccinea, Quercus falcata, Quercus stellata*, and *Quercus velutina* are among the oaks which dominate this dry-mesic forest. *Quercus falcata* reaches the northern extent of its range within this community. Other tree species include *Carya ovata, Carya glabra*, and *Carya alba*. The density and diversity of subcanopy, shrub, and herbaceous species are substantially less than are found in mesic forests due to limited moisture availability during most of the growing season. Typical shrubs and small trees include *Cornus florida* and *Sassafras albidum*. Common herbaceous species include *Sanicula canadensis, Desmodium nudiflorum, Desmodium nuttallii, Symphyotrichum urophyllum (= Aster sagittifolius), Symphyotrichum patens (= Aster patens), Solidago ulmifolia*, and *Podophyllum peltatum*.

Global Dynamics: Historically, fire may have periodically affected this community, increasing its range into more moist sites (Fralish et al. 1991, Robertson and Heikens 1994). Fires in the Shawnee and Ozark Hills just north of the range of this type were more frequent (almost annual) from the early 1900s to 1930, but there is little information on presettlement (prior to 1800) fire frequency (Robertson and Heikens 1994). Erosion also converts mesic forest soils to dry-mesic, creating conditions which may favor the occurrence of this community.

This community is a climax community where dry-mesic conditions dominate on mid to upper slopes of eastern oak - hickory associations. Logging and fire select for the occurrence of this community on more moist sites. Erosion can also affect soil water-holding capacity, converting mesic soils to dry-mesic, which creates conditions favoring the occurrence of this forest. Drier conditions and canopy openings increase the occurrence of black oak, while more moist conditions favor white oak.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus coccinea	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus falcata	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus stellata	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus velutina	Tree canopy	Broad-leaved deciduous tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Cornus florida	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Nyssa sylvatica	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer rubrum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.

Sassafras albidum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium stamineum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Toxicodendron radicans	Herb (field)	Vine/Liana	X	.	.
Dichanthelium boscii	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Carya alba Tree canopy	Broad-leaved deciduous tree	X	.	.	
Carya glabra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carya ovata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus falcata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carpinus caroliniana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Diospyros virginiana	Tree subcanopy	Broad-leaved deciduous tree	.	.	X
Fraxinus americana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Parthenocissus quinquefolia	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Desmodium nuttallii	Herb (field)	Semi-shrub	X	.	.
Desmodium canescens	Herb (field)	Forb	X	.	.
Desmodium nudiflorum	Herb (field)	Forb	X	.	.
Podophyllum peltatum	Herb (field)	Forb	X	.	.
Sanicula canadensis	Herb (field)	Forb	X	.	.
Solidago ulmifolia	Herb (field)	Forb	X	.	.
Symphyotrichum cordifolium	Herb (field)	Forb	X	.	.
Symphyotrichum patens	Herb (field)	Forb	X	.	.
Carex hirsutella	Herb (field)	Graminoid	.	.	X
Dichanthelium dichotomum	Herb (field)	Graminoid	.	.	X

Higher Taxon Name Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Elephantopus tomentosus	-	P	state-vulnerable
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Poa annua -	P	exotic	
Rhynchosia tomentosa	-	P	state-imperiled
Vicia hirsuta	-	P	exotic
Vitis labrusca	-	P	state-vulnerable

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Agkistrodon contortrix	-	A	
Callirhytis quercuspunctata	-	A	
Caprimulgus vociferus	-	A	
Chionaspis corni	-	A	
Cyanocitta cristata	-	A	
Dendroica cerulea	-	A	
Dryocopus pileatus	-	A	
Eurytides marcellus	-	A	
Glaucomys volans	-	A	
Hylocichla mustelina	-	A	
Lynx rufus -	A		
Melanerpes carolinus	-	A	
Melanerpes erythrocephalus	-	A	
Meleagris gallopavo	-	A	
Myotis sodalis	G2	A	Federally listed endangered; globally imperiled
Nymphalis antiopa	-	A	

Odocoileus virginianus	-	A
Piranga olivacea	-	A
Sayornis phoebe	-	A
Sciurus carolinensis	-	A
Synanthedon scitula	-	A
Tamias striatus	-	A
Thryothorus ludovicianus	-	A

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

• *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067)--lacks southern red oak as a dominant canopy species and occupies a broader range of habitats.
• *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070)
• *Quercus falcata - Quercus (coccinea, stellata) / Vaccinium (pallidum, stamineum)* Forest (CEGL007247)
• *Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest (CEGL007244)
• *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)--lacks southern red oak as a dominant canopy species and occupies a broader range of habitats.

Global Related Concepts:

• Dry-mesic Upland Forest (White and Madany 1978) [Dry-mesic Upland Forest is a community name based on moisture availability and topographic position. A broad range of species occur in this community.] **B**
• Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) **B**
• Terrestrial: Forest: Hardwood (TNC 1985) **B**
• UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) **B**
• Western Mesophytic Forest (Braun 1950) [Western Mesophytic Forest relies on moisture availability and geographic region to define a community. A broad range of species occur in this community.] **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Stands that have been classified as this association (CEGL005018) differ from *~Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795) in that they exhibit a variable composition, including *Quercus falcata* (which nears the northern edge of its range here) and *Quercus stellata*. These stands may be drier than the *Quercus alba - Quercus velutina* ones, or some other factor may lead to their development. This is a type that was developed for southern Indiana, where *Quercus falcata* is even more of a novelty. Some stands of CEGL007795 are difficult to distinguish from CEGL005018, as the presence/absence of the various *Quercus* taxa is very similar, but usually cover values vary sufficiently to make this distinction. *Quercus falcata* may have become more prevalent in these stands following the lessening of the importance of fire in the landscape following park establishment, based on the general assumption that *Quercus falcata* is less tolerant of fire than *Quercus stellata*. Braun (1950) refers to "more xeric" communities "on flatter uplands with poor soil" containing these two oaks in addition to *Quercus velutina* and *Quercus marilandica*. In our data, the latter species is limited, mostly occurring in woodlands (more open stands) with *Quercus stellata*. These are classified as *~Quercus stellata / Viburnum rufidulum / Schizachyrium scoparium - (Sorghastrum nutans, Helianthus eggertii)* Woodland (CEGL004686).

Mammoth Cave National Park Other Comments:

Global Classification Comments: More information is needed to distinguish this association from those recognized in the Southeast, such as *~Quercus falcata - Quercus alba - Carya alba / Oxydendrum arboreum / Vaccinium stamineum* Forest (CEGL007244) and *~Quercus falcata - Quercus (coccinea, stellata) / Vaccinium (pallidum, stamineum)* Forest (CEGL007247). The type does not appear to occur in the Ozark region, and in Arkansas, *Quercus falcata* is more common in the coastal plain. Selective removal of oaks for sawtimber can cause shifts in tree species dominance, thereby creating classification difficulties. *Quercus falcata* is a key dominant distinguishing this oak type from others. Braun (1950, p. 154-158) noted the prominence of *Quercus falcata* and *Quercus alba* on the low hills of the Mississippi Embayment Section of her Western Mesophytic Forest Region as well as in the Mississippian Plateau (TNC 1995a).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is scattered across uplands in the central part of the park. It is found neither on pure sandstones nor limestones, but on mixed or intermediate geologies.

Global Range: This dry-mesic southern red oak - mixed oak forest type is found in the central United States in the unglaciated parts of the Interior Low Plateau region of Illinois, Indiana, and Kentucky. This community occupies narrow dry-mesic habitats within the Interior Low Plateau and Appalachian Plateau of Fenneman (1928).

Nations: US

States/Provinces: IL, IN?, KY, TN

TNC Ecoregions: 44:C

TNC Ecoregion Comments:
USFS Ecoregions: 222Ca:CP?, 222Ch:CP?, 222De:CCC, 222Dg:CCC, 222Di:CCP, 222E:CP
Federal Lands: NPS (Abe Lincoln Birthplace, Mammoth Cave); USFS (Land Between the Lakes?, Shawnee)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.25, MACA.28, MACA.48, MACA.59, MACA.60, MACA.64, MACA.79, MACA.80, MACA.99, MACA.100, MACA.705, MACA.722, MACA.740, MACA.744.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Guetersloh, mod. M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Behler 1988.	.	.	X	.	.	.	.	.	
Braun 1950 .	X	X	X	.	.	.	.	.	
Bull and Farrand 1977	.	.	.	X	.	.	.	.	.
Clark and Hutchinson 1994	.	.	.	X	.	.	.	.	.
Craighead 1949	.	.	.	X	.	.	.	.	.
Duncan and Duncan 1988	.	.	.	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Eyre 1980 .	.	.	X	.	.	.	.	.	
Fenneman 1928	.	.	.	X	X	.	.	.	.
Fralish et al. 1991	.	X	.	X	.	.	.	.	.
Illinois Nature Preserve Commission 1973	.	.	.	X	.	.	.	.	.
Kuchler 1964	.	.	X	X	.	.	.	.	.
Little 1980a.	.	.	X	.	.	.	.	.	
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Mohlenbrock 1986	.	.	.	X	.	.	.	.	.
Nelson 1985	.	.	.	X	.	.	.	.	.
Niering 1979	.	.	.	X	.	.	.	.	.
Robertson and Heikens 1994	.	X	.	X	.	.	.	.	.
Schwartz and Schwartz 1959	.	.	.	X	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1985 .	.	X	X	.	.	.	.	.	
TNC 1995a .	X	.	X	.	.	.	.	.	
Thornbury 1965	.	.	.	X	.	.	.	.	.
UNESCO 1973	.	.	X	X	.	.	.	.	.
Voigt and Mohlenbrock 1964	.	.	.	X	.	.	.	.	.
White and Madany 1978	.	.	X	X	.	.	.	.	.

A.243 Quercus falcata *Forest Alliance*

Southern Red Oak Forest Alliance

ALLIANCE CONCEPT

Summary: Dry oak forests with canopies characteristically dominated by *Quercus falcata*, typically with some combination of *Quercus stellata, Quercus velutina*, and *Quercus coccinea*. The relative dominance of these four species is variable between associations across the range of this alliance. *Quercus alba* may be present (although more likely in the understory than in the canopy), but it will rarely contribute to the dominance. Within its range, some examples have strong dominance by *Quercus coccinea*. In the Atlantic Coastal Plain, *Quercus nigra* may be the other oak sharing dominance with *Quercus falcata*. *Vaccinium* spp. are common in the understory of some stands (including successional ones on subxeric, intermediate sites). Some typical occurrences are found on well-drained sandy loam or clay loam soils that are often, although not always, shallow. Some other examples are found on sites with unusual soil conditions, such as hardpans with retarded drainage. These typically occur in upland flats and have been called xerohydric because they occasionally will have standing water in the winter due to a perched water table, but are droughty by the end of the growing season. The range of forests of this alliance is throughout the East Gulf Coastal Plain, West Gulf Coastal Plain, Upper West Gulf Coastal Plain, Piedmont, Carolina Sandhills, low mountains, and Cumberland and Interior Low plateaus. The overall distribution in the Atlantic Coastal Plain and Ouachita Mountains needs assessment.
Environment: Some typical occurrences are found on well-drained sandy loam or clay loam soils that are often, although not always, shallow. These are generally subxeric, intermediate sites. Some other examples are found on sites with

unusual soil conditions, such as hardpans with retarded drainage. These typically occur in upland flats and have been called xerohydric because they occasionally will have standing water in the winter due to a perched water table, but are droughty by the end of the growing season.

Vegetation: Stands of this alliance are dry oak forests with canopies characteristically dominated by *Quercus falcata*, typically with some combination of *Quercus stellata, Quercus velutina*, and *Quercus coccinea*. The relative dominance of these four species is variable between associations across the range of this alliance. *Quercus alba* may be present (although more likely in the understory than in the canopy), but it will rarely contribute to the dominance. Within its range, some examples have strong dominance by *Quercus coccinea*. In the Atlantic Coastal Plain, *Quercus nigra* may be the other oak sharing dominance with *Quercus falcata*. *Vaccinium* spp. are common in the understory of often successional stands on subxeric, intermediate sites.

Dynamics:

Similar Alliances:

- *Pinus taeda - Quercus nigra* Forest Alliance (A.406)
- *Quercus alba - (Quercus nigra)* Forest Alliance (A.238)
- *Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241)

Similar Alliance Comments: Compare to ~*Quercus alba - Quercus (falcata, stellata)* Forest Alliance (A.241). Some stands with *Quercus alba, Quercus falcata*, and *Quercus nigra* could be difficult to place among these three alliances.

ALLIANCE DISTRIBUTION

Range: This alliance is found from Oklahoma, Kentucky, and North Carolina, south to Louisiana, Mississippi, and South Carolina, in the East Gulf Coastal Plain, Upper West Gulf Coastal Plain, Piedmont, Cumberland Plateau, Carolina Sandhills, low mountains, Interior Low Plateau, Ozarks, and Ouachitas. Its distribution and extent in the Atlantic Coastal Plain needs assessment. It is also reported from the Chesapeake Bay Region and the Northern Piedmont.

Nations: US

Subnations: AL, AR, DC, DE, GA, IN?, KY, LA, MD, MO?, MS, NC, NJ, OK, SC, TN, TX

TNC Ecoregions: 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 52:P, 53:C, 56:C, 57:C, 58:C, 62:C

USFS Ecoregions: 221Hc:CPP, 221Ja:CCP, 221Jb:CCC, 222Ag:CCC, 222Cb:CCC, 222Cc:CCP, 222Ce:CCP, 222Cg:CCC, 222Da:CCC, 222Dc:CC?, 222Dg:CCC, 222Eb:CCC, 222Ef:CCC, 222Eg:CCC, 222Ej:CCC, 222El:CCC, 231Aa:CCC, 231Ae:CC?, 231Ba:CCC, 231Bb:CCC, 231Be:CCC, 231Bg:CCC, 231Bi:CCC, 231Bk:CCC, 231Cc:CCC, 231Cd:CCC, 231Ea:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Ba:CCP, 232Bb:CCP, 232Bh:CCP, 232Bi:CC?, 232Bk:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCP, 232Bt:CCC, 232Bu:CCP, 232Bv:CC?, 232Bx:CCC, 232Bz:CCP, 232Ca:CC?, 232Ce:CC?, 232Ci:CCC, 232Fa:CCP, 232Fb:CCP, 232Fe:CCC, 234Aa:CCP, 234Ab:CCC, 234Ac:CCC, 234Ae:CCC, 234Ag:CCP, 234Ah:CC?, 234Am:CC?, 234An:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCP, M231Ab:CCP, M231Ac:CCP, M231Ad:CCP

Federal Lands: DOD (Arnold, Fort Benning); NPS (Buffalo River, Chickamauga-Chattanooga, Fort Donelson, Little River Canyon, Mammoth Cave, Natchez Trace, National Capital-East, Shiloh); TVA (Tellico); USFS (Angelina, Bankhead, Bienville, Cherokee?, Conecuh, Davy Crockett, De Soto, Holly Springs, Homochitto, Kisatchie?, Ouachita, Sabine, Sam Houston, St. Francis, Talladega, Tombigbee, Tuskegee); USFWS (Cape May, Chesapeake Marshlands, Prime Hook, Supawna Meadows)

ALLIANCE SOURCES

Author(s): M. Pyne/A.S. Weakley 2-96, mod.

References: Andreu and Tukman 1995, Diamond 1993, Evans 1991, Hoagland 1998a, Major pers. comm., Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Wharton 1945

[CEGL004412] *Quercus falcata* Flatwoods Forest

Translated Name: **Southern Red Oak Flatwoods Forest**

Common Name: **Southern Red Oak Flatwoods Forest**

Ecological System(s):

- South-Central Interior / Upper Coastal Plain Wet Flatwoods (CES203.480)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne, J. Campbell and M. Evans

ELEMENT CONCEPT

Global Summary: This southern red oak flatwoods forest is found in parts of the Interior Low Plateau and adjacent areas of the Upper East Gulf Coastal Plain of the southern United States. Stands occur on somewhat poorly drained sites. The vegetation is dominated by *Quercus falcata*. It is perhaps marginally a wetland and is better drained than *Quercus phellos* flatwoods. The canopy may also contain some *Quercus alba* and *Quercus stellata*, and possibly *Carya alba*. The ground

cover is predominantly leaf litter and most occurrences are thought to be fire-suppressed. At Shiloh National Military Park (Tennessee) *Chasmanthium laxum, Krigia dandelion*, and *Carex complanata* were the most abundant herbaceous plants. It is known historically from the Upper East Gulf Coastal Plain of western Kentucky (eastern Gulf Coastal Plain on tertiary terraces), western Tennessee, and northwestern Mississippi (the "flatwoods belt"), as well as the Shawnee Hills and the Knobs region of Kentucky.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This southern red oak flatwoods forest was sampled at one location in the park. The site is a flat upland bench at 243 m (797 feet) elevation. Soil is silt clay with impeded drainage which could result in occasional standing water. The unvegetated surface is dominated by leaf litter (80% cover) with some wood (20%). Evidence of disturbance includes fire suppression and wind/ice damage.

Global Environment: In Kentucky, stands occur on broad flats underlain by fragipans that impede drainage. Although these sites are wet, they are perhaps only considered as marginal wetlands by many definitions. They occur in limited areas of the Jackson Purchase region of western Kentucky where loess deposits thin out near the eastern edge of the region, as well as in related areas of the coastal plains and Interior Low Plateau. At Shiloh National Military Park (Tennessee), this association occurs in an area which is very flat, called flatwoods. It has standing water after heavy rain (>5 inches during the prior 2 days). The site may have a fragipan or other impermeable soil horizon which allows water to stay for short periods at the surface of the soil and stand. Despite this, the site is described as mesic and not called a wetland. The surface soil is silt loam.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate (60% cover) tree canopy, 20-35 m tall, is dominated by *Quercus falcata* and includes *Acer rubrum* and *Nyssa sylvatica*. The sparse (20%) subcanopy (10-15 m) is dominated by canopy species. The moderate (50%) tall-shrub layer (2-5 m) includes *Liquidambar styraciflua, Liriodendron tulipifera, Oxydendrum arboreum, Prunus serotina*, and *Sassafras albidum*. The sparse (30%) short-shrub layer (0.5-1 m) is dominated by sapling *Quercus alba* and includes saplings of other tree species as well as *Frangula caroliniana, Sassafras albidum*, and *Vaccinium stamineum*. The very sparse (10%) herbaceous layer includes *Mitchella repens*. Vines (10%) include *Smilax glauca* and *Smilax rotundifolia*

Global Vegetation: Stands of this vegetation type are dominated by *Quercus falcata*. The canopy may also contain some *Quercus alba* and *Quercus stellata*, and possibly *Carya alba*. The ground cover is predominantly leaf litter, and most occurrences are thought to be fire-suppressed. This association as documented at Shiloh National Military Park is a forest with the canopy completely dominated by *Quercus falcata*. Many of these trees are quite large. There are no other canopy trees in the plot (SHIL.22). The subcanopy has a variety of trees, the most common being *Nyssa sylvatica, Liquidambar styraciflua*, and *Acer rubrum*. Also in the subcanopy (in order of abundance) are *Quercus stellata, Carya alba, Ulmus alata, Liriodendron tulipifera, Fraxinus pennsylvanica*, and *Prunus serotina*. The most abundant tall shrubs (including tree species) are *Acer rubrum, Liquidambar styraciflua*, then *Carya alba, Nyssa sylvatica*, and *Cornus florida*. Less common as tall shrubs are *Quercus falcata, Vaccinium arboreum, Ulmus alata, Carya glabra, Juniperus virginiana var. virginiana, Amelanchier arborea*, and *Quercus phellos*. The most abundant plant in the short-shrub layer is *Vitis rotundifolia*. Other plants are rather sparse as short shrubs; in order of abundance they are *Quercus falcata, Nyssa sylvatica, Vaccinium arboreum, Rubus argutus, Lonicera japonica, Vaccinium stamineum, Ulmus alata, Hypericum hypericoides, Amelanchier arborea, Rosa carolina, Parthenocissus quinquefolia, Quercus phellos, Toxicodendron radicans, Fraxinus pennsylvanica, Smilax rotundifolia, Rhus copallinum, Liriodendron tulipifera*, and *Carya glabra*. The open areas have the most herbaceous plant cover. The most abundant herbaceous plants are *Chasmanthium laxum* and (less abundant) *Krigia dandelion*, then *Carex complanata, Scutellaria integrifolia, Oxalis stricta, Potentilla simplex (= var. simplex), Danthonia spicata, Dichanthelium laxiflorum, Elephantopus carolinianus*, and *Dichanthelium dichotomum*. Herbaceous plants present at trace amounts are *Lactuca canadensis, Viola X palmata, Vernonia missurica, Eupatorium rotundifolium var. ovatum, Hypoxis hirsuta, Stachys latidens, Galium triflorum*, and *Schizachyrium scoparium*.

Global Dynamics: Fire appears to be important in maintaining the open structure of these stands.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Nyssa sylvatica	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus falcata	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus alba	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Oxydendrum arboreum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Rubus argutus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Smilax glauca	Herb (field)	Vine/Liana	X	.	.

Mitchella repens	Herb (field)	Forb	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (31-Jan-2007). This is an unusual upland wetland community, never abundant in the landscape and severely impacted by agriculture and other intensive land uses. Even historically, it was known only from the Upper East Gulf Coastal Plain of western Kentucky, western Tennessee, and northwestern Mississippi (the "flatwoods belt"), and the Shawnee Hills and Knobs region of Kentucky. Most occurrences are small in size and lack any jurisdictional wetland protection. Most historic occurrences have been cleared, drained and tiled, and the few remaining sites are small and degraded. Fire suppression has also caused degradation of remaining examples.

RELATED CONCEPTS

Global Similar Associations:

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: In Kentucky, historic occurrences have been cleared, drained and tiled, and remaining sites are small and degraded. Similar flatwoods vegetation occurs elsewhere in Kentucky but have temporarily flooded hydrology and different canopy dominants [see *~Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286) and *~Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329)]. This type is also better drained than *Quercus phellos* flatwoods. It is known historically from the Upper East Gulf Coastal Plain of western Kentucky (eastern Gulf Coastal Plain on tertiary terraces), western Tennessee, and northwestern Mississippi (the "flatwoods belt"), as well as the Shawnee Hills and the Knobs region of Kentucky. See the dissertation of Wharton (1945) for information on this association in the Knobs region.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: As far as presently known, this association is restricted to one site near the southern boundary of the park. This is on flatter terrain rather than the dissected terrain (e.g., valleys and ridges) that comprises most of the park.

Global Range: This southern red oak flatwoods forest is found in parts of the Interior Low Plateau and Upper East Gulf Coastal Plain of the United States, ranging from Kentucky and Tennessee into parts of Indiana and Mississippi.

Nations: US

States/Provinces: IN?, KY, MS, TN

TNC Ecoregions: 43:C, 44:C

TNC Ecoregion Comments:

USFS Ecoregions: 222Cb:CCC, 222Cc:CCP, 222Ce:CCP, 222Cg:CCC, 222Da:CCC, 222Dg:CCC, 222Eg:CCC, 231Ba:CCC, 231Bk:CCC

Federal Lands: NPS (Mammoth Cave, Natchez Trace, Shiloh)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.743.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne, J. Campbell and M. Evans, mod. C.W. Nordman

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Wharton 1945	.	X	.	X	.	.	.	.	.

A.1912 Quercus muehlenbergii - (Acer saccharum) *Forest Alliance*

Chinkapin Oak - (Sugar Maple) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes a variety of dry, dry-mesic, and mesic forests, dominated by *Quercus muehlenbergii* and possibly *Acer saccharum*, the canopy often also including other hardwood species associated with high base substrates (e.g., limestone or dolomite) under a variety of moisture conditions. These include *Quercus alba, Quercus shumardii, Fraxinus americana, Fraxinus quadrangulata, Acer barbatum, Tilia americana, Carya* spp., *Juglans nigra*, and *Liriodendron tulipifera* (in the more interior portions of the alliance's distribution), and *Quercus sinuata var. sinuata* and *Carya myristiciformis* (in the southwestern, Coastal Plain portion of the alliance's distribution). The habitat of this alliance includes mesic and dry-mesic forests over limestones in the Nashville Basin of Tennessee, dry-mesic slopes associated with prairie openings in Louisiana, moist limestone slopes in the Edwards Plateau of Texas, blackland soils in the upper West Gulf Coastal Plain of Arkansas, lowlands and mesic slopes of Oklahoma and adjacent Arkansas, as well as related habitats in states farther east (e.g., Alleghenies and lower Cumberland Plateau escarpment). Forests in Kentucky and Tennessee have *Quercus shumardii* and *Frangula caroliniana* and occur over limestone on south-facing slopes. There are scattered occurrences on benches and clifftops on the Daniel Boone National Forest. In the Coastal Plain of Virginia, this alliance is represented by somewhat open canopy 'shell barren' forests dominated by *Quercus muehlenbergii* with *Acer barbatum*. On rare occurrences of limestone in the Southern Blue Ridge of North Carolina, *Quercus muehlenbergii* occurs with *Juglans nigra, Fraxinus americana*, and *Acer saccharum*. Understory species may include *Cornus florida, Cercis canadensis, Calycanthus floridus, Cornus alternifolia, Ostrya virginiana*, and *Hydrangea arborescens*. In the Northeast, the shrub layer is sparse and may contain *Hamamelis virginiana, Zanthoxylum americanum*, and *Cornus alternifolia*. In some more southerly examples, shrubs may include *Forestiera ligustrina, Frangula caroliniana*, and *Symphoricarpos orbiculatus*. The herbaceous layer may contain *Asclepias quadrifolia, Clematis occidentalis (= Clematis verticillaris)* (in northeastern examples), *Packera obovata (= Senecio obovatus), Phryma leptostachya, Saxifraga virginiensis, Arabis laevigata*, and *Triosteum aurantiacum*. Two unusual communities of this alliance are lowland forests from the Upper West Gulf Coastal Plain of Arkansas. In the Northeast, the habitat is characterized as upper slopes or summits of limestone or marble ridges with dry soil-moisture regimes. Limestone outcrops or boulders may be present, as well as Karst collapse features. In the Southeast, mesic to dry limestone-derived soils may occur as well on flatter landforms, as in the Nashville Basin of Tennessee. In the Southeast, this vegetation is known from the Ridge and Valley, lower Cumberland Plateau escarpment, Highland Rim escarpment, and Nashville Basin in Tennessee; the Highland Rim, Bluegrass and Dripping Springs escarpment in Kentucky; the Cumberland Plateau in Alabama; as well as rarely in the Southern Blue Ridge and Coastal Plain. Isolated occurrences are reported in northern Arkansas on moderately shallow soils, often on glade margins. It also occurs in the Arbuckle Mountains of Oklahoma and the Edwards Plateau of Texas. If this alliance occurs in the Upper East Gulf Coastal Plain, stands would contain *Acer barbatum* instead of *Acer saccharum*.

Environment: This alliance includes a variety of dry, dry-mesic, and mesic forests associated with high base substrates (e.g., limestone or dolomite). This includes mesic and dry-mesic forests over limestones in the Nashville Basin of Tennessee, dry-mesic slopes associated with prairie openings in Louisiana, moist limestone slopes in the Edwards Plateau of Texas, blackland soils in the upper West Gulf Coastal Plain of Arkansas, lowlands and mesic slopes of Oklahoma and adjacent Arkansas, as well as related habitats in states farther east (e.g., Alleghenies and lower Cumberland Plateau escarpment). Forests in Kentucky and Tennessee have *Quercus shumardii* and *Frangula caroliniana* and occur over limestone on south-facing slopes. There are scattered occurrences on benches and clifftops on the Daniel Boone National Forest. In the Coastal Plain of Virginia, this alliance is represented by somewhat open canopy 'shell barren' forests. Two unusual communities of this alliance are lowland forests from the Upper West Gulf Coastal Plain of Arkansas. In the Northeast, the habitat is characterized as upper slopes or summits of limestone or marble ridges with dry soil-moisture regimes. Limestone outcrops or boulders may be present, as well as Karst collapse features. In the Southeast, mesic to dry limestone-derived soils may occur as well on flatter landforms, as in the Nashville Basin of Tennessee.

Vegetation: This alliance includes a variety of dry, dry-mesic, and mesic forests, dominated by *Quercus muehlenbergii* and possibly *Acer saccharum* (within its range); the canopy often also includes other hardwood species associated with high base substrates (e.g., limestone or dolomite) under a variety of moisture conditions. These include *Quercus alba, Quercus shumardii, Fraxinus americana, Fraxinus quadrangulata, Acer barbatum, Tilia americana, Carya* spp., *Juglans nigra*, and *Liriodendron tulipifera* (in the more interior portions of the alliance's distribution), *Quercus sinuata var. sinuata* and *Carya myristiciformis* (in the southwestern, Coastal Plain portion of the alliance's distribution), and *Quercus buckleyi, Fraxinus texensis, Ulmus crassifolia*, and *Quercus sinuata var. breviloba* (in the Edwards Plateau and Lampasas Cutplain of central Texas). The habitat of this alliance includes mesic and dry-mesic forests over limestones in the Nashville Basin of Tennessee, dry-mesic slopes associated with prairie openings in Louisiana, moist limestone slopes in the Edwards Plateau of Texas, blackland soils in the upper West Gulf Coastal Plain of Arkansas, lowlands and mesic

slopes of Oklahoma and adjacent Arkansas, as well as related habitats in states farther east (e.g., Alleghenies and lower Cumberland Plateau escarpment). Forests in Kentucky and Tennessee have *Quercus shumardii* and *Frangula caroliniana* and occur over limestone on south-facing slopes. There are scattered occurrences on benches and clifftops on the Daniel Boone National Forest. In the Coastal Plain of Virginia, this alliance is represented by somewhat open canopy 'shell barren' forests dominated by *Quercus muehlenbergii* with *Acer barbatum*. On rare occurrences of limestone in the Southern Blue Ridge of North Carolina, *Quercus muehlenbergii* occurs with *Juglans nigra, Fraxinus americana*, and *Acer saccharum*. Understory species may include *Cornus florida, Cercis canadensis, Calycanthus floridus, Cornus alternifolia, Ostrya virginiana*, and *Hydrangea arborescens*. In the Northeast, the shrub layer is sparse and may contain *Hamamelis virginiana, Zanthoxylum americanum*, and *Cornus alternifolia*. In some more southerly examples, shrubs may include *Forestiera ligustrina, Frangula caroliniana*, and *Symphoricarpos orbiculatus*. The herbaceous layer may contain *Asclepias quadrifolia, Clematis occidentalis (= Clematis verticillaris)* (in northeastern examples), *Packera obovata (= Senecio obovatus), Phryma leptostachya, Saxifraga virginiensis, Arabis laevigata*, and *Triosteum aurantiacum*.

Dynamics:

Similar Alliances:

- *Acer grandidentatum - Quercus buckleyi - Quercus muehlenbergii* Forest Alliance (A.215)
- *Fraxinus quadrangulata - (Juniperus virginiana)* Woodland Alliance (A.1913)
- *Quercus muehlenbergii* Woodland Alliance (A.621)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance may be found nearly throughout the eastern U.S. from Vermont to North Carolina and possibly South Carolina and west from Illinois to Texas as well as Ontario in southern Canada. In the Southeast, this vegetation is known from the Ridge and Valley, lower Cumberland Plateau escarpment, Highland Rim escarpment, and Central Basin in Tennessee; the Highland Rim, Bluegrass and Dripping Springs escarpment in Kentucky; the Cumberland Plateau in Alabama; the Arbuckle Mountains of Oklahoma; and the Edwards Plateau and Lampasas Cutplain of Texas, as well as rarely in the Southern Blue Ridge and Coastal Plain. Isolated occurrences are reported in northern Arkansas on moderately shallow soils, often on glade margins.

Nations: CA, US

Subnations: AL, AR, CT, DC?, GA, IL, IN, KY, LA, MA, MD, MI?, MS?, NC, NJ, NY, OH, OK, ON, PA, SC?, TN, TX, VA, VT, WV

TNC Ecoregions: 29:C, 32:C, 33:C, 37:C, 38:C, 39:C, 40:C, 41:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 56:C, 57:C, 58:C, 59:C, 60:?, 61:C, 63:C, 64:C

USFS Ecoregions: 212B:CC, 212E:CC, 212Fa:C??, 212Ga:C??, 212Gb:C??, 221Ae:CCC, 221B:CC, 221Dc:CC?, 221Ea:CCC, 221Hc:CCC, 221Hd:CCP, 221Ja:CCC, 221Jb:CCC, 221Jc:CCP, 222An:CC?, 222Cg:CCC, 222Df:CCP, 222Dg:CCC, 222Ea:CC?, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ee:CCC, 222Ef:CCC, 222Eg:CCC, 222Eh:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCP, 222Fa:CCP, 222Fb:CCC, 222Fc:CC?, 222Fd:CCC, 222Fe:CCP, 222Ff:CCP, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222I:CC, 231Ba:CP?, 231Be:CP?, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Dc:CCP, 231De:CCC, 231Ea:CCP, 231Eb:CCC, 231Gc:CCC, 232Br:CCC, 232Ch:CCC, 232Cj:CCC, 232Fa:CCC, 251Ea:P??, 251Eb:P??, 251Ec:P??, 251Ed:P??, 255Af:CCC, 311A:CC, 315D:CC, M212B:CC, M212Cb:CCC, M212Cc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Bd:CC?, M221Be:CCC, M221Ca:CC?, M221Cb:CCC, M221Cc:CC?, M221Ce:CCC, M221Da:CCC, M221Db:CC?, M221Dc:CCC, M221Dd:CCC, M222Aa:CCC

Federal Lands: COE (J. Percy Priest?, Lake Millwood); DOD (Fort Hood, Yorktown); NPS (Abe Lincoln Birthplace, Antietam, Big South Fork, Bluestone, Buffalo River, C&O Canal, Chickamauga-Chattanooga, Colonial, Cumberland Gap, George Washington Birthplace, Great Smoky Mountains?, Harpers Ferry, Mammoth Cave, Manassas, Natchez Trace, National Capital-East?, New River Gorge, Russell Cave, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Hoosier, Jefferson, Monongahela?, Ozark, Pisgah, Shawnee); USFWS (Wichita Mountains)

ALLIANCE SOURCES

Author(s): D.J. Allard and D. Faber-Langendoen, mod. J. Teague

References: Allard 1990, Andreu and Tukman 1995, Bowen et al. 1995, Campbell 1980, Crites and Clebsch 1986, Diamond 1993, Diggs et al. 1999, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Fowells 1965, Hoagland 1997, Hoagland 1998a, Pyne 1994, Schafale and Weakley 1990, Smith 1991, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, Ware and Ware 1992

[CEGL004741] *Acer saccharum - Carya ovata - Juglans nigra / Symphoricarpos orbiculatus / Galium circaezans* Forest

Translated Name: **Sugar Maple - Shagbark Hickory - Black Walnut / Coralberry / Licorice Bedstraw Forest**
Common Name: **Interior Low Plateau Mesic Sugar Maple - Hickory Forest**

Ecological System(s):
- South-Central Interior Mesophytic Forest (CES202.887)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Pyne and C.S. Major

ELEMENT CONCEPT

Global Summary: This association represents mesic forests over limestone in portions of the unglaciated Interior Low Plateau, including the Mitchell Plain and the dissected Knobs region of Kentucky, and the Nashville Basin of Tennessee, dominated by *Acer saccharum* with *Carya ovata* and *Juglans nigra*. Scattered individuals of *Quercus muehlenbergii, Quercus shumardii*, and *Tilia americana var. heterophylla* are also present in the more-or-less closed canopy (about 70% closure). *Carya ovata* may occur as patches or as scattered individuals. Stands of this association may be smaller-scale patches embedded in a less mesic matrix of oak-dominated forests. The high predominance of *Acer saccharum* in preference to oaks is presumably due to these more mesic and/or fire-sheltered conditions, but in some cases it may be the result of the removal of oaks by logging. The subcanopy contains *Acer saccharum, Ostrya virginiana, Cercis canadensis*, and *Celtis occidentalis*, with one or more *Carya* spp. In the shrub stratum, *Symphoricarpos orbiculatus* is a common component.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This mesic sugar maple - hickory forest was sampled at one location in the park. The site is a somewhat steep, east-facing lower slope at 155 m (508 feet) elevation. The substrate is limestone and soil is moderately well-drained silt loam. The unvegetated surface is dominated by leaf litter (45% cover) with some exposed bedrock (10%), large rocks (5%), wood (10%) and bare soil (30%). No evidence of disturbance was reported. Examples are intermediate in slope position and composition between oak-dominated forest (e.g., CEGL008442) above, and mesic terrace forest (e.g., CEGL008429 or CEGL007879) below.

Global Environment: This association represents mesic forests over limestone in portions of the unglaciated Interior Low Plateau, including the Mitchell Plain and the dissected Knobs region of Kentucky, and the Nashville Basin of Tennessee. In one example near the Duck River in Maury County, Tennessee, this vegetation has developed on soils derived from Ordovician limestone, in an area of alternating karst collapse features and residual rectangular-linear arrays of limestone boulders and slabs. Deeper soils have accumulated in the collapse features and the interstices between the boulders; this configuration contributes to the herbaceous diversity of the community. This situation would tend to be generally fire-sheltered. In Kentucky (Abraham Lincoln Birthplace National Historic Site units), one site is located beside an old road high atop a knob on a gentle ridge with an eastern aspect. The second site is on a steep, south-facing lower slope at 227 m elevation that is fairly protected by its low position opposite an adjacent knob, and somewhat mesic for a south-facing slope. Soils are moderately well- to well-drained, dry-mesic clay loams.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by *Acer saccharum* and *Carya ovata* along with *Carya alba, Fraxinus americana, Platanus occidentalis*, and *Ulmus rubra*. The moderate (60%) subcanopy (15-20 m) is codominated by *Acer saccharum* and *Carya ovata*. The very sparse (10%) tall-shrub layer (2-5 m) includes *Acer saccharum* and *Aesculus glabra*, and the sparse (20%) short-shrub layer (0.5-1 m) includes *Asimina triloba, Fagus grandifolia, Lindera benzoin*, and *Symphoricarpos orbiculatus*. The very sparse (<5%) herbaceous layer is made up of *Pilea pumila, Polygonum virginianum*, and *Sedum ternatum*.

Global Vegetation: Stands of this association are dominated by *Acer saccharum* with *Carya* spp. (e.g., *Carya alba, Carya ovata*) and *Juglans nigra*. Scattered individuals of *Quercus muehlenbergii, Quercus shumardii*, other *Quercus* spp., and *Tilia americana var. heterophylla* may also be present. The subcanopy contains *Acer saccharum, Ostrya virginiana, Cercis canadensis*, and *Celtis occidentalis*, with occasional *Carya cordiformis*. In the shrub stratum, *Symphoricarpos orbiculatus* is most prevalent; also present are *Rhus aromatica, Forestiera ligustrina, Frangula caroliniana, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Some examples contain *Cornus florida, Viburnum rufidulum, Nyssa sylvatica, Fraxinus americana, Staphylea trifolia, Asimina triloba*, and *Lindera benzoin*. In one Tennessee example, dense stands of vigorous (over 1 m tall) *Polymnia canadensis* are present on the exposed limestone slabs and boulders. *Asplenium rhizophyllum* occurs on the sheltered vertical surfaces of the boulders, along with several mosses. *Sedum pulchellum* and *Parietaria pensylvanica* are also characteristic of these limestone exposures. Some herbs which occur in deeper soils include *Dichanthelium boscii, Bromus pubescens, Chasmanthium sessiliflorum, Elymus villosus,*

Elymus hystrix, Carex spp., *Saxifraga virginiensis, Sanicula canadensis var. canadensis, Phryma leptostachya, Geum canadense, Galium circaezans, Arabis laevigata var. laevigata, Trillium cuneatum, Viola X palmata, Agrimonia* sp., and *Dioscorea quaternata*.

Global Dynamics: Stands of this association may be smaller-scale patches embedded in a less mesic matrix of oak-dominated forests. The high predominance of *Acer saccharum* in preference to oaks is presumably due to these more mesic and/or fire-sheltered conditions, but in some cases it may be the result of the removal of oaks by logging.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Carya ovata	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Carya alba Tree canopy	Broad-leaved deciduous tree	X	.	.	
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree	X	.	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	.	.
Ulmus rubra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Aesculus glabra	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Asimina triloba	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Fagus grandifolia	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	X	.
Pilea pumila	Herb (field)	Forb	X	.	.
Sedum ternatum	Herb (field)	Forb	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (15-Mar-2007). This type was originally described from the Central Basin of Tennessee. Additional data from Kentucky has led to its becoming better defined with an expanded range. It is somewhat restricted in its habitat and range, and some doubt remains about its global rarity.

RELATED CONCEPTS

Global Similar Associations:

- *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017)--from areas to the east and north.

Global Related Concepts:

- IA6k. Sugar Maple - Oak - Hickory Forest (Allard 1990) [in part] **B**
- Sugar Maple - Oak - Hickory Forest (Pyne 1994) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments: There is only one plot at MACA assigned to this type, it was taken very close to a plot of CEGL008442, and may in effect be an ecotonal variant of it (or it could be a rare type that is not sampled). It is being retained in the classification, and was used as a mapping unit, but more information is necessary.

Global Classification Comments: In one example near the Duck River in Maury County, Tennessee, this vegetation has developed on soils derived from Ordovician limestone, in an area of alternating karst collapse features and residual rectangular-linear arrays of limestone boulders and slabs. Deeper soils have accumulated in the collapse features and the interstices between the boulders; this configuration contributes to the herbaceous diversity of the community. This situation would tend to be generally fire-sheltered.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is found in the eastern and southern parts of the park, where limestone substrates predominate. Examples of it are rare and of limited extent in the park, and it will probably not be used as a mapping unit.

Global Range: This association represents mesic forests over limestone in portions of the unglaciated Interior Low Plateau.

Nations: US

States/Provinces: AL?, KY, TN

TNC Ecoregions: 44:C

TNC Ecoregion Comments:
USFS Ecoregions: 222Dg:CCC, 222Ed:CCC
Federal Lands: NPS (Abe Lincoln Birthplace, Mammoth Cave, Stones River?); TVA (Columbia)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.84.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Pyne 1994 .	.	X	X	.	.	.	.	.	
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

[CEGL003876] *Quercus imbricaria - Quercus shumardii - Quercus muehlenbergii / Celtis occidentalis / Urtica chamaedryoides* Forest

Translated Name: **Shingle Oak - Shumard Oak - Chinkapin Oak / Common Hackberry / Dwarf Stinging Nettle Forest**
Common Name: **Interior Plateau Shingle Oak - Shumard Oak - Chinquapin Oak Forest**
Ecological System(s):
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard
Circumscription Confidence:
Concept Author(s): C.W. Nordman

ELEMENT CONCEPT

Global Summary: This forest is found in small patches on flat to rolling uplands on somewhat rocky soils derived from Mississippian and Ordovician limestones in the Interior Low Plateau of Tennessee and Kentucky, including the Nashville Basin and the Mammoth Cave Uplands. Stands are dominated by *Quercus imbricaria, Quercus shumardii*, and *Quercus muehlenbergii* with *Quercus stellata*. *Celtis occidentalis* is important as an understory species, and *Urtica chamaedryoides* is a characteristic herbaceous species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This mixed oak forest was sampled at two locations in the park. One site is a gentle, west-facing lower slope with moderately well-drained clay loam soil, the other a somewhat steep, east-facing midslope sinkhole. The unvegetated surface at one site is dominated by leaf litter (90% cover) with some wood (10%). Evidence of disturbance includes past logging, an old road/log run, and the presence of exotic plants.
Global Environment: This forest is found in small patches on flat to rolling uplands in the Interior Low Plateau of Tennessee and Kentucky, including the Nashville Basin and the Mammoth Cave Uplands. It is found on rich soils derived from Mississippian and Ordovician limestones, which have limestone fragments at the surface as small rocks. The area where this is documented may have karst features.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is dominated by *Quercus imbricaria* along with *Carya ovalis, Fraxinus americana, Quercus alba, Quercus rubra*, and *Quercus velutina*. The sparse (30%) subcanopy (15-20 m) is codominated by *Quercus imbricaria, Carya ovalis*, and *Juniperus virginiana*. The very sparse (<5%) tall-shrub layer (2-5 m) includes *Carya cordiformis* and *Juniperus virginiana*. The sparse (30%), yet diverse (35 taxa reported from one plot) short-shrub layer (0.5-1 m) is made up of saplings of tree species, including *Carya cordiformis, Cercis canadensis, Cornus florida, Symphoricarpos orbiculatus, Ulmus alata*, and six species of *Quercus*. The very sparse (10%) herbaceous layer, also quite diverse (70 taxa reported) includes *Acalypha virginica, Ageratina altissima, Agrimonia rostellata, Arisaema dracontium, Arisaema triphyllum, Chimaphila maculata, Galium triflorum, Goodyera pubescens, Panax quinquefolius, Polystichum acrostichoides, Pycnanthemum incanum,*

Sisyrinchium angustifolium, Uvularia perfoliata, and many others. Vines include *Parthenocissus quinquefolia, Toxicodendron radicans*, and *Smilax* spp.

Global Vegetation: Stands of this forest are dominated by *Quercus imbricaria, Quercus shumardii*, and *Quercus muehlenbergii* with *Quercus stellata* also important as a canopy tree. *Quercus falcata, Fraxinus americana, Carya ovata, Carya ovalis, Quercus alba, Quercus velutina*, and *Prunus serotina* are less important but may be present in the canopy. *Celtis occidentalis, Maclura pomifera*, and *Juniperus virginiana* are present in the understory. *Symphoricarpos orbiculatus* and *Parthenocissus quinquefolia* are important low shrubs. *Urtica chamaedryoides, Polymnia canadensis, Stellaria media*, and *Iodanthus pinnatifidus* are present in the herbaceous layer.

Global Dynamics: *Juniperus virginiana* and the exotic plants *Lonicera japonica* and *Lonicera maackii* have apparently increased following disturbance of stands of this type.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Carya ovalis	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus imbricaria	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree	X	.	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Juglans cinerea	-	P	

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (5-Sep-2008). This type is restricted to limestone strata of the Interior Low Plateau of Tennessee and Kentucky. In the Nashville Basin and Mammoth Cave Uplands, these upland forests remain mostly in small stands, threatened by development pressures and invasion by the exotic plants *Lonicera japonica* and *Lonicera maackii*. This type is limited to an area where the nominal species all occur.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus muehlenbergii - Quercus (falcata, shumardii, stellata) / Cercis canadensis / Viburnum rufidulum* Forest (CEGL007699)
- *Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808)--does not have *Quercus imbricaria* as an important component.

Global Related Concepts:

- IA6j. Interior Calcareous Oak - Hickory Forest (Allard 1990) [in part?] **?**
- IA6l. Cedar - Oak - Hackberry Elm Forest (Allard 1990) [in part] **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments: *Quercus imbricaria* is found at Mammoth Cave only in karst valleys and out on the Sinkhole Plain in the Diamond Caverns vicinity. There is discussion of the potential significance of this in Olson and Noble (2005; p. 26).

Global Classification Comments: *Quercus imbricaria* ranges from southern Iowa and southern Michigan to Pennsylvania, west to eastern Kansas and Oklahoma, and south to Louisiana, Mississippi, Alabama, and Georgia. It is generally not found west of the Appalachians, and it is most frequently found in the limestone regions of the Midwest and the Interior Low Plateau.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: At Mammoth Cave National Park, this association is frequent throughout the sink valleys.

Global Range: This association is found in the Interior Low Plateau of Tennessee and Kentucky. It has been documented from the Nashville Basin and Mammoth Cave Uplands.

Nations: US

States/Provinces: KY, TN

TNC Ecoregions: 44:C

TNC Ecoregion Comments:
USFS Ecoregions: 222Dg:CCC, 222Ec:CC?, 222Ed:CCC
Federal Lands: DOD (J. Percy Priest?); NPS (Mammoth Cave, Stones River)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.27, MACA.94.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): C.W. Nordman, mod. M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990	.	X	.	.	.	.	.	.	
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

[CEGL008442] *Quercus shumardii - Quercus muehlenbergii - Acer (barbatum, leucoderme, saccharum) / Ostrya virginiana* Forest

Translated Name: **Shumard Oak - Chinkapin Oak - (Southern Sugar Maple, Chalk Maple, Sugar Maple) / Hophornbeam Forest**
Common Name: **Shumard Oak - Chinkapin Oak Mesic Limestone Forest**
Ecological System(s):
- Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Pyne and A.S. Weakley

ELEMENT CONCEPT

Global Summary: This deciduous forest association accommodates mesic forests dominated by *Quercus shumardii* and *Quercus muehlenbergii*, with one of several related *Acer* spp. (e.g., sugar maples - *Acer barbatum, Acer leucoderme, Acer saccharum*), depending on where the stand is located. The canopy composition varies considerably with geography. This forest occurs on soils derived from limestones, dolomites or other basic substrates, on sloping to steeply sloping topography on middle to lower slopes. In addition to the nominal species, the canopy may also contain various *Carya* spp. (including *Carya alba, Carya glabra, Carya ovalis, Carya ovata*, and/or *Carya carolinae-septentrionalis*) and other basophilic and/or mesic hardwood species, including *Fraxinus americana, Fraxinus quadrangulata* (within its range), *Diospyros virginiana*, and *Ulmus* spp. (including *Ulmus alata, Ulmus americana, Ulmus rubra*, and/or *Ulmus serotina*). Other oaks, including *Quercus alba, Quercus rubra*, and *Quercus velutina*, may be present, but will not dominate the canopy. *Liriodendron tulipifera* and/or *Liquidambar styraciflua* may be present, perhaps grading in from adjoining mixed mesic forests. Subcanopy species include *Ostrya virginiana*, the *Acer* spp. mentioned above, *Aesculus* spp., *Cornus florida, Ulmus* spp., *Cercis canadensis, Celtis laevigata, Fraxinus quadrangulata*, and *Prunus* spp. Shrubs and woody vines, which vary considerably with geography and site moisture conditions, may include *Asimina triloba, Berchemia scandens, Calycanthus floridus, Crataegus* spp., *Euonymus americanus, Euonymus atropurpureus, Forestiera ligustrina, Frangula caroliniana, Lindera benzoin, Rhododendron canescens, Sideroxylon lycioides, Staphylea trifolia, Symphoricarpos orbiculatus*, and *Viburnum rufidulum*. Other common woody vines include *Bignonia capreolata, Lonicera sempervirens, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Herbs are a mixture of mesic and submesic limestone species, which also vary widely with geography.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This Shumard oak - chinquapin oak dry-mesic limestone forest was sampled at four locations in the park. Sites are gentle to somewhat steep, east- and south-facing mid to upper slopes. Soils are well-drained silt loam and sandy loam. The unvegetated surface is dominated by leaf litter (45-95% cover) with some exposed bedrock (0-10%), large rocks (0-10%), wood (5-10%) and bare soil (0-30%). Evidence of disturbance includes past logging and the presence of exotic plants.
Global Environment: This forest occurs on soils derived from limestones, dolomites or other basic substrates, on sloping to steeply sloping topography on middle to lower slopes.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 15-35 m tall, is dominated by *Quercus muehlenbergii* and may include *Acer saccharum, Carya glabra, Carya ovata, Fraxinus americana*, and *Quercus shumardii*, among others. The moderate (40-60%) subcanopy (15-20 m) is dominated by *Acer saccharum*. The very sparse to moderate (10-40%) tall-shrub layer (2-10 m) may include *Aesculus glabra, Cornus florida, Ostrya virginiana*, and *Quercus muehlenbergii*. The very sparse to moderate (5-50%) short-shrub layer (0.5-1 m) may include *Lindera benzoin, Asimina triloba, Celtis laevigata, Fraxinus pennsylvanica, Ostrya virginiana*, and *Ulmus alata*. The sparse to dense (80%) herbaceous layer may be dominated by *Arundinaria gigantea* and may also include *Ageratina altissima, Amphicarpaea bracteata, Brachyelytrum erectum, Cardamine diphylla, Galium circaezans, Hymenocallis caroliniana, Monarda russeliana, Polystichum acrostichoides*, and *Verbesina* sp. Vines include *Bignonia capreolata, Smilax glauca*, and *Smilax rotundifolia*. This community also supports state-critically imperiled *Matelea carolinensis*.

Global Vegetation: This association accommodates mesic forests dominated by *Quercus shumardii* and *Quercus muehlenbergii*, with one of several related *Acer* spp. (e.g., sugar maples - *Acer barbatum, Acer leucoderme, Acer saccharum*), depending on where the stand is located. The canopy composition varies considerably with geography. In addition to the nominal species, the canopy may also contain various *Carya* spp. (including *Carya alba, Carya glabra, Carya ovalis, Carya ovata*, and/or *Carya carolinae-septentrionalis*) and other basophilic and/or mesic hardwood species, including *Fraxinus americana, Fraxinus quadrangulata* (within its range), *Diospyros virginiana*, and *Ulmus* spp. (including *Ulmus alata, Ulmus americana, Ulmus rubra*, and/or *Ulmus serotina*). Other oaks, including *Quercus alba, Quercus rubra*, and *Quercus velutina*, may be present but will not dominate the canopy. *Liriodendron tulipifera* and/or *Liquidambar styraciflua* may be present, perhaps grading in from adjoining mixed mesic forests. One example in the Outer Nashville Basin of Tennessee contains *Quercus macrocarpa*. The canopy of examples from Georgia's Ridge and Valley may contain more Appalachian species, including *Aesculus flava, Halesia tetraptera, Tilia americana var. heterophylla*, and *Magnolia acuminata*. These latter two species may be found in the subcanopy of examples generally across its range. Subcanopy species include the *Acer* spp. mentioned above, *Aesculus* spp., *Cornus florida, Ostrya virginiana, Ulmus* spp., *Cercis canadensis, Celtis laevigata, Fraxinus quadrangulata*, and *Prunus* spp. Shrubs and woody vines, which vary considerably with geography and site moisture conditions, may include *Asimina triloba, Berchemia scandens, Calycanthus floridus, Crataegus* spp., *Euonymus americanus, Euonymus atropurpureus, Forestiera ligustrina, Frangula caroliniana, Lindera benzoin, Rhododendron canescens, Sideroxylon lycioides, Staphylea trifolia, Symphoricarpos orbiculatus*, and *Viburnum rufidulum*. Other common woody vines include *Bignonia capreolata, Lonicera sempervirens, Parthenocissus quinquefolia*, and *Toxicodendron radicans*. Herbs, a mixture of mesic and submesic limestone species (also varying widely with geography), may include *Actaea pachypoda, Ageratina altissima (= Eupatorium rugosum), Arabis laevigata, Asarum canadense, Asplenium platyneuron, Asplenium resiliens, Boehmeria cylindrica, Carex purpurifera, Carex* spp., *Caulophyllum thalictroides, Actaea racemosa (= Cimicifuga racemosa), Chasmanthium sessiliflorum, Claytonia virginica, Clematis virginiana, Cocculus carolinus, Desmodium pauciflorum, Dichanthelium boscii, Dioscorea quaternata, Elymus* sp., *Galium circaezans, Hepatica nobilis var. acuta, Hexastylis arifolia var. ruthii, Hydrophyllum canadense, Pachysandra procumbens, Passiflora lutea, Polygonatum biflorum, Polygonum virginianum, Polystichum acrostichoides, Ruellia caroliniensis, Sanicula* spp., *Silene stellata, Silene virginica, Solidago curtisii, Solidago sphacelata, Spigelia marilandica, Stellaria pubera, Tiarella cordifolia, Verbesina virginica*, and *Viola* spp. The exotics *Euonymus fortunei, Lonicera japonica*, and *Lonicera maackii* may invade examples of this forest.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Quercus muehlenbergii	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Carya glabra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Carya ovata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus shumardii	Tree canopy	Broad-leaved deciduous tree	X	X	.
Ostrya virginiana	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	X	.
Aesculus glabra	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Asimina triloba	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Ageratina altissima	Herb (field)	Forb	X	.	.
Monarda russeliana	Herb (field)	Forb	X	.	.
Verbesina virginica	Herb (field)	Forb	X	.	.
Arundinaria gigantea	Herb (field)	Graminoid	X	.	.

Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name | Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name | Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Alliaria petiolata	-	P	exotic
Matelea carolinensis	-	P	state-critically imperiled

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Juglans cinerea	-	P	

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (13-Jun-2000). This mesic, basophilic, oak-dominated forest association occurs on soils derived from limestones or other basic substrates, on upper to mid slopes. It is documented from the Interior Low Plateau of Tennessee, the Cumberlands of Alabama, and the Ridge and Valley of Georgia. Some examples may be protected on lands of the TVA, Army Corps of Engineers, and U.S. Forest Service. Most, if not all, high-quality examples have been eliminated or severely impacted by timber removal, grazing, soil erosion, and fire suppression. Other current threats include windthrow, microclimate modification from intensive silvicultural practices on adjacent uplands, forest type conversion, and herbicide use. Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus muehlenbergii, Quercus shumardii*). Removal of the oaks through logging could result in a successional canopy dominated by *Liriodendron tulipifera, Acer saccharum, Fagus grandifolia*, etc., in which case the vegetation of these sites would be indistinguishable from other mesic, non-oak forests.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - Quercus stellata / Ostrya virginiana - Acer barbatum / Chasmanthium sessiliflorum* Forest (CEGL008443)
- *Quercus muehlenbergii - Carya* spp. / *Ostrya virginiana* Upper East Gulf Coastal Plain Forest (CEGL003903)--of the Upper East Gulf Coastal Plain.
- *Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808)--is slightly less mesic.
- *Quercus muehlenbergii - Quercus shumardii* Forest (CEGL004602)--occurs west of the Mississippi River.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: This association differs from mixed mesophytic forests by being oak-dominated; it differs from rich *Quercus alba - Quercus rubra* forests by being dominated by different oaks; and it differs from drier *Quercus muehlenbergii - Quercus shumardii* forests by having more mesic canopy associates as well as more mesic shrub and herb layers. This concept originated with the more mesic manifestations of *Quercus muehlenbergii - Quercus shumardii*-dominated vegetation in Alabama, Georgia, and Tennessee. Additional information is needed regarding landscape position, variation, and floristics of this association across its range. Forests dominated by these nominal oaks seem to range from mesic (this association) to relatively xeric, ~*Quercus muehlenbergii - Quercus shumardii - Carya (carolinae-septentrionalis, ovata)* Forest (CEGL007808). The relationship of these phases to the overall geographic distribution of this association and its more xeric equivalent (CEGL007808) and their western relative ~*Quercus muehlenbergii - Quercus shumardii* Forest (CEGL004602) remains under investigation. Stands on which this association concept is based occur at Warner Park (Nashville, Tennessee); Flint Creek in the Bankhead National Forest (Alabama); and Little Mountain in the Chattahoochee National Forest (Georgia).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range:

Global Range: The range of this association includes the Interior Low Plateau of Kentucky and Tennessee, the Cumberlands of Alabama, and the Ridge and Valley of Georgia.

Nations: US

States/Provinces: AL, GA, KY, TN

TNC Ecoregions: 44:C, 50:C

TNC Ecoregion Comments:

USFS Ecoregions: 221Hc:CCC, 222Dg:CCC, 222Eb:CC?, 222Ec:CCC, 222Ed:CC?, 222Ee:CC?, 222Ef:CCC, 222Eg:CCP, 222Eh:CCP, 222Fa:C??, 222Fb:C??, 222Fc:C??, 222Fd:C??, 231Cd:CCC, 231Ce:CC?, 231De:CCC
Federal Lands: DOD (J. Percy Priest?); NPS (Mammoth Cave, Natchez Trace, Russell Cave); TVA (Columbia?); USFS (Bankhead, Chattahoochee, Chattahoochee (Southern Blue Ridge), Daniel Boone)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.68, MACA.85, MACA.735, MACA.739. The assignment of MACA.68 and MACA.85 to this type is somewhat ambiguous.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M.P. Schafale and A.S. Weakley, mod. M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.248 Quercus prinus - (Quercus coccinea, Quercus velutina) *Forest Alliance*

Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes xeric oak forests strongly dominated by *Quercus prinus* or *Quercus prinus* with admixtures of *Quercus coccinea* and/or *Quercus velutina*, occurring in the southern and central Appalachians, Ridge and Valley, Cumberland Plateau, Piedmont, Interior Low Plateau, and possibly in the northern Appalachians. These forests occur on convex, upper slopes and ridgetops, south-facing slopes, over thin, rocky, infertile soils in the Appalachians, typically below 1066 m (3500 feet) where windthrow and ice damage are common natural disturbances. In the Piedmont these forests occur on low mountains and hills, on rocky, well-drained, acidic soils, sometimes associated with outcrops of quartzite or other resistant rock. In the Piedmont and Ridge and Valley, and in areas transitional to these provinces, *Quercus stellata* and *Quercus marilandica* may be canopy associates. Other canopy/subcanopy associates include *Acer rubrum, Amelanchier arborea, Carya alba, Carya glabra, Cornus florida, Hamamelis virginiana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus rigida, Pinus strobus, Quercus alba, Quercus rubra, Robinia pseudoacacia*, and *Sassafras albidum*. In the Appalachians, a dense ericaceous shrub layer is characteristic, with species such as *Gaylussacia baccata, Gaylussacia ursina, Kalmia latifolia, Leucothoe recurva, Rhododendron maximum, Vaccinium pallidum*, and *Vaccinium stamineum*. In the upper Piedmont *Kalmia latifolia, Vaccinium arboreum*, and *Vaccinium pallidum* are common. In the montane distribution of this alliance, forests of this alliance have replaced forests formerly dominated or codominated by *Castanea dentata*, and chestnut sprouts are common in the understory. Other shrub species found in forests of this alliance include *Chionanthus virginicus, Diospyros virginiana, Robinia hispida, Sassafras albidum, Styrax grandifolius, Symplocos tinctoria, Viburnum acerifolium, Viburnum prunifolium*, and *Viburnum rufidulum*. Herbaceous cover is typically sparse in these dry, rocky forests and species vary with geographic location.
Environment: These forests occur on convex, upper slopes and ridgetops, south-facing slopes, over thin, rocky, infertile soils in the Appalachians, typically below 1066 m (3500 feet), where windthrow and ice damage are common natural disturbances. In the Piedmont these forests occur on low mountains and hills, on rocky, well-drained, acidic soils, sometimes associated with outcrops of quartzite or other resistant rock.
Vegetation: This alliance consists of xeric oak forests in the Appalachians, Interior Plateau, and Piedmont, dominated by pure *Quercus prinus* or *Quercus prinus* with admixtures of *Quercus coccinea* and/or *Quercus velutina*. In the Piedmont and Ridge and Valley, and in areas transitional to these provinces, *Quercus stellata* and *Quercus marilandica* may be canopy associates. Other canopy/subcanopy associates include *Acer rubrum, Amelanchier arborea, Carya alba, Carya glabra, Cornus florida, Hamamelis virginiana, Magnolia fraseri, Nyssa sylvatica, Oxydendrum arboreum, Pinus rigida, Pinus strobus, Quercus alba, Quercus rubra, Robinia pseudoacacia*, and *Sassafras albidum*. In the Appalachians, a dense ericaceous shrub layer is characteristic, with species such as *Gaylussacia baccata, Gaylussacia ursina, Kalmia latifolia, Leucothoe recurva, Rhododendron maximum, Vaccinium pallidum*, and *Vaccinium stamineum*. In the upper Piedmont *Kalmia latifolia, Vaccinium arboreum*, and *Vaccinium pallidum* are common. In the montane distribution of this alliance, forests of this alliance have replaced forests formerly dominated or codominated by *Castanea dentata*, and chestnut sprouts are common in the understory. Other shrub species found in forests of this alliance include *Chionanthus virginicus, Diospyros virginiana, Robinia hispida, Sassafras albidum, Styrax grandifolius, Symplocos tinctoria, Viburnum*

acerifolium, Viburnum prunifolium, and *Viburnum rufidulum*. Herbaceous cover is typically sparse in these dry, rocky forests and species vary with geographic location. Some typical herbaceous species include *Antennaria plantaginifolia, Aureolaria laevigata, Chamaelirium luteum, Chimaphila maculata, Danthonia spicata, Dichanthelium commutatum, Dichanthelium dichotomum, Dioscorea quaternata, Epigaea repens, Galax urceolata, Galium latifolium, Gaultheria procumbens, Goodyera pubescens, Hieracium venosum, Lysimachia quadrifolia, Medeola virginiana, Monotropa uniflora, Potentilla canadensis, Pteridium aquilinum, Stenanthium gramineum, Uvularia puberula*, and *Uvularia sessilifolia*.

Dynamics:

Similar Alliances:

- *Acer rubrum - Nyssa sylvatica - Magnolia fraseri* Forest Alliance (A.2009)
- *Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance (A.401)
- *Pinus strobus - Quercus (coccinea, prinus)* Forest Alliance (A.402)
- *Quercus prinus - Quercus (alba, falcata, rubra, velutina)* Forest Alliance (A.249)
- *Quercus prinus - Quercus rubra* Forest Alliance (A.250)--occurs on more mesic sites, have a more diverse canopy, and have an overall more diverse species composition than forests in this alliance.

Similar Alliance Comments: Forests in this alliance (A.248) differ from forests in ~*Quercus prinus - Quercus rubra* Forest Alliance (A.250) by lacking dominance by *Quercus rubra* and occurring on more extreme sites.

ALLIANCE DISTRIBUTION

Range: This alliance occurs in the southern and central Appalachians, Ridge and Valley, Cumberland Plateau, Piedmont, Interior Low Plateau, and possibly in the northern Appalachians. It ranges from Illinois east to Maine, south to Virginia and possibly Florida, and west to Kentucky. It also occurs in Ontario, Canada.

Nations: CA, US

Subnations: AL, CT, DC, DE, GA, IL, IN, KY, MA, MD, ME, NC, NH, NJ, NY, OH, ON, PA, RI, SC, TN, VA, VT, WV

TNC Ecoregions: 38:C, 43:P, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 58:C, 59:C, 60:C, 61:C, 63:C, 64:C

USFS Ecoregions: 212A:CC, 212D:CC, 212Ec:CCC, 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 221Aa:CC?, 221Ac:CCP, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCP, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Hc:CCC, 221He:CCC, 221Ja:CCP, 221Jb:CCC, 221Jc:CCP, 222Aq:CCC, 222Cf:CCP, 222Cg:CCP, 222Da:CCP, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Dg:CCC, 222Dh:CCP, 222Dj:CCP, 222Eb:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCP, 222El:CCC, 222Em:CCC, 222Eo:CCC, 222Fd:CCC, 222Hb:CCC, 231Aa:CCP, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Be:CPP, 231Cc:CCC, 231Cd:CCC, 231Dc:CCC, 232Aa:CCP, 232Ac:CCP, 232Ad:CCC, 232Ba:CP?, 232Bc:CP?, 232Bd:CPP, 232Br:CPP, 232Ch:CPP, M212Ba:CCP, M212Bb:CCP, M212Ca:CCC, M212Cb:CCC, M212Cc:CCC, M212Cd:CCP, M212De:CCC, M212Ea:CCC, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:CCP, M221Cb:CCC, M221Cc:CCP, M221Cd:CCP, M221Ce:CCP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort Knox); NPS (Big South Fork, Blue Ridge Parkway, C&O Canal, Carl Sandburg Home, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Cumberland Gap, Delaware Water Gap, George Washington Parkway, Gettysburg, Great Smoky Mountains, Harpers Ferry, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, National Capital-East, New River Gorge, Obed, Rock Creek, Russell Cave, Shenandoah, Upper Delaware, Valley Forge, Weir Farm, Wolf Trap); TVA (Land Between the Lakes, Tellico); USFS (Allegheny, Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Hoosier, Jefferson, Monongahela, Nantahala, Oconee?, Pisgah, Shawnee, Sumter, Talladega?, Uwharrie, Wayne)

ALLIANCE SOURCES

Author(s): D. Faber-Langendoen/D.J. Allard

References: Allard 1990, Arends 1981, Callaway et al. 1987, Cooper 1963, DuMond 1970, Eastern Ecology Working Group n.d., Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Fleming and Moorhead 1996, Gibbon 1966, Golden 1974, Martin 1989, McLeod 1988, Mowbray 1966, Nelson 1986, Newell and Peet 1996a, Patterson 1994, Peet and Christensen 1980, Rawinski 1992, Rawinski et al. 1996, Schafale and Weakley 1990, Schmalzer 1978, Smith 1991, Swain and Kearsley 2001, Tobe et al. 1992, Wells 1974, Wheat 1986, Whittaker 1956

[CEGL005022] *Quercus prinus / Smilax* spp. Forest

Translated Name: **Chestnut Oak / Greenbrier species Forest**

Common Name: **Interior Low Plateau Chestnut Oak Forest**

Ecological System(s):

- Ozark-Ouachita Dry-Mesic Oak Forest (CES202.708)
- Western Highland Rim Prairie and Barrens (CES202.352)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This chestnut oak / greenbrier forest type is found in the Interior Low Plateau region of the United States. Stands occur on dry sandy, rocky, and gravelly, noncalcareous, thin to deep upland soils of steep mid and upper slopes of hills, bluffs and ridges. Aspect is generally southern and western. Bedrock is predominantly sandstone (sometimes chert), with boulders and rock fragments at or near the surface. The dominant tree species is *Quercus prinus*. A variety of other tree species may also be present such as *Quercus velutina, Carya ovalis, Quercus alba, Quercus coccinea*, and *Quercus stellata*. The understory of this type is poorly developed (less than 50% cover) and consists of scattered, open-grown trees and shrubs and vines, including *Vaccinium arboreum* and *Smilax rotundifolia*. Ground cover consists of mixed herbaceous species and is generally sparse (less than 20%). Typical herbaceous species include *Antennaria plantaginifolia* and *Danthonia spicata*. There may be an abundance of lichens (*Cladina subtenuis, Xanthoparmelia conspersa (= Parmelia conspersa)*) and mosses (*Leucobryum glaucum*) occurring on exposed rock and dead wood.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This chestnut oak / greenbrier forest was sampled at one location in the park. The site is a gentle, east-facing upper slope at 206 m (675 feet) elevation. Soil is dry-mesic, well-drained silt loam. The unvegetated surface is dominated by leaf litter (85% cover) with some wood (15%). No evidence of disturbance was reported.

Global Environment: Stands occur on dry sandy, rocky, and gravelly, non-calcareous, thin to deep upland soils of steep mid and upper slopes of hills, bluffs and ridges. Aspect is generally southern and western. Bedrock is predominantly sandstone (sometimes chert), with boulders and rock fragments at or near the surface (TNC 1995a). This type occurs on Saffell soils in Stewart County, Tennessee, which are deep and well-drained silt loams formed in Coastal Plain gravelly materials. Because of the high content of gravel in these soils (up to 65% by volume), these sites have very low moisture-holding capacity and occur on the most xeric end of the moisture gradient at Land Between the Lakes (Fralish et al. 1999, Close et al. 2002). This type may occur on steep slopes (up to 60%) which are unstable due to movement of pebbles and rocks; the surface of some sites is heavily covered by white pebbles (Fralish et al. 1999).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately dense (70% cover) tree canopy, 20-35 m tall, is codominated by *Quercus prinus, Quercus alba*, and *Quercus coccinea*. The moderate (50%) subcanopy (10-15 m) includes *Carya glabra* and *Quercus alba*. The sparse (20%) tall-shrub layer (2-5 m) is dominated by *Ostrya virginiana* along with *Acer rubrum* and *Acer saccharum*. The sparse (30%) short-shrub layer (0.5-1 m) includes equal amounts of *Vaccinium arboreum, Vaccinium pallidum*, and *Vaccinium stamineum*. The moderately dense (70%) herbaceous layer is dominated by *Carex picta*. Vines are dominated by *Smilax rotundifolia*.

Global Vegetation: Trees in this forest make their best growth on steep lower slopes of small spur ridges. Individual trees are medium in size (8-20 m), with open, spreading, and often irregularly shaped crowns. Canopy closure is around 80-90%. The dominant tree species is *Quercus prinus*, but a variety of other tree species may also be present (Fralish et al. 1999). These other species include *Quercus alba, Quercus velutina, Quercus coccinea*, and *Carya ovalis*. The understory is poorly developed (less than 50% cover), possibly due to the droughty, nutrient-poor status of the soils. It may consist of scattered, open-grown trees and shrubs and vines, including *Vaccinium arboreum, Smilax rotundifolia, Sassafras albidum, Cornus florida, Fagus grandifolia, Ostrya virginiana*, and *Cercis canadensis*. Ground cover consists of mixed herbaceous species and is generally sparse (less than 20%), with an abundance of lichens and mosses occurring on exposed rock and dead wood. Typical herbaceous species include *Antennaria plantaginifolia* and *Danthonia spicata* (TNC 1995a). *Carex picta* can be important in examples of this type in the Brown County Hills Subsection of Indiana (Van Kley et al. 1995).

Global Dynamics: This community is heavily influenced by the droughty, nutrient-poor soils. In portions of its natural range, this community may have resulted from fire suppression in barrens and savannas (Fralish et al. 1999). Natural disturbance includes seasonal drought, wind damage, cyclic fire, and occasionally lightning strikes. Periodic fire encourages regeneration of oaks and hickories, and may contribute to poor development of the understory in this type. Where fire is suppressed, sugar maple and American beech can become invasive (TNC 1995a).

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus coccinea	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus prinus	Tree canopy	Broad-leaved deciduous tree	X	X	.
Carya glabra	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer rubrum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Acer saccharum	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Ostrya virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium pallidum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium stamineum	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vaccinium arboreum	Short shrub/sapling	Broad-leaved evergreen shrub	X	.	.
Smilax rotundifolia	Herb (field)	Vine/Liana	X	X	.
Carex picta Herb (field)	Graminoid	X	.	.	

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Carya ovalis	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus prinus	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus stellata	Tree canopy	Broad-leaved deciduous tree	.	.	X
Quercus velutina	Tree canopy	Broad-leaved deciduous tree	X	.	.
Parthenocissus quinquefolia	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Smilax bona-nox	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Smilax glauca	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Toxicodendron radicans	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Cercis canadensis	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Cornus florida	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Fagus grandifolia	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Ostrya virginiana	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Sassafras albidum	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Vaccinium arboreum	Tall shrub/sapling	Broad-leaved evergreen tree	X	.	.
Antennaria plantaginifolia	Herb (field)	Forb	.	.	X
Aristolochia serpentaria	Herb (field)	Forb	X	.	.
Dioscorea quaternata	Herb (field)	Forb	X	.	.
Danthonia spicata	Herb (field)	Graminoid	.	.	X
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.
Leucobryum glaucum	Nonvascular	Moss	X	.	.
Cladina subtenuis	Nonvascular	Lichen	X	.	.
Xanthoparmelia conspersa	Nonvascular	Lichen	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Agkistrodon contortrix	-	A	
Aristolochia serpentaria	-	P	
Caprimulgus vociferus	-	A	
Crotalus horridus	-	A	
Eumeces fasciatus	-	A	
Glaucomys volans	-	A	
Lynx rufus -	A		
Meleagris gallopavo	-	A	
Odocoileus virginianus	-	A	
Piranga olivacea	-	A	
Piranga rubra	-	A	
Quercus prinus	-	P	
Sceloporus undulatus	-	A	
Scincella lateralis	-	A	
Sciurus carolinensis	-	A	

Tamias striatus - A

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (5-Sep-2008). This type is apparently somewhat restricted in habitat, but with a wide range, and not highly threatened. *Quercus prinus* replaces itself after canopy removal, its seeds germinate in the shade of parent trees, and stands can also replace themselves from stump sprouts. Stands are threatened primarily by conversion to other forest types (e.g., pine plantations) or to other land uses (e.g., pasture, housing development).

RELATED CONCEPTS

Global Similar Associations:

- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)--is an eastern Allegheny type which is perhaps less xeric.
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700)--which is a more dry-mesic and diverse forest found to the south of CEGL005023.

Global Related Concepts:

- *Quercus prinus - (Quercus coccinea) - Q. velutina/Smilax* spp. Forest (F86) (TNC 1995a) **?**
- Black Oak: 110 (Eyre 1980) **B**
- CT IV *Quercus prinus, Quercus alba, Acer rubrum, Oxydendron* (sic) *arboreum* (Badger et al. 1997) **B**
- Dry Sandstone Forest (White and Madany 1978) [Other names listed rely upon moisture availability, topographic position, and bedrock to establish community boundaries.] **B**
- Dry Upland Forest (White and Madany 1978) [Other names listed rely upon moisture availability, topographic position, and bedrock to establish community boundaries.] **B**
- Eastern Broadleaf Forests: 100: Oak-Hickory Forest (*Quercus-Carya*) (Kuchler 1964) **B**
- Gravel barrens community (Fralish et al. 1999) **?**
- Terrestrial: Forest: Hardwood (TNC 1985) **B**
- UNESCO FORMATION CODE: I.B.3a (UNESCO 1973) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: In regard to forests at Mammoth Cave National Park containing *Quercus prinus, Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700) represents the mixed (but majority *Quercus prinus*) stands in the central and southern part of the park, this association (CEGL005022) for the more "xeric" *Quercus prinus* stands to the north in primarily sandstone areas. Two other associations, *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431) and *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271), were considered for application at Mammoth Cave but were rejected as inappropriate or unnecessary. Badger et al. (1997) list a CT IV *Quercus prinus, Quercus alba, Acer rubrum, Oxydendron* (sic) *arboreum* (Badger et al. 1997, pp. 1-35). Habitat: upper slopes primarily in the northwest corner of the park (e.g., on sandstones) [CEGL005022; CEGL007700]; it is also called "*Quercus prinus, Quercus alba, Acer rubrum, Carya glabra*" (pp. 4-36).

Mammoth Cave National Park Other Comments:

Global Classification Comments: In Illinois stands of this type, *Smilax* spp. are not as common as in Indiana. Some stands may have more of a mixed oak component. Type is also found in the Shawnee Hill region of Kentucky. Distribution of this type in the Southeast needs to be assessed. A subtype occurs in the Ozark Hills of southern Illinois where *Quercus prinus* and *Quercus velutina* codominate stands. *Cornus florida, Amelanchier arborea, Sassafras albidum*, and *Ostrya virginiana* are typical shrub and small tree components. This subtype may in fact belong to the *Quercus velutina - Quercus prinus - Carya* spp. Ozark Forest found in Missouri and Arkansas (TNC 1995a).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range:

Global Range: This chestnut oak / greenbrier forest type is found in the Interior Low Plateau region of the United States, ranging from southern Illinois east to southern Ohio and south to Kentucky and possibly Tennessee. This community occurs on dry, rocky, and gravelly upper slopes and ridgetops where soil chemistry is affected by acidic bedrock. Occurrences can be large as chestnut oak and black oak are dominant species on dry uplands east of the Mississippi River.

Nations: US

States/Provinces: IL, IN, KY, OH, TN

TNC Ecoregions: 38:C, 44:C, 50:?

TNC Ecoregion Comments:

USFS Ecoregions: 221D:PP, 221Ec:PPP, 221Ed:PPP, 221Ef:PPP, 221H:PP, 222Aq:CCC, 222Da:CCP, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Dg:CCC, 222Dh:CCP, 222Dj:CCP, 222Ei:CCC, 222Ek:CCP, 222El:CCC, 222Em:CCC, 231A:PP, 231C:PP, 231D:PP, M221A:PP, M221C:PP

Federal Lands: DOD (Fort Knox); NPS (Mammoth Cave); USFS (Land Between the Lakes, Shawnee, Wayne)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.709.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Guetersloh, mod. M. Pyne, D. Faber-Langendoen, R.E. Evans

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Badger et al. 1997	.	X	X	X	.	.	.	.	.
Behler 1988.	.	.	X	.	.	.	.	.	
Bull and Farrand 1977	.	.	.	X	.	.	.	.	.
Clark and Hutchinson 1994	.	.	.	X	.	.	.	.	.
Close et al. 2002	.	.	.	X	.	.	.	.	.
Craighead 1949	.	.	.	X	.	.	.	.	.
Duncan and Duncan 1988	.	.	.	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Eyre 1980 .	.	X	X	.	.	.	.	.	
Fralish et al. 1999	.	.	X	X	.	.	.	.	.
Illinois Nature Preserve Commission 1973	.	.	.	X	.	.	.	.	.
Kuchler 1964	.	.	X	X	.	.	.	.	.
Little 1980a.	.	.	X	.	.	.	.	.	
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Mohlenbrock 1986	.	.	.	X	.	.	.	.	.
Nelson 1985	.	.	.	X	.	.	.	.	.
Niering 1979	.	.	.	X	.	.	.	.	.
SAF 1967 .	.	.	X	.	.	.	.	.	
Schwartz and Schwartz 1959	.	.	.	X	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1985 .	.	X	X	.	.	.	.	.	
TNC 1995a .	X	X	X	.	.	.	.	.	
Thornbury 1965	.	.	.	X	.	.	.	.	.
UNESCO 1973	.	.	X	X	.	.	.	.	.
Van Kley et al. 1995	.	.	.	X	.	.	.	.	.
Voigt and Mohlenbrock 1964	.	.	.	X	.	.	.	.	.
White and Madany 1978	.	.	X	X	.	.	.	.	.

A.249 Quercus prinus - Quercus (alba, falcata, rubra, velutina) *Forest Alliance*

Chestnut Oak - (White Oak, Southern Red Oak, Northern Red Oak, Black Oak) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance includes dry-mesic to mesic forests dominated by *Quercus prinus* occurring in admixture with other *Quercus* species, in the Blue Ridge, Piedmont, Ridge and Valley, Cumberland Plateau, and the Interior Low Plateau. Forests in this alliance are known from moderately sheltered low ridges, flats and valleys at lower elevations (760-1035 m [2500-3400 feet]) in the Blue Ridge, from upper slopes, draws and gorge slopes in the Cumberland Plateau, and from upper to middle, dry-mesic slopes in the Piedmont. This alliance provisionally includes forests over limestone in the lower portions of the Ridge and Valley. *Quercus prinus* is the leading dominant in these forests, but other common canopy species can include *Quercus alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus velutina, Acer rubrum, Carya alba, Carya glabra, Carya ovalis, Carya ovata, Carya pallida, Fagus grandifolia, Liriodendron tulipifera, Nyssa sylvatica*, and *Pinus strobus*. The subcanopy often contains *Cornus florida* and *Oxydendrum arboreum*. Drier examples can contain *Juniperus virginiana var. virginiana*. The ground flora varies depending on available light, moisture and soil nutrients but can be quite diverse, especially in associations with sparse shrub cover. Vines are common. In the Cumberland Plateau, forests in this alliance have replaced forests once dominated by *Castanea dentata* and often have chestnut sprouts in the understory.

Environment: Forests in this alliance are known from moderately sheltered low ridges, flats, and valleys at lower elevations (762-1036 m [2500-3400 feet]) in the Blue Ridge, from upper slopes, draws, and gorge slopes in the Cumberland Plateau, and from upper to middle, dry-mesic slopes in the Piedmont. This alliance provisionally includes forests over limestone in the lower portions of the Ridge and Valley.

Vegetation: Dry-mesic to mesic forests dominated by *Quercus prinus* occurring in admixture with other *Quercus* species. *Quercus prinus* is the leading dominant in these forests, but other common canopy species can include *Quercus*

alba, Quercus coccinea, Quercus falcata, Quercus rubra, Quercus velutina, Acer rubrum, Carya alba, Carya glabra, Carya ovalis, Carya ovata, Carya pallida, Fagus grandifolia, Liriodendron tulipifera, Nyssa sylvatica, and *Pinus strobus*. The subcanopy often contains *Cornus florida* and *Oxydendrum arboreum*. Drier examples can contain *Juniperus virginiana var. virginiana*. Other common species in the subcanopy/shrub stratum include *Acer rubrum, Carya glabra, Cercis canadensis, Hamamelis virginiana, Kalmia latifolia, Nyssa sylvatica, Rhododendron calendulaceum, Rhododendron maximum, Robinia pseudoacacia, Stewartia ovata, Symplocos tinctoria, Vaccinium stamineum*, and *Viburnum acerifolium*. The ground flora varies depending on available light, moisture, and soil nutrients, but can be quite diverse, especially in associations with sparse shrub cover. Herbaceous species characteristic of these dry-mesic to mesic oak - hickory forests include *Symphyotrichum cordifolium (= Aster cordifolius), Symphyotrichum retroflexum (= Aster curtisii), Eurybia macrophylla (= Aster macrophyllus), Symphyotrichum undulatum (= Aster undulatus), Botrychium virginianum, Carex nigromarginata, Chimaphila maculata, Actaea racemosa (= Cimicifuga racemosa), Collinsonia canadensis, Coreopsis major, Cypripedium parviflorum var. pubescens (= Cypripedium pubescens), Danthonia compressa, Danthonia spicata, Dioscorea villosa, Epigaea repens, Eupatorium album, Eupatorium purpureum, Galax urceolata, Galium triflorum, Houstonia purpurea (= Hedyotis purpurea), Hieracium venosum, Iris cristata, Maianthemum racemosum, Medeola virginiana, Melanthium parviflorum, Polystichum acrostichoides, Prenanthes altissima, Pycnanthemum incanum, Scutellaria ovata, Tephrosia virginiana, Uvularia perfoliata*, and *Uvularia puberula*. Vines are common and species that may be present include *Parthenocissus quinquefolia, Smilax* spp., and *Toxicodendron radicans*. In the Cumberland Plateau, forests in this alliance have replaced forests once dominated by *Castanea dentata*, and often have chestnut sprouts in the understory.

Dynamics:

Similar Alliances:

- *Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)--includes *Quercus prinus* forests that occur in more xeric environments and contains associations distinguished by having a species composition that reflects a more xeric environment and are typically less species-rich.
- *Quercus prinus - Quercus rubra* Forest Alliance (A.250)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: Forests in this alliance occur in the Blue Ridge, Piedmont, Ridge and Valley, Cumberland Plateau, and the Interior Low Plateau. It ranges from Connecticut south to South Carolina and possibly Georgia and west to Kentucky, Alabama, and possibly Mississippi.

Nations: US

Subnations: AL, DC, DE, GA, KY, MD, MS?, NC, NJ, NY, SC, TN, VA, WV

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C, 62:C

USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221Hd:CCP, 221He:CCP, 221Jb:CCC, 222Cc:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Eg:CCC, 222Eo:CCC, 222Fd:CCC, 231Aa:CCP, 231Ab:CCC, 231Ac:CCP, 231Af:CCC, 231Ah:CCP, 231Ai:CCC, 231Bc:CCC, 231Bd:CCC, 231Be:CCC, 231Bk:CCC, 231Db:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, 232Ch:CCC, M221Aa:CCC, M221Ab:CCC, M221Be:CCC, M221Ca:CCP, M221Cb:CCC, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCP, M221Dc:CCC, M221Dd:CCC

Federal Lands: DOE (Oak Ridge); NPS (Blue Ridge Parkway, Bluestone, C&O Canal, Chattahoochee River, Chickamauga-Chattanooga, Cumberland Gap, George Washington Birthplace, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Mammoth Cave, Natchez Trace, National Capital-East, New River Gorge, Obed, Russell Cave, Shenandoah, Shiloh); TVA (Land Between the Lakes?, Tellico); USFS (Cherokee, Daniel Boone, George Washington, Holly Springs?, Jefferson, Nantahala, Pisgah, Talladega, Uwharrie); USFWS (Mountain Longleaf?)

ALLIANCE SOURCES

Author(s): M.P. Schafale/A.S. Weakley, mod. S. Simon/G. Kauffman/D.M. Danley

References: Andreu and Tukman 1995, Eyre 1980, Fralish and Crooks 1989, Franklin et al. 1993, Golden 1979, Martin 1971, McLeod 1988, Nowacki and Abrams 1992, Patterson 1994, Schafale and Weakley 1990, Schmalzer 1978, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d., Thomas 1966, Wells 1970c, Wells 1974, Wieland 1994b

[CEGL007700] *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest

Translated Name: **Chestnut Oak - Oak species / Farkleberry - (Mountain Laurel, Bigleaf Snowbell) Forest**

Common Name: **Interior Low Plateau Chestnut Oak - Mixed Oak Forest**

Ecological System(s):

- East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (CES203.483)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)
- Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)

Status: Standard
Circumscription Confidence: 1 - Strong
Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: This community occurs over shallow, rocky soils on narrow ridgetops, upper slopes, and midslopes of south- to southwest-facing ridges in the Interior Low Plateau and nearby provinces such as the Southern Cumberlands and adjacent Southern Ridge and Valley. It may also occur in the Upper East Gulf Coastal Plain. This is the dominant forest type found on narrow ridges of the dissected western escarpment of the Eastern Highland Rim of Tennessee at about 350 m (1100 feet) elevation. These forests have canopies which are strongly dominated by *Quercus prinus*, with *Quercus coccinea* and/or *Quercus velutina*, and with lesser amounts of *Quercus rubra, Quercus alba, Nyssa sylvatica, Acer rubrum var. rubrum*, and *Carya alba*. The understory may contain *Oxydendrum arboreum, Fagus grandifolia, Sassafras albidum, Aralia spinosa*, and/or *Cornus florida*. The shrub stratum may be dense to sparse, partly dominated by ericaceous species. Typical shrub species can include *Viburnum acerifolium, Hypericum frondosum, Vaccinium stamineum, Vaccinium arboreum, Vaccinium pallidum, Vaccinium corymbosum*, and *Gaylussacia baccata*. Some examples will contain patches of *Kalmia latifolia*, or *Styrax grandifolius* may replace *Viburnum acerifolium* in some locales. *Smilax glauca* and *Smilax rotundifolia* are typically present. *Castanea dentata* may occur as root sprouts, and decaying stumps may still be evident. Scattered individuals of *Pinus echinata* or *Pinus virginiana* may be present in the subcanopy of some examples. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* and *Chimaphila maculata*. Other common species may include *Tipularia discolor, Antennaria plantaginifolia, Cypripedium acaule, Danthonia spicata, Epigaea repens, Helianthus divaricatus, Helianthus hirsutus, Dichanthelium dichotomum (= Panicum dichotomum)*, and *Polystichum acrostichoides*. Mats of mosses may cover the ground surface where herbaceous cover and leaf litter are sparse.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This chestnut oak forest was sampled at four locations in the park. Sites range from gentle to steep, east-, southeast- and northwest-facing mid to upper slopes, benches and ridges at 220 to 250 m (720-820 feet) elevation. Soils are well-drained sandy loam. The unvegetated surface is dominated by leaf litter (85-98% cover) with some large rocks (0-10%), wood (0-5%) and bare soil (0-1%). Evidence of disturbance includes past fire, roads/trails, and the presence of exotic plants.

Global Environment: Stands occur on dry/xeric upper slopes, midslopes and narrow ridgetops. Soils are typically shallow and occur over non-calcareous bedrock of sandstone, conglomerate, or shale, or, to the south, over thin loess and siliceous limestones and cherts.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The tree canopy, 20-50 m tall, may be lacking or very dense (0-90% cover) and is dominated by *Quercus prinus* and may include *Liriodendron tulipifera, Quercus alba, Quercus coccinea*, and *Quercus velutina*. The moderate (30-50%) subcanopy (10-20 m) is dominated by *Acer saccharum* and may include *Acer rubrum, Carya glabra, Nyssa sylvatica, Oxydendrum arboreum*, and *Quercus prinus*. The very sparse to dense (where canopy is lacking) (10-80%) tall-shrub layer (2-5 m) is made up of canopy species and may also include *Hamamelis virginiana, Kalmia latifolia, Vaccinium arboreum*, and *Vaccinium stamineum*. The sparse (10-40%) short-shrub layer (1-2 m) is dominated by tall-shrub species and may include *Amelanchier arborea, Cercis canadensis, Diospyros virginiana, Fagus grandifolia, Ilex opaca var. opaca*, and *Sassafras albidum*. The sparse (20%) herbaceous layer includes *Aralia spinosa, Athyrium filix-femina, Chimaphila maculata, Desmodium rotundifolium, Dichanthelium boscii, Dryopteris marginalis, Erechtites hieraciifolia, Euonymus americanus, Heuchera parviflora, Iris verna*, and *Polystichum acrostichoides*. Vines (up to 50%) are dominated by *Smilax rotundifolia*.

Global Vegetation: These forests have canopies which are strongly dominated by *Quercus prinus*, with *Quercus coccinea* and/or *Quercus velutina*, and with lesser amounts of *Quercus rubra, Quercus alba, Nyssa sylvatica, Acer rubrum var. rubrum*, and *Carya alba*. The understory may contain *Oxydendrum arboreum, Fagus grandifolia, Sassafras albidum, Aralia spinosa*, and/or *Cornus florida*. The shrub stratum may be dense to sparse, partly dominated by ericaceous species. Typical shrub species include *Viburnum acerifolium, Hypericum frondosum, Vaccinium stamineum, Vaccinium pallidum, Vaccinium corymbosum*, and *Gaylussacia baccata*. Some examples will contain patches of *Kalmia latifolia*. Some Tennessee stands (e.g., in 222Eg, the Western Highland Rim) are outside of the range of *Viburnum acerifolium*, which is typically replaced by *Styrax grandifolius* in these situations. *Smilax glauca* and *Smilax rotundifolia* are typically present. *Castanea dentata* may occur as root sprouts, and decaying stumps may still be evident. Scattered

individuals of *Pinus echinata* or *Pinus virginiana* may be present in the subcanopy of some examples. The herb layer is typically sparse and includes subshrubs such as *Epigaea repens* and *Chimaphila maculata*. Other common species may include *Tipularia discolor, Antennaria plantaginifolia, Cypripedium acaule, Danthonia spicata, Epigaea repens, Helianthus divaricatus, Helianthus hirsutus, Dichanthelium dichotomum (= Panicum dichotomum)*, and *Polystichum acrostichoides*. Mats of mosses may cover the ground surface where herbaceous cover and leaf litter are sparse.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Quercus prinus	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Acer rubrum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer saccharum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Oxydendrum arboreum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Hamamelis virginiana	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Kalmia latifolia	Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	X	X	.
Vaccinium arboreum	Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	X	X	.
Quercus prinus	Tall shrub/sapling	Broad-leaved deciduous shrub	X	X	.
Smilax rotundifolia	Herb (field)	Vine/Liana	X	.	.
Iris verna Herb (field)	Forb	X	.	.	
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (24-Oct-2002). This is a widespread type; *Quercus prinus* replaces itself after canopy removal, seeds germinate in the shade of parent trees, and stands can also replace themselves from stump sprouts. Stands are threatened primarily by conversion to other forest types (e.g., pine plantations) or to other land uses (e.g., pasture, housing development).

RELATED CONCEPTS

Global Similar Associations:

- *Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest (CEGL002068)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059)--Appalachian oak-maple.
- *Quercus prinus - (Quercus coccinea) / Carya pallida / Vaccinium arboreum - Vaccinium pallidum* Forest (CEGL008431)
- *Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268)--of the Ridge and Valley.
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)--a related type of the Western Allegheny and related northern ecoregions.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282)--a more eastern equivalent?
- *Quercus prinus / Smilax* spp. Forest (CEGL005022)--is perhaps a more xeric type.

Global Related Concepts:

- CT IV *Quercus prinus, Quercus alba, Acer rubrum, Oxydendron* (sic) *arboreum* (Badger et al. 1997) **B**
- Chestnut Oak, HR (Pyne 1994) **B**
- IA6d. Chestnut Oak Slope and Ridge Forest (Allard 1990) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Badger et al. (1997) list a CT IV *Quercus prinus, Quercus alba, Acer rubrum, Oxydendron* (sic) *arboreum* (Badger et al. 1997, pp. 1-35). Habitat: upper slopes primarily in the northwest corner of the park (e.g., on sandstones) [CEGL005022; CEGL007700]; it is also called "*Quercus prinus, Quercus alba, Acer rubrum, Carya glabra*" (pp. 4-36).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This is at least part of the historic chestnut oak forest after loss of chestnut in the Interior Low Plateau and related ecoregions. More detailed floristic information is needed to reliably distinguish this association from other closely related forests in this alliance, such as ~*Quercus prinus - Carya ovata - Quercus rubra / Acer saccharum* Forest (CEGL007268) of the Ridge and Valley, ~*Quercus (prinus, coccinea) / Kalmia latifolia / (Galax*

urceolata, Gaultheria procumbens) Forest (CEGL006271) of the Southern Blue Ridge, and the apparently more xeric ~*Quercus prinus / Smilax* spp. Forest (CEGL005022) of the lower Midwest and Kentucky.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range:

Global Range: This chestnut oak - mixed oak forest community ranges in the United States from the Cumberlands / Southern Ridge and Valley, and Interior Low Plateau of Kentucky, Tennessee, Georgia and Alabama (and possibly into the Upper East Gulf Coastal Plain of Mississippi).

Nations: US

States/Provinces: AL?, GA, KY, MS?, TN

TNC Ecoregions: 43:C, 44:C, 50:C

TNC Ecoregion Comments: ECO43 changed from P to C for NATR (mjr 4-07). ECO43 & ECO50 added (MP 10-02).

USFS Ecoregions: 221Hc:CCC, 221Hd:CCP, 221He:CCP, 222Cc:CPP, 222Ce:CPP, 222Cf:CPP, 222Cg:CPP, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Eg:CCC, 222Eo:CCC, 222Fd:CCC, 231Be:CCC

Federal Lands: NPS (Chickamauga-Chattanooga, Mammoth Cave, Natchez Trace, Obed); USFS (Daniel Boone, Holly Springs?, Land Between the Lakes?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.1, MACA.4, MACA.61, MACA.86.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne, mod. T. Govus

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
Badger et al. 1997	.	X	X	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Pyne 1994 .	.	X	X	.	.	.	.	.	
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.251 Quercus rubra - (Acer saccharum) *Forest Alliance*

Northern Red Oak - (Sugar Maple) Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in the midwestern, southeastern and eastern United States as well as Ontario, Canada, contains mesic forests dominated by *Quercus rubra*. Although *Acer saccharum* may not be dominant, its usual association with more mesic habitats makes it characteristic of this alliance. Ericaceous shrubs may be present but, except in some cases for *Kalmia latifolia*, are generally not prominent in these communities. Other canopy associates may include *Quercus alba, Quercus velutina, Betula lenta* (in the East), *Fraxinus americana, Tilia americana, Ulmus americana, Acer rubrum*, and *Fagus grandifolia*. In the East *Cornus florida* often forms a prominent subcanopy; in the Midwest *Prunus virginiana, Prunus serotina*, and *Ostrya virginiana* can do the same. Typical shrubs include *Hamamelis virginiana, Acer pensylvanicum* (in the North), *Lindera benzoin, Amelanchier* spp., and *Corylus cornuta*. *Viburnum acerifolium* is a characteristic shrub in this alliance. Herbs include *Polystichum acrostichoides, Medeola virginiana*, and *Geranium maculatum*. These forests typically occur on deep, moist to well-drained loams and silt loams on north and east midslopes and coves. In the Southeast, this alliance includes mesophytic forests associated with base-rich substrates in the Ozarks and the central Ouachita Mountains. These forests are found over soils derived from limestone or dolomite and occur on moist slopes or swales, mesic slopes, and upper floodplain terraces. Some characteristic species include *Acer saccharum, Quercus rubra, Quercus velutina, Carya cordiformis, Fraxinus americana, Ulmus americana, Liquidambar styraciflua, Celtis laevigata, Asimina triloba, Arundinaria gigantea, Elymus virginicus, Euonymus atropurpureus, Ilex decidua, Ilex opaca, Ostrya virginiana, Sapindus saponaria var. drummondii*, and *Staphylea trifolia*. In the southern Ouachita Mountains, *Acer barbatum* may be a component, rather than *Acer saccharum*. Stands may also occur on dry-mesic fine sandy loams and loamy sands. Historically, fire probably maintained stands in this alliance by decreasing competing woody species and improving light and moisture conditions for oak seedlings. Successful establishment of *Quercus rubra* and other associated oaks in this alliance is usually thought to require oak saplings in the understory prior to canopy disturbances or large-scale fires that remove competitors. Current *Quercus rubra*-dominated stands in parts of this alliance's range may result from a combination of natural and human-caused disturbances.

Environment: These forests typically occur on deep, moist to well-drained loams and silt loams on northern and eastern midslopes and coves. Some stands occur on dry-mesic fine sandy loams and loamy sands (Nowacki et al. 1990). Historically, fire probably maintained stands in this alliance by decreasing competing woody species and improving light and moisture conditions for oak seedlings. Successful establishment of *Quercus rubra* and other associated oaks in this alliance is usually thought to require oak saplings in the understory prior to canopy disturbances or large-scale fires that remove competitors (Crow 1988, Nowacki et al. 1990). Current *Quercus rubra*-dominated stands in parts of this alliance's range may result from a combination of natural and human-caused disturbances (Nowacki et al. 1990).
Vegetation: This alliance, found primarily in the Midwest and Eastern United States and Ontario, Canada, contains mesic forests dominated by *Quercus rubra*. Although *Acer saccharum* may not be dominant, its usual association with more mesic habitats makes it characteristic of this alliance. Ericaceous shrubs may be present but except for *Kalmia latifolia*, are generally not prominent in these communities. Other canopy associates may include *Quercus alba, Quercus velutina, Betula lenta* (in the east), *Fraxinus americana, Tilia americana, Ulmus americana, Acer rubrum*, and *Fagus grandifolia*. In the east *Cornus florida* often forms a prominent subcanopy; in the Midwest *Prunus virginiana, Prunus serotina*, and *Ostrya virginiana* can do the same. Typical shrubs include *Hamamelis virginiana, Acer pensylvanicum* (in the north), *Lindera benzoin, Amelanchier* spp., and *Corylus cornuta*. *Viburnum acerifolium* is a characteristic shrub in this alliance. Herbs include *Polystichum acrostichoides, Medeola virginiana*, and *Geranium maculatum*.
Dynamics:
Similar Alliances:
- *Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)--includes temporarily flooded forests dominated by *Acer saccharum* and *Carya cordiformis*.
- *Acer saccharum - Tilia americana - (Quercus rubra)* Forest Alliance (A.220)
- *Fagus grandifolia - Acer saccharum - (Liriodendron tulipifera)* Forest Alliance (A.227)--includes mesophytic forests of the interior highlands with significant coverage by *Fagus grandifolia*.
- *Fagus grandifolia - Quercus alba* Forest Alliance (A.228)--includes mesophytic forests of the interior highlands with significant coverage by *Fagus grandifolia*.
- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235)--includes mafic and calcareous forests in the Southern Blue Ridge.
- *Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)--widespread and variable "oak-hickory" forests, some members are dominated by *Quercus rubra*.
- *Quercus rubra* Montane Forest Alliance (A.272)--forests dominated by *Quercus rubra* in extreme montane landscapes over 1070 m (3500 feet).

Similar Alliance Comments: The relationship of this alliance (A.251) to many other forest alliances needs to be assessed.

ALLIANCE DISTRIBUTION

Range: This alliance is found throughout the northeastern and midwestern United States and into southern Canada.
Nations: CA, US
Subnations: AL?, AR, CT, IA?, IL, IN, KY, MA, MD, ME, MI, MN, MO, NB, NH, NJ, NY, OH, OK, ON, PA, RI, TN, VA, VT, WI, WV?
TNC Ecoregions: 32:?, 36:C, 38:C, 39:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions: 212Ba:CC?, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CCC, 212Ec:CPP, 212Ed:CPP, 212Fa:CCC, 212Fb:CCP, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCP, 212Hc:CCC, 212Hl:CCP, 212Hm:CCP, 212Hn:CCP, 212Ho:CCP, 212Hp:CCP, 212Hq:CCP, 212Hs:CCP, 212Ht:CCP, 212Hu:CCP, 212Hv:CCP, 212Hw:CCC, 212Hx:CCP, 212Hy:CCP, 212Ia:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Jd:CCC, 212Jf:CC?, 212Jj:CCC, 212Jl:CCC, 212Jn:CCP, 212Jo:CCP, 212Kb:CPP, 212Lb:CCC, 212Lc:CCP, 212Ld:CC?, 212Na:CP?, 212Nb:CPP, 212Nd:CPP, 221Aa:CCP, 221Ad:CCP, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCC, 221Al:CCC, 221Am:CCC, 221Ba:CCC, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCC, 221Eb:CC?, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Hc:CCC, 221He:CCC, 222Ac:CCC, 222Ad:CC?, 222Ae:CC?, 222Ag:CCC, 222Aj:CCP, 222Ak:CCC, 222Am:CC?, 222An:CCC, 222Ao:CCC, 222Ap:CCC, 222Aq:CCC, 222Db:CCC, 222Dc:CCC, 222Dg:CCC, 222Dh:CCC, 222Dj:CCC, 222Ea:CCC, 222Eb:CCC, 222Em:CCP, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 222Ga:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Ib:CCC, 222Id:CCP, 222Ja:CCP, 222Jb:CCC, 222Jc:CCC, 222Jg:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Lb:CCC, 222Lc:CCC, 222Ld:CCC, 222Le:CCC, 222M:CP, 231Al:CCP, 231Ap:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CC?, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Ci:CCC, 251Cj:CCC, 251Dc:CCC, 251De:CCC, 251Dg:CCC, M212Ac:CC?, M212Ad:CC?, M212Ae:CCC, M212Ag:CCC, M212Ba:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Ca:CCC, M212Cb:CCC, M212Cc:CCC, M212Cd:CCP, M212Ea:CPP, M212Eb:CPP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC,

M221Be:CCP, M221Bf:CCC, M221Ca:CC?, M221Cb:CC?, M221Cc:CC?, M221Cd:CCP, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M222Aa:CCC, M222Ab:CCC

Federal Lands: COE (Bull Shoals Lake, Dale Hollow?, Greers Ferry Lake, Norfork Lake); NPS (Acadia, Allegheny Portage Railroad, Antietam, Apostle Islands, Big South Fork, Blue Ridge Parkway?, Boston Harbor Islands, Buffalo River, C&O Canal, Catoctin Mountain, Delaware Water Gap, Fort Necessity, Friendship Hill, Indiana Dunes, Isle Royale, Mammoth Cave, Marsh-Billings-Rockefeller, Minute Man, Morristown, Ozark Riverways, Saint Croix, Saratoga, Shenandoah, Sleeping Bear Dunes, Upper Delaware, Weir Farm); USFS (Allegheny, Chequamegon, Chequamegon-Nicolet, Chippewa?, Daniel Boone, Finger Lakes, George Washington, Green Mountain, Huron, Huron-Manistee, Jefferson, Manistee, Mark Twain, Monongahela, Nicolet?, Ottawa, Ouachita, Ozark, Superior, Wayne, White Mountain?); USFWS (Assabet River, Eastern Massachusetts, Erie, Great Meadows, Iroquois, Montezuma, Moosehorn?, Oxbow, Rachel Carson)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group, mod.

References: Crow 1988, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Hoagland 1998a, Midwestern Ecology Working Group n.d., Nelson 1985, Nowacki et al. 1990, Smith 1991, Steyermark 1940, Swain and Kearsley 2001

[CEGL007698] *Quercus rubra - Acer saccharum - Tilia americana var. heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest

Translated Name: **Northern Red Oak - Sugar Maple - Appalachian Basswood - Yellow Buckeye - (Kentucky Yellow-wood) Forest**

Common Name: **Rich Appalachian Red Oak - Sugar Maple Forest**

Ecological System(s):

- South-Central Interior Mesophytic Forest (CES202.887)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: This is a mesophytic northern red oak - mixed hardwood forest which ranges from the Eastern Highland Rim of Tennessee north into the Cumberlands and Interior Low Plateau of Kentucky. The canopy of stands is typically dominated by *Quercus rubra* with *Carya ovata, Liriodendron tulipifera, Acer saccharum, Tilia americana var. heterophylla, Aesculus flava, Carya cordiformis, Carya ovalis, Prunus serotina var. serotina, Fraxinus* sp., and *Juglans nigra*. *Quercus alba* may sometimes be present. The subcanopy may contain the above-mentioned canopy species as well as *Fagus grandifolia, Ulmus americana, Ostrya virginiana, Juglans cinerea*, and *Cladrastis kentukea* (within its limited range). *Acer saccharum* may be a strong dominant in this stratum. Shrubs and small trees may include *Cornus florida, Asimina triloba*, and *Euonymus americanus*. The herbaceous flora is rich and diverse, including *Pachysandra procumbens, Caulophyllum thalictroides, Cardamine angustata (= Cardamine heterophylla), Cardamine concatenata, Cardamine diphylla, Packera obovata (= Senecio obovatus), Trillium flexipes, Phacelia bipinnatifida, Hydrophyllum appendiculatum, Delphinium tricorne, Monarda clinopodia* (*sensu lato*), *Iris cristata, Stellaria pubera, Carex austrocaroliniana, Carex plantaginea, Polystichum acrostichoides* (which may be dominant), *Adiantum pedatum, Asplenium resiliens*, and *Asplenium rhizophyllum*, as well as *Climacium americanum* and other mosses. On the dissected western escarpment of the Eastern Highland Rim of Tennessee, this association has been documented from the Mississippian Fort Payne Formation at 275-350 m (900-1100 feet) elevation. On the dissected eastern escarpment of the Cumberland Plateau and on Short Mountain, an isolated Plateau remnant, it presumably occurs on other Mississippian limestone strata at 350-600 m (1100-2000 feet) elevation. The exotic tree *Ailanthus altissima* may invade this community, usurping the role of *Liriodendron tulipifera* as a canopy-gap successional species.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This red oak - sugar maple forest was sampled at 14 locations in the park. Stands of this type are typically found on lower, slightly concave slopes, downslope from oak-hickory stands (e.g., *~Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795) and *~Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest (CEGL005018)). Sites range from moderate to steep, lower to upper slopes, ridges and benches of mostly eastern aspects at 177 to 257 m (580-843 feet) elevation. Soils are rapidly drained to well-drained clay loam, sandy loam, silt loam and loam. The unvegetated surface is dominated by leaf litter (10-100% cover) with some exposed bedrock (0-10%), large rocks (0-15%), wood (0-75%) and bare soil (0-

5%). Evidence of disturbance includes past logging and clearing, animal grazing/browsing, possible pine bark beetle damage, and the presence of exotic plants.

Global Environment: On the dissected western escarpment of the Eastern Highland Rim of Tennessee, this association has been documented from the Mississippian Fort Payne Formation at 275-350 m (900-1100 feet) elevation. On the dissected eastern escarpment of the Cumberland Plateau and on Short Mountain, an isolated Plateau remnant, it presumably occurs on other Mississippian limestone strata at 350-600 m (1100-2000 feet) elevation.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This association is intermediate in composition and landscape position between upland oak-hickory forests and the non-oak mesic coves and rich lower slopes. The moderate to dense (60-80% cover) tree canopy, 15-50 m tall, is dominated by *Quercus rubra*, often with *Acer saccharum* and *Liriodendron tulipifera*; additional species may include *Carya cordiformis, Carya ovata, Fagus grandifolia, Fraxinus americana, Quercus alba*, and *Quercus muehlenbergii*. The sparse to moderately dense (30-70%) subcanopy (10-15 m) is dominated by *Acer saccharum* and may include other canopy species as well as *Acer rubrum, Oxydendrum arboreum, Sassafras albidum*, and *Ulmus rubra*. The sparse (20-40%) tall-shrub layer (2-5 m) is made up saplings of the tree species and may include *Asimina triloba, Cercis canadensis, Cornus florida, Lindera benzoin, Ulmus alata*, and others. The sparse (20-40%) short-shrub layer (0.5-2 m) includes tall-shrub species as well as *Euonymus americanus, Ostrya virginiana, Symphoricarpos orbiculatus*, and others. The very sparse to dense (10-80%) herbaceous layer is dominated by *Polystichum acrostichoides* and includes *Adiantum pedatum, Amphicarpaea bracteata, Arisaema triphyllum, Asplenium platyneuron, Brachyelytrum erectum, Collinsonia canadensis, Desmodium nudiflorum, Dichanthelium boscii, Dioscorea quaternata, Galium circaezans, Maianthemum racemosum, Panax quinquefolius, Phegopteris hexagonoptera, Phryma leptostachya, Pilea pumila, Podophyllum peltatum, Polygonum virginianum, Solidago caesia, Thalictrum thalictroides, Uvularia perfoliata*, and many others. Vines (30%) include *Parthenocissus quinquefolia, Smilax ecirrata, Smilax glauca, Smilax rotundifolia, Toxicodendron radicans*, and *Vitis rotundifolia*.

Global Vegetation: The canopy of stands is typically dominated by *Quercus rubra* with *Carya ovata, Liriodendron tulipifera, Acer saccharum, Tilia americana var. heterophylla, Aesculus flava, Carya cordiformis, Carya ovalis, Prunus serotina var. serotina, Fraxinus* sp., and *Juglans nigra*. *Quercus alba* may sometimes be present. The subcanopy may contain the above-mentioned canopy species, as well as *Fagus grandifolia, Ulmus americana, Ostrya virginiana, Juglans cinerea*, and *Cladrastis kentukea* (within its range). *Acer saccharum* may be a strong dominant in this stratum. Shrubs and small trees may include *Cornus florida, Asimina triloba*, and *Euonymus americanus*. The herbaceous flora is rich and diverse, including *Pachysandra procumbens, Caulophyllum thalictroides, Cardamine angustata (= Cardamine heterophylla), Cardamine concatenata, Cardamine diphylla, Packera obovata (= Senecio obovatus), Trillium flexipes, Phacelia bipinnatifida, Hydrophyllum appendiculatum, Delphinium tricorne, Monarda clinopodia* (*sensu lato*), *Iris cristata, Stellaria pubera, Carex austrocaroliniana, Carex plantaginea, Polystichum acrostichoides* (which may be dominant), *Adiantum pedatum, Asplenium resiliens*, and *Asplenium rhizophyllum*, as well as *Climacium americanum* and other mosses.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Fagus grandifolia	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus alba	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Carya cordiformis	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Cercis canadensis	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Cornus florida	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Ostrya virginiana	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Toxicodendron radicans	Herb (field)	Vine/Liana	X	.	.
Amphicarpaea bracteata	Herb (field)	Forb	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name | Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name | Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (27-Feb-1998).

RELATED CONCEPTS

Global Similar Associations:

- *Acer (nigrum, saccharum) - Carya cordiformis* Forest (CEGL004411)
- *Acer (saccharum, barbatum) - Quercus rubra - Carya cordiformis / Asimina triloba* Forest (CEGL002060)
- *Quercus alba - Quercus rubra - Acer saccharum - Carya cordiformis / Lindera benzoin* Forest (CEGL002058)
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059)
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173)
- *Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest (CEGL006125)
- *Quercus rubra - Tilia americana var. heterophylla - Halesia tetraptera var. monticola / Collinsonia canadensis - Tradescantia subaspera* Forest (CEGL007878)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: This association should be compared to other associations in the I.B.2.N.a *~Quercus rubra - (Acer saccharum)* Forest Alliance (A.251) and the I.B.2.N.a *~Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance (A.235). It is distinguished from the Appalachian cove forests of the latter alliance by its dominance by *Quercus rubra* and its somewhat less diverse herbaceous flora. Campbell (2001) could not clearly crosswalk his eastern Kentucky Appalachian types to this type, suggesting that the concept of this association needs further review.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is scattered around the central part of the park. It is less likely on sites with strongly sandstone geologies. It is most extensive along lower to midslopes along the Green River and its tributaries; small patches are also found around the margins of sinkholes. In both cases, it is intermediate in composition and landscape position between upland oak-hickory forests and the non-oak mesic coves and rich lower slopes.

Global Range: This mesic maple-oak forest ranges from the Eastern Highland Rim of Tennessee north into the Interior Low Plateau (Mammoth Cave Uplands) and Cumberlands of Kentucky.

Nations: US

States/Provinces: AL?, KY, TN

TNC Ecoregions: 44:C, 50:C

TNC Ecoregion Comments: ECO50 changed from P to C (MP/DFL 2-01).

USFS Ecoregions: 221Hc:CCC, 221He:CCP, 222Dg:CCC, 222Dj:CCC, 222Ea:CCP, 222Eb:CCC, 222Fa:CCP, 222Fb:CCC

Federal Lands: DOD (Dale Hollow?); NPS (Big South Fork, Mammoth Cave); USFS (Daniel Boone)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.2, MACA.18, MACA.21, MACA.38, MACA.41, MACA.76, MACA.91, MACA.106, MACA.704, MACA.708, MACA.712, MACA.726, MACA.738, MACA.750.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Campbell 2001	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

I.B.2.N.d. Temporarily flooded cold-deciduous forest

A.287 Liquidambar styraciflua - (Liriodendron tulipifera, Acer rubrum) *Temporarily Flooded Forest Alliance*

Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: This southeastern alliance includes a variety of bottomland communities of moderately wet floodplains of the lower Piedmont, Interior Low Plateau, and Coastal Plain, extending north and west into the Cumberland Plateau and Ridge and Valley, as well as the Ouachita Mountains and Ozarks. This alliance is fairly common in the lower Piedmont of Georgia, as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass region) where it is somewhat successional. Soils are relatively acidic. *Liriodendron tulipifera* is dominant in disturbed areas of Kentucky and is common on well-drained floodplains of Kentucky without *Liquidambar styraciflua*. Conversely, *Liriodendron tulipifera* is absent in Ouachita - Ozark examples. Stands are dominated by *Liquidambar styraciflua* with or without some combination of *Liriodendron tulipifera* and *Acer rubrum* as codominants. Canopy and subcanopy associates vary with geography and substrate, but may include *Acer barbatum, Ilex opaca var. opaca, Aesculus sylvatica, Quercus nigra, Carya cordiformis, Platanus occidentalis, Betula nigra, Carpinus caroliniana ssp. caroliniana, Cornus florida, Fagus grandifolia, Juglans nigra, Morus rubra var. rubra, Ostrya virginiana var. virginiana, Oxydendrum arboreum, Pinus echinata, Prunus serotina var. serotina, Quercus alba, Quercus rubra var. rubra, Ulmus rubra, Ulmus americana, Ulmus alata, Juniperus virginiana var. virginiana, Nyssa sylvatica, Fraxinus americana*, and *Fraxinus pennsylvanica*. The shrub layer often is well-developed and includes *Euonymus americanus, Lindera benzoin var. benzoin, Corylus americana, Viburnum acerifolium, Viburnum nudum var. nudum, Viburnum prunifolium, Viburnum rufidulum, Hamamelis virginiana, Asimina triloba*, and *Ilex decidua* among others. Vines are prominent and species include *Vitis rotundifolia, Apios americana, Campsis radicans, Aristolochia serpentaria, Bignonia capreolata, Dioscorea quaternata, Gelsemium sempervirens, Parthenocissus quinquefolia (= var. quinquefolia), Campsis radicans, Passiflora lutea, Smilax bona-nox, Smilax glauca (= var. glauca), Smilax hugeri, Smilax rotundifolia*, and *Toxicodendron radicans ssp. radicans*. The herbaceous layer can be species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides, Trillium cuneatum, Arisaema triphyllum ssp. triphyllum, Asplenium platyneuron var. platyneuron, Botrychium virginianum, Carex* spp., *Carex impressinervia, Carex striatula, Galium circaezans, Geum canadense, Polystichum acrostichoides*, and *Scutellaria integrifolia* among many others. The exotics *Microstegium vimineum, Ligustrum sinense*, and *Lonicera japonica* may be common in examples of this alliance.

Environment: This alliance includes a variety of bottomland communities of moderately wet floodplains. It is fairly common in the lower Piedmont of Georgia (J. Ambrose pers. comm.), as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass region) where it is somewhat successional (L. McKinney pers. comm.). Soils are relatively acidic.

Vegetation: This alliance includes a variety of bottomland communities dominated by *Liquidambar styraciflua* with or without some combination of *Liriodendron tulipifera* and *Acer rubrum* as codominants. Canopy and subcanopy associates vary with geography and substrate, but may include *Acer barbatum, Ilex opaca var. opaca, Aesculus sylvatica, Quercus nigra, Carya cordiformis, Platanus occidentalis, Betula nigra, Carpinus caroliniana ssp. caroliniana, Cornus florida, Fagus grandifolia, Juglans nigra, Morus rubra var. rubra, Ostrya virginiana var. virginiana, Oxydendrum arboreum, Pinus echinata, Prunus serotina var. serotina, Quercus alba, Quercus rubra var. rubra, Ulmus rubra, Ulmus americana, Ulmus alata, Juniperus virginiana var. virginiana, Nyssa sylvatica, Fraxinus americana*, and *Fraxinus pennsylvanica*. *Liriodendron tulipifera* is dominant in disturbed areas of Kentucky and is common on well-drained floodplains of Kentucky without *Liquidambar styraciflua*. Conversely, *Liriodendron tulipifera* is absent in Ouachita - Ozark examples. Some stands may exhibit dominance by *Acer rubrum*. The shrub layer often is well-developed and species include *Euonymus americanus, Lindera benzoin var. benzoin, Corylus americana, Viburnum acerifolium, Viburnum nudum var. nudum, Viburnum prunifolium, Viburnum rufidulum, Hamamelis virginiana, Asimina triloba*, and *Ilex decidua* among others. Vines are prominent and species include *Vitis rotundifolia, Apios americana, Campsis radicans, Aristolochia serpentaria, Bignonia capreolata, Dioscorea quaternata, Gelsemium sempervirens, Parthenocissus quinquefolia (= var. quinquefolia), Campsis radicans, Passiflora lutea, Smilax bona-nox, Smilax glauca (= var. glauca), Smilax hugeri, Smilax rotundifolia*, and *Toxicodendron radicans ssp. radicans*. The herbaceous layer can be species-rich and often has good sedge development. Common species in this layer include *Thalictrum thalictroides, Trillium cuneatum, Arisaema triphyllum ssp. triphyllum, Asplenium platyneuron var. platyneuron, Botrychium virginianum, Carex* spp., *Carex impressinervia, Carex striatula, Galium circaezans, Geum canadense, Polystichum acrostichoides*, and *Scutellaria integrifolia* among many others. Soils are relatively acidic. The exotics *Microstegium vimineum, Ligustrum sinense*, and *Lonicera japonica* may be common in examples of this alliance.

Dynamics:

Similar Alliances:
- *Liquidambar styraciflua - (Acer rubrum)* Seasonally Flooded Forest Alliance (A.321)
- *Liquidambar styraciflua* Forest Alliance (A.234)
- *Liriodendron tulipifera* Forest Alliance (A.236)
- *Pinus taeda - Liquidambar styraciflua - Nyssa biflora* Temporarily Flooded Forest Alliance (A.433)
- *Pinus taeda - Liriodendron tulipifera* Temporarily Flooded Forest Alliance (A.434)--includes related associations with longer hydroperiods.

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is fairly common in the lower Piedmont of Georgia (J. Ambrose pers. comm.), as well as on small stream floodplains and bottoms in all of the Interior Low Plateau of Kentucky (except the Bluegrass Region) where it is somewhat successional (L. McKinney pers. comm.). Its range extends north and west into the Cumberland Plateau and Ridge and Valley, as well as the Ouachita Mountains and Ozarks.

Nations: US

Subnations: AL, AR, DC, FL?, GA, KY, MD, MS, NC, NJ, OK, SC, TN, VA

TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 50:C, 52:C, 53:?, 56:C, 57:C, 58:C

USFS Ecoregions: 221Hc:CCC, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCC, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCC, 222Di:CCP, 222Ea:CC?, 222Eb:CCC, 222Ec:CC?, 222Ed:CC?, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CC?, 222Ei:CC?, 222Ej:CC?, 222Ek:CC?, 222En:CC?, 222Eo:CC?, 231Aa:CCC, 231Ab:CCC, 231Ac:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ag:CC?, 231Ah:CC?, 231Ai:CC?, 231Aj:CC?, 231Ak:CCC, 231Al:CC?, 231Am:CC?, 231An:CCC, 231Ao:CC?, 231Ap:CC?, 231Ba:CCC, 231Bb:CC?, 231Bc:CC?, 231Bd:CCC, 231Be:CCC, 231Bf:CC?, 231Bg:CCC, 231Bh:CC?, 231Bi:CCC, 231Bj:CC?, 231Bk:CCC, 231Bl:CC?, 231Ca:CC?, 231Cb:CC?, 231Cc:CCC, 231Cd:CCC, 231Ce:CC?, 231Cf:CC?, 231Cg:CCC, 231Da:CC?, 231Db:CC?, 231Dc:CC?, 231Dd:CC?, 231De:CC?, 231Ga:CCP, 231Gb:CCP, 231Gc:CCC, 232Ad:CCC, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bd:CCC, 232Be:CCP, 232Bf:CCP, 232Bg:CCP, 232Bh:CCP, 232Bi:CCP, 232Bj:CCP, 232Bk:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCC, 232Bs:CCC, 232Bt:CCP, 232Bu:CCP, 232Bv:CCP, 232Bx:CCP, 232Bz:CCP, 232Cg:CCC, 234Ab:PP?, 234An:PPP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Belvoir, Fort Benning, Fort Gordon); DOE (Oak Ridge?, Savannah River Site); NPS (Big South Fork, Buffalo River, Carl Sandburg Home, Chickamauga-Chattanooga, Colonial, Cowpens, Fort Donelson, Fredericksburg-Spotsylvania, George Washington Parkway, Guilford Courthouse, Horseshoe Bend, Kennesaw Mountain, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, National Capital-East, Ninety Six, Ocmulgee, Petersburg, Prince William, Richmond, Shiloh, Thomas Stone); USFS (Bankhead?, Bienville?, Daniel Boone, De Soto?, Delta?, Francis Marion?, Holly Springs?, Homochitto?, Oconee, Ouachita, Ozark, Sumter?, Talladega?, Tombigbee?, Tuskegee?, Uwharrie)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. M. Pyne

References: Ambrose pers. comm., Foti 1994a, Foti 1994b, Jones et al. 1981b, McKinney pers. comm., Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

[CEGL007330] *Liquidambar styraciflua - (Liriodendron tulipifera)* Temporarily Flooded Forest

Translated Name: **Sweetgum - (Tuliptree) Temporarily Flooded Forest**

Common Name: **Successional Sweetgum Floodplain Forest**

Ecological System(s):
- East Gulf Coastal Plain Large River Floodplain Forest (CES203.489)
- Southern Piedmont Small Floodplain and Riparian Forest (CES202.323)
- South-Central Interior Small Stream and Riparian (CES202.706)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): A.S. Weakley, mod. R. White

ELEMENT CONCEPT

Global Summary: This widespread association of the southeastern United States is dominated by *Liquidambar styraciflua*, but can be dominated by *Liriodendron tulipifera* in some cases, and occurs on heavily disturbed sites such as wetland old fields that have been recovering for the past 10-60 years. This is a successional community that develops following clearcutting or other disturbance along floodplains of major creeks and other temporarily flooded areas. As this

community ages, it often begins to approach the composition of more natural ~*Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest (CEGL004418). This association is known from the Piedmont, Interior Low Plateau, Inner South Atlantic Coastal Plain, Upper East Gulf Coastal Plain, and possibly other provinces. *Acer rubrum* may be a major component of the canopy and subcanopy and may even partially dominate in some instances. In more mature examples, other canopy/subcanopy species which may occur to a lesser extent and often as scattered emergents are *Quercus alba, Quercus phellos, Quercus nigra, Nyssa sylvatica*, and *Cornus florida*. Stands in the Inner Coastal Plain of South Carolina typically contain *Persea palustris* and *Magnolia virginiana*. Some stands, as on the Chattahoochee River in Georgia, may contain *Acer negundo* as a codominant canopy/subcanopy component. The shrub layer can contain *Carpinus caroliniana, Itea virginica, Vitis rotundifolia, Parthenocissus quinquefolia, Smilax rotundifolia*, and/or *Rubus* sp., in addition to canopy/subcanopy species. *Lonicera japonica* is often abundant in the understory. On disturbed sites, the shrub layer is often dominated by *Ligustrum sinense*, and the ground layer is typically solid *Microstegium vimineum* or a tangle of *Smilax rotundifolia* and *Rubus* sp. The herbaceous layer may include *Chasmanthium laxum, Carex* spp., *Boehmeria cylindrica*, and *Botrychium biternatum*, sometimes growing on hummocks in standing water.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This successional sweetgum floodplain forest was sampled at one location in the park. The site is an alluvial terrace above the normal floodplain of the Green River at 133 m (437 feet) elevation. The unvegetated surface is made up entirely of leaf litter (100% cover). Evidence of disturbance includes the presence of exotic plants and trails where human activity may be difficult to monitor.

Global Environment: This association occurs on disturbed sites such as wetland old fields. This is a successional community that develops following clearcutting or other disturbance along floodplains of major creeks and other temporarily flooded areas. These are productive stream terraces subject to occasional flooding (Jones et al. 1981b).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The very dense (90% cover) tree canopy, 20-35 m tall, is codominated by *Liquidambar styraciflua, Liriodendron tulipifera*, and *Fraxinus americana*. The moderate (50%) subcanopy (10-15 m) is codominated by *Juniperus virginiana, Liquidambar styraciflua*, and *Ulmus americana*. The sparse (20%) short-shrub layer (0.5-1 m) includes *Arundinaria gigantea* and *Lindera benzoin*. The herbaceous layer is solidly covered (100%) by *Elymus virginicus, Verbesina* sp., and the invasive exotic *Microstegium vimineum*.

Global Vegetation: The canopy of this association is dominated by *Liquidambar styraciflua* but can be dominated by *Liriodendron tulipifera* in some cases. *Acer rubrum* may be a major component of the canopy and subcanopy and may even partially dominate in some instances (TNC 1998a). In more mature examples, other canopy/subcanopy species which may occur to a lesser extent and often as scattered emergents are *Quercus alba, Quercus phellos, Quercus nigra, Fraxinus americana, Carya* spp., *Nyssa sylvatica*, and *Cornus florida*. Stands in the Inner Coastal Plain of South Carolina typically contain *Persea palustris* and *Magnolia virginiana* (Jones et al. 1981b). The shrub layer contains *Carpinus caroliniana, Itea virginica, Vitis rotundifolia, Parthenocissus quinquefolia, Smilax rotundifolia*, and *Rubus* sp., in addition to canopy/subcanopy species. *Lonicera japonica* is often abundant in the understory. On disturbed sites, the shrub layer is often dominated by *Ligustrum sinense*, and the ground layer is typically solid *Microstegium vimineum* or a tangle of *Smilax rotundifolia* and *Rubus* sp. The herbaceous layer may include *Chasmanthium laxum, Carex* spp., *Boehmeria cylindrica*, and *Botrychium biternatum*, sometimes growing on hummocks in standing water. Various *Carex* species may be present.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Liquidambar styraciflua	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Fraxinus americana	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	X	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	X	.	.
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Lindera benzoin	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Verbesina alternifolia	Herb (field)	Forb	X	.	.
Arundinaria gigantea	Herb (field)	Graminoid	X	.	.
Elymus virginicus	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Liquidambar styraciflua	Tree canopy	Broad-leaved deciduous tree	X	.	.

Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	.	.	.
Smilax rotundifolia	Short shrub/sapling	Vine/Liana	.	X	.
Boehmeria cylindrica	Herb (field)	Forb	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (8-Aug-2000). This is a successional community which develops following clearcutting or other disturbance along floodplains of major creeks and other temporarily flooded areas.

RELATED CONCEPTS

Global Similar Associations:

- *Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum* Forest (CEGL004418)--may be difficult to distinguish from older versions of this community; trees are older, uneven-aged, and the herbaceous layer more diverse in this association (CEGL004418).
- *Quercus alba - Carya (alba, ovata) - Liriodendron tulipifera - (Quercus phellos) / Cornus florida* Forest (CEGL007709)
- *Quercus phellos - Quercus alba / Vaccinium fuscatum - (Viburnum nudum) / Carex (barrattii, intumescens)* Forest (CEGL007364)

Global Related Concepts:

- Sweet gum-red maple-red bay community (Jones et al. 1981b) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: At Arnold Air Force Base (Tennessee), this community is found primarily in the vicinity of Hunt Creek, Heron Pond, and Sinking Pond in areas that have experienced logging. Prior to logging, these areas would probably have had canopies dominated by *Quercus phellos* or *Quercus alba*, with the overall community structure being that of *~Quercus alba - Carya (alba, ovata) - Liriodendron tulipifera - (Quercus phellos) / Cornus florida* Forest (CEGL007709) or possibly *~Quercus phellos - Quercus alba / Vaccinium fuscatum - (Viburnum nudum) / Carex (barrattii, intumescens)* Forest (CEGL007364). The sweet gum-red maple-red bay community of Jones et al. (1981b) (2 stands sampled) is included here.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association could possibly occur on any upper floodplain terrace in the park, depending on its past disturbance history.

Global Range: This association is known from the Piedmont, Interior Low Plateau, Inner South Atlantic Coastal Plain, and possibly other provinces.

Nations: US

States/Provinces: AL, GA, KY, MS, NC, NJ, SC, TN, VA

TNC Ecoregions: 43:C, 44:C, 50:C, 52:C, 56:C, 57:C, 58:C

TNC Ecoregion Comments: ECO58 & 232BR added for FRSP (mjr 3-07). ECO57 changed from ? to C (MP 2-01). ECO50 changed from P to C (MP/DFL 2-01). ECO56 changed from ? to C (MP 10-00) based on crosswalk of Jones et al. (1981b) type here. ECO43 and ECO44 changed from ? to C and ECO50 changed from ? to P (MP 1-00).

USFS Ecoregions: 221Hc:CCC, 222Cg:CCC, 222Dg:CCC, 222Eb:CCC, 222Eg:CCC, 231Aa:CCC, 231Ab:CCC, 231Ae:CCC, 231Ak:CCC, 231An:CCC, 231Ba:CCC, 231Bd:CCC, 231Be:CCC, 231Bg:CCC, 231Bi:CCC, 231Bk:CCC, 231Cc:CCC, 231Cd:CCC, 231D:CC, 232Bd:CCC, 232Br:CCC, 232Cg:CCC

Federal Lands: DOD (Arnold, Fort Benning?); DOE (Savannah River Site); NPS (Big South Fork, Chickamauga-Chattanooga?, Cowpens, Fort Donelson, Fredericksburg-Spotsylvania, George Washington Parkway, Horseshoe Bend, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, Shiloh); USFS (Bankhead?, Bienville?, Daniel Boone, De Soto?, Delta?, Francis Marion?, Holly Springs?, Homochitto?, Oconee?, Sumter (Piedmont)?, Talladega (Oakmulgee)?, Talladega?, Tombigbee?, Tuskegee?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.65.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): mod. R. White

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Jones et al. 1981b	.	X	X	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	

A.288 Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum) *Temporarily Flooded Forest Alliance*

American Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance occur on the fronts, terraces, and levees of small, medium and large rivers of the Atlantic Coastal Plain, Southern Ridge and Valley, Interior Low Plateau, Ozark Highlands, Ouachita Mountains, Arkansas Valley, East and West Gulf coastal plains, Mississippi River Alluvial Plain, Cumberland Plateau, Southern Blue Ridge, and lower Piedmont. These forests are dominated by *Platanus occidentalis* or a mixture of it with *Fraxinus pennsylvanica, Celtis laevigata*, and *Acer saccharinum*, as well as *Acer negundo, Ulmus americana, Liquidambar styraciflua, Ulmus alata, Planera aquatica, Juglans nigra, Celtis occidentalis, Carya illinoinensis, Quercus nigra, Salix nigra, Carya cordiformis, Quercus pagoda*, and *Carya aquatica*. The understory may be dense and typically contains *Asimina triloba, Crataegus viridis, Crataegus spathulata*, and *Lindera benzoin*. Herbaceous species that may be present include *Elymus virginicus, Carex grayi, Carex lupulina, Carex abscondita, Chasmanthium latifolium, Boehmeria cylindrica, Polygonum virginianum, Elymus virginicus, Pilea pumila, Leersia lenticularis*, and others. Vines may be abundant and species include *Bignonia capreolata, Toxicodendron radicans*, and *Smilax tamnoides (= Smilax hispida)*. This alliance does not include typical alluvial forests of the upper Piedmont and Blue Ridge, but forests in this alliance may occur in these areas in restricted calcareous situations. In Arkansas, these forests occur during point bar succession as intermediates between forests dominated by *Salix* and *Populus*, and those dominated by *Carya illinoinensis*. In Kentucky and Arkansas, *Fraxinus americana, Fraxinus pennsylvanica, Ulmus rubra*, and *Ulmus americana* are common in these forests. According to K. Ribbeck (pers. comm.) "Sycamore - River Birch - Silver Maple" forests of the Pearl River in Louisiana are included here.

Environment: Forests in this alliance occur on fronts, terraces, and levees of small, medium and large rivers, particularly where there are base-rich inputs to the sediments. In Arkansas, these forests occur during point bar succession as intermediates between forests dominated by *Salix* and *Populus*, and those dominated by *Carya illinoinensis* (T. Foti pers. comm.).

Vegetation: These forests are dominated by *Platanus occidentalis* or a mixture of it with *Fraxinus pennsylvanica, Celtis laevigata*, and *Acer saccharinum*, as well as *Acer negundo, Ulmus americana, Liquidambar styraciflua, Ulmus alata, Planera aquatica, Juglans nigra, Celtis occidentalis, Carya illinoinensis, Quercus nigra, Salix nigra, Carya cordiformis, Quercus pagoda*, and *Carya aquatica*. *Asimina triloba, Crataegus viridis, Crataegus spathulata*, and *Lindera benzoin* may be fairly dense in the understory. Herbaceous species that may be present include *Elymus virginicus, Carex grayi, Carex lupulina, Carex abscondita, Chasmanthium latifolium, Boehmeria cylindrica, Polygonum virginianum, Elymus virginicus, Pilea pumila, Leersia lenticularis*, and others. Vines may be abundant and species include *Bignonia capreolata, Toxicodendron radicans*, and *Smilax tamnoides (= Smilax hispida)*. In Kentucky and Arkansas, *Fraxinus americana, Fraxinus pennsylvanica, Ulmus rubra*, and *Ulmus americana* are common in these forests. In the Cumberland Plateau of Alabama, *Platanus occidentalis* is codominant with *Celtis laevigata* and *Liriodendron tulipifera*.

Dynamics:

Similar Alliances:

- *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)--with stronger dominance by *Acer saccharinum*.
- *Fraxinus pennsylvanica - Ulmus americana - Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286)
- *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289)

Similar Alliance Comments: Is this alliance (A.288) in a more base-rich and/or lower gradient environment than A.289?

ALLIANCE DISTRIBUTION

Range: Forests in this alliance occur on the fronts, terraces, and levees of small, medium and large rivers of the Atlantic Coastal Plain, Southern Ridge and Valley, Cumberland Plateau, Interior Low Plateau, Ozark Highlands, Ouachita Mountains, Arkansas Valley, East and West Gulf coastal plains, Mississippi River Alluvial Plain, and lower Piedmont. It also ranges into the southern midwestern United States. This alliance does not include typical alluvial forests of the upper Piedmont and Blue Ridge, but forests in this alliance may occur in these areas in restricted calcareous situations.

Nations: US

Subnations: AL, AR, CT, DC, DE, GA, IN, KY, LA, MA, MD, MO, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, TX, VA, VT, WV
TNC Ecoregions: 24:C, 29:C, 31:C, 32:?, 37:C, 38:C, 39:P, 40:C, 41:C, 42:C, 43:C, 44:C, 45:C, 49:C, 50:C, 51:C, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 63:C
USFS Ecoregions: 212E:C?, 212Fb:CCP, 212Fc:CCC, 221Af:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Fa:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Cb:CCP, 222Cd:CCP, 222Ce:CCP, 222Cg:CCC, 222De:CCP, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CCP, 222Eg:CCC, 222Eh:CCP, 222Em:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Hb:CCC, 222Hf:CCC, 222I:C?, 222O:C?, 231Aa:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCP, 231Al:CCC, 231Ap:CCC, 231Ba:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCC, 231Bg:CCP, 231Bh:CCC, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Cd:CCC, 231Da:CCC, 231Dc:CCC, 231Ef:CCC, 231Eg:CCP, 231Eh:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ad:CCC, 232Bb:CCC, 232Bj:CCC, 232Bk:CCP, 232Bl:CCP, 232Bq:CCC, 232Br:CCP, 232Bs:CCC, 232Bu:CCP, 232Bv:CCP, 232Ca:CPP, 232Fa:CCP, 232Fb:CCP, 232Fc:CCP, 232Fd:CCP, 234Aa:CCP, 234Ab:CC?, 234Ac:CCC, 234Ae:CCP, 234Ag:CCC, 234Ah:CC?, 234Ai:CCP, 234Am:CCC, 234An:CCC, 251Cd:CPP, 251Eb:CCC, 255Da:CCP, 255Db:CCC, 315:C, M212Bd:CCC, M221Aa:CCC, M221Ab:CCC, M221Cd:CCC, M221Da:CCC, M221Db:CCP, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231:P
Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold, Fort Benning); NPS (Abe Lincoln Birthplace, Antietam, Blue Ridge Parkway, Buffalo River, C&O Canal, Chattahoochee River, Chickamauga-Chattanooga, Congaree Swamp, Delaware Water Gap, Eisenhower, Fort Donelson, Friendship Hill, George Washington Parkway, Gettysburg, Great Smoky Mountains, Harpers Ferry, Kennesaw Mountain, Mammoth Cave, Manassas, Monocacy, Natchez Trace, National Capital-East, Ninety Six, Ocmulgee, Ozark Riverways, Rock Creek, Russell Cave, Shiloh, Upper Delaware, Valley Forge, Vicksburg); USFS (Angelina, Bankhead, Bienville, Chattahoochee, Daniel Boone, Davy Crockett, De Soto, Delta?, George Washington, Holly Springs, Homochitto, Hoosier, Jefferson, Kisatchie, Mark Twain, Oconee, Ozark, Pisgah?, Sabine, Sam Houston, St. Francis?, Tombigbee?, Tuskegee, Wayne?); USFWS (Erie, San Bernard?)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod.
References: Allard 1990, Diamond 1993, Evans 1991, Eyre 1980, Foti pers. comm., Ribbeck pers. comm., Southeastern Ecology Working Group n.d.

[CEGL007334] *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest

Translated Name: **American Sycamore - Silver Maple - Black Walnut - Slippery Elm Forest**
Common Name: **Sycamore - Silver Maple Calcareous Floodplain Forest**
Ecological System(s):
- South-Central Interior Large Floodplain (CES202.705)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This sycamore - silver maple floodplain forest occurs along riverfronts in calcareous areas of the east-central United States, including forests along small streams. Stands are dominated by *Platanus occidentalis*, with a mixture of other species, including *Acer negundo, Acer saccharinum, Fraxinus americana, Fraxinus pennsylvanica, Juglans nigra, Ulmus americana*, and *Ulmus rubra*. Shrubs include *Asimina triloba* and *Lindera benzoin*. Vines may be abundant, including *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Arisaema triphyllum, Asarum canadense, Boehmeria cylindrica, Elymus virginicus, Pilea pumila, Polygonum virginianum*, and others.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Mammoth Cave National Park Environment: This sycamore - silver maple floodplain forest is restricted to terraces and floodplains of larger rivers (the Green and its tributaries). It was sampled at five locations in the park. Sites range from temporarily flooded flat to gentle and moderate west- and south-facing alluvial terraces at 188 to 225 m (617-737 feet) elevation. Soils are poorly drained to well-drained clay loam, sandy clay loam, sandy loam and loam. The unvegetated surface is made up of leaf litter (5-98% cover), wood (2-10%) and bare soil (0-93%). Evidence of disturbance includes past logging, flooding, grazing/browsing by animals, and heavy infestation by exotic plants.
Global Environment: This association occurs along riverfronts in calcareous areas, including forests along small streams (Weakley et al. 1998). The creation in 2000 of ~*Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera /*

Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata Forest (CEGL008429) may dictate that the use of this type (CEGL007334), at least in their range of overlap, would be more appropriate for large rivers rather than "small streams."

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to very dense (60-90% cover) tree canopy, 20-35 m tall, is dominated by *Platanus occidentalis* and may include *Acer negundo, Acer saccharinum, Acer saccharum, Fraxinus pennsylvanica*, and *Juglans nigra*. The sparse to moderate (20-60%) subcanopy (5-20 m) is made up of canopy species (with the exception of *Platanus occidentalis*), along with *Ulmus americana* and *Ulmus rubra*. The sparse to dense (20-80%) tall-shrub layer (1-5 m) may include *Asimina triloba* and *Lindera benzoin*. The sparse (10-20%) short-shrub layer (0.5-2 m) is made up of tall-shrub species as well as *Symphoricarpos orbiculatus*. The moderately sparse to very dense (40-90%) herbaceous layer includes *Ageratina altissima, Amphicarpaea bracteata, Arundinaria gigantea, Boehmeria cylindrica, Cardamine hirsuta, Carex grayi, Chasmanthium latifolium, Claytonia virginica, Corydalis flavula, Pilea pumila, Polygonum virginianum, Stellaria media, Teucrium canadense, Verbesina alternifolia* (dominant), and invasive exotic *Microstegium vimineum*. An additional 15 species of exotic plants were reported from five plots. Vines include *Smilax tamnoides, Toxicodendron radicans, Vitis aestivalis*, and *Vitis palmata*. In addition, this community supports state-critically imperiled *Matelea carolinensis* and state-vulnerable *Cystopteris tenuis*.

Global Vegetation: Stands are dominated by *Platanus occidentalis*, with a mixture of other species, including *Acer negundo, Acer saccharinum, Fraxinus americana, Fraxinus pennsylvanica, Juglans nigra, Ulmus americana*, and *Ulmus rubra*. Shrubs include *Asimina triloba* and *Lindera benzoin*. Vines may be abundant, including *Parthenocissus quinquefolia* and *Toxicodendron radicans*. Herbaceous species include *Arisaema triphyllum, Asarum canadense, Boehmeria cylindrica, Elymus virginicus, Pilea pumila, Polygonum virginianum*, and others (Van Kley et al. 1995, Weakley et al. 1998). *Acer saccharinum* may be a differential species in relation to some of the other associations in this alliance, as it is apparently absent from the southeastern Atlantic Coastal Plain and at the edge of its range in the southern Piedmont.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer negundo	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Acer saccharinum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	X	.
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Ageratina altissima	Herb (field)	Forb	X	.	.
Boehmeria cylindrica	Herb (field)	Forb	X	.	.
Pilea pumila	Herb (field)	Forb	X	.	.
Verbesina alternifolia	Herb (field)	Forb	X	.	.
Carex grayi Herb (field)	Graminoid	X	.	.	
Chasmanthium latifolium	Herb (field)	Graminoid	X	.	.
Microstegium vimineum	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer negundo	Tree canopy	Broad-leaved deciduous tree	.	X	.
Acer saccharinum	Tree canopy	Broad-leaved deciduous tree	.	X	.
Fraxinus pennsylvanica	Tree canopy	Broad-leaved deciduous tree	.	X	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	.	X	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous tree	.	X	.
Alliaria petiolata	Herb (field)	Forb	.	X	.
Chaerophyllum procumbens	Herb (field)	Forb	.	X	.
Mertensia virginica	Herb (field)	Forb	.	X	.
Verbesina alternifolia	Herb (field)	Forb	.	X	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Ailanthus altissima	-	P	exotic
Alliaria petiolata	-	P	exotic
Allium vineale	-	P	exotic

Arctium minus	-	P	exotic
Cardamine hirsuta	-	P	exotic
Cynodon dactylon	-	P	exotic
Cystopteris tenuis	-	P	state-vulnerable
Glechoma hederacea	-	P	exotic
Lamium amplexicaule	-	P	exotic
Lespedeza cuneata	-	P	exotic
Matelea carolinensis	-	P	state-critically imperiled
Microstegium vimineum	-	P	exotic
Ranunculus bulbosus	-	P	exotic
Stellaria media	-	P	exotic
Taraxacum officinale	-	P	exotic
Verbascum thapsus	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Erythronium albidum	-	P	VA S2
Maianthemum stellatum	-	P	VA S2?

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (4-Jan-2001). This type is apparently somewhat restricted in habitat, but with a wide range, and not highly threatened. Timber removal will cause disruption, but permanent conversion to other forest types is less likely. This community and other types of floodplain forests are threatened by alteration of the hydroperiod by artificial impoundments or river diversion projects, or the disruption of the floodplain communities by forestry or agriculture.

RELATED CONCEPTS

Global Similar Associations:

- *Acer negundo* Forest (CEGL005033)--is dominated by *Acer negundo*; there may be small patches of *Acer negundo* imbedded in examples of CEGL007334.
- *Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis - (Elymus virginicus)* Forest (CEGL006217)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586)
- *Fraxinus pennsylvanica - Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest (CEGL002410)
- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427)
- *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014)
- *Platanus occidentalis - Acer negundo - Juglans nigra / Asimina triloba / Mertensia virginica* Forest (CEGL004073)--is found in Maryland, Virginia, West Virginia, and possibly Pennsylvania.
- *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429)--on small to medium-sized terraces of small streams.
- *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458)

Global Related Concepts:

- ELTP 61: *Platanus / Asarum*, Wet-mesic Bottomlands (Van Kley et al. 1995) =
- IIA6e. Southern Appalachian Alluvial Forest (Allard 1990) [in part] **B**
- Silver Maple - Sycamore Forest on Base-rich Alluvium (Palmer-Ball et al. 1988) =
- Sycamore-green ash floodplain forest (CAP pers. comm. 1998) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Larger floodplains of the Green River and its larger tributaries, typically with *Acer saccharinum*, are classified as this association (CEGL007334). It also seems to accommodate the portions of stands that exhibit dominance by *Acer negundo*, so the use of ~*Acer negundo* Forest (CEGL005033) to classify stands should not be necessary. Most smaller streams and "alluviated sinkholes" will classify as ~*Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest (CEGL008429). Some small streams in the sandstone-oriented northwest side apparently represent examples of ~*Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340), an association in the ~*Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This type could be in Illinois and Missouri. It is not well characterized yet and may be difficult to distinguish from other floodplain forests where *Platanus* is conspicuous without being dominant. For example, see ~*Acer saccharinum - Ulmus americana* Forest (CEGL002586), ~*Fraxinus pennsylvanica - Celtis* spp. - *Quercus* spp. - *Platanus occidentalis* Bottomland Forest (CEGL002410), ~*Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427), and ~*Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest

(CEGL002014). It is possible that CEGL002410 could be merged with this type, depending on level of dominance required for *Platanus*.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: Within the park, this association is restricted to terraces and floodplains of larger rivers (the Green and its tributaries).

Global Range: This association occurs on river and large stream floodplains in calcareous areas of the east-central United States from Indiana and Kentucky and possibly Ohio, south to Tennessee. Range extent may be approximately 300,000 square km.

Nations: US

States/Provinces: GA, IN, KY, MO, OH, PA, TN, VA

TNC Ecoregions: 43:C, 44:C, 45:C, 49:C, 50:C, 51:C

TNC Ecoregion Comments: 231Aa:CCP, 231Ae:CCP, 231Ak:CCP, 231Al:CCC, 231Ap:CCC, 232Ad:CCC removed, transferred to CEGL004073. Review WAP (ECO49) assignment (MP 9-05). ECO59 and ECO61 removed when CEGL004073 was split out (KDP 3-04). ECO61 changed from C to ? per Lundgren et al. 2000 (SLN 3-03). ECO43 added based on presence at Shiloh (MP 8-02). ECO51 added based on Fleming and Coulling 2001. ECO52 (also 231A & SC) removed, see CEGL007730 (MP 2001-05-11). ECO58 removed (LAS 10-00) per Chesapeake Bay ecology group. ECO52 changed from C to ? (REE 9-00). ECO58 and ECO61 added (LAS 3-00).

USFS Ecoregions: 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Eg:CCC, 221Fa:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Cg:CCC, 222De:CCP, 222Dg:CCC, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Eg:CCC, 222Em:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCC, 222Fb:CCC, 222Fc:CCC, 222Fd:CCC, 222Hb:CCC, 222Hf:CCC, 231Aa:PPP

Federal Lands: NPS (Chickamauga-Chattanooga, Fort Donelson, Mammoth Cave, Natchez Trace, Ozark Riverways, Shiloh); USFS (Daniel Boone, Jefferson?, Wayne?); USFWS (Erie)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name — Relationship — Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.6, MACA.20, MACA.34, MACA.82, MACA.83, MACA.736.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): D. Faber-Langendoen, mod. K.D. Patterson

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
CAP pers. comm. 1998	.	.	X	X	.	.	.	.	.
Palmer-Ball et al. 1988	.	.	X	X	.	.	.	.	.
Schafale and Weakley 1990	.	X	.	X	X	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Van Kley et al. 1995	.	.	X	X	.	.	.	.	.
Weakley et al. 1998	.	.	.	X	.	.	.	.	.

[CEGL008429] *Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera benzoin - Arundinaria gigantea / Amphicarpaea bracteata* Forest

Translated Name: **American Sycamore - Sugarberry - Tuliptree / Northern Spicebush - Giant Cane / American Hog-peanut**

Forest

Common Name: **Rich Levee Mixed Hardwood Bottomland Forest**

Ecological System(s):

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

Status: Standard

Circumscription Confidence: 3 - Weak

Concept Author(s): J. Teague

ELEMENT CONCEPT

Global Summary: This forest occurs on infrequently flooded, base-rich alluvial terraces along small streams in the upper southeastern United States. In addition to *Platanus occidentalis, Celtis laevigata*, and *Liriodendron tulipifera*, other dominants of the closed canopy can include *Acer negundo, Juglans nigra, Acer saccharum*, and *Fraxinus pennsylvanica*. Several other canopy components are possible. Midstory components include *Carpinus caroliniana, Acer barbatum, Ulmus rubra*, and *Tilia americana*. The understory is often dominated by *Lindera benzoin*. The ground cover flora is

variable in composition and cover. Ground cover components include *Polystichum acrostichoides, Elymus virginicus, Verbesina occidentalis, Verbesina virginica, Verbesina alternifolia, Viola* sp., *Chasmanthium latifolium, Polygonum virginianum, Amphicarpaea bracteata, Boehmeria cylindrica*, and *Laportea canadensis*. This community is reported to have a rich herbaceous flora in the spring. The invasive exotics *Glechoma hederacea, Ligustrum sinense*, and *Microstegium vimineum* may invade examples of this community.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This sycamore bottomland forest is found along small streams and in "alluviated sinkholes." It was sampled at nine locations in the park. Sites are flat to gently sloping alluvial flats and sinkholes at 75 to 268 m (246-880 feet) elevation. Soils are saturated to temporarily flooded, well-drained to poorly drained sand, silt loam, clay loam, loam, and silty clay. The unvegetated surface is dominated by leaf litter (80-98% cover) with some exposed bedrock (0-3%), wood (0-5%), bare soil (0-15%), and standing water (0.10%). Evidence of disturbance includes past logging and clearing, trails, and the presence of exotic plants.

Global Environment: This association occurs on terraces of small, base-rich streams in the Cumberland Plateau, Ridge and Valley, and Interior Low Plateau. These alluvial deposits are apparently somewhat calcareous, resulting from erosion of limestone strata within the surrounding watersheds.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate to dense (50-80% cover) tree canopy, 15-35 m tall, is dominated by *Platanus occidentalis* and may include *Acer rubrum, Acer saccharinum, Acer saccharum, Liquidambar styraciflua*, and *Liriodendron tulipifera*. The sparse to moderate (30-60%) subcanopy (10-15 m) may include *Acer negundo, Acer saccharum, Carpinus caroliniana, Liriodendron tulipifera, Prunus serotina var. serotina, Ulmus americana*, and others. The sparse to moderate (30-60%) tall-shrub layer (2-5 m) includes *Asimina triloba, Cornus florida*, and *Lindera benzoin*, as does the sparse to moderate (20-50%) short-shrub layer (0.5-2 m) along with *Symphoricarpos orbiculatus*. The sparse to total-cover (30-100%) herbaceous layer may include *Ageratina altissima, Amphicarpaea bracteata, Athyrium filix-femina ssp. asplenioides, Boehmeria cylindrica, Circaea lutetiana ssp. canadensis, Hackelia virginiana, Onoclea sensibilis, Pilea pumila, Polygonum virginianum, Polystichum acrostichoides, Scrophularia marilandica, Verbesina alternifolia*, and the invasive exotic *Microstegium vimineum* (which may dominant to the exclusion of all else). Vines (10%) include *Campsis radicans, Parthenocissus quinquefolia, Smilax tamnoides*, and *Toxicodendron radicans*. In addition, this community supports seedlings of state-critically imperiled *Castanea dentata*.

Global Vegetation: In addition to *Platanus occidentalis, Celtis laevigata*, and *Liriodendron tulipifera*, other dominants of the closed canopy can include *Acer negundo, Juglans nigra, Acer saccharum*, and *Fraxinus pennsylvanica*. Other canopy components include *Quercus shumardii, Quercus muehlenbergii, Quercus michauxii, Quercus lyrata, Carya glabra, Carya ovata, Fraxinus americana*, and *Aesculus glabra* or *Aesculus flava*. Midstory components include *Carpinus caroliniana, Acer barbatum, Ulmus rubra, Ostrya virginiana*, and *Tilia americana*, in addition to the species represented in the canopy. The understory is often dominated by *Lindera benzoin*. Other understory components include *Arundinaria gigantea*, which may be dominant in patches, *Asimina triloba, Sambucus canadensis*, and *Ulmus americana*. The ground cover flora is variable in composition and cover. Ground cover components include *Polystichum acrostichoides, Elymus virginicus, Verbesina occidentalis, Verbesina virginica, Verbesina alternifolia, Viola* sp., *Chasmanthium latifolium, Polygonum virginianum, Amphicarpaea bracteata, Boehmeria cylindrica, Laportea canadensis, Smallanthus uvedalius, Ageratina altissima, Geum canadense, Sanicula canadensis, Elephantopus carolinianus, Polymnia canadensis, Amphicarpaea bracteata, Campanulastrum americanum, Circaea lutetiana ssp. canadensis*, and *Teucrium canadense*. This community is reported to have a rich herbaceous flora in the spring. The invasive exotics *Glechoma hederacea, Ligustrum sinense*, and *Microstegium vimineum* may invade examples of this community.

Global Dynamics: This community is located on terraces along small streams that probably experience yearly floods of short duration.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Prunus serotina var. *serotina*	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Acer rubrum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	X	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	X	.
Acer negundo	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Acer saccharum	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Carpinus caroliniana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Ulmus americana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	X	.

Cornus florida	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Symphoricarpos orbiculatus	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Amphicarpaea bracteata	Herb (field)	Forb	X	.	.
Boehmeria cylindrica	Herb (field)	Forb	X	.	.
Pilea pumila	Herb (field)	Forb	X	.	.
Polygonum virginianum	Herb (field)	Forb	X	.	.
Verbesina alternifolia	Herb (field)	Forb	X	.	.
Microstegium vimineum	Herb (field)	Graminoid	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Allium vineale	-	P	exotic
Castanea dentata	-	P	state-critically imperiled
Commelina communis	-	P	exotic
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic
Perilla frutescens	-	P	exotic
Rosa multiflora	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (5-Sep-2008). This association is probably found at scattered localities in the southern Cumberland Plateau, the southern Ridge and Valley, and the Interior Low Plateau, where it is confined to base-rich terraces along small streams. Numerous examples are protected on public lands, and as some of its dominants are not species which provide high-quality timber, it may be less impacted by timber harvest than oak-dominated floodplain forests.

RELATED CONCEPTS

Global Similar Associations:

- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334)--on the riverfronts of medium to large streams/rivers.

Global Related Concepts:

- CT I *Liriodendron tulipifera, Acer negundo, Platanus occidentalis, Acer saccharum* (Badger et al. 1997) =

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Most small streams and "alluviated sinkholes" will classify as this association (CEGL008429), with *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334) being used to classify stands on the floodplain of the Green River and perhaps its larger tributaries. The use of *Acer negundo* Forest (CEGL005033) to classify stands should not be necessary. In addition, there are small streams in the sandstone-oriented northwest side that apparently represent examples of *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest (CEGL007340), an association in the *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera)* Temporarily Flooded Forest Alliance (A.289). Badger et al. (1997) list a CT I *Liriodendron tulipifera, Acer negundo, Platanus occidentalis, Acer saccharum* (pp. 1-31). Habitat: floodplains of the Green and Nolin rivers [CEGL008429]; also called "*Acer negundo, Liriodendron tulipifera, Platanus occidentalis, Juglans nigra*" (pp. 4-25).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This association was originally described from the Bankhead National Forest in the Cumberland Plateau of northern Alabama. It also includes occurrences in the Ridge and Valley portion of the Chattahoochee National Forest of Georgia, and the Interior Low Plateau of Tennessee and Kentucky.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found on flat to gently sloping alluvial flats along small streams and in "alluviated sinkholes."

Global Range: This association is found in the southern Cumberland Plateau, the southern Ridge and Valley, and the Interior Low Plateau from Alabama and Georgia to Kentucky.

Nations: US

States/Provinces: AL, GA, KY, TN

TNC Ecoregions: 44:C, 50:C
TNC Ecoregion Comments: ECO44 added (MP 2-07).
USFS Ecoregions: 222Dg:CCC, 222Dj:CCC, 231Cd:CCC, 231Da:CCC, 231Dc:CCC
Federal Lands: NPS (Abe Lincoln Birthplace, Chickamauga-Chattanooga, Mammoth Cave?, Russell Cave); USFS (Bankhead, Chattahoochee, Chattahoochee (Southern Blue Ridge))

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.43, MACA.63, MACA.97, MACA.103, MACA.111, MACA.713, MACA.719, MACA.733, MACA.734.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): J. Teague, mod. E.L. Jones and M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Badger et al. 1997	.	X	X	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.

A.289 Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera) *Temporarily Flooded Forest Alliance*

American Sycamore - (Sweetgum, Tuliptree) Temporarily Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance typically are dominated by *Platanus occidentalis* with *Liquidambar styraciflua* and/or *Liriodendron tulipifera*, and typically occur on rocky streambeds and alluvial deposits on relatively high-gradient rivers. The alliance is distributed in the upper Piedmont, Appalachian Mountains, Interior Low Plateau, Cumberland Mountains, and Cumberland Plateau regions. In the eastern part of the Interior Low Plateau, vegetation of this alliance may be in lower gradient situations. Other canopy and understory species that may be present include *Aesculus sylvatica* (within its range), *Asimina triloba, Cornus florida, Alnus serrulata, Fraxinus americana, Acer rubrum, Carpinus caroliniana, Ulmus americana*, and *Fagus grandifolia* in the non-montane part of the distribution. Species present in the montane occurrences include *Platanus occidentalis, Liriodendron tulipifera, Betula alleghaniensis*, and *Betula lenta*, with *Carpinus caroliniana, Hamamelis virginiana, Liquidambar styraciflua, Betula nigra, Fraxinus americana, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. *Euonymus americanus* is a typical shrub species in the lower elevation occurrences, while *Rhododendron maximum* and *Leucothoe fontanesiana* are common at higher elevations. Herbaceous species vary as well by geography and elevation, and may include *Arisaema triphyllum, Sanicula canadensis, Saururus cernuus, Campanula divaricata, Dichanthelium dichotomum var. dichotomum, Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Viola sororia*, and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex crinita, Carex digitalis, Carex plantaginea, Carex swanii*, and/or *Carex torta*).
Environment: Forests in this alliance typically occur on rocky streambeds and alluvial deposits on relatively high-gradient rivers.
Vegetation: Forests in this alliance typically are dominated by *Platanus occidentalis* with *Liquidambar styraciflua* and/or *Liriodendron tulipifera*. Other canopy and understory species that may be present include *Aesculus sylvatica* (within its range), *Asimina triloba, Cornus florida, Alnus serrulata, Fraxinus americana, Acer rubrum, Carpinus caroliniana, Ulmus americana*, and *Fagus grandifolia* in the non-montane part of the distribution. Species present in the montane occurrences include *Platanus occidentalis, Liriodendron tulipifera, Betula alleghaniensis*, and *Betula lenta*, with *Carpinus caroliniana, Hamamelis virginiana, Liquidambar styraciflua, Betula nigra, Fraxinus americana, Acer rubrum, Pinus virginiana, Pinus strobus*, and *Tsuga canadensis*. *Euonymus americanus* is a typical shrub species in the lower elevation occurrences, while *Rhododendron maximum* and *Leucothoe fontanesiana* are common at higher elevations. Herbaceous species vary as well by geography and elevation, and may include *Arisaema triphyllum, Sanicula canadensis, Saururus cernuus, Campanula divaricata, Dichanthelium dichotomum var. dichotomum, Amphicarpaea bracteata, Actaea racemosa (= Cimicifuga racemosa), Polystichum acrostichoides, Eurybia divaricata (= Aster divaricatus), Viola sororia*, and *Viola blanda*. *Carex* species may be common (e.g., *Carex appalachica, Carex austrocaroliniana, Carex blanda, Carex crinita, Carex digitalis, Carex plantaginea, Carex swanii*, and/or *Carex torta*).

Dynamics:

Similar Alliances:

- *Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum)* Temporarily Flooded Forest Alliance (A.288)
- *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171)

Similar Alliance Comments: Is A.289 in a less base-rich and/or higher gradient environment than A.288?

ALLIANCE DISTRIBUTION

Range: The alliance is distributed in the upper Piedmont, Appalachian Mountains, Interior Low Plateau, Cumberland Mountains, Cumberland Plateau, and Chesapeake Bay regions. In the eastern part of the Interior Low Plateau, vegetation of this alliance may be in lower gradient situations. This alliance extends from Delaware south to Georgia, and west Kentucky, Tennessee, and possibly Mississippi.

Nations: US

Subnations: AL, DC, DE, GA, KY, MD, MS?, NC, NJ, PA?, SC, TN, VA, WV

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 58:C, 59:C, 61:C, 62:C

USFS Ecoregions: 221Da:CC?, 221Db:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CP?, 221Jb:CP?, 221Jc:CP?, 222C:CP, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CC?, 222Eg:CC?, 222Eh:CCP, 222En:CCC, 222Eo:CCC, 231Aa:CCP, 231Ae:CCC, 231Ag:CCC, 231Aj:CCC, 231Ak:CCC, 231Al:CCC, 231Ap:CCC, 231Be:C??, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CC?, 231Cf:CCP, 231Da:CCP, 231Db:CCP, 231Dd:CCC, 232Ac:CCC, 232Ad:CCC, 232Br:CCC, M221Ab:C??, M221Ad:C??, M221Ba:CCC, M221Bb:CCC, M221Be:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold); NPS (Appomattox Court House, Big South Fork, Blue Ridge Parkway, Bluestone, Booker T. Washington, C&O Canal, Catoctin Mountain, Cumberland Gap, George Washington Parkway, Great Smoky Mountains, Kings Mountain, Mammoth Cave, Manassas, New River Gorge, Rock Creek, Shenandoah, Wolf Trap); USFS (Chattahoochee, Cherokee, Daniel Boone, Nantahala, Pisgah, Sumter)

ALLIANCE SOURCES

Author(s): S. Simon, G. Kauffman, D.M. Danley

References: Allard 1990, Evans 1991, Eyre 1980, Flinchum 1977, McLeod 1988, Newell and Peet 1995, Rawinski 1992, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

[CEGL007340] *Platanus occidentalis - Liquidambar styraciflua / Carpinus caroliniana - Asimina triloba* Forest

Translated Name: **American Sycamore - Sweetgum / American Hornbeam - Pawpaw Forest**

Common Name: **Sycamore - Sweetgum Streambottom Forest**

Ecological System(s):

- Central Appalachian River Floodplain (CES202.608)
- South-Central Interior Small Stream and Riparian (CES202.706)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): S. Landaal

ELEMENT CONCEPT

Global Summary: This forest, dominated by *Platanus occidentalis* and *Liquidambar styraciflua*, occurs on small to medium-sized streams and on larger streams on active first bottoms and possibly on levees where flooding may be frequent but is of short duration. The community occurs in the Piedmont of Virginia, North Carolina, South Carolina and Georgia, and in the Interior Low Plateau, the Cumberlands, Ridge and Valley, and adjacent provinces of Tennessee and Kentucky. Other trees present can include *Acer rubrum, Liriodendron tulipifera, Quercus phellos, Celtis occidentalis, Juglans nigra, Fraxinus* spp., and *Ulmus* spp. Other woody species common to this community include *Carpinus caroliniana, Aesculus sylvatica, Cornus florida, Alnus serrulata, Fraxinus americana, Acer rubrum, Asimina triloba, Toxicodendron radicans, Parthenocissus quinquefolia, Ulmus americana, Fagus grandifolia*, and *Euonymus americanus*. In addition, *Arundinaria gigantea* may be present or even abundant. Herbaceous species that may be found include *Arisaema triphyllum, Sanicula canadensis, Saururus cernuus, Campanula divaricata, Laportea canadensis, Salvia lyrata, Chasmanthium latifolium, Dichanthelium dichotomum var. dichotomum, Viola sororia*, and *Carex crinita*. Because of repeated flooding, this community may remain on a site indefinitely. It develops from communities dominated by *Salix* spp. and *Populus* spp., and probably from others.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This sycamore - tuliptree Forest was sampled at one location in the park. The site is located just below a sandstone rockhouse and covers the streambanks near the head of a drainage. Soil is well-

drained sandy loam. The unvegetated surface is dominated by leaf litter (87% cover) with some large rocks (5%) and wood (8%). No evidence of disturbance was reported. It seems to be confined to northwestern part of the park, on small streams in sandstone-capped, non-karstic topography. This association has not been used as a mapping unit.

Global Environment: This forest occurs on small to medium-sized streams and on larger streams on active first bottoms and possibly on levees where flooding may be frequent but is of short duration. Because of repeated flooding, this community may remain on a site indefinitely. This is a Zone IV community with a likelihood of 51-100% of flooding with intermittent periodicity for 1-2 months (12.5-25% of total) of the growing season. Flooding usually occurs in late winter and spring. Common soil orders for this community include Entisols, Inceptisols and Alfisols, and soils are relatively fertile because of frequent sediment deposition. It develops from communities dominated by *Salix* spp., *Populus* spp., and probably others.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The dense (80% cover) tree canopy, 20-35 m tall, is dominated by *Liriodendron tulipifera* and includes *Platanus occidentalis, Acer saccharum, Carya glabra*, and *Fraxinus americana*. The very sparse (10%) subcanopy (15-20 m) is dominated by *Betula alleghaniensis* and includes *Acer rubrum, Acer saccharum, Fagus grandifolia, Sassafras albidum*, and *Tsuga canadensis*. The sparse (20%) tall-shrub layer (2-5 m) is dominated by *Asimina triloba* and *Magnolia tripetala* and includes subcanopy species, as well as *Lindera benzoin*. The very sparse (10%) short-shrub layer (0.5-1 m) has the same makeup as the tall-shrub layer. The moderately dense (70%) herbaceous layer is dominated by *Cardamine concatenata* and *Erythronium americanum* and includes *Arisaema triphyllum, Claytonia virginica, Maianthemum racemosum ssp. racemosum, Polygonatum biflorum, Polystichum acrostichoides*, and *Thalictrum thalictroides*. This association has not been used as a mapping unit.

Global Vegetation: This forest is dominated by *Platanus occidentalis, Liquidambar styraciflua*, and sometimes *Acer rubrum*. Other canopy trees can include *Liriodendron tulipifera, Quercus phellos, Celtis occidentalis, Juglans nigra, Fraxinus americana, Fraxinus pennsylvanica, Ulmus americana, Fagus grandifolia*, and *Ulmus rubra*. The subcanopy or tall-shrub layer may be dominated by *Asimina triloba* in some examples. Other woody species common to this community include *Carpinus caroliniana, Aesculus sylvatica, Cornus florida, Alnus serrulata, Cercis canadensis, Lindera benzoin, Symphoricarpos orbiculatus, Smilax rotundifolia, Acer rubrum, Toxicodendron radicans, Parthenocissus quinquefolia*, and *Euonymus americanus*. In addition, *Arundinaria gigantea* may be present or even abundant. Herbaceous species that may be found include *Arisaema triphyllum, Sanicula canadensis, Onoclea sensibilis, Saururus cernuus, Campanula divaricata, Laportea canadensis, Salvia lyrata, Chasmanthium latifolium, Chasmanthium laxum, Dichanthelium dichotomum var. dichotomum, Dichanthelium scoparium, Viola sororia*, and *Carex crinita* In the southern Piedmont of Virginia, stands dominated by the nominal trees are more common on larger streams. On smaller streams, stands may be highly mixed, with most of the above-cited trees plus *Carya cordiformis, Quercus michauxii, Quercus shumardii*, and *Ulmus alata*. *Carpinus caroliniana* dominates the understory, with *Asimina triloba, Ilex decidua*, and *Lindera benzoin* also highly constant. The most constant herbs in plot samples are *Lysimachia ciliata, Carex blanda, Carex amphibola, Viola sororia, Chasmanthium latifolium*, and *Poa autumnalis*.

Global Dynamics: This is a Zone IV community with a likelihood of 51-100% of flooding with intermittent periodicity for 1-2 months (12.5-25% of total) of the growing season. Flooding usually occurs in late winter and spring. This vegetation may follow timber removal on active first bottoms and where flooding may be frequent and of long duration. It is apparently a stable community once established. It also develops from communities dominated by *Salix* spp., *Populus* spp., and probably others.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer saccharum	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	.	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	X	.
Betula alleghaniensis	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Magnolia tripetala	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Asimina triloba	Tall shrub/sapling	Broad-leaved deciduous shrub	X	X	.
Cardamine concatenata	Herb (field)	Forb	X	.	.
Erythronium americanum	Herb (field)	Forb	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Betula nigra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liquidambar styraciflua	Tree canopy	Broad-leaved deciduous tree	X	.	.
Liriodendron tulipifera	Tree canopy	Broad-leaved deciduous tree	X	.	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	.	.

Acer negundo	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Carpinus caroliniana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Asimina triloba	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Lindera benzoin	Tall shrub/sapling	Broad-leaved deciduous tree	X	.	.
Laportea canadensis	Herb (field)	Forb	X	.	.
Salvia lyrata	Herb (field)	Forb	X	.	.
Arundinaria gigantea	Herb (field)	Graminoid	X	.	.
Chasmanthium latifolium	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (19-May-2005). This is not an inherently rare forest type. It may establish or re-establish itself following canopy removal.

RELATED CONCEPTS

Global Similar Associations:

- *Liriodendron tulipifera - Acer (rubrum, negundo) - (Platanus occidentalis) / Carpinus caroliniana / Polygonum virginianum* Forest (CEGL006492)
- *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera) / Asimina triloba* Forest (CEGL006603)
- *Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa* Forest (CEGL007730)--somewhat overlapping in range, in different alliance (A.288).
- *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458)

Global Related Concepts:

- Eutrophic Seasonally Flooded Forest (Rawinski 1992) **B**
- IIA6f. "Interior" Small Stream Swamp Forest (Allard 1990) **?**
- IIA7g. Sycamore - Sweetgum - American Elm Riverfront Forest (Allard 1990) [in part] **B**
- Red Maple - Black Gum - Sweetgum, HR (Pyne 1994) **B**
- Sycamore - Pecan - American Elm (25) (USFS 1988) **?**
- Sycamore - Sweetgum - American Elm: 94 (Eyre 1980) **B**
- Sycamore-sweetgum-tuliptree floodplain forest (CAP pers. comm. 1998) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: There are some small streams in the park that apparently represent examples of this association (CEGL007340), but it has not been used as a mapping unit..

Mammoth Cave National Park Other Comments:

Global Classification Comments: The former *Platanus occidentalis - (Liquidambar styraciflua, Acer rubrum) / (Carpinus caroliniana) / Onoclea sensibilis* Forest (CEGL007701) was combined with this type (CEGL007340), broadening its range in the Cumberlands and Interior Low Plateau. *Aesculus sylvatica* does not occur in Kentucky. Related vegetation in the Interior Low Plateau may belong in the *~Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum)* Temporarily Flooded Forest Alliance (A.288). This association (and its alliance A.289) was originally conceived as having a more montane or upper piedmontane affinity, in contrast to associations in A.288. This type may be more likely in the upper/inner Piedmont (in contrast to *~Platanus occidentalis - Celtis laevigata - Fraxinus pennsylvanica / Lindera benzoin - Ilex decidua / Carex retroflexa* Forest (CEGL007730), of A.288, which is more likely in the portions of the Piedmont closer to the Coastal Plain, e.g., the Oconee National Forest).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association appears to be restricted to the northwestern part of the park, on small streams in sandstone-capped, non-karstic topography. It has been documented from a stream which flows out of a hemlock-hardwood ravine classified as *~Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest (CEGL005043).

Global Range: The community occurs in the Piedmont of Virginia, North Carolina, South Carolina and Georgia. It also occurs along small to medium-sized streams in the Interior Low Plateau, Cumberlands, the Ridge and Valley, and adjacent provinces of Tennessee and Kentucky.

Nations: US

States/Provinces: AL?, GA, KY, MS?, NC, SC, TN, VA

TNC Ecoregions: 44:C, 50:C, 52:C, 59:C

TNC Ecoregion Comments: ECO44 added (CWN 5-05). ECO58 removed (SLN 8-01); not considered by Chesapeake Bay Ecology Group (October 2000). ECO50 confirmed CSRV ecology team, changed from ? to C (SL 5-00). ECO58 added (LAS 10-99).
USFS Ecoregions: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222C:CP, 222Dj:CCC, 222Eb:CCC, 222Ec:CCC, 222Ed:CC?, 222Eg:CC?, 222En:CCC, 222Eo:CCC, 231Ag:CCC, M221Cd:CCC, M221Dc:C??, M221Dd:C??
Federal Lands: DOD (Arnold); NPS (Big South Fork, Cumberland Gap, Mammoth Cave); USFS (Daniel Boone, Sumter, Sumter (Piedmont))

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary: This association has not been used as a mapping unit.
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.69.[reassign?]
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): S. Landaal, mod. C.W. Nordman and G.P. Fleming
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
Burns and Honkala 1990b	.	.	.	X	.	.	.	.	.
CAP pers. comm. 1998	.	.	X	X	.	.	.	.	.
Clark and Benforado 1981	.	.	.	X	.	.	.	.	.
Dickson and Segelquist 1978	.	.	.	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Eyre 1980 .	.	X	X	.	.	.	.	.	
Faulkner and Patrick n.d.	.	.	.	X	.	.	.	.	.
Fleming et al. 2001	.	.	.	X	.	.	.	.	.
Flinchum 1977	.	.	.	X	.	.	.	.	.
Klimas et al. 1981	.	.	.	X	.	.	.	.	.
McWilliams and Rosson 1990	.	.	.	X	.	.	.	.	.
Nelson 1986	.	X	.	X	.	.	.	.	.
Newell and Peet 1995	.	.	.	X	.	.	.	.	.
Putnam 1951	.	.	.	X	.	.	.	.	.
Putnam et al. 1960	.	.	.	X	.	.	.	.	.
Pyne 1994 .	.	X	X	.	.	.	.	.	
Rawinski 1992	.	.	X	X	.	.	.	.	.
Schafale and Weakley 1990	.	X	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	.	.	X	.	.	.	.	.	
USFS 1988 .	.	X	X	.	.	.	.	.	
Wharton 1978	.	.	.	X	.	.	.	.	.
Wharton et al. 1982	.	.	.	X	.	.	.	.	.

I.B.2.N.e. Seasonally flooded cold-deciduous forest

A.329 Quercus palustris - (Quercus bicolor) *Seasonally Flooded Forest Alliance*

Pin Oak - (Swamp White Oak) Seasonally Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in the central midwestern and northeastern United States, contains "flatwood" and poorly drained floodplain communities, as well as ponds. Many stands are seasonally wet (mostly during winter and early spring) with a shallow, perched water table that tend to be dry in late summer and early fall, a condition often leading to vegetation called "flatwoods." Although flatwoods are best developed on soils with massive, brittle fragipans, they are also well-represented on relatively impermeable clay soils that are found on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. Fragipans (or hardpans) are usually developed from glacial till of Illinoisan age in the Midwest. During the rainy season, water slowly permeates these soils and ponds in depressions. The soil dries rapidly in the summer or during drought, and herbaceous vegetation wilts in response to this stress. The penetration of tree roots in the subsoil and burrowing by animals are limited by the hardpan, and tree species may appear somewhat stunted. Some stands are found on seasonally saturated sites that receive groundwater seepage. This water, combined with

rainwater, keeps the soils saturated during wet periods and moist during dry periods. The soils have a pH below 5.5. The parent material is sand, gravelly or sandy alluvium, muck, or peat. Stands are characterized by a closed to partially open canopy dominated by *Quercus bicolor* and/or *Quercus palustris*. Other tree species associates include *Liquidambar styraciflua, Quercus alba, Quercus coccinea, Acer rubrum, Carya ovata, Nyssa sylvatica*, and others. Throughout much of its range, this alliance is dominated by *Quercus palustris*. *Quercus bicolor* can occur in pure stands, or in association with *Quercus palustris, Quercus coccinea, Quercus alba*, and *Acer rubrum*. *Quercus macrocarpa* occurs more commonly in the Great Lakes lakeplain and *Quercus pagoda* in the Interior Plateau. Shrub and herb layers are generally sparse, containing such species as *Gaylussacia baccata, Vaccinium corymbosum, Carex stipata, Scirpus cyperinus, Thelypteris palustris, Glyceria striata*, and *Isoetes* spp. Stands found in seepage areas have a more hydrophytic flora, including species such as *Alnus serrulata, Cephalanthus occidentalis, Carex crinita, Onoclea sensibilis*, and *Osmunda regalis*.
Environment: Many stands are seasonally wet (mostly during winter and early spring) with a shallow, perched water table, but tend to be dry in late summer and early fall, a condition often leading to vegetation called "flatwoods." Although flatwoods are best developed on soils with massive, brittle fragipans, they are also well-represented on relatively impermeable clay soils that are found on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. Fragipans (or hardpans) are usually developed from glacial till of Illinoisan age in the Midwest (White and Madany 1978). During the rainy season, water slowly permeates these soils and ponds in depressions. The soil dries rapidly in the summer or during drought, and herbaceous vegetation wilts in response to this stress. The penetration of tree roots in the subsoil and burrowing by animals is limited by the hardpan (Nelson 1985, White and Madany 1978), and tree species may appear somewhat stunted. Some stands are found on seasonally saturated sites that receive groundwater seepage. This water, combined with rainwater, keeps the soils saturated during wet periods and moist during dry periods. The soils have a pH below 5.5. The parent material is sand, gravelly or sandy alluvium, muck, or peat (Nelson 1985).
Vegetation: This alliance, found in the central midwestern and northeastern states, contains 'flatwood' and poorly drained floodplain communities characterized by a closed to partially open canopy dominated by *Quercus bicolor* and/or *Quercus palustris*. Other tree species associates include *Liquidambar styraciflua, Quercus alba, Quercus coccinea, Acer rubrum, Carya ovata, Nyssa sylvatica*, and others. Throughout much of its range, this alliance is dominated by *Quercus palustris*. *Quercus bicolor* can occur in pure stands, or in association with *Quercus palustris, Quercus coccinea, Quercus alba*, and *Acer rubrum*. *Quercus macrocarpa* occurs more commonly in the Great Lakes lakeplain and *Quercus pagoda* in the Interior Plateau. Shrub and herb layers are generally sparse, containing such species as *Gaylussacia baccata, Vaccinium corymbosum, Carex stipata, Scirpus cyperinus, Thelypteris palustris, Glyceria striata*, and *Isoetes* spp. Stands found in seepage areas have a more hydrophytic flora, including species such as *Alnus serrulata, Cephalanthus occidentalis, Carex crinita, Onoclea sensibilis*, and *Osmunda regalis*.
Dynamics:
Similar Alliances:
- *Quercus alba - (Nyssa sylvatica)* Seasonally Flooded Forest Alliance (A.1996)
- *Quercus phellos* Seasonally Flooded Forest Alliance (A.330)
- *Quercus stellata* Flatwoods Forest Alliance (A.261)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in the eastern U.S. from New Hampshire to Virginia and west to Illinois and Oklahoma, and in Canada in Ontario.
Nations: CA, US
Subnations: AR, CT, DC, DE, IA, IL, IN, KY, MA, MD, MI, MO, NH, NJ, NY, OH, OK, ON, PA, TN?, VA, WV
TNC Ecoregions: 32:C, 36:C, 37:C, 38:C, 39:C, 42:C, 43:C, 44:C, 45:C, 46:C, 48:C, 49:C, 50:C, 52:C, 58:C, 59:C, 60:C, 61:C, 62:C, 64:P
USFS Ecoregions: 212Fa:CCP, 212Fb:CCC, 212Fc:CCP, 212Ga:CCP, 212Gb:CCP, 221Ae:CCC, 221Af:CCC, 221Ai:CCC, 221Ak:CCC, 221Am:CCC, 221Ba:CPP, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCP, 221Eb:CCC, 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221Fb:CCC, 221He:CCC, 222Aa:CCC, 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Aj:CCC, 222Al:CCC, 222An:CCC, 222Ao:CCP, 222Ch:CCC, 222Da:CC?, 222Db:CCC, 222Dc:CCC, 222De:CCP, 222Dg:CCC, 222Di:CCC, 222Ej:CCC, 222Ek:CCP, 222Em:CCC, 222Fa:CCC, 222Fb:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Id:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Ki:CCC, 222Kj:CCC, 231Ad:CCC, 231Ae:CCC, 231Ak:CCC, 231Al:CCC, 231Ap:CCC, 231B:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCC, 232Ac:CCC, 232Ad:CCC, 232Bb:C??, 234Ac:CCC, 234Am:CCC, 234An:CCC, 251Cc:CCC, 251Cf:CCC, 251Dg:CCC, 251Dh:CC?, 255Aa:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCP, M221Bc:CCC, M221Bd:CCP, M221Be:CCC, M221Ca:CC?, M221Cb:CCP, M221Da:CCC, M222Ab:CCC

Federal Lands: COE (Arkansas River); DOD (Fort Belvoir, Fort Chaffee, Lexington-Bluegrass?); NPS (C&O Canal, Gateway, George Washington Parkway, Indiana Dunes, Mammoth Cave, Manassas, National Capital-East, Prince William); USFS (Daniel Boone, Finger Lakes, Hoosier, Mark Twain, Monongahela, Ozark, Shawnee, Wayne); USFWS (Great Swamp, Holla Bend, Reelfoot?)

ALLIANCE SOURCES

Author(s): D.J. Allard/D. Faber-Langendoen

References: Braun 1936, Bryant 1978, Eyre 1980, Faber-Langendoen et al. 1996, Fike 1999, Fleming 2002b, Fleming and Patterson 2004, Fleming and Weber 2003, Foti et al. 1994, Hoagland 1998a, Jones 1989a, Madany 1981, Meijer et al. 1981, Midwestern Ecology Working Group n.d., Nelson 1985, Orzell et al. 1985, Reschke 1990, Smith 1991, White and Madany 1978

[CEGL002432] *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest

Translated Name: **Pin Oak - Swamp White Oak - (Sweetgum) Mixed Hardwood Forest**

Common Name: **Pin Oak Mixed Hardwood Depression Forest**

Ecological System(s):

- North-Central Interior Wet Flatwoods (CES202.700)
- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)

Status: Standard

Circumscription Confidence: 3 - Weak

Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This pin oak - swamp white oak forest community type is found in the central United States. Stands occur on wet, poorly drained depressions and contain a closed to partially open canopy dominated by *Quercus palustris* and *Acer rubrum*. Oaks should comprise at least 25% of the dominance in a stand. Other typical canopy associates may dominate, including *Liquidambar styraciflua, Nyssa sylvatica*, and *Quercus bicolor*. Other wetland hardwood species can occur, including *Acer saccharinum, Betula nigra, Quercus macrocarpa*, and *Quercus rubra*. Shrub and vine species are variable and may include *Cornus* spp., *Lindera benzoin, Parthenocissus quinquefolia*, and *Sambucus canadensis*. Herbaceous species also vary widely. Herbaceous species noted from a site in the Western Allegheny Plateau include *Cinna arundinacea* (dominant), with other associates including *Carex blanda, Carex laxiculmis, Carex rosea, Elymus riparius, Elymus virginicus, Cardamine bulbosa, Cardamine pensylvanica, Claytonia virginica, Oxalis violacea*, and *Podophyllum peltatum*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This pin oak forest was sampled at three locations in the park. The sites include a series of ephemeral ponds (and some permanent) throughout flat ridgetop areas with a sandstone cap. The presence of green frogs suggests that some ponds have water all summer and possibly all year. Elevations are 244 and 267 m (800-875 feet), and soils are very poorly drained muck. The unvegetated surface is made up of leaf litter (18-65% cover), wood (2-5%), standing water (0-30%), and bare soil (0-80%). Evidence of disturbance includes past logging and the presence of exotic plants. Badger et al. (1997) list this as "CT IX" and state that it consists of "upland wet woods" and is mostly found "on ridges south of the Green River." Olson et al. (2000) mention "upland swamps with stands of pin oak, sweetgum, and red maple" but comment that these are "too small to be mapped."

Global Environment: This community is found on flat, poorly drained areas (or in wet, poorly drained depressions). Many stands are seasonally wet, with a seasonally saturated hydrology. Soils are often fine-grained (silts and clays) of lacustrine origin. It is primarily, but not exclusively, found in unglaciated terrain. Habitat in Kentucky includes terraces which are not frequently flooded, or in upland swales in the Karst Plain.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately dense (60-70% cover) tree canopy, 15-35 m tall, is dominated by *Quercus palustris* and may include substantial amounts of *Acer rubrum* and *Nyssa sylvatica* (which may be present rather than, or in addition to, *Liquidambar styraciflua)*.The sparse (20-30%) subcanopy (5-10 m) is dominated by canopy species along with lesser amounts of *Carya ovata* and *Fraxinus americana*. The very sparse (10-20%) tall-shrub layer (1-5 m) is dominated by *Cephalanthus occidentalis* and *Liriodendron tulipifera*, as is the very sparse (10-20%) short-shrub layer (0.5-1 m). The sparse (10-30%) herbaceous layer includes *Boehmeria cylindrica, Leersia virginica, Ludwigia palustris, Lycopus virginicus, Polygonum hydropiperoides*, and the floating aquatic *Lemna minor*. *Sphagnum* spp. have 10% cover in one stand. Vines include *Campsis radicans*.

Global Vegetation: Stands contain a closed to partially open canopy dominated by *Quercus palustris* and *Acer rubrum*. Oaks should comprise at least 25% of the dominance in a stand. Other typical canopy associates may dominate, including

Liquidambar styraciflua, Nyssa sylvatica, and *Quercus bicolor*. Other wetland hardwood species can occur, including *Acer saccharinum, Betula nigra, Quercus macrocarpa*, and *Quercus rubra*. Shrub and vine species are variable and may include *Cornus* spp., *Lindera benzoin, Parthenocissus quinquefolia*, and *Sambucus canadensis*. Herbaceous species also vary widely [see Anderson (1996) maple-ash-oak type for a list of species]. Some herbs reported from this or related vegetation in the bluegrass basin of Kentucky by Bryant (1978) include *Lycopus virginicus, Alisma subcordatum, Ludwigia alternifolia, Penthorum sedoides, Polygala sanguinea, Polygala verticillata, Polygonum sagittatum, Conoclinium coelestinum (= Eupatorium coelestinum), Eupatorium perfoliatum, Mimulus ringens, Liparis liliifolia, Platanthera peramoena, Saururus cernuus, Ophioglossum engelmannii, Carex squarrosa, Scirpus atrovirens, Juncus effusus, Eleocharis* spp., and *Luzula* sp. This more acidic swamp vegetation would be unusual in the Central Bluegrass, but occurs more frequently in the Knobs Transition Region (Meijer et al. 1981).

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus palustris	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Nyssa sylvatica	Tree canopy	Broad-leaved deciduous tree	X	.	.
Cephalanthus occidentalis	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Liriodendron tulipifera	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Campsis radicans	Herb (field)	Vine/Liana	X	.	.
Boehmeria cylindrica	Herb (field)	Forb	X	.	.
Ludwigia palustris	Herb (field)	Forb	X	.	.
Polygonum hydropiperoides	Herb (field)	Forb	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (25-Feb-2000). Many stands have been drained and converted to agriculture (M. Leahy pers. comm. 1999).

RELATED CONCEPTS

Global Similar Associations:

- *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173)
- *Quercus bicolor - Fraxinus pennsylvanica / Carex* spp. Forest (CEGL004422)--a related higher pH type.
- *Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241)
- *Quercus macrocarpa - Quercus bicolor - (Celtis occidentalis)* Woodland (CEGL002140)
- *Quercus palustris - (Fraxinus nigra) / Lindera benzoin / Carex bromoides* Forest (CEGL007399)
- *Quercus palustris - (Quercus bicolor) / Carex crinita / Sphagnum* spp. Forest (CEGL002406)
- *Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes* spp. Forest (CEGL002101)--overlaps geographically.
- *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005037)--overlaps geographically.
- *Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum* Sand Flatwoods Forest (CEGL002100)--overlaps geographically.
- *Quercus palustris* Pond Forest (CEGL007809)
- *Quercus phellos - (Quercus lyrata) / Carex* spp. - *Leersia* spp. Forest (CEGL002102)

Global Related Concepts:

- CT IX *Quercus palustrus* (sic), *Acer rubrum, Nyssa sylvatica, Liquidambar styraciflua* (Badger et al. 1997) =
- Maple-Ash-Oak Swamps (Anderson 1996) [Anderson (1996) appears to lump maple-ash and maple-ash-oak together. Here, they are separated, as done in Anderson (1982) with maple-ash having less than 25% oaks.] **B**
- Pin Oak - Red Maple - Elm - Sweet Gum Associes (Braun 1936) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: There are rare forested upland depression ponds on Mammoth Cave National Park which should be attributable to this association (CEGL002432). The forested wetland vegetation at these sites may only be represented by a narrow band around the depression pond, the center of which is

lacking in trees and is of a longer hydroperiod than the forested margin. In some examples, *Nyssa sylvatica* may be present rather than, or in addition to, *Liquidambar styraciflua*. Badger et al. (1997) list this as "CT IX" and state that it is mostly found "on ridges south of the Green River." Olson et al. (2000) mention "upland swamps with stands of pin oak, sweetgum, and red maple" but comment that these are "too small to be mapped."

Mammoth Cave National Park Other Comments:

Global Classification Comments: Type is similar to *~Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum* Sand Flatwoods Forest (CEGL002100); it should also be compared with *~Quercus bicolor / Vaccinium corymbosum / Carex stipata* Forest (CEGL006241). Related Arkansas vegetation is found in *~Quercus palustris* Pond Forest (CEGL007809). This type is broadly defined to include stands with *Quercus palustris, Quercus bicolor*, and *Acer rubrum* as dominants, and *Liquidambar styraciflua* as a diagnostic species. Perhaps *Quercus palustris* and *Quercus bicolor* should together represent between 25-50% of the dominance (cover, basal area). However, there are stands in central Illinois and Missouri beyond the range of *Liquidambar styraciflua* that have been placed, at least temporarily, in this type. Stands in the Western Allegheny Plateau ecoregion may differ from stands further west. Stands in central Indiana and northwest Ohio (lakeplain) with *Fagus grandifolia* and *Quercus palustris* are placed in *~Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173) or without beech, with *Quercus bicolor*, and till or clayey lacustrine deposits into *~Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005037). This community is found in extreme southwest Ohio on the Illinoisan till plain. In Indiana, which also contains the Illinoisan till plain, the type occurs more widely. Bryant (1978) reports forests on "flat, poorly drained land" in an abandoned Pliocene channel of the Kentucky River in the Inner Bluegrass Subsection (222Fa). This vegetation seems to pertain to this type, and is reported to be dominated by *Quercus palustris* and *Acer rubrum*, with *Fagus grandifolia, Liquidambar styraciflua, Quercus alba, Quercus bicolor, Quercus velutina, Nyssa sylvatica*, and *Fraxinus americana*. According to J. Campbell (pers. comm. 2000), Bryant's (1978) type, which occurs in the Bluegrass region, belongs here. It is rarer in the Bluegrass Basin than eastward in the adjacent Knobs Transition Region.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This type is uncommon and of very limited extent at Mammoth Cave National Park. Badger et al. (1997) state that it is mostly found "on ridges south of the Green River."

Global Range: This pin oak - swamp white oak forest is found in the central United States, ranging from Iowa, Missouri, Kentucky, and Tennessee east in a band to southwestern Ohio and possibly to Pennsylvania and West Virginia. It is also reported from Delaware.

Nations: US

States/Provinces: DE:S4?, IA, IL, IN, KY, MO, OH, PA?, TN?, WV?

TNC Ecoregions: 36:C, 38:?, 42:C, 43:?, 44:C, 48:C, 49:C, 50:C

TNC Ecoregion Comments: ECO50 added (MP/DFL 2-01).

USFS Ecoregions: 221Eb:CCC, 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 221Eg:CCC, 221F:CC, 221He:CCC, 222Ab:C??, 222Ag:C??, 222Ch:CPP, 222Db:CCC, 222De:CCP, 222Dg:CCC, 222Di:CCP, 222Ej:CCC, 222Ek:CCP, 222Em:CCC, 222Fa:CCC, 222Fe:CCC, 222Ff:CCC, 222Ga:CCC, 222Gc:CCC, 222Ge:CCC, 222H:CC, 234An:CCC, 251Cc:CCC, 251Cf:CCC, M222Ab:C??

Federal Lands: NPS (Mammoth Cave); USFS (Daniel Boone, Wayne)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.46, MACA.89, MACA.745.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): D. Faber-Langendoen, mod. L.A. Sneddon

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Anderson 1982	.	.	.	X	.	.	.	.	.
Anderson 1996	.	.	X	X	.	.	.	.	.
Badger et al. 1997	.	.	X	.	.	.	.	.	.
Braun 1936 .	.	X	X	.	.	.	.	.	
Bryant 1978	.	.	.	X	.	.	.	.	.
Evans 1991 .	.	.	X	.	.	.	.	.	
Fike 1999 .	X	.	X	.	.	.	.	.	
INAI unpubl. data	.	.	.	.	.	.	.	.	.
Leahy pers. comm.	.	.	.	.	X	.	.	.	.
Meijer et al. 1981	.	.	.	X	.	.	.	.	.

Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.334 Salix nigra *Seasonally Flooded Forest Alliance*

Black Willow Seasonally Flooded Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance contains *Salix nigra* communities with seasonally flooded hydrology, i.e., the water table is below the soil surface by the end of the growing season in most years. They can occur in the swamps away from the river, behind the levees in the Mississippi River floodplain with *Carya aquatica* (K. Ribbeck pers. comm.), as well as on newly accreted areas on large river floodplains and along lakeshores, irrigation reservoirs, and borrow areas. These forests also may develop following clearcut logging in swamp forests. Species composition varies with geography and topographic setting. Other canopy species that may be present include *Quercus lyrata, Taxodium distichum, Nyssa aquatica, Nyssa biflora, Morella cerifera (= Myrica cerifera), Gleditsia triacanthos, Fraxinus pennsylvanica, Acer rubrum*, and *Celtis laevigata*. *Cephalanthus occidentalis* is a common shrub in these forests. The vine component is often well-developed. These communities are often short-lived and succeed to bottomland hardwood forests. However, reportedly in Mississippi, long-persisting forests of this type have huge trees on loamy soils of low terraces with little understory (R. Wieland pers. comm.). In the Columbia Bottomlands area of coastal Texas, vegetation classified in this alliance occupies large shallow ponds in ancient river floodplains. The successional status of this vegetation is undetermined, but it is apparently long persisting.

Environment: This alliance contains *Salix nigra* communities with seasonally flooded hydrology, i.e., the water table is below the soil surface by the end of the growing season in most years. They can occur in the swamps away from the river, behind the levees in the Mississippi River floodplain with *Carya aquatica* (K. Ribbeck pers. comm.), as well as on newly accreted areas on large river floodplains and along lakeshores, irrigation reservoirs, and borrow areas. These forests also may develop following clearcut logging in swamp forests. In the Columbia Bottomlands area of coastal Texas, vegetation classified in this alliance occupies large shallow ponds in ancient river floodplains.

Vegetation: Species composition varies with geography and topographic setting. Other species that may be present include *Quercus lyrata, Taxodium distichum, Nyssa aquatica, Nyssa biflora, Morella cerifera (= Myrica cerifera), Gleditsia triacanthos, Fraxinus pennsylvanica, Acer rubrum*, and *Celtis laevigata*. *Cephalanthus occidentalis* is a common shrub in these forests. The vine component often is well-developed.

Dynamics: These communities are often short-lived and succeed to bottomland hardwood forests. However, reportedly in Mississippi, long-persisting forests of this type have huge trees on loamy soils of low terraces with little understory (R. Wieland pers. comm.). The successional status of this vegetation in the Columbia Bottomlands area of coastal Texas is undetermined but it is apparently long persisting.

Similar Alliances:

- *Salix nigra* Temporarily Flooded Forest Alliance (A.297)
- *Salix nigra* Temporarily Flooded Shrubland Alliance (A.948)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found throughout the southeastern United States from Virginia to Florida and west to Texas.

Nations: US

Subnations: AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA

TNC Ecoregions: 29:C, 31:C, 32:P, 33:C, 37:P, 38:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 50:C, 52:C, 53:C, 56:C, 57:C, 58:C

USFS Ecoregions: 221Db:CCP, 221Eb:CCP, 221Ha:CCP, 221Hc:CCP, 221Hd:CCP, 221He:CCP, 221Ja:CCP, 221Jb:CCC, 221Jc:CCP, 222Ab:CCP, 222Ag:CCP, 222Ah:CCP, 222Al:CCP, 222Am:CCP, 222An:CCP, 222Ca:CCP, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCP, 222Dd:CCP, 222De:CCP, 222Dg:CCC, 222Di:CCP, 222Dj:CCP, 222Ea:CCP, 222Eb:CCC, 222Ec:CCP, 222Ed:CCP, 222Ee:CCP, 222Ef:CCP, 222Eg:CCP, 222Eh:CCP, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222En:CCC, 222Eo:CCC, 222Fa:CCP, 222Fb:CCP, 222Fc:CCP, 222Fd:CCP, 222Ff:CCP, 231Aa:CCP, 231Ab:CCP, 231Ac:CCP, 231Ad:CCP, 231Ae:CCP, 231Af:CCP, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCP, 231Am:CCP, 231An:CCP, 231Ao:CCP, 231Ap:CCP, 231Ba:CCP, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCP, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCP, 231Eb:CCP, 231Ec:CCP, 231Ed:CCP, 231Ee:CCP, 231Ef:CCP, 231Eg:CCP, 231Eh:CCP, 231Ei:CCP, 231Ej:CCP, 231Ek:CCP, 231El:CCP, 231Em:CCP, 231En:CCP, 231Fa:CCP, 231Fb:CCP, 231Ga:CCP, 231Gb:CCP, 231Gc:CCP, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bd:CCC, 232Bg:CCP, 232Bh:CCP, 232Bi:CCP,

232Bj:CCC, 232Bk:CCP, 232Bl:CCP, 232Bm:CCP, 232Bn:CCP, 232Bo:CCP, 232Bp:CCP, 232Bq:CCC, 232Br:CCP, 232Bs:CCC, 232Bt:CCP, 232Bu:CCP, 232Bv:CCP, 232Bx:CCP, 232Bz:CCC, 232Ca:CCP, 232Cb:CCP, 232Cc:CCP, 232Cd:CCP, 232Cf:CCP, 232Cg:CCP, 232Ch:CCP, 232Ci:CCP, 232Cj:CCP, 232Dc:CCP, 232Eb:CCC, 232Ee:CCP, 232Fa:CCP, 232Fb:CCP, 232Fc:CCP, 232Fd:CCP, 232Fe:CCP, 234Aa:CCC, 234Ab:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CCC, 234Af:CCC, 234Ag:CCC, 234Ah:CCC, 234Ai:CCC, 234Aj:CCC, 234Ak:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251Ea:CCP, 251Ec:CCP, 251Ed:CCP, 251Fb:CCP, 251Fc:CCP, 255Aa:CCP, 255Ab:CCP, 255Ac:CCP, 255Ad:CCP, 255Ae:CCP, 255Af:CCP, 255Ag:CCP, 255Ah:CCP, 255Ai:CCC, 255Aj:CCP, 255Ak:CCP, 255Ba:CCP, 255Ca:CCP, 255Cc:CCP, 255Cd:CCP, 255Ce:CCP, 255Db:CCC, 311A:CC, 332E:CC, M221Aa:CCP, M221Ab:CCP, M221Ba:CCP, M221Bd:CCP, M221Be:CCP, M221Ca:CCP, M221Cb:CCP, M221Cc:CCP, M221Cd:CCP, M221Ce:CCP, M221Da:CCP, M221Db:CCP, M221Dc:CCP, M221Dd:CCP, M222Aa:CCP, M222Ab:CCP, M231Aa:CCP, M231Ab:CCP, M231Ac:CCP, M231Ad:CCP

Federal Lands: DOD (Arnold, Fort Hood); NPS (Back Bay?, Mammoth Cave); USFS (Angelina?, Apalachicola, Bienville, Conecuh?, Daniel Boone, Davy Crockett?, De Soto, Delta, Francis Marion, Holly Springs, Kisatchie, Ocala, Sabine?, Sam Houston?, St. Francis, Tombigbee?, Tuskegee); USFWS (Aransas, Chincoteague, San Bernard)

ALLIANCE SOURCES

Author(s): A.S. Weakley

References: Allard 1990, Allen 1958, Evans 1991, Eyre 1980, Klimas 1988b, Ribbeck pers. comm., Southeastern Ecology Working Group n.d., TNC 1998a, Wieland pers. comm.

[CEGL007703] *Salix nigra - Acer (rubrum, saccharinum) / Alnus serrulata - Cephalanthus occidentalis* Forest

Translated Name: **Black Willow - (Red Maple, Silver Maple) / Hazel Alder - Common Buttonbush Forest**

Common Name: **Interior Low Plateau Willow Pond Forest**

Ecological System(s):

- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)

Status: Standard

Circumscription Confidence: 3 - Weak

Concept Author(s): M. Pyne, C.S. Major and M.J. Russo

ELEMENT CONCEPT

Global Summary: This wetland willow forest association may occur on the margins of natural depression ponds, but it also includes vegetation on the margins of impoundment reservoirs. The canopy near the shoreline is dominated by *Salix nigra*. Other *Salix* species (including *Salix caroliniana*) may be present in some examples. *Acer rubrum* and *Acer saccharinum* are also important species. *Cephalanthus occidentalis* and *Acer rubrum* usually dominate the shrub layer. *Alnus serrulata* and *Itea virginica* are also present. *Triadenum walteri* grows on hummocks at the bases of trees and shrubs. *Juncus effusus* is often found in the herbaceous layer.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This black willow wetland forest was sampled at one location in the park. The site is on the rim of a large depressional pond near "Wondering Woods." The vegetation and presence of fish indicate that it is permanently wet. The elevation is 212 m(695 feet). The unvegetated surface is dominated by standing water (70% cover) with some leaf litter (20%) large rocks (2%), wood (2%), and bare soil (2%). Evidence of disturbance includes the presence of exotic plants. This association has not been used as a mapping unit.

Global Environment: This wetland willow forest association may occur on the margins of natural depression ponds, but it also includes vegetation on the margins of impoundment reservoirs.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: *Salix nigra* dominates the tall- and short-shrub layers, which may also include tall *Platanus occidentalis* and short *Rubus* sp., *Toxicodendron radicans*, and exotic *Rosa multiflora*. Herbs include *Asplenium platyneuron, Carex tribuloides, Juncus* sp., *Scirpus* sp., *Symphyotrichum*, and *Vernonia* sp. No stratum or percent coverage data were collected. The vegetation sampled has more of a shrubland appearance than a forest. This association has not been used as a mapping unit.

Global Vegetation: In typical examples, the canopy is dominated by *Salix nigra*. Other *Salix* species (including *Salix caroliniana*) may be present in some examples. *Acer rubrum* and *Acer saccharinum* are also important species. *Cephalanthus occidentalis* and *Acer rubrum* usually dominate the shrub layer. *Alnus serrulata* and *Itea virginica* are also present. *Triadenum walteri* may grow on hummocks at the bases of trees and shrubs. *Juncus effusus* is often found in the herbaceous layer. The exotics *Lonicera japonica* and *Rosa multiflora* may be found in some examples.

Global Dynamics: Water levels fluctuate somewhat in examples of this association, typically being higher in the winter and spring, then drawing down in the summer and fall. Examples on the margins of impoundment reservoirs will have more stable water levels.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Salix nigra Shrub/sapling (tall & short)	Broad-leaved deciduous shrub		X	X	.
Platanus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Toxicodendron radicans	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Vernonia gigantea	Herb (field)	Forb	X	.	.
Carex tribuloides	Herb (field)	Graminoid	X	.	.
Asplenium platyneuron	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lonicera japonica	-	P	exotic
Rosa multiflora	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (30-Dec-2008). This is a natural to semi-natural, successional community dominated by native species. It may occur on the margins of natural depression ponds, but it also includes vegetation on the margins of impoundment reservoirs.

RELATED CONCEPTS

Global Similar Associations:

- *Salix nigra / (Cephalanthus occidentalis)* Forest (CEGL004773)--is a related, more southern and western type.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: This community was only sampled near "Wondering Woods" in the southeastern part of the park, in land that has been recently added and is in a more early-successional state than most of the park. The one plot attributed to this type is an incomplete "quickplot." This association has not been used as a mapping unit.

Mammoth Cave National Park Other Comments:

Global Classification Comments: At Arnold Air Force Base (Coffee and Franklin counties, Tennessee), this wetland community occurs along the border of Woods Reservoir. This community often grades into an herbaceous community dominated by *Juncus effusus*. Investigate merge with ~*Salix nigra / (Cephalanthus occidentalis)* Forest (CEGL004773), a related type found to the south and west.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found on a pond rim near "Wondering Woods."

Global Range: This type is described from the Interior Low Plateau of Tennessee and is also likely to occur in the adjacent Upper East Gulf Coastal Plain and Cumberlands/Southern Ridge and Valley. Its range includes Kentucky and Tennessee, as well as possibly Alabama, Georgia, and Mississippi.

Nations: US

States/Provinces: AL?, GA?, KY, MS?, TN

TNC Ecoregions: 43:?, 44:C, 50:C

TNC Ecoregion Comments: ECO50 changed from ? to C (MP/DFL 2-01).

USFS Ecoregions: 221H:PP, 222C:CP, 222Dg:CCC, 222Eb:CCC, 222En:CCC, 222Eo:CCC, 231B:PP, 231C:PP

Federal Lands: DOD (Arnold); NPS (Mammoth Cave); USFS (Daniel Boone)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary: This association has not been used as a mapping unit.

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.74.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne, C.S. Major and M.J. Russo

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	

I.B.2.N.g. Saturated cold-deciduous forest

A.348 Acer rubrum - Nyssa sylvatica *Saturated Forest Alliance*

Red Maple - Blackgum Saturated Forest Alliance

ALLIANCE CONCEPT

Summary: This alliance covers deciduous forested acidic seeps, saturated swamp forests, and "basin swamps" of the eastern and southeastern United States. These wetland forests occur where surface water is seldom present, but the substrate is saturated to the surface for extended periods during the growing season. They include forested acidic seeps on hillsides or streamheads, on edges of floodplains, and other poorly drained depressions. Individual occurrences of these forests tend to be small in extent and can provide habitat for rare plant species. Forests in this alliance have variable canopy composition, but *Acer rubrum* and *Nyssa sylvatica* are common components. Canopy composition differs from the surrounding upland and varies with geography. Typical canopy species across the range of this alliance include *Acer rubrum var. trilobum, Nyssa sylvatica*, and *Liquidambar styraciflua*. Understory and shrub species include *Alnus serrulata, Ilex opaca var. opaca, Photinia pyrifolia (= Aronia arbutifolia)*, and *Ilex verticillata*. Characteristic herbaceous species are *Osmunda cinnamomea* and *Osmunda regalis*. *Sphagnum* spp. are typical.

Environment: These wetland forests occur where surface water is seldom present, but the substrate is saturated to the surface for extended periods during the growing season, and include forested acidic seeps on hillsides or streamheads, on edges of floodplains, and other poorly drained depressions. Individual occurrences of these forests tend to be small in extent, and can provide habitat for rare plant species.

Vegetation: Forests in this alliance have variable canopy composition, but *Acer rubrum* and *Nyssa sylvatica* are common components. Canopy composition differs from the surrounding upland and varies with geography. Typical canopy species across the range of this alliance include *Acer rubrum var. trilobum, Nyssa sylvatica*, and *Liquidambar styraciflua*. Associations placed in this alliance generally contain *Nyssa sylvatica* instead of *Nyssa biflora* (which is normally found in the Coastal Plain to the east and south of this alliance's range, but some stands of these associations may vary from this general assumption, which is further confounded by identification problems between these two taxa. Understory and shrub species include *Alnus serrulata, Ilex opaca var. opaca, Photinia pyrifolia (= Aronia arbutifolia)*, and *Ilex verticillata*. Characteristic herbaceous species are *Osmunda cinnamomea* and *Osmunda regalis*. *Sphagnum* spp. are typical.

Dynamics:

Similar Alliances:

- *Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance (A.3035)
- *Acer rubrum* Saturated Woodland Alliance (A.657)
- *Magnolia virginiana - Nyssa biflora - (Quercus laurifolia)* Saturated Forest Alliance (A.378)
- *Nyssa biflora - Acer rubrum - (Liriodendron tulipifera)* Saturated Forest Alliance (A.351)--includes similar forests, but with *Nyssa biflora*, typically found in the Coastal Plain to the east and south of this (A.348) alliance's range.
- *Pinus rigida - Acer rubrum* Saturated Forest Alliance (A.3005)
- *Quercus laurifolia - Nyssa biflora* Saturated Forest Alliance (A.352)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is known from the Cumberland Plateau of Alabama, Kentucky and Tennessee; the Allegheny Plateau of Kentucky; the Upper East Gulf Coastal Plain of Kentucky and Tennessee; the Piedmont of North Carolina, South Carolina, and Virginia; the Arkansas River Valley; and the Coastal Plain of North Carolina, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia. It is also found in Georgia, Oklahoma, Connecticut, Massachusetts, Maine, New Hampshire, New York, Rhode Island, Vermont, West Virginia, and possibly Illinois and Louisiana.

Nations: US

Subnations: AL, AR, CT, DC, DE, GA, IL?, KY, LA?, MA, MD, ME, NC, NH, NJ, NY, OK, PA, RI, SC, TN, VA, VT, WV

TNC Ecoregions: 32:P, 38:P, 39:C, 40:C, 41:C, 43:C, 44:C, 49:C, 50:C, 51:C, 52:C, 53:P, 56:P, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C

USFS Ecoregions: 212Aa:CCP, 212Ab:CCP, 212Ba:CCP, 212Bb:CCP, 212Ca:CCP, 212Cb:CCP, 212Da:CCP, 212Db:CCP, 212Dc:CCP, 212Ec:CPP, 212Ed:CP?, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC,

212Gb:CCC, 221Aa:CCC, 221Ab:CCC, 221Ac:CCC, 221Ad:CCC, 221Ae:CCC, 221Af:CCC, 221Ag:CCC, 221Ah:CCC, 221Ai:CCC, 221Ak:CCP, 221Al:CCC, 221Am:CCC, 221Ba:CCP, 221Bb:CCC, 221Bc:CCP, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Dc:CCC, 221Ea:CCP, 221Eb:CCP, 221Fa:CPP, 221Fb:CPP, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Ca:CC?, 222Cb:CCC, 222Ce:CCC, 222Cg:CCC, 222Dc:CCP, 222Dg:CCC, 222Eg:CC?, 222Eo:CCC, 222G:CC, 222Ia:CPP, 231Aa:CCC, 231Ad:CCC, 231Ae:CCC, 231Af:CCC, 231Ak:CCC, 231Al:CCC, 231An:CCC, 231Ao:CCP, 231Bc:CCC, 231Be:CCC, 231Ca:CCC, 231Cc:CCC, 231Cd:CCC, 231Db:CCC, 231Dc:CCC, 231De:CCC, 231Ec:CCC, 231F:CC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCP, 232Ab:CCC, 232Ac:CCP, 232Ad:CCC, 232Ae:CCC, 232Ba:CCP, 232Bb:CCP, 232Bc:CCP, 232Bq:CCC, 232Br:CCC, 232Bt:CCC, 232Bz:CCC, 232Ch:CP?, M212Aa:CC?, M212Ab:CC?, M212Ac:CCP, M212Ad:CCP, M212Bb:CCC, M212Bc:CCP, M212Bd:CCC, M212Cb:CCC, M212Cc:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCP, M221Bc:CCC, M221Bd:CCP, M221Be:CCC, M221Bf:CCP, M221Ca:CC?, M221Cb:CCC, M221Cc:CC?, M221Ce:CC?, M221Da:CCC, M221Db:CC?, M221Dd:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Fort A.P. Hill, Fort Belvoir, Fort Jackson, Pine Bluff Arsenal); NPS (Assateague Island, Big South Fork, Blue Ridge Parkway, Boston Harbor Islands, C&O Canal?, Cape Cod, Catoctin Mountain, Delaware Water Gap, Fire Island, Fredericksburg-Spotsylvania, Gateway, George Washington Birthplace, George Washington Parkway?, Kings Mountain, Little River Canyon, Mammoth Cave, Minute Man, Natchez Trace, National Capital-East, New River Gorge, Petersburg, Prince William, Richmond, Shenandoah, Shiloh, Thomas Stone, Weir Farm); USFS (Allegheny, Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Green Mountain, Monongahela, Ouachita, Ozark, Talladega?, Uwharrie, White Mountain); USFWS (Assabet River, Cape May, Felsenthal?, Great Meadows, Great Swamp, Mountain Longleaf, Overflow?, Oxbow, Parker River, Pond Creek?)

ALLIANCE SOURCES

Author(s): K.D. Patterson/J. Campbell

References: Allard 1990, Breden 1989, Campbell 1989b, Eastern Ecology Working Group n.d., Evans 1991, Fike 1999, Fleming et al. 2001, Fleming et al. 2004, Foti 1994b, Funk 1975, Funk and Fuller 1978, Harvill 1967, Heckscher 1994, Schafale and Weakley 1990, Schafale pers. comm., Smith 1991, Swain and Kearsley 2001

[CEGL007443] *Acer rubrum var. trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest

Translated Name: **Carolina Red Maple - Blackgum / Cinnamon Fern - Slender Woodoats - Greater Bladder Sedge / Yellow Peatmoss Forest**

Common Name: **Appalachian Forested Acidic Seep**

Ecological System(s):

- Cumberland Seepage Forest (CES202.361)
- Southern and Central Appalachian Bog and Fen (CES202.300)
- South-Central Interior Small Stream and Riparian (CES202.706)
- Southern Appalachian Seepage Wetland (CES202.317)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): J. Campbell and K.D. Patterson

ELEMENT CONCEPT

Global Summary: These forested acidic seeps occur in the Cumberland Plateau, the Ridge and Valley, areas of the western portions of the Southern Blue Ridge at lower elevations, as well as in the Appalachian Plateaus of Kentucky (Cliff section), and western Kentucky at the edge of the Shawnee Hills (Dripping Springs Escarpment). These forests are found primarily in streamhead swales on broad ridges on sandy, saturated soils derived from shales and sandstones. This community develops where a perched water table is present, as opposed to seepage from the base of a slope [for vegetation related to this latter condition, see *~Acer rubrum var. trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum var. nudum / Woodwardia areolata* Forest (CEGL004425)]. Canopy coverage can be moderately dense to quite open. Canopy composition is highly variable, but *Acer rubrum var. trilobum, Nyssa sylvatica, Liriodendron tulipifera*, and *Liquidambar styraciflua* are common. Subcanopy trees can include *Ilex opaca var. opaca, Carpinus caroliniana*, and (within range) *Magnolia macrophylla*. Tall shrubs are scattered and may be locally dominant. Typical shrubs include *Ilex verticillata, Alnus serrulata, Rhododendron maximum, Photinia melanocarpa (= Aronia melanocarpa), Vaccinium simulatum, Viburnum nudum var. nudum*, and *Cornus foemina*. In examples from the Southern Blue Ridge, *Viburnum nudum var. cassinoides* will replace *Viburnum nudum var. nudum* in this type. Woody vines can be common and include *Toxicodendron radicans* and (especially towards the southern part of the association's distribution),

Decumaria barbara and *Bignonia capreolata*. Typical herbaceous species include *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Chasmanthium laxum, Thelypteris noveboracensis, Woodwardia areolata, Oxypolis rigidior, Carex intumescens, Carex debilis, Carex crinita, Medeola virginiana, Lobelia cardinalis, Juncus effusus var. pylaei, Scirpus polyphyllus, Rubus hispidus, Solidago patula var. patula, Athyrium filix-femina ssp. asplenioides*, and *Viola X primulifolia*. *Platanthera integrilabia* and *Platanthera clavellata* are also known from these forested seeps but are more typical in more open woodland seeps [see *~Acer rubrum* Saturated Woodland Alliance (A.657)]. Patches of *Sphagnum* spp. are common and *Sphagnum lescurii* is typical. In the Daniel Boone National Forest (Kentucky), some stands can contain *Tsuga canadensis* and be transitional to *~Tsuga canadensis - Acer rubrum - (Liriodendron tulipifera, Nyssa sylvatica) / Rhododendron maximum / Sphagnum* spp. Forest (CEGL007565).

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This red maple - sweetgum wetland forest was sampled at one location in the park. The site is a gently sloping, southeast-facing saturated channel bed with very poorly drained muck soil. The unvegetated surface is dominated by leaf litter (80% cover) with some wood (5%), standing water (5%), bare soil (5%), and lichens (5%). Evidence of disturbance includes the presence of exotic plants. This association has not been used as a mapping unit.

Global Environment: These forests are found primarily in streamhead swales on broad ridges on sandy, saturated soils derived from shales and sandstones. This community develops where a perched water table is present, as opposed to seepage from the base of a slope.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately sparse (40% cover) tree canopy, 15-20 m tall, is codominated by *Acer rubrum, Liquidambar styraciflua*, and *Platanus occidentalis* and includes *Liriodendron tulipifera*. The moderately sparse (40%) subcanopy (10-15 m) is dominated by *Acer rubrum* and *Liquidambar styraciflua*. The moderately sparse (40%) tall-shrub layer (2-5 m) is dominated by *Cephalanthus occidentalis* and *Lindera benzoin*, as is the very sparse (5%) short-shrub layer (0.5-1 m). The very sparse (5%) herbaceous layer includes *Boehmeria cylindrica, Carex lurida, Carex vulpinoidea, Eupatorium fistulosum, Impatiens* sp., *Juncus coriaceus*, and *Onoclea sensibilis*. Vines (10%) are dominated by *Apios americana*.

Global Vegetation: Canopy coverage can be moderately dense to quite open. Canopy composition is highly variable, but *Acer rubrum var. trilobum, Nyssa sylvatica, Liriodendron tulipifera*, and *Liquidambar styraciflua* are common. Subcanopy trees can include *Ilex opaca var. opaca, Carpinus caroliniana*, and (within range) *Magnolia macrophylla*. Tall shrubs are scattered and may be locally dominant. Typical shrubs include *Ilex verticillata, Alnus serrulata, Rhododendron maximum, Photinia melanocarpa (= Aronia melanocarpa), Photinia pyrifolia (= Aronia arbutifolia), Vaccinium simulatum, Viburnum nudum var. nudum, Arundinaria gigantea*, and *Cornus foemina*. In examples from the Southern Blue Ridge, *Viburnum nudum var. cassinoides* will replace *Viburnum nudum var. nudum* in this type. Woody vines can be common, and include *Toxicodendron radicans* and (especially towards the southern part of the association's distribution), *Decumaria barbara* and *Bignonia capreolata*. Typical herbaceous species include *Osmunda cinnamomea, Osmunda regalis var. spectabilis, Chasmanthium laxum, Thelypteris noveboracensis, Woodwardia areolata, Woodwardia virginica, Oxypolis rigidior, Carex intumescens, Carex debilis, Carex crinita, Medeola virginiana, Lobelia cardinalis, Oxypolis rigidior, Juncus effusus var. pylaei, Scirpus polyphyllus, Rubus hispidus, Solidago patula var. patula, Lycopus uniflorus, Athyrium filix-femina ssp. asplenioides*, and *Viola X primulifolia*. *Platanthera integrilabia* and *Platanthera clavellata* are also known from these forested seeps but are more typical in the more open woodland seeps [see *~Acer rubrum* Saturated Woodland Alliance (A.657)]. Patches of *Sphagnum* spp. are common and *Sphagnum lescurii* is typical. These forests are found primarily in streamhead swales on broad ridges on sandy, saturated soils derived from shales and sandstones. This community develops where a perched water table is present, as opposed to seepage from the base of a slope [for vegetation related to this latter condition, see *~Acer rubrum var. trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum var. nudum / Woodwardia areolata* Forest (CEGL004425)]. In the Daniel Boone National Forest (Kentucky), some stands can contain *Tsuga canadensis*, and be transitional to *~Tsuga canadensis - Acer rubrum - (Liriodendron tulipifera, Nyssa sylvatica) / Rhododendron maximum / Sphagnum* spp. Forest (CEGL007565).

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Acer rubrum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Liquidambar styraciflua	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Platanus occidentalis	Tree canopy	Broad-leaved deciduous tree	X	.	.
Lindera benzoin	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Apios americana	Herb (field)	Vine/Liana	X	.	.

Onoclea sensibilis	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Cypripedium kentuckiense	G3	P	
Hexastylis shuttleworthii var. *harperi*	G4T3	P	
Platanthera integra	G3G4	P	
Platanthera integrilabia	G2G3	P	Federal candidate for listing

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (30-Dec-2008). This association is restricted to a small-scale wetland habitat in a limited region. It is vulnerable to alteration or destruction by various anthropogenic activities, including hydrologic modifications. Most examples are on private land and remain unprotected.

RELATED CONCEPTS

Global Similar Associations:

- *Acer rubrum var. trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum var. nudum / Woodwardia areolata* Forest (CEGL004425)--is related to seepage at the base of a slope.
- *Acer rubrum var. trilobum / Alnus serrulata / Calamagrostis coarctata* Saturated Woodland (CEGL003737)--is more open and on coarser substrates.

Global Related Concepts:

- IIA9a. Forested Mountain Seep (Allard 1990) [in part] **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: At Mammoth Cave National Park, there are some small-scale "seepage" areas which could be attributed to *~Acer rubrum var. trilobum - Nyssa sylvatica / Osmunda cinnamomea - Chasmanthium laxum - Carex intumescens / Sphagnum lescurii* Forest (CEGL007443). This vegetation is rare and poorly understood at MACA, and in any case seems to be too small in scale to be mappable. This association has not been used as a mapping unit.

Mammoth Cave National Park Other Comments:

Global Classification Comments: There is a good deal of variability in examples of saturated *Acer rubrum var. trilobum - Nyssa sylvatica* forests in this region, in terms of hydroperiod, extent, and environment. More typical examples exhibit dominance or at least codominance by *Osmunda cinnamomea*, but some apparently drier or shorter hydroperiod examples are dominated by *Thelypteris noveboracensis* instead, and often lack *Sphagnum* or have it at very low density. These are included here as marginal to the concept and may represent either part of the natural variation or lower quality examples. Often this apparent variability is present within one stream reach. Some "examples" or parts of examples are very narrow bands along streams, and these are effectively below the minimum size for an occurrence, and thus would be mappable only at the very finest scales.

Examples are known from the Somerset and Stearns ranger districts of the Daniel Boone National Forest, in the Appalachian Plateaus, Cliff section of Kentucky. Similar seeps are known from western Kentucky, at the edge of the Shawnee Hills; they are included here for now. Related vegetation from the Cretaceous Gravel Hills of the Mississippi Embayment, which occurs at the bases of slopes rather than in streamheads on broad ridges, is accommodated in *~Acer rubrum var. trilobum - Nyssa sylvatica / Rhododendron canescens - Viburnum nudum var. nudum / Woodwardia areolata* Forest (CEGL004425). This association is known from Tennessee in the southwestern portion of the southern Blue Ridge. A similar woodland community is *~Acer rubrum var. trilobum / Alnus serrulata / Calamagrostis coarctata* Saturated Woodland (CEGL003737). In general, stands of this association (CEGL007443) have greater canopy cover and thereby denser shade, as well as being in a finer-textured, mucky substrate - in contrast to the more open canopy and coarser-textured, sandier substrate of CEGL003737.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: The full extent of this type at the park is uncertain; examples of this or related vegetation are small and of uncertain classification. They are widely scattered in the middle section of the park. This association has not been used as a mapping unit.

Global Range: This community is known from the Cumberland Plateau of Alabama, Tennessee and Kentucky, the adjacent Ridge and Valley, as well as lower elevation areas of the western portions of the Southern Blue Ridge in Tennessee and Georgia, the Appalachian Plateaus of Kentucky (Cliff section), and at the edge of the Shawnee Hills in western Kentucky.
Nations: US
States/Provinces: AL, GA, KY, TN
TNC Ecoregions: 44:C, 50:C, 51:C
TNC Ecoregion Comments: ECO51 changed from PERIPHERAL to LIMITED (AW 6-00).
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Dg:CCC, 222Eo:CCC, 222G:CC, 231Ca:CCC, 231Cc:CCC, 231Cd:CCC, 231Db:CCC, 231Dc:CCC, 231De:CCC, M221Dd:CCC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Big South Fork, Little River Canyon, Mammoth Cave); USFS (Bankhead, Chattahoochee, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, Talladega (Talladega)?); USFWS (Mountain Longleaf)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes: This association has not been used as a mapping unit.
Mammoth Cave National Park Plots: MACA.110.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): J. Campbell and K.D. Patterson
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
Evans 1991 .	X	.	X	.	.	.	.	.	
NatureServe Ecology - Southeastern U.S. unpubl. data	.	X	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

I.C.3.N.a. Mixed needle-leaved evergreen - cold-deciduous forest

A.413 Tsuga canadensis - Liriodendron tulipifera *Forest Alliance*

Eastern Hemlock - Tuliptree Forest Alliance

ALLIANCE CONCEPT

Summary: Forests in this alliance include acidic cove forests and mesic successional forests, mostly of the southern and central Appalachians, but also occurring in the Cumberland Plateau and Cumberland Mountains of Kentucky, Tennessee, and Alabama; the Allegheny Plateau of West Virginia; and isolated occurrences in the Interior Low Plateau of Indiana and Tennessee, and the Piedmont and inner Coastal Plain of Virginia and Maryland. These forests occur in deep coves, moist flats, and ravines but are occasionally found along larger stream bottoms, typically at elevations below 1068 m (3500 feet). Forests in this alliance are dominated by *Tsuga canadensis*, occurring with various hardwood species of mesic forests, including *Liriodendron tulipifera, Tilia americana var. heterophylla, Magnolia acuminata, Quercus rubra, Fraxinus americana, Betula lenta, Fagus grandifolia, Halesia tetraptera*, and others. Common shrubs are *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*. Herbaceous cover is typically sparse and includes acid-loving species such as *Polystichum acrostichoides, Goodyera pubescens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* sp., and *Tiarella cordifolia*.
Environment: These forests occur in deep coves, moist flats, and ravines but are occasionally found along larger stream bottoms, typically at elevations below 1068 m (3500 feet).
Vegetation: Forests in this alliance are dominated by *Tsuga canadensis*, occurring with various hardwood species of mesic forests, including *Liriodendron tulipifera, Tilia americana var. heterophylla, Magnolia acuminata, Quercus rubra, Fraxinus americana, Betula lenta, Fagus grandifolia, Halesia tetraptera*, and others. Common shrubs are *Rhododendron maximum, Kalmia latifolia*, and *Leucothoe fontanesiana*. Herbaceous cover is typically sparse and includes acid-loving species such as *Polystichum acrostichoides, Goodyera pubescens, Thelypteris noveboracensis, Galax urceolata, Hexastylis* sp., and *Tiarella cordifolia*.
Dynamics:
Similar Alliances:
- *Pinus strobus - Tsuga canadensis* Forest Alliance (A.127)

- *Tsuga canadensis - (Pinus strobus)* Temporarily Flooded Forest Alliance (A.171)
- *Tsuga canadensis - Betula alleghaniensis* Forest Alliance (A.412)--occurs either at higher elevations in the southern Appalachians or at more northern latitudes, and has hardwood associates more typical of these environments.

Similar Alliance Comments: There may be some conceptual overlap or classification difficulties where these alliances overlap in range.

ALLIANCE DISTRIBUTION

Range: Forests in this alliance include acidic cove forests and mesic successional forests, mostly of the southern and central Appalachians, but also occurring in the Cumberland Plateau and Cumberland Mountains of Kentucky, Tennessee, and Alabama, the Allegheny Plateau of West Virginia, and isolated occurrences in the Interior Low Plateau of Indiana and Tennessee. Isolated occurrences are also found in the Piedmont and inner Coastal Plain of Virginia and Maryland. This alliance ranges from New Jersey south to Georgia and west to Indiana and Tennessee.

Nations: US

Subnations: AL, GA, IN, KY, MD, NC, NJ, NY, OH, PA, SC, TN, VA, WV

TNC Ecoregions: 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 58:C, 59:C, 60:C, 61:C

USFS Ecoregions: 212Fc:CPP, 221Ae:CCC, 221Bd:CCC, 221Db:CCC, 221Ea:CCC, 221Eb:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222De:CC?, 222Dj:CCC, 222Eb:CCC, 222Ek:CCC, 222Em:CCC, 222Eo:CCC, 222Hb:CCC, 222Hf:CCC, 231Aa:CCC, 231Ad:CCC, 231Ae:CCC, 231Ak:CCC, 231Al:CCC, 231Ap:CCP, 231Ca:CCC, 231Cc:CCP, 231Cd:CCC, 232Ad:CCC, 232Br:CCC, 232Bt:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Be:CCC, M221Ca:CCC, M221Cb:CCC, M221Cc:CCC, M221Cd:CCC, M221Ce:CCC, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCC, M231Ad:CCC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Allegheny Portage Railroad, Big South Fork, Blue Ridge Parkway, Bluestone, C&O Canal?, Carl Sandburg Home, Catoctin Mountain, Cumberland Gap, Delaware Water Gap, George Washington Parkway, Great Smoky Mountains, Harpers Ferry, Mammoth Cave, Manassas?, Monocacy?, Morristown, New River Gorge, Obed, Prince William, Shenandoah); USFS (Bankhead, Chattahoochee, Cherokee, Daniel Boone, George Washington, Hoosier?, Jefferson, Nantahala, Pisgah, Sumter, Wayne); USFWS (Erie, Mason Neck)

ALLIANCE SOURCES

Author(s): D. Taylor, mod. G.P. Fleming

References: Cooper and Hardin 1970, Coulling 1999, Eyre 1980, Fike 1999, Gettman 1974, Golden 1974, Lea 2004, Malter 1977, McLeod 1988, Nemeth 1973, Newell and Peet 1995, Newell et al. 1997, Patterson 1994, Prentice et al. 1991, Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., Winstead and Nicely 1976

[CEGL005043] *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest

Translated Name: **Eastern Hemlock - American Beech - Sugar Maple / (American Witch-hazel, Mountain Laurel) Forest**

Common Name: **East-central Hemlock Hardwood Forest**

Ecological System(s):
- Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563)
- Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593)
- South-Central Interior Mesophytic Forest (CES202.887)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This community is found in parts of the Interior Low Plateau, the Western Allegheny Plateau, and possibly the Central Appalachians of Virginia in the northeastern and east-central United States. Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys. Soils are typically acidic silty to sandy loams, with a sandstone or shale parent material. The overstory is dominated by *Tsuga canadensis, Acer saccharum, Acer rubrum*, and *Fagus grandifolia*. Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis, Betula lenta, Carya* spp., *Liriodendron tulipifera, Nyssa sylvatica, Pinus strobus, Prunus serotina, Quercus alba, Quercus rubra*, and *Tilia americana*. The shrub layer, occasionally sparse, contains *Hamamelis virginiana, Lindera benzoin*, and *Viburnum acerifolium*, as well as ericaceous shrubs, including *Kalmia latifolia* (except in the northern portion of the Western Allegheny Plateau) and *Rhododendron maximum*. The ground layer contains the ferns *Botrychium virginianum, Dryopteris intermedia, Dryopteris marginalis, Polystichum acrostichoides*, and the herbs *Arisaema triphyllum, Maianthemum canadense, Mitchella repens, Podophyllum peltatum,*

Viola blanda, and *Viola rotundifolia*, among others. Three subtypes are possible: (1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens, Kalmia latifolia*, and *Dryopteris marginalis* may be indicative; (2) more gently sloped valleys, with shrubs such as *Hamamelis virginiana, Viburnum acerifolium*; and (3) rolling lakeplain ridges. The Kentucky examples, which are mesic rather than dry-mesic, may lack *Acer saccharum, Maianthemum canadense*, and several other species, and may contain *Magnolia* spp. (e.g., *Magnolia tripetala, Magnolia acuminata*, and *Magnolia macrophylla*) (J. Campbell pers. comm. 2000). In addition, *Betula lenta* (widespread on Appalachian plateaus) is replaced by *Betula alleghaniensis (var. macrolepis*?) in western Kentucky and southern Indiana.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This hemlock - beech - sugar maple forest was sampled at three locations in the park. Sites are typically somewhat steep, northeast- or northwest-facing midslopes with moderately well- to well-drained sandy clay and sandy loam soils. However, one stand is located on a flat alluvial terrace with well-drained clay loam soil at 224 m (734 feet) elevation. The unvegetated surface is dominated by leaf litter (71-90% cover) with some exposed bedrock (0-20%), large rocks (0-20%), wood (2-10%), and standing water (0-3%). Evidence of disturbance includes past logging and the presence of exotic plants.

Global Environment: Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys, but also in more gently sloped valleys and rolling lakeplain ridges. Soils are typically acidic, silty to sandy loams, with a sandstone or shale parent material (Anderson 1982). Some Indiana stands occur on limestone (M. Homoya pers. comm. 1999).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The dense (70-80% cover) tree canopy, 20-35 m tall, is dominated by *Tsuga canadensis, Fagus grandifolia, Liriodendron tulipifera*, and *Quercus rubra* and may include *Acer saccharum, Quercus alba*, and others. The moderate (50-60%) subcanopy (10-20 m) is dominated by *Tsuga canadensis* along with other canopy species. The moderately sparse (30-40%) tall-shrub layer (2-5 m) is dominated by *Asimina triloba* and *Tsuga canadensis* and may include *Carpinus caroliniana, Cornus florida, Ilex opaca var. opaca, Magnolia acuminata*, and *Magnolia tripetala*. The sparse (20-30%) short-shrub layer (0.5-1 m) includes many tall-shrub species as well as *Euonymus americanus* and *Lindera benzoin*. The very sparse to moderately dense (10-70%) herbaceous layer may include *Arisaema triphyllum, Athyrium filix-femina ssp. asplenioides, Cardamine concatenata* (dominant in one stand), *Deparia acrostichoides, Dryopteris intermedia, Dryopteris marginalis, Erythronium americanum* (another dominant), *Mitchella repens, Polystichum acrostichoides, Thelypteris noveboracensis*, and others. Vines include *Bignonia capreolata*.

Global Vegetation: The overstory is dominated by *Tsuga canadensis, Acer saccharum, Acer rubrum*, and *Fagus grandifolia*. Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis, Betula lenta, Carya* spp., *Liriodendron tulipifera, Nyssa sylvatica, Pinus strobus, Prunus serotina, Quercus alba, Quercus rubra*, and *Tilia americana*. The shrub layer, occasionally sparse, contains *Hamamelis virginiana, Lindera benzoin*, and *Viburnum acerifolium*, as well as ericaceous shrubs, including *Kalmia latifolia* and *Rhododendron maximum*. The ground layer contains the ferns *Botrychium virginianum, Dryopteris intermedia, Dryopteris marginalis, Polystichum acrostichoides*, and the herbs *Arisaema triphyllum, Maianthemum canadense, Mitchella repens, Podophyllum peltatum, Viola blanda*, and *Viola rotundifolia*, among others. Three subtypes are possible: (1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens, Kalmia latifolia*, and *Dryopteris marginalis* may be indicative; (2) more gently sloped valleys, with shrubs such as *Hamamelis virginiana, Viburnum acerifolium*; and (3) rolling lakeplain ridges (Black and Mack 1976, Anderson 1982). In Virginia, this type would be expected north of the range of *Rhododendron maximum* (G. Fleming pers. comm. 2000). The Kentucky examples, which are mesic rather than dry-mesic, may lack *Acer saccharum, Maianthemum canadense*, and several other species, and may contain *Magnolia* spp., (e.g., *Magnolia tripetala, Magnolia acuminata*, and *Magnolia macrophylla*) (J. Campbell pers. comm. 2000). In addition, *Betula lenta* (widespread on Appalachian Plateaus) is replaced by *Betula alleghaniensis (var. macrolepis*?) in western Kentucky and southern Indiana.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Tsuga canadensis	Tree (canopy & subcanopy)	Needle-leaved tree	X	X	.
Acer saccharum	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Liriodendron tulipifera	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Fagus grandifolia	Tree canopy	Broad-leaved deciduous tree	X	X	.
Quercus rubra	Tree canopy	Broad-leaved deciduous tree	X	.	.
Tsuga canadensis	Shrub/sapling (tall & short)	Needle-leaved shrub	X	X	.
Asimina triloba	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Magnolia acuminata	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Magnolia tripetala	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.

Ilex opaca var. *opaca*	Short shrub/sapling	Broad-leaved evergreen shrub	X	.	.
Bignonia capreolata	Herb (field)	Vine/Liana	X	.	.
Cardamine concatenata	Herb (field)	Forb	X	.	.
Erythronium americanum	Herb (field)	Forb	X	.	.
Deparia acrostichoides	Herb (field)	Fern or fern ally	X	.	.
Polystichum acrostichoides	Herb (field)	Fern or fern ally	X	.	.
Thelypteris noveboracensis	Herb (field)	Fern or fern ally	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Microstegium vimineum	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

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

RELATED CONCEPTS

Global Similar Associations:

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

Global Related Concepts:

- CT VIII *Tsuga canadensis, Fagus grandifolia, Liriodendron tulipifera, Acer saccharum* (Badger et al. 1997) =

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Badger et al. (1997) list this as CT VIII *Tsuga canadensis, Fagus grandifolia, Liriodendron tulipifera, Acer saccharum* (pp. 1-45). Habitat: sandstone cliffs and hydric floodplains (also pp. 4-54).

Mammoth Cave National Park Other Comments:

Global Classification Comments: This type appears to vary from pure evergreen to mixed evergreen-deciduous. Black and Mack (1976) suggest that this type contains more temperate species, such as several *Dryopteris* spp. (*Dryopteris intermedia, Dryopteris marginalis*) and *Viburnum acerifolium* when compared to more northern/boreal types, such as *~Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042), which contains *Clintonia borealis, Coptis trifolia*, and *Cornus canadensis*. One of their subtypes, the steep-walled sandstone gorges and talus, where *Hydrangea arborescens, Kalmia latifolia*, and *Dryopteris marginalis* may be indicative, has some conceptual and environmental overlap with *~Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407) of the southern Cumberland Plateau and Central Appalachians.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This community is restricted to the sandstone-capped, non-karstic topography of the northwestern part of the park.

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

Nations: US

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

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

TNC Ecoregion Comments: ECO61 reinstated as per LNE classification meeting (5-12-03) as per G. Podniesinski and S. Perles (SLN 2-04). ECO61 removed per Lundgren et al. 2000 (LNE ecoregional plan) (SLN 2-03). ECO49 subsections edited per WAP ecology group and from OH EORs (LAS 1-03). ECO59 added (MP 4-00). ECO61 added (LAS 10-99).
USFS Ecoregions: 212:C, 221D:CC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 222De:CC?, 222Dj:CCC, 222Ek:CCC, 222Em:CCC, 222Hb:CCC, 222Hf:CCC
Federal Lands: NPS (Mammoth Cave); USFS (Wayne); USFWS (Erie)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.45, MACA.70, MACA.710.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): D. Faber-Langendoen
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Anderson 1982	.	.	.	X	.	.	.	.	.
Badger et al. 1997	.	X	X	X	.	.	.	.	.
Black and Mack 1976	.	.	.	X	.	.	.	.	.
Campbell pers. comm.	.	.	.	X	.	.	.	.	.
Eastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Fike 1999 .	X	.	X	.	.	.	.	.	
Fleming pers. comm.	.	.	.	X	.	.	.	.	.
Harrison 2004	.	.	.	.	.	.	.	.	.
Homoya pers. comm.	.	.	.	X	.	.	.	.	.
ONHD unpubl. data	.	.	.	.	.	.	.	.	.

II. Woodland

II.B.2.N.a. Cold-deciduous woodland

A.621 Quercus muehlenbergii *Woodland Alliance*

Chinkapin Oak Woodland Alliance

ALLIANCE CONCEPT

Summary: This alliance contains woodland communities in which *Quercus muehlenbergii* is a characteristic, and sometimes dominant, tree. Communities of this alliance are usually restricted to shallow soils derived from calcareous bedrock on gently rolling terrain or on slopes, which may be steep. They are found primarily on limestone in the Ozarks and sedimentary rock provinces of the Appalachians. The moisture regime of these communities is generally dry to well-drained. The canopy is often sparse, with widely spaced trees, although the physiognomy is variable. These woodlands often occur in association with 'glade' vegetation. Associated canopy species include *Quercus alba, Celtis tenuifolia, Cercis canadensis, Cornus florida, Carya ovata, Carya carolinae-septentrionalis, Fraxinus americana, Fraxinus quadrangulata, Ostrya virginiana*, and *Juniperus virginiana var. virginiana*. In addition, *Quercus austrina* may be present within its range. Shrubs are sparse in some examples, the understory characterized by light-demanding herbs such as *Bouteloua curtipendula, Asclepias verticillata, Schizachyrium scoparium, Helianthus divaricatus, Sorghastrum nutans, Eryngium yuccifolium, Carex meadii, Anemone cylindrica, Desmodium* spp., and *Andropogon gerardii*. Some more shrubby Alabama dolomite examples may contain *Sideroxylon lycioides, Acer leucoderme, Cercis canadensis var. canadensis, Cornus florida, Hypericum frondosum*, and *Croton alabamensis var. alabamensis*. Kentucky, Tennessee, and Arkansas examples contain *Cercis canadensis* as an associate in the subcanopy. It is uncommon but present in the Interior Low Plateau (e.g., steep, southwest-facing rocky slopes on limestones above the Green River at Mammoth Cave National Park). There are several other associations in the Northeast and Midwest.
Environment: Communities of this alliance are usually restricted to shallow soils derived from calcareous bedrock on gently rolling terrain or on slopes, which may be steep. The moisture regime of these communities is generally dry to well-drained. Stands are primarily found on limestone in the Ozarks and Interior Low Plateau and the sedimentary rock provinces of the Appalachians, but are also present on calcareous shell in the Coastal Plain of Virginia.
Vegetation: This alliance contains woodland communities in which *Quercus muehlenbergii* is a characteristic, and sometimes dominant, tree. The canopy is often sparse, with widely spaced trees, although the physiognomy is variable. These woodlands often occur in association with 'glade' vegetation. Associated canopy species include *Celtis tenuifolia, Cercis canadensis, Cornus florida, Carya ovata, Ostrya virginiana*, and *Juniperus virginiana var. virginiana*. Shrubs are

sparse, the understory characterized by light-demanding herbs such as *Bouteloua curtipendula, Asclepias verticillata, Schizachyrium scoparium, Helianthus divaricatus, Sorghastrum nutans, Eryngium yuccifolium, Carex meadii, Anemone cylindrica, Desmodium* spp., and *Andropogon gerardii*. Kentucky and Arkansas examples contain *Cercis canadensis* as an associate in the subcanopy. In addition, Kentucky examples would probably have *Acer saccharum, Quercus stellata*, and *Juniperus virginiana var. virginiana* on shallow, dry, calcareous soils. Northern examples may contain *Cornus racemosa.*

Dynamics:

Similar Alliances:

- *Fraxinus quadrangulata - (Juniperus virginiana)* Woodland Alliance (A.1913)
- *Quercus macrocarpa - Quercus (alba, ellipsoidalis, velutina)* Woodland Alliance (A.619)
- *Quercus macrocarpa* Woodland Alliance (A.620)
- *Quercus muehlenbergii - (Acer saccharum)* Forest Alliance (A.1912)--related vegetation of shell-rich substrates of the Coastal Plains.

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Michigan, Iowa, Kansas, Missouri, Ohio, Wisconsin, Alabama, Arkansas, Vermont, Maryland, Pennsylvania, Tennessee, Kentucky, Virginia, and West Virginia, and possibly in Illinois, Texas, and Louisiana. It is not thought to occur in Oklahoma (B. Hoagland pers. comm.), nor in Georgia (J. Ambrose pers. comm.). It also occurs in Ontario, Canada.

Nations: CA, US

Subnations: AL, AR, IA, IL?, IN, KS, KY, LA?, MD, MI, MO, OH, OK?, ON, PA, TN?, TX?, VA, WI, WV

TNC Ecoregions: 36:C, 37:C, 38:C, 39:?, 40:C, 43:?, 44:C, 46:C, 48:C, 49:C, 50:C, 59:C

USFS Ecoregions: 212Ea:CCC, 221D:C?, 221Ec:CC?, 221Ha:CCP, 221Hc:CCP, 221Hd:CCP, 221He:CCP, 221Ja:CCP, 221Jb:CCP, 221Jc:CCP, 222Ab:CCC, 222Ac:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCP, 222Ak:CC?, 222Am:CC?, 222An:CCC, 222Ao:CCC, 222De:CCP, 222Dg:CCC, 222Ea:CC?, 222Eb:CC?, 222Ec:CCP, 222Ed:CCP, 222Eg:CCP, 222Eh:CC?, 222Fa:CC?, 222Fb:CCP, 222I:CC, 222Lc:CCC, 231Cc:C??, 231Cd:C??, 231Cf:C??, 231Cg:C??, 231Da:CC?, 231Dc:CCC, 231De:CC?, 231Eb:CCC, 231Ga:CP?, 231Gb:CP?, 231Gc:CP?, 232Br:CCC, 251Ce:CCC, 251Cq:CCC, 251Ea:CCC, M212A:CC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Be:CCC, M222Aa:CCC, M222Ab:CCP

Federal Lands: COE (Lake Millwood); NPS (Buffalo River, Effigy Mounds, Mammoth Cave, Ozark Riverways, Saint Croix); USFS (George Washington, Hoosier, Jefferson, Mark Twain, Ozark)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. M. Pyne

References: Ambrose pers. comm., Bartgis 1993, Faber-Langendoen et al. 1996, Fike 1999, Hoagland pers. comm., Midwestern Ecology Working Group n.d., Smith 1991

[CEGL004267] *Quercus muehlenbergii - (Juniperus virginiana var. virginiana)* Unglaciated Bluff Woodland

Translated Name: **Chinkapin Oak - (Eastern Red-cedar) Unglaciated Bluff Woodland**

Common Name: **Chinquapin Oak Unglaciated Bluff Woodland**

Ecological System(s):

- Central Interior Calcareous Cliff and Talus (CES202.690)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne and M. Whited

ELEMENT CONCEPT

Global Summary: This chinquapin oak bluff woodland occurs primarily on bluffs of rivers in the southern unglaciated Interior Low Plateau of the United States. Stands occur in scattered areas along steep south- to southwest-facing bluffs or steep slopes, for example on the Green River of Kentucky. The underlying soils and bedrock presumably have a calcareous or circumneutral influence. Stands contain an open tree layer, with *Quercus muehlenbergii* as the characteristic dominant, and *Juniperus virginiana var. virginiana* as a common associate. Scattered individuals of *Quercus alba* and *Quercus velutina* may be present. *Ostrya virginiana* may be present in any or all woody strata. Shrubs are often of sparse cover and may include *Rhus aromatica, Ulmus alata, Sideroxylon lycioides*, and. *Symphoricarpos orbiculatus*, which may be relatively abundant as a low shrub. The herb layer is very open (usually <40% stratum cover) and somewhat diverse, with characteristically calciphilic and light-demanding forbs, low shrubs, and vines present. Graminoids include *Brachyelytrum erectum, Chasmanthium latifolium, Bromus* sp., *Dichanthelium boscii*, and *Dichanthelium commutatum*. It

very likely occurs on other major rivers (Red, Cumberland, Tennessee), but these habitats can be difficult to access and are not often surveyed in detail.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This chinquapin oak - red-cedar woodland was sampled at one location in the park. The site is a very steep, southwest-facing xeric cliff at 180 m (590 feet) elevation. This very specific habitat consists generally of lower, steep, drier slopes, with southerly aspects on limestones. It would be expected to occur on other south- or southwest-facing slopes, which can be about 30-40 degrees but may be steeper. These are the large open slopes of the Green River. Soils are shallow, dry, stony, calcareous loams derived from limestone or dolomite bedrock.

Global Environment: This vegetation type occurs in scattered areas on steep slopes along the major rivers in the unglaciated Interior Low Plateau, such as the Green River of Kentucky at elevations ranging from 160-200 m (500-660 feet). Slopes are typically south- or southwest-facing and about 30-40 degrees but may be steeper. Soils are shallow, dry, stony, calcareous loams derived from limestone or dolomite bedrock. This vegetation type is generally associated with exposed, xeric cliffs and other large outcrops of carbonate rock. Sites are typically on the upper portions or spur crests of sideslopes undercut by rivers or large streams. Slopes are predominantly and sometimes dramatically convex, with rugged, complex, and variable microtopography. Surface cover of exposed bedrock and loose stones is high, with most plants rooted in crevices and on thin-soiled ledges. The surficial rock and associated edaphic stresses often limit both vegetation cover and species richness, which is comparatively low. Periodic drought stress appears to result in occasional mortality of trees and shrubs in these habitats.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The sparse (30% cover) somewhat stunted tree canopy, 10-55 m tall, is dominated by *Quercus muehlenbergii* and *Juniperus virginiana* and includes lesser amounts of *Juglans nigra* and *Quercus rubra*. The sparse (30%) subcanopy (5-10 m) is dominated by *Juniperus virginiana* and *Ostrya virginiana*. The sparse (20%) tall-shrub layer (1-2 m) and sparse (20%) short-shrub layer (0.5-1 m) include *Carya alba, Celtis occidentalis, Cercis canadensis, Fraxinus americana*, and *Ostrya virginiana* (dominant). The sparse (30%) herbaceous layer includes *Brachyelytrum erectum, Chasmanthium latifolium, Monarda russeliana, Symphyotrichum shortii*, and many others; 30 species were reported from a quick survey.

Global Vegetation: Stands contain an open tree layer, with *Quercus muehlenbergii* as the characteristic dominant and *Juniperus virginiana* as a common associate or codominant. Scattered individuals of *Quercus alba* and *Quercus velutina* may be present. Trees are generally widely spaced and relatively short (3-10 m). Other associates include *Acer saccharum, Carya alba, Cercis canadensis, Celtis laevigata* (or *Celtis tenuifolia*?), *Fraxinus americana*, and *Quercus rubra* (which is stunted and at low cover). *Ostrya virginiana* may be present in any or all woody strata. Shrubs are often of sparse cover and may include *Rhus aromatica, Ulmus alata, Sideroxylon lycioides*, and. *Symphoricarpos orbiculatus*, which may be relatively abundant. The herb layer is very open (usually <40% stratum cover) and somewhat diverse, with low shrubs and vines present. Graminoids include *Brachyelytrum erectum, Chasmanthium latifolium, Bromus* sp., *Dichanthelium boscii*, and *Dichanthelium commutatum*. Associated forbs, many of which are characteristically calciphilic and light-demanding, include *Antennaria plantaginifolia, Blephilia ciliata, Galium circaezans, Helianthus microcephalus, Heuchera americana, Houstonia longifolia, Monarda russeliana, Packera obovata (= Senecio obovatus), Polymnia canadensis, Ruellia caroliniensis, Scutellaria elliptica, Solidago sphacelata, Symphyotrichum shortii (= Aster shortii)*, and *Tragia cordata*. Pteridophytes include *Asplenium platyneuron, Cheilanthes lanosa*, and *Pellaea atropurpurea*. Most sampled stands form woodlands with stunted trees 6-10 m tall contributing 40-60% cover. Exotic weeds are occasionally present in small numbers but do not thrive in the thin, rocky soils. More information is needed about this type, as few stands have been available for characterization.

Global Dynamics: Due to the dry nature of the habitat, management is usually not necessary to maintain its woodland character. The physiognomy of the type may have varied from more open conditions to more closed-canopy conditions.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree (canopy & subcanopy)	Needle-leaved tree	X	X	.
Quercus muehlenbergii	Tree canopy	Broad-leaved deciduous tree	X	X	.
Ostrya virginiana	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Ostrya virginiana	Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	X	.	.
Cercis canadensis	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Monarda russeliana	Herb (field)	Forb	X	.	.
Symphyotrichum shortii	Herb (field)	Forb	X	.	.
Brachyelytrum erectum	Herb (field)	Graminoid	X	.	.
Chasmanthium latifolium	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (5-Sep-2008). This association has a relatively restricted range, being limited to the Interior Low Plateau region of the eastern United States. It occurs on large bluffs along major rivers, in linear bands of 2-5 hectares, but some may exceed 10 hectares, depending on local geologic and topographic expression. It is restricted to thin, rocky calcareous soils derived from limestone or dolomite bedrock. Examples are difficult to access and, as a result, many are secure. Some are protected on Mammoth Cave National Park. Further evidence is needed to more firmly establish the rank of this type.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus muehlenbergii - Cercis canadensis / Packera obovata - Lithospermum canescens* Woodland (CEGL006231)
- *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131)--typically on gentler slopes and with patchy trees.
- *Quercus muehlenbergii - Quercus (alba, velutina) - (Juniperus virginiana var. virginiana)* Bluff Woodland (CEGL002144)--similar but restricted to more northerly latitudes.

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: This open calcareous bluff woodland occurs in the Interior Low Plateau region of the eastern United States. It is described from the Crawford-Mammoth Cave Uplands (71a of EPA) in Kentucky. Field survey of this vegetation and its cliff habitats can be a dangerous undertaking, and many stands have not been thoroughly explored or sampled.

Mammoth Cave National Park Other Comments:

Global Classification Comments: This association is similar in some respects to limestone glades, but its presence on steep wooded slopes distinguishes it from these associations (e.g., ~*Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation (CEGL005131)). This type is defined from a limited number of samples and consists of small to medium-sized inclusions on steep slopes, especially on river bluffs or steep slopes. Due to the dry nature of the habitat, management is usually not necessary to maintain its woodland character.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found at Still House Hollow Bluff, and could be present at other bluffs of a similar steepness and aspect (generally southern exposures), particularly the large open slopes of the Green River.

Global Range: This chinquapin oak woodland occurs primarily on bluffs of major rivers in the unglaciated Interior Low Plateau of the United States, such as the Green River of Kentucky. It is described from the Crawford-Mammoth Cave Uplands (71a of EPA) in Kentucky, but this or similar vegetation could occur on steep rocky slopes above major rivers in related areas of Alabama, Indiana, or Tennessee. Its complete range is not known. There are related types known from the West and North.

Nations: US

States/Provinces: AL?, IN?, KY, TN?

TNC Ecoregions: 44:C

TNC Ecoregion Comments:

USFS Ecoregions: 222Dg:CCC

Federal Lands: NPS (Mammoth Cave)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.747.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne and M. Whited

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.

A.625 Quercus stellata - Quercus marilandica *Woodland Alliance*

Post Oak - Blackjack Oak Woodland Alliance

ALLIANCE CONCEPT

Summary: This alliance includes open-canopy stands, typically dominated by *Quercus stellata* and/or *Quercus marilandica*, found throughout the southeastern and lower midwestern United States. These communities are physiognomically variable, locally varying from deciduous to mixed, these mixed stands often having substantial *Juniperus virginiana var. virginiana* or *Juniperus ashei* (within their respective ranges) especially as a result of fire suppression. These post oak - blackjack oak woodlands are more edaphically extreme or frequently burned than the corresponding ~*Quercus stellata - Quercus marilandica* Forest Alliance (A.253), which is currently more common due to fire suppression. Some examples occur on 2:1 montmorillonitic clays, while others are on sandstone- or limestone-derived soils. The floristic composition of associated woody species can be quite variable in this wide-ranging alliance. Canopy and subcanopy associates, in addition to *Quercus stellata* and *Quercus marilandica*, may include *Juniperus virginiana var. virginiana, Juniperus ashei, Pinus echinata, Pinus virginiana, Carya texana, Carya glabra, Cornus florida, Quercus alba, Quercus falcata, Quercus fusiformis, Quercus prinus, Quercus velutina, Ulmus crassifolia, Fraxinus texensis, Diospyros virginiana, Chionanthus virginicus, Cercis canadensis, Forestiera pubescens*, and *Vaccinium arboreum*. *Pinus palustris* may be present in this alliance in the West Gulf Coastal Plain of eastern Texas and western Louisiana. In associations on mafic substrates, *Carya carolinae-septentrionalis, Ulmus alata, Fraxinus americana*, and *Cercis canadensis* are common. *Acer rubrum* and *Liquidambar styraciflua* increase with disturbance. Shrubs may be sparse to dense, and species present include *Viburnum rafinesquianum, Ilex longipes, Symphoricarpos orbiculatus, Gaylussacia baccata, Rhododendron canescens, Vaccinium stamineum, Vaccinium corymbosum*, and *Viburnum prunifolium*. In the southeastern Coastal Plain, some stands may contain *Quercus margarettiae*. A rare type that occurs in North and South Carolina has an herbaceous layer containing many prairie species such as *Silphium terebinthinaceum, Solidago nemoralis, Coreopsis major, Liatris aspera, Andropogon gerardii*, and *Sorghastrum nutans*. The most common herbaceous species are *Schizachyrium scoparium* and *Danthonia spicata*.

In Tennessee, woodlands in this alliance occur in the Central Basin and adjacent Highland Rim and may contain *Andropogon gerardii, Schizachyrium scoparium*, and/or *Sorghastrum nutans*. Pines are absent; instead, *Juniperus virginiana var. virginiana* may be present in the more-or-less open subcanopy. Shrubs in the Central Basin examples include *Forestiera ligustrina, Hypericum frondosum, Rhus aromatica*, and *Viburnum rufidulum*. Fire suppression in these sites may lead to dense undergrowth of *Juniperus*. In Louisiana and eastern Texas (and in the Sandhills of the southeastern Coastal Plain), this alliance results mostly from pine removal and fire suppression, and examples only marginally fit this concept. This alliance occurs on xeric sites in northwestern Arkansas and may include some of Arkansas's glade/outcrop complexes and prairie communities, as well as ridgetop savanna / glade communities. This alliance is widespread throughout the southeastern and lower midwestern United States and occurs in the following regions: Ozarks, Interior Low Plateau, Boston Mountains, Southern Piedmont, Southern Ridge and Valley, Arkansas Valley, Ouachita Mountains, Atlantic Coastal Plain, Upper East Gulf Coastal Plain (Black Belt), Crowley's Ridge, and the Prairie Parkland.

Environment: Some examples of this alliance occur on 2:1 clays (montmorillonitic), loams, sands and others on limestone- and sandstone-derived soils. This alliance occurs on xeric sites in northwestern Arkansas and may include some of Arkansas's glade/outcrop complexes and prairie communities. In the East Central Texas Plains, Crosstimbers and Edwards Plateau of Texas (Level III Ecoregions 33, 29 and 30, respectively (Griffith et al. 2004)), this alliance occurs on dry sites with a variety of soil types, from sands to gravelly clays that developed over Pleistocene alluvium and Cretaceous, Permian and Pennsylvanian sands, sandstones and limestone. In Louisiana and the Piney Woods of eastern Texas (and in the Sandhills of the southeastern Coastal Plain), this alliance results mostly from pine removal and fire suppression, and examples only marginally fit this concept.

Vegetation: *Quercus stellata* is a constant and diagnostic canopy dominant of this wide-ranging alliance, but the floristic composition of associated woody species can be quite variable. Canopy and subcanopy associates, in addition to *Quercus stellata* and *Quercus marilandica*, may include *Pinus echinata, Pinus virginiana, Carya texana, Carya glabra, Cornus florida, Ulmus crassifolia, Juniperus virginiana, Juniperus ashei, Quercus alba, Quercus velutina, Quercus falcata, Quercus prinus, Quercus fusiformis, Fraxinus texensis, Diospyros virginiana, Chionanthus virginicus, Cercis canadensis, Forestiera pubescens*, and *Vaccinium arboreum*. In associations on mafic substrates, *Carya carolinae-septentrionalis, Ulmus alata, Ulmus crassifolia, Quercus fusiformis, Fraxinus americana, Sideroxylon lanuginosum*, and *Cercis canadensis* are common. *Acer rubrum* and *Liquidambar styraciflua* increase with disturbance (within their ranges).

Shrubs may be sparse to dense, and species present include *Viburnum rafinesquianum, Ilex longipes, Symphoricarpos orbiculatus, Viburnum prunifolium, Forestiera pubescens, Viburnum rufidulum, Ilex decidua*, and *Vaccinium stamineum*. In the southeastern Coastal Plain, some stands may contain *Quercus margarettiae*. A rare type that occurs in North and South Carolina has an herbaceous layer containing many prairie species, such as *Silphium terebinthinaceum, Solidago nemoralis, Coreopsis major, Liatris aspera, Andropogon gerardii*, and *Sorghastrum nutans*. The most common herbaceous species are *Schizachyrium scoparium* and/or *Danthonia spicata*. In Tennessee, woodlands in this alliance occur in the Central Basin and adjacent Highland Rim and may contain *Andropogon gerardii, Schizachyrium scoparium*, and/or *Sorghastrum nutans*. Pines are absent; instead, *Juniperus virginiana var. virginiana* may be present in the more-or-less open subcanopy. Shrubs in these examples include *Forestiera ligustrina, Hypericum frondosum, Rhus aromatica*, and *Viburnum rufidulum*. Fire suppression in these sites may lead to dense undergrowth of *Juniperus* spp. In contrast to stands of the *~Quercus stellata - Quercus marilandica* Forest Alliance (A.253), stands of this alliance would be expected to have relatively grassy, rather than shrubby, understories.

Dynamics: Fire, climate, native grazing and edaphic factors all likely played a roll historically in maintaining an open structure in this vegetation. Loss of these natural processes often results in a shift toward a more closed canopy, an increase in successional woody species such as *Juniperus* spp., and a decrease in native grass cover.

Similar Alliances:

- *Juniperus virginiana - Quercus (stellata, velutina, marilandica)* Forest Alliance (A.383)
- *Quercus alba - Quercus stellata - Quercus velutina - (Quercus falcata)* Woodland Alliance (A.613)
- *Quercus prinus - Quercus marilandica* Woodland Alliance (A.623)
- *Quercus stellata - Quercus marilandica* Forest Alliance (A.253)--with a more closed canopy.

Similar Alliance Comments: The geographic and taxonomic relationship between these alliances needs to be clarified. These post oak - blackjack oak woodlands are more edaphically extreme or frequently burned than the corresponding *~Quercus stellata - Quercus marilandica* Forest Alliance (A.253), which is currently more common due to fire suppression. The taxonomic and floristic variability of this alliance may warrant separation into two or more distinct alliances.

ALLIANCE DISTRIBUTION

Range: This alliance is widespread throughout the southeastern, south-central and lower midwestern United States and occurs in the following regions: Ozarks, Interior Low Plateau, Boston Mountains, Southern Piedmont, Southern Ridge and Valley, Arkansas Valley, Ouachita Mountains, Atlantic Coastal Plain, Upper East Gulf Coastal Plain (Black Belt), Crowley's Ridge, Prairie Parkland, Crosstimbers and Prairies, Oak Woods and Prairies and the Edwards Plateau.. In addition, an inland dune association of New Jersey and New York is placed here.

Nations: US

Subnations: AL, AR, GA, IA?, IL, IN, KS, KY, LA, MO, MS, NC, NJ, NY, OK, SC, TN, TX, VA

TNC Ecoregions: 28:C, 29:C, 32:C, 33:C, 36:C, 37:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 52:C, 53:C, 56:P, 57:P, 62:C

USFS Ecoregions: 221Dc:CCC, 221Ha:CCP, 221Hc:CCC, 221Hd:CCP, 221He:CCP, 221Ja:CCP, 221Jb:CCC, 221Jc:CCP, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCC, 222Aj:CCC, 222Ak:CCC, 222Am:CCC, 222An:CCC, 222Aq:CCP, 222Ca:CCC, 222Cb:CCP, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Ch:CCP, 222Da:CCP, 222Db:CCP, 222Dc:CCC, 222Dd:CCP, 222De:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCP, 222Dj:CCC, 222Ea:CCP, 222Eb:CCC, 222Ec:CCC, 222Ed:CCC, 222Ee:CCP, 222Ef:CCP, 222Eg:CCC, 222Eh:CCC, 222Ei:CCP, 222Ej:CCP, 222Ek:CCP, 222En:CCP, 222Eo:CCP, 222Fa:CCP, 222Fb:CCP, 222Fc:CCP, 222Fd:CCP, 222Ff:CCP, 222Gb:CCC, 222Gc:CCP, 222Gd:CCP, 231Aa:CCC, 231Ab:CCP, 231Ac:CCP, 231Ad:CCP, 231Ae:CCC, 231Af:CCC, 231Ag:CCP, 231Ah:CCP, 231Ai:CCP, 231Aj:CCP, 231Ak:CCP, 231Al:CCP, 231Am:CCP, 231An:CCP, 231Ao:CCC, 231Ap:CCP, 231Ba:CCC, 231Bb:CCP, 231Bc:CCP, 231Bd:CCP, 231Be:CCP, 231Bf:CCP, 231Bg:CCP, 231Bh:CCP, 231Bi:CCP, 231Bj:CCP, 231Bk:CCP, 231Bl:CCP, 231Ca:CCP, 231Cb:CCP, 231Cc:CCP, 231Cd:CCC, 231Ce:CCP, 231Cf:CCP, 231Cg:CCP, 231Da:CCP, 231Db:CCP, 231Dc:CCP, 231Dd:CCP, 231De:CCP, 231Ea:CCC, 231Eb:CCC, 231Eh:CCC, 231Ej:CCC, 231Em:CCC, 231En:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ac:CCC, 232Bj:CC?, 232Bl:CC?, 232Bm:CC?, 232Bn:CC?, 232Bq:CCC, 232Fa:CCP, 232Fb:CCC, 232Fe:CCC, 234Ab:CCC, 234Ac:CCC, 234Ae:CCC, 234Ah:CC?, 251Cc:CCP, 251Cd:CCP, 251Ci:CCC, 251E:CC, 251Fc:CC?, 255Aa:CCC, 255Ab:CCC, 255Ac:CCP, 255Ad:CCC, 255Ae:CCC, 255Af:CCC, 255Ah:CCC, 255Ai:CCC, 255Aj:CCC, 255Ak:CCC, 255Ba:CCC, 255Ca:CCC, 255Cf:CCC, 311A:CC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: COE (Falls Lake, J. Percy Priest?, Kerr Reservoir, Lake Millwood); DOD (Arnold, Fort Benning, Fort Chaffee, Fort Hood, Fort Polk); NPS (Buffalo River, Chickasaw NRA, Mammoth Cave, Natchez Trace, Ozark Riverways, Shiloh, Stones River); USFS (Angelina, Cherokee, Conecuh, Daniel Boone, Davy Crockett?, De Soto, Holly

Springs, Kisatchie, Oconee, Ouachita, Ozark, Sabine, Sam Houston, Shawnee, Sumter, Talladega?, Tombigbee, Tuskegee, Uwharrie); USFWS (Piedmont)

ALLIANCE SOURCES

Author(s): D.J. Allard, mod. J. Teague

References: Allard 1990, Burns and Honkala 1990b, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Griffith et al. 2004, Hoagland 1998a, Nelson 1986, Pyne 1994, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d.

[CEGL004686] *Quercus stellata / Viburnum rufidulum / Schizachyrium scoparium - (Sorghastrum nutans, Helianthus eggertii)* Woodland

Translated Name: **Post Oak / Rusty Blackhaw / Little Bluestem - (Yellow Indiangrass, Eggert's Sunflower) Woodland**

Common Name: **Western Highland Rim Post Oak Barrens**

Ecological System(s):

- Western Highland Rim Prairie and Barrens (CES202.352)
- Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: These woodlands are dominated by *Quercus stellata*; a scattered to dense subcanopy of *Juniperus virginiana var. virginiana* may be present. This community occurs as open patches (10x30 m or larger) on droughty mid to upper slopes in the unglaciated Interior Low Plateau, including on shaly siltstones of the Fort Payne Formation in the dissected escarpment of the Western Highland Rim of Tennessee, and related sites at Mammoth Cave National Park (Kentucky). The soils in Tennessee examples are mapped as Bodine; this is a droughty, excessively well-drained soil from which calcium ions have been removed by leaching, making it more acidic. The vegetation most frequently occurs on south- to southwest-facing slopes at an elevation of 150-260 m (500-850 feet) msl but may occur on other aspects as well. This community provides habitat for *Helianthus eggertii*. While fire undoubtedly played a role in its maintenance, local edaphic conditions function to maintain this distinctive vegetation. The presence of a subcanopy of *Juniperus virginiana var. virginiana* is probably a symptom of fire suppression. Other woody plants observed include *Quercus marilandica* in the canopy, *Cercis canadensis* in the subcanopy, and *Viburnum rufidulum* in the shrub stratum. *Schizachyrium scoparium* dominates the herbaceous stratum, with *Sorghastrum nutans* present in some examples. Distinctive herbaceous species present include *Eryngium yuccifolium, Ionactis linariifolius, Liatris squarrosa, Polytaenia nuttallii*, and *Parthenium integrifolium var. integrifolium*. The herb layer also contains *Dodecatheon meadia, Manfreda virginica, Monarda fistulosa, Symphyotrichum shortii (= Aster shortii), Ruellia humilis, Helianthus divaricatus*, and *Isanthus brachiatus*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This post oak woodland was sampled at three locations in the park. Sites are gentle to moderate, south-facing (dry) mid to upper slopes at 238 to 262 m (780-860 feet) elevation. Soils are rapidly drained to well-drained sandy loam and silt loam. The unvegetated surface is dominated by leaf litter (80-98% cover) with some wood (0-3%), bare soil (0-2%), and lichens (0-20%). Evidence of disturbance includes past logging, animal grazing/browsing, erosion, fire suppression, and the presence of exotic plants. Drought and shallow soils at these sites contribute to the death of some of the larger trees and function to keep the sites open and favor light-demanding grasses and forbs.

Global Environment: This community occurs as open patches (10x30 m or larger) on mid to upper slopes of shaly siltstones of the Fort Payne Formation in the dissected escarpment of the Western Highland Rim of Tennessee. The soils are mapped as Bodine; this is a droughty, excessively well-drained soil from which calcium ions have been removed by leaching, making it more acidic. The vegetation most frequently occurs on south- to southwest-facing slopes at an elevation of 500-850 feet msl but may occur on other aspects as well. While fire undoubtedly played a role in its maintenance, local edaphic conditions function to maintain this distinctive vegetation. The presence of a subcanopy of *Juniperus virginiana var. virginiana* is probably a symptom of fire suppression.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The height of stands of this woodland can be quite variable, ranging from 5-35 m in sampled plots. The moderately sparse (40-50% cover) tree canopy is dominated by *Quercus stellata* but may also include substantial amounts of *Carya alba, Carya glabra, Cornus florida, Juniperus virginiana, Quercus coccinea*, and/or *Quercus marilandica*. The subcanopy (10-15 m) may be lacking or sparse (0-30%) includes *Juniperus virginiana,*

Quercus marilandica, Quercus stellata, and *Ulmus alata*. The sparse (30%) tall-shrub layer (1-5 m) may include *Juniperus virginiana, Nyssa sylvatica, Pinus virginiana, Rhus copallinum, Vaccinium arboreum*, and others. The sparse (20%) short-shrub layer (0.5-1 m) may include *Cercis canadensis, Liriodendron tulipifera, Rhus copallinum, Rosa carolina, Rubus argutus, Rubus flagellaris, Sassafras albidum*, and *Vaccinium arboreum*. The very sparse to moderate (10-50%) herbaceous layer may include *Andropogon gerardii, Coreopsis major, Danthonia spicata, Dichanthelium commutatum, Dichanthelium laxiflorum, Helianthus hirsutus, Lespedeza violacea, Lobelia spicata, Manfreda virginica, Packera anonyma, Parthenium integrifolium, Schizachyrium scoparium, Sericocarpus linifolius, Sorghastrum nutans, Tephrosia virginiana*, and others. Vines include *Smilax glauca* and *Vitis aestivalis*. This community also supports state-vulnerable *Dichanthelium aciculare*.

Global Vegetation: These woodlands are dominated by *Quercus stellata*; a scattered to dense subcanopy of *Juniperus virginiana var. virginiana* may be present. The presence of a subcanopy of *Juniperus virginiana var. virginiana* is probably a symptom of fire suppression. Other woody plants observed include *Quercus marilandica* in the canopy, *Cercis canadensis* in the subcanopy, and *Viburnum rufidulum* in the shrub stratum. *Schizachyrium scoparium* dominates the herbaceous stratum, with *Sorghastrum nutans* present in some examples. Distinctive herbaceous species present include *Eryngium yuccifolium, Ionactis linariifolius, Liatris squarrosa, Polytaenia nuttallii*, and *Parthenium integrifolium var. integrifolium*. The herb layer also contains *Dodecatheon meadia, Manfreda virginica, Monarda fistulosa, Symphyotrichum shortii (= Aster shortii), Ruellia humilis, Helianthus divaricatus*, and *Isanthus brachiatus*.

Global Dynamics: The vegetation most frequently occurs on south- to southwest-facing slopes at an elevation of 150 to 260 m (500-850 feet) but may occur on other aspects as well. While fire undoubtedly played a role in its maintenance, local edaphic conditions function to maintain this distinctive vegetation. The presence of a subcanopy of *Juniperus virginiana var. virginiana* is probably a symptom of fire suppression. In the absence of fire, all but the most droughty sites will probably become converted to forest. These remnant woodlands are probably representative of the more typical vegetation structure of the region during periods before extensive fire suppression.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree (canopy & subcanopy)	Needle-leaved tree	X	.	.
Carya glabra	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus marilandica	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	.	.
Quercus stellata	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Cornus florida	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus coccinea	Tree canopy	Broad-leaved deciduous tree	X	.	.
Ulmus alata Tree subcanopy	Broad-leaved deciduous tree	X	.	.	
Vaccinium arboreum	Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	X	.	.
Juniperus virginiana	Tall shrub/sapling	Needle-leaved shrub	X	.	.
Smilax glauca	Herb (field)	Vine/Liana	X	.	.
Helianthus hirsutus	Herb (field)	Forb	X	.	.
Lobelia spicata	Herb (field)	Forb	X	.	.
Manfreda virginica	Herb (field)	Forb	X	.	.
Sericocarpus linifolius	Herb (field)	Forb	X	.	.
Tephrosia virginiana	Herb (field)	Forb	X	.	.
Andropogon gerardii	Herb (field)	Graminoid	X	.	.
Danthonia spicata	Herb (field)	Graminoid	X	.	.
Dichanthelium laxiflorum	Herb (field)	Graminoid	X	.	.
Schizachyrium scoparium	Herb (field)	Graminoid	X	X	.
Sorghastrum nutans	Herb (field)	Graminoid	X	X	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Daucus carota	-	P	exotic
Dichanthelium aciculare	-	P	state-vulnerable

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Helianthus eggertii	G3	P	

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (5-Sep-2008). This woodland association is found in a restricted range and specific set of habitat conditions. It is known from areas of exposed, droughty soils in the unglaciated Interior Low Plateau of the central United States. Fire may have been an important factor in maintaining this vegetation type; in the absence of fire, all but the most droughty sites will probably convert to forest. These remnant woodlands are likely representative of the more typical vegetation structure of the region during periods before extensive fire suppression.

RELATED CONCEPTS

Global Similar Associations:

- *Quercus marilandica - (Juniperus virginiana) / Schizachyrium scoparium - Danthonia spicata* Wooded Herbaceous Vegetation (CEGL002428)

Global Related Concepts:

- Dry Post Oak - Blackjack Oak Forest (Pyne 1994) **B**
- IA6c. Dry Post Oak - Blackjack Oak Forest (Allard 1990) [in part] **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: Braun (1950) refers to "more xeric" communities "on flatter uplands with poor soil" containing *Quercus stellata* and *Quercus falcata* in addition to *Quercus velutina* and *Quercus marilandica*. In our data, the latter species is limited, mostly occurring in woodlands (more open stands) with *Quercus stellata*. These are referred to this association (CEGL004686), which seems to be the clearest fit with Braun's concept, but the correspondence is imperfect.

Mammoth Cave National Park Other Comments: This association was previously only known from small patches (about 10x30 m) on mid to upper slopes of shaly siltstones of the Fort Payne Formation in the dissected escarpment of the Western Highland Rim in northwestern Davidson County, Tennessee. There, it most frequently occurs on south- to southwest-facing slopes at an elevation of 200 to 230 m (650-750 feet) but may occur on other aspects as well. Stands have also been found in Kentucky at Mammoth Cave National Park. The presence of a subcanopy of *Juniperus virginiana var. virginiana* is probably a symptom of fire suppression.

Global Classification Comments: Examples are known from Beaman Park and Ridgetop Barrens, Davidson County, Tennessee. Stands have also been found in Kentucky at Mammoth Cave National Park. The same or closely related vegetation could occur in Alabama.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: Examples of this community have been found in two different locations on opposite ends of the park: on a dry ridge near the southern boundary on the Gherkin Formation, and on the far north boundary, presumably on a sandstone-derived soil.

Global Range: This association is known from areas of exposed, droughty soils in the unglaciated Interior Low Plateau of the central United States. It has been documented from Kentucky and Tennessee and could also occur on related strata and landforms in Alabama.

Nations: US

States/Provinces: AL?, KY, TN

TNC Ecoregions: 44:C

TNC Ecoregion Comments:

USFS Ecoregions: 222Dg:CCC, 222Dj:CCC, 222Ec:CCP, 222Eg:CCC, 222Eh:CCC

Federal Lands: NPS (Mammoth Cave, Natchez Trace)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.44, MACA.55, MACA.749.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990	.	X	X	X	.	.	.	.	
Braun 1950	X	.	.	.	.	.	.	.	
Frick 1939	X	.	X	X	.	.	.	.	
Pyne 1994	.	X	X	X	.	.	.	.	
Pyne 1997	X	.	X	X	.	.	.	.	
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.

III. Shrubland

III.B.2.N.a. Temperate cold-deciduous shrubland

A.1905 (Hydrangea *spp.,* Philadelphus *spp.)* / Heuchera *spp. Shrubland Alliance*

(Hydrangea species, Mock Orange species) / Alumroot species Shrubland Alliance

ALLIANCE CONCEPT

Summary: Stands of this alliance are physiognomically variable, edaphically controlled areas without a tree canopy. They are open zones in a primarily forested environment. Some examples are dry and others are moist with evident, at least seasonal, seepage. Stands occur in rocky places, typically either on solid vertical and near-vertical exposures, or cobble/channery debris fields of varying sizes. At a given location, the substrate may be composed of limestone, siltstone, mudstone, calcareous sandstones, as well as mafic metamorphic and igneous rocks. This alliance is potentially widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, Interior Low Plateau, and Interior Highlands. The vegetation composition is variable and often has a mixed and variable physiognomy. Individual occurrences may be herb-dominated, shrub-dominated, or sparsely vegetated with vascular plants (though sometimes with dense patchy cover of mosses, hepatics, or lichens). Characteristic shrubs are *Hydrangea* spp. (*Hydrangea arborescens, Hydrangea cinerea, Hydrangea radiata*), *Philadelphus* spp. (*Philadelphus hirsutus, Philadelphus inodorus, Philadelphus pubescens*), *Toxicodendron radicans, Physocarpus opulifolius*, and *Ribes* spp. (*Ribes cynosbati*). Characteristic herbs are *Heuchera* spp. (*Heuchera americana var. americana, Heuchera americana var. hirsuticaulis, Heuchera americana var. hispida, Heuchera caroliniana, Heuchera villosa var. arkansana, Heuchera villosa var. villosa*). Other species which are typical include various ferns (e.g., *Woodsia obtusa, Dryopteris* spp., *Cystopteris* spp.) and/or grasses (e.g., *Dichanthelium* spp., *Danthonia spicata, Deschampsia flexuosa*, and others). Some characteristic mosses include *Anomodon attenuatus* and *Anomodon rostratus*.

Environment: This alliance is known from vertical and near-vertical exposures of limestone, siltstone, mudstone, calcareous sandstones, and may also occur on mafic metamorphic and igneous rocks.

Vegetation: Characteristic shrubs are *Hydrangea* spp. (*Hydrangea arborescens, Hydrangea cinerea, Hydrangea radiata*), *Philadelphus* spp. (*Philadelphus hirsutus, Philadelphus inodorus, Philadelphus pubescens*), *Toxicodendron radicans, Physocarpus opulifolius*, and *Ribes* spp. (*Ribes cynosbati*). Characteristic herbs are *Heuchera* spp. (*Heuchera americana var. americana, Heuchera americana var. hirsuticaulis, Heuchera americana var. hispida, Heuchera caroliniana, Heuchera villosa var. arkansana, Heuchera villosa var. villosa*). Other species which are typical include *Dichanthelium* spp., *Woodsia obtusa, Dryopteris* spp., *Cystopteris* spp., *Danthonia spicata, Deschampsia flexuosa*, and others. Characteristic mosses include *Anomodon attenuatus* and *Anomodon rostratus*.

Dynamics:

Similar Alliances:

- *Impatiens pallida - Cystopteris bulbifera - Adoxa moschatellina* Herbaceous Alliance (A.1598)--appears to be related midwestern alliance in terms of its environment to some members of this alliance (A.1905).

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: The alliance is potentially widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, Interior Low Plateau, and Interior Highlands. It is found in Alabama, Arkansas, Kentucky, North Carolina, Tennessee, Virginia and Maryland, and possibly Georgia, Mississippi, and Oklahoma.

Nations: US

Subnations: AL, AR, GA, KY, MD, MS?, NC, OK?, TN, VA

TNC Ecoregions: 38:C, 39:C, 43:P, 44:C, 50:C, 51:C, 52:C, 59:P

USFS Ecoregions: 221Hc:CCC, 222Dg:CCC, 222Ea:CCC, 222Eb:CCC, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Eo:CCC, 231A:CC, 231Be:CPP, 231Gb:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC

Federal Lands: NPS (Abe Lincoln Birthplace, Blue Ridge Parkway?, C&O Canal, Harpers Ferry, Kennesaw Mountain, Mammoth Cave, Manassas, Natchez Trace, Russell Cave); USFS (Chattahoochee?, Cherokee, Jefferson, Ouachita?, Ozark, Pisgah)

ALLIANCE SOURCES

Author(s): A.S. Weakley, mod. M. Pyne

References: Southeastern Ecology Working Group n.d.

[CEGL004708] *Hydrangea arborescens / Impatiens (capensis, pallida) - Heuchera villosa* Shrubland

Translated Name: **Wild Hydrangea / (Orange Jewelweed, Yellow Jewelweed) - Rock Alumroot Shrubland**

Common Name: **Highland Rim Limestone Cliff/Talus Seep**

Ecological System(s):

- Central Interior Calcareous Cliff and Talus (CES202.690)
- Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: This association includes forb-dominated seepage vegetation from low to moderate elevations (about 305-400 m [1000-1300 feet]) in the Interior Low Plateau, Highland Rim Section. Examples are found on saturated, sloping to concave to near-vertical exposures of gray calcareous mudstones and/or siltstones of the Fort Payne Formation, as well as on other calcareous substrates, and on the walls of sinkholes which develop in the St. Louis Limestone at Mammoth Cave National Park, Kentucky. These exposures vary greatly in size, from about 10 to perhaps 50 square meters. The seeps occur where blocky limestones with vertical fissures and joints overlie more flatly bedded strata. Herbs observed include *Impatiens capensis, Impatiens pallida, Heuchera villosa, Saxifraga virginiensis, Dodecatheon meadia, Cardamine diphylla, Polymnia canadensis*, and *Thaspium pinnatifidum* (*sensu lato*). They are primarily herbaceous systems but may be ringed by shrubs. *Hydrangea arborescens* is invariably present and often dominant in this marginal shrub zone; other shrubs present include *Staphylea trifolia* and *Hypericum prolificum*. Sheltered areas under rock overhangs or boulders may harbor thallose liverworts and various mosses, including *Mnium* sp. This distinctive vegetation is maintained by seepage from the siltstones; this seepage and the steep irregular topography do not allow trees to take hold and dominate the community. In a sparsely vegetated variant on near-vertical, gently concave exposures of gray siltstone talus of the Fort Payne, *Polymnia canadensis* and *Heuchera villosa* dominate; also present in this variant are *Pellaea atropurpurea, Monarda fistulosa*, and *Packera obovata (= Senecio obovatus)*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This smooth hydrangea shrubland was sampled at one location in the park. The site is a cliff overhang in a sinkhole in the St. Louis Limestone. The unvegetated surface is dominated by exposed bedrock (90% cover) with some leaf litter (5%) and bare soil (5%). Due to the inaccessibility of the site, limited data could be collected.

Global Environment: This association includes forb-dominated seepage vegetation from low to moderate elevations (about 300-400 m [1000-1300 feet]) in the Interior Low Plateau, Highland Rim Section. Examples are found on saturated, sloping to concave to near-vertical exposures of gray calcareous mudstones and/or siltstones of the Fort Payne Formation, as well as on other calcareous substrates, as in sinkholes which develop in the St. Louis Limestone at Mammoth Cave National Park, Kentucky. These exposures vary greatly in size, from about 10 to perhaps 50 square meters.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderate (50%) tall-shrub layer (1-2 m) is dominated almost exclusively by *Hydrangea arborescens*; no other species were reported. The sparse (30%) herbaceous layer includes *Heuchera americana, Hydrophyllum* sp., *Impatiens pallida*, and *Sedum ternatum*. Vines include *Parthenocissus quinquefolia*. Only limited floristic data could be collected due to the inaccessibility of the site.

Global Vegetation: Stands are characterized by moderate cover of *Hydrangea arborescens* over scattered and variable herbs, ferns, and nonvascular plants. Herbs observed include *Impatiens capensis, Impatiens pallida, Heuchera villosa, Saxifraga virginiensis, Dodecatheon meadia, Cardamine diphylla, Polymnia canadensis*, and *Thaspium pinnatifidum* (*sensu lato*). Other *Heuchera* spp. may be present. Some examples are primarily herbaceous, but may be ringed by shrubs. *Hydrangea arborescens* is invariably present and often dominant in this marginal shrub zone; other shrubs present include *Staphylea trifolia* and *Hypericum prolificum*. Sheltered areas under rock overhangs or boulders may harbor thallose liverworts and various mosses, including *Mnium* sp. In a sparsely vegetated variant on near-vertical, gently concave exposures of gray siltstone talus of the Fort Payne, *Polymnia canadensis* and *Heuchera villosa* dominate; also present in this variant are *Pellaea atropurpurea, Monarda fistulosa*, and *Packera obovata (= Senecio obovatus)*.

Global Dynamics: The seeps occur where blocky limestones with vertical fissures and joints overlie more flatly bedded strata. This distinctive vegetation is maintained by seepage from the siltstones; this seepage and the steep irregular topography do not allow trees to take hold and dominate the community.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Hydrangea arborescens	Tall shrub/sapling	Broad-leaved deciduous shrub	X	X	.

Parthenocissus quinquefolia	Herb (field)	Vine/Liana	X	.	.
Heuchera americana	Herb (field)	Forb	X	X	.
Impatiens pallida	Herb (field)	Forb	X	X	.
Sedum ternatum	Herb (field)	Forb	X	.	.

Higher Taxon Name	Note
Hydrophyllum sp.	dominant forb

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Thaspium pinnatifidum	G2G3	P	vulnerable

CONSERVATION STATUS RANK

Global Rank & Reasons: G3 (31-Jan-2007). This community is restricted to the southern Interior Low Plateau. It is well-distributed in the Eastern and Western Highland Rim of Tennessee, extending north at least into south-central Kentucky (at Mammoth Cave National Park), and may range as far south and west as Alabama and northeastern Mississippi. There are probably at least 50 EOs of this community, although not many are documented. Most sites would be expected to be small ones, less than an acre in extent. An outstanding example would need to be well-situated in a matrix of hardwood forest, and well-buffered from disturbances or hydrologic alterations. This association is threatened by the effects of upslope timber removal and from alterations to the groundwater hydrology. This type would generally not have decreased in extent, although some examples may be less well-buffered or protected from disturbance than in the past.

RELATED CONCEPTS

Global Similar Associations:
Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: This shrubland was only sampled once from a distance as the steep terrain made it impossible to get closer.
Mammoth Cave National Park Other Comments:
Global Classification Comments: These habitats are commonly utilized by a variety of salamanders. The *Heuchera villosa* present in this community has often been treated as *Heuchera villosa var. macrorhiza*, now recognized by Kartesz (1999) as *Heuchera villosa var. villosa*. Vegetation related to this ("Calcareous Seep") is reported from Mississippi; its precise composition needs to be verified.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is of local and limited distribution, on limestones not sandstones. The best known (and only sampled) stand is in Cedar Sink, a sinkhole in the St. Louis Limestone.
Global Range: This association is well-distributed in the Eastern and Western Highland Rim of Tennessee, extending north at least into south-central Kentucky (at Mammoth Cave National Park), and may range as far south and west as Alabama and northeastern Mississippi.
Nations: US
States/Provinces: AL?, KY, MS?, TN
TNC Ecoregions: 43:P, 44:C
TNC Ecoregion Comments:
USFS Ecoregions: 221Hc:CCC, 222Dg:CCC, 222Ea:CCC, 222Eb:CCC, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Eo:CCC, 231Be:PPP
Federal Lands: NPS (Abe Lincoln Birthplace, Mammoth Cave, Natchez Trace)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: MACA.57.
Local Description Author(s): M.J. Russo and M. Pyne
Global Description Author(s): M. Pyne
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Pyne 1997 .	X	.	X	X	.	.	.	.	
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Wieland 1994b	.	.	.	X	X	.	.	.	.
Wieland 2000b	.	.	.	X	.	.	.	.	.

A.908 Rubus (argutus, trivialis) *Shrubland Alliance*

(Sawtooth Blackberry, Southern Dewberry) Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance includes successional vegetation which develops following disturbance (complete forest canopy removal) dominated by *Rubus argutus* and/or *Rubus trivialis*. Many examples also contain *Smilax* spp. and a great variety of tree saplings and other woody species. In central Tennessee, these may include *Quercus* spp., *Liquidambar styraciflua, Acer rubrum*, and *Rhus copallinum*. Herbs in central Tennessee examples may include *Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*; grasses may include *Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium*, and *Sorghastrum nutans*.

Environment: Stands of this alliance are successional, and develop following disturbance (complete forest canopy removal).

Vegetation: Stands of this alliance are successional and develop following disturbance (complete forest canopy removal). These stands are dominated by *Rubus argutus* and/or *Rubus trivialis*. Many examples also contain *Smilax* spp. and a great variety of tree saplings and other woody species. In central Tennessee, these may include *Quercus* spp., *Liquidambar styraciflua, Acer rubrum*, and *Rhus copallinum*. Herbs in central Tennessee examples may include *Solidago* spp., *Helianthus* spp., other Asteraceae spp., *Hypericum* spp., *Potentilla simplex*; grasses may include *Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium*, and *Sorghastrum nutans*.

Dynamics: Stands of this alliance are successional and develop following disturbance (complete forest canopy removal).

Similar Alliances:

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found from Kentucky, Tennessee and the Carolinas south into Georgia and possibly Mississippi and Alabama. Its full distribution has not been documented.

Nations: US

Subnations: AL?, GA, KY, MS?, NC, SC, TN

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 56:C

USFS Ecoregions: 221Ae:CCC, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222Ed:CCC, 231Aa:CCC, 231Ae:CCC, 232Ce:CCC, M221Dd:CCC

Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold); NPS (Big South Fork, Blue Ridge Parkway, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Kings Mountain, Mammoth Cave?, Ninety Six, Obed, Stones River); USFS (Talladega, Tuskegee?)

ALLIANCE SOURCES

Author(s): M.J. Russo 2-97, mod. M. Pyne

References: Southeastern Ecology Working Group n.d.

[CEGL004732] *Rubus (argutus, trivialis) - Smilax (glauca, rotundifolia)* Shrubland

Translated Name: **(Sawtooth Blackberry, Southern Dewberry) - (Whiteleaf Greenbrier, Common Greenbrier) Shrubland**

Common Name: **Blackberry - Greenbrier Successional Shrubland Thicket**

Ecological System(s):

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M.J. Russo

ELEMENT CONCEPT

Global Summary: Stands of this successional community develop following disturbance (complete forest canopy removal). These stands are dominated by greenbrier species (*Smilax glauca, Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus, Rubus trivialis*). Many examples include a great variety of tree saplings and other woody species (*Quercus* spp., *Liquidambar styraciflua, Acer rubrum, Diospyros virginiana, Juniperus virginiana var.*

virginiana, Rhus copallinum), herbs (*Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*), and grasses (*Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium, Lolium* spp., and *Sorghastrum nutans*). Communities that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have *Lonicera japonica* as a codominant vine overtopping much of the blackberry and greenbrier.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This association was not documented at Mammoth Cave, although it is expected to occur there.

Global Environment: This community can exist in both lowlands and uplands that have been cleared but have not been further disturbed by continued mowing or plowing for 3-5 years.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This association was not documented at Mammoth Cave, although it is expected to occur there.

Global Vegetation: Stands of this association are dominated by greenbrier species (*Smilax glauca, Smilax rotundifolia*) and blackberries/dewberries (*Rubus argutus, Rubus trivialis*). They also contain a great variety of tree saplings and other woody species (e.g., *Quercus* spp., *Liquidambar styraciflua, Acer rubrum, Rhus copallinum*). Some herbs in central Tennessee examples may include *Solidago* spp., Asteraceae spp., *Helianthus* spp., *Hypericum* spp., *Potentilla simplex*; grasses may include *Andropogon* spp., *Dichanthelium* spp., *Panicum* spp., *Schizachyrium scoparium, Lolium* spp., and *Sorghastrum nutans*. Communities that are surrounded by relatively intact ecosystems will tend to have more native species. Those surrounded by old fields or fragmented by development tend to have *Lonicera japonica* as a codominant vine overtopping much of the blackberry and greenbrier.

Global Dynamics: Stands of this successional community develop following disturbance (complete forest canopy removal) followed by a period of no disturbance of 3-5 years.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Symphyotrichum georgianum	G2G3	P	Federal candidate for listing

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (1-Oct-2001). This type represents ruderal successional vegetation dominated by species native to North America.

RELATED CONCEPTS

Global Similar Associations:

Global Related Concepts:

- Abandoned Strip Mines (Schmalzer and DeSelm 1982) **I**
- Cleared Areas (Schmalzer and DeSelm 1982) **I**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: In sandy parts of the southeastern U.S. Coastal Plain (e.g., Fort Benning, Georgia) the common blackberry is *Rubus cuneifolius*, and it does not form monocultural stands worthy of recognition as a vegetation type. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, this community is often found in powerline corridors and other areas that have experienced total canopy removal.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association was not documented at Mammoth Cave, although it is expected to occur there. It results from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist.

Global Range: This ruderal successional vegetation could be found throughout the upper southern United States.

Nations: US

States/Provinces: AL?, GA, KY, MS?, NC, SC, TN

TNC Ecoregions: 43:C, 44:C, 50:C, 51:C, 52:C, 56:C
TNC Ecoregion Comments: ECO56 & 232Ce added for Coastal Georgia Land Conservation Initiative (mjr 8-08). ECO51 & M221Dd added for Cherokee Nation (mjr 11-07).
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222Ed:CCC, 231Aa:CCC, 231Ae:CCC, 232Ce:CCC, M221Dd:CCC
Federal Lands: BIA (Eastern Band of Cherokee); DOD (Arnold); NPS (Big South Fork, Blue Ridge Parkway, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Cumberland Gap, Kings Mountain, Mammoth Cave?, Ninety Six, Obed, Stones River); USFS (Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: None.
Local Description Author(s): M. Pyne
Global Description Author(s): M.J. Russo, mod. R. White
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Peet et al. unpubl. data 2002	.	.	.	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	.	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	

III.B.2.N.e. Seasonally flooded cold-deciduous shrubland

A.988 Cephalanthus occidentalis *Seasonally Flooded Shrubland Alliance*

Common Buttonbush Seasonally Flooded Shrubland Alliance

ALLIANCE CONCEPT

Summary: This alliance is widespread in North America. It occurs in the Coastal Plain of Delaware, Maryland and Virginia and possibly along the Atlantic Coast north to Massachusetts, the Interior Low Plateau of Tennessee, and possibly adjoining states, in the Gulf Coastal Plain, in the Edwards Plateau and Lampasas Cutplain of central Texas and in California. Vegetation in this alliance occurs in seasonally flooded basins and lakeshores in which the water level generally is beneath the soil surface by the end of the growing season. It occurs in ponds over fragipan soils in southeastern central Tennessee. *Cephalanthus occidentalis* is the dominant species. Herbaceous species that may be present vary geographically and may include *Carex striata, Glyceria* spp., *Polygonum amphibium*, and *Panicum verrucosum*.
Environment: This alliance grows in seasonally flooded basins in which the water is generally subsurface by the end of the growing season. In southeastern Tennessee, this alliance includes shrub vegetation of ponds over fragipan soils. California's Mediterranean climate typically saturates floodplains throughout the winter months and allows gradual dry-down by mid-summer. In California, yearly precipitation totals average approximately 50 to 80 cm. Summers are quite dry and warm; winters are cool and moist. In California, the alliance is often associated with quiet waters like sloughs and oxbow lakes but is restricted to intermittently flooded, seasonally saturated floodplains. It requires poorly aerated, fine-textured soils.
Vegetation: Stands of this alliance are dominated by *Cephalanthus occidentalis*. Other shrubs present in California may include *Salix exigua, Salix lucida ssp. lasiandra*, and *Cornus sericea*. The herbaceous layer may be dominated by graminoids. In the east, associates include *Decodon verticillatus, Carex striata, Glyceria* spp., *Polygonum amphibium*, and *Panicum verrucosum*.
Dynamics: Seasonal flooding is important to maintain this alliance.
Similar Alliances:
- *Cephalanthus occidentalis* Semipermanently Flooded Shrubland Alliance (A.1011)

Similar Alliance Comments: *Cephalanthus occidentalis* is often found as a component of other riparian alliances. Where it forms stands, it often occurs in a fine-grained mosaic with other riparian alliances, like the ~*Salix lucida* Temporarily Flooded Shrubland Alliance (A.979).

ALLIANCE DISTRIBUTION

Range: This alliance is widespread in North America. It occurs in the Coastal Plain in Delaware, Maryland and Virginia and possibly along the Atlantic Coast north to Massachusetts, the Interior Low Plateau of Tennessee, and possibly adjoining states, in the Gulf Coastal Plain, in the Edwards Plateau and Lampasas Cutplain of central Texas and in California. In California, this alliance occurs throughout the inner northern and central Coast Ranges, the foothills of the Sierra Nevada and the Klamath and Cascade mountains, and in the Great Central Valley.
Nations: US
Subnations: AL?, AR, CA, DE, GA, IL, IN, KY, MA?, MD, MO, MS?, RI?, TN, TX, VA
TNC Ecoregions: 4:C, 5:C, 13:C, 15:C, 29:C, 32:P, 38:C, 39:C, 40:C, 43:P, 44:C, 50:C, 58:C, 59:C, 62:C
USFS Ecoregions: 221A:CC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Dg:CCC, 222Eb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ac:CCC, 232B:CC, 234Aa:CCP, 234Ac:CCC, 234Ae:CCC, 234Af:CCP, 234Ag:CCP, 234Ah:CCP, 234Ai:CCP, 234Ak:CCP, 234Al:CCP, 234Am:CCP, 234An:CCC, 255Ai:CCC, 262A:CC, M221Ab:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC, M261A:CC, M261C:CC, M261F:CC, M261G:CC, M262A:CC
Federal Lands: DOD (Arnold, Fort Benning, Fort Hood); NPS (Mammoth Cave, Ozark Riverways); USFS (George Washington, Mark Twain); USFWS (Felsenthal, Pond Creek, Prime Hook)

ALLIANCE SOURCES

Author(s): Eastern Ecology Group, mod. M. Schindel and J. Teague
References: Eastern Ecology Working Group n.d., Holland 1986b, Sawyer and Keeler-Wolf 1995, Sneddon 1994

[CEGL004742] *Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland

Translated Name: **Common Buttonbush / Eastern Rosemallow Depression Pond Shrubland**
Common Name: **Buttonbush Sinkhole Pond Swamp**
Ecological System(s):
- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)
- East Gulf Coastal Plain Depression Pondshore (CES203.558)

Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): M. Pyne and M.J. Russo, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This buttonbush sinkhole pond type occurs in the south-central United States. This shrubland occupies the central portions of small shallow water depressions which have little or no arborescent overstory; adjacent trees are commonly *Quercus phellos* and *Liquidambar styraciflua*. *Cephalanthus occidentalis* and *Hibiscus moscheutos ssp. moscheutos* comprise the shrub stratum in water less than 1 m deep. Other woody species commonly encountered along drier margins of Tennessee examples include *Cornus amomum, Cornus foemina, Cornus racemosa, Nyssa biflora, Vaccinium fuscatum, Acer rubrum, Carpinus caroliniana, Oxydendrum arboreum, Itea virginica, Smilax rotundifolia*, and *Salix humilis*. Sedges and grasses are the dominant herbaceous species present and may include *Juncus repens, Rhynchospora corniculata, Carex gigantea, Carex intumescens, Leersia hexandra, Saccharum baldwinii, Glyceria septentrionalis, Panicum hemitomon*, and *Dulichium arundinaceum*. The last two species may develop into separate associations forming a mosaic within the small open depressions. Other herbs which may occur include *Polygonum hydropiperoides, Polygonum amphibium, Proserpinaca pectinata, Triadenum walteri*, and *Ludwigia* spp. In Missouri, species include *Bidens discoidea, Carex alata, Carex comosa, Decodon verticillatus, Galium tinctorium, Glyceria acutiflora, Hibiscus moscheutos ssp. lasiocarpos, Triadenum walteri (= Hypericum walteri)*, and *Hottonia inflata*. State-rare species that may be found in Tennessee examples of this community include *Ludwigia sphaerocarpa, Carex barrattii, Panicum hemitomon*, and *Dichanthelium dichotomum var. ensifolium (= Dichanthelium ensifolium)*. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. Soils are silt loams, which are poorly drained soils derived from a thin layer of loess-like silt overlying cherty limestone residuum. They are also underlain by fragipans which may occur as little as 30 cm below the surface or up to 1 m deep. This layer is rarely uniform in thickness, ranging from 15-75 cm thick, or development, ranging from weakly to strongly developed. These soils have variable chemistry, but can be very acidic and low in nutrients.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine
Mammoth Cave National Park Environment: This buttonbush sinkhole pond shrubland was sampled at one location in the park. The site is a flat depression at 300 m (980 feet) elevation. The unvegetated surface is made up of leaf litter (40% cover) and standing water (60%). No other environmental data were recorded. This vegetation occurs as part of a

zonation, being found between the open water of the pond and a surrounding ring of wetland forest, ~*Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432).

Global Environment: Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. Soils are silt loams, which are poorly drained soils derived from a thin layer of loess-like silt overlying cherty limestone residuum. They are also underlain by fragipans which may occur as little as 30 cm below the surface or up to 1 meter deep. This layer is rarely uniform in thickness, ranging from 15-75 cm thick, or in development, ranging from weakly to strongly developed. These soils have variable chemistry, but can be very acidic and low in nutrients (Nelson 1985, TNC 1998a).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: At Mammoth Cave, stands are dominated by moderate cover of *Cephalanthus occidentalis*, with *Cornus foemina* and other shrubs and small trees. Depending on the scale of the sample plot, some low cover of trees from surrounding forested zones may be included, as well as herbs. This community is dominated by the shrub layer; however, in this example, there is a very sparse (10% cover) emergent tree canopy, 15-20 m tall, of *Acer rubrum var. trilobum* and *Quercus palustris*. The sparse (30%) tall-shrub layer (2-5 m) is dominated by *Cephalanthus occidentalis* and includes lesser amounts of *Cornus foemina*. The moderate (50%) herbaceous layer includes *Carex crinita, Carex lurida, Dulichium arundinaceum*, and the floating aquatic *Lemna minor*. *Apios americana* is the dominant vine. Stands are typically adjacent to and/or interfingered with areas of ~*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413) and ~*Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432).

Global Vegetation: This shrubland occupies the central portions of small shallow water depressions which have little or no arborescent overstory; adjacent trees are commonly *Quercus phellos* and *Liquidambar styraciflua*. *Cephalanthus occidentalis* and *Hibiscus moscheutos ssp. moscheutos* comprise the shrub stratum in water less than 1 m deep. Other woody species commonly encountered along drier margins of Tennessee examples include *Cornus amomum, Cornus foemina, Cornus racemosa, Nyssa biflora, Vaccinium fuscatum, Acer rubrum, Carpinus caroliniana, Oxydendrum arboreum, Itea virginica, Smilax rotundifolia*, and *Salix humilis*. Sedges and grasses are the dominant herbaceous species present and may include *Juncus repens, Rhynchospora corniculata, Carex gigantea, Carex intumescens, Leersia hexandra, Saccharum baldwinii, Glyceria septentrionalis, Panicum hemitomon*, and *Dulichium arundinaceum*. The last two species may develop into separate associations forming a mosaic within the small open depressions. Other herbs which may occur include *Polygonum hydropiperoides, Polygonum amphibium, Proserpinaca pectinata, Triadenum walteri*, and *Ludwigia* spp. In Missouri, species include *Bidens discoidea, Carex alata, Carex comosa, Decodon verticillatus, Galium tinctorium, Glyceria acutiflora, Hibiscus moscheutos ssp. lasiocarpos, Triadenum walteri (= Hypericum walteri)*, and *Hottonia inflata* (Nelson 1985). State-rare species that may be found in Tennessee examples of this community include *Ludwigia sphaerocarpa, Carex barrattii, Panicum hemitomon*, and *Dichanthelium dichotomum var. ensifolium (= Dichanthelium ensifolium)* (TNC 1998a).

Global Dynamics: This shrubland occupies the central portions of small shallow water depressions, which are subject to seasonal flooding, thus restricting plant growth to certain flood-tolerant taxa. In fire-prone landscapes, fires may pass through these communities on occasion.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Cephalanthus occidentalis	Tall shrub/sapling	Broad-leaved deciduous shrub	X	X	.
Cornus foemina	Tall shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Apios americana	Herb (field)	Forb	X	.	.
Carex crinita	Herb (field)	Graminoid	X	.	.
Carex lurida	Herb (field)	Graminoid	X	.	.
Dulichium arundinaceum	Herb (field)	Graminoid	X	.	.
Lemna minor	Floating aquatic	Aquatic herb (floating & submergent)	X	.	.

.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (19-Sep-2001). There are probably fewer than 100 occurrences rangewide. Currently 22 occurrences have been documented from Missouri (where it is ranked S1). The community may also occur in Indiana. There are probably fewer than 500 acres rangewide. Currently 85 acres have been documented at 17 of the 22 known sites. This community is documented from 6 ecoregion subsections in the Ozark Highlands section. This community has fairly narrow habitat requirements and may have always been rare. Very few high-quality examples are known in Tennessee.

RELATED CONCEPTS

Global Similar Associations:

- *Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413)
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191)
- *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905)
- *Nyssa aquatica / Cephalanthus occidentalis* Pond Forest (CEGL004712)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: At Mammoth Cave National Park, some open-canopy depression ponds are in effect a combination of herbaceous communities ~*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413) and ~*Typha latifolia* Southern Herbaceous Vegetation (CEGL004150), and shrubby buttonbush-dominated vegetation, ~*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742). One plot each has been attributed to CEGL002413 and CEGL004742, but CEGL004150 is also present at MACA, although no plots were sampled.

Mammoth Cave National Park Other Comments:

Global Classification Comments: Type concept of the former CEGL002414 was taken from the Missouri state type - "pond shrub swamp" (Nelson 1985). The herbaceous equivalent of Missouri examples of this type (Nelson's "pond shrub swamp") is ~*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413), and distinctions between the two may be difficult to make. Type needs continuing rangewide review and integration. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, examples of this community can be found at Clay Pond, Cow Pond, Lemm Pond, and Heron Ponds. Will this type require geographic subdivision as more information becomes available?

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This community is found at Sloan's Pond. There may be other examples as well. It could occur throughout the park in open, wet areas.

Global Range: This buttonbush sinkhole pond type occurs in the south-central United States, ranging from Missouri, Illinois, and Indiana, south to Tennessee and Georgia, and possibly Alabama and Mississippi.

Nations: US

States/Provinces: AL?, GA, IL, IN, KY, MO:S2, MS?, TN

TNC Ecoregions: 38:C, 43:P, 44:C, 50:C

TNC Ecoregion Comments: ECO38 added REE 1-01. ECO50 changed from ? to C per Jon Ambrose SL 5-00.

USFS Ecoregions: 222Dg:CCC, 222Eb:CCC

Federal Lands: DOD (Arnold); NPS (Mammoth Cave, Ozark Riverways); USFS (Mark Twain)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes: This vegetation is also found adjacent to plot MACA.706.

Mammoth Cave National Park Plots: MACA.53.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Pyne, mod. D. Faber-Langendoen

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Nelson 1985	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	X	.	.	.	.	

V. Herbaceous Vegetation

V.A.5.N.a. Tall sod temperate grassland

A.1192 Andropogon gerardii - (Sorghastrum nutans) *Herbaceous Alliance*

Big Bluestem - (Yellow Indiangrass) Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance is a very widespread mesic tallgrass prairie, which occurs in central North America. Stands of this alliance occur on flat to rolling topography. In the western and southern U.S., stands are found on lower slopes and valleys that receive extra moisture. On the western plains, the alliance can be found in areas with gravelly soil where water infiltrates below the surface but is held by an impermeable subsurface layer. Floodplain and toeslope soils are deep and fine-textured, whereas the foothills soils are coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance in found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams). In other parts of this alliance's range, stands can be found on many topographic positions. Soils are generally fertile, deep, slightly acidic, and moderately to well-drained. In glacial lakeplains near the Great Lakes, soils tend to be more poorly drained. Soils moisture is generally mesic, although it can vary from dry-mesic to wet-mesic. Soil texture can range from clay loams to sands.

Most communities have moderately dense to dense vegetation dominated by graminoids 1-2 m tall. *Andropogon gerardii* is dominant across this alliance's range. Other abundant species include *Bouteloua curtipendula, Pascopyrum smithii* (in the western portions of this alliance's range), *Schizachyrium scoparium, Sorghastrum nutans* (in the center and east), *Sporobolus heterolepis* (in the Great Plains), and *Hesperostipa spartea (= Stipa spartea)* (in the northern Great Plains). In Montana, *Festuca idahoensis* (at its eastern range limits) is codominant in an association in this alliance. Forbs are abundant in stands of this alliance, especially in the more humid East. Among these are *Aletris farinosa* (in the East), Asteraceae spp., *Echinacea pallida, Helianthus grosseserratus, Liatris pycnostachya, Phlox pilosa, Ratibida pinnata, Silphium laciniatum* (in the center), and *Solidago* spp. *Galium boreale* and *Oxalis* sp. are more common in northern tallgrass prairies than in southern. Trees and tall shrubs are infrequent in high-quality stands, especially in the Great Plains. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Quercus macrocarpa* (in the central and eastern portions of this alliance's range).

In the far western extent, vegetation in this alliance is a relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparium, Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses. The alliance is found in mesic areas along the Colorado Front Range. Landform position and soil texture dictate potential sites, as precipitation is generally not adequate to support stands of this alliance. In localized areas, hydrological processes of the site enhance the soil moisture. Along the Front Range, "relict" true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands. Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach for plant roots.

Environment: Stands of this alliance occur on flat to rolling topography. In the west and south, stands are found on lower slopes and valleys that receive extra moisture (Hanson and Whitman 1938). In other parts of this alliance's range, stands can be found on many topographic positions. Soils are generally fertile, deep, slightly acidic, and moderately to well-drained (Curtis 1959, Tatina 1987). In glacial lakeplains near the Great Lakes, soils tend to be more poorly drained (Comer et al. 1995). Soil moisture is generally mesic, although it can vary from dry-mesic to wet-mesic. Soil texture can range from clay loams to sands.

In the west, this alliance is found in mesic areas along the Colorado Front Range and Missouri River Basin in Montana and Wyoming. Landform position and soil texture dictate potential sites, as precipitation is generally not adequate to support stands of this alliance. In localized areas, hydrologic processes of the site enhance the soil moisture. Along the Front Range, 'relict' true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands (Bichel 1959, Livingston 1952). Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach of plant roots. On the plains the alliance can be found in areas with gravelly soil where water infiltrates below the surface, but is held by an impermeable subsurface layer. Floodplain and toeslope soils are deep and fine-textured, whereas the foothills soils are coarse-textured, often with

cobble-sized rocks. In the northwestern plains, this alliance is found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams).

Vegetation: This alliance is a very widespread mesic tallgrass prairie, which occurs in central North America. Most communities have moderately dense to dense vegetation dominated by graminoids 1-2 m tall. *Andropogon gerardii* is dominant across this alliance's range. Other abundant species include *Bouteloua curtipendula, Pascopyrum smithii* (in the western portions of this alliance's range), *Schizachyrium scoparium, Sorghastrum nutans* (in the center and east), *Sporobolus heterolepis* (in the Great Plains), and *Hesperostipa spartea (= Stipa spartea)* (in the northern Great Plains). Forbs are abundant in stands of this alliance, especially in the more humid east. Among these are *Aletris farinosa* (in the east), Asteraceae spp., *Echinacea pallida, Helianthus grosseserratus, Liatris pycnostachya, Phlox pilosa, Ratibida pinnata, Silphium laciniatum* (in the center), and *Solidago* spp. Diamond and Smeins (1988) found *Galium boreale* and *Oxalis* sp. to be more common in northern tallgrass prairies than in southern. Trees and tall shrubs are infrequent in high quality stands, especially in the Great Plains. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Quercus macrocarpa* (in the central and eastern portions of this alliance's range).

In the far western extent, vegetation in this alliance is either relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains or a western version of the northern tallgrass prairie along the Missouri basin. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans, Panicum virgatum, Schizachyrium scoparium, Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also common grasses. In Montana, *Festuca idahoensis* (at its eastern range limits) is codominant in an association in this alliance.

Dynamics: Over-grazing can change a tallgrass prairie site to a mixed grass and eventually a shortgrass site. Heavy summer grazing is especially hard on the warm season tallgrass species. Introduced *Poa* spp. and weedy herbs often replace the tall grasses. Fire is important to maintain the grassland from invading woody vegetation and maintaining species diversity. Much potential habitat in the Colorado Front Range foothills may have been invaded by *Pinus ponderosa* because of decades of fire suppression.

Similar Alliances:

- *Andropogon gerardii - (Calamagrostis canadensis, Panicum virgatum)* Herbaceous Alliance (A.1191)--is typically wet-mesic.
- *Andropogon gerardii - (Sorghastrum nutans)* Temporarily Flooded Herbaceous Alliance (A.1337)--is found in the East.
- *Festuca idahoensis* Herbaceous Alliance (A.1251)
- *Populus tremuloides - Quercus* spp. - *Salix* spp. Shrubland Alliance (A.903)
- *Quercus macrocarpa - (Quercus alba)* Wooded Herbaceous Alliance (A.1491)
- *Quercus macrocarpa* Wooded Medium-Tall Herbaceous Alliance (A.1505)--may also overlap floristically.
- *Schizachyrium scoparium - Sorghastrum nutans* Herbaceous Alliance (A.1198)--is typically dry-mesic.
- *Symphoricarpos occidentalis* Temporarily Flooded Shrubland Alliance (A.961)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is most common in tallgrass prairies of the Great Plains. Stands occur from Texas and Arkansas north into Montana, and east into Michigan, Ohio, Virginia and Tennessee. In Canada it is found in southern Saskatchewan, southern Manitoba, and southern and northwestern Ontario.

Nations: CA, US

Subnations: AR, CO, IA, IL, IN, KS, KY, MB, MI, MN, MO, MT, ND, NE, OH, OK, ON, SD, SK, TN, VA, WI, WY

TNC Ecoregions: 20:C, 25:C, 26:C, 27:C, 28:C, 30:C, 32:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 42:C, 43:C, 44:C, 45:C, 46:C, 48:C, 50:C, 51:C, 59:C

USFS Ecoregions: 212Hx:CCC, 212Hy:CCC, 221Hc:CPP, 221Ja:CCC, 222Ab:CCC, 222Ae:CC?, 222Ag:CCP, 222Ah:CCP, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Cb:CCC, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Da:C??, 222Dc:C??, 222Dd:C??, 222Dg:C??, 222Dj:C??, 222Ea:CC?, 222Eb:CCC, 222Ec:CCP, 222Ed:CCP, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Ei:CC?, 222Ej:CCC, 222Ek:CCC, 222En:CCC, 222Eo:CCC, 222Fa:CC?, 222Fb:CC?, 222Fc:CC?, 222Fd:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222He:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kc:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 222Qb:CCC, 231Ba:CPP, 231Bg:CP?, 231Bh:CP?, 231Bj:CP?, 231Bk:CP?, 231Cd:CP?, 231Ce:CPP, 231Da:CP?, 231Eh:CCC, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Ae:CCC, 234Aj:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bc:CCC, 251Bd:CCC, 251Be:CCC, 251Bf:CCC, 251Ca:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCP, 251Ce:CCP, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCP, 251Cm:CCC, 251Cn:CCC, 251Co:CCP, 251Cp:CCC, 251Cq:CCC, 251Da:CCC, 251Db:CCP, 251Dc:CCC, 251Dd:CCC,

251De:CCC, 251Df:CCP, 251Dg:CCC, 251Dh:CCC, 251Ea:CCC, 251Eb:CCC, 251Ec:CCC, 251Ed:CCC, 251Fb:CCC, 251Fc:CCP, 251Fd:CCC, 255Aa:CCC, 255Ag:CCC, 255Ah:CCC, 255Ai:CCC, 255Aj:CCC, 255Ba:CCC, 255Ca:CCC, 255Cd:CCC, 255Cf:CCC, 331C:CC, 331D:C?, 331E:CP, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332A:CP, 332D:CP, 332E:CC, 411:C, M221C:C?, M221Db:CCC, M231Aa:CCC, M231Ab:CC?, M231Ac:CC?, M231Ad:CC?, M331H:CC, M331I:CC, M334A:CC

Federal Lands: DOD (Arnold, Fort Chaffee); DOE (Oak Ridge); NPS (Effigy Mounds, Mammoth Cave?, Wind Cave); USFS (Daniel Boone)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group, mod. K. Schulz

References: Allard 1990, Bichel 1959, Branson et al. 1961, Branson et al. 1964, Branson et al. 1965, Bunin 1985, Clements 1904, Comer et al. 1995b, Culwell and Scow 1981, Culwell and Scow 1982, Curtis 1959, Diamond 1993, Diamond and Smeins 1988, Evans 1991, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Hadley and Branson 1965, Hansen et al. 1984, Hanson 1957, Hanson and Dahl 1956, Hanson and Whitman 1938, Hoagland 1998a, James 1930, Johnston 1987, Kettler pers. comm., Kittel et al. 1996, Kuchler 1964, Livingston 1947, Livingston 1952, Marr 1964b, Midwestern Ecology Working Group n.d., Moir 1969b, Moir 1972, Moulton et al. 1980, Mutel 1976, Pyne 1994, Ramaley and Kelso 1931, Robbins 1917, Soil Conservation Service 1978, Tatina 1987, Taylor and Holst 1976, Tolstead 1942, Vestal 1914, Wasser and Hess 1982

[CEGL004677] *Andropogon gerardii - (Sorghastrum nutans)* Kentucky Herbaceous Vegetation

Translated Name: **Big Bluestem - (Yellow Indiangrass) Kentucky Herbaceous Vegetation**

Common Name: **Kentucky Mesic Tallgrass Prairie**

Ecological System(s):

- East Gulf Coastal Plain Jackson Plain Prairie and Barrens (CES203.353)
- Cumberland Wet-Mesic Meadow and Savanna (CES202.053)
- Pennyroyal Karst Plain Prairie and Barrens (CES202.355)

Status: Standard

Circumscription Confidence: 3 - Weak

Concept Author(s): Southeastern Ecology Group

ELEMENT CONCEPT

Global Summary: This tallgrass prairie type is found in Kentucky, adjacent Tennessee, and possibly in the Central Appalachians. Sites are often on depressions or slopes below ridges, with more mesic conditions and reduced disturbances. The vegetation is dominated by tallgrass species. The grasses *Saccharum alopecuroidum (= Erianthus alopecuroides)* and *Andropogon gerardii* are often abundant, along with *Sorghastrum nutans* and *Schizachyrium scoparium*. *Piptochaetium avenaceum* is locally abundant in more brushy or shady areas. Other common grasses include *Andropogon glomeratus, Andropogon gyrans, Andropogon virginicus, Danthonia spicata* (in brushy areas), *Elymus virginicus var. virginicus (= Elymus glabriflorus var. australis), Dichanthelium commutatum (= Panicum commutatum), Dichanthelium laxiflorum (= Panicum laxiflorum), Dichanthelium dichotomum var. dichotomum (= Panicum microcarpon), Dichanthelium ravenelii (= Panicum ravenelii)*, and *Tridens flavus*. Among the most abundant herbs are *Symphyotrichum dumosum (= Aster dumosus), Desmodium glabellum, Helianthus microcephalus, Lespedeza hirta*, and *Lespedeza violacea (= Lespedeza intermedia)*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: Vegetation resembling this association was sampled at Mammoth Cave in small patches as part of a managed restoration landscape at "Wondering Woods". Its status as part of the natural vegetation of Mammoth Cave is not fully understood. It has not been used as a mapping unit. Any areas of this would be mapped as CEGL004044 (Successional Broomsedge Vegetation).

Global Environment: Sites are often on depressions or slopes below ridges, with more mesic conditions and reduced disturbances.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: Vegetation resembling this association was sampled at Mammoth Cave in small patches as part of a managed restoration landscape. Its status as part of the natural vegetation of Mammoth Cave is not fully understood. It has not been used as a mapping unit.

Global Vegetation: The vegetation is dominated by tallgrass species. The grasses *Saccharum alopecuroidum (= Erianthus alopecuroides)* and *Andropogon gerardii* are often abundant, along with *Sorghastrum nutans* and *Schizachyrium scoparium*. *Piptochaetium avenaceum* is locally abundant in more brushy or shady areas. Other common grasses include *Andropogon glomeratus, Andropogon gyrans, Andropogon virginicus, Danthonia spicata* (in brushy

areas), *Elymus virginicus var. virginicus (= Elymus glabriflorus var. australis), Dichanthelium commutatum (= Panicum commutatum), Dichanthelium laxiflorum (= Panicum laxiflorum), Dichanthelium dichotomum var. dichotomum (= Panicum microcarpon), Dichanthelium ravenelii (= Panicum ravenelii)*, and *Tridens flavus*. Sedges are generally minor species, but *Carex striatula* may be characteristic. The ferns *Pteridium aquilinum* and *Dennstaedtia punctilobula* are common in some brushy areas. Among the most abundant herbs are *Symphyotrichum dumosum (= Aster dumosus), Desmodium glabellum, Helianthus microcephalus, Lespedeza hirta*, and *Lespedeza violacea (= Lespedeza intermedia)*. Other common (or characteristic) species may include *Angelica venenosa, Symphyotrichum patens (= Aster patens), Coreopsis major, Desmodium laevigatum, Desmodium viridiflorum, Eupatorium fistulosum, Eupatorium pilosum, Helianthus atrorubens, Helianthus divaricatus, Helianthus strumosus, Hieracium gronovii, Rudbeckia fulgida, Solidago altissima, Solidago nemoralis*, and *Solidago odora*. The most abundant woody species include *Acer rubrum, Liriodendron tulipifera, Rhus copallinum*, and *Quercus alba, Quercus prinus, Quercus stellata, Quercus velutina, Quercus coccinea*, and *Quercus falcata*. Other common species are *Carya glabra, Carya pallida, Carya alba (= Carya tomentosa), Cornus florida, Kalmia latifolia, Rubus allegheniensis, Rubus pensilvanicus* group, *Sassafras albidum*, and *Smilax* spp. (Campbell 2001). More information may be available from Marc Evans (KSNPC).

Global Dynamics: The taller species may be favored by the submesic conditions and by the less intensive disturbance from mowing or herbiciding compared to other sites.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G1G2 (11-Feb-2001). This vegetation type has been vastly reduced in extent, and today may only consist of roadside remnants.

RELATED CONCEPTS

Global Similar Associations:

- *Andropogon gerardii - Sorghastrum nutans - Pycnanthemum virginianum* Herbaceous Vegetation (CEGL006039)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: These sites are somewhat analogous to "tall-grass prairies" further west, but are smaller patches in a forested landscape, at least under current climate and land-use patterns. See Campbell (2001) for a comparison between CEGL006039 and CEGL004677 in Kentucky. Apparently related tall-grass vegetation seen in the vicinity of Allardt, Tennessee (Fentress County), is also referred here (M. Pyne pers. obs.).

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: Vegetation resembling this association was sampled at Mammoth Cave in small patches as part of a managed restoration landscape. Its status as part of the natural vegetation of Mammoth Cave is not fully understood. It has not been used as a mapping unit.

Global Range: This association is restricted to Kentucky and possibly adjacent Tennessee.

Nations: US

States/Provinces: KY, TN

TNC Ecoregions: 43:P, 44:C, 50:C, 59:?

TNC Ecoregion Comments: ECO44 & ECO50 changed from P to C MP/DFL 2-01.

USFS Ecoregions: 222Eo:CCC

Federal Lands: NPS (Mammoth Cave?); USFS (Daniel Boone?)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: None.

Local Description Author(s): M. Pyne
Global Description Author(s): Southeastern Ecology Group
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Braun 1950 .	.	.	X	.	.	.	.	.	
Campbell 2001	.	.	.	X	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.1198 Schizachyrium scoparium - Sorghastrum nutans *Herbaceous Alliance*

Little Bluestem - Yellow Indiangrass Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, comprising dry-mesic tallgrass prairies, is found in the central United States and southern Canada. Most stands of this alliance are found on gentle to moderately steep slopes, although stands on flat plains can occur. The most prevalent slope aspects are south or west. Soils range from shallow to deep and are well-drained to excessively well-drained. Most are loams or sands, but some can be gravel or clay. These soils are formed from eolian or alluvial sand, limestone, dolomite, sandstone, glacial till, glacial outwash, chert, loess, or shale. The vegetation is characterized by moderate to dense cover of medium and tall grasses and a diverse mixture of forbs. Woody species are absent to rare but can be uncommon in some communities. The most abundant species across the range of this alliance are *Bouteloua curtipendula, Schizachyrium scoparium*, and *Sorghastrum nutans*. Other graminoids species common in parts of this alliance are *Andropogon gerardii, Bouteloua hirsuta, Carex* spp., *Danthonia spicata, Hesperostipa spartea (= Stipa spartea)*, and *Sporobolus heterolepis*. In the far southern part of the alliance's range, associations can contain *Andropogon glomeratus, Panicum virgatum*, and *Sporobolus clandestinus*. Some of the many forbs which can be found in this alliance include *Symphyotrichum ericoides (= Aster ericoides), Echinacea pallida, Helianthus* spp., *Hedyotis nigricans var. nigricans* (in Illinois and Missouri), *Lespedeza capitata* (especially on sand), *Lithospermum canescens, Clinopodium arkansanum (= Calamintha arkansana)* (in Illinois), and *Solidago nemoralis*. In the Southeast, *Ratibida pinnata* or *Baptisia australis var. minor* may be found, as well as a variety of forbs with Coastal Plain affinities. Characteristic forbs occurring in central Texas include *Liatris mucronata, Calylophus berlandieri, Melampodium leucanthum, Helianthus maximiliani, Oenothera macrocarpa, Silphium albiflorum*, and *Chamaecrista fasciculata*. Woody species that are found in stands of this alliance are those that can adapt to the dry to dry-mesic conditions, such as *Acer rubrum* and *Juniperus virginiana* (within their respective ranges).

In the Southeast, this alliance includes a variety of relatively restricted communities which are rare and/or have been greatly reduced through land-use change. Many of these occur on distinctive soils or geologic formations, such as calcareous clays. This includes the Jackson Formation of Mississippi and Louisiana; the Cook Mountain Formation, Fleming Formation, and Morse Clays of Louisiana; the Demopolis and related formations of the Alabama Black Belt; as well as blackland prairies on Alfisols, Mollisols, and Vertisols in Texas, and isolated occurrences on the Catahoula Formation in eastern Texas. This alliance also occurs in the Coosa River valley of northwestern Georgia and northeastern Alabama and the Arbuckle Mountains of Oklahoma. It includes remnant prairielike vegetation occupying small areas (<1 acre) of mafic substrates in the Southern Blue Ridge plateau underlain by magnesium-rich bedrock; this vegetation is disjunct from the principal distribution of this alliance. In the south-central U.S., this alliance once occurred over large areas in the Central Great Plains, Crosstimbers, Edwards Plateau, Texas Blackland Prairie and East Central Texas Plains of Texas (Level III Ecoregions 27, 29, 30, 32 and 33, respectively (Griffith et al. 2004)).

Environment: Most stands of this alliance are found on gentle to moderately steep slopes, although stands on flat plains can occur (Curtis 1959, Nelson 1985). The most prevalent slope aspects are southern or western. Soils range from shallow to deep and are well-drained to excessively well-drained (White and Madany 1978, Chapman 1984). Most are loams or sands, but some can be gravel or clay. These soils are formed from eolian or alluvial sand, limestone, dolomite, sandstone, glacial till, glacial outwash, chert, loess, or shale.

Vegetation: The vegetation is characterized by moderate to dense cover of medium and tall grasses and a diverse mixture of forbs. Woody species are absent to rare but can be uncommon in some communities. The most abundant species across the range of this alliance are *Bouteloua curtipendula, Schizachyrium scoparium*, and *Sorghastrum nutans*. Other graminoids species common in parts of this alliance are *Andropogon gerardii, Bouteloua hirsuta, Carex* spp., *Danthonia spicata, Hesperostipa spartea (= Stipa spartea)*, and *Sporobolus heterolepis*. Many forbs can be found in communities of this alliance. Among them are *Symphyotrichum ericoides (= Aster ericoides), Echinacea pallida, Helianthus* spp., *Hedyotis nigricans (= Houstonia nigricans)* (in Illinois and Missouri), *Lespedeza capitata* (especially on sand), *Lithospermum canescens, Clinopodium arkansanum (= Satureja arkansana)* (in Illinois), and *Solidago nemoralis*.

Characteristic forbs occurring in central Texas include *Liatris mucronata, Calylophus berlandieri, Melampodium leucanthum, Helianthus maximiliani, Oenothera macrocarpa, Silphium albiflorum*, and *Chamaecrista fasciculata*. Woody species that are found in stands of this alliance are those that can adapt to the dry to dry-mesic conditions, such as *Acer rubrum* and *Juniperus virginiana*.

Dynamics: Fire, climate, native grazing and edaphic factors all played a roll historically in maintaining an open structure in this vegetation. Loss of these natural processes often results in a decrease in native grass cover and increase in woody invaders. Threats to these communities include fire suppression, livestock grazing, and damage by feral hogs and vehicles. The current range of this alliance has been reduce greatly from its historic extent.

Similar Alliances:

- *Andropogon gerardii - (Sorghastrum nutans)* Herbaceous Alliance (A.1192)
- *Quercus macrocarpa - (Quercus alba)* Wooded Herbaceous Alliance (A.1491)
- *Quercus velutina - (Quercus ellipsoidalis)* Wooded Herbaceous Alliance (A.1492)
- *Schizachyrium scoparium - Bouteloua curtipendula* Herbaceous Alliance (A.1225)
- *Schizachyrium scoparium - Paspalum plicatulum* Herbaceous Alliance (A.1197)
- *Schizachyrium scoparium* Herbaceous Alliance (A.1240)

Similar Alliance Comments: The associations in this and related alliances are not clearly differentiated and characterized. Some communities in this alliance (A.1198) are very similar to communities in this similar alliance (A.1225). Characteristic species and environmental features need to be further elucidated to clarify the difference between these vegetation types. There are many rare associations placed within this alliance.

ALLIANCE DISTRIBUTION

Range: This alliance is found in the eastern United States from Massachusetts to Georgia and west to Wisconsin and Texas, in Canada in southern Ontario.

Nations: CA, US

Subnations: AL, AR, CT, GA, IA, IL, IN, KS, KY, LA, MA, MI, MN, MO, MS, NY, OH, OK, ON, PA, TN, TX, VA, WI, WV

TNC Ecoregions: 29:C, 32:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:?, 56:C, 59:C, 61:C, 62:C

USFS Ecoregions: 212Hu:CCC, 212Hy:CCP, 212Jd:CCC, 212Jg:CCC, 212Kb:CCC, 212Mb:C??, 212Nc:CCC, 221D:CC, 221Ea:CCC, 221Ed:CCP, 221Eg:CCC, 221Fa:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCC, 222Ab:CCC, 222Ac:CCC, 222Ae:CC?, 222Ag:CCC, 222Ai:CCC, 222Ak:CC?, 222Am:CCC, 222Ao:CCC, 222Aq:CCC, 222Ca:CC?, 222Cb:CCC, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Da:CP?, 222Dc:CP?, 222Dd:CP?, 222Dg:CP?, 222Dh:CPP, 222Dj:CP?, 222Ea:CC?, 222Eb:CCC, 222Ec:CCP, 222Ed:CCP, 222Ee:CC?, 222Ef:CCP, 222Eg:CCC, 222Eh:CCC, 222Ei:CC?, 222Ej:CCC, 222Ek:CCC, 222En:CCC, 222Eo:CCC, 222Fa:C??, 222Fb:C??, 222Fc:C??, 222Fd:C??, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222Ib:CCP, 222If:CCC, 222Ja:CCP, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222La:CCC, 222Lb:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 231Ba:CCC, 231Bg:CC?, 231Bh:CC?, 231Bi:CCC, 231Bj:CCC, 231Bk:CCC, 231Bl:CCC, 231Cd:CP?, 231Ce:CPP, 231Da:CC?, 231Dc:CCC, 231De:CCC, 231Ea:CCC, 231Eb:CCC, 231Eh:CCC, 231Ej:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCC, 232Bn:CCC, 232Fa:CCC, 232Fb:CC?, 232Fe:CCC, 234Ac:CCC, 234Ae:CCC, 234Aj:CC?, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Ca:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Ch:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCC, 251Da:CCC, 251Db:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Ea:CCC, 251Eb:CCC, 251Fb:C??, 251Fc:C??, 255Ai:CCC, 255Aj:CCC, 255Ba:CCC, 255Cd:CCP, 255Cf:CCP, 255D:CC, 263A:CC, M221Db:CCC, M231Aa:???, M231Ab:???, M231Ac:???, M231Ad:???, M242A:CC, M261A:CC

Federal Lands: COE (Lake Millwood); DOD (Arnold, Fort Campbell, Fort Chaffee, Fort Hood); DOE (Oak Ridge); NPS (Big South Fork, Blue Ridge Parkway, Chickamauga-Chattanooga?, Indiana Dunes, Mammoth Cave?, Natchez Trace, Obed?, Saint Croix, Stones River); TVA (Land Between the Lakes); USFS (Bienville, Caddo/LBJ, Daniel Boone, Huron-Manistee, Kisatchie, Manistee, Sam Houston, Shawnee, Tombigbee)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group, mod. J. Teague

References: Allard 1990, Chapman 1984, Curtis 1959, DeSelm 1990, Diamond 1993, Diamond and Smeins 1984, Diamond and Smeins 1985, Diamond and Smeins 1988, Diamond and Smeins 1990, Evans 1991, Evers 1955, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Griffith et al. 2004, Hart and Lester 1993, Heikens et al. 1994, Homoya 1994, Hutchison 1994, MNNHP 1993, Martin and Smith 1991, Midwestern Ecology Working Group n.d., Nelson 1985, Pyne 1994, Reschke 1990, Rostlund 1957, Smith 1996a, Smith et al. 1989, Swain and Kearsley 2001, Turner et al. 1999, Voigt and Mohlenbrock 1964, White and Madany 1978, Wieland 1995

[CEGL007707] *Schizachyrium scoparium - Andropogon (gyrans, ternarius, virginicus)* Herbaceous Vegetation

Translated Name: **Little Bluestem - (Elliott's Bluestem, Splitbeard Bluestem, Broomsedge Bluestem) Herbaceous Vegetation**

Common Name: **Little Bluestem - Bluestem Grassland**

Ecological System(s):

- Eastern Highland Rim Prairie and Barrens (CES202.354)
- Western Highland Rim Prairie and Barrens (CES202.352)
- Cumberland Sandstone Glade and Barrens (CES202.337)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Pyne

ELEMENT CONCEPT

Global Summary: This mixed-grass association represents a variety of essentially native perennial grasslands which are (or have been) human-maintained to some extent and which contain a variable mix of *Schizachyrium scoparium* with *Andropogon* spp. It may occur on annually mowed powerline rights-of-way, mowed successional or abandoned agricultural fields, pastures, etc. Examples are known from the Eastern and Western Highland Rim of Tennessee, related areas of Kentucky, as well as possibly Alabama. It is described and documented from the Cumberland Plateau and Interior Low Plateau, but it could range into the adjacent Upper East Gulf Coastal Plain. *Schizachyrium scoparium* is codominant along with a variable mixture of the nominal *Andropogon* species. In examples from the Eastern Highland Rim of Coffee County, Tennessee (Arnold Air Force Base), other dominant grasses may include *Dichanthelium aciculare (= Dichanthelium angustifolium), Gymnopogon brevifolius*, and *Dichanthelium dichotomum var. dichotomum (= var. ramulosum)*. On the Western Highland Rim of middle Tennessee, these barrens occur on winter-wet, summer-dry loessal soils, which are generally deep, with chert fragments; rock outcrops are absent. The presence of this vegetation may be related to remnant surficial deposits of Cretaceous gravels which remain on some of the high flat ridges in this landscape. Some forbs found in these examples include *Asclepias amplexicaulis, Sericocarpus linifolius, Boltonia* sp., *Comandra umbellata, Eupatorium album, Eupatorium serotinum, Galium pilosum, Helianthus atrorubens, Helianthus mollis, Hypericum virgatum (= Hypericum denticulatum var. acutifolium), Hypericum punctatum, Mimosa microphylla (= Schrankia microphylla), Monarda fistulosa, Parthenium integrifolium, Pycnanthemum tenuifolium, Rudbeckia hirta, Sabatia angularis*, and *Tephrosia virginiana*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This association was not documented at Mammoth Cave, although it is expected to occur there. It has not been used as a mapping unit.

Global Environment: This association may occur on annually mowed powerline rights-of-way, mowed successional or abandoned agricultural fields, roadsides, pastures, etc.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This association was not documented at Mammoth Cave, although it is expected to occur there. It has not been used as a mapping unit.

Global Vegetation: In stands of this association, *Schizachyrium scoparium* is codominant along with a variable mixture of the nominal *Andropogon* species. In examples from the Eastern Highland Rim of Coffee County, Tennessee (Arnold Air Force Base), other dominant grasses may include *Dichanthelium aciculare (= Dichanthelium angustifolium), Gymnopogon brevifolius*, and *Dichanthelium dichotomum var. dichotomum (= Dichanthelium dichotomum var. ramulosum)*. Other common species may include *Eurybia hemispherica (= Aster paludosus ssp. hemisphericus), Symphyotrichum dumosum (= Aster dumosus), Sericocarpus linifolius (= Aster solidagineus), Coreopsis major, Eupatorium hyssopifolium, Eupatorium rotundifolium, Helianthus angustifolius, Liatris microcephala, Liatris spicata, Packera anonyma (= Senecio anonymus), Solidago juncea, Solidago odora, Chamaecrista fasciculata, Chamaecrista nictitans, Lespedeza capitata, Stylosanthes biflora, Lobelia puberula, Diodia teres, Potentilla simplex, Aristida longispica, Calamagrostis coarctata, Dichanthelium dichotomum, Sorghastrum nutans, Pteridium aquilinum*, and *Smilax glauca*. At Arnold Air Force Base, one possibly distinctive phase of this vegetation is found on less well-drained soils (Tyler loam and Holston loam). The dominant species here are *Andropogon virginicus, Schizachyrium scoparium, Dichanthelium scoparium, Dichanthelium dichotomum*, and *Sorghastrum nutans*. Other common species in this phase include *Diodia teres, Aristida dichotoma, Aristida longispica, Paspalum laeve, Calamagrostis coarctata, Chasmanthium laxum, Gymnopogon brevifolius, Panicum anceps*, and *Eleocharis microcarpa*. Examples from other situations may exhibit a different mix of native forbs.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (19-Jan-2000). This perennial grassland type may have been distributed widely in the Cumberland Plateau, Interior Low Plateau and adjacent Upper East Gulf Coastal Plain at one time, but its frequency of occurrence has declined. The combination of lack of fire and changing agricultural patterns with more recent land conversion from agriculture to either forestry or suburban development has altered or destroyed many sites. Even though there are very few element occurrences of this type, this may not reflect its true distribution or rarity. Some of the sites where this vegetation type is found have particular soil characteristics (hardpans, surficial gravels) which have promoted its persistence. While moderately restricted in its environmental preferences, this perennial grassland type requires management (fire and/or mowing) for its maintenance. Existing examples are representative of a savanna-woodland mosaic that existed in parts of the southern Interior Low Plateau (and possibly adjacent Upper East Gulf Coastal Plain) before and shortly after settlement. Many examples have presumably been converted to agriculture or other land uses. Some in the western Highland Rim are on unprotected private land, and others are on Arnold Air Force Base, where they are managed with fire and/or mowing to maintain their herbaceous diversity.

RELATED CONCEPTS

Global Similar Associations:

- *Andropogon gerardii - Schizachyrium scoparium - (Calamagrostis coarctata, Panicum virgatum)* Herbaceous Vegetation (CEGL007706)
- *Andropogon virginicus var. virginicus* Herbaceous Vegetation (CEGL004044)
- *Juniperus virginiana var. virginiana / Rhus copallinum / Schizachyrium scoparium* Woodland (CEGL007704)--is a variant with dominance by Eastern red-cedar.
- *Pinus rigida / Schizachyrium scoparium - Sorghastrum nutans - Baptisia tinctoria* Woodland (CEGL003617)

Global Related Concepts:

- Gravel Barrens (DeSelm 1988) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: Described from Arnold Air Force Base, Coffee County, Tennessee. See also *~Andropogon gerardii - Schizachyrium scoparium - (Calamagrostis coarctata, Panicum virgatum)* Herbaceous Vegetation (CEGL007706), in the V.A.5.N.a *~Andropogon gerardii - (Sorghastrum nutans)* Herbaceous Alliance (A.1192), which is more mesic and has a more limited distribution.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association was not documented at Mammoth Cave, although it is expected to occur there. It is thought to be a type of natural grassland, but may also result from secondary plant succession on cleared forest land, and may occur throughout the park where these land use conditions exist. It has not been used as a mapping unit. Any areas of this which exist at Mammoth Cave would be mapped as CEGL004044 (Successional Broomsedge Vegetation).

Global Range: The full range of this type is not known, but it could be scattered across the Cumberland Plateau, southern Interior Low Plateau of Alabama, Kentucky, and Tennessee, on various substrates. It could be found in the adjacent Upper East Gulf Coastal Plain, but no examples there have been documented.

Nations: US

States/Provinces: AL?, KY, TN

TNC Ecoregions: 44:C, 50:C

TNC Ecoregion Comments: ECO50 added (MP/DFL 2-01).

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Cb:CP?, 222Cf:CPP, 222Cg:CPP, 222Eb:CCC, 222Ef:CCP, 222Eg:CCC, 222Eo:CCC

Federal Lands: DOD (Arnold); NPS (Big South Fork, Chickamauga-Chattanooga?, Mammoth Cave?, Obed?); USFS (Daniel Boone)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:
Mammoth Cave National Park Inventory Notes:
Mammoth Cave National Park Plots: None.
Local Description Author(s): M. Pyne
Global Description Author(s): M. Pyne, mod. C.W. Nordman
References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
DeSelm 1988	.	X	X	X	.	.	.	.	.
Palmer-Ball et al. 1988	.	.	.	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	X	.	.	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	

V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

A.1208 Andropogon virginicus *Herbaceous Alliance*

Broomsedge Bluestem Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance includes vegetation dominated by *Andropogon virginicus var. virginicus* that occurs on old fields, pastures, and rocky sites. Associated species vary with geography and habitat and include typical pioneer species. This is a very wide-ranging alliance. There is no known natural vegetation in this alliance.
Environment: Stands of this alliance occur on old fields, pastures, and rocky sites.
Vegetation: Stands of this alliance are dominated by *Andropogon virginicus var. virginicus*. Associated species vary with geography and habitat and include typical pioneer species.
Dynamics:
Similar Alliances:
Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, New York, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and Missouri, and possibly Illinois, Indiana, and elsewhere.
Nations: US
Subnations: AL, AR, CT, DE, GA, IL, IN, KY, LA, MA, MD, ME, MO?, MS, NC, NH, NJ, NY, OK, PA, RI, SC, TN, TX, VA, VT, WV
TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 48:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions: 212Fc:CCC, 221Ab:CCC, 221Bc:CCC, 221Bd:CCC, 221C:CP, 221Db:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 222Eg:CCC, 222Ib:CCC, 231Aa:CCC, 231Ae:CCC, 231Ba:CCC, 231Be:CCC, 231Cc:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCC, 232Ac:CCC, 232Bt:CCC, 232Ce:CCC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CC?, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Abe Lincoln Birthplace, Big South Fork, Boston Harbor Islands, Cape Cod, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Delaware Water Gap, Fire Island, Fort Donelson, Gateway, Kings Mountain, Little River Canyon, Mammoth Cave?, Natchez Trace, Ninety Six, Saratoga, Shiloh, Stones River, Upper Delaware, Weir Farm); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita?, Ozark?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria, Great Swamp, Iroquois)

ALLIANCE SOURCES

Author(s): A.S. Weakley
References: Hoagland 1998a, Southeastern Ecology Working Group n.d.

[CEGL004044] *Andropogon virginicus var. virginicus* Herbaceous Vegetation

Translated Name: **Broomsedge Bluestem Herbaceous Vegetation**
Common Name: **Successional Broomsedge Vegetation**
Ecological System(s):
Status: Standard
Circumscription Confidence: 1 - Strong
Concept Author(s): A.S. Weakley

ELEMENT CONCEPT

Global Summary: This association includes herbaceous-dominated vegetation that has been anthropogenically altered and/or maintained, especially on old fields and pastures. Examples support predominately native species or a mixture of native and exotic species, one of the most dominant or characteristic species being *Andropogon virginicus var. virginicus*. *Lolium pratense (= Festuca pratensis)* can dominate fields early in the season. This is a very common and wide-ranging association that can be quite variable in terms of species composition. Additional components are other perennial grasses and herbaceous species, most with pioneer or weedy tendencies, the exact composition of which will vary with geography, management history, and habitat.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: There are some old field areas on the park, but many more in the buffer zone that are mapped as this type. Some of these are more pure broomsedge bluestem, some contain Indiangrass and more conservative prairie species (some of these may be attributable to CEGL004677). It may result from secondary plant succession on cleared forest land, and may occur throughout the park where these land-use conditions exist.
Global Environment: This vegetation typically occurs on old fields, pastures, and rocky sites. It will persist indefinitely under a regular mowing regime, e.g., in powerline corridors.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This community is defined by the dense (80% cover) herbaceous layer. However, in one stand there is also a sparse (10%) tree layer (5-10 m tall) of *Acer rubrum* and *Quercus falcata* and shrub layer (2-5 m) that includes successional tree species as well as *Cercis canadensis, Corylus americana, Rhus copallinum*, and *Rubus* spp. Dominants in the herb layer include *Andropogon gerardii, Rudbeckia hirta*, and *Schizachyrium scoparium*. Additional common species include *Andropogon gyrans, Coreopsis tripteris, Daucus carota, Erigeron* spp., *Helianthus* sp., *Lespedeza cuneata, Liatris aspera*, and *Silphium terebinthinaceum*, among others. This community also contains many exotic plant species, in addition to state-vulnerable *Clematis glaucophylla*.
Global Vegetation: Stands of this community are dominated by *Andropogon virginicus var. virginicus*, sometimes codominant with *Lolium pratense*. Associated species vary with geography and habitat and include typical pioneer species. Species with high cover values in plot samples attributed to this type include *Tridens flavus, Setaria parviflora (= Setaria geniculata), Eragrostis spectabilis*, and *Panicum anceps* (NatureServe Ecology unpubl. data). On the eastern Highland Rim of Tennessee (Arnold Air Force Base), associated species include *Diodia teres, Aristida dichotoma, Aristida oligantha, Packera anonyma (= Senecio anonymus), Paspalum laeve, Lespedeza virginica*, and *Plantago virginica*. *Rubus argutus* and *Smilax* spp. may be locally abundant but are not dominant. In clearcuts, *Schizachyrium scoparium, Danthonia spicata*, and *Dichanthelium* spp. are also common, as are occasional *Quercus* spp. and *Rubus argutus*. The plot at Shiloh National Military Park (western Tennessee) was a mowed field of mostly native species, dominated by *Andropogon virginicus var. virginicus*. *Paspalum setaceum* and *Tridens flavus* were codominant (with less cover). Other herbaceous plants with high cover values were *Setaria parviflora (= Setaria geniculata), Diodia teres, Schizachyrium scoparium*, and less common were *Packera anonyma, Sorghum halepense*, and *Cyperus retrorsus*. At less than 1% cover were *Polypremum procumbens, Oxalis stricta, Eragrostis spectabilis, Salvia lyrata, Solanum carolinense, Digitaria sanguinalis, Panicum anceps, Croton willdenowii (= Crotonopsis elliptica), Trifolium pratense, Kummerowia striata, Coreopsis pubescens, Plantago lanceolata*, and *Mecardonia acuminata*. At only a trace amount of cover were *Conyza canadensis, Acalypha virginica, Solidago* sp., *Erigeron annuus, Sida spinosa, Hypericum drummondii, Polygala verticillata, Eupatorium capillifolium, Passiflora incarnata*, and *Asclepias amplexicaulis*. In West Virginia, common associates include *Sorghastrum nutans, Dichanthelium clandestinum, Anthoxanthum odoratum, Phleum pratense, Dactylis glomerata, Daucus carota, Lotus corniculatus, Trifolium pratense, Leucanthemum vulgare, Solidago canadensis, Solidago rugosa*, and *Solidago nemoralis*.
Global Dynamics: This association may develop temporarily following clear-cutting, and will persist indefinitely under a regular mowing regime, e.g., in powerline corridors and maintained fields. If undisturbed, these grasslands will rapidly succeed to shrubs, and eventually to tree species.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Andropogon gerardii	Herb (field)	Graminoid	X	.	.
Rudbeckia hirta	Herb (field)	Graminoid	X	.	.
Schizachyrium scoparium	Herb (field)	Graminoid	.	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Andropogon virginicus var. *virginicus*	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Clematis glaucophylla	-	P	state-vulnerable
Coronilla varia	-	P	exotic
Daucus carota	-	P	exotic
Dianthus armeria	-	P	exotic
Lespedeza cuneata	-	P	exotic
Leucanthemum vulgare	-	P	exotic
Trifolium pratense	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (8-Aug-2000). This is a ruderal community and represents vegetation resulting from succession following anthropogenic disturbance of an area. It is not a conservation priority for its own sake and does not receive a conservation rank.

RELATED CONCEPTS

Global Similar Associations:

- *Schizachyrium scoparium - Andropogon (gyrans, ternarius, virginicus)* Herbaceous Vegetation (CEGL007707)

Global Related Concepts:

- Old fields (Vanderhorst 2001a) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification Comments: Phenology can affect apparent composition: in West Virginia, fields visited early in the season had high cover of *Lolium pratense*, while those sampled later in the season were dominated by *Andropogon virginicus*.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: Stands of this type result from primary or secondary plant succession on cleared forest land or abandoned agricultural land, and may occur throughout the park where these land-use conditions exist. One grassland plot was taken in a recently-acquired area called "Wondering Woods."

Global Range: This community ranges throughout most or all of the southeastern United States, extending north to Virginia and West Virginia.

Nations: US

States/Provinces: AL, AR, GA, IL, IN, KY, LA, MO?, MS, NC, OK, SC, TN, TX, VA, WV

TNC Ecoregions: 31:C, 32:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 50:C, 51:P, 52:C, 53:C, 56:C, 57:C, 59:C

TNC Ecoregion Comments: ECO52 changed from P to C for CHAT/KEMO (mjr 11-08).

USFS Ecoregions: 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cg:CCC, 222Eg:CCC, 231Aa:CCC, 231Ba:CCC, 231Be:CCC, 231Cc:CCC, 231Fa:CCP, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232B:CC, 232Ce:CCC, 232F:CC, 255Da:CCC, 255Dc:CCC, M221Aa:CCC, M221Ab:CCC, M221Ba:CC?, M221Bb:CCC, M221Bd:CC?, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning, Fort Gordon); NPS (Abe Lincoln Birthplace, Big South Fork, Chattahoochee River, Chickamauga-Chattanooga?, Cowpens, Fort Donelson, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, Ninety Six, Shiloh, Stones River); USFS (Cherokee, George Washington, Jefferson, Oconee?, Ouachita (Coastal Plain)?, Ouachita (Mountains)?, Ouachita?, Ozark?, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?); USFWS (Anahuac, Big Boggy?, Brazoria)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name | Relationship | Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.77, MACA.92.

Local Description Author(s): M. Pyne and M.J. Russo

Global Description Author(s): A.S. Weakley, mod. C.W. Nordman and S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Fleming and Coulling 2001	.	X	.	X	.	.	.	.	.
Hoagland 2000	.	.	.	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Penfound 1953	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	
Tarr et al. 1980	.	.	.	X	.	.	.	.	.
Vanderhorst 2001a	.	X	X	X	.	.	.	.	.
Vanderhorst and Streets 2006	.	X	.	X	.	.	.	.	.
White and Madany 1978	.	.	.	.	.	.	.	.	.

A.1213 Lolium (arundinaceum, pratense) *Herbaceous Alliance*

(Tall Fescue, Meadow Ryegrass) Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance includes sites dominated by European tall or meadow fescues, including the taxa *Lolium pratense* and *Lolium arundinaceum* (formerly treated as *Festuca elatior* and *Festuca arundinacea*, respectively). This non-native vegetation occurs in a variety of different ecological and anthropogenic settings such as pastures, and hayfields, with more-or-less cultural origins, though sometimes no longer actively maintained. These communities are sometimes nearly monospecific, but can also be very diverse and contain many native species of grasses, sedges, and forbs. The dominant species in this alliance are of uncertain and controversial generic placement.

Environment: This alliance occurs in a variety of ecological and anthropogenic settings, such as pastures, hayfields, and old pastures, more-or-less cultural, though sometimes no longer actively maintained. Because of its wide range of site adaptation and its vigorous seedling growth, tall fescue is often used to seed roadsides and disturbed areas (Rayburn 1993), and it has been estimated that *Lolium arundinaceum* has been seeded on more than 14 million hectares in the eastern United States (Bransby n.d.). Although the individual species (*Lolium arundinaceum*) may be found from the Pacific Northwest to the southern states, the core distribution of this alliance occurs in the fescue belt which extends across northern Missouri to Washington, DC, south to the middle of Mississippi, Alabama and Georgia (Bransby n.d.). *Lolium arundinaceum* is adapted to a wide range of soils, but it grows best on clay soils high in organic matter in moist environments (Duble n.d.). It also tolerates wet soils and short periods of flooding and is tolerant of low soil pH (Rayburn 1993). However, due to its temperate nature and preference for heavy clay soils, *Lolium arundinaceum* does not survive well in the immediate vicinity of the Gulf Coast, where summers are long and very hot, and soils are typically sandy and prone to drought (Bransby n.d.). In the southern United States, tall fescue is best adapted in Oklahoma, Arkansas, Missouri, Tennessee, Kentucky, Virginia, and northern parts of North Carolina, Georgia and Texas (Duble n.d.). It grows well in the Black Belt region of Alabama and Mississippi where it is commonly found in mixture with *Paspalum dilatatum* (dallisgrass) (Bransby n.d.).

Vegetation: These communities range from nearly monospecific, being dominated by exotic *Lolium* species, to diverse mixtures containing many native species of grasses, sedges, and forbs (NatureServe Ecology unpubl. data). In the Black Belt region of Alabama and Mississippi, it is commonly found in mixture with *Paspalum dilatatum* (dallisgrass) (Bransby n.d.). The exotics *Lespedeza cuneata* and *Bromus tectorum* may be present in stands.

Dynamics: Tall fescue is drought-tolerant and will survive during dry periods in a dormant state (Duble n.d.). It is especially well adapted to the "transition zone" of the United States where summers are too hot and humid for cool-season grasses and winters too cold for warm-season grasses. It is deep-rooted and forms a dense sod. The presence of a symbiotic fungal endophyte (*Neotyphodium coenophialum*) helps provide *Lolium arundinaceum* a competitive advantage over native species (Bacon and Siegel 1988). Prescribed burning (unless combined with other treatments, such as herbicides) is not effective at decreasing *Lolium arundinaceum* cover (Washburn et al. 2002).

Similar Alliances:
- *Dactylis glomerata - Rumex acetosella* Herbaceous Alliance (A.1190)
- *Phleum pratense* Herbaceous Alliance (A.1195)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is currently defined for the southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada. It is currently described from West Virginia south to Georgia and west to Missouri and Oklahoma. It may also occur in Canada in Nova Scotia, New Brunswick and Quebec.
Nations: CA, US
Subnations: AL, AR, GA, KY, MD, MO, MS, NC, OK, SC, TN, VA, WV
TNC Ecoregions: 38:C, 39:C, 40:P, 43:C, 44:C, 50:C, 51:C, 52:C, 57:C, 58:C, 59:C
USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eg:CCC, 231Ae:CCC, 231Bh:CCC, 231Bi:CCC, M221Cb:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231Aa:CCP, M231Ab:CCP, M231Ac:CCP, M231Ad:CCP
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Big South Fork, Blue Ridge Parkway, Buffalo River, Carl Sandburg Home, Chickamauga-Chattanooga, Cowpens, Cumberland Gap, Fort Donelson, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, New River Gorge, Ninety Six, Obed, Russell Cave, Shenandoah, Shiloh, Stones River, Thomas Stone, Vicksburg); USFS (Cherokee, Ouachita, Ozark)

ALLIANCE SOURCES

Author(s): A.S. Weakley 95-05, mod. A.S. Weakley
References: Bacon and Siegel 1988, Bransby n.d., Duble n.d., Kartesz 1999, NatureServe Ecology - Southeastern U.S. unpubl. data, Rayburn 1993, Southeastern Ecology Working Group n.d., Washburn et al. 2002

[CEGL004048] *Lolium (arundinaceum, pratense)* Herbaceous Vegetation

Translated Name: **(Tall Fescue, Meadow Fescue) Herbaceous Vegetation**
Common Name: **Cultivated Meadow**
Ecological System(s):
Status: Standard
Circumscription Confidence: 2 - Moderate
Concept Author(s): A.S. Weakley

ELEMENT CONCEPT

Global Summary: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European "tall or meadow fescues" of uncertain and controversial generic placement. Several other exotic grasses (*Agrostis gigantea, Dactylis glomerata, Holcus lanatus, Phleum pratense*, and *Poa pratensis*, for example) are common associates. These communities are sometimes nearly monospecific but can also be very diverse and contain many native as well as exotic species of grasses, sedges, and forbs. Exotic forbs include the legumes *Lespedeza cuneata, Trifolium campestre, Trifolium hybridum, Trifolium pratense*, and *Trifolium repens*, as well as *Achillea millefolium, Calystegia sepium, Daucus carota, Leucanthemum vulgare, Oxalis stricta*, and *Plantago lanceolata*. Common native herbs include *Apocynum cannabinum, Desmodium canescens, Dichanthelium clandestinum, Erigeron annuus, Fragaria virginiana, Potentilla simplex, Solanum carolinense, Solidago canadensis*, and *Verbesina occidentalis*. This vegetation is currently defined for the central and southern Appalachians, Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:
Mammoth Cave National Park Environment: This association was not documented at Mammoth Cave, although it is expected to occur there. It has been mapped extensively, around the periphery of the park.
Global Environment: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. It occurs in areas which have been cleared in the past, including abandoned farmlands, strip mines, and other areas disturbed by human activities.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This association was not documented at Mammoth Cave, although it is expected to occur there. Stands are presumably dominated by nearly monospecific stands of the European "tall or meadow fescues" (*Lolium* spp.). but can also be very diverse and contain many native species of grasses, sedges, and forbs.

Composition varies greatly depending upon past land use and recent history of the site. Woody encroachment is restricted to low cover by *Toxicodendron radicans* and species of *Rubus*, both of which become more abundant in older stands.

Global Vegetation: This association represents early-successional herbaceous and herb-shrub vegetation dominated by or having a large component of exotic grasses and legumes. The dominant species in this association are the European "tall or meadow fescues" (*Lolium* spp.). These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. Woody encroachment is restricted to low cover by *Toxicodendron radicans* and species of *Rubus*, both of which become more abundant in older stands. Scattered individuals of various shrubs may be present, including *Crataegus crus-galli, Fraxinus pennsylvanica, Fraxinus americana, Rosa multiflora, Robinia pseudoacacia, Cornus florida, Elaeagnus umbellata, Sambucus canadensis (= Sambucus nigra ssp. canadensis)*, and *Sassafras albidum*. In the Central Appalachians and northern Cumberlands, the dominant exotic grasses include *Agrostis gigantea, Dactylis glomerata, Holcus lanatus, Lolium pratense, Phleum pratense*, and *Poa pratensis*. Exotic forbs include the legumes *Lespedeza cuneata, Trifolium campestre, Trifolium hybridum, Trifolium pratense*, and *Trifolium repens*, as well as *Achillea millefolium, Calystegia sepium, Daucus carota, Leucanthemum vulgare, Oxalis stricta*, and *Plantago lanceolata*. Common native herbs include *Apocynum cannabinum, Desmodium canescens, Dichanthelium clandestinum, Erigeron annuus, Fragaria virginiana, Potentilla simplex, Solanum carolinense, Solidago canadensis*, and *Verbesina occidentalis*. In the Black Belt region of Alabama and Mississippi, it is commonly found in mixture with *Paspalum dilatatum* (Bransby n.d.), and the exotic *Bromus tectorum* may be present in stands.

Global Dynamics: This association varies greatly depending upon past land use and recent history of the site. Some examples that have been recently farmed may be monocultures of *Lolium*, whereas other fields that were traditionally lightly grazed may have much higher diversity. If not grazed, periodically mowed or burned, vegetation will succeed towards woody physiognomy.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Higher Taxon Name	Note				

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Achillea millefolium	Herb (field)	Forb	.	X	.
Apocynum cannabinum	Herb (field)	Forb	.	X	.
Calystegia sepium	Herb (field)	Forb	.	X	.
Daucus carota	Herb (field)	Forb	.	X	.
Desmodium canescens	Herb (field)	Forb	.	X	.
Erigeron annuus	Herb (field)	Forb	.	X	.
Fragaria virginiana	Herb (field)	Forb	.	X	.
Lespedeza cuneata	Herb (field)	Forb	.	X	.
Leucanthemum vulgare	Herb (field)	Forb	.	X	.
Oxalis stricta	Herb (field)	Forb	.	X	.
Plantago lanceolata	Herb (field)	Forb	.	X	.
Potentilla simplex	Herb (field)	Forb	.	X	.
Solanum carolinense	Herb (field)	Forb	.	X	.
Solidago canadensis	Herb (field)	Forb	.	X	.
Trifolium hybridum	Herb (field)	Forb	.	X	.
Trifolium pratense	Herb (field)	Forb	.	X	.
Trifolium repens	Herb (field)	Forb	.	X	.
Agrostis gigantea	Herb (field)	Graminoid	X	.	.
Dactylis glomerata	Herb (field)	Graminoid	.	X	.
Dichanthelium clandestinum	Herb (field)	Graminoid	.	X	.
Holcus lanatus	Herb (field)	Graminoid	.	X	.
Phleum pratense	Herb (field)	Graminoid	X	.	.
Poa pratensis	Herb (field)	Graminoid	.	X	.

Higher Taxon Name	Note
Lolium spp. dominant graminoids	

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Berberis canadensis	G3	P	vulnerable

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (5-Jan-2000). This vegetation is dominated by an exotic species, is of anthropogenic origin, and is thus not a conservation priority.

RELATED CONCEPTS

Global Similar Associations:

- *Dactylis glomerata - Phleum pratense - Festuca* spp. - *Solidago* spp. Herbaceous Vegetation (CEGL006107)
- *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333)

Global Related Concepts:

- *Festuca pratensis - (Holcus lanatus) - Solidago canadensis* herbaceous vegetation (Vanderhorst 2001b) =
- Cleared Areas (Schmalzer and DeSelm 1982) **B**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments: This association has been mapped extensively around the periphery of the park.

Global Classification Comments: *Lolium pratense* and *Lolium arundinaceum* are two closely related species which were traditionally treated as *Festuca pratensis (= Festuca elatior)* and *Festuca arundinacea*, and could alternately be treated as *Schedonorus pratensis* and *Schedonorus arundinaceus*. Conversion to Kartesz (1999) standard has necessitated the shift to the *Lolium* names from *Festuca*.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association has been mapped extensively around the periphery of the park; no plots were sampled of this vegetation type. It results from the planting of *Lolium* spp. for agricultural forage or pasture, and may occur throughout the park where these land-use conditions exist.

Global Range: This association is currently documented from the southern half of the Central Appalachians through the Gulf Coastal Plain and west to the Ozarks and Ouachitas. It is possible throughout much of the eastern United States.

Nations: US

States/Provinces: AL, AR, GA, KY, MD, MO, MS, NC, OK, SC, TN, VA, WV

TNC Ecoregions: 38:C, 39:C, 40:P, 43:C, 44:C, 50:C, 51:C, 52:C, 57:C, 59:C

TNC Ecoregion Comments: ECO44 added (CWN 4-04). ECO40 & ECO43 added (MP 3-03) ECO50:C added (ASW 6-00). ECO52 and ECO57 added (MP 2-00).

USFS Ecoregions: 221Hc:CCC, 221He:CCC, 222Eg:CCC, 231Ae:CCC, 231Bh:CCC, 231Bi:CCC, M221Cb:CCC, M221Cd:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231A:CC

Federal Lands: BIA (Eastern Band of Cherokee); NPS (Abe Lincoln Birthplace, Big South Fork, Blue Ridge Parkway, Buffalo River?, Carl Sandburg Home, Chickamauga-Chattanooga, Cowpens, Cumberland Gap, Fort Donelson, Great Smoky Mountains, Guilford Courthouse, Kings Mountain, Little River Canyon, Mammoth Cave, Natchez Trace, New River Gorge, Ninety Six, Obed, Russell Cave, Shiloh, Stones River, Thomas Stone, Vicksburg); USFS (Cherokee, Ouachita, Ouachita (Coastal Plain)?, Ouachita (Mountains), Ozark)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: None.

Local Description Author(s): M. Pyne

Global Description Author(s): A.S. Weakley, mod. S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Bransby n.d.	.	.	.	X	X	.	.	.	.
Heath et al. 1973	.	.	.	X	.	.	.	.	.
Hoagland 2000	.	.	.	X	.	.	.	.	.
Kartesz 1999	.	.	.	X	.	.	.	.	.
NatureServe Ecology - Southeastern U.S. unpubl. data	.	.	.	X	.	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	.	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
Vanderhorst 2001b	.	X	X	X	.	.	.	X	.
Vanderhorst et al. 2007	.	X	.	X	.	.	.	.	.

V.A.5.N.l. Semipermanently flooded temperate or subpolar grassland

A.1439 Carex comosa - (Carex decomposita) *Semipermanently Flooded Herbaceous Alliance*

Longhair Sedge - (Cypress-knee Sedge) Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in the midwestern United States, is characterized by graminoid-dominated sinkholes and depressions of terraces and broad, level uplands, often in karst topography. The soils are very poorly drained, and surface water may be present for much of the growing season. Soils are deep peats or mucks, or sometimes mineral. Vegetation composition and cover can be variable, depending on yearly and seasonal fluctuations in water depth. Typical dominants include *Carex comosa, Carex decomposita, Glyceria acutiflora, Dulichium arundinaceum, Nuphar advena, Scirpus* and/or *Schoenoplectus* spp., and *Wolffia brasiliensis*. Shrubs, especially *Cephalanthus occidentalis*, are sometimes present.

Environment: Stands of this alliance are found in sinkholes and depressions of terraces and broad, level uplands, often in karst topography. The soils are very poorly drained, and surface water may be present for much of the growing season. Soils are deep peats or mucks, or sometimes mineral.

Vegetation: Vegetation composition and cover can be variable, depending on yearly and seasonal fluctuations in water depth (Nelson 1985). Typical dominants include *Carex comosa, Carex decomposita, Glyceria acutiflora, Dulichium arundinaceum, Nuphar advena, Scirpus* and/or *Schoenoplectus* spp., and *Wolffia brasiliensis*. Shrubs, especially *Cephalanthus occidentalis*, are sometimes present (Homoya and Hedge 1985).

Dynamics:

Similar Alliances:

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in Indiana, Missouri, Kentucky and possibly Tennessee.

Nations: US

Subnations: IN, KY, MO, TN?

TNC Ecoregions: 36:C, 38:C, 44:C

USFS Ecoregions: 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Am:CCC, 222Dg:CCC, 222Ek:CCC, 234:P, 251Ce:CCC

Federal Lands: NPS (Mammoth Cave, Ozark Riverways); USFS (Mark Twain)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group

References: Faber-Langendoen et al. 1996, Homoya 1983, Homoya and Hedge 1985, Midwestern Ecology Working Group n.d., Nelson 1985

[CEGL002413] *Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation

Translated Name: **Longhair Sedge - Cypress-knee Sedge - Threeway Sedge - Stalked Water-horehound Herbaceous Vegetation**

Common Name: **Sinkhole Pond Marsh**

Ecological System(s):

- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This sinkhole pond marsh type is found in the Interior Highlands region of the United States. Stands occur in sinkholes and depressions of terraces and broad level uplands, including those with karst topography. Soils are very poorly drained, with surface water present for extended periods of the year, sometimes up to 1 m in depth. Soils are deep (>100 cm) consisting of peat, muck, or mineral. The parent material may be sand, rock or loess, where depressions occur on hardpans. The vegetation is variable, depending on water fluctuations, with zones of tall emergents, submerged aquatics, or vegetative mats. Dominant emergents include *Typha latifolia, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)* and *Nelumbo lutea*. In Missouri, other characteristic plants include *Carex comosa, Glyceria acutiflora, Potamogeton diversifolius, Alopecurus aequalis, Galium tinctorium, Sagittaria rigida, Dulichium arundinaceum, Hottonia inflata, Ceratophyllum echinatum, Viola lanceolata, Wolffia brasiliensis (= Wolffia papulifera), Isoetes engelmannii*. Sand ponds are characterized by *Iris fulva, Carex crus-corvi, Rhynchospora corniculata, Juncus nodatus,*

Saururus cernuus, and *Hydrolea uniflora*. Indiana ponds may contain *Sparganium androcladum, Nuphar advena (= Nuphar lutea ssp. advena), Cephalanthus occidentalis, Decodon verticillatus, Utricularia gibba*, and *Carex comosa*.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This sinkhole pond marsh was sampled once in the park at Sloans Pond. The elevation is 259 m (850 m). The unvegetated surface is made up of leaf litter (20% cover), standing water (50%) and bare soil (30%).

Global Environment: Stands occur in sinkholes and depressions of terraces and broad level uplands, including those in karst topography. Soils are very poorly drained, with surface water present for extended periods of the year, sometimes up to 1 m in depth. Soils are deep (>100 cm) consisting of peat, muck, or mineral. The parent material may be sand, rock or loess, where depressions occur on hardpans (Nelson 1985).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This community is dominated by the herbaceous layer; however, in this example, there is a very sparse (10% cover) shrub layer (0.5-1 m) of *Acer rubrum, Hibiscus moscheutos*, and *Salix nigra* (on the edges of the community patch). The moderately dense (70%) herbaceous layer is dominated by *Dulichium arundinaceum, Rhynchospora corniculata*, and *Typha latifolia*. Other herbaceous plants include *Rhexia virginica, Carex crinita, Carex lurida*, and *Polygonum* spp.

Global Vegetation: The vegetation is variable, depending on water fluctuations, with zones of tall emergents, submerged aquatics, or vegetative mats. Dominant emergents include *Typha latifolia, Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)* and *Nelumbo lutea*. In Missouri, other characteristic plants include *Carex comosa, Glyceria acutiflora, Potamogeton diversifolius, Alopecurus aequalis, Galium tinctorium, Sagittaria rigida, Dulichium arundinaceum, Hottonia inflata, Ceratophyllum echinatum, Viola lanceolata, Wolffia brasiliensis (= Wolffia papulifera), Isoetes engelmannii*. Sand ponds are characterized by *Iris fulva, Carex crus-corvi, Rhynchospora corniculata, Juncus nodatus, Saururus cernuus*, and *Hydrolea uniflora*. Indiana ponds may contain *Sparganium androcladum, Nuphar advena (= Nuphar lutea ssp. advena), Cephalanthus occidentalis, Decodon verticillatus, Utricularia gibba*, and *Carex comosa* (Homoya et al. 1985, Nelson 1985).

Global Dynamics: Droughts may cause these sinkholes to dry out completely (Nelson 1985).

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Dulichium arundinaceum	Herb (field)	Graminoid	X	X	.
Rhynchospora corniculata	Herb (field)	Graminoid	X	.	.
Typha latifolia	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Carex decomposita	G3	P	

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Mar-2000). The SRANK for Missouri will be revisited (M. Leahy pers. comm. 1999).

RELATED CONCEPTS

Global Similar Associations:

- *Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742)
- *Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905)
- *Scirpus cyperinus - Panicum rigidulum - Rhynchospora corniculata - (Dulichium arundinaceum)* Herbaceous Vegetation (CEGL004719)

Global Related Concepts:

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: At Mammoth Cave National Park, some open-canopy depression ponds are in effect a combination of herbaceous communities ~*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413) and ~*Typha latifolia* Southern Herbaceous Vegetation (CEGL004150) and shrubby buttonbush-dominated vegetation, ~*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742). One plot each has been attributed to

CEGL002413 and CEGL004742, and CEGL004150 is also present at MACA, although no plots were sampled. At Mammoth Cave, one extensive example is found at Sloan's Pond and is visible from the boardwalk there.

Mammoth Cave National Park Other Comments:

Global Classification Comments: The concept of the type is taken from the Indiana state classification - sinkhole pond (Homoya et al. 1985) and Missouri state classification - pond marsh (Nelson 1985). Nelson provides lists of additional species in Missouri that are restricted to, but potentially not consistently found in, this type. See also thesis work by Haefner (1993), a survey of sinkhole ponds in karst plain topography. This type is found in Kentucky (e.g., Kentucky Broadhead Swamp?, Mammoth Cave) and ought to be in Tennessee. Other sinkhole pond types, ~*Decodon verticillatus* Seasonally Flooded Shrubland (CEGL003905) and ~*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742) may overlap floristically with this type.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This community is found at Sloan's Pond. There may be other examples as well, and it could occur throughout the park in open, wet areas.

Global Range: This sinkhole pond marsh type is found in the Interior Highlands region of the United States, ranging from southern Indiana and southeastern Missouri to Kentucky and possibly Tennessee.

Nations: US

States/Provinces: IN, KY, MO:S1, TN?

TNC Ecoregions: 36:C, 38:C, 44:C

TNC Ecoregion Comments:

USFS Ecoregions: 222Ab:CCC, 222Af:CCC, 222Ag:CCC, 222Am:CCC, 222Dg:CCC, 222Ek:CCC, 234:P, 251Ce:CCC

Federal Lands: NPS (Mammoth Cave, Ozark Riverways); USFS (Mark Twain)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes: This vegetation is also found adjacent to plot MACA.53.

Mammoth Cave National Park Plots: MACA.706.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): D. Faber-Langendoen

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Haefner 1983	.	.	.	X	.	.	.	.	.
Homoya et al. 1985	.	.	.	X	.	.	.	.	.
Leahy pers. comm.	.	.	.	.	X	.	.	.	.
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Nelson 1985	.	.	.	X	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.

A.1436 Typha (angustifolia, latifolia) - (Schoenoplectus *spp.) Semipermanently Flooded Herbaceous Alliance*

(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance, found in virtually every state in the United States and probably most Canadian provinces, contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. This alliance is found most commonly along lake margins and in shallow basins, and occasionally in river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes. *Lythrum salicaria*, an exotic species from Europe, has become a common associate of many eastern *Typha* marshes. In the Southeast, this alliance is widespread and currently representative of a wide variety of mixed marshes with no clear dominants. Vegetation in this alliance may be natural or semi-natural and includes mixed stands of the nominal species, as well as essentially monospecific stands of *Typha latifolia*. These monospecific stands occur especially in artificial wetlands, such as borrow pits or ponds. This alliance occurs on hydric soils in wetlands, ditches, ponds, lakes, and rivers, as well as on shorelines and streambanks. Inundation is commonly 3-6 dm (1-2 feet) in depth. These marshes have hydric soils and are flooded with water levels ranging from several centimeters to more than 1 m for a significant part of the growing season. Occurrences may display areas of open water, but emergent vegetation dominates (80% cover). Seasonal flooding during winter and spring or flooding during heavy rains help maintain these

marshes by causing water exchange which replenishes freshwater and circulates nutrients and organic debris. Soils which support this community can be mineral or organic but are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. Vegetative diversity and density is highly variable in response to water depth, water chemistry, and natural forces. Associated species vary widely; in the Midwest they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa)*, bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus)*, and *Schoenoplectus heterochaetus (= Scirpus heterochaetus)*, and broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*. Floating aquatics such as *Lemna minor* may predominate in deeper zones.

Environment: This alliance is found most commonly along lake or pond margins, slow-moving ditches, in shallow basins, adjacent to stream or river channels in wet mud, oxbows, and occasionally in river backwaters. Elevations range from near sea level to around 2000 m in Colorado. Sites where this alliance occurs are typically semipermanently flooded, inundated with 30-100 cm of water throughout the year. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). Soils are characterized by accumulations of organic matter over deposits of fine silt and clay (Hansen et al. 1995), or loams, sandy loams, or coarse sand (Jones and Walford 1995, Bundy et al. 1996). *Typha* often occurs in pure stands, and can colonize areas recently exposed by either natural or human causes.

Adjacent herbaceous wetland vegetation types can be dominated by species of *Scirpus* and/or *Schoenoplectus, Carex*, or *Eleocharis*. Riparian shrublands or forests include those dominated by species of *Salix, Fraxinus*, or *Populus*.

Vegetation: This alliance, is found at low to moderate elevations in virtually every state in the United States and probably most Canadian provinces. It contains stands dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; in the central and western United States, they include many sedges such as *Carex aquatilis, Carex rostrata, Carex pellita (= Carex lanuginosa)*, and bulrushes such as *Schoenoplectus americanus (= Scirpus americanus), Schoenoplectus acutus (= Scirpus acutus), Schoenoplectus tabernaemontani (= Scirpus tabernaemontani)*, and *Schoenoplectus heterochaetus (= Scirpus heterochaetus)*. Other graminoids can include *Juncus* spp., *Eleocharis* spp., or *Glyceria* spp. In the central and eastern parts of its range, broad-leaved herbs such as *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum, Hibiscus moscheutos*, and *Verbena hastata*, may be present. In the west, forbs may include *Mentha arvensis, Polygonum amphibium, Epilobium ciliatum* and many others. Floating aquatics such as *Lemna minor* may predominate in deeper zones (Anderson 1982, MNNHP 1993, Hansen et al. 1995).

Dynamics: *Typha angustifolia* occupies inundated and disturbed grounds and can tolerate deeper water and higher alkalinity levels than *Typha latifolia* (Great Plains Flora Association 1986). *Typha* species are prolific seed producers, spreading rapidly to become the early colonizers of wet mineral soil and will persist under wet conditions (Hansen et al. 1995). Roots and lower stems are well-adapted to prolonged submergence, but periods of draw-down are required for seed germination to occur (Hansen et al. 1995). These are important wetland communities for many species of birds and waterfowl. Hansen et al. (1995) report that in Montana heavy livestock use may convert stands to *Carex nebrascensis*-dominated communities.

Similar Alliances:

- *Carex* spp. - *Typha* spp. Saturated Herbaceous Alliance (A.1465)
- *Phragmites australis* Semipermanently Flooded Herbaceous Alliance (A.1431)
- *Schoenoplectus acutus - (Schoenoplectus tabernaemontani)* Semipermanently Flooded Herbaceous Alliance (A.1443)
- *Schoenoplectus americanus* Semipermanently Flooded Herbaceous Alliance (A.1432)
- *Schoenoplectus robustus* Semipermanently Flooded Herbaceous Alliance (A.1434)
- *Typha domingensis* Seasonally Flooded Temperate Herbaceous Alliance (A.1392)
- *Typha* spp. - (*Schoenoplectus* spp., *Juncus* spp.) Seasonally Flooded Herbaceous Alliance (A.1394)
- *Zizania (aquatica, palustris)* Semipermanently Flooded Herbaceous Alliance (A.1441)

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is found in virtually every state in the United States and is likely to be found in most Canadian provinces.

Nations: CA, US

Subnations: AB, AL, AR, AZ, BC, CA, CO, CT, DC?, DE, FL?, GA, IA, ID, IL, IN, KS, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, ON, OR, PA, QC, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, WY

TNC Ecoregions: 1:C, 2:C, 4:P, 5:P, 6:C, 7:C, 8:P, 10:C, 11:C, 12:C, 13:C, 14:C, 15:C, 17:C, 18:P, 19:C, 20:C, 21:P, 22:P, 23:C, 25:C, 26:C, 27:C, 28:C, 31:C, 32:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:P, 51:C, 52:C, 53:C, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C, 64:C, 68:P
USFS Ecoregions: 212Aa:C??, 212Ab:C??, 212Ba:C??, 212Bb:C??, 212Ca:CC?, 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CC?, 212Ea:CCC, 212Ec:CCP, 212Ed:CCP, 212Ee:CCP, 212Fa:CCC, 212Fb:CCC, 212Fc:CCC, 212Fd:CCC, 212Ga:CCC, 212Gb:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCC, 212Hh:CCP, 212Hi:CCC, 212Hj:CCC, 212Hk:CCC, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCP, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hu:CCC, 212Hv:CCC, 212Hw:CCC, 212Hx:CCC, 212Hy:CCP, 212Ia:CCC, 212Ib:CCP, 212Ja:CCC, 212Jb:CCP, 212Jc:CCP, 212Jf:CCP, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCC, 212Jo:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 212Nd:CCP, 212Oa:CCC, 212Ob:CCC, 212Pa:CCC, 212Pb:CCC, 221Aa:CCP, 221Ab:CCC, 221Ac:CC?, 221Ad:CC?, 221Ae:CCC, 221Af:CC?, 221Ag:CC?, 221Ah:CC?, 221Ai:CCC, 221Ak:CC?, 221Al:CCC, 221Am:CC?, 221Ba:CCP, 221Bb:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CC?, 221Dc:CC?, 221Ea:CC?, 221Eb:CC?, 221Ec:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CC?, 221H:CC, 221Ja:CC?, 221Jc:CC?, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222Am:CCC, 222An:CCC, 222Cf:CCP, 222Cg:CCP, 222D:CC, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 222F:CC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222Ib:CCC, 222Ic:CCC, 222Id:CC?, 222Ie:CCP, 222If:CCC, 222Ja:CCC, 222Jc:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kd:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC, 222Lc:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 222Q:CC, 231Aa:C??, 231Ae:C??, 231Af:C??, 231Ak:C??, 231Al:C??, 231Am:C??, 231An:C??, 231Ao:C??, 231Ap:C??, 231C:CC, 231E:CC, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Aa:CCC, 232Ab:CCC, 232Ac:CCC, 232Ad:CC?, 232Bc:C??, 232Bd:C??, 232Br:C??, 232Ce:CCC, 232Ch:CC?, 232Cj:CC?, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 242A:CC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Cm:CCC, 251Cp:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Eb:CCC, 251Ed:CCC, 251F:CC, 255Aa:CCC, 255C:CC, 255Da:CCC, 255Dc:CCC, 261A:CC, 262A:CC, 263A:CC, 311A:CC, 315B:CC, 322B:CC, 331C:CC, 331F:CP, 331H:CC, 331I:CC, 332A:CP, 332B:C?, 332C:CC, 332D:CP, 332E:CC, 341B:CC, 341C:CC, 342:C, M212Aa:CP?, M212Ab:CP?, M212Ac:CP?, M212Ad:CP?, M212Ba:CC?, M212Bb:CCC, M212Ca:CP?, M212Cb:CPP, M212Cc:CP?, M212Cd:CP?, M212Da:CC?, M212Db:CC?, M212Dc:CC?, M212Ea:CCC, M212Eb:CCC, M212Fa:C??, M212Fb:C??, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Ca:C??, M221Cb:C??, M221Cc:C??, M221Cd:C??, M221Da:CCC, M221Db:CCP, M221Dc:CCP, M221Dd:CCP, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC, M261E:CC, M331F:CC, M331I:CC, M333C:CC, M334A:CC
Federal Lands: DOD (Arnold, Fort Benning); NPS (Acadia, Agate Fossil Beds, Badlands, Blue Ridge Parkway?, Boston Harbor Islands, C&O Canal?, Cape Cod, Capitol Reef, Chickamauga-Chattanooga?, Cumberland Island, Delaware Water Gap, Fort Laramie, Great Sand Dunes, Indiana Dunes, Isle Royale, John Day Fossil Beds, Johnstown Flood, Lake Meredith, Mammoth Cave, Minute Man, National Capital-East?, Ninety Six, Pictured Rocks, Saint-Gaudens, Saratoga, Scotts Bluff, Sleeping Bear Dunes, Theodore Roosevelt, Upper Delaware, Voyageurs, Wind Cave, Yosemite); PC (Waterton Lakes); USFS (Allegheny, Black Hills, Chequamegon, Chequamegon-Nicolet, Chippewa, Daniel Boone?, Green Mountain, Hiawatha, Huron, Huron-Manistee, Kisatchie, Manistee, Monongahela?, Nantahala, Nicolet, Oconee?, Ottawa?, Ouachita, Ozark, Pisgah?, Superior, Talladega?, Tuskegee?, Wallowa-Whitman, White Mountain?); USFWS (Anahuac, Aroostook, Assabet River, Brazoria, Carlton Pond?, Erie, Great Meadows, Great Swamp, Iroquois, Kofa, Lacreek, Little River, Montezuma, Moosehorn, Nomans Land Island, Nulhegan Basin, Ouray, Oxbow, Pondicherry?, Prime Hook, Rachel Carson?, Reelfoot, San Bernard)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group, mod. M.S. Reid
References: Anderson 1982, Apfelbaum 1985, Bundy et al. 1996, Bunin 1985, Christy 1973, Eggers and Reed 1987, Faber-Langendoen et al. 1996, Fike 1999, Foti 1994b, Foti et al. 1994, Grace and Wetzel 1981, Great Plains Flora Association 1986, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Hoagland 2000, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999a, Komarkova 1976, Komarkova 1986, Kovalchik 1993, Lindauer 1978, Lindauer and Christy 1972, MNNHP 1993, Masek 1979, McEachern 1979, Midwestern Ecology Working Group n.d., Mitsch and Gosselink 1993, Mohlenbrock 1959, Muldavin et al. 1993b, Muldavin et al. 2000a, Padgett et al. 1989, Sawyer and Keeler-Wolf 1995, Segadas-Vianna 1951, Simkins 1931, Smith 1991, TNC 1995b, Tolstead 1942, Wharton 1978, Youngblood et al. 1985a

[CEGL004150] *Typha latifolia* Southern Herbaceous Vegetation

Translated Name: **Broadleaf Cattail Southern Herbaceous Vegetation**

Common Name: **Southern Cattail Marsh**

Ecological System(s):

- East Gulf Coastal Plain Depression Pondshore (CES203.558)
- East Gulf Coastal Plain Large River Floodplain Forest (CES203.489)
- Atlantic Coastal Plain Embayed Region Tidal Freshwater Marsh (CES203.259)
- Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066)
- Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018)
- West Gulf Coastal Plain Large River Floodplain Forest (CES203.488)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): L.M. Smith, A.S. Weakley and J.E. Mohan, mod. K.D. Patterson

ELEMENT CONCEPT

Global Summary: This association is a semi-natural type, consisting of *Typha latifolia* as an essentially monospecific stand, especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season. The dominant species, *Typha latifolia*, often forms dense, almost monotypic stands. *Carex* spp. and *Schoenoplectus* spp. (= *Scirpus* spp.) are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. It is a widespread type. In the Interior Low Plateau of Tennessee, *Typha latifolia* is commonly found with *Scirpus cyperinus* in roadside ditches and on the margins of ponds and reservoirs.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This type was observed at Mammoth Cave at Sloans Pond in a complex with other herbaceous wetland vegetation, but there is no plot to specifically document it.

Global Environment: This type is found especially in artificial wetlands, such as borrow pits or ponds. The water table is at or above the soil surface for at least part of the growing season.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This vegetation is primarily a monospecific stand of *Typha latifolia*. It may occur in ditches and on the edges of natural and hydrologically enhanced ponds. It is best developed in the absence of a tree canopy.

Global Vegetation: Stands of this association consist of *Typha latifolia* as an essentially monospecific stand. *Carex* spp. and *Schoenoplectus* spp. (= *Scirpus* spp.) are often found in this community, especially on the margins. Other co-occurring species of this association are not fully understood. In the Interior Low Plateau of Tennessee, *Typha latifolia* is commonly found with *Scirpus cyperinus*. In addition, *Juncus effusus* and an occasional *Alnus serrulata* are also present.

Global Dynamics:

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Typha latifolia	Herb (field)	Graminoid	X	X	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const

Higher Taxon Name	Note

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (14-Jun-2001). This is a wide-ranging type that includes naturally occurring and artificial wetlands.

RELATED CONCEPTS

Global Similar Associations:

- *Scirpus cyperinus* Seasonally Flooded Southern Herbaceous Vegetation (CEGL003866)
- *Typha (angustifolia, domingensis, latifolia)* - *Schoenoplectus americanus* Herbaceous Vegetation (CEGL002032)
- *Typha (angustifolia, latifolia)* - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
- *Typha (latifolia, angustifolia)* Western Herbaceous Vegetation (CEGL002010)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)

- *Typha* spp. Great Plains Herbaceous Vegetation (CEGL002389)

Global Related Concepts:

- IID6a. Natural Impoundment Pond (Allard 1990) [in part] **B**
- L5D2aI2a. *Typha latifolia* (Foti et al. 1994) **?**
- P5A4bII2a. *Typha latifolia* (Foti et al. 1994) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: At Mammoth Cave National Park, some open-canopy depression ponds are in effect a combination of herbaceous communities ~*Carex comosa - Carex decomposita - Dulichium arundinaceum - Lycopus rubellus* Herbaceous Vegetation (CEGL002413) and ~*Typha latifolia* Southern Herbaceous Vegetation (CEGL004150) and shrubby buttonbush-dominated vegetation, ~*Cephalanthus occidentalis / Hibiscus moscheutos ssp. moscheutos* Depression Pond Shrubland (CEGL004742). CEGL004150 is present at MACA, although no plots were sampled. One plot each has been attributed to CEGL002413 and CEGL004742.

Mammoth Cave National Park Other Comments:

Global Classification Comments: This community is a common element found in many Southeastern wetland systems, but little work has been done to determine its diagnostic features and component species. The variability of this association across its range and its relation to adjacent types in this and related alliances are not fully understood. At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, this vegetation is found scattered along the border of Woods Reservoir. It appears to be a component of a mosaic of communities which form bands from the edge of the reservoir to the surrounding forest. The band found at the reservoir's edge is dominated by *Typha latifolia* and *Scirpus cyperinus*. *Juncus* sp., grasses, and an occasional *Alnus serrulata* are also present. The *Typha latifolia* grows patchily, being concentrated in dense clumps throughout the outer band.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: At Mammoth Cave, one example of this community is found at Sloans Pond and is visible from the boardwalk there. It could occur in other open, wet places throughout the park.

Global Range: This vegetation is possible throughout the southeastern United States.

Nations: US

States/Provinces: AL, AR, FL?, GA, KY, LA, MS, NC, OK, SC, TN, TX, VA, WV

TNC Ecoregions: 31:C, 38:C, 39:C, 41:C, 42:C, 43:C, 44:C, 50:P, 52:?, 53:P, 56:C, 57:P, 59:C

TNC Ecoregion Comments: ECO56 changed from P to C & 232Ce added for CUIS (mjr 7-08). ECO42 changed from P to C (MP 10-03). ECO43 changed from P to C (MP 8-02). ECO31 added (JT 5-01). ECO52 added (MP 7-99).

USFS Ecoregions: 221:C, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Cf:CCP, 222Cg:CCP, 222Eb:CCC, 222Eg:CCP, 222Eh:CCP, 231A:C?, 231Fb:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ce:CCC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251:P, 255Da:CCC, 255Dc:CCC, M221:C, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Arnold, Fort Benning); NPS (Chickamauga-Chattanooga?, Cumberland Island, Mammoth Cave, Ninety Six); USFS (Daniel Boone?, Kisatchie, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Talladega (Oakmulgee)?, Talladega (Talladega)?, Talladega?, Tuskegee?); USFWS (Anahuac, Brazoria, Reelfoot, San Bernard)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: None.

Local Description Author(s): M. Pyne

Global Description Author(s): L.M. Smith, A.S. Weakley and J.E. Mohan, mod. K.D. Patterson

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	.	.	.	.	.	
Blair and Hubbell 1938	.	.	.	X	.	.	.	.	.
Foti 1994b .	X	.	X	.	.	.	.	.	
Foti et al. 1994	.	X	X	X	.	.	.	.	.
Grace and Wetzel 1981	.	X	.	X	.	.	.	.	.
Hoagland 2000	.	.	.	X	.	.	.	.	.
McCoy 1958	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1998a .	X	.	X	.	.	.	.	.	

V.A.6.N.q. Bedrock temperate or subpolar grassland with a sparse tree layer

A.1919 (Juniperus virginiana) / Schizachyrium scoparium - (Bouteloua curtipendula) *Wooded Herbaceous Alliance*

(Eastern Red-cedar) / Little Bluestem - (Sideoats Grama) Wooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: Perennial grasslands (variously locally called barrens, glades, and/or prairies) dominated by *Schizachyrium scoparium*, possibly also *Bouteloua curtipendula*, with a scattered canopy of needle-leaved trees, or mixed needle-leaved evergreen and broad-leaved deciduous trees, particularly one or more of *Juniperus virginiana var. virginiana, Quercus muehlenbergii*, and/or *Quercus stellata*. Specimens of *Juniperus virginiana* are relatively short and compact. The open grown canopy oaks have short trunks, spreading limbs, and rounded crowns with many branches. These trees can be found scattered individually or in isolated clumps and patches. *Juniperus ashei* may replace *Juniperus virginiana var. virginiana* in the southwestern-most portion of the alliance's range. The subcanopy is absent or very sparse. Commonly encountered shrubs include *Cornus florida, Ulmus alata, Rhus copallinum*, and *Symphoricarpos orbiculatus*. *Toxicodendron radicans* also displays a shrubby growth form. Herbaceous cover is very uneven, ranging from very dense in some areas to absent in others. Characteristic species include *Andropogon gerardii, Bouteloua curtipendula, Schizachyrium scoparium, Sorghastrum nutans, Helianthus divaricatus, Manfreda virginica, Silphium* spp., *Liatris* spp., *Rudbeckia* spp., *Sabatia angularis*, and *Verbesina alternifolia*. In the western portion of the alliance's range, some characteristic species may include *Rudbeckia missouriensis, Draba reptans, Mentzelia oligosperma, Physalis pumila, Astragalus distortus, Erysimum capitatum, Castilleja purpurea, Lesquerella filiformis, Nothocalais cuspidata, Penstemon cobaea*, and *Clematis fremontii*. *Smilax bona-nox* and *Smilax glauca* are the most frequently encountered vines and may form dense mats when present. Aspect is variable; stands occur primarily on south- and southwest-facing slopes. Soils which support stands of this alliance are stony, shallow to moderately deep, neutral to alkaline, and primarily composed of weathered mineral matter, loess, and organic debris which collects in cracks and crevices of the bedrock. Parent material is limestone rock, cherty limestone, dolomite, or calcareous shale which is exposed at the surface, resulting in a very shallow, well-drained substrate. The soils may contain a homogenous mixture of rock fragments of various sizes. Organic matter is low, and there is little or no horizon development. These soils are nutrient poor, and are extremely susceptible to erosion, partly due to freeze-thaw and subsequent mass wasting. Although predominantly droughty and excessively drained, these sites can be seasonally wet, and water is occasionally ponded in shallow depressions.

Environment: Aspect is variable; stands occur primarily on south- and southwest-facing slopes. Soils which support stands of this alliance are stony, shallow to moderately deep, neutral to alkaline, and primarily composed of weathered mineral matter, loess, and organic debris which collects in cracks and crevices of the bedrock. Parent material is limestone rock, cherty limestone, dolomite, or calcareous shale which is exposed at the surface, resulting in a very shallow, well-drained substrate. The soils may contain a homogenous mixture of rock fragments of various sizes. Organic matter is low, and there is little or no horizon development. These soils are nutrient poor, and are extremely susceptible to erosion, partly due to freeze-thaw and subsequent mass wasting. Although predominantly droughty and excessively drained, these sites can be seasonally wet, and water is occasionally ponded in shallow depressions.

Vegetation: Perennial grasslands (variously locally called barrens, glades, and/or prairies) dominated by *Schizachyrium scoparium*, possibly also *Bouteloua curtipendula*, with a scattered canopy of needle-leaved trees, or mixed needle-leaved evergreen and broad-leaved deciduous trees, particularly one or more of *Juniperus virginiana var. virginiana, Quercus muehlenbergii*, and/or *Quercus stellata*. Specimens of *Juniperus virginiana* are relatively short and compact. The open grown canopy oaks have short trunks, spreading limbs, and rounded crowns with many branches. These trees can be found scattered individually or in isolated clumps and patches. *Juniperus ashei* may replace *Juniperus virginiana var. virginiana* in the southwestern-most portion of the alliance's range. The subcanopy is absent or very sparse. Commonly encountered shrubs include *Cornus florida, Ulmus alata, Rhus copallinum*, and *Symphoricarpos orbiculatus*. *Toxicodendron radicans* also displays a shrubby growth form. Herbaceous cover is very uneven, ranging from very dense in some areas to absent in others. Characteristic species include *Andropogon gerardii, Bouteloua curtipendula, Schizachyrium scoparium, Sorghastrum nutans, Helianthus divaricatus, Manfreda virginica, Silphium* spp., *Liatris* spp., *Rudbeckia* spp., *Sabatia angularis*, and *Verbesina alternifolia*. In the western portion of the alliance's range, some characteristic species may include *Rudbeckia missouriensis, Draba reptans, Mentzelia oligosperma, Physalis pumila, Astragalus distortus, Erysimum capitatum, Castilleja purpurea, Lesquerella filiformis, Nothocalais cuspidata, Penstemon cobaea*, and *Clematis fremontii*. *Smilax bona-nox* and *Smilax glauca* are the most frequently encountered vines and may form dense mats when present.

Dynamics:

Similar Alliances:

- *(Fraxinus americana, Juniperus virginiana) / Carex pensylvanica - Schizachyrium scoparium* Wooded Herbaceous Alliance (A.3014)
- *(Quercus stellata, Quercus marilandica) / Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920)
- *Bouteloua curtipendula* Herbaceous Alliance (A.1244)
- *Juniperus virginiana* Woodland Alliance (A.545)
- *Sporobolus (neglectus, vaginiflorus)* Herbaceous Alliance (A.1815)

Similar Alliance Comments: This alliance is similar to the ~*(Quercus stellata, Quercus marilandica) / Schizachyrium scoparium* Wooded Herbaceous Alliance (A.1920) but occurs on more base-rich substrates. It is also related to the ~*Juniperus virginiana* Woodland Alliance (A.545) and some elements of xeric oak woodland alliances. In general, this formation/alliance should be compared with related woodlands. See also the ~*Sporobolus (neglectus, vaginiflorus)* Herbaceous Alliance (A.1815) for the annual grass-dominated portion of glades, where this has been recognized as distinct.

ALLIANCE DISTRIBUTION

Range: This alliance is found in Alabama, Arkansas, Connecticut, Georgia, Kentucky, Oklahoma, New Jersey, New York, Pennsylvania, Tennessee, Virginia, West Virginia, Illinois, Indiana, Kansas, Missouri, Ohio, and possibly in Maryland, Louisiana and Texas.

Nations: US

Subnations: AL, AR, CT, GA, IL, IN, KS, KY, LA?, MA?, MD?, MO, NJ, NY, OH, OK, PA, TN, TX?, VA, WV

TNC Ecoregions: 32:C, 36:C, 37:C, 38:C, 39:C, 40:C, 43:C, 44:C, 45:?, 46:C, 49:C, 50:C, 59:C, 61:C

USFS Ecoregions: 221A:CC, 221Ea:CCP, 221Ec:CCC, 221H:CC, 221Ja:CCP, 222Aa:CCC, 222Ab:CCC, 222Ac:CCC, 222Ad:CCC, 222Ae:CCC, 222Af:CCC, 222Ag:CCC, 222Ah:CCP, 222Aj:CCC, 222Ak:CCC, 222Al:CCC, 222Am:CCC, 222An:CC?, 222Aq:CCC, 222De:CCC, 222Df:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCC, 222Eg:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222En:CCP, 222Eo:CCC, 222Fa:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 231Be:CCC, 231Ce:CCC, 231Da:CCC, 231Dc:CCC, 231Eb:CCC, 251Cd:CCP, 251Ce:CCP, 251Cf:CCC, 251Ci:CCC, 251Ea:CCP, 255:C, M222Aa:CCP, M222Ab:CCC, M231Aa:CCP, M231Ab:CCC, M231Ac:CCP, M231Ad:CCP

Federal Lands: COE (J. Percy Priest?, Lake Millwood?); NPS (Abe Lincoln Birthplace, Buffalo River, Chickamauga-Chattanooga, Harpers Ferry, Mammoth Cave, Ozark Riverways, Stones River); TVA (Columbia); USFS (Bankhead?, Daniel Boone, Hoosier, Mark Twain, Ouachita, Ozark, Shawnee)

ALLIANCE SOURCES

Author(s): Midwestern Ecology Group/Southeastern Ecology Group

References: Allard 1990, Carpenter 1996, DeSelm 1988, Faber-Langendoen et al. 1996, Fehrenbacher et al. 1982, Fike 1999, Foti 1994b, Fralish 1987, Hoagland 1998a, Nelson 1985, Smith 1991, Southeastern Ecology Working Group n.d., White and Madany 1978

[CEGL005131] *Quercus muehlenbergii - Juniperus virginiana / Schizachyrium scoparium - Manfreda virginica* Wooded Herbaceous Vegetation

Translated Name: **Chinkapin Oak - Eastern Red-cedar / Little Bluestem - False Aloe Wooded Herbaceous Vegetation**

Common Name: **Central Limestone Glade**

Ecological System(s):

- Central Interior Highlands Calcareous Glade and Barrens (CES202.691)
- Nashville Basin Limestone Glade and Woodland (CES202.334)
- Southern Ridge and Valley Calcareous Glade and Woodland (CES202.024)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): M. Guetersloh

ELEMENT CONCEPT

Global Summary: This limestone glade or barrens community is found in the central and eastern United States. Stands occur on gentle to steep slopes of hills, knobs, ridges, bluffs along streams, and broad terraces. Aspect is variable, but this vegetation is generally best developed on southern and western exposures. Parent material is limestone, cherty limestone, dolomite, or calcareous shale which is exposed at the surface, resulting in a very shallow, well-drained substrate. Soils are neutral to alkaline, shallow to moderately deep, and contain a homogenous mixture of rock fragments of various sizes. Herbaceous cover is very uneven, ranging from very dense in some areas to absent in others. Some dominant or characteristic grasses include *Schizachyrium scoparium, Sorghastrum nutans, Aristida* spp., and *Sporobolus compositus*. In deeper soil areas *Andropogon gerardii* may be present. At some sites *Bouteloua curtipendula* is present, but it may be rare or absent at others. Forbs vary in dominance by site. *Quercus muehlenbergii* and *Juniperus virginiana var. virginiana*

can form a sparse canopy. *Quercus stellata* may be common in parts of the range. Other scattered trees which may be present include *Cercis canadensis, Fraxinus quadrangulata, Quercus velutina, Quercus alba, Quercus marilandica*, and *Liriodendron tulipifera*. The subcanopy is absent or very sparse. Commonly encountered shrubs include *Celtis tenuifolia, Cornus florida, Ulmus alata, Rhus aromatica, Rhus copallinum*, and *Symphoricarpos orbiculatus*. This vegetation may exist as more extensive areas, or in some southeastern cases, it may be limited to a more narrow zone between vegetation dominated by woody plants and that dominated by annual grasses.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System:

Mammoth Cave National Park Environment: This limestone glade community is primarily found in the east and southeast portions of Mammoth Cave National Park, due to the greater extent of limestone outcrops there compared with other parts of the park. Some adjacent areas, which may have provided habitat for barrens communities in karst valleys, are now dominated by dense stands of *Juniperus virginiana* and are classed as ~*Juniperus virginiana var. virginiana* - (*Quercus* spp.) Forest (CEGL007124). The glade community was sampled at one location in the park. The site is a moderate, south-facing (dry) midslope bedrock outcrop at 188 m (617 feet) elevation. Soil is well-drained clay loam. The unvegetated surface is made up of leaf litter (30% cover), exposed bedrock (5%), large rocks (5%), small rocks (30%), and bare soil (30%). The 1930s aerial photographs show similar forest cover for this site (MACA47) at that time, but it is possible that a combination of a lack of grazing and fire suppression may have led to a more closed canopy, which leaves little habitat for glade species. A fire history study and age determinations for red-cedars in glades both here and at other glade community sites in the park is highly recommended. Additional evidence of disturbance includes the presence of roads/trails and exotic plants. This association has not been used as a mapping unit.

Global Environment: This community occurs on gentle to steep slopes of hills, knobs, ridges, bluffs along streams, and broad terraces. Aspect is variable, but the community is generally best developed on southern and western exposures. Parent material is limestone, cherty limestone, dolomite, or calcareous shale which is exposed at the surface, resulting in a very shallow, well-drained substrate. Soils are neutral to alkaline, shallow to moderately deep, and contain a homogenous mixture of rock fragments of various sizes. They can erode easily, partly due to freeze-thaw and subsequent mass wasting (TNC 1995a).

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: The moderately sparse (40% cover) somewhat stunted canopy (5-10 m) is codominated by *Juniperus virginiana* and *Quercus muehlenbergii*, as is the moderately sparse (40%) tall-shrub layer (2-5 m) which also includes small amounts of *Carya alba, Celtis occidentalis, Cercis canadensis, Frangula caroliniana, Fraxinus americana, Quercus imbricaria*, and *Quercus rubra*. The very sparse (10%) short-shrub layer (0.5-1 m) is made up of tall-shrub species, as well as *Cornus florida, Hypericum dolabriforme*, and *Rhus copallinum*. The moderately sparse (40%) herbaceous layer is diverse and includes *Coreopsis tripteris, Croton monanthogynus, Dichanthelium laxiflorum, Echinacea pallida, Eupatorium purpureum, Euphorbia corollata, Galactia volubilis, Helianthus divaricatus, Helianthus hirsutus, Helianthus occidentalis, Ipomoea pandurata, Lobelia spicata, Manfreda virginica, Ratibida pinnata, Sabatia angularis, Schizachyrium scoparium, Sorghastrum nutans, Sporobolus vaginiflorus, Tridens flavus*, and many others; nearly 100 species were reported from one sampled plot. This community also supports state-imperiled *Agrimonia gryposepala*.

Global Vegetation: Herbaceous cover is very uneven, ranging from very dense in some areas to absent in others. Some dominant or characteristic grasses include *Schizachyrium scoparium, Sorghastrum nutans, Aristida* spp., and *Sporobolus compositus*. In deeper soil areas *Andropogon gerardii* may be present. At some sites *Bouteloua curtipendula* is present, but it may be rare or absent at others. Forbs vary in dominance by site and include *Asclepias verticillata, Comandra umbellata, Coreopsis tripteris, Croton monanthogynus, Echinacea simulata, Galactia regularis, Hexalectris spicata, Helianthus divaricatus, Helianthus hirsutus, Hypericum dolabriforme, Hypericum sphaerocarpum, Euphorbia corollata, Gaura* spp., *Lespedeza hirta, Lespedeza virginica, Liatris aspera, Liatris cylindracea, Liatris squarrosa, Leavenworthia exigua var. exigua, Lithospermum canescens, Lobelia spicata var. leptostachys, Manfreda virginica, Matelea obliqua, Ophioglossum engelmannii, Physostegia virginiana, Ratibida pinnata, Rudbeckia hirta, Ruellia humilis, Sabatia angularis, Scutellaria parvula, Silphium trifoliatum, Solidago nemoralis, Verbesina helianthoides, Verbesina virginica*, and *Zizia aptera*. *Quercus muehlenbergii* and *Juniperus virginiana var. virginiana* can form a sparse canopy. *Quercus stellata* may be common in parts of the range. Other scattered trees which may be present include *Cercis canadensis, Fraxinus quadrangulata, Quercus velutina, Quercus alba, Quercus marilandica*, and *Liriodendron tulipifera*. The subcanopy is absent or very sparse. Commonly encountered shrubs include *Celtis tenuifolia, Cornus florida, Ulmus alata, Rhus aromatica, Rhus copallinum*, and *Symphoricarpos orbiculatus*. This vegetation may exist as more extensive areas, or in some southeastern cases, it may be limited to a more narrow zone between vegetation dominated by woody plants and that dominated by annual grasses (TNC 1995a, D. Minney pers. comm. 2000).

Mammoth Cave National Park Dynamics: Environmental conditions that favor the establishment and maintenance of this community include rapidly drained, thin, stony soils, internal drainage through carbonate rocks (karst hydrology), sun-beaten south to southwest aspects with summer droughts lasting 3-5 weeks or more, and limited water availability for most of the growing season. Natural disturbances include grazing, wind, storms, and periodic fire, which are overlain on the droughty habitat conditions. Due to low fuel levels on the ground and bedrock outcrops which serve as firebreaks, the frequency and intensity of fire was probably low. Fire history research in glades and adjacent community types is needed to provide a solid foundation for management and ecological restoration work. Periodic fire at probably low frequency and intensity may help to maintain this community, but it must be kept in mind that *Juniperus virginiana* is not fire-tolerant, but some of these trees at Mammoth Cave appear to be very old. Herds of elk, deer, and bison once roamed the area, and their grazing and browsing provided an important mechanism for maintaining the "barrens" or glade-like character of these sites.

Global Dynamics: Natural disturbance includes periodic fire, wind, storm, and drought. Environmental extremes including rapidly drained, thin, stony soils, summer droughts lasting 3-5 weeks or more, and limited water availability for most of the growing season favor the establishment of this association. Periodic fire may help to maintain this community, especially after disturbance from logging or grazing. Fire suppression encourages a transition from woodland to forest. Herds of elk, deer, and bison once roamed these hills, and their grazing and browsing provided a primary mechanism for maintaining the "barrens" or glade character.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree (canopy & subcanopy)	Needle-leaved tree	X	X	.
Quercus muehlenbergii	Tree (canopy & subcanopy)	Broad-leaved deciduous tree	X	X	.
Coreopsis tripteris	Herb (field)	Forb	X	.	.
Helianthus hirsutus	Herb (field)	Forb	X	.	.
Ipomoea pandurata	Herb (field)	Forb	X	.	.
Sabatia angularis	Herb (field)	Forb	X	.	.
Schizachyrium scoparium	Herb (field)	Graminoid	X	X	.
Sporobolus vaginiflorus	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Juniperus virginiana	Tree canopy	Needle-leaved tree	X	.	.
Quercus muehlenbergii	Tree canopy	Broad-leaved deciduous tree	X	.	.
Quercus stellata	Tree canopy	Broad-leaved deciduous tree	X	.	.
Juniperus virginiana	Tree subcanopy	Needle-leaved tree	.	.	X
Cercis canadensis	Tree subcanopy	Broad-leaved deciduous tree	X	.	.
Fraxinus americana	Tree subcanopy	Broad-leaved deciduous tree	.	.	X
Smilax bona-nox	Shrub/sapling (tall & short)	Vine/Liana	X	.	.
Smilax glauca	Shrub/sapling (tall & short)	Vine/Liana	.	.	X
Manfreda virginica	Short shrub/sapling	Succulent shrub	X	.	.
Helianthus divaricatus	Herb (field)	Forb	X	.	.
Andropogon gerardii	Herb (field)	Graminoid	X	.	.
Bouteloua curtipendula	Herb (field)	Graminoid	.	.	X
Schizachyrium scoparium	Herb (field)	Graminoid	X	.	.
Sorghastrum nutans	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note
Cladonia spp.	Dominant (nonvascular)
Parmelia spp.	Dominant (nonvascular)

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Agrimonia gryposepala	-	P	state-imperiled
Lonicera japonica	-	P	exotic
Taraxacum officinale	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Agkistrodon contortrix	-	A	
Aimophila aestivalis	G3	A	
Archilochus colubris	-	A	
Aspidoscelis sexlineata	-	A	
Astragalus crassicarpus var. *trichocalyx*	-	P	

Astragalus distortus	-	P	
Berchemia scandens	-	P	
Berlandiera betonicifolia	-	P	Formerly entered as Berlandiera texana (Kartesz 1994), which is now merged into the new concept B. betonicifolia (Kartesz 1999).
Bombycilla cedrorum	-	A	
Chondestes grammacus	-	A	
Colaptes auratus	-	A	
Cotinus obovatus	-	P	
Cyanocitta cristata	-	A	
Delphinium alabamicum	G2	P	
Dendroica discolor	-	A	
Echinacea simulata	G3	P	
Erysimum capitatum	-	P	
Galium arkansanum	-	P	
Hypericum dolabriforme	-	P	
Lampropeltis calligaster	-	A	
Lanius ludovicianus	-	A	
Leavenworthia crassa	G1	P	Federal candidate for listing
Leavenworthia exigua var. *exigua*	G4T3	P	vulnerable
Leavenworthia uniflora	-	P	The only Indiana occurrence of this species is in this community in the Muscatatuck Flats and Canyons Section.
Meleagris gallopavo	-	A	
Odocoileus virginianus	-	A	
Passerina cyanea	-	A	
Polygala senega	-	P	
Sayornis phoebe	-	A	
Sceloporus undulatus	-	A	
Sciurus carolinensis	-	A	
Sialia sialis -	A		
Thryomanes bewickii	-	A	
Thryothorus ludovicianus	-	A	
Toxostoma rufum	-	A	
Trimerotropis saxatilis	G3	A	
Zizia aptera -	P		

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (2-Nov-1999). There are probably over 100 occurrences rangewide. Eighty-three have been documented: 32 in Illinois (S2), 48 in Indiana (S2S3), and 3 in Ohio (S2). Although no other occurrences are documented, the community is also reported in Alabama, Georgia, Kentucky, Tennessee, West Virginia, and Virginia (all S?). It is found in 15 ecoregional subsections. The present range of this community is probably very close to its presettlement range, but lack of fire permits increased dominance by woody species.

RELATED CONCEPTS

Global Similar Associations:

- *Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464)--is a zonal component within this type.
- *Quercus muehlenbergii - (Juniperus virginiana var. virginiana)* Unglaciated Bluff Woodland (CEGL004267)
- *Quercus muehlenbergii - Quercus (alba, velutina) - (Juniperus virginiana var. virginiana)* Bluff Woodland (CEGL002144)--is the more northern equivalent of this type.
- *Quercus stellata - Quercus marilandica - Quercus velutina - Carya texana / Schizachyrium scoparium* Woodland (CEGL002149)
- *Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Wooded Herbaceous Vegetation (CEGL002391)

Global Related Concepts:

- *Juniperus virginiana / Schizachyrium scoparium - Bouteloua curtipendula - Sisyrinchium albidum - Packera millefolia* Wooded Herbaceous Vegetation (Fleming pers. comm.) **?**
- Barrens type (Hutchison 1994) [is sometimes treated broadly as a barrens type] **?**
- Barrens type (Hutchison et al. 1986) [is sometimes treated broadly as a barrens type] **?**
- Central and Eastern Grassland and Forest Combinations: 83: Cedar Glades (*Quercus-Juniperus-Sporobolus*) (Kuchler 1964) **B**
- Eastern Redcedar: 46 (Eyre 1980) **B**
- Post Oak - Blackjack Oak: 40 (Eyre 1980) **B**
- Terrestrial: Savanna (TNC 1985) **B**
- UNESCO FORMATION CODE: V.B.1c (UNESCO 1973) **B**
- Xeric Limestone Prairie (Baskin et al. 1994) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments: At Mammoth Cave National Park, the calcareous xeric habitats with exposed limestone ledges are termed "cedar-oak glades", and the calcareous sub-xeric habitats with soil cover on the sinkhole plain and in karst valleys may have been a mosaic of barrens, woodland or savanna, and forest depending on highly localized habitat conditions. These and other red-cedar - oak glade communities in the park merit further careful and targeted study.

Mammoth Cave National Park Other Comments: This association has not been used as a mapping unit.

Global Classification Comments: In Indiana, *Quercus stellata* is typical, *Bouteloua curtipendula* is rare, and *Sorghastrum nutans* is common. In Illinois, *Sorghastrum nutans* is more common than *Bouteloua curtipendula*. This type was developed in the Midwest and attributed to various southeastern states. Its relation to other eastern and southeastern alkaline glades needs further investigation. In Tennessee, this community might be called a limestone barren, as the term "glade" is restricted to bedrock-defined openings that are mostly flat, pavement-like, and dominated by annual grasses rather than perennial ones. In Indiana, this community is commonly called a cedar glade because stands of *Juniperus virginiana* border many of the sites of the community. *Juniperus virginiana*, which occurs with *Quercus stellata*, was probably rare in this community before the time of European settlement and consequent fire suppression. *~Quercus muehlenbergii - Quercus (alba, velutina) - (Juniperus virginiana var. virginiana)* Bluff Woodland (CEGL002144) is the more northern equivalent of this type. In southeastern Ohio, this type also contains a distinctive zone tracked as a separate type, the *~Juniperus virginiana / Schizachyrium scoparium - Silphium terebinthinaceum var. luciae-brauniae - Carex juniperorum - Castilleja coccinea* Wooded Herbaceous Vegetation (CEGL004464). In Kentucky, examples of the xeric Central Limestone Glade are restricted to unusual geologic conditions (outcrops and shallow soil over limestone) and are widely scattered in the central part of the state.

In the Ozark Hills region of southern Illinois, a variant of this type occurs on very steep slopes. The herbaceous layer is quite variable because of soil erosion.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This association is found on exposures of Mississippian limestone, especially in the east and southeast portion of the park where these outcrops are most abundant. One extensive area is located on Dennison Ferry Road. It is embedded in a matrix of *Juniperus virginiana* forests and woodlands.

Global Range: This limestone glade or barrens community is found in the central and eastern United States, ranging from southern Illinois, Kentucky, Tennessee and Alabama, east to Georgia, western Virginia, West Virginia, and Ohio.

Nations: US

States/Provinces: AL, GA, IL:S2, IN:S2S3, KY, OH, TN, VA, WV

TNC Ecoregions: 36:C, 38:C, 43:?, 44:C, 49:C, 50:C, 59:?

TNC Ecoregion Comments: WAP ecology group reviewed and attributed appropriate subsections. Regarded to be peripheral in OH portion of WAP and not present in the WV portion of WAP. ECO49 changed from ? to C (LAS 1-03). ECO50 changed from ? to C (MP 2-00).

USFS Ecoregions: 221Ec:CCC, 222Aq:CCC, 222De:CCC, 222Df:CCC, 222Dg:CCC, 222Dh:CCC, 222Di:CCC, 222Ei:CCC, 222Ek:CCC, 222El:CCC, 222Fc:CCC, 222Fd:CCC, 222Fe:CCC, 231Da:CCC, 251Cf:CCC, 251Ci:CCC

Federal Lands: DOD (J. Percy Priest?); NPS (Abe Lincoln Birthplace, Chickamauga-Chattanooga, Mammoth Cave, Stones River); TVA (Columbia); USFS (Bankhead?, Shawnee)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name — Relationship — Note

Mammoth Cave National Park Map Units Summary: This association has not been used as a mapping unit.

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.47.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): M. Guetersloh

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Baskin and Baskin 1982	.	.	.	X	.	.	.	.	.
Baskin et al. 1994	.	X	X	X	.	.	.	.	.
Evans 1991 .	X	.	X	.	.	.	.	.	
Eyre 1980 .	.	X	X	.	.	.	.	.	
Fleming et al. 2001	.	.	.	X	.	.	.	.	.
Fleming pers. comm.	.	.	X	X	.	.	.	.	.
Fralish 1987	.	X	.	X	.	.	.	.	.
Heikens and Robertson 1994	.	.	.	X	.	.	.	.	.

Heikens et al. 1994	.	.	.	X	.	.	.	.	.
Homoya 1994	.	.	.	X	.	.	.	.	.
Homoya et al. 1988	.	.	.	.	.	.	.	.	.
Hutchison 1994	.	X	X	X	.	.	.	.	.
Hutchison et al. 1986	.	X	X	X	.	.	.	.	.
Kuchler 1964	.	.	X	X	.	.	.	.	.
Midwestern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
Minney pers. comm.	.	.	.	X	.	.	.	.	.
Nelson 1985	.	.	.	X	.	.	.	.	.
Quarterman and Powell 1978	.	.	.	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC 1985 .	.	X	X	.	.	.	.	.	
TNC 1995a .	X	.	X	.	.	.	.	.	
UNESCO 1973	.	.	X	X	.	.	.	.	.
Voigt and Mohlenbrock 1964	.	.	.	X	.	.	.	.	.
White and Madany 1978	.	X	.	X	.	.	.	.	.

V.B.2.N.d. Temporarily flooded temperate perennial forb vegetation

A.1657 Justicia americana *Temporarily Flooded Herbaceous Alliance*

American Water-willow Temporarily Flooded Herbaceous Alliance

ALLIANCE CONCEPT

Summary: This alliance covers rocky river shoals dominated by *Justicia americana* with *Orontium aquaticum, Podostemum ceratophyllum, Leersia* spp., *Lemna minor, Saururus cernuus*, and others. A sparse canopy may be present, and species may include *Carpinus caroliniana ssp. caroliniana, Fagus grandifolia*, and *Fraxinus pennsylvanica*. There is some apparent regional variation in the associated species. More Appalachian examples may contain *Orontium aquaticum* as a codominant. In parts of the Ridge and Valley and Piedmont, *Hymenocallis caroliniana (= Hymenocallis coronaria)* is codominant. In the Edwards Plateau of central Texas, associated with *Justicia americana* are *Bacopa monnieri, Fuirena simplex, Eleocharis geniculata (= Eleocharis caribaea), Eleocharis montevidensis*, and *Cyperus* spp.

Environment: This alliance occurs on the shoals or bars of rocky streams and riverbeds.

Vegetation: This alliance, found primarily in the southeastern United States, is made up of riverside herbaceous communities dominated by *Justicia americana* with *Orontium aquaticum, Podostemum ceratophyllum, Leersia* spp., *Lemna minor, Saururus cernuus*, and others. A sparse tree canopy may be present, and species may include *Carpinus caroliniana ssp. caroliniana, Fagus grandifolia*, and *Fraxinus pennsylvanica*. There is some apparent regional variation in the associated species. More Appalachian examples may contain *Orontium aquaticum* as a codominant (Schmalzer and DeSelm 1982). In parts of the Ridge and Valley and Piedmont, *Hymenocallis caroliniana (= Hymenocallis coronaria)* is codominant. In the Edwards Plateau of central Texas, associated with *Justicia americana* are *Bacopa monnieri, Fuirena simplex, Eleocharis geniculata (= Eleocharis caribaea), Eleocharis montevidensis*, and *Cyperus* spp. Further study is needed to characterize this alliance and document its regional variability.

Dynamics:

Similar Alliances:

Similar Alliance Comments:

ALLIANCE DISTRIBUTION

Range: This alliance is distributed in the Edwards Plateau of Texas, Ozark Highlands, Boston Mountains, Ouachita Mountains, Interior Low Plateau, Cumberland Plateau, Piedmont, and Arkansas Valley. It is found from Pennsylvania to Ohio, south to Georgia and west to Texas and Oklahoma.

Nations: US

Subnations: AL, AR, GA, KY, MD, NC, NJ, NY, OH, OK, PA, SC, TN, TX, VA, WV

TNC Ecoregions: 29:C, 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C

USFS Ecoregions: 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Ga:CCP, 212Gb:CCP, 221Am:CCP, 221Ba:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCP, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Ab:CCC, 222Ag:CCC, 222Ah:CCC, 222An:CCC, 222Dg:CCC, 222Eb:CCC, 222Eg:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cc:CCC, 231Cd:CCC, 231Dc:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 315D:CC, 321B:PP, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222Aa:CCC, M222Ab:CCC, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC

Federal Lands: DOD (Fort Hood); NPS (Big South Fork, Blue Ridge Parkway?, C&O Canal, Delaware Water Gap, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ozark, Pisgah, Sumter, Uwharrie, Wayne); USFWS (Cahaba River)

ALLIANCE SOURCES

Author(s): A.S. Weakley

References: Allard 1990, Faber-Langendoen et al. 1996, Fike 1999, Foti et al. 1994, Hoagland 2000, Nelson 1986, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Southeastern Ecology Working Group n.d.

[CEGL004286] *Justicia americana* Herbaceous Vegetation

Translated Name: **American Water-willow Herbaceous Vegetation**

Common Name: **Water-willow Rocky Bar and Shore**

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)

Status: Standard

Circumscription Confidence: 2 - Moderate

Concept Author(s): A.S. Weakley, mod. D. Faber-Langendoen

ELEMENT CONCEPT

Global Summary: This association is found primarily in the Piedmont, Central Appalachians, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. It provides habitat in some portions of its range for globally rare dragonflies and herbs. *Justicia americana* is the characteristic dominant. *Saururus cernuus* is often present and may be codominant. Other herbaceous species that may be present include *Leersia oryzoides, Leersia virginica, Lemna minor, Orontium aquaticum, Podostemum ceratophyllum, Scirpus* sp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani, Cyperus* spp., *Eleocharis* spp., *Diodia teres, Gratiola brevifolia, Bidens* spp., *Polygonum caespitosum var. longisetum*, and *Xyris difformis var. difformis*. Exotics include *Lythrum salicaria* and *Lysimachia vulgaris*. A sparse canopy layer, which can include *Carpinus caroliniana ssp. caroliniana, Salix interior, Acer saccharinum, Platanus occidentalis, Betula nigra, Fagus grandifolia*, and *Fraxinus pennsylvanica*, among other species, may be present. Scattered shrub seedlings of *Salix nigra, Betula nigra, Acer saccharinum*, or *Platanus occidentalis* may also be present.

ENVIRONMENTAL DESCRIPTION

USFWS Wetland System: Palustrine

Mammoth Cave National Park Environment: This water-willow rocky bar and shore association was sampled at one location in the park. The site is a gently sloping, temporarily flooded river bar at 147 m (482 feet) elevation. It is on an island in the Green River just below the Green River Ferry which floods periodically. Soil is poorly drained silty clay. The unvegetated surface is dominated by leaf litter (75% cover) with some small rocks (20%) and bare soil (5%). Evidence of disturbance includes the presence of fire rings (an indication of use by campers) and exotic plants.

Global Environment: This association occurs on the shoals or bars of rocky streams and riverbeds, on bedrock, boulders, cobble, gravel, and sands. They are subject to frequent high energy floods, and are entirely submerged by most flood events. During extreme low water periods, the soil below the beds can be exposed, showing a varied mixture of sand, gravel and cobbles, often with deposits of silt and muck. Stands commonly occur on the edge of the river and at the heads and tails of islands and may sometimes occur on deposition bars in the middle of the river. Substrate pH was circumneutral (6.0 - 6.5) in two samples. Slopes range from level to moderate but are typically gentle. Elevations of West Virginia stands range from 73 to at least 654 m; the type occurs at lower elevations in the Piedmont and Coastal Plain.

VEGETATION DESCRIPTION

Mammoth Cave National Park Vegetation: This community is dominated by the herbaceous layer; however, in this example, there is a sparse (5% cover) emergent shrub layer of *Celtis occidentalis, Acer rubrum*, and *Platanus occidentalis*. The moderate (60%) herbaceous layer is dominated by *Justicia americana, Eleocharis tenuis*, and *Hibiscus laevis* and includes *Chasmanthium latifolium, Diodia virginiana, Ipomoea pandurata, Phyla lanceolata, Xanthium strumarium*, and others. Many exotic species have invaded this community.

Global Vegetation: *Justicia americana* is the dominant(and sometimes the only) species, forming lawnlike stands in shallow reaches of rivers. Cover by *Justicia americana* ranges from 40 to 85%. *Saururus cernuus* is often present and may be codominant. Other herbaceous species may be present but rarely achieve more than 1% cover; they include *Leersia oryzoides, Leersia virginica, Lemna minor, Orontium aquaticum, Podostemum ceratophyllum, Scirpus* sp., *Schoenoplectus pungens, Schoenoplectus tabernaemontani, Cyperus* spp., *Elodea* sp., *Eleocharis* spp., *Equisetum arvense, Bidens* spp., *Polygonum caespitosum var. longisetum, Diodia teres, Gratiola brevifolia*, and *Xyris difformis var. difformis*. Exotics include *Lythrum salicaria* and *Lysimachia vulgaris*. In some areas, *Justicia* usually grows in nearly pure patches, so that few other species are associated with it. *Bidens* spp., *Cuscuta gronovii, Mimulus ringens, Polygonum* spp., *Rumex* spp., and *Salix interior* can occur (Anderson 1982). Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum, Betula nigra, Fraxinus pennsylvanica*, and *Platanus occidentalis*. A sparse canopy layer may be present, which can include *Carpinus caroliniana, Fagus grandifolia*, and *Fraxinus pennsylvanica*, among others. Scattered shrub seedlings of *Salix nigra, Betula nigra, Acer saccharinum*, or *Platanus occidentalis* may also be present. In the Cumberland Plateau of Alabama, *Justicia americana* is present in dense patches with some interspersion of other species, including *Pilea pumila, Boehmeria cylindrica, Eclipta prostrata (= Eclipta alba), Juncus coriaceus, Mikania scandens, Ludwigia palustris, Leersia* sp., and *Bidens* sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* growing along streambanks or in shallow riffles "along or with" *Justicia americana* 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* was overwhelmingly dominant (50-75% mean cover), and no associated species occurred in more than 48% of the plots. Vascular plant species richness in sampled plots is low (typically 6-14 taxa). The exotic invasive *Lythrum salicaria* was found in one West Virginia plot but has not been observed in abundance in this community, possibly due to intolerance of high-energy flooding.

Global Dynamics: Stands in some situations may be obliterated by ongoing river channeling. Anderson (1982) describes some of the life-history characteristics of *Justicia americana* that allow it to persist in river channels.

MAMMOTH CAVE NATIONAL PARK FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Celtis occidentalis	Short shrub/sapling	Broad-leaved deciduous shrub	X	.	.
Hibiscus laevis	Herb (field)	Forb	X	.	.
Justicia americana	Herb (field)	Forb	X	X	.
Eleocharis tenuis	Herb (field)	Graminoid	X	.	.

Higher Taxon Name	Note

GLOBAL FLORISTIC COMPOSITION

Species Name	Stratum	Lifeform	Dom	Char	Const
Justicia americana	Herb (field)	Forb	X	X	.
Polygonum amphibium	Herb (field)	Forb	.	X	.
Polygonum caespitosum var. *longisetum*	Herb (field)	Forb	.	X	.
Saururus cernuus	Herb (field)	Forb	.	X	.
Leersia oryzoides	Herb (field)	Graminoid	.	X	.
Leersia virginica	Herb (field)	Graminoid	.	X	.
Schoenoplectus pungens	Herb (field)	Graminoid	.	X	.

Higher Taxon Name	Note
Eleocharis spp.	characteristic graminoids

MAMMOTH CAVE NATIONAL PARK OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Alliaria petiolata	-	P	exotic
Cardamine hirsuta	-	P	exotic
Chenopodium ambrosioides	-	P	exotic
Datura stramonium	-	P	exotic
Diplotaxis tenuifolia	-	P	exotic
Glechoma hederacea	-	P	exotic
Lespedeza cuneata	-	P	exotic
Rumex salicifolius	-	P	exotic

GLOBAL OTHER NOTEWORTHY SPECIES

Species Name	GRank	Animal	Note (*specify Rare (geog area), Invasive, Animal, Other*)
Lysimachia vulgaris	-	P	exotic
Lythrum salicaria	-	P	invasive exotic
Ptilimnium nodosum	G2	P	Federally listed endangered; globally imperiled
Sagittaria secundifolia	G1	P	Federally listed threatened; globally critically imperiled

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (12-Sep-1997).

RELATED CONCEPTS

Global Similar Associations:

- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285)
- *Justicia americana - Peltandra virginica* Herbaceous Vegetation [Provisional] (CEGL006579)
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696)

Global Related Concepts:

- *Justicia americana* riparian herbaceous vegetation (Vanderhorst 2001b) =
- Aquatic Types (Schmalzer and DeSelm 1982) [in part] **B**
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) [in part] **B**
- Lizard's tail emergent bed (Perles et al. 2004) **?**
- Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) **?**
- Water willow emergent bed (Perles et al. 2004) **?**

CLASSIFICATION & OTHER COMMENTS

Mammoth Cave National Park Classification Comments:

Mammoth Cave National Park Other Comments:

Global Classification 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* (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

ELEMENT DISTRIBUTION

Mammoth Cave National Park Range: This vegetation is found in shallow portions of the Green River and its tributaries.

Global Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, Pennsylvania, and Delaware.

Nations: US

States/Provinces: AL, AR, GA, KY, MD, NC, NJ, NY, OH:S4, OK, PA:S5, SC?, TN, VA, WV

TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 45:C, 48:C, 49:C, 50:C, 51:C, 52:C, 59:C, 60:C, 61:C

TNC Ecoregion Comments: ECO60 added (SLN 3-03). ECO61 added (LAS 10-99).

USFS Ecoregions: 212Fa:CCP, 212Fb:CCC, 212Fc:CCC, 212Ga:CCP, 212Gb:CCP, 221Am:CCP, 221Ba:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCP, 221Ec:CCC, 221Ed:CCP, 221Ef:CCP, 221Ha:CCC, 221Hc:CCC, 221He:CCC, 222Dg:CCC, 222Eb:CCC, 222Eg:CCC, 222Ej:CCP, 222En:CCC, 222Eo:CCC, 222Ha:CCC, 231Af:CCC, 231B:CC, 231Cc:CCC, 231Cd:CCC, 231D:CC, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Cb:CCC, M221Cd:CCC, M221Da:CCC, M221Dc:CCC, M222A:CC, M231A:CC

Federal Lands: NPS (Big South Fork, C&O Canal, Delaware Water Gap, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Pisgah, Sumter (Mountains)?, Sumter (Piedmont)?, Sumter?, Uwharrie, Wayne)

ELEMENT SOURCES

Mammoth Cave National Park Map Units: Map Unit Name	Relationship	Note

Mammoth Cave National Park Map Units Summary:

Mammoth Cave National Park Inventory Notes:

Mammoth Cave National Park Plots: MACA.42.

Local Description Author(s): M.J. Russo and M. Pyne

Global Description Author(s): A.S. Weakley, mod. D. Faber-Langendoen and S.C. Gawler

References (enter Reference Code when known, otherwise, enter Short Citation; enter full citation if reference is new)

Reference (*=concept ref)	name	classif	related	char	rank	eospec	eorank	manage	image
Allard 1990 .	.	X	X	X	.	.	.	.	
Anderson 1982	.	.	.	X	.	.	.	.	.
Anderson 1996	.	.	.	X	.	.	.	.	.
Fike 1999 .	X	.	X	.	.	.	.	.	
Fleming 2007	.	X	.	X	.	.	.	.	X
Fleming et al. 2001	.	.	.	X	.	.	.	.	.
Harrison 2004	.	.	.	.	.	.	.	.	.
Hoagland 1997	.	.	.	.	X	.	.	.	.
Hoagland 2000	.	X	.	X	.	.	.	.	.

Lea 2000 .	X	.	X	.	.	.	.	.	
Lea 2004 .	X	.	X	.	.	.	.	.	
Major et al. 1999	.	.	.	X	.	.	.	.	.
McCoy 1958	.	.	.	X	.	.	.	.	.
Nelson 1986	.	X	.	X	X	.	.	.	.
ONHD unpubl. data	.	.	.	.	.	.	.	.	.
Palmer-Ball et al. 1988	.	.	.	X	.	.	.	.	.
Peet et al. unpubl. data 2002	.	.	.	X	.	.	.	.	.
Penfound 1953	.	.	.	X	.	.	.	.	.
Perles et al. 2004	.	.	X	X	.	.	.	.	.
Schafale 1998b	.	.	X	X	.	.	.	.	.
Schafale 2002	.	.	.	.	.	.	.	.	.
Schafale and Weakley 1990	.	X	.	X	X	.	.	.	.
Schmalzer and DeSelm 1982	.	.	X	X	.	.	.	.	.
Schotz pers. comm.	.	.	.	.	.	.	.	.	.
Southeastern Ecology Working Group n.d.*	X°	.	.	.	.	.	.	.	.
TDNH unpubl. data	.	.	.	.	.	.	.	.	.
TNC and WPC 2004	.	X	.	X	.	.	.	.	.
Vanderhorst 2001b	.	X	X	X	.	.	.	X	.
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Appendix III. Plot sheet used for permanent plots

SEVENTEEN PARKS PROJECT: Permanent Plot *Sampling Form* Page 1

County:_____ **Location (Park) Code**_____ **Plot Code:**____ **Jurisdiction (State):**___ **Location org:**_NPS_

Provisional community name_____

*Classified community name*_____
Classifier _____ *Date*_____ *NVC ELCODE*_____

Survey date:_____ **Surveyor initials:**_____

Directions to plot:

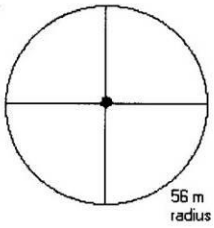
Tagged tree is a _____ of ____ cm dbh with tag #_____. Conduit is at a bearing of ___ degrees and ___ m from tree.

Directions to tag tree (including any notes on best access route):

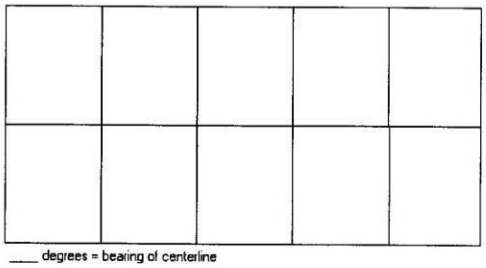
Time taken to walk to plot:_____

PLOT CONFIGURATION (Depict the plot layout with respect to the 1 hectare and attempt to draw in conduit, points where GPS positions were collected, witness trees, locations of pictures taken, and sketches of all communities within the 1 hectare!)

Plot representativeness -Is the 1 hectare all the same? ___YES ___ NO - If not, depict in circle below)



1 ha circle



___ degrees = bearing of centerline

20 x 50 Meter plot

Est. Extent of occurrence of community:

< 1HA 1-10 HA 10-100HA > 100HA

PIC #_____ **Description of pic(s):**_____

_____

Select one: UTM OR Lat/long (If lat/long, then values are _____ **N** _____ **W**

GPS Techniques/Equipment _Garmin GPS III Plus__ **Datum(pick one)** __NAD 83_OR_NAD27___ Zone:__16__OR__17__

GPS Unit ID _____ **GPS file name** ___ ___ ___ ___ ___ ___ (standard = First letter of park + # of plot (C04)

Field UTM X ___ ___ ___ ___ ___ ___ **m E Y** ___ ___ ___ ___ ___ ___ ___ **m N Elevation** _____ **m / ft**

Averaging performed (at least 120 observations)? ____ **Coordinate accuracy** _____ **m / ft DOP** _____ **# sats** _____

Community Survey
Page 1

SEVENTEEN PARKS PROJECT: Permanent Plot *Sampling Form*

County:_____ **Location (Park) Code**_____ **Plot Code:**____ **Jurisdiction (State):**___ **Location org:**_NPS_

ENVIRONMENTAL / SITE INFORMATION

Measured Slope _____ ° ____ %

__ Flat	0 °	0 %
__ Gentle	0-5 °	1-9%
__ Moderate	6-14 °	10-25%
__ Somewhat steep	15-25 °	26-49%
__ Steep	27-45 °	50-100%
__ Very steep	45-69 °	101-275%
__ Abrupt	70-100 °	276-300
__ ovrhng/shltrd	>100 °	>300%

Measured Aspect ____ ° (N=0 °)

__ Flat	__ SE 113-157 °
__ Variable	__ S 158-202 °
__ N 338-22 °	__ SW 203-247 °
__ NE 23-67 °	__ W 248-292 °
__ E 68-112 °	__ NW 293-337

Topographic Position
__ Interfluve (Ridge/summit/crest) __ Toeslope
__ High Slope (upper/convex slope)
__ Midslope __ Low level (terrace)
__ Lowslope (lower/footslope) __ Channel bed

Cowardin System
_ Upland _ Palustrine
_ Estuarine _ Lacustrine _ Riverine

Landform (check most applicable)

__ Alluvial flat	__ Cove	__ Ridge
__ Alluvial terrace	__ Depression	__ Ridgetop bedrock outcrop
__ Bald	__ Draw	__ Saddle
__ Bank	__ Exogenous dome	__ Seep
__ Bar	__ Floodplain	__ Toe slope
__ Bench	__ Gap	__ Slope
__ Bottomlands	__ Gorge	__ Streambed
__ Cliff	__ Hillslope bedrock outcrop	__ Streamhead
	__ Midslope	__ Periglacial boulderfield
	__ Nose slope	__ Ravine

Rock types present:

Hydrologic Regime (check only for wetlands)
__ Not a wetland (Upland: XERIC : DRY - MESIC : MESIC)
__ Intermittently flooded __ Permanently flooded __ Semipermanently flooded __ Temporarily Flooded (e.g. floodplains)
__ Seasonally Flooded (e.g. seasonal ponds) __ Saturated (e.g. bogs, perennial seeps) __ Unknown __ Irregularly flooded _ Irrglrly exposed

QUALITATIVE ASSESSMENT:

A) HYDROLOGY:

B) LANDSCAPE AND LANDUSE HISTORY (including disturbance history and possible threats to sustainability):

Soil Texture:
__ Sand __ Peat __ Silt loam __Muck
__ Sandy loam __ Loam __ Clay loam __Clay

Drainage:
__ Rapidly drained __ Moderately well drained __Somewhat poorly drained
__ Well drained __ Poorly drained __ Very poorly drained

Ground cover

____% Bedrock	____% Litter, duff	____% Other _____
____% Large rocks (cobbles, boulders >10cm)	____% Wood (> 1 cm)	
____% Small rocks (gravel, 0.2-10 cm)	____% Water	
____% Sand (0.1-2 mm)	____% Bare soil	

Leaf type:
__Broad-leaved
__Needle-leaved
__Microphyllous
__Graminoid
__Broad-leaved herbaceous
__Pteridophyte
__Extremely xeromorphic
Mixed

Leaf phenology (dominant stratum)
__ Evergreen
__ Cold-deciduous
__ Drought-deciduous
__ Mixed evergreen-cold-deciduous
__ Mixed evergreen drought deciduous
__ Herb - Annual
__ Herb - Perennial

Physiognomic Class
__ Forest (closed tree canopy)
__ Woodland (open tree canopy)
__ Shrubland
__ Dwarf Shrubland
__ Herbaceous (less than 25% woody layers)
__ Nonvascular
__ Sparse Vegetation

Natural and Anthropogenic Disturbance

_ logging	_ fire	_ Hydrologic
_ erosion	_ trails/roads	_ Agriculture
_ grazing/browsing	_ wind/ice damage	_ Old Growth
_ pine bark beetle	_ exotic plants	_ Fire Suppression
_ dogwood anthr	ORV	

Disturbance and animal use comments:

SEVENTEEN PARKS PROJECT: Permanent Plot *Sampling Form*

County:_____ **Location (Park) Code**_____ **Plot Code:**____ **Jurisdiction (State):**___ **Location org: NPS**_

QUANTITATIVE VEGETATION SAMPLE

STRATA	STRATA HEIGHT	COVER CLASS	DOMINANT/DIAGNOSTIC SPECIES
Emergent – T1			
Tree Canopy T2			
Understory T3			
Tall shrub S1			
Short shrub S2			
Herbaceous			
Non-vascular			
Vine/liana			
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):			

Height scale	Cover cls for strata
01 < .5m	5%
02 .5-1m	10%
03 1-2m	20%
04 2-5m	30%
05 5-10m	40%
06 10-15m	50%
07 15-20m	60%
08 20-35m	70%
09 35-50m	80%
10 >50m	90%
	100%

***T1**: Emergent | **T2**: Tree Canopy | **T3** Subcanopy | **S1** Tall Shrub (>1m; to 5m) | **S2** Short Shrub (< 1m) | **H** Herbaceous | **N** Nonvascular | **V** Vines (lianas) | **E** Epiphytes*

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM (enter cover values for each stratum AND for Total cover)

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total Cover	Name (7 letter code or full name)	Collected? Spec #?	Discarded ?

Cover cls
1 trace
2 0.1-1%
3 1-2%
4 2-5%
5 5-10%
6 10-25%
7 25-50%
8 50-75%
9 75-95%
10 >95%

SEVENTEEN PARKS PROJECT: Permanent Plot *Sampling Form*

County:______________ Location (Park) Code________ Plot Code:_____ Jurisdiction (State):___ Location org:_NPS_

SPECIES COMPOSITION AND COVER/ABUNDANCE CLASS BY STRATUM

T 1	T 2	T 3	S 1	S 2	H	N	V	E	Total cover	Name (7 letter acronym or full name)	Collected? Spec #?	Discar ded?

Cover classes
1. trace
2. 0.1-1%
3. 1-2%
4. 2-5%
5. 5-10%
6. 10-25%
7. 25-50%
8. 50-75%
9. 75-95%
10. >95%

T1: Emergent

T2: Tree Can

T3 Subcanopy

S1 Tall Shrub (>1m; to 5m)

S2 Short Shrub (< 1m)

H Herbaceous

N Nonvascular

V Vines (lianas)

E Epiphytes

Use bottom of this sheet or additional pages for other species in 1 ha plot

Appendix IV. Photos of selected plots of Mammoth Cave National Park



Plot 02, E view



Plot 03, W view



Plot 14, E view



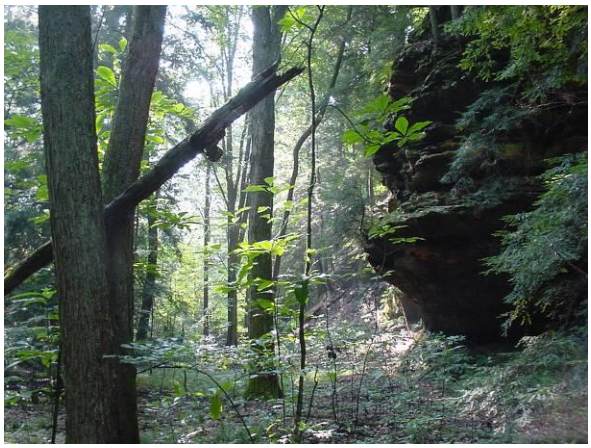
Plot 20, NNE view



Plot 23, E view



Plot 38, S view



Plot 45, SE view, Rockhouse



Plot 57, Cedar Sink, general view



Plot 70, E view



Plot 97, N view



Plot 102, general view, large boulder



Plot 103, general view



Plot 106, general view with Mountain Laurel, *Kalmia latifolia*



Plot 708, E view



Plot 710, general view with Eastern Hemlock, *Tsuga canadensis*



Plot 714, N view



Plot 718, general view



Plot 78, Walking Fern, *Asplenium rhizophyllum*



Plot 738, mesic Red Oak, Hickory, Beech slope; general view



Plot 747, Chinquapin Oak bluff woodland, E view



Plot 747, rocky bluff in general vicinity



Plot 751, rich lower slope forest, E view



Sloan's Pond, (Plot 706), general view



Reindeer Lichen (*Cladonia*) near Plot 01



Cock's-comb Orchid, *Hexalectris spicata*



Wood's bunchflower, *Melanthium woodii,* Plot 73



Foliage of Ginseng, *Panax quinquefolius* and Virginia Creeper, *Parthenocissus quinquefolia*



Gray coneflower, *Ratibida pinnata,* Plot 47



The dangers of field work… "Where did that snake go?... Ouch!"



Scenic sandstone