

**VASCULAR PLANT INVENTORY AND ECOLOGICAL
COMMUNITY CLASSIFICATION FOR RUSSELL CAVE NATIONAL
MONUMENT**



Report for the Vertebrate and Vascular Plant Inventories:
Appalachian Highlands and Cumberland/Piedmont Networks

Prepared by NatureServe for the National Park Service
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This report consists of the main report along with a series of appendices with information about the plants and plant (ecological) 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 www.natureserveexplorer.org.

Cover photo: Mouth of Russell Cave. Photo by Rickie White.

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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 Russell Cave National Monument in three ways:

- 1) Ecologists from NatureServe and the Natural Heritage Network established 12 permanently marked one-hectare circular plots within the park. In addition, ecologists established one observation point inside the park boundary. The permanently marked plots are available to be used by researchers on studies ranging from bird point counts to individual plant monitoring.
- 2) Ecologists collected data on all unique vegetation communities within the park and identified eight natural and two human-modified or successional vegetation associations (unique ecological assemblages of plants) within the park boundary. The rarest community inside the park boundary is the Shumard Oak - Chinquapin Oak Mesic Limestone Forest (G2G3).
- 3) For this project, ecologists collected and vouchered seven specimens representing seven species new to the park. These vouchers were added to the existing list of vouchers already collected. The vouchers were delivered to NPS in Summer 2006. The species count for the park stands now at 460 fully documented species (not including subspecies and varieties). NatureServe ecologists estimate that 85-98% of the vascular species of the park are documented. The most highly globally ranked species native to the site in the park is stoneroot (*Collinsonia verticillata*, G3).

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. NPS units are currently compiling the information needed to begin to assess the current state of natural resources at specific parks. 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 Fall 2002, NatureServe began work on the ecological community inventory portion of the project at Russell Cave National Monument.

Russell Cave was established as a park to preserve the significant cultural resources of the cave, but the non-cave areas adjacent to the main cave mouth were also preserved. Due to its underlying geology, these areas represent a mixture of limestone influenced circumneutral/basic soils and more acidic soils that provide habitat for a wide array of plant species and plant communities. After assessing the past and current state of research in the park, we began to work on accomplishing three primary objectives:

- 1) Establish at least 15 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 encountered in the park that have not already been documented and entered into NPSpecies.

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

Study Area

Russell Cave National Monument is located in Jackson County, Alabama and occupies the southern terminus of the Appalachian Mountains in the southern Ridge and Valley ecoregion (Bailey et. al 1994). The monument encompasses approximately 126 hectares with elevations ranging from 195-506 meters. The climate of the monument is considered temperate with summer temperatures averaging 85-90 degrees Fahrenheit and snowfall averaging 1-3 inches per year (National Park Service 1999).

The geology and vegetation of the monument is characterized by Pennsylvanian and Pottsville formation sandstone in the higher elevations that supports mostly oak dominated forests. Lower

elevations are characterized by Mississippian limestone and shale which support forests dominated by more mesic and calciphitic vegetation (DiPietro 1994).

Land Use History

Russell Cave National Monument is considered to have one of the most complete archeological records in the eastern United States (National Park Service 1999). Evidence suggests Native Americans had inhabited the area for almost 9,000 years. The cave itself was used as a shelter although it difficult to know to what extent, with evidence suggesting it was used permanently by some and intermittently by others. After European occupation, early settlers used the cave as a hunting camp. More recently, the lowland areas were used as farm and grazing lands and some of the lowest elevations in the park are still maintained as open field.

Methods

The inventory and monitoring project covers three main areas: permanent plot establishment for future research in the park, a vascular plant species inventory of any plants not already found and vouchered for the park, and an ecological community inventory/classification of all the vegetation associations within the park according to the National Vegetation Classification (Grossman et al. 1998).

Permanent Plot Establishment

Judy Teague and Brigitte O'Donoghue from 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 boundary as mandated by the *Study Plan for Vertebrate and Vascular Plant Inventories* (Nichols 2000). They manipulated the GIS layers supplied to us with the program ArcView (ArcView 1992). We chose a 56-meter buffer around the current park boundary 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, we established an evenly spaced grid system (we chose the approximate grid size of 1500 meters by 1500 meters *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, we recorded the coordinates for one grid point (Figure 1 and Table 1).

The grid did not fully represent all of the vegetation communities in the park, so once we were out in the field we selected plot locations away from the grid that represented any communities not sampled by the grid design.

Once at the park, we met with park personnel at Little River and Russell Cave and described the project's goals. Through this process, we identified priority areas of the park for additional plot establishment and species inventory. In 2002-2004, we established nine plots on the grid system

and an additional three plots off of the grid in habitats not covered by any of the grid points (Figure 1). In addition, ecologists established one observation point/quickplot inside the park boundary. Using the GPS Garmin III+ and V 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 iron 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. Due to variation in signal strength, accuracy may be less than five meters in some cases. In 2003 and 2004, we recorded additional data at each point, visiting each point a second time at a different time of year to ensure that we had the most complete species list possible for each permanent plot.

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 quadrat within the hectare in which to place our standardized vegetation monitoring plot. Within the quadrat, we measured environmental characteristics, identified every vascular plant to species where possible, and estimated cover values for all plants (see Appendix I for a blank version of the data sheet used). For each species found within the 20x50 meter quadrat, we assigned a cover value by strata and an overall cover value for the plot based on a modified Braun Blanquet cover class scale (Braun-Blanquet 1928). 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 the spring of 2003 and 2004 to resample the plots to attempt to document any species that we had missed the previous summer.

Our team of ecologists and data managers examined the plot sheets for errors, 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 Southern Ridge and Valley Province and also with written descriptions of each related classification unit. In addition, we thoroughly reviewed the existing literature to ensure that our product took into account previous studies (e.g. Barnett-Lawrence 1994). Using qualitative analysis techniques comparing the community plots to the existing NVC descriptions, we produced the draft park vegetation classification (Appendix IV).

Those researchers interested in accessing this data should contact the archivist or resource manager at the park for details and specific plot locations.

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 occasionally

discovered plant species within the plots that had not already been documented. We collected any new specimens encountered within the plots and recorded the GPS coordinates using our 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 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, r1 is the number of species present in only one quadrat, and n is the number of plots sampled. First-order jackknife estimates often underestimate number of species as evidenced by the lowest estimate in our first-order jackknife (McCune and Grace 2002), so we used a variety of measures including 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 and collected seven new species (Tables 2,3) that had not been confirmed previously from the park, adding to the list of 453 species already vouchered and fully documented for the park. We created seven vouchers for the herbarium at Russell Cave (Table 3) from the plants we collected and photographed and added those to the list of those already collected and/or documented by previous researchers (DiPietro 1994).

Using various estimates and assumptions explained in the methods section, the estimate for total number of species in the park ranged from 460 to 530 species. Excluding varieties, subspecies, and unidentifiable collections, researchers past and present have confirmed approximately 460 species within the park. Using these estimates, the species area curve jackknife method estimates that we have most documented between 86 and 100% of the species currently within the boundary of the park (Table 4). 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, the beta value was 3.7, and the gamma value was 334.

Using the information gathered in each plot, we discerned ten distinct vegetation associations (NatureServe 2005) within seven distinct natural ecological systems (Comer et al. 2003) (Table 6). Eight of the ten communities identified are considered “natural” as opposed to “semi-natural”, “human modified/successional” or “exotic species dominated”. Listed below are the common names of all of the communities. All communities have been mapped on the landscape by photointerpreters and/or documented with at least one vegetation plot. Those considered natural communities have names preceded by an asterisk in the list below.

Red-cedar Successional Forest (CEGL007124)

*Rich Low-Elevation Appalachian Oak Forest (CEGL007233)

* White Oak - Mixed Oak Dry-Mesic Alkaline Forest (CEGL002070)

* Shumard Oak - Chinquapin Oak Mesic Limestone Forest (CEGL008442)

* Xeric Ridgetop Chestnut Oak Forest (CEGL008431)

* Chestnut Oak - Shagbark Hickory - Sugar Maple Forest (CEGL007268)

* Rich Levee Mixed Hardwood Bottomland Forest (CEGL008429)

Cultivated Meadow (CEGL004048)

* Appalachian Mafic Cliff (Low-Elevation Type) (CEGL004395)

* Cumberland Plateau Sandstone Cliff (Dry Type) (CEGL004392)

While working in the park, we also captured some digital images of plots and plants. These images are indexed (Table 7) and a selection of them can be seen in Appendix II.

Finally, we have included in this report an appendix describing all of the ecological communities for the park in detail (Appendix IV) as well as the key to associations and ecological systems in

the park (Appendix III). This tool helps those with a basic understanding of vegetation to classify community types within the park quickly and easily.

Discussions/Conclusions

Species Inventory

As of the end of this project, there are 460 documented vascular plant species in the park boundary. No species in the park are considered federally threatened or endangered. There are also no species in the park that are on the “candidate” list for federal status. Most species in the park are considered globally secure (G4 or G5 NatureServe ranking). According to NatureServe’s ranking system and status as a commercially exploited species, the least globally secure plant in the park is ginseng (*Panax quinquefolius*) (G3G4).

The state of Alabama maintains a list of species considered rare or threatened for the state and a list of species of special concern. Even though most of the species in the park are considered globally secure, there are still a number of species found in the park that are considered to be imperiled in the state of Alabama. Many of these species fall in the southern end of their ranges near this park. Both common serviceberry (*Amelanchier arborea*) and twoleaf miterwort (*Mitella diphylla*) are on the edge or their range in Alabama and therefore are considered state rank S1. In addition, Goldenseal (*Hydrastis canadensis*), American smoketree (*Cotinus obovatus*), American beakgrass (*Diarrhena americana*), cream avens (*Geum virginianum*), white bergamot (*Monarda clinopodia*), and Indian-pipe (*Monotropa hypopithys*) are all globally secure species but have an Alabama Srank of S2 because of their relative rarity within the state boundary.

According to our assessment, at least 12% (55 species) of the plant species in the park are not native to the continent (or in some cases, are native to the continent but not native to Alabama). Most of these species were plantings 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 five species found within the park are considered aggressive invasive species that are significant or severe threats and are actively outcompeting and replacing native species in other parts of the Southeast (see table 5). In particular, Japanese stiltgrass, multiflora rose, and Japanese honeysuckle are large problems in mesic hardwood forests and floodplain forests throughout the tract.

Vegetation Community Analysis

The unit of 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 addition to 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):

Red-cedar Successional Forest (CEGL007124)

Vegetation: This association is represented by a dense stand of *Juniperus virginiana* var. *virginiana* accented by a sparse occurrence of *Cercis canadensis*, *Frangula caroliniana*, *Acer barbatum*, *Quercus muehlenbergii*, *Quercus shumardii*, and several other species beginning to invade from adjoining forested areas. Herbs, while generally scarce, are exemplified by a good diversity of species, specifically opportunistic and invasive taxa such as *Lolium arundinaceum*, *Festuca arundinacea*, *Toxicodendron radicans*, *Lonicera japonica*, and *Microstegium vimineum*, among others.

Environment: The example at Russell Cave National Monument appears to be an artifact of recently abandoned agricultural land. While the terrain is rugged and bouldery, the limestone derived soils are moist and fertile allowing a dense stand of *Juniperus virginiana* var. *virginiana* to flourish.

Rich Low-Elevation Appalachian Oak Forest (CEGL007233)

Vegetation: The closed canopy is dominated by *Quercus alba*, *Quercus rubra*, *Fagus grandifolia*, and *Liriodendron tulipifera*, and less frequently *Fraxinus americana*, *Carya ovata*, *Carya alba*, and *Celtis laevigata*. Characteristic subcanopy species include *Ulmus rubra*, *Morus rubra*, and *Sassafras albidum*, as well as smaller individuals of the foregoing canopy species. The shrub layer is generally sparse (less than 35% cover) containing immature examples of taxa found in the overstory, in addition to the following: *Frangula caroliniana*, *Ostrya virginiana*, *Cornus florida*, *Callicarpa americana*, *Lindera benzoin*, *Euonymus americana*, and *Asimina triloba*. Principal and otherwise noteworthy herbs are *Polystichum acrostichoides*, *Carex digitalis*, *Actaea pachypoda*, *Silene stellata*, *Panax quinquefolius*, *Podophyllum peltatum*, *Phlox divaricata*, and *Arisaema triphyllum*, among others.

Environment: This association occupies soil derived from Bangor and Montagle limestones, on moderate to steep slopes characterized by a mosaic of rocky outcrops and silty loams mixed with residue from eroded sandstone washed down from further upslope on Montague Mountain. Natural community examples are located at roughly mid-slope, falling within an elevation of 268 to 335 m (880-1100 feet).

White Oak - Mixed Oak Dry-Mesic Alkaline Forest (CEGL002070)

Vegetation: This association represents a dense-canopied forest containing the nominal species, as well as *Quercus velutina* and less commonly *Fraxinus americana* and *Nyssa sylvatica*. A similar suite of species also characterize the subcanopy, which is often associated with additional taxa having a tolerance of shade, including *Acer barbatum*, *Fagus grandifolia*, *Carya alba*, *Ostrya virginiana*, *Cornus florida*, and *Oxydendrum arboreum*. While sparse, *Juniperus virginiana* var. *virginiana* is seldom absent from view typically favoring areas with greater canopy openings. The shrub component assumes a patchy distribution where *Amelanchier arborea*, *Cercis canadensis*, *Viburnum rufidulum*, *Frangula caroliniana*, *Sassafras albidum*, and smaller individuals of the abovementioned canopy associates serve as principal species. The

exotic *Ligustrum sinense* is also present but sparse. Woody vines include *Toxicodendron radicans*, *Vitis rotundifolia*, *Smilax glauca*, and *Lonicera japonica*, all of which frequently function as ground cover. The herb layer is relatively diverse and includes *Pellaea atropurpurea*, *Bromus pubescens*, *Dichanthelium boscii*, *Arisaema triphyllum*, *Trillium cuneatum*, *Polygonatum biflorum*, *Maianthemum racemosum*, *Uvularia perfoliata*, *Phlox divaricata*, and *Thalictrum thalictroides*.

Environment: This is a low to mid elevation community that occupies a broad range of gradients on Montague Mountain. Soils are well-drained moist, silty loams containing numerous rock fragments, underlain by limestone.

Shumard Oak - Chinquapin Oak Mesic Limestone Forest (CEGL008442)

Vegetation: This forested community is represented by a closed-canopy (greater than 75 % cover) of various hardwoods dominated by *Quercus muehlenbergii*, *Quercus shumardii*, and *Carya ovata*, with a lesser amount of *Fraxinus americana*, *Ulmus americana*, *Liriodendron tulipifera*, and *Fagus grandifolia*. The subcanopy and shrub layers contain the aforementioned species, as well as a fair abundance of *Acer barbatum*, *Fraxinus quadrangulata*, *Ostrya virginiana*, *Cercis canadensis*, *Frangula caroliniana*, *Staphylea trifoliata*, *Lindera benzoin*, and *Symphoricarpos orbiculatus*. Although sparse, *Juniperus virginiana* var. *virginiana* is a conspicuous member of the understory. Woody vines include *Bignonia capreolata*, *Toxicodendron radicans*, *Vitis rotundifolia*, and *Parthenocissus quinquefolia*. *Lonicera japonica* is also present, an exotic species that assumes its greatest abundance along the forest border adjoining the lawn. The herbaceous component is luxuriant and diverse, with some of the more noteworthy species being *Pellaea atropurpurea*, *Arisaema triphyllum*, *Thalictrum thalictroides*, *Spigelia marilandica*, *Lithospermum tuberosum*, *Phlox divaricata*, *Uvularia grandiflora*, *Viola conspersa*, *Maianthemum racemosum*, *Sedum ternatum*, and *Silphium trifoliatum* var. *latifolium*.

Environment: This forest occurs on soil derived from Bangor and Monteagle limestones, on sloping to steeply sloping topography on the lower and middle slope of Montague Mountain.

Xeric Ridgetop Chestnut Oak Forest (CEGL008431)

Vegetation: This association is characterized as a closed-canopy deciduous forest dominated by *Quercus prinus* with an admixture of *Quercus coccinea*, *Quercus alba*, *Quercus velutina*, and *Carya alba*. *Carya glabra*, *Nyssa sylvatica*, and *Pinus echinata* are also present, but are generally of secondary importance. The subcanopy is commonly represented by *Oxydendrum arboreum*, *Acer rubrum*, *Cornus florida*, and *Quercus stellata*, as well as several species of the foregoing canopy cover. Although seldom absent from either stratum *Quercus marilandica*, *Fagus grandifolia*, and *Sassafras albidum* are occasional and often widely distributed. The shrub component is relatively diverse but generally open, with the following species appearing most typical: *Rhododendron canescens*, *Kalmia latifolia*, *Vaccinium arboreum*, *Vaccinium pallidum*, *Chimaphila maculata*, and *Diospyros virginiana*. Several species of herbs, although sparse, are well represented with the more frequently encountered taxa being *Coreopsis major*, *Solidago odora*, *Tephrosia virginiana*, *Danthonia spicata*, *Aristolochia serpentaria*, *Asclepias variegata*, *Viola palmata*, and *Hieracium venosum*. Characteristic vines include *Vitis rotundifolia*, *Smilax rotundifolia*, and *Smilax glauca*.

Environment: This community type is confined to the summit of Montague Mountain where it occurs in an elevational range of 472 to 503 m (1550-1650 feet). As with most of the Cumberland Plateau in Alabama and adjacent Tennessee, the soils are classified as the Muskingum series, a fine sandy loam derived from the Pottsville Formation, being chiefly comprised of sandstone but also varying amounts siltstone, shale, and coal.

Chestnut Oak - Shagbark Hickory - Sugar Maple Forest (CEGL007268)

Vegetation: This mixed hardwood forest is characterized by a prominence of straight, tall individuals of *Quercus prinus* accented, in slightly lesser abundance, by *Quercus velutina*, *Quercus alba*, *Liriodendron tulipifera*, *Carya ovata*, and *Carya alba*. Occasional individuals of other species, such as *Quercus rubra*, *Fagus grandifolia*, *Oxydendrum arboreum*, *Nyssa sylvatica*, *Acer barbatum*, *Acer rubrum*, and *Fraxinus americana* also occur in the canopy or subcanopy. The shrub and herbaceous layers are relatively sparse with small stems of the foregoing overstory species in addition to various herbs such as *Dioscorea villosa*, *Desmodium nudiflorum*, *Podophyllum peltatum*, *Spigelia marilandica*, and *Polystichum acrostichoides* serving as typical associates. Principal vines include *Toxicodendron radicans*, *Parthenocissus quinquefolia*, and *Smilax* spp., which often sprawl along the ground.

Environment: In Russell Cave National Monument, this association occurs from the mid to upper slope of Montague Mountain, generally at an elevation of 335 to 442 m (1100-1450 feet). The soils are characterized as residue from weathered limestone that has been greatly influenced by sandstone sediments washed down from higher slopes. For the most part, because of steep and rugged topographic features, external drainage is likely to be rapid, decreasing in velocity on gently sloping benches.

Rich Levee Mixed Hardwood Bottomland Forest (CEGL008429)

Vegetation: The canopy of this deciduous forest association is dominated by *Celtis laevigata* and *Liriodendron tulipifera*, which are frequently accompanied by a suite of secondary species typical of bottomlands in the region. In addition to the above-mentioned taxa, the canopy also contains *Quercus michauxii*, *Acer barbatum*, and *Pinus taeda*, with the last named grading in from mixed mesic forests adjacent to park property. Subcanopy species include the canopy components highlighted above, as well as *Acer negundo* and, to a lesser degree, *Acer rubrum*. Shrubs and vines, which are generally patchy in distribution, are primarily represented by *Lindera benzoin*, *Vitis rotundifolia*, various *Smilax* (namely *S. tamnoides*), and immature specimens of the foregoing canopy species. Chinese privet (*Ligustrum sinense*) has become well established in portions of this association and is now beginning to out-compete native vegetation. A rich and diverse herbaceous component is readily apparent throughout most of the growing season, often presenting a colorful display of wildflowers. *Amphicarpaea bracteata*, *Laportea canadensis*, and *Ageratina altissima* appear to serve as principal species, while *Leersia virginica*, *Chasmanthium latifolium*, *Elymus virginicus*, *Impatiens pallida*, and *Solidago flexicaulis* are also well represented. Exotic species, most notably *Microstegium vimineum*, *Glechoma hederacea*, and *Dioscorea oppositifolia* are common, having colonized several areas within the floodplain.

Environment: This association occurs as a terrace along a small stream that emanates from Russell Cave. The topography is relatively level, having developed through periodic flooding

where alluvial sediments derived of weathered substrates from Montague Mountain and adjacent areas are deposited.

Cultivated Meadow (CEGL004048)

Vegetation: The vegetation is primarily comprised of various grasses, most notably *Festuca arundinacea*, *Lolium arundinaceum*, and *Paspalum notatum*. Floral diversity is relatively high, specifically in those areas less maintained, containing a rich assortment of native and exotic grasses, sedges, and forbs.

Environment: This association is characterized as maintained lawn and early successional field in the vicinity of the interpretive facility and resident cabin area.

Appalachian Mafic Cliff (Low-Elevation Type) (CEGL004395)

Vegetation: This is an open-canopied association characterized by a prominence of small trees, shrubs, and vines. While species diversity is high, *Acer barbatum*, *Fraxinus americana*, *Cercis canadensis*, *Toxicodendron radicans*, and *Vitis rotundifolia* appear most abundant. Typical herbs include *Pellaea atropurpurea*, *Dryopteris marginalis*, *Asplenium platyneuron*, *Dichanthelium dichotomum*, *Heuchera americana*, *Amphicarpaea bracteata*, and *Solidago caesia*. Although sparse, the exotic *Lonicera japonica* and *Microstegium vimineum* are also present.

Environment: A small representation of this association occupies the near-vertical limestone ledges in the vicinity of Russell Cave.

Cumberland Plateau Sandstone Cliff (Dry Type) (CEGL004392)

Vegetation: Because of harsh growing conditions the vegetation is often very sparse, covering approximately 20 % of the rock surface. Vascular vegetation is restricted to rock shelves and crevices where soil accumulation is sufficient to sustain a low diversity of shrubs and herbs. *Kalmia latifolia*, *Heuchera parviflora* var. *parviflora*, *Mitchella repens*, and *Dichanthelium dichotomum* serve as principal species, while *Vaccinium pallidum*, *Hydrangea cinerea*, *Parthenocissus quinquefolia*, *Porteranthus trifoliatus*, and *Carex virescens* occur in lesser abundance and are therefore recognized as secondary importance. Nonvascular plants attain their greatest development in crevices and along the undersides of ledges where favorable moisture conditions allow several species to flourish.

Environment: This association occupies vertical, east-facing sandstone cliffs near the summit of Montague Mountain, where cliffs assume various height dimensions extending from approximately five feet near the Monument's southern border to greater than 30 feet along the northern boundary. Although generally dry and sparsely vegetated (~ 80% unvegetated), crevices and the undersides of ledges often have higher moisture retention capacities lending themselves to support a greater prominence of flora, most notably nonvascular plants. As intimated throughout the region these cliffs are typically shaded by a mixture hardwoods and pine, with minimal exposure to the sun.

Ecological Community Summary

At Russell Cave National Monument, ecologists/botanists with this project identified ten ecological community types within or adjacent to the park boundary. These types range from dry upland oak-hickory forests to hardwood bottomlands. Much of the area is forested with older second/third growth forests. Most of the communities in the park are considered globally secure but at least one is of special note in terms of conservation concern. Of special note is the Shumard Oak - Chinquapin Oak Mesic Limestone Forest which is currently a G2G3 community according to the NatureServe global ranking system. G2G3 means that the community at best rare or uncommon and at worst imperiled globally. Since this community is restricted to relatively small patches of limestone in the Ridge and Valley province, it is considered the highest priority community from a conservation standpoint in the park.

Some recommendations for future management of these community types and vegetation at the park include:

- 1) Control highly invasive exotics in all communities, but especially those highly ranked community types such as the Shumard Oak - Chinquapin Oak Mesic Limestone Forest. Also protect high quality examples of other community types from invasion. Although Japanese stiltgrass (*Microstegium vimineum*) is extremely difficult to control effectively, efforts at control might improve ecosystem quality in areas where stilt grass has invaded very high quality examples of mesic oak-hickory stands.
- 2) Continue to protect high quality examples of all natural communities within the park. Although many natural communities in the park are globally common, the park protects some of the best high quality examples of these forests in the immediate area.

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Figure 1. Map of Russell Cave National Monument with plot locations.

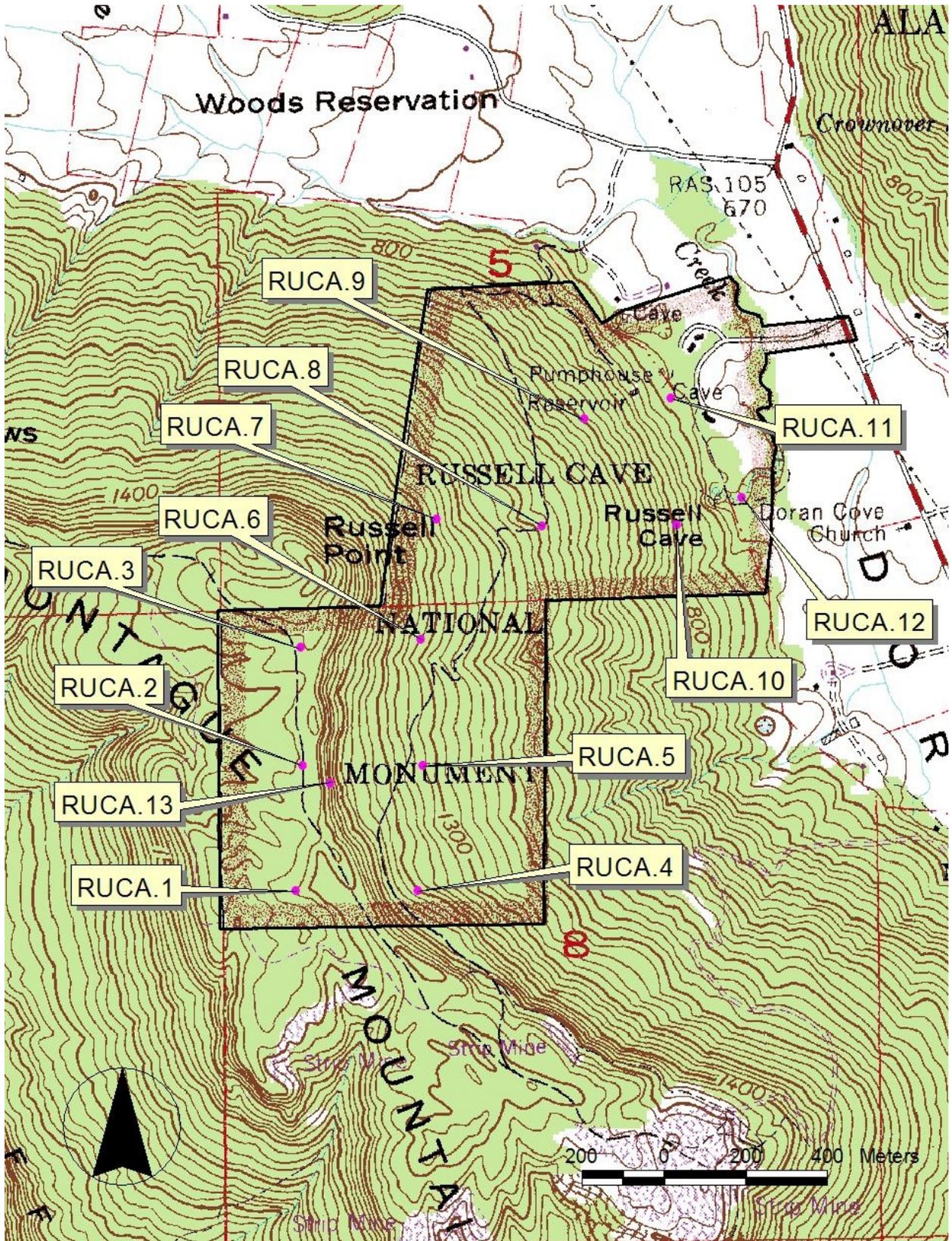
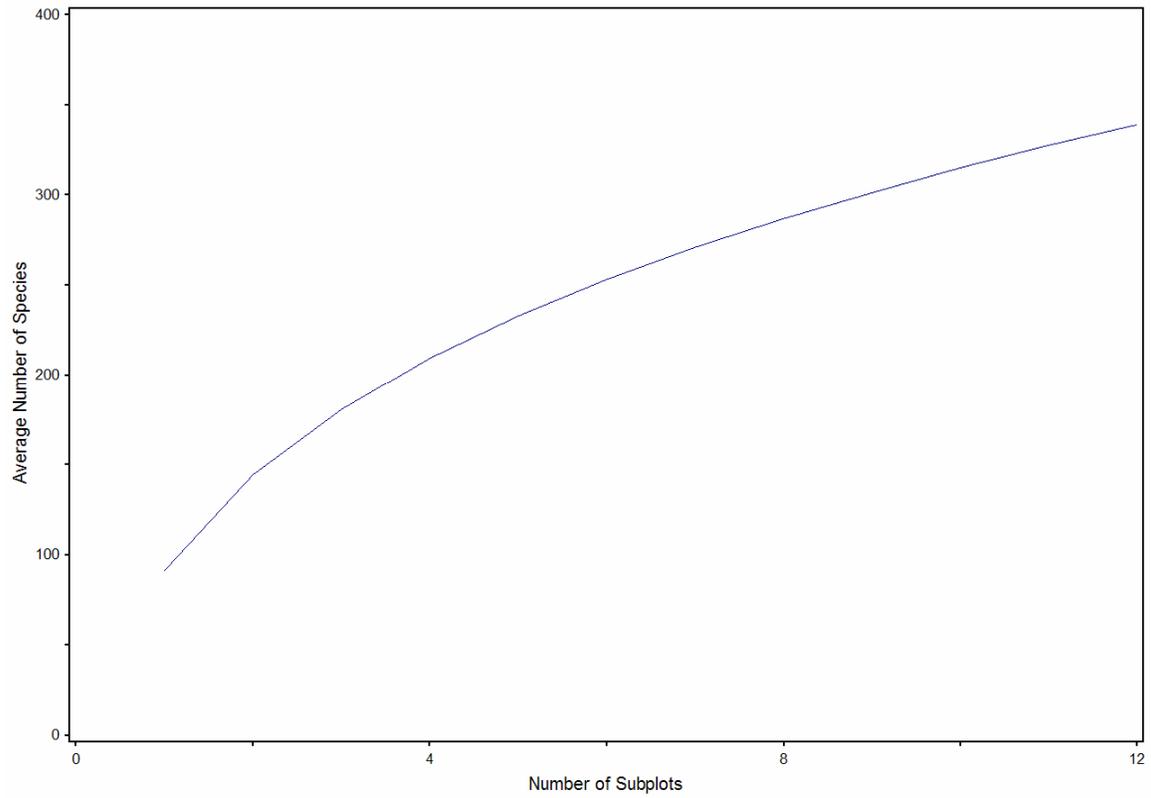


Figure 2. Species area curve for Russell Cave National Monument using all plots.



First-order jackknife estimate of number of species in park = 460
Second-order jackknife estimate of number of species in park = 530

Table 1. Plot numbers and locations for all permanent plots established at Russell Cave National Monument.

Plot Number	X Coordinate	Y Coordinate	Datum	Zone	Type of plot
RUCA.1	607629	3870162	NAD 83	16	Full
RUCA.2	607646	3870466	NAD 83	16	Full
RUCA.3	607640	3870755	NAD 83	16	Full
RUCA.4	607927	3870162	NAD 83	16	Full
RUCA.5	607939	3870468	NAD 83	16	Full
RUCA.6	607934	3870774	NAD 83	16	Full
RUCA.7	607971	3871068	NAD 83	16	Full
RUCA.8	608229	3871051	NAD 83	16	Full
RUCA.9	608330	3871313	NAD 83	16	Full
RUCA.10	608557	3871055	NAD 83	16	Full
RUCA.11	608542	3871362	NAD 83	16	Full
RUCA.12	608715	3871121	NAD 83	16	Full
RUCA.13	607712	3870424	NAD 83	16	Quickplot

Table 2. Native vascular plant species documented from Russell Cave National Monument

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Acalypha virginica</i>		Virginia Copperleaf	G5	SNR	28195	DiPietro 1994
<i>Acalypha virginica</i> var. <i>rhomboidea</i>	<i>Acalypha rhomboidea</i>	Common Copperleaf	G5	SNR	182109	DiPietro 1994
<i>Acer negundo</i>		Box-elder	G5T5?	SNR	28749	DiPietro 1994
<i>Acer rubrum</i>		Red Maple	G5	SNR	28728	DiPietro 1994
<i>Acer saccharinum</i>		Silver Maple	G5	SNR	28757	Documented in PLOTS Database 2006
<i>Acer saccharum</i>		Sugar Maple	G5	SNR	28731	DiPietro 1994
<i>Achillea millefolium</i>		White Snakeroot	G5	SNR	35423	Documented in PLOTS Database 2006
<i>Actaea pachypoda</i>		White Baneberry	G5	S5	18722	DiPietro 1994
<i>Adiantum pedatum</i>		Northern Maidenhair	G5	SNR	17311	DiPietro 1994
<i>Aesculus flava</i>		Yellow Buckeye	G5	SNR	28717	DiPietro 1994
<i>Ageratina altissima</i> var. <i>altissima</i>		White Snakeroot	G5T5	SNR	182398	DiPietro 1994
<i>Agrimonia pubescens</i>		Soft Groovebur	G5	SNR	25099	DiPietro 1994
<i>Agrostis perennans</i>		Upland Bentgrass	G5	SNR	40423	DiPietro 1994
<i>Ailanthus altissima</i>		Tree of Heaven	G5	SNA	28827	Rogers 2000
<i>Ajuga reptans</i>		Common Bugle	G5	SNA	32454	Documented in PLOTS Database 2006
<i>Albizia julibrissin</i>		Silktree	G5	SNA	26449	DiPietro 1994
<i>Allium canadense</i> var. <i>canadense</i>		Meadow Garlic	G5T5	SNR	182590	DiPietro 1994
<i>Amaranthus hybridus</i>		Smooth Amaranth	G5?	SNR	20735	DiPietro 1994
<i>Amaranthus retroflexus</i>		Redfoot Amaranth	G5	SNA	20745	DiPietro 1994
<i>Amaranthus spinosus</i>		Spiny Amaranth	G5	SNR	20748	DiPietro 1994
<i>Ambrosia artemisiifolia</i>		Annual Ragweed	G5	SNR	36496	DiPietro 1994
<i>Ambrosia trifida</i>		Great Ragweed	G5	SNR	36521	DiPietro 1994
<i>Amelanchier arborea</i>		Common Serviceberry	G5	S1?	25110	Documented in PLOTS Database 2006
<i>Amelanchier laevis</i>		Allegheny Serviceberry	G4G5 Q	SNR	182046	DiPietro 1994
<i>Amphicarpaea bracteata</i>		American Hog-peanut	G5	SNR	182067	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
Anemone virginiana		Tall Thimbleweed	G5	SNR	18451	DiPietro 1994
Angelica venenosa		Hairy Angelica	G5	SNR	29453	DiPietro 1994
Antennaria plantaginifolia		Pussytoes	G5	SNR	36717	DiPietro 1994
Aralia spinosa		Devil's Walkingstick	G5	SNR	29378	DiPietro 1994
Arisaema dracontium		Green Dragon	G5	SNR	42529	DiPietro 1994
Arisaema triphyllum		Jack-in-the-Pulpit	G5	SNR	42525	DiPietro 1994
Aristolochia serpentaria		Turpentine-root	G4	SNR	18342	DiPietro 1994
Arnoglossum atriplicifolium		Pale Indian-plantain	G4G5	SNR	36583	DiPietro 1994
Arundinaria gigantea		Giant Cane	G5	SNR	40477	DiPietro 1994
Asclepias quadrifolia		Fourleaf Milkweed	G5	SNR	30297	DiPietro 1994
Asclepias syriaca		Common Milkweed	G5	SNR	30310	Documented in PLOTS Database 2006
Asclepias variegata		Red-ring Milkweed	G5	SNR	30319	DiPietro 1994
Asimina triloba		Common Pawpaw	G5	SNR	18117	DiPietro 1994
Asplenium pinnatifidum		Lobed Spleenwort	G4	SNR	17354	DiPietro 1994
Asplenium platyneuron		Ebony Spleenwort	G5	SNR	17355	DiPietro 1994
Asplenium resiliens		Black-stem Spleenwort	G5	SNR	17358	DiPietro 1994
Asplenium rhizophyllum		Walking Fern	G5	SNR	17359	DiPietro 1994
Aster cordifolius	Symphyotrichum cordifolium	Common Blue Wood Aster	G5	SNR	193078	DiPietro 1994
Aster cordifolius ssp. sagittifolius	Symphyotrichum cordifolium	Common Blue Wood Aster			193078	DiPietro 1994
Aster dumosus	Symphyotrichum dumosum	Rice Button American-aster	G5	SNR	35511	DiPietro 1994
Aster patens var. patens	Symphyotrichum patens	Late Purple American-aster	G5	SNR	522232	Documented in PLOTS Database 2006
Aster patens var. phlogifolius	Symphyotrichum phlogifolium	Late Purple Aster	G5	SNR	193240	DiPietro 1994
Aster paternus	Sericocarpus asteroides	Toothed Whitetop Aster	G5	SNR	35625	DiPietro 1994
Aster pilosus var. pilosus	Symphyotrichum pilosum var. pilosum	White Oldfield Aster	G5	SNR	193246	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
Aster shortii	Symphotrichum shortii	Short's American-aster	G5	SNR	35652	DiPietro 1994
Astilbe biternata		False Goat's Beard	G5	SNR	24305	DiPietro 1994
Athyrium filix-femina		Southern Ladyfern	G5T5	SNR	17412	DiPietro 1994
Aureolaria pedicularia		Fernleaf Yellow False Foxglove	G5	SNR	33489	DiPietro 1994
Aureolaria virginica		Downy Yellow False Foxglove	G5	SNR	33490	DiPietro 1994
Berchemia scandens		Rattan-vine	G5	SNR	28447	Documented in PLOTS Database 2006
Bidens aristosa		Bearded Beggarticks	G5	SNR	35713	DiPietro 1994
Bidens bipinnata		Spanish-needles	G5	SNR	500993	DiPietro 1994
Bidens frondosa		Devil's Pitchfork	G5	SNR	35707	DiPietro 1994
Bignonia capreolata		Crossvine	G5	SNR	34307	DiPietro 1994
Boehmeria cylindrica		Small-spike False Nettle	G5	SNR	19121	DiPietro 1994
Botrychium dissectum		Cutleaf Grapefern	G5	SNR	17171	NatureServe 2006
Botrychium virginianum		Rattlesnake Fern	G5	SNR	17173	DiPietro 1994
Brachyelytrum erectum		Bearded Shorthusk	G5	SNR	41527	DiPietro 1994
Bromus pubescens		Common Eastern Brome	G5	SNR	40514	DiPietro 1994
Callicarpa americana		Beautyberry	G5	SNR	32144	DiPietro 1994
Calycanthus floridus var. floridus		Sweet-shrub	G5T4	SNR	527038	DiPietro 1994
Calycocarpum lyonii		Cupseed	G5	SNR	18862	DiPietro 1994
Calystegia sepium		Hedge False Bindweed	G5	SNR	30650	DiPietro 1994
Campanulastrum americanum		American Bellflower	G5	SNR	501172	DiPietro 1994
Campsis radicans		Trumpetvine	G5	SNR	34309	DiPietro 1994
Cardamine concatenata		Cutleaf Toothwort	G5	SNR	22787	DiPietro 1994
Cardamine diphylla		Crinkleroot	G5	SNR	22792	DiPietro 1994
Cardamine dissecta		Forkleaf Toothwort	G4?	SNR	501194	DiPietro 1994
Cardamine hirsuta		Hairy Bittercress	G5	SNA	22797	DiPietro 1994
Carex albicans var. albicans		White-tinge Sedge	G5T4 T5	SNR	527064	DiPietro 1994
Carex blanda		Eastern Sedge	G5?	SNR	39379	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Carex caroliniana</i>		Carolina Sedge	G5	SNR	39382	DiPietro 1994
<i>Carex cephalophora</i>		Oval-leaf Sedge	G5	SNR	39383	DiPietro 1994
<i>Carex complanata</i>		Hirsute Sedge	G5	SNR	39551	DiPietro 1994
<i>Carex digitalis</i>		Slender Wood Sedge	G5	SNR	39576	DiPietro 1994
<i>Carex frankii</i>		Frank's Sedge	G5	SNR	39393	DiPietro 1994
<i>Carex interior</i>		Inland Sedge	G5	SNA	39652	DiPietro 1994
<i>Carex laxiflora</i> var. <i>laxiflora</i>		Loose-flower Sedge	G5T5	SNR	527110	DiPietro 1994
<i>Carex leavenworthii</i>		Leavenworth's Sedge	G5	SNR	39663	DiPietro 1994
<i>Carex muehlenbergii</i>		Muhlenberg's Sedge	G5	SNR	39423	DiPietro 1994
<i>Carex retroflexa</i>		Reflexed Sedge	G5	SNR	39782	DiPietro 1994
<i>Carex rosea</i>		Rosy Sedge	G5	SNR	39429	DiPietro 1994
<i>Carex striatula</i>		Lined Sedge	G4G5	SNR	39822	DiPietro 1994
<i>Carex virescens</i>		Ribbed Sedge	G5	SNR	39867	DiPietro 1994
<i>Carex vulpinoidea</i>		Fox Sedge	G5	SNR	39442	DiPietro 1994
<i>Carpinus caroliniana</i>		American Hornbeam	G5	SNR	19504	DiPietro 1994
<i>Carya alba</i>		Mockernut Hickory	G5	SNR	501306	DiPietro 1994
<i>Carya cordiformis</i>		Bitternut Hickory	G5	SNR	19227	DiPietro 1994
<i>Carya glabra</i>		Pignut Hickory	G5	SNR	19231	DiPietro 1994
<i>Carya illinoensis</i>		Pecan	G5	SNR	19234	DiPietro 1994
<i>Carya ovata</i>		Shagbark Hickory	G5	SNR	19242	DiPietro 1994
<i>Castanea dentata</i>		American Chestnut	G4	SNR	19454	DiPietro 1994
<i>Celastrus scandens</i>		American Bittersweet	G5	S2	27974	Documented in PLOTS Database 2006
<i>Celtis laevigata</i>		Sugarberry	G5	SNR	19042	DiPietro 1994
<i>Cerastium glomeratum</i>		Sticky Chickweed	G5	SNA	19955	DiPietro 1994
<i>Cercis canadensis</i>		Eastern Redbud	G5	SNR	25782	DiPietro 1994
<i>Chaerophyllum tainturieri</i>		Hairy-fruit Chervil	G5	SNR	29617	DiPietro 1994
<i>Chamaecrista fasciculata</i>		Sleepingplant	G5	SNR	501383	DiPietro 1994
<i>Chamaecrista nictitans</i> ssp. <i>nictitans</i>		Partridge-pea	G5T5	SNR	523837	DiPietro 1994
<i>Chamaelirium luteum</i>		Fairy Wand	G5	SNR	42894	Documented in PLOTS Database 2006
<i>Chamaesyce maculata</i>		Spotted Sandmat	G5?	SNR	501435	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Chasmanthium latifolium</i>		River-oats	G5	SNR	41547	DiPietro 1994
<i>Chasmanthium laxum</i> var. <i>sessiliflorum</i>	<i>Chasmanthium sessiliflorum</i>	Longleaf Spikegrass	G5	SNR	527299	DiPietro 1994
<i>Chenopodium album</i>		Lamb's-quarters	G5	SNR	20592	DiPietro 1994
<i>Chenopodium ambrosioides</i>		Wormseed Goosefoot	GNR	SNA	20590	DiPietro 1994
<i>Chimaphila maculata</i>		Striped Pipsissewa	G5	SNR	23767	DiPietro 1994
<i>Chrysopsis mariana</i>		Maryland Goldenaster	G5	SNR	202495	DiPietro 1994
<i>Cinna arundinacea</i>		Sweet Woodreed	G5	SNR	40583	DiPietro 1994
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>		Broadleaf Enchanter's-nightsshade	G5T5	SNR	27569	DiPietro 1994
<i>Cirsium altissimum</i>		Tall Thistle	G5	SNR	36337	DiPietro 1994
<i>Claytonia virginica</i>		Virginia Springbeauty	G5	SNR	20382	DiPietro 1994
<i>Clematis terniflora</i>		Sweet Autumn Virginsbower	G5	SNA	18712	DiPietro 1994
<i>Clematis virginiana</i>		Virgin's-Bower	G5	SNR	18716	Documented in PLOTS Database 2006
<i>Clitoria mariana</i>		Atlantic Pigeonwings	G5	SNR	26542	DiPietro 1994
<i>Cocculus carolinus</i>		Carolina Coralbead	G5	SNR	18864	DiPietro 1994
<i>Collinsonia canadensis</i>		Richweed	G5	SNR	32474	DiPietro 1994
<i>Collinsonia verticillata</i>		Stoneroot	G3	SNR	32476	DiPietro 1994
<i>Commelina communis</i>		Asiatic Dayflower	G5	SNA	39127	DiPietro 1994
<i>Conopholis americana</i>		Compact Dodder	G5	SNR	34274	Documented in PLOTS Database 2006
<i>Conyza canadensis</i>		Canada Horseweed	G5	SNR	37113	DiPietro 1994
<i>Corallorhiza odontorhiza</i>		Autumn Coralroot	G5	SNR	43525	DiPietro 1994
<i>Coreopsis major</i>		Greater Tickseed	G5	SNR	37143	DiPietro 1994
<i>Cornus florida</i>		Flowering Dogwood	G5	SNR	27806	DiPietro 1994
<i>Cotinus coggygria</i>		European Smoketree	G5	SNA	28800	DiPietro 1994
<i>Cotinus obovatus</i>		American Smoketree	G4	S2	28801	DiPietro 1994
<i>Crataegus</i> sp.		Hawthorn	?	?	24539	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Croton glandulosus</i>		Vente-Conmigo	G5	SNR	28275	DiPietro 1994
<i>Croton monanthogynus</i>		Prairie-tea	G5	SNR	28283	DiPietro 1994
<i>Cryptotaenia canadensis</i>		Canada Honewort	G5	SNR	29475	DiPietro 1994
<i>Cuscuta compacta</i>		Dodder	G5	SNR	30725	Documented in PLOTS Database 2006
<i>Cynodon dactylon</i>		Bermudagrass	G5	SNA	41619	DiPietro 1994
<i>Cynoglossum virginianum</i>		Wild Comfrey	G5	SNR	31891	DiPietro 1994
<i>Cyperus croceus</i>		Baldwin's Flatsedge	G5	SNR	501917	DiPietro 1994
<i>Cyperus echinatus</i>		Globe Flatsedge	G5	SNR	501920	DiPietro 1994
<i>Cyperus strigosus</i>		Straw-colored Flatsedge	G5	SNR	39901	DiPietro 1994
<i>Cypripedium acaule</i>		Pink Lady's-slipper	G5	S3	43534	DiPietro 1994
<i>Cypripedium parviflorum</i> var. <i>pubescens</i>		Lesser Yellow Lady's-slipper	G5T5	S3	501945	DiPietro 1994
<i>Cystopteris bulbifera</i>		Bulblet Bladderfern	G5	SNR	17481	DiPietro 1994
<i>Cystopteris protrusa</i>		Lowland Bladderfern	G5	SNR	17485	Documented in PLOTS Database 2006
<i>Dactylis glomerata</i>		Orchard Grass	GNR	SNA	193446	DiPietro 1994
<i>Danthonia spicata</i>		Poverty Oatgrass	G5	SNR	41642	DiPietro 1994
<i>Datura stramonium</i>		Jimsonweed	G5	SNA	30520	DiPietro 1994
<i>Daucus carota</i>		Queen Anne's Lace	G5	SNA	29477	DiPietro 1994
<i>Deparia acrostichoides</i>		Silver False Spleenwort	G5	S4	501994	DiPietro 1994
<i>Desmodium canescens</i>		Hoary Tick-trefoil	G5	SNR	25792	DiPietro 1994
<i>Desmodium glutinosum</i>		Large Tick-trefoil	G5	SNR	25800	DiPietro 1994
<i>Desmodium laevigatum</i>		Smooth Tick-trefoil	G5	SNR	25806	Documented in PLOTS Database 2006
<i>Desmodium nudiflorum</i>		Naked-flower Tick-trefoil	G5	SNR	25812	DiPietro 1994
<i>Desmodium paniculatum</i>		Narrowleaf Tick-trefoil	G5	SNR	25815	DiPietro 1994
<i>Desmodium pauciflorum</i>		Few-flower Tick-trefoil	G5	SNR	25816	DiPietro 1994
<i>Desmodium perplexum</i>		Perplexed Tick-trefoil	G5	SNR	25785	Documented in PLOTS Database 2006

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<i>Desmodium rotundifolium</i>		Prostrate Tick-trefoil	G5	SNR	502020	DiPietro 1994
<i>Diarrhena americana</i>		American Beakgrass	G4?	S2	41644	NatureServe 2006
<i>Dichantherium aciculare</i>		Needleleaf Rosette Grass	G4G5	SNR	41653	DiPietro 1994
<i>Dichantherium boscii</i>		Bosc's Witchgrass	G5	SNR	41655	DiPietro 1994
<i>Dichantherium clandestinum</i>		Deer-tongue Witchgrass	G5?	SNR	41656	Documented in PLOTS Database 2006
<i>Dichantherium commutatum</i>		Variable Rosette Grass	G5	SNR	41647	DiPietro 1994
<i>Dichantherium dichotomum</i>		Witchgrass	G5	SNR	41659	DiPietro 1994
<i>Dichantherium latifolium</i>		Broadleaf Rosette Grass	G5	SNR	41648	DiPietro 1994
<i>Dichantherium villosissimum</i>		White-hair Witchgrass	G5	SNR	502040	DiPietro 1994
<i>Dicliptera brachiata</i>		Wild Mudwort	G5	SNR	502049	Documented in PLOTS Database 2006
<i>Dioscorea oppositifolia</i>		Chinese Yam	G5	SNA	502075	DiPietro 1994
<i>Dioscorea quaternata</i>		Fourleaf Yam	G5	SNR	43371	DiPietro 1994
<i>Dioscorea villosa</i>		Wild Yam	G4G5	SNR	43367	Documented in PLOTS Database 2006
<i>Diospyros virginiana</i>		Eastern Persimmon	G5	SNR	23855	DiPietro 1994
<i>Disporum lanuginosum</i>	<i>Prosartes lanuginosa</i>	Yellow Fairybells	G5	SNR	42919	Documented in PLOTS Database 2006
<i>Dryopteris marginalis</i>		Marginal Woodfern	G5	SNR	17541	DiPietro 1994
<i>Duchesnea indica</i>		Indian Strawberry	G5	SNA	25163	DiPietro 1994
<i>Echinochloa crus-galli</i> var. <i>crus-galli</i>		Large Barnyardgrass	G5	SNA	527837	DiPietro 1994
<i>Elephantopus carolinianus</i>		Carolina Elephant's-foot	G5	SNR	37297	DiPietro 1994
<i>Elephantopus tomentosus</i>		Devil's Grandmother	G5	SNR	37300	DiPietro 1994
<i>Eleusine indica</i>		Indian Goosegrass	G5	SNA	41692	DiPietro 1994
<i>Elymus hystrix</i>		Bottlebrush Grass	G5	SNR	40698	DiPietro 1994
<i>Elymus virginicus</i>		Virginia Wild Rye	G5	SNR	40681	DiPietro 1994
<i>Epifagus virginiana</i>		Beechdrops	G5	SNR	34276	DiPietro 1994

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<i>Eragrostis hirsuta</i>		Big-top Lovegrass	G5	SNR	40744	DiPietro 1994
<i>Erechtites hieraciifolia</i> var. <i>hieraciifolia</i>		American Burnweed	G5T5	SNR	196276	Documented in PLOTS Database 2006
<i>Erigeron annuus</i>		Eastern Daisy Fleabane	G5	SNR	35804	DiPietro 1994
<i>Erigeron philadelphicus</i>		Philadelphia Fleabane	G5	SNR	35809	DiPietro 1994
<i>Erigeron strigosus</i>		Prairie Fleabane	G5	SNR	35951	DiPietro 1994
<i>Euonymus americanus</i>		American Strawberry-bush	G5	SNA	502577	DiPietro 1994
<i>Euonymus atropurpureus</i>		Eastern Wahoo	G5	S3	502579	NatureServe 2006
<i>Eupatorium album</i>		White Thoroughwort	G5	SNR	35982	Documented in PLOTS Database 2006
<i>Eupatorium hyssopifolium</i>		Hyssopleaf Thoroughwort	G5	SNR	35979	DiPietro 1994
<i>Eupatorium incarnatum</i>		Pink Thoroughwort	G5	SNR	502514	DiPietro 1994
<i>Eupatorium purpureum</i>		Purple Joe-pyeweed	G5	SNR	502522	DiPietro 1994
<i>Eupatorium serotinum</i>		Late Thoroughwort	G5	SNR	35981	DiPietro 1994
<i>Euphorbia corollata</i>		Flowering Spurge	G5	SNR	28057	DiPietro 1994
<i>Euphorbia dentata</i>		Toothed Spurge	G5	SNR	502535	DiPietro 1994
<i>Euphorbia mercurialina</i>		Mercury Spurge	G4	SNR	28101	DiPietro 1994
<i>Eurybia divaricata</i>		White Wood-aster	G5	SNR	513440	Documented in PLOTS Database 2006
<i>Fagus grandifolia</i>		American Beech	G5	SNR	19462	DiPietro 1994
<i>Festuca arundinacea</i>	<i>Lolium arundinaceum</i>	Tall Fescue	G5	SNA	40810	DiPietro 1994
<i>Festuca subverticillata</i>		Nodding Fescue	G5	SNR	502612	DiPietro 1994
<i>Fragaria virginiana</i>		Virginia Strawberry	G5	SNR	24639	Documented in PLOTS Database 2006
<i>Frangula caroliniana</i>		Carolina Buckthorn	G5	SNR	506986	DiPietro 1994
<i>Fraxinus americana</i>		White Ash	G5	SNR	32931	DiPietro 1994
<i>Fraxinus quadrangulata</i>		Blue Ash	G5	SNR	32947	DiPietro 1994
<i>Galinsoga quadriradiata</i>		Shaggy Soldier	G5	SNA	37415	DiPietro 1994
<i>Galium aparine</i>		Sticky Willy	G5	SNR	34797	DiPietro 1994
<i>Galium circaezans</i>		Licorice Bedstraw	G5	SNR	34800	DiPietro 1994

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<i>Galium pilosum</i>		Hairy Bedstraw	G5	SNR	34907	Documented in PLOTS Database 2006
<i>Galium triflorum</i>		Sweet-scent Bedstraw	G5	SNR	34933	DiPietro 1994
<i>Gamochaeta purpurea</i>		Spoonleaf Purple Everlasting	G5	SNR	37421	DiPietro 1994
<i>Gentiana villosa</i>		Striped Gentian	G4	S3	29990	Documented in PLOTS Database 2006
<i>Geranium carolinianum</i>		Carolina Crane's-bill	G5	SNR	29105	DiPietro 1994
<i>Geranium maculatum</i>		Spotted Geranium	G5	SNR	29107	DiPietro 1994
<i>Geum canadense</i>		White Avens	G5	SNR	24645	DiPietro 1994
<i>Geum virginianum</i>		Cream Avens	G5	S2	24665	DiPietro 1994
<i>Glechoma hederacea</i>		Ground Ivy	G5	SNA	502801	DiPietro 1994
<i>Gnaphalium obtusifolium</i>		Rabbit-Tobacco	G5	SNR	36694	DiPietro 1994
<i>Goodyera pubescens</i>		Downy Rattlesnake-plantain	G5	SNR	43594	Documented in PLOTS Database 2006
<i>Hamamelis virginiana</i>		American Witch-hazel	G5	SNR	19033	DiPietro 1994
<i>Hedera</i> sp.		Ivy	?	?	29392	DiPietro 1994
<i>Helenium amarum</i>		Fiveleaf Sneezeweed	G5	SNR	36007	DiPietro 1994
<i>Helianthus decapetalus</i>		Thinleaf Sunflower	G5	SNR	502923	DiPietro 1994
<i>Helianthus divaricatus</i>		Spreading Sunflower	G5	SNR	36636	Documented in PLOTS Database 2006
<i>Helianthus hirsutus</i>		Whiskered Sunflower	G5	SNR	36646	DiPietro 1994
<i>Heliopsis helianthoides</i>		Smooth Oxeye	G5	SNR	37605	DiPietro 1994
<i>Hemerocallis fulva</i>		Orange Daylily	G5	SNA	42943	Documented in PLOTS Database 2006
<i>Hepatica nobilis</i> var. <i>acuta</i>		Sharp-lobe Liverleaf	G5T5	SNR	528378	DiPietro 1994
<i>Heuchera americana</i>		Common Alumroot	G5	SNR	24340	DiPietro 1994
<i>Heuchera parviflora</i>		Cave Alumroot	G4	SNR	24365	DiPietro 1994
<i>Hexastylis arifolia</i> var. <i>ruthii</i>		Appalachian Arrowleaf Heartleaf	G5T4 ?	SNR	528439	DiPietro 1994
<i>Hieracium gronovii</i>		Queendevil	G5	SNR	37710	DiPietro 1994

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Hieracium venosum		Rattlesnake-weed	G5	SNR	37734	DiPietro 1994
Hordeum pusillum		Little Barley	G5	SNR	40866	DiPietro 1994
Houstonia purpurea var. purpurea		Venus' Pride	G5T5	SNR	196210	DiPietro 1994
Houstonia pusilla		Tiny Bluet	G5	SNR	35052	DiPietro 1994
Hybanthus concolor		Green Violet	G5	SNR	22026	DiPietro 1994
Hydrangea arborescens		Smooth Hydrangea	G5	SNR	24195	Documented in PLOTS Database 2006
Hydrangea cinerea		Ashy Hydrangea	G4	S4	503096	DiPietro 1994
Hydrastis canadensis		Goldenseal	G4	S2	18781	DiPietro 1994
Hypericum hypericoides		St. Andrew's-cross	G5	SNR	503138	DiPietro 1994
Hypericum mutilum		Dwarf St. John's-wort	G5	SNR	21421	DiPietro 1994
Hypericum punctatum		Spotted St. John's-wort	G5	SNR	21422	DiPietro 1994
Hypoxis hirsuta		Eastern Yellow Star-grass	G5	SNR	503146	DiPietro 1994
Ilex decidua		Possum-haw	G5	SNR	27998	DiPietro 1994
Ilex montana		Mountain Holly	G5	SNR	28002	DiPietro 1994
Ilex opaca		American Holly	G5	SNR	27982	DiPietro 1994
Impatiens capensis		Orange Jewelweed	G5	SNR	29182	DiPietro 1994
Impatiens pallida		Yellow Jewelweed	G5	SNR	29189	DiPietro 1994
Ionactis linariifolius		Stiff Aster	G5	SNR	507245	Documented in PLOTS Database 2006
Ipomoea pandurata		Man-of-the-Earth	G5	SNR	30786	Documented in PLOTS Database 2006
Ipomoea purpurea		Tall Morning Glory	G5	SNA	30789	DiPietro 1994
Iris cristata		Crested Dwarf Iris	G5	SNR	43204	DiPietro 1994
Juglans nigra		Black Walnut	G5	S3S4	19254	DiPietro 1994
Juncus tenuis		Poverty Rush	G5	SNR	39243	DiPietro 1994
Juniperus virginiana		Eastern Red-cedar	G5	S5	18048	DiPietro 1994
Kalmia latifolia		Mountain Laurel	G5	SNR	23677	DiPietro 1994
Krigia biflora		Two-flower Dwarf-dandelion	G5	SNR	37810	DiPietro 1994
Krigia cespitosa			G5	SNR	37811	DiPietro 1994
Kummerowia striata		Japanese clover	G5	SNA	503294	Documented in PLOTS Database 2006

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<i>Lactuca canadensis</i>		Florida Blue Lettuce	G5	SNR	36596	DiPietro 1994
<i>Lactuca floridana</i>		Woodland Lettuce	G5	SNR	36599	DiPietro 1994
<i>Lamium amplexicaule</i>		Henbit Deadnettle	G5	SNA	32539	DiPietro 1994
<i>Lamium purpureum</i>		Purple Deadnettle	GNR	SNA	32543	DiPietro 1994
<i>Laportea canadensis</i>		Canadian Wood-nettle	G5	SNR	19127	DiPietro 1994
<i>Leersia virginica</i>		White Cutgrass	G5	SNR	40890	DiPietro 1994
<i>Lespedeza cuneata</i>		Sericea Lespedeza	G5	SNA	25898	DiPietro 1994
<i>Lespedeza hirta</i>		Hairy Bushclover	G5	SNR	25900	DiPietro 1994
<i>Lespedeza intermedia</i>	<i>Lespedeza violacea</i>	Wand Bushclover	G5	SNR	25903	DiPietro 1994
<i>Lespedeza repens</i>		Creeping Bushclover	G5	SNR	503402	DiPietro 1994
<i>Lespedeza virginica</i>		Wand Lespedeza	G5	SNR	25915	DiPietro 1994
<i>Leucanthemum vulgare</i>		Oxeye Daisy	G5	SNA	37903	DiPietro 1994
<i>Liatris aspera</i>		Rough Blazingstar	G4G5	SNR	37909	DiPietro 1994
<i>Ligusticum canadense</i>		Canadian Wild Lovage	G4	SNR	29528	DiPietro 1994
<i>Ligustrum japonicum</i>		Japanese Privet	G5	SNA	503449	Documented in PLOTS Database 2006
<i>Ligustrum sinense</i>		Chinese Privet	G5	SNA	32979	Documented in PLOTS Database 2006
<i>Ligustrum vulgare</i>		European Privet	G5	SNA	32980	DiPietro 1994
<i>Lilium canadense</i>		Canada Lily	G5	S2	42732	Documented in PLOTS Database 2006
<i>Lilium michauxii</i>		Carolina Lily	G4G5	SNR	42741	Documented in PLOTS Database 2006
<i>Lindera benzoin</i>		Northern Spicebush	G5	SNR	18147	DiPietro 1994
<i>Linum virginianum</i>		Woodland Flax	G4G5	SNR	29202	DiPietro 1994
<i>Liquidambar styraciflua</i>		Sweetgum	G5	SNR	19027	DiPietro 1994
<i>Liriodendron tulipifera</i>		Tuliptree	G5	SNR	18086	DiPietro 1994
<i>Lithospermum tuberosum</i>		Southern Stoneseed	G4	SNR	31954	DiPietro 1994
<i>Lobelia cardinalis</i>		Cardinal-flower	G5	SNR	34505	DiPietro 1994
<i>Lobelia inflata</i>		Indian-tobacco	G5	SNR	34524	DiPietro 1994

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<i>Lobelia puberula</i>		Downy Lobelia	G5	SNR	34529	DiPietro 1994
<i>Lolium perenne</i> ssp. <i>perenne</i>		Perennial Ryegrass	G5	SNA	524261	DiPietro 1994
<i>Lolium pratense</i>		Meadow Fescue	G5	SNA	507983	Documented in PLOTS Database 2006
<i>Lonicera flava</i>		Yellow Honeysuckle	G5?	S3	35292	Documented in PLOTS Database 2006
<i>Lonicera japonica</i>		Japanese Honeysuckle	G5	SNA	35283	DiPietro 1994
<i>Luzula echinata</i>		Hedgehog Woodrush	G5	SNR	39342	DiPietro 1994
<i>Lysimachia quadrifolia</i>		Whorled Yellow Loosestrife	G5	SNR	23997	DiPietro 1994
<i>Magnolia acuminata</i>		Cucumber-tree	G5	SNR	18071	DiPietro 1994
<i>Magnolia virginiana</i>		Sweetbay	G5	SNR	18070	Documented in PLOTS Database 2006
<i>Mahonia aquifolium</i>		Holly leaved Barberry	G5	SNR	195030	DiPietro 1994
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>		Feathery False Lily-of-the-valley	G5T5	SNR	524297	DiPietro 1994
<i>Matelea carolinensis</i>		Maroon Carolina Milkvine	G4	SNR	30369	DiPietro 1994
<i>Medicago lupulina</i>		Black Medick	G5	SNA	503721	Documented in PLOTS Database 2006
<i>Melica mutica</i>		Two-flower Melicgrass	G5	SNR	41858	DiPietro 1994
<i>Melilotus alba</i>	<i>Melilotus officinalis</i>	Yellow Sweetclover	G5	SNA	26149	DiPietro 1994
<i>Menispermum canadense</i>		Common Moonseed	G5	SNR	18871	DiPietro 1994
<i>Microstegium vimineum</i>		Japanese stiltgrass	G5	SNA	503829	DiPietro 1994
<i>Mimosa quadrivalvis</i> var. <i>angustata</i>		Little-leaf Sensitive-briar	G5T5	SNR	537549	DiPietro 1994
<i>Mitchella repens</i>		Partridgeberry	G5	SNR	35063	DiPietro 1994
<i>Mitella diphylla</i>		Twoleaf Miterwort	G5	S1	24407	DiPietro 1994
<i>Monarda clinopodia</i>		White Bergamot	G5	S2	32288	DiPietro 1994
<i>Monarda fistulosa</i>		Wild Bergamot	G5	SNR	565311	NatureServe 2006
<i>Monotropa hypopithys</i>		American Pinesap	G5	S2	503871	DiPietro 1994
<i>Monotropa uniflora</i>		Indian-pipe	G5	SNR	23778	DiPietro 1994

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Morus alba		White Mulberry	G5	SNA	19066	DiPietro 1994
Morus rubra		Red Mulberry	G5	SNR	19070	DiPietro 1994
Myosotis arvensis		Field forget-me-not	G5	SNR	31692	DiPietro 1994
Nemophila aphylla		Small-flower Baby-blue-eyes	G5	SNR	31422	DiPietro 1994
Nyssa sylvatica		Blackgum	G5	SNR	27821	DiPietro 1994
Obolaria virginica		Virginia Pennywort	G5	SNR	30104	DiPietro 1994
Oenothera laciniata		Cutleaf Evening-primrose	G5	SNR	27371	DiPietro 1994
Osmorhiza claytonii		Blank Sweet-cicely	G5	SNR	29789	DiPietro 1994
Osmunda cinnamomea var. cinnamomea		Cinnamon Fern	G5T5	SNR	529311	DiPietro 1994
Osmunda regalis var. spectabilis		Royal Fern	G5T5	SNR	529314	DiPietro 1994
Ostrya virginiana		Eastern Hop-hornbeam	G5	SNR	19511	DiPietro 1994
Oxalis stricta		Common Yellow Wood Sorrel	G5	SNR	29095	DiPietro 1994
Oxalis violacea		Violet Wood Sorrel	G5	SNR	29098	DiPietro 1994
Oxydendrum arboreum		Sourwood	G5	SNR	23690	DiPietro 1994
Packera anonyma		Small's Ragwort	G5	SNR	518137	Documented in PLOTS Database 2006
Panax quinquefolius		American Ginseng	G3G4	S4	29399	DiPietro 1994
Parthenocissus quinquefolia		Virginia Creeper	G5	SNR	28602	DiPietro 1994
Paspalum dilatatum		Dallisgrass	G5	SNA	40997	DiPietro 1994
Passiflora incarnata		Purple Passionflower	G5	SNR	504139	DiPietro 1994
Passiflora lutea		Yellow Passionflower	G5	SNR	22226	Documented in PLOTS Database 2006
Paulownia tomentosa		Princesstree	G5	SNA	33460	DiPietro 1994
Pedicularis canadensis		Canadian Lousewort	G5	SNR	33362	DiPietro 1994
Pellaea atropurpurea		Purple Cliffbrake	G5	SNR	17641	DiPietro 1994
Penstemon canescens		Gray Beardtongue	G4	SNR	33846	DiPietro 1994
Penstemon hirsutus		Hairy Beardtongue	G4	SNR	33924	DiPietro 1994
Perilla frutescens		Beefsteak Plant	GNR	SNA	32634	DiPietro 1994

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<i>Phacelia bipinnatifida</i>		Fernleaf Scorpionweed	G5	SNR	31459	DiPietro 1994
<i>Phegopteris hexagonoptera</i>		Broad Beech Fern	G5	SNR	504296	DiPietro 1994
<i>Phlox amoena</i>		Hairy Phlox	G4	SNR	30910	Documented in PLOTS Database 2006
<i>Phlox amplifolia</i>		Largeleaf Phlox	G3G5	SNR	30911	DiPietro 1994
<i>Phlox divaricata</i>		Wild Blue Phlox	G5	SNR	30934	DiPietro 1994
<i>Phlox glaberrima</i>		Smooth Phlox	G5	SNR	30940	DiPietro 1994
<i>Phlox pilosa</i>		Downy Phlox	G5	SNR	30974	DiPietro 1994
<i>Phryma leptostachya</i>		American Lopseed	G5	SNR	504348	DiPietro 1994
<i>Physalis heterophylla</i>		Clammy Ground-cherry	G5	SNR	30601	DiPietro 1994
<i>Phytolacca americana</i>		American Pokeweed	G5	SNR	19523	DiPietro 1994
<i>Pilea pumila</i>		Canadian Clearweed	G5	SNR	19130	DiPietro 1994
<i>Pinus echinata</i>		Shortleaf Pine	G5	S4S5	183335	DiPietro 1994
<i>Pinus palustris</i>		Longleaf Pine	G5	S4	18038	DiPietro 1994
<i>Pinus taeda</i>		Loblolly Pine	G5	S5	18037	DiPietro 1994
<i>Pinus virginiana</i>		Virginia Pine	G5	S5	183394	DiPietro 1994
<i>Piptochaetium avenaceum</i>		Eastern Speargrass	G5	SNR	504408	Documented in PLOTS Database 2006
<i>Pityopsis graminifolia</i> var. <i>graminifolia</i>		Narrowleaf Silk-grass	G5T4	SNR	196350	DiPietro 1994
<i>Plantago lanceolata</i>		Narrowleaf Plantain	G5	SNA	32874	DiPietro 1994
<i>Plantago major</i>		Common Plantain	G5	SNA	32887	Documented in PLOTS Database 2006
<i>Plantago rugelii</i>		Black-seed Plantain	G5	SNR	504439	DiPietro 1994
<i>Plantago virginica</i>		Pale-seed Plantain	G5	SNR	32895	DiPietro 1994
<i>Platanus occidentalis</i>		Sycamore	G5	SNR	19020	DiPietro 1994
<i>Pleopeltis polypodioides</i>		Resurrection Fern	G5T NR	SNR	524534	DiPietro 1994
<i>Poa cuspidata</i>		Early Bluegrass	G5	SNR	41122	DiPietro 1994
<i>Poa pratensis</i>		Kentucky Bluegrass	G5	SNR	41088	DiPietro 1994
<i>Podophyllum peltatum</i>		Mayapple	G5	SNR	18850	DiPietro 1994
<i>Polygonatum biflorum</i>		Smooth Solomon's-seal	G5	SNR	43006	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Polygonum caespitosum</i> var. <i>longisetum</i>		Oriental ladythumb	G5	SNA	566299	DiPietro 1994
<i>Polygonum hydropiperoides</i>		Swamp Smartweed	G5	SNR	20857	DiPietro 1994
<i>Polygonum pennsylvanicum</i>		Pennsylvania Smartweed	G5	SNR	20861	DiPietro 1994
<i>Polygonum persicaria</i>		Spotted Lady's-thumb	G3G5	SNR	20915	DiPietro 1994
<i>Polygonum punctatum</i>		Dotted Smartweed	G5	SNR	20862	DiPietro 1994
<i>Polygonum scandens</i>		Climbing False Buckwheat	G5	SNR	20924	DiPietro 1994
<i>Polygonum virginianum</i>		Jumpseed	G5	SNR	20931	DiPietro 1994
<i>Polystichum acrostichoides</i>		Christmas Fern	G5	SNR	17675	DiPietro 1994
<i>Populus deltoides</i>		Eastern Cottonwood	G5	S4S5	22445	Documented in PLOTS Database 2006
<i>Porteranthus stipulatus</i>		Indian-physic	G5	SNR	25284	DiPietro 1994
<i>Porteranthus trifoliatus</i>		Bowman's-root	G4G5	SNR	25285	DiPietro 1994
<i>Potentilla simplex</i>		Common Cinquefoil	G5	SNR	24751	DiPietro 1994
<i>Prenanthes</i> sp.		Rattlesnake Root	?	?	38268	DiPietro 1994
<i>Prunella vulgaris</i>		Common Self-heal	G5	SNR	32381	DiPietro 1994
<i>Prunus angustifolia</i>		Chickasaw Plum	G5	SNR	24768	DiPietro 1994
<i>Prunus serotina</i>		Black Cherry	G5	SNR	24764	DiPietro 1994
<i>Pteridium aquilinum</i>		Bracken Fern	G5	SNR	17224	DiPietro 1994
<i>Pueraria montana</i> var. <i>lobata</i>		Kudzu	G5	SNA	529930	DiPietro 1994
<i>Pycnanthemum incanum</i>		Hoary Mountainmint	G5	SNR	32662	DiPietro 1994
<i>Pycnanthemum tenuifolium</i>		Narrowleaf Mountainmint	G5	SNR	32668	DiPietro 1994
<i>Pyrrhopappus carolinianus</i>		Carolina False-dandelion	G5	SNR	38324	DiPietro 1994
<i>Quercus alba</i>		White Oak	G5	SNR	19290	DiPietro 1994
<i>Quercus coccinea</i>		Scarlet Oak	G5	SNR	19288	DiPietro 1994
<i>Quercus falcata</i>		Southern Red Oak	G5	SNR	19277	DiPietro 1994
<i>Quercus marilandica</i>		Blackjack Oak	G5	SNR	19374	DiPietro 1994
<i>Quercus michauxii</i>		Swamp Chestnut Oak	G5	SNR	19279	Documented in PLOTS Database 2006

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Quercus muehlenbergii</i>		Chinquapin Oak	G5	SNR	504714	DiPietro 1994
<i>Quercus palustris</i>		Pin Oak	G5	?	19281	DiPietro 1994
<i>Quercus prinus</i>		Chestnut Oak	G5	SNR	19398	DiPietro 1994
<i>Quercus rubra</i>		Northern Red Oak	G5	SNR	19408	DiPietro 1994
<i>Quercus shumardii</i>		Shumard Oak	G5	SNR	19417	Documented in PLOTS Database 2006
<i>Quercus stellata</i>		Post Oak	G5	SNR	19422	DiPietro 1994
<i>Quercus velutina</i>		Black Oak	G5	SNR	19447	DiPietro 1994
<i>Ranunculus abortivus</i>		Kidneyleaf Buttercup	G5	SNR	18559	DiPietro 1994
<i>Ranunculus acris</i>		Tall Buttercup	G5	SNR	18583	DiPietro 1994
<i>Ranunculus hispidus</i> var. <i>hispidus</i>		Bristly Buttercup	G5T5	SNR	194958	DiPietro 1994
<i>Ranunculus recurvatus</i>		Blisterwort	G5	SNR	18641	DiPietro 1994
<i>Rhododendron calendulaceum</i>		Flame Azalea	G5	SNR	23707	DiPietro 1994
<i>Rhododendron canescens</i>		Wild Azalea	G5	SNR	23712	Documented in PLOTS Database 2006
<i>Rhododendron periclymenoides</i>		Pink Azalea	G5	SNR	23726	DiPietro 1994
<i>Rhus copallinum</i>		Winged Sumac	G5	SNR	504754	DiPietro 1994
<i>Rhus glabra</i>		Smooth Sumac	G5	SNR	28782	DiPietro 1994
<i>Robinia pseudoacacia</i>		Black Locust	G5	SNR	504804	DiPietro 1994
<i>Rosa multiflora</i>		Multiflora Rose	G5	SNA	24833	DiPietro 1994
<i>Rubus argutus</i>		Southern Blackberry	G5	SNR	24877	DiPietro 1994
<i>Rubus flagellaris</i>		Northern Dewberry	G5	SNR	24921	Documented in PLOTS Database 2006
<i>Rubus occidentalis</i>		Black Raspberry	G5	SNR	24854	DiPietro 1994
<i>Rubus trivialis</i>		Southern Dewberry	G5	SNR	25067	DiPietro 1994
<i>Rudbeckia hirta</i>		Black-eyed-Susan	G5	SNR	36765	DiPietro 1994
<i>Ruellia caroliniensis</i>		Carolina Wild Petunia	G5	SNR	34373	DiPietro 1994
<i>Rumex acetosella</i>		Common Sheep Sorrel	G5	SNA	20934	DiPietro 1994
<i>Rumex pulcher</i>		Fiddle Dock	G5	SNA	20942	DiPietro 1994
<i>Salvia lyrata</i>		Lyreleaf Sage	G5	SNR	32690	DiPietro 1994
<i>Salvia urticifolia</i>		Nettleleaf Sage	G5	SNR	32750	Documented in PLOTS Database 2006

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Sambucus canadensis</i>		Common Elderberry	G5	SNR	35317	DiPietro 1994
<i>Sanguinaria canadensis</i>		Bloodroot	G5	SNR	18990	DiPietro 1994
<i>Sanicula canadensis</i>		Canadian Black Snakeroot	G5	SNR	29850	DiPietro 1994
<i>Saponaria officinalis</i>		Bouncingbet	G5	SNA	20039	DiPietro 1994
<i>Sassafras albidum</i>		Sassafras	G5	SNR	18158	DiPietro 1994
<i>Saxifraga virginensis</i>		Early Saxifrage	G5	SNR	24303	DiPietro 1994
<i>Schizachyrium scoparium</i>		Little Bluestem	G5	SNR	42076	DiPietro 1994
<i>Scleria triglomerata</i>		Whip Nutrush	G5	SNR	40318	DiPietro 1994
<i>Scrophularia marilandica</i>		Carpenter's-square	G5	SNR	34037	DiPietro 1994
<i>Scutellaria elliptica</i> var. <i>hirsuta</i>		Hairy Skullcap	G5T NR	SNR	196140	DiPietro 1994
<i>Scutellaria ovata</i> ssp. <i>ovata</i>		Heartleaf Skullcap	G5T5	SNR	32773	DiPietro 1994
<i>Sedum ternatum</i>		Woodland Stonecrop	G5	SNR	24184	DiPietro 1994
<i>Senecio glabellus</i>	<i>Packera glabella</i>	Butterweed	G5	SNR	36138	DiPietro 1994
<i>Senecio pauperculus</i>	<i>Packera paupercula</i>	Balsam Ragwort	G5	SNR	36168	DiPietro 1994
<i>Senna obtusifolia</i>		Coffeeweed	G5	SNR	505165	DiPietro 1994
<i>Setaria viridis</i>		Green Bristlegrass	G5	SNA	41231	DiPietro 1994
<i>Sherardia arvensis</i>		Blue Fieldmadder	G5	SNA	35237	DiPietro 1994
<i>Silene stellata</i>		Widow's Frill	G5	SNR	20127	DiPietro 1994
<i>Silene virginica</i>		Fire-pink	G5	SNR	20141	DiPietro 1994
<i>Silphium asteriscus</i>		Starry Rosinweed	G5	SNR	38387	DiPietro 1994
<i>Silphium trifoliatum</i> var. <i>trifoliatum</i>		Threeleaf Rosinweed	G4?T 4?	SNR	530391	DiPietro 1994
<i>Sisymbrium officinale</i>		Hedgemustard	G5	SNA	23316	DiPietro 1994
<i>Sisyrinchium angustifolium</i>		Narrowleaf Blue-eyed-grass	G5	SNR	43240	DiPietro 1994
<i>Smallanthus uvedalius</i>		Bear's-foot	G4G5	SNA	505252	DiPietro 1994
<i>Smilax bona-nox</i>		Fringed Greenbrier	G5	SNR	43341	DiPietro 1994
<i>Smilax glauca</i>		Whiteleaf Greenbrier	G5	SNR	43342	DiPietro 1994
<i>Smilax hugeri</i>		Huger's Carrion-flower	G4	SNR	505254	NatureServe 2006

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Smilax rotundifolia</i>		Roundleaf Greenbrier	G5	SNR	43346	Documented in PLOTS Database 2006
<i>Smilax tamnoides</i>		Chinaroot	G5	SNR	43348	Documented in PLOTS Database 2006
<i>Solanum carolinense</i>		Carolina Horse-nettle	G5	SNR	30413	DiPietro 1994
<i>Solanum dulcamara</i>		Climbing Nightshade	G5	SNR	30414	DiPietro 1994
<i>Solidago arguta</i>		Atlantic Goldenrod	G5	SNR	36230	Documented in PLOTS Database 2006
<i>Solidago caesia</i>		Wreath Goldenrod	G5	SNR	36238	DiPietro 1994
<i>Solidago canadensis</i> var. <i>canadensis</i>		Canadian Goldenrod	G5T5	SNA	530444	DiPietro 1994
<i>Solidago flexicaulis</i>		Zigzag Goldenrod	G5	SNR	36257	Documented in PLOTS Database 2006
<i>Solidago gigantea</i>		Giant Goldenrod	G5	SNR	36259	DiPietro 1994
<i>Solidago hispida</i>		Hairy Goldenrod	G5	SNR	36266	DiPietro 1994
<i>Solidago juncea</i>		Early Goldenrod	G5	SNR	36270	DiPietro 1994
<i>Solidago odora</i> var. <i>odora</i>		Anise-scented Goldenrod	G5T5	SNR	530467	DiPietro 1994
<i>Solidago speciosa</i> var. <i>erecta</i>	<i>Solidago erecta</i>	Slender Goldenrod	G5	SNR	530478	DiPietro 1994
<i>Sphenopholis intermedia</i>		Slender Wedgescale	G5	SNR	505324	DiPietro 1994
<i>Sphenopholis nitida</i>		Shiny Wedgescale	G5	SNR	41281	DiPietro 1994
<i>Spigelia marilandica</i>		Woodland Pinkroot	G4	SNR	505330	DiPietro 1994
<i>Staphylea trifolia</i>		American Bladdernut	G5	SNR	28646	DiPietro 1994
<i>Stellaria media</i>		Common Chickweed	GNR	SNA	20169	DiPietro 1994
<i>Stellaria pubera</i>		Great Chickweed	G5	SNR	20193	DiPietro 1994
<i>Stylosanthes biflora</i>		Side-beak Pencil-flower	G5	SNR	26973	DiPietro 1994
<i>Symphoricarpos orbiculatus</i>		Coralberry	G5	SNR	35337	DiPietro 1994
<i>Symphyotrichum lateriflorum</i>		Calico Aster	G5	SNR	522220	Documented in PLOTS Database 2006
<i>Taraxacum officinale</i>		Common Dandelion	G5	SNR	36213	DiPietro 1994
<i>Tephrosia virginiana</i>		Goat's-rue	G5	SNR	26998	DiPietro 1994
<i>Teucrium canadense</i>		American Germander	G5	SNR	32352	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Thalictrum dioicum</i>		Early Meadowrue	G5	SNR	18669	DiPietro 1994
<i>Thalictrum thalictroides</i>		Rue-anemone	G5	SNR	18683	DiPietro 1994
<i>Thaspium trifoliatum</i> var. <i>aureum</i>		Purple Meadow-parsnip	G5T5	SNR	530637	DiPietro 1994
<i>Thelypteris noveboracensis</i>		New York Fern	G5	SNR	17261	DiPietro 1994
<i>Tiarella cordifolia</i>		Heartleaf Foamflower	G5	SNR	24530	DiPietro 1994
<i>Tilia americana</i> var. <i>heterophylla</i>		Appalachian Basswood	G5T5	SNR	530692	DiPietro 1994
<i>Tipularia discolor</i>		Crippled Crane-fly	G4G5	SNR	43703	DiPietro 1994
<i>Toxicodendron radicans</i>		Eastern Poison-ivy	G5	SNR	28821	DiPietro 1994
<i>Tradescantia ohiensis</i>		Spiderwort	G5	SNR	39169	Documented in PLOTS Database 2006
<i>Tradescantia subaspera</i> var. <i>montana</i>		Zigzag Spiderwort	G5T3 T5Q	SNR	530714	DiPietro 1994
<i>Tragia cordata</i>		Heartleaf Noseburn	G4	SNR	28428	Documented in PLOTS Database 2006
<i>Tridens flavus</i>		Tall Redtop	G5	SNR	42227	DiPietro 1994
<i>Trifolium campestre</i>		Field Clover	G5	SNA	26231	DiPietro 1994
<i>Trifolium pratense</i>		Red Clover	G5	SNA	26313	DiPietro 1994
<i>Trifolium repens</i>		White Clover	G5	SNA	26206	DiPietro 1994
<i>Trillium catesbaei</i>		Bashful Wakerobin	G4	SNR	43064	DiPietro 1994
<i>Trillium cuneatum</i>		Little Sweet Trillium	G4G5	SNR	43056	DiPietro 1994
<i>Triodanis perfoliata</i>		Claspingleaf Venus'-looking-glass	G5	SNR	34615	DiPietro 1994
<i>Triodanis perfoliata</i> var. <i>biflora</i>		Claspingleaf Venus'-Looking-glass	G5T5	SNR	530742	DiPietro 1994
<i>Tsuga canadensis</i>		Eastern Hemlock	G4G5	S4	183397	DiPietro 1994
<i>Ulmus alata</i>		Winged Elm	G5	SNR	19051	DiPietro 1994
<i>Ulmus americana</i>		American Elm	G5?	SNR	19049	DiPietro 1994
<i>Ulmus rubra</i>		Slippery Elm	G5	SNR	19050	DiPietro 1994
<i>Uvularia grandiflora</i>		Large-flower Bellwort	G5	SNR	43109	Documented in PLOTS Database 2006
<i>Uvularia perfoliata</i>		Perfoliate Bellwort	G5	SNR	43110	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Uvularia sessilifolia</i>		Wingstem	G5	SNR	43112	Documented in PLOTS Database 2006
<i>Vaccinium arboreum</i>		Farkleberry	G5	SNR	23580	DiPietro 1994
<i>Vaccinium corymbosum</i>		Highbush Blueberry	G5	SNR	23573	DiPietro 1994
<i>Vaccinium pallidum</i>		Hillside Blueberry	G5	SNR	23610	DiPietro 1994
<i>Vaccinium stamineum</i>		Deerberry	G5	SNR	23615	DiPietro 1994
<i>Valerianella locusta</i>		European Cornsalad	G5	SNA	35392	DiPietro 1994
<i>Valerianella radiata</i>		Beaked Cornsalad	G5	SNR	35397	DiPietro 1994
<i>Verbascum thapsus</i>		Common Mullein	G5	SNA	33394	DiPietro 1994
<i>Verbena brasiliensis</i>		Brazilian vervain	G5	SNA	32086	DiPietro 1994
<i>Verbena urticifolia</i>		White Vervain	G5	SNR	32127	DiPietro 1994
<i>Verbesina alternifolia</i>		Wingstem	G5	SNR	38597	Documented in PLOTS Database 2006
<i>Verbesina helianthoides</i>		Gravelweed	G5	SNR	38604	DiPietro 1994
<i>Vernonia gigantea</i> ssp. <i>gigantea</i>		Giant Ironweed	G5T5	SNR	38635	DiPietro 1994
<i>Veronica hederifolia</i>		Ivyleaf Speedwell	G5	SNA	33418	DiPietro 1994
<i>Veronica serpyllifolia</i> ssp. <i>serpyllifolia</i>		Thymeleaf Speedwell	G5	SNA	33424	DiPietro 1994
<i>Viburnum acerifolium</i>		Mapleleaf Viburnum	G5	SNR	35255	DiPietro 1994
<i>Viburnum rhytidophyllum</i>		Leatherleaf Arrowwood	G5	SNR	505679	DiPietro 1994
<i>Viburnum rufidulum</i>		Rusty Blackhaw	G5	SNR	35274	DiPietro 1994
<i>Vicia caroliniana</i>		Carolina Wood Vetch	G5	SNR	26334	DiPietro 1994
<i>Vicia sativa</i>		Spring Vetch	G5	SNA	26355	DiPietro 1994
<i>Vinca minor</i>		Periwinkle	G5	SNA	30238	DiPietro 1994
<i>Viola bicolor</i>		Field Pansy	G5	SNR	22047	DiPietro 1994
<i>Viola conspersa</i>		American Bog Violet	G5	SNR	22060	DiPietro 1994
<i>Viola palmata</i> var. <i>palmata</i>	<i>Viola</i> x <i>palmata</i>	Early Blue Violet	G5	SNR	531142	DiPietro 1994
<i>Viola pedata</i>		Bird's-foot Violet	G5	SNR	22130	DiPietro 1994
<i>Viola sororia</i>		Common Blue Violet	G5	SNR	22169	DiPietro 1994

Latin Name (NPS)	Latin Name (NatureServe)	Common Name	G-Rank	S-Rank	TSN #	Data Source
<i>Viola striata</i>		Striped Violet	G5	SNR	22171	DiPietro 1994
<i>Viola triloba</i> var. <i>dilatata</i>		Three Lobe Violet	G5T5 ?	SNR	541758	Documented in PLOTS Database 2006
<i>Viola tripartita</i>		Three-parted Yellow Violet	G5	SNR	22178	DiPietro 1994
<i>Vitis aestivalis</i>		Summer Grape	G5	SNR	28607	DiPietro 1994
<i>Vitis rotundifolia</i>		Muscadine	G5	SNR	28609	DiPietro 1994

Numeric ranks:

G1 = Critically imperiled globally

G2 = Imperiled globally

G3 = Rare or uncommon

G4 = Widespread, abundant, and apparently secure, but with cause for long-term concern globally

G5 = Demonstrably widespread, abundant and secure globally

GNR = Not globally ranked (usually exotic species)

S1 = Critically imperiled statewide

S2 = Imperiled statewide

S3 = Rare or uncommon statewide

S4 = Widespread, abundant, and apparently secure, but with cause for long-term concern

S5 = Demonstrably widespread, abundant and secure statewide

SNR = not state ranked

Qualifiers:

? = Inexact numeric rank

Q = Questionable taxonomy

Table 3. List of vouchers collected at Russell Cave National Monument

Latin Name	COMMON NAME	TSN	Catalog#	Accession#	Collector	Habitat
<i>Botrychium dissectum</i>	cutleaf grapefern	17171	15488	RUCA-00074	Rickie White & Alfred Schotz	Rocky creek bed mesic forest
<i>Diarrhena americana</i>	American beakgrain	41644	15489	RUCA-00074	Alfred Schotz & Carlen Emanuel	Rocky creek bed mesic forest
<i>Euonymus atropurpurea</i>	eastern wahoo	502579	15490	RUCA-00074	Rickie White & Heather McCoy	Mesic oak slope
<i>Monarda fistulosa</i>	wild bergamot	565311	15491	RUCA-00074	?	Rocky creek bed mesic forest
<i>Smallanthus uvedalius</i>	hairy leafcup	505252	15492	RUCA-00074	Rickie White & Heather McCoy	Mesic oak slope
<i>Smilax hugeri</i>	Huger's carrionflower	505254	15493	RUCA-00074	Rickie White & Heather McCoy	Mesic oak slope
<i>Viburnum rhytidophyllum</i>	leatherleaf arrowwood	505679	15494	RUCA-00074	Rickie White & Alfred Schotz	Rocky creek bed mesic forest

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

Diversity Measures			
# of plots	alpha	beta	gamma
12	91	3.7	345

alpha = average species richness per plot

beta = measure of the heterogeneity of the data (gamma/alpha)

gamma = total species for all plots/park

	Estimate of # of species in park	If estimate is correct, % of species confirmed for park (based on 460 species confirmed)
First-order jackknife estimate (all plots)	460	100%
Second-order jackknife estimate (all plots)	533	86%

Table 5. Exotic species documented from Russell Cave National Monument

Latin Name (NPS)	Latin Name (NatureServe)	Common Name (NRCS)	TSN #	Data Source	IRANK
<i>Ailanthus altissima</i>		tree of heaven	28827	Documented in plots	Medium
<i>Ajuga reptans</i>		common bugle	32454	Documented in plots	
<i>Albizia julibrissin</i>		silk tree	26449	DiPietro 1994	Medium/Low
<i>Amaranthus retroflexus</i>		redroot amaranth	20745	DiPietro 1994	Not Ranked
<i>Cardamine hirsuta</i>		hairy bittercress	22797	DiPietro 1994	
<i>Cerastium glomeratum</i>		sticky chickweed	19955	DiPietro 1994	
<i>Clematis terniflora</i>		sweet autumn virginsbower	18712	DiPietro 1994	
<i>Cotinus coggygria</i>		European smoketree	28800	DiPietro 1994	
<i>Cynodon dactylon</i>		Bermudagrass	41619	DiPietro 1994	Medium/Low
<i>Datura stramonium</i>		jimsonweed	30520	DiPietro 1994	High/Low
<i>Daucus carota</i>		Queen Anne's lace	29477	DiPietro 1994	Low
<i>Dioscorea oppositifolia</i>		Chinese yam	502075	DiPietro 1994	High/Low
<i>Duchesnea indica</i>		Indian strawberry	25163	DiPietro 1994	Low/Insignificant
<i>Echinochloa crus-galli</i> var. <i>crus-galli</i>		Large Barnyardgrass	527837	DiPietro 1994	
<i>Eleusine indica</i>		Indian goosegrass	41692	DiPietro 1994	
<i>Festuca arundinacea</i>		Tall fescue	40810	DiPietro 1994	
<i>Galinsoga quadriradiata</i>		shaggy soldier	37415	DiPietro 1994	
<i>Glechoma hederacea</i>		ground ivy	502801	DiPietro 1994	Medium/Insignificant
<i>Hedera</i> sp.		Ivy	29392	DiPietro 1994	
<i>Hemerocallis fulva</i>		orange daylily	42943	Documented in plots	
<i>Ipomoea purpurea</i>		tall morning-glory	30789	DiPietro 1994	Medium/Low
<i>Kummerowia striata</i>		Japanese clover	503294	Documented in plots	
<i>Lamium amplexicaule</i>		henbit deadnettle	32539	DiPietro 1994	
<i>Lespedeza cuneata</i>		sericea lespedeza	25898	DiPietro 1994	Medium
<i>Leucanthemum vulgare</i>		oxeye daisy	37903	DiPietro 1994	Medium/Low
<i>Ligustrum japonicum</i>		Japanese privet	503449	Documented in plots	High/Medium
<i>Ligustrum sinense</i>		Chinese privet	32979	Documented in plots	
<i>Ligustrum vulgare</i>		European privet	32980	DiPietro 1994	High/Medium

Latin Name (NPS)	Latin Name (NatureServe)	Common Name (NRCS)	TSN #	Data Source	IRANK
<i>Lolium perenne</i> ssp. <i>perenne</i>		perennial ryegrass	524261	DiPietro 1994	
<i>Lolium pratense</i>		>>Schedonorus <i>pratensis</i>	507983	Documented in plots	
<i>Lonicera japonica</i>		Japanese honeysuckle	35283	DiPietro 1994	High/Medium
<i>Mahonia aquifolium</i>		Holly leaved Barberry	195030	DiPietro 1994	
<i>Medicago lupulina</i>		black medick	503721	Documented in plots	
<i>Melilotus albus</i>	<i>Melilotus officinalis</i>	yellow sweetclover	26149	DiPietro 1994	
<i>Microstegium vimineum</i>		Japanese stiltgrass	503829	DiPietro 1994	High/Medium
<i>Morus alba</i>		white mulberry	19066	DiPietro 1994	High/Medium
<i>Myosotis arvensis</i>		Field forget-me-not	31692	DiPietro 1994	
<i>Paspalum dilatatum</i>		dallisgrass	40997	DiPietro 1994	
<i>Paulownia tomentosa</i>		princesstree	33460	DiPietro 1994	Medium/Low
<i>Plantago lanceolata</i>		narrowleaf plantain	32874	DiPietro 1994	High/Low
<i>Polygonum caespitosum</i> var. <i>longisetum</i>		Oriental ladysthumb	566299	DiPietro 1994	
<i>Pueraria montana</i> var. <i>lobata</i>		kudzu	529930	DiPietro 1994	Medium
<i>Rosa multiflora</i>		multiflora rose	24833	DiPietro 1994	Medium/Low
<i>Rumex acetosella</i>		common sheep sorrel	20934	DiPietro 1994	Medium/Low
<i>Rumex pulcher</i>		fiddle dock	20942	DiPietro 1994	
<i>Saponaria officinalis</i>		bouncingbet	20039	DiPietro 1994	Low/Insignificant
<i>Setaria viridis</i>		green bristlegrass	41231	DiPietro 1994	
<i>Sherardia arvensis</i>		blue fieldmadder	35237	DiPietro 1994	
<i>Sisymbrium officinale</i>		hedgemustard	23316	DiPietro 1994	
<i>Solanum dulcamara</i>		climbing nightshade	30414	DiPietro 1994	
<i>Trifolium campestre</i>		field clover	26231	DiPietro 1994	
<i>Trifolium pratense</i>		red clover	26313	DiPietro 1994	Low/Insignificant
<i>Trifolium repens</i>		white clover	26206	DiPietro 1994	Medium/Low
<i>Verbascum thapsus</i>		common mullein	33394	DiPietro 1994	Medium
<i>Verbena brasiliensis</i>		Brazilian vervain	32086	DiPietro 1994	
<i>Veronica hederifolia</i>		ivyleaf speedwell	33418	DiPietro 1994	

Latin Name (NPS)	Latin Name (NatureServe)	Common Name (NRCS)	TSN #	Data Source	IRANK
Veronica serpyllifolia ssp. serpyllifolia		thymeleaf speedwell	33424	DiPietro 1994	
Viburnum rhytidophyllum		Leatherleaf Arrowwood	505679	DiPietro 1994	
Vicia sativa		Spring Vetch	26355	DiPietro 1994	
Vinca minor		common periwinkle	30238	DiPietro 1994	Low

I-Rank Value Definitions (from Morse et al. 2004):

High: Species represents a severe threat to native species and ecological communities.

Medium: Species represents a moderate threat to native species and ecological communities.

Low: Species represents a significant but relatively low threat to native species and ecological communities.

Insignificant: Species represents and insignificant threat to native species and ecological communities.

Blank: I-Rank not yet determined.

Table 6. Association numbers, plot numbers, and global ranks of all associations identified at Russell Cave National Monument.

CEGL #	Systems	Ecological Associations (Scientific name)	Ecological Associations (Name #2)	Ecological Associations (Name #3)	Plots	Global Rank
7124	Semi-natural Forest	<i>Juniperus virginiana</i> var. <i>virginiana</i> - (<i>Quercus spp.</i>) Forest	Eastern Red-cedar - (Oak species) Forest	Red-cedar Successional Forest		GNR
7233	Southern and Central Appalachian Cove Forest	<i>Quercus alba</i> - (<i>Quercus rubra</i> , <i>Acer saccharum</i> , <i>Fagus grandifolia</i>) / <i>Aesculus flava</i> Forest	White Oak - (Northern Red Oak, Sugar Maple, American Beech) / Yellow Buckeye Forest	Rich Low-Elevation Appalachian Oak Forest	7, 8, 9	G4
2070	Southern Ridge and Valley Dry Calcareous Forest	<i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Quercus muehlenbergii</i> / <i>Cercis canadensis</i> Forest	White Oak - Northern Red Oak - Chinquapin Oak / Redbud Forest	White Oak - Mixed Oak Dry-Mesic Alkaline Forest	10	G4G5
8442	Southern Ridge and Valley Dry Calcareous Forest	<i>Quercus shumardii</i> - <i>Quercus muehlenbergii</i> - <i>Acer (barbatum, leucoderme, saccharum)</i> / <i>Ostrya virginiana</i> Forest	Shumard Oak - Chinquapin Oak - (Southern Sugar Maple, Chalk Maple, Sugar Maple) / Eastern Hop-hornbeam Forest	Shumard Oak - Chinquapin Oak Mesic Limestone Forest	11	G2G3
8431	Southern Appalachian Oak Forest	<i>Quercus prinus</i> - (<i>Quercus coccinea</i>) / <i>Carya pallida</i> / <i>Vaccinium arboreum</i> - <i>Vaccinium pallidum</i> Forest	Rock Chestnut Oak - (Scarlet Oak) / Sand Hickory / Farkleberry - Hillside Blueberry Forest	Xeric Ridgetop Chestnut Oak Forest	1, 2, 3	G4G5
7268	Southern Interior Low Plateau Dry Oak Forest	<i>Quercus prinus</i> - <i>Carya ovata</i> - <i>Quercus rubra</i> / <i>Acer saccharum</i> Forest	Rock Chestnut Oak - Shagbark Hickory - Northern Red Oak / Sugar Maple Forest	Chestnut Oak - Shagbark Hickory - Sugar Maple Forest	4, 5, 6	G4?
8429	South-Central Interior Small Stream and Riparian	<i>Platanus occidentalis</i> - <i>Celtis laevigata</i> - <i>Liriodendron tulipifera</i> / <i>Lindera benzoin</i> - <i>Arundinaria gigantea</i> / <i>Amphicarpaea bracteata</i> Forest	Sycamore - Sugarberry - Tuliptree / Northern Spicebush - Giant Cane / Hog-peanut Forest	Rich Levee Mixed Hardwood Bottomland Forest	12	G3G4Q
4048	Exotic-dominated Community	<i>Lolium (arundinaceum, pratense)</i> Herbaceous Vegetation	(Tall Fescue, Meadow Fescue) Herbaceous Vegetation	Cultivated Meadow		GNA

CEGL #	Systems	Ecological Associations (Scientific name)	Ecological Associations (Name #2)	Ecological Associations (Name #3)	Plots	Global Rank
4395	Southern Appalachian Montane Cliff and Talus	(<i>Hydrangea arborescens</i> , <i>Toxicodendron radicans</i>) / <i>Heuchera americana</i> - (<i>Dichanthelium depauperatum</i> , <i>Woodsia obtusa</i>) <i>Shrubland</i>	(Smooth Hydrangea, Poison-ivy) / Common Alumroot - (Starved Witchgrass, Common Cliff Fern) Shrubland	Appalachian Mafic Cliff (Low-Elevation Type)		GNR
4392	Central Interior Highlands Dry Acidic Glade and Barrens	<i>Asplenium montanum</i> - <i>Heuchera parviflora</i> var. <i>parviflora</i> - <i>Silene rotundifolia</i> Sparse Vegetation	Mountain Spleenwort - Cave Alumroot - Sandstone Fire-pink Sparse Vegetation	Cumberland Plateau Sandstone Cliff (Dry Type)		G3G4

Numeric 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

GNA = Not ranked (usually because an exotic species dominated type or human modified)

GNR = Not ranked yet

Qualifiers:

? = Inexact numeric rank

Q = Questionable taxonomy

Table 7. Plot photo names and photo descriptions for Russell Cave National Monument.

Photo file name	Date taken	Description of photo
RUCA04a.jpg	8-8-2002	Plot 4
RUCA04b.jpg	8-8-2002	Plot 4
RUCA04c.jpg	8-8-2002	Plot 4
RUCA04d.jpg	8-8-2002	Plot 4
RUCA05a.jpg	8-8-2002	Plot 5
RUCA05b.jpg	8-8-2002	Plot 5
RUCA05c.jpg	8-8-2002	Plot 5
RUCA05d.jpg	8-8-2002	Plot 5
RUCA09a.jpg	8-8-2002	Plot 9
RUCA09b.jpg	8-8-2002	Plot 9
RUCA09c.jpg	8-8-2002	Plot 9
RUCA09d.jpg	8-8-2002	Plot 9
RUCA10a.jpg	8-9-2002	Plot 10
RUCA10b.jpg	8-9-2002	Plot 10
RUCA10c.jpg	8-9-2002	Plot 10
RUCA10d.jpg	8-9-2002	Plot 10
RUCA11a.jpg	8-9-2002	Plot 11
RUCA11b.jpg	8-9-2002	Plot 11
RUCA11c.jpg	8-9-2002	Plot 11
RUCA11d.jpg	8-9-2002	Plot 11
RUCA-AlSchotz.jpg	8-9-2002	Photo of Al Schotz of Alabama Natural Heritage Program
RUCA-fieldcrew.jpg	8-9-2002	Field crew for Alabama Natural Heritage (Al Schotz, NPS interns)
RussellCavemouth.jpg	8-9-2002	Russell Cave mouth

Appendix I. Plot sheet used for permanent plots (formatted to fit in this report)

Location name _____ *Jurisdiction (State):* _____
 Location organization (NPS, USFS, etc.) _____
 Air photo # (if known) _____ Polygon code (if known) _____ Subplot? Y or N Subplot Parent Code _____

Provisional community name _____
 Classified community name _____
 Classifier _____ Date _____

TUSNVC Elcode _____ *EONum-Suffix* _____

Sublocation (I.D.able feature on topo map) _____
USGS Quad name _____ *Quad code (if known)* _____
 Survey date: _____ Surveyors: _____

Directions to permanent marker and to the plot (use reverse of sheet if necessary):

Vegetation Plot length (m) _____ *Plot width (m)* _____ *Plot shape (rectangle?)* _____ *Permanent? Y or N*
 Digital photos **Regular camera** **No pictures taken** **Roll# or disc #** _____ **Frame #** _____
Plot representativeness (is the matrix the same?) _____

_____ **UTM** _____ **Lat/long** (If lat/long, then values are _____ N _____ W)

GPS Techniques/Equipment _____ **GPS file name** _____

Field UTM X _____ **m E** **Corrected UTM X** _____ **m E**
Field UTM Y _____ **m N** **Corrected UTM Y** _____ **m N**
Coordinate accuracy _____ **m / ft** **UTM Zone** _____ **GPS location with respect to permanent marker if not 0,0:** x _____ y _____
 _____ *Estimated position marked on Topo. Sheet.* **Elevation** _____ **m / ft** **topo map?** **altimeter?** **DEM?** **GPS?**

Measured Slope _____ °	Measured Aspect _____ ° (N=0 °)	Topographic Position
<input type="checkbox"/> Flat 0 ° 0 %	<input type="checkbox"/> Flat	<input type="checkbox"/> Interfluve (Ridge, summit or crest)
<input type="checkbox"/> Gentle 0-5 ° 1-9%	<input type="checkbox"/> Variable	<input type="checkbox"/> High Slope (upper slope, convex slope)
<input type="checkbox"/> Mod 6-14 ° 10-25%	<input type="checkbox"/> N 338-22 °	<input type="checkbox"/> Midslope (middle slope)
<input type="checkbox"/> Somewhat steep	<input type="checkbox"/> NE 23-67 °	<input type="checkbox"/> Lowslope (lower slope, footslope)
15-25 ° 26-49%	<input type="checkbox"/> E 68-112 °	<input type="checkbox"/> Toeslope (alluvial toeslope)
<input type="checkbox"/> Steep 27-45 ° 50-100%	<input type="checkbox"/> SE 113-157 °	<input type="checkbox"/> Low level (terrace)
<input type="checkbox"/> Very steep	<input type="checkbox"/> S 158-202 °	<input type="checkbox"/> Channel bed
45-69 ° 101-275%	<input type="checkbox"/> SW 203-247 °	
<input type="checkbox"/> Abrupt	<input type="checkbox"/> W 248-292 °	
70-100 ° 276-300%	<input type="checkbox"/> NW 293-337 °	
<input type="checkbox"/> overhanging/sheltered		
>100 ° >300%		

Landform (check most applicable)		
<input type="checkbox"/> Alluvial flat	<input type="checkbox"/> Depression	<input type="checkbox"/> Ridge
<input type="checkbox"/> Alluvial terrace	<input type="checkbox"/> Draw	<input type="checkbox"/> Ridgetop bedrock outcrop
<input type="checkbox"/> Bank	<input type="checkbox"/> Floodplain	<input type="checkbox"/> Saddle
<input type="checkbox"/> Bar	<input type="checkbox"/> Gap	<input type="checkbox"/> Scour
<input type="checkbox"/> Bench	<input type="checkbox"/> Hanging valley	<input type="checkbox"/> Seep
<input type="checkbox"/> Cliff	<input type="checkbox"/> Knob	<input type="checkbox"/> Toe slope
<input type="checkbox"/> Colluvial Slope	<input type="checkbox"/> Midslope	<input type="checkbox"/> Slope
<input type="checkbox"/> Cove	<input type="checkbox"/> Mima mound	<input type="checkbox"/> Streambed
<input type="checkbox"/> Debris Slide	<input type="checkbox"/> Nose slope	<input type="checkbox"/> Slough
	<input type="checkbox"/> Ravine	<input type="checkbox"/> Streamhead

Geology

Igneous Rocks:	Sedimentary Rocks:	Metamorphic Rocks:
<input type="checkbox"/> Granitic (Granite, Schyolite, Syenite, Trachyte)	<input type="checkbox"/> Conglomerates and Breccias	<input type="checkbox"/> Gneiss
<input type="checkbox"/> Dioritic (Diorite, Dacite, Andesite)	<input type="checkbox"/> Sandstone & conglomerate	<input type="checkbox"/> Schist
<input type="checkbox"/> Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite Diabase, Traprock)	<input type="checkbox"/> Siltstone (calcareous or noncalc)	<input type="checkbox"/> Slate and Phyllite
	<input type="checkbox"/> Shale (calcareous or noncalc)	<input type="checkbox"/> Marble
	<input type="checkbox"/> Limestone and Dolomite	<input type="checkbox"/> Serpentine (Ultramafic)
	<input type="checkbox"/> Gypsum	
	<input type="checkbox"/> Marl	<input type="checkbox"/> Y Other _____

Hydrologic Regime (check only for wetlands) <input type="checkbox"/> Intermittently flooded <input type="checkbox"/> Permanently flooded <input type="checkbox"/> Semipermanently flooded <input type="checkbox"/> Temporarily Flooded (e.g. floodplains) <input type="checkbox"/> Seasonally Flooded (e.g. seasonal ponds) <input type="checkbox"/> Saturated (e.g. bogs, perennial seeps) <input type="checkbox"/> Unknown <input type="checkbox"/> Not a wetland (Upland: XERIC : DRY - MESIC : MESIC)	<i>Salinity/Halinity Modifiers:</i> <i>Upland (N/A)</i> <i>Coastal Tidal: Saltwater- Tidal</i> <i>Coastal Tidal – Brackish</i> <i>Coastal Tidal – Freshwater</i> <i>Inland Saltwater</i> <i>Inland Brackish seeps)</i> <i>Unknown</i>	Hydrology Evidence (Describe the hydrological factors that caused you to assign the type to the hydrologic regime that you chose.):
--	--	--

<i>Environmental comments:</i> <hr/> <i>Landscape comments:</i>
--

Soil Texture: <input type="checkbox"/> Sand <input type="checkbox"/> Sandy loam <input type="checkbox"/> Loam <input type="checkbox"/> Silt loam <input type="checkbox"/> Clay loam <input type="checkbox"/> Clay <input type="checkbox"/> Peat <input type="checkbox"/> Muck	<i>Soil Taxon Description:</i> _____ Drainage: <input type="checkbox"/> Rapidly drained <input type="checkbox"/> Somewhat poorly drained <input type="checkbox"/> Well drained <input type="checkbox"/> Poorly drained <input type="checkbox"/> Moderately well drained <input type="checkbox"/> Very poorly drained Soil depth (optional): _____
--	---

Ground cover (adds to 100%) _____% Bedrock _____% Litter, duff _____% Bryophyte/lichen _____% Large rocks (cobbles, boulders >10cm) _____% Wood (> 1 cm) _____% Other _____ _____% Small rocks (gravel, 0.2-10 cm) _____% Water _____% Sand (0.1-2 mm) _____% Bare soil

Leaf type: <input type="checkbox"/> Broad-leaved <input type="checkbox"/> Needle-leaved <input type="checkbox"/> Microphyllous <input type="checkbox"/> Graminoid <input type="checkbox"/> Broad-leaved herbaceous <input type="checkbox"/> Pteridophyte <input type="checkbox"/> Extremely xeromorphic	Leaf phenology (dominant stratum) - Evergreen <input type="checkbox"/> Cold-deciduous <input type="checkbox"/> Drought-deciduous <input type="checkbox"/> Mixed evergreen-cold-deciduous <input type="checkbox"/> Mixed evergreen drought deciduous <input type="checkbox"/> Herb - Annual <input type="checkbox"/> Herb - Perennial	Physiognomic Class <input type="checkbox"/> Forest (closed tree canopy) <input type="checkbox"/> Woodland (open tree canopy) <input type="checkbox"/> Shrubland <input type="checkbox"/> Dwarf Shrubland <input type="checkbox"/> Herbaceous (less than 25% woody layers) <input type="checkbox"/> Nonvascular <input type="checkbox"/> Sparse Vegetation
---	--	---

QUANTITATIVE VEGETATION SAMPLE

STRATA	STRATA HEIGHT	COVER CLASS	DOMINANT/DIAGNOSTIC SPECIES	Height scale	Cover cls
Emergent T1				01 < .5m	5%
Tree canopy T2				02 .5-1m	10%
Under-story T3				03 1-2m	20%
Tall shrub S1				04 2-5m	30%
Short shrub S2				05 5-10m	40%
Herbaceous				06 15-20m	50%
Non-vascular				07 15-20m	60%
Vine/liana				08 20-35m	70%
Other notable species (indicators of distinctive conditions, e.g. high pH soil, elevation, geographic region, other particularly abundant species):				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 COMP AND COVER 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 #?	Diagnostic?	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%

Appendix II. Photos of selected plots of Russell Cave National Monument.



Plot 4.



Plot 9.



Al Schotz collecting data.



Plot 10.

Appendix III. Key to the Ecological Communities of Russell Cave National Monument

1. Wetland

Rich Levee Mixed Hardwood Bottomland Forest [CEGL008429]

1. Non-wetland

a. Forest or woodland

1. Primarily conifer

Red-cedar Successional Forest [CEGL007124]

2. Primarily deciduous

a. Xeric forests of sandy and gravelly soils occupying exposed slope positions. Canopy dominated by or exhibiting strong presence of chestnut oak with other oaks and hickories in the canopy and sub-canopy.

1. Forests of west and north facing high slopes and ridgetops over soils derived from sandstone with closed canopies dominated by *Quercus prinus* and sometimes *Q. coccinea*. Understory is characterized by a dense to open ericaceous layer and sparse herbaceous layer.

Xeric Ridgetop Chestnut Oak Forest [CEGL008431]

2. Forests of north facing high slopes and ridges over soils derived from sandstone. The most abundant canopy tree is usually *Quercus prinus*, but typical associates include other oaks (*Q. rubra* and *velutina*), shagbark hickory, pignut hickory and sugar maple which may be dominant in fire suppressed stands. Sub-canopies are sparse with typically less than 25% cover of stems of canopy and subcanopy species.

Chestnut Oak – Shagbark Hickory - Sugar Maple Forest [CEGL007268]

b. Forests of mesic and/or calcareous slopes. Canopy dominated by *Quercus alba* and/or mesic oak species (*Q. muehlenbergii*, *rubra*, *shumardii*). Other mesic hardwoods often codominate such as *Fagus grandifolia*, *Aesculus flava* and maples (*Acer saccharum*, *leucoderme*, *barbatum*).

1. Forests occupying steep to moderate lower and upper slopes with mixed canopies of oaks (*Q. alba* – *rubra* - *velutina* – *muhlenbergii*) and various hickories (*Carya* spp.).

a. Mesic forests of east and north mesic aspects with canopies dominated by *Quercus alba* and *Quercus rubra*, with various mixtures of *Fagus grandifolia*, *Fraxinus americana*, *Liriodendron tulipifera*, *Quercus velutina*, and hickories (*Carya* spp.) with a rich shrub and herbaceous layer.

Rich Low-Elevation Appalachian Oak Forest [CEGL007233]

b. Dry-mesic to dry forests with abundant rock fragments. Canopies are dominated by *Quercus alba*, *Quercus rubra*, *Quercus velutina*, and *Quercus muehlenbergii* commonly with *Carya alba* and *C. ovata* associated. Herbaceous layer less diverse and vines such as *Parthenocissus quinquefolia* and *Toxicodendron radicans* are common.

White Oak - Mixed Oak Dry-Mesic Alkaline Forest [CEGL002070]

2. Forests of rocky and boulder strewn substrates occupying low to middle slopes. Canopies dominated by *Quercus muhlenbergii* and *Q. shumardii* with

other basophilic hardwood species including maples (*Acer saccharum* – *barbatum*- *leucoderme*) and *Fraxinus americana*.

Shumard Oak - Chinquapin Oak Mesic Limestone Forest [CEGL008442]

b. Shrub or herbaceous vegetation

1. Shrub and vine dominated vertical or near vertical rock exposures dominated by *Hydrangea arborescens*, *Toxicodendron radicans* ssp. *radicans*, *Parthenocissus quinquefolia*, *Philadelphus hirsutus*, *Philadelphus inodorus*, and *Cercis canadensis*.
Appalachian Mafic Cliff (Low-Elevation Type) [CEGL004395]

2. Herbaceous dominated vegetation

a. Frequently mowed herbaceous area fields and meadows dominated by fescues (*Lolium arundinaceum* - *pratense*)

Cultivated Meadow [CEGL004048]

b. Sparse herbaceous vegetation of vertical sandstone cliffs with scattered individuals of *Heuchera parviflora* var. *parviflora*, *Silene rotundifolia*, *Asplenium montanum*, *Asplenium bradleyi*, *Mitchella repens*, *Kalmia latifolia*, and *Decumaria* larbara.

Cumberland Plateau Sandstone Cliff (Dry Type) [CEGL004392]

Appendix IV. Vegetation Classification for Russell Cave National Monument

**INTERNATIONAL ECOLOGICAL
CLASSIFICATION STANDARD:**

TERRESTRIAL ECOLOGICAL CLASSIFICATIONS

Russell Cave National Monument

29 January 2007

by

NatureServe

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

This subset of the International Ecological Classification Standard covers vegetation association attributed to Russell Cave National Monument. 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 Mark Hall, Project Manager/Regional Vegetation Ecologist-Appalachian Trail, Arlington, VA <mark_hall@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:

United States

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

Canada

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

Latin American and Caribbean

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

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

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Red-cedar Successional Forest

JUNIPERUS VIRGINIANA VAR. *VIRGINIANA* - (*QUERCUS* SPP.) FOREST

EASTERN RED-CEDAR - (OAK SPECIES) FOREST

IDENTIFIER: C EGL007124

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup (I.A.8.N.)	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest
Formation (I.A.8.N.c.)	Conical-crowned temperate or subpolar needle-leaved evergreen forest
Alliance	<i>Juniperus virginiana</i> Semi-natural Forest Alliance (A.137)
Alliance (English name)	Eastern Red-cedar Forest Alliance
Association	<i>Juniperus virginiana</i> var. <i>virginiana</i> - (<i>Quercus</i> spp.) Forest
Association (English name)	Eastern Red-cedar - (Oak species) Forest
Association (Common name)	Red-cedar Successional Forest

ECOLOGICAL SYSTEM(S): (CES203.482)	East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland
	East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest (CES203.506)
	Southern Interior Low Plateau Dry-Mesic Oak Forest (CES202.898)
	Southern Ridge and Valley / Cumberland Dry Calcareous Forest (CES202.457)
	East Gulf Coastal Plain Limestone Forest (CES203.502)

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:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: The example at Russell Cave National Monument appears to be an artifact of recently abandoned agricultural land. While the terrain is rugged and bouldery, the limestone-derived soils are moist and fertile allowing a dense stand of *Juniperus virginiana* var. *virginiana* to flourish.

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

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This association is represented by a dense stand of *Juniperus virginiana* var. *virginiana* accented by a sparse occurrence of *Cercis canadensis*, *Frangula caroliniana*, *Acer barbatum*, *Quercus muehlenbergii*, *Quercus shumardii*, and several other species beginning to invade from adjoining forested areas. Herbs, while generally scarce, are exemplified by a good diversity of species, specifically opportunistic and invasive taxa such as *Lolium arundinaceum*, *Festuca arundinacea*, *Toxicodendron radicans*, *Lonicera japonica*, and *Microstegium vimineum*, among others.

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.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global Stratum		
•	Tree subcanopy	Needle-leaved tree <i>Juniperus virginiana</i> var. <i>virginiana</i>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

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.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 3 - Weak

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL 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.

GLOBAL SIMILAR ASSOCIATIONS:

Juniperus virginiana Midwest Forest (CEGL002593)

Juniperus virginiana var. *virginiana* / *Rhus copallinum* / *Schizachyrium scoparium* Woodland (CEGL007704)

GLOBAL RELATED CONCEPTS:

Eastern Redcedar: 46 (Eyre 1980) B

IB5a. Eastern Red Cedar Woodland (Allard 1990) ?

Red cedar, RV (Pyne 1994) B

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association was sampled on the lower slope of Montague Mountain, proximal to the northern boundary in the northeast section of the park.

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?

USFS ECOREGIONS: 221Hc:CCC, 222Ak:CCP, 222Cg:CCC, 222Eb:CCC, 222Ed:CCC, 222Eg:CCC, 222Ej:CCC, 222En:CCC, 222Eo:CCC, 222Lc:CCP, 222Me:CCP, 231:C, 251Cc:CC?, 251Ch:CCP, M221Be:CCC

FEDERAL LANDS: DOD (Arnold, Camp Gruber, J. Percy Priest); NPS (Big South Fork, Blue Ridge Parkway?, Chickamauga-Chattanooga, Chickasaw NRA, Cumberland Gap, Fort Donelson, Kings Mountain, Lincoln Birthplace, Mammoth Cave, Natchez Trace, Russell Cave, Shiloh, Stones River); TVA (Columbia, Tellico); USFS (Bankhead, Cherokee?, Daniel Boone, Ouachita (Mountains)?, Ouachita?, Ozark)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: none.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: K.D. Patterson, mod. M. Pyne

REFERENCES: Allard 1990, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Gallyoun et al. 1996, Hoagland 2000, NatureServe Ecology - Southeastern U.S. unpubl. data, Pyne 1994, Rice 1960, Rosson 1995, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Rich Low-Elevation Appalachian Oak Forest

***QUERCUS ALBA* - (*QUERCUS RUBRA*, *ACER SACCHARUM*, *FAGUS GRANDIFOLIA*) / *AESCULUS FLAVA* FOREST**

WHITE OAK - (NORTHERN RED OAK, SUGAR MAPLE, AMERICAN BEECH) / YELLOW BUCKEYE FOREST

IDENTIFIER: CEGL007233

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)

Alliance	Quercus alba - (Quercus rubra, Carya spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	<i>Quercus alba</i> - (<i>Quercus rubra</i> , <i>Acer saccharum</i> , <i>Fagus grandifolia</i>) / <i>Aesculus flava</i> Forest
Association (English name)	White Oak - (Northern Red Oak, Sugar Maple, American Beech) / Yellow Buckeye Forest
Association (Common name)	Rich Low-Elevation Appalachian Oak Forest
ECOLOGICAL SYSTEM(S):	South-Central Interior Mesophytic Forest (CES202.887) Southern and Central Appalachian Cove Forest (CES202.373)

ELEMENT CONCEPT

GLOBAL SUMMARY: This mesic upland forest of the Ridge and Valley and adjacent Southern Blue Ridge is dominated by *Quercus alba*, *Carya ovata*, and *Carya alba*. *Quercus rubra* may be a dominant component of the canopy as well. Other species that may be present in the canopy are *Acer saccharum*, *Liriodendron tulipifera*, *Quercus velutina*, *Carya glabra*, *Fraxinus americana*, *Fagus grandifolia*, *Prunus serotina*, *Ulmus rubra*, and *Juglans nigra*. *Acer saccharum* may strongly dominate the subcanopy, this perhaps being a result of fire suppression. Other common subcanopy species include *Fraxinus americana*, *Ostrya virginiana*, *Asimina triloba*, *Fagus grandifolia*, *Oxydendrum arboreum*, and *Ulmus alata*. In the Ridge and Valley, examples may infrequently contain *Pinus virginiana*, *Quercus prinus*, *Aesculus flava*, *Tilia americana* var. *heterophylla*, *Pinus echinata*, *Pinus strobus*, and *Tsuga canadensis*. Shrubs of various heights are commonly present; these may include *Frangula caroliniana*, *Corylus cornuta*, *Vaccinium stamineum*, *Cercis canadensis*, *Acer rubrum*, *Morus rubra*, and *Lindera benzoin*. The herbaceous stratum may contain *Podophyllum peltatum*, *Toxicodendron radicans*, *Polystichum acrostichoides*, *Maianthemum racemosum* ssp. *racemosum*, and *Desmodium* spp. (specifically *Desmodium pauciflorum* and *Desmodium nudiflorum*).

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This association occupies soil derived from Bangor and Montegale limestones, on moderate to steep slopes characterized by a mosaic of rocky outcrops and silty loams mixed with residue from eroded sandstone washed down from upslope on Montague Mountain. Natural community examples are located at roughly midslope, falling within an elevation of 268 to 335 m (880-1100 feet).

GLOBAL ENVIRONMENT: The slope aspects that these communities occur on are northwest to east which create the mesic conditions that this community requires.

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: The closed canopy is dominated by *Quercus alba*, *Quercus rubra*, *Fagus grandifolia*, and *Liriodendron tulipifera*, and less frequently *Fraxinus americana*, *Carya ovata*, *Carya alba*, and *Celtis laevigata*. Characteristic subcanopy species include *Ulmus rubra*, *Morus rubra*, and *Sassafras albidum*, as well as smaller individuals of the foregoing canopy species. The shrub layer is generally sparse (less than 35% cover) containing immature examples of taxa found in the overstory, in addition to *Frangula caroliniana*, *Ostrya virginiana*, *Cornus florida*, *Callicarpa americana*, *Lindera benzoin*, *Euonymus americanus*, and *Asimina triloba*. Principal and otherwise noteworthy herbs are *Polystichum acrostichoides*, *Carex digitalis*, *Actaea pachypoda*, *Silene stellata*, *Panax quinquefolius*, *Podophyllum peltatum*, *Phlox divaricata*, and *Arisaema triphyllum*, among others.

GLOBAL VEGETATION: The canopy is generally closed (>75% cover). Other species that may be regularly present in the canopy are *Fagus grandifolia*, *Fraxinus americana*, *Quercus rubra*, and *Quercus velutina*. In addition, canopy species that may be infrequently present are *Pinus virginiana*, *Quercus prinus*, *Aesculus flava*, *Nyssa sylvatica*, *Quercus falcata*, *Quercus muehlenbergii*, *Tilia americana* var. *heterophylla*, *Pinus echinata*, *Pinus strobus*, *Prunus serotina*, *Quercus coccinea*, *Ulmus alata*, *Juglans nigra*, *Tsuga canadensis*, and *Ulmus rubra*. Subcanopy species that may be present are *Carya glabra*, *Quercus alba*, *Ostrya virginiana*, *Asimina triloba*, *Nyssa sylvatica*, *Fagus grandifolia*, *Tsuga canadensis*, *Oxydendrum arboreum*, *Ulmus alata*, *Cornus florida*, *Juniperus virginiana*, *Liquidambar styraciflua*, and *Prunus serotina*. The subcanopy has a percent cover of less than 50%. *Acer saccharum* strongly dominates the subcanopy. In the Tellico Pilot Project this species had a relative frequency value of >90% and an average canopy cover dominance of >25%. It is speculated that this high dominance is due to

the mesic site conditions and suppression of fire. The shrub and herbaceous layers tend to have a percent cover of >25%. The shrub layers may contain small stems of species found in the canopy and subcanopy as well as the following: *Morus rubra*, *Frangula caroliniana*, *Vaccinium stamineum*, *Cercis canadensis*, *Acer rubrum*, and *Lindera benzoin*. The herbaceous strata may contain *Podophyllum peltatum*, *Toxicodendron radicans*, *Polystichum acrostichoides*, *Maianthemum racemosum* ssp. *racemosum*, *Desmodium pauciflorum*, and *Desmodium nudiflorum*.

A stand on the western edge of the Blue Ridge (Cherokee National Forest, Tennessee, M221Dd418, Dry Branch #1) contains *Quercus alba*, *Carya ovata*, *Fraxinus americana*, *Quercus rubra*, *Aesculus flava*, *Juniperus virginiana* var. *virginiana*, *Juglans nigra*, and *Quercus stellata* in the canopy; *Ostrya virginiana*, *Cercis canadensis*, *Ulmus rubra*, *Fraxinus americana*, *Ulmus alata*, *Quercus prinus*, and *Juniperus virginiana* var. *virginiana* in the subcanopy; *Frangula caroliniana* as a tall shrub; *Symphoricarpos orbiculatus* and *Vaccinium stamineum* in the low-shrub stratum; *Parthenocissus quinquefolia* as a woody vine; and *Bromus pubescens*, *Elymus hystrix*, *Carex* sp., *Carex pennsylvanica*, *Sedum ternatum*, *Asplenium platyneuron*, *Hybanthus concolor*, *Carex communis*, *Dichanthelium boscii* (= *Panicum boscii*), *Asplenium resiliens*, *Symphyotrichum undulatum* (= *Aster undulatus*), *Dioscorea quaternata*, *Solidago caesia*, *Galium circaezans*, *Antennaria plantaginifolia*, *Pellaea atropurpurea*, *Verbesina occidentalis*, *Scutellaria elliptica*, *Arabis* sp., *Agrimonia* sp., *Geum* sp., *Symphyotrichum divaricatum* (= *Aster divaricatus*), *Conyza canadensis*, *Hepatica nobilis* var. *obtusata*, *Maianthemum racemosum*, *Monarda fistulosa*, *Sanicula canadensis*, *Solidago erecta* (= *Solidago speciosa* var. *erecta*), *Viola X palmata*, and *Thalictrum* sp. as herbs.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global		
<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
•	Tree canopy	Broad-leaved deciduous tree <i>Carya alba</i> , <i>Carya glabra</i> , <i>Carya ovata</i> , <i>Liriodendron tulipifera</i> , <i>Quercus alba</i>
•	Tree subcanopy	Broad-leaved deciduous tree <i>Acer saccharum</i> , <i>Carya alba</i> , <i>Carya ovata</i> , <i>Fraxinus americana</i>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Fagus grandifolia*

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G4 (14-Jan-2000). This is not an inherently rare forest type. It is presumed to be relatively common throughout its known range. It is at least a moderately widespread type, although its full range is not known. It occurs on a variety of aspects and elevations, and it is not restricted to any highly specific geologic substrates. It is poorly documented through EOs, and not much data are available on the specific condition of examples of this type. Some stands have been impacted by removal of more valuable timber species and loss of herbaceous species diversity from the disturbance effects of logging. In all probability, most examples which are not on public land have been repeatedly logged and their composition altered thereby. Remaining unprotected examples are threatened by timber removal, conversion to other managed forest types, and/or development into residential or commercial real estate. The Rank was formerly G3G5. Changing this to G4 helps to clarify its status.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: Originally described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeastern Monroe County; 26 stands sampled) as the *Quercus alba* - *Carya ovata* - *Carya alba* Forest, where it was recorded from slopes with northwestern, northern and eastern aspects at elevations from 820-1000 feet. The high dominance of *Acer saccharum* in the subcanopy of some stands is thought to be due to the mesic site conditions combined with fire suppression. More information is needed on the variability of this community across its range. Described from Ridge and Valley, the concept is generally applied to forests in the Southern Cumberlands and adjacent Interior Low Plateau, but the range of variability is not fully understood. This is an unglaciated equivalent of a Midwestern element of glaciated landscapes, *Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068) of Indiana, Illinois, and Missouri north to Ontario. A related drier forest association is *Quercus alba* - *Quercus rubra* - *Carya ovata* / *Cercis canadensis* - *Juniperus virginiana* var. *virginiana* Forest (CEGL007240). May be similar to some limestone forests in Virginia's Ridge and Valley (*Acer saccharum* var. *saccharum* - *Quercus rubra* - *Carya* [*glabra*, *ovata*] / *Ageratina altissima* Forest (Fleming 1999)) (G. Fleming pers. comm.). In addition, the association has been identified in the far western edge of the Great Smoky Mountains National Park at a southerly aspect at about 1870 feet in elevation.

GLOBAL SIMILAR ASSOCIATIONS:

Acer saccharum - *Quercus muehlenbergii* / *Cercis canadensis* Forest (CEGL006017)--is a drier association found to the North and East.

Quercus alba - *Quercus rubra* - *Carya* (*alba*, *ovata*) / *Cornus florida* Acid Forest (CEGL002067)

Quercus alba - *Quercus rubra* - *Carya ovata* / *Cercis canadensis* - *Juniperus virginiana* var. *virginiana* Forest (CEGL007240)--is a related drier forest association.

Quercus alba - *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068)--is an equivalent of glaciated landscapes of the Midwest.

Quercus alba - *Quercus velutina* - *Carya* (*ovata*, *alba*, *glabra*) - *Pinus* sp. Forest (CEGL007231)

Quercus prinus - *Quercus rubra* - *Carya* spp. - *Fraxinus americana* / *Cercis canadensis* / *Solidago sphacelata* Forest (CEGL008549)

Quercus rubra - *Acer saccharum* - *Liriodendron tulipifera* Forest (CEGL006125)--has a more northeasterly distribution.

GLOBAL RELATED CONCEPTS:

Quercus alba - *Carya ovata* - *Carya alba* Forest (Andreu and Tukman 1995) ?

IA6i. Interior Upland Dry-Mesic Oak - Hickory Forest (Allard 1990) B

Mesic White Oak Type (Schmalzer and DeSelm 1982) =

Mesotrophic Forest (Rawinski 1992) B

White Oak - Northern Red Oak, RV (Pyne 1994) B

White Oak: 53 (Eyre 1980) B

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This is a mid-elevation association, primarily confined to the northwestern portion of the park.

GLOBAL RANGE: At least a moderately widespread type, this association is probably present throughout the Ridge and Valley and possibly adjoining ecoregions. A comprehensive review of related types is not complete.

NATIONS: US

STATES/PROVINCES: AL, GA, KY, TN, VA?

USFS ECOREGIONS: 221Ha:CCC, 221Hc:CCC, 221He:CCC, 221Ja:CCP, 221Jb:CCC, 222Eb:PPP, 231Cc:CCC, 231Dc:CCC, M221Dd:CCC

FEDERAL LANDS: DOE (Oak Ridge); NPS (Chickamauga-Chattanooga, Great Smoky Mountains, Obed, Russell Cave); TVA (Tellico); USFS (Chattahoochee, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (3 plots): RUCA.7, RUCA.8, RUCA.9.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: M. Andreu and M. Tukman, mod. M. Pyne

REFERENCES: Allard 1990, Andreu and Tukman 1995, Eyre 1980, Fleming 1999, Fleming pers. comm., NatureServe Ecology - Southeastern U.S. unpubl. data, Pyne 1994, Rawinski 1992, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

White Oak - Mixed Oak Dry-Mesic Alkaline Forest

QUERCUS ALBA - *QUERCUS RUBRA* - *QUERCUS MUEHLENBERGII* / *CERCIS CANADENSIS* FOREST

WHITE OAK - NORTHERN RED OAK - CHINQUAPIN OAK / EASTERN REDBUD FOREST

IDENTIFIER: C EGL002070

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus alba</i> - (<i>Quercus rubra</i> , <i>Carya</i> spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	<i>Quercus alba</i> - <i>Quercus rubra</i> - <i>Quercus muehlenbergii</i> / <i>Cercis canadensis</i> Forest
Association (English name)	White Oak - Northern Red Oak - Chinquapin Oak / Eastern Redbud Forest
Association (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)
North-Central Interior Dry-Mesic Oak Forest and Woodland (CES202.046)

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:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This is a low- to mid-elevation community that occupies a broad range of gradients on Montague Mountain. Soils are well-drained, moist silty loams containing numerous rock fragments, underlain by limestone.

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

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This association represents a dense-canopied forest containing the nominal species, as well as *Quercus velutina* and less commonly *Fraxinus americana* and *Nyssa sylvatica*. A similar suite of species also characterizes the subcanopy, which is often associated with additional taxa having a tolerance of shade, including *Acer barbatum*, *Fagus grandifolia*, *Carya alba*, *Ostrya virginiana*, *Cornus florida*, and *Oxydendrum arboreum*. While sparse, *Juniperus virginiana* var. *virginiana* is seldom absent from view, typically favoring areas with greater canopy openings. The shrub component assumes a patchy distribution where *Amelanchier arborea*, *Cercis canadensis*, *Viburnum rufidulum*, *Frangula caroliniana*, *Sassafras albidum*, and smaller individuals of the above-mentioned canopy associates serve as principal species. The exotic *Ligustrum sinense* is also present but sparse. Woody vines include *Toxicodendron radicans*, *Vitis rotundifolia*, *Smilax glauca*, and *Lonicera japonica*, all of which frequently function as ground cover. The herb layer is relatively diverse and includes *Pellaea atropurpurea*, *Bromus pubescens*, *Dichanthelium boscii*, *Arisaema triphyllum*, *Trillium cuneatum*, *Polygonatum biflorum*, *Maianthemum racemosum*, *Uvularia perfoliata*, *Phlox divaricata*, and *Thalictrum thalictroides*.

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).

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global		
<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
•	Tree canopy	Broad-leaved deciduous tree <i>Quercus alba</i> , <i>Quercus muehlenbergii</i> , <i>Quercus rubra</i>
•	Tree subcanopy	Broad-leaved deciduous tree <i>Acer saccharum</i>

- Shrub/sapling (tall & short) Vine/Liana *Parthenocissus quinquefolia*,
Smilax bona-nox, *Toxicodendron radicans*
- Herb (field) Forb *Arisaema dracontium*, *Hybanthus*
concolor
- Herb (field) Graminoid *Carex jamesii*

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Agkistrodon contortrix*, *Callirhytis quercuspunctata*, *Caprimulgus vociferus*, *Chionaspis corni*, *Cyanocitta cristata*, *Dendroica cerulea*, *Dryocopus pileatus*, *Eumeces laticeps*, *Eurytides marcellus*, *Glaucomys volans*, *Hyllocichla mustelina*, *Isotria medeoloides*, *Juglans cinerea*, *Lynx rufus*, *Melanerpes carolinus*, *Melanerpes erythrocephalus*, *Meleagris gallopavo*, *Myotis sodalis*, *Nymphalis antiopa*, *Odocoileus virginianus*, *Piranga olivacea*, *Sayornis phoebe*, *Schizura badia*, *Sciurus carolinensis*, *Sciurus niger*, *Tamias striatus*, *Thryothorus ludovicianus*

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G4G5 (22-Jun-1998).

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: 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.

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* Acid 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* / *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) B
Dry-mesic Upland Forest (S) (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

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association occurs on Montague Mountain, extending from low to midslope.

GLOBAL RANGE: This white oak - red oak, dry-mesic alkaline forest community is found in calcareous regions of 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, OK?, TN

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, 222Dh:CCC, 222Di:CCC, 222Ec:CCC, 222Ed:CCC, 222Eg:CCC, 222Ej:CCP, 222Ek:CCC, 222Em:CCP, 222Eo:CCC, 222Fa:CCP, 222Fb:CCC, 222Fe:CCC, 231Cd:CCC, 231Gb:CCC, 251Cd:CCC, 251Ce:CCC, 251Ea:CCC, M222Aa:PPP

FEDERAL LANDS: NPS (Buffalo River, Fort Donelson, Lincoln Birthplace, Mammoth Cave, Natchez Trace, Ozark, Russell Cave, Shiloh); USFS (Bankhead, Daniel Boone, Mark Twain, Ouachita (Mountains)?, Ouachita?, Ozark, Shawnee)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (1 plot): RUCA.10.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: M. Guetersloh, mod. M. Pyne and D. Faber-Langendoen

REFERENCES: Evans 1991, Eyre 1980, Fralish 1987, Fralish et al. 1991, Kuchler 1964, Midwestern Ecology Working Group n.d., NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Robertson and Heikens 1994, Robertson et al. 1984, Schotz pers. comm., TDNH unpubl. data, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, White and Madany 1978

Shumard Oak - Chinquapin Oak Mesic Limestone Forest

***QUERCUS SHUMARDII* - *QUERCUS MUEHLENBERGII* - *ACER (BARBATUM, LEUCODERME, SACCHARUM)* / *OSTRYA VIRGINIANA* FOREST**

SHUMARD OAK - CHINQUAPIN OAK - (SOUTHERN SUGAR MAPLE, CHALK MAPLE, SUGAR MAPLE) / EASTERN HOP-HORNBEAM FOREST

IDENTIFIER: C EGL008442

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus muehlenbergii</i> - (<i>Acer saccharum</i>) Forest Alliance (A.1912)
Alliance (English name)	Chinquapin Oak - (Sugar Maple) Forest Alliance
Association	<i>Quercus shumardii</i> - <i>Quercus muehlenbergii</i> - <i>Acer (barbatum, leucoderme, saccharum)</i> / <i>Ostrya</i>
	<i>Shumard Oak - Chinquapin Oak - (Southern Sugar Maple, Chalk Maple, Sugar Maple) / Eastern</i>
Association (English name)	<i>virginiana</i> Forest
	Hop-hornbeam Forest
Association (Common name)	Shumard Oak - Chinquapin 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)

ELEMENT CONCEPT

GLOBAL SUMMARY: This deciduous forest association accommodates mesic examples of forests dominated by *Quercus shumardii* and *Quercus muehlenbergii*, with various *Carya* spp. and other basophilic and/or mesic hardwood species. 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 some mixture of *Acer* spp. (either *Acer barbatum*, *Acer leucoderme*, or *Acer saccharum* depending on geography), *Carya* spp. (including *Carya alba*, *Carya glabra*, *Carya ovalis*, *Carya ovata*, and/or *Carya carolinae-septentrionalis*), *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 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*, *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:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This forest occurs on soil derived from Bangor and Montagle limestones, on sloping to steeply sloping topography on the lower and middle slope of Montague Mountain.

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

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This forested community is represented by a closed canopy (greater than 75 % cover) of various hardwoods dominated by *Quercus muehlenbergii*, *Quercus*

shumardii, and *Carya ovata*, with a lesser amount of *Fraxinus americana*, *Ulmus americana*, *Liriodendron tulipifera*, and *Fagus grandifolia*. The subcanopy and shrub layers contain the aforementioned species, as well as a fair abundance of *Acer barbatum*, *Fraxinus quadrangulata*, *Ostrya virginiana*, *Cercis canadensis*, *Frangula caroliniana*, *Staphylea trifolia*, *Lindera benzoin*, and *Symphoricarpos orbiculatus*. Although sparse, *Juniperus virginiana* var. *virginiana* is a conspicuous member of the understory. Woody vines include *Bignonia capreolata*, *Toxicodendron radicans*, *Vitis rotundifolia*, and *Parthenocissus quinquefolia*. *Lonicera japonica* is also present, an exotic species that assumes its greatest abundance along the forest border adjoining the lawn. The herbaceous component is luxuriant and diverse, with some of the more noteworthy species being *Pellaea atropurpurea*, *Arisaema triphyllum*, *Thalictrum thalictroides*, *Spigelia marilandica*, *Lithospermum tuberosum*, *Phlox divaricata*, *Uvularia grandiflora*, *Viola labradorica* (= *Viola conspersa*), *Maianthemum racemosum*, *Sedum ternatum*, and *Silphium trifoliatum* var. *latifolium*.

GLOBAL VEGETATION: The canopy of this deciduous forest association is dominated by *Quercus shumardii* and *Quercus muehlenbergii*, with various *Carya* spp. and other basophilic and/or mesic hardwood species. The canopy composition varies considerably with geography. In addition to the nominal species, the canopy may also contain some mixture of *Acer* spp. (either *Acer barbatum*, *Acer leucoderme*, or *Acer saccharum* depending on geography), *Carya* spp. (including *Carya alba*, *Carya glabra*, *Carya ovalis*, *Carya ovata*, and/or *Carya caroliniae-septentrionalis*), *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*, *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*, *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*, *Dichantheium 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.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
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Global

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
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CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Juglans cinerea*

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.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL 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).

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:

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association is found on the lower and middle slope of Montague Mountain.

GLOBAL RANGE: The range of this association includes the Interior Low Plateau of Tennessee, the Cumberlands of Alabama, and the Ridge and Valley of Georgia. It may range into limestone areas of Kentucky.

NATIONS: US

STATES/PROVINCES: AL, GA, KY?, TN

USFS ECOREGIONS: 221Hc:CCC, 222Eb:CC?, 222Ec:CCC, 222Ed:CC?, 222Ee:CC?, 222Ef:CC?, 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

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (1 plot): RUCA.11.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: M.P. Schafale and A.S. Weakley

REFERENCES: NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Xeric Ridgetop Chestnut Oak Forest

***QUERCUS PRINUS* - (*QUERCUS COCCINEA*) / *CARYA PALLIDA* / *VACCINIUM ARBOREUM* - *VACCINIUM PALLIDUM* FOREST**

CHESTNUT OAK - (SCARLET OAK) / SAND HICKORY / FARKLEBERRY - HILLSIDE BLUEBERRY FOREST

IDENTIFIER: C EGL008431

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	<i>Quercus prinus</i> - (<i>Quercus coccinea</i> , <i>Quercus velutina</i>) Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	<i>Quercus prinus</i> - (<i>Quercus coccinea</i>) / <i>Carya pallida</i> / <i>Vaccinium arboreum</i> - <i>Vaccinium pallidum</i>
Forest	Chestnut Oak - (Scarlet Oak) / Sand Hickory / Farkleberry - Hillside Blueberry
Association (English name)	Forest
Association (Common name)	Xeric Ridgetop Chestnut Oak Forest

ECOLOGICAL SYSTEM(S): Southern Appalachian Oak Forest (CES202.886)
Southern Piedmont Dry Oak-(Pine) Forest (CES202.339)
Allegheny-Cumberland Dry Oak Forest and Woodland (CES202.359)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association includes xeric rock chestnut oak forests on high slopes and ridges in the southern Cumberland Plateau, southern Ridge and Valley, Southern Blue Ridge, and occasionally in the Piedmont of North Carolina, South Carolina, and Georgia. This forest occurs over rocky, shallow soils derived from various geologies. These include sandstone, quartzite (in the Piedmont), schist, or weakly metamorphosed, metasedimentary rocks (in the western edge of the Southern Blue Ridge). This is a closed-canopy, deciduous forest with open to sparse shrub layers and a sparse to absent herb layer. The canopy is dominated by *Quercus prinus*, sometimes sharing dominance with *Quercus coccinea*. Other oaks in the canopy can include *Quercus velutina*, *Quercus stellata*, and *Quercus alba*, although these oaks are not dominant. Hickories (e.g., *Carya glabra*, *Carya pallida*) may be present in the canopy and/or subcanopy. Some examples may have coverage of pine in the canopy, most commonly *Pinus virginiana* and *Pinus echinata*. The most common subcanopy trees are *Acer rubrum*, *Carya pallida*, *Cornus florida*, *Nyssa sylvatica*, and *Oxydendrum arboreum*. The most constant shrub species are *Chimaphila maculata*, *Vaccinium arboreum*, *Vaccinium pallidum*, *Vaccinium stamineum*, *Diospyros virginiana*, and *Sassafras albidum*. Herb coverage is sparse, with little constancy among examples. Some of the more typical herb

species are *Euphorbia corollata*, *Hieracium venosum*, *Carex nigromarginata*, and *Solidago odora*, but many other species may occur.

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This community type is confined to the summit of Montague Mountain where it occurs in an elevational range of 472 to 503 m (1550-1650 feet). As with most of the Cumberland Plateau in Alabama and adjacent Tennessee, the soils are classified as the Muskingum series, a fine sandy loam derived from the Pottsville Formation, being chiefly comprised of sandstone but also varying amounts siltstone, shale, and coal.

GLOBAL ENVIRONMENT: This forest is found on north- and west-facing high slopes and ridgetops over soils derived from sandstone, in the Cumberland Plateau and Ridge and Valley, or weakly metamorphosed, metasedimentary rocks in the western edge of the Southern Blue Ridge. Examples range from 225 to 732 m (740-2400 feet) elevation, with most examples occurring over 274 m (900 feet) elevation. Examples in the Piedmont are usually over metamorphic rock such as schist or quartzite. In the Blue Ridge, this type does not generally reach elevations above 732 m (2400 feet).

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This association is characterized as a closed-canopy deciduous forest dominated by *Quercus prinus* with an admixture of *Quercus coccinea*, *Quercus alba*, *Quercus velutina*, and *Carya alba*. *Carya glabra*, *Nyssa sylvatica*, and *Pinus echinata* are also present, but are generally of secondary importance. The subcanopy is commonly represented by *Oxydendrum arboreum*, *Acer rubrum*, *Cornus florida*, and *Quercus stellata*, as well as several species of the foregoing canopy cover. Although seldom absent from either stratum, *Quercus marilandica*, *Fagus grandifolia*, and *Sassafras albidum* are occasional and often widely distributed. The shrub component is relatively diverse but generally open, with *Rhododendron canescens*, *Kalmia latifolia*, *Vaccinium arboreum*, *Vaccinium pallidum*, *Chimaphila maculata*, and *Diospyros virginiana* appearing most typical. Several species of herbs, although sparse, are well-represented with the more frequently encountered taxa being *Coreopsis major*, *Solidago odora*, *Tephrosia virginiana*, *Danthonia spicata*, *Aristolochia serpentaria*, *Asclepias variegata*, *Viola palmata*, and *Hieracium venosum*. Characteristic vines include *Vitis rotundifolia*, *Smilax rotundifolia*, and *Smilax glauca*.

GLOBAL VEGETATION: This is a closed-canopy, deciduous forest with open to sparse shrub layers and a sparse to absent herb layer. The canopy is dominated by *Quercus prinus* sometimes sharing dominance with *Quercus coccinea* (and in some Piedmont examples, with *Quercus coccinea* as the dominant canopy tree). Other oaks in the canopy can include *Quercus velutina*, *Quercus stellata*, and *Quercus alba*, although these oaks are not dominant. Hickories (e.g., *Carya glabra*, *Carya pallida*) may be present in the canopy and/or subcanopy. Some examples may have coverage of pine in the canopy, most commonly *Pinus virginiana* and *Pinus echinata*. The most common subcanopy trees are *Acer rubrum*, *Carya pallida*, *Cornus florida*, *Nyssa sylvatica*, and *Oxydendrum arboreum*. Other minor species in the canopy and subcanopy can include *Carya glabra*, *Castanea dentata*, and *Magnolia macrophylla*. The most constant shrub species are *Chimaphila maculata*, *Vaccinium arboreum*, *Vaccinium pallidum*, *Vaccinium stamineum*, *Diospyros virginiana*, and *Sassafras albidum*. Other shrubs that can occur in examples of this community are *Lyonia ligustrina*, *Castanea pumila*, *Viburnum acerifolium*, *Rhododendron alabamense*, and *Rhododendron canescens*. Herb coverage is sparse, with little constancy among examples. Some of the more typical herb species are *Euphorbia corollata*, *Hieracium venosum*, *Carex nigromarginata*, and *Solidago odora*, but many other species may occur. In the lower Piedmont of Georgia, some additional herbs may include *Schizachyrium scoparium*, *Dichanthelium boscii*, *Piptochaetium avenaceum*, *Tephrosia virginiana*, *Verbesina virginica*, *Hypoxis hirsuta*, *Tragia urticifolia*, *Brickellia eupatorioides*, *Scutellaria elliptica*, *Arnoglossum atriplicifolium*, *Pityopsis aspera*, and *Coreopsis major*.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

Stratum

Lifeform

Species

Global

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
•	Tree canopy	Broad-leaved deciduous tree <i>Quercus coccinea</i> , <i>Quercus prinus</i>
•	Tree subcanopy	Broad-leaved deciduous tree <i>Acer rubrum</i>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Acer rubrum*, *Oxydendrum arboreum*, *Quercus coccinea*, *Quercus prinus*

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G4G5 (31-Jan-2003). This is a wide-ranging type, found on a variety of substrates in several ecoregions; its threats are limited.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: This association was defined from examples found in the southern Ridge and Valley of northwestern Georgia, the Cumberland Plateau of northern Alabama, and the western edge of the Southern Blue Ridge in northern Georgia and southeastern Tennessee, where it represents the driest oak forests of this region. This type may be present in the McCreary and Somerset ranger districts of the Daniel Boone National Forest (Kentucky). Stands of *Quercus prinus* along ecoregional transitions may be difficult to classify [see similar associations].

GLOBAL SIMILAR ASSOCIATIONS:

Quercus (pinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens) Forest (CEGL006271)--is defined for the Southern Blue Ridge. Has dense, less diverse, ericaceous shrub layer and more acid-loving, Blue Ridge species.

Quercus prinus - Carya spp. - Quercus velutina / Vaccinium arboreum / Iris verna var. smalliana Forest (CEGL007261)--is defined for the lower Piedmont of Alabama and has Coastal Plain affinities.

Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia) Forest (CEGL005023)

Quercus prinus - Quercus alba / Oxydendrum arboreum / Vitis rotundifolia Forest (CEGL006281)--is defined for the Piedmont and occurs on granite monadnocks.

Quercus prinus - Quercus marilandica Piedmont Woodland (CEGL003708)--can often be found in adjacent ridgetop areas of the Piedmont but has a more open canopy and contains *Quercus marilandica*.

Quercus prinus - Quercus spp. / Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius) Forest (CEGL007700)--is a broadly defined type for the Appalachian Plateau and Interior Low Plateau.

GLOBAL RELATED CONCEPTS:

Chestnut Oak Forest (Lipps and DeSelm 1969) ?

Chestnut Oak Forest (Lipps 1966) ?

Chestnut Oak Type (Chapman 1957)

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association is confined to the summit of Montague Mountain, in the westernmost section of the monument.

GLOBAL RANGE: This association occurs in the southern Cumberland Plateau and southern Ridge and Valley of Georgia, Tennessee and Alabama, and ranges into the Southern Blue Ridge and Piedmont regions as well. This or related vegetation is reported from the Daniel Boone National Forest of Kentucky; this needs investigation.

NATIONS: US

STATES/PROVINCES: AL, GA, KY?, SC, TN

USFS ECOREGIONS: 221Hc:CCC, 221He:CCC, 231Aj:CCC, 231Cd:CCC, 231Dc:CCC, M221Dd:CCC

FEDERAL LANDS: NPS (Big South Fork, Chickamauga-Chattanooga, Kings Mountain, Little River Canyon?, Obed, Russell Cave); USFS (Bankhead, Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone?)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (3 plots): RUCA.1, RUCA.2, RUCA.3.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: mod. R. White

REFERENCES: Chapman 1957, Govus 2002, Lipps 1966, Lipps and DeSelm 1969, NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Chestnut Oak - Shagbark Hickory - Sugar Maple Forest

QUERCUS PRINUS - CARYA OVATA - QUERCUS RUBRA / ACER SACCHARUM
FOREST

**CHESTNUT OAK - SHAGBARK HICKORY - NORTHERN RED OAK / SUGAR
MAPLE FOREST**

IDENTIFIER: CEG007268

NVC Classification

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

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

ELEMENT CONCEPT

GLOBAL SUMMARY: These dry-mesic forests of the Ridge and Valley and adjacent sedimentary ecoregions (Cumberlands, Interior Low Plateau) occur near the tops of calcareous ridges, gorge slopes, spurs, and knobs with northerly aspects. Elevations range from 250 to 1000 m (800-3250 feet). Soils are very well-drained, acidic to circumneutral, and derived from sandstone and shales. The canopy is dominated by *Quercus prinus* with other oaks and hickories, typically with *Acer saccharum* as a canopy associate and/or a subcanopy dominant. Some examples are strongly dominated by *Quercus prinus*. Other examples with more diverse canopies include *Quercus rubra*,

Carya ovata, *Carya glabra*, *Acer saccharum*, *Fraxinus americana*, and *Quercus velutina*. The canopy is generally closed (greater than 75% cover). The subcanopy may be dominated by *Acer saccharum* in some examples due to fire suppression. Other subcanopy species may include *Carya ovata*, *Carya glabra*, *Quercus rubra*, *Quercus muehlenbergii*, *Aesculus flava*, and *Juniperus virginiana*. The subcanopy is relatively sparse with cover less than 25%. The shrub and herbaceous layers are sparse with small stems of canopy and subcanopy species along with herbaceous species such as *Actaea racemosa*, *Ageratina altissima*, *Arisaema triphyllum*, *Carex albursina*, *Campanulastrum americanum*, *Chimaphila maculata*, *Dioscorea quaternata*, *Eurybia divaricata*, *Galium circaeans*, *Galium triflorum*, *Geranium maculatum*, *Polystichum acrostichoides*, *Prosartes lanuginosa*, *Sanicula canadensis*, *Sedum ternatum*, *Solidago caesia*, and species of *Viola*.

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: In Russell Cave National Monument, this association occurs from the mid- to upper slope of Montague Mountain, generally at an elevation of 335 to 442 m (1100-1450 feet). The soils are characterized as residue from weathered limestone that has been greatly influenced by sandstone sediments washed down from higher slopes. For the most part, because of steep and rugged topographic features, external drainage is likely to be rapid, decreasing in velocity on gently sloping benches.

GLOBAL ENVIRONMENT: In the Ridge and Valley of Tennessee, these forests occur near the tops of calcareous ridges and knobs with northerly aspects that range from 250 to 1000 m (800-3250 feet), on very well-drained, gravelly, sandy soils (Andreu and Tukman 1995). The sites are characterized by very well-drained, gravelly, sandy soils and exposed topographical positions. On the Tellico Pilot Project study site many of these communities were found on the following soil series: Dandridge, Tellico, and Steekee. The Tellico series is an Ultisol while the others are Inceptisols; all can be described as well- to excessively well-drained soils. The Tellico and Steekee soils are strongly acid or very strongly acid. The Dandridge soils are slightly acid neutral or mildly alkaline. At New River Gorge in West Virginia, this association is the predominant upland forest type on lower to upper colluvial gorge slopes with relatively warm, dry aspects, and it also occurs in smaller patches on plateaus, ridge spurs and convex upper slopes, often north-facing. Stands occur both on sandstones of the Pottsville Group and on shales of the Mauch Chunk Group. Elevations of mapped stands range from 249 to 985 m. Slopes range from flat to very steep (0 to 51 degrees, mean = 25 degrees). Soils are mostly well-drained sandy to clay loams mapped in the Calvin, Dekalb, and Gilpin series. Soil chemistry analyzed from 10 plots indicates extremely acidic to slightly acidic soils (mean pH = 4.92) with intermediate levels of most nutrients and somewhat higher levels of some nutrients (K, Mg, Mn, P) compared to other community types nearby.

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This mixed hardwood forest is characterized by a prominence of straight, tall individuals of *Quercus prinus* accented, in slightly lesser abundance, by *Quercus velutina*, *Quercus alba*, *Liriodendron tulipifera*, *Carya ovata*, and *Carya alba*. Occasional individuals of other species, such as *Quercus rubra*, *Fagus grandifolia*, *Oxydendrum arboreum*, *Nyssa sylvatica*, *Acer barbatum*, *Acer rubrum*, and *Fraxinus americana*, also occur in the canopy or subcanopy. The shrub and herbaceous layers are relatively sparse, with small stems of the foregoing overstory species in addition to various herbs such as *Dioscorea villosa*, *Desmodium nudiflorum*, *Podophyllum peltatum*, *Spigelia marilandica*, and *Polystichum acrostichoides* serving as typical associates. Principal vines include *Toxicodendron radicans*, *Parthenocissus quinquefolia*, and *Smilax* spp., which often sprawl along the ground.

GLOBAL VEGETATION: This association is a closed-canopy deciduous forest dominated by species of *Quercus*, often with *Carya* spp., and often with an abundance of *Acer saccharum* in the canopy and/or shrub layers. *Quercus prinus* is the most typical canopy dominant; other dominants can include *Quercus rubra*, *Acer saccharum*, *Quercus alba*, *Fraxinus americana*, and *Carya ovata*. Other canopy associates include *Carya glabra*, *Quercus velutina*, and *Liriodendron tulipifera*. Subcanopy species that may be present are *Carya ovata*, *Carya glabra*, *Quercus rubra*, *Quercus muehlenbergii*, *Acer saccharum*, *Aesculus flava*, and *Juniperus virginiana*. The subcanopy may be dominated by *Acer saccharum* in some examples due to fire suppression. The subcanopy is typically relatively sparse with less than 25% cover. Vines, which may occur in the understory or reach into the canopy, include *Aristolochia macrophylla*, *Parthenocissus quinquefolia*, *Toxicodendron radicans*, and *Vitis aestivalis* var. *bicolor*. Common tall shrubs or short trees include *Cercis canadensis*, *Halesia tetraptera*, *Hamamelis virginiana*,

and *Ostrya virginiana*. The shrub and herbaceous layers are sparse with small stems of canopy and subcanopy species along with herbaceous species. The most common shrubs are *Viburnum acerifolium* and *Smilax rotundifolia*. Common herbs include *Actaea racemosa*, *Ageratina altissima*, *Arisaema triphyllum*, *Carex albursina*, *Campanulastrum americanum*, *Chimaphila maculata*, *Dioscorea quaternata*, *Eurybia divaricata*, *Galium circaezans*, *Galium triflorum*, *Geranium maculatum*, *Polystichum acrostichoides*, *Prosartes lanuginosa*, *Sanicula canadensis*, *Sedum ternatum*, *Solidago caesia*, and species of *Viola*. Vascular plant species richness in 26 West Virginia sampled plots (New River) ranged from 27 to 54 taxa (mean = 42).

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global Stratum	Lifeform	Species
•	Tree (canopy & subcanopy)	Broad-leaved deciduous tree <i>Acer saccharum</i> , <i>Carya glabra</i>
•	Tree canopy	Broad-leaved deciduous tree <i>Quercus alba</i> , <i>Quercus prinus</i> , <i>Quercus rubra</i>
•	Shrub/sapling (tall & short)	Broad-leaved deciduous tree <i>Acer saccharum</i>
•	Shrub/sapling (tall & short)	Vine/Liana <i>Smilax rotundifolia</i>
•	Short shrub/sapling	Broad-leaved deciduous tree <i>Quercus prinus</i>
•	Herb (field)	Fern or fern ally <i>Pleopeltis polypodioides</i> ssp. <i>polypodioides</i>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Actaea racemosa*, *Ageratina altissima*, *Arisaema triphyllum*, *Carex albursina*, *Dioscorea quaternata*, *Eurybia divaricata*, *Galium circaezans*, *Galium triflorum*, *Geranium maculatum*, *Parthenocissus quinquefolia*, *Polystichum acrostichoides*, *Prosartes lanuginosa*, *Quercus rubra*, *Sanicula canadensis*, *Sedum ternatum*, *Solidago caesia*, *Viburnum acerifolium*

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G4? (9-Oct-2001). This community is believed to be relatively common and secure, although good mature examples of large size may be uncommon. Additional information is needed relative to its distribution and relation to other similar communities. The rank was formerly G3G5, and changing it to G4? (which is equivalent) makes it clear that this is not to be considered a rare community type.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: Two variants of this association (14 stands sampled; 19 stands sampled) were described from Tellico Pilot Project (Ridge and Valley of Tennessee, northeast Monroe County). This may be similar to vegetation reported from limestone in the Ridge and Valley of Virginia.

GLOBAL SIMILAR ASSOCIATIONS:

Quercus prinus - *Quercus rubra* - *Carya (ovata, glabra)* - *Pinus virginiana* Forest (CEGL007269)
Quercus prinus - *Quercus* spp. / *Vaccinium arboreum* - (*Kalmia latifolia*, *Styrax grandifolius*) Forest (CEGL007700)

GLOBAL RELATED CONCEPTS:

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

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association appears to be restricted to the southern portion of the monument, generally from the mid- to upper slope of Montague Mountain.

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

NATIONS: US

STATES/PROVINCES: AL, KY?, TN, VA?, WV

USFS ECOREGIONS: 221Ha:CCC, 221Hc:CCC, 221He:CCP, 221Jb:CCC, 222E:CC, M221Cb:CCC, M221Cd:CCC

FEDERAL LANDS: DOE (Oak Ridge); NPS (New River Gorge, Russell Cave); TVA (Tellico); USFS (Cherokee?)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (3 plots): RUCA.4, RUCA.5, RUCA.6.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: M. Andreu and M. Tukman, mod. S.C. Gawler

REFERENCES: Allard 1990, Andreu and Tukman 1995, Evans 1991, Eyre 1980, Oberholster 1993, Pyne 1994, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst 2007

Rich Levee Mixed Hardwood Bottomland Forest

***PLATANUS OCCIDENTALIS* - *CELTIS LAEVIGATA* - *LIRIODENDRON TULIPIFERA* / *LINDERA BENZOIN* - *ARUNDINARIA GIGANTEA* / *AMPHICARPAEA BRACTEATA* FOREST**

SYCAMORE - SUGARBERRY - TULIPTREE / NORTHERN SPICEBUSH - GIANT CANE / AMERICAN HOG-PEANUT FOREST

IDENTIFIER: Cegl008429

NVC Classification

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)

Alliance	Platanus occidentalis - (Fraxinus pennsylvanica, Celtis laevigata, Acer
saccharinum) Temporarily	Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest
Alliance	
Alliance (English name)	Flooded Forest Alliance (A.288)
Association	Platanus occidentalis - Celtis laevigata - Liriodendron tulipifera / Lindera
benzoin - Arundinaria	Sycamore - Sugarberry - Tuliptree / Northern Spicebush - Giant Cane / American
Hog-peanut Forest	
Association (English name)	gigantea / Amphicarpaea bracteata Forest
Association (Common name)	Rich Levee Mixed Hardwood Bottomland Forest
ECOLOGICAL SYSTEM(S):	South-Central Interior Small Stream and Riparian (CES202.706)

ELEMENT CONCEPT

GLOBAL SUMMARY: This forest occurs on infrequently flooded, base-rich alluvial terraces along small streams. It was originally described from the Bankhead National Forest in the Cumberland Plateau of northern Alabama, and also includes occurrences in the Ridge and Valley portion of the Chattahoochee National Forest of Georgia, and Chickamauga-Chattanooga National Military Park. In addition to *Platanus occidentalis*, *Celtis laevigata*, and *Liriodendron tulipifera*, other dominants of the closed canopy can include *Acer negundo*, *Juglans nigra* and *Fraxinus pennsylvanica*. Other canopy components can include *Quercus shumardii*, *Quercus muehlenbergii*, *Carya glabra*, *Carya ovata*, and occasionally *Fraxinus americana*. Midstory components include *Carpinus caroliniana*, *Acer barbatum*, *Ulmus rubra*, and *Tilia americana*. The understory is dominated by *Lindera benzoin*. Other understory components include *Arundinaria gigantea*, which may be dominant in patches, and *Asimina triloba*. 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*, and *Boehmeria cylindrica*. This community is reported to have a rich herbaceous flora in the spring. *Microstegium vimineum* is a common invasive exotic in this community.

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM: Palustrine

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This association occurs as a terrace along a small stream that emanates from Russell Cave. The topography is relatively level, having developed through periodic flooding where alluvial sediments derived of weathered substrates from Montague Mountain and adjacent areas are deposited.

GLOBAL ENVIRONMENT: This association occurs on small stream terraces in the Cumberland Plateau of northern Alabama and Ridge and Valley of northwestern Georgia. These alluvial deposits are apparently somewhat calcareous, resulting from erosion of limestone strata within the surrounding watersheds.

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: The canopy of this deciduous forest association is dominated by *Celtis laevigata* and *Liriodendron tulipifera*, which are frequently accompanied by a suite of secondary species typical of bottomlands in the region. In addition to the above-mentioned taxa, the canopy also contains *Quercus michauxii*, *Acer barbatum*, and *Pinus taeda*, with the last named grading in from mixed mesic forests adjacent to park property. Subcanopy species include the canopy components highlighted above, as well as *Acer negundo* and, to a lesser degree, *Acer rubrum*. Shrubs and vines, which are generally patchy in distribution, are primarily represented by *Lindera benzoin*, *Vitis rotundifolia*, various *Smilax* spp. (namely *Smilax tamnoides*), and immature specimens of the foregoing canopy species. *Ligustrum sinense* (Chinese privet) has become well-established in portions of this association and is now beginning to out-compete native vegetation. A rich and diverse herbaceous component is readily apparent throughout most of the growing season, often presenting a colorful display of wildflowers. *Amphicarpaea bracteata*, *Laportea canadensis*, and *Ageratina altissima* appear to serve as principal species, while *Leersia virginica*, *Chasmanthium latifolium*, *Elymus virginicus*, *Impatiens pallida*, and *Solidago flexicaulis* are also well-represented. Exotic species, most notably *Microstegium vimineum*, *Glechoma hederacea*, and *Dioscorea oppositifolia*, are common, having colonized several areas within the floodplain.

GLOBAL VEGETATION: In addition to *Platanus occidentalis*, *Celtis laevigata*, and *Liriodendron tulipifera*, other dominants of the closed canopy can include *Acer negundo*, *Juglans nigra* and *Fraxinus pennsylvanica*. Other canopy components include *Quercus shumardii*, *Quercus muehlenbergii*, *Carya glabra*, *Carya ovata*, and *Fraxinus americana*. Midstory components include *Carpinus caroliniana*, *Acer barbatum*, *Ulmus rubra*, and *Tilia americana*. The understory is dominated by *Lindera benzoin*. Other understory components include *Arundinaria gigantea*, which may be dominant in patches, and *Asimina triloba*. 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*, and *Boehmeria cylindrica*. This community is reported to have a rich herbaceous flora in the spring. *Microstegium vimineum* is a common invasive exotic in this community.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global		
<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT: *Diarrhena americana*

GLOBAL:

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G3G4Q (13-Jun-2000). As currently described, this association is restricted geographically to the southern Cumberland Plateau and portions of the southern Ridge and Valley. In addition, it is confined to calcareous terraces along small streams. The global rank reflects the possibility that this type may be considered more common as a result of taxonomic revision.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 3 - Weak

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS:

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:

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association is known only from the bottomland associated with the stream emanating from the cave entrance.

GLOBAL RANGE: As currently described, the range of this association is confined to the southern Cumberland Plateau and portions of the southern Ridge and Valley.

NATIONS: US

STATES/PROVINCES: AL, GA

USFS ECOREGIONS: 231Cd:CCC, 231Da:CCC, 231Dc:CCC

FEDERAL LANDS: NPS (Chickamauga-Chattanooga, Russell Cave); USFS (Bankhead, Chattahoochee, Chattahoochee (Southern Blue Ridge))

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: (1 plot): RUCA.12.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: J. Teague

REFERENCES: NatureServe Ecology - Southeastern U.S. unpubl. data, Schotz pers. comm., Southeastern Ecology Working Group n.d.

Appalachian Mafic Cliff (Low-Elevation Type)

(*HYDRANGEA ARBORESCENS*, *TOXICODENDRON RADICANS*) / *HEUCHERA AMERICANA* - (*DICHANTHELIUM DEPAUPERATUM*, *WOODSIA OBTUSA*)
SHRUBLAND

(SMOOTH HYDRANGEA, POISON-IVY) / COMMON ALUMROOT - (STARVED WITCHGRASS, COMMON CLIFF FERN) SHRUBLAND

IDENTIFIER: C EGL004395

NVC Classification

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance (A.1905)	(<i>Hydrangea</i> spp., <i>Philadelphus</i> spp.) / <i>Heuchera</i> spp. Shrubland Alliance
Alliance (English name)	(<i>Hydrangea</i> species, <i>Mock Orange</i> species) / Alumroot species Shrubland Alliance
Association (<i>Dichantheium</i> <i>Common Cliff Fern</i>)	(<i>Hydrangea arborescens</i> , <i>Toxicodendron radicans</i>) / <i>Heuchera americana</i> - (<i>Smooth Hydrangea</i> , <i>Poison-ivy</i>) / <i>Common Alumroot</i> - (<i>Starved Witchgrass</i> ,
Association (English name)	<i>depauperatum</i> , <i>Woodsia obtusa</i>) Shrubland Shrubland
Association (Common name)	Appalachian Mafic Cliff (Low-Elevation Type)

ECOLOGICAL SYSTEM(S): Central Interior Calcareous Cliff and Talus (CES202.690)
North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)
Southern Appalachian Montane Cliff and Talus (CES202.330)

ELEMENT CONCEPT

GLOBAL SUMMARY: This association is variable in composition and vegetative cover but includes a range of dry, basic cliffs of variable geology in the interior low-elevation southeastern United States. The association, as broadly defined, is widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, and possibly the Interior Low Plateau. It is peripheral in the western Piedmont (e.g., the South Mountains?). Stands are

characterized by the presence of scattered to moderately dense vines and forbs. Characteristic vines, shrubs, and scattered shrubs may include *Hydrangea arborescens*, *Toxicodendron radicans* ssp. *radicans*, *Parthenocissus quinquefolia*, *Philadelphus hirsutus*, *Philadelphus inodorus*, and *Cercis canadensis*. Characteristic herbaceous species (very variable from occurrence to occurrence) include *Heuchera americana*, *Dichanthelium depauperatum*, *Woodsia obtusa*, *Viola triloba* (= *Viola X palmata* var. *triloba*), *Oxalis violacea*, *Carex* sp., *Dichanthelium depauperatum*, *Parietaria pennsylvanica*, *Danthonia spicata*, and *Dichanthelium dichotomum*. The exotic *Microstegium vimineum* may be present

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: A small representation of this association occupies the near-vertical limestone ledges in the vicinity of Russell Cave.

GLOBAL ENVIRONMENT:

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: This is an open-canopied association characterized by a prominence of small trees, shrubs, and vines. While species diversity is high, *Acer barbatum*, *Fraxinus americana*, *Cercis canadensis*, *Toxicodendron radicans*, and *Vitis rotundifolia* appear most abundant. Typical herbs include *Pellaea atropurpurea*, *Dryopteris marginalis*, *Asplenium platyneuron*, *Dichanthelium dichotomum*, *Heuchera americana*, *Amphicarpaea bracteata*, and *Solidago caesia*. Although sparse, the exotics *Lonicera japonica* and *Microstegium vimineum* are also present.

GLOBAL VEGETATION:

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
Global		
<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G3? (8-Jan-2007). There are maybe ten occurrences in NC.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: Originally created from NPS small parks project data from Russell Cave plot 10. Reworked based on NC element occurrence data.

GLOBAL SIMILAR ASSOCIATIONS:

Hydrangea arborescens / *Sedum ternatum* - *Polypodium virginianum* Shrubland (CEGL006479)
Piedmont Mafic Cliff Sparse Vegetation (CEGL003982)

GLOBAL RELATED CONCEPTS:

IE3a. Southern Appalachian Mafic Cliff (Allard 1990) ?

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association is restricted to the opening of Russell Cave.

GLOBAL RANGE: The association, as broadly defined, is widespread in the Southern Blue Ridge, Cumberlands and Southern Ridge and Valley, and possibly the Interior Low Plateau and Central Appalachians. It is peripheral in the western Piedmont.

NATIONS: US

STATES/PROVINCES: AL, GA?, NC, TN?, VA?

USFS ECOREGIONS: 221:C, 231:C, M221Dc:CCC

FEDERAL LANDS: NPS (Blue Ridge Parkway?, Russell Cave); USFS (Pisgah)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: none.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: A.S. Weakley and A. Andreu, mod. M. Pyne

REFERENCES: Allard 1990, Schafale 2002, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

Cultivated Meadow

LOLIUM (ARUNDINACEUM, PRATENSE) HERBACEOUS VEGETATION

(TALL FESCUE, MEADOW FESCUE) HERBACEOUS VEGETATION

IDENTIFIER: C EGL004048

NVC Classification

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	Lolium (arundinaceum, pratense) Herbaceous Alliance (A.1213)
Alliance (English name)	(Tall Fescue, Meadow Ryegrass) Herbaceous Alliance
Association	<i>Lolium (arundinaceum, pratense)</i> Herbaceous Vegetation
Association (English name)	(Tall Fescue, Meadow Fescue) Herbaceous Vegetation
Association (Common name)	Cultivated Meadow

ECOLOGICAL SYSTEM(S):

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:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This association is characterized as maintained lawn and early-successional field in the vicinity of the interpretive facility and residential cabin area.

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

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: The vegetation is primarily comprised of various grasses, most notably *Lolium arundinaceum* (= *Festuca arundinacea*) and *Paspalum notatum*. Floral diversity is relatively high, specifically in those areas less maintained, containing a rich assortment of native and exotic grasses, sedges and forbs.

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 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* (dallisgrass) (Bransby n.d.), and the exotic *Bromus tectorum* may be present in stands.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
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Global

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
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•	Herb (field)	Graminoid <i>Agrostis gigantea</i> , <i>Phleum pratense</i>
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CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Achillea millefolium*, *Apocynum cannabinum*, *Calystegia sepium*, *Dactylis glomerata*, *Daucus carota*, *Desmodium canescens*, *Dichanthelium clandestinum*, *Erigeron annuus*, *Fragaria virginiana*, *Holcus lanatus*,

Lespedeza cuneata, Leucanthemum vulgare, Oxalis stricta, Plantago lanceolata, Poa pratensis, Potentilla simplex, Solanum carolinense, Solidago canadensis, Trifolium hybridum, Trifolium pratense, Trifolium repens

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

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.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL 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*.

GLOBAL SIMILAR ASSOCIATIONS:

Dactylis glomerata - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation (CEGL006107)

Schizachyrium scoparium - *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

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association is confined to the vicinity of the interpretive center and residential housing area.

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

USFS ECOREGIONS: 221Hc:CCC, 221He:CCC, 222Eg:CCC, 231Ae:CCC, 231Bh:CCC, M221Cb:CCC, M221Dc:CCC, M221Dd:CCC, M222Ab:CCC, M231A:CC

FEDERAL LANDS: NPS (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, Lincoln Birthplace, 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

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: none.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: A.S. Weakley, mod. S.C. Gawler

REFERENCES: Bransby n.d., Heath et al. 1973, Hoagland 2000, Kartesz 1999, NatureServe Ecology - Southeastern U.S. unpubl. data, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001b, Vanderhorst 2007

Cumberland Plateau Sandstone Cliff (Dry Type)

***ASPENIUM MONTANUM* - *HEUCHERA PARVIFLORA* VAR. *PARVIFLORA* - *SILENE ROTUNDIFOLIA* SPARSE VEGETATION**

MOUNTAIN SPLEENWORT - CAVE ALUMROOT - SANDSTONE FIRE-PINK SPARSE VEGETATION

IDENTIFIER: C EGL004392

NVC Classification

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated cliffs (VII.A.1.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
Formation	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
Alliance	<i>Asplenium montanum</i> Sparsely Vegetated Alliance (A.1831)
Alliance (English name)	Mountain Spleenwort Sparsely Vegetated Alliance
Association	<i>Asplenium montanum</i> - <i>Heuchera parviflora</i> var. <i>parviflora</i> - <i>Silene rotundifolia</i>
Sparse	Mountain Spleenwort - Cave Alumroot - Sandstone Fire-pink Sparse Vegetation
Association (English name)	Vegetation
Association (Common name)	Cumberland Plateau Sandstone Cliff (Dry Type)

ECOLOGICAL SYSTEM(S): Central Interior Highlands Dry Acidic Glade and Barrens (CES202.692)
Cumberland Acidic Cliff and Rockhouse (CES202.309)

ELEMENT CONCEPT

GLOBAL SUMMARY: This community occurs relatively on dry, exposed vertical sandstone cliffs in the Cumberland Plateau of Tennessee, Kentucky, Virginia, Georgia, and Alabama. Vegetation consists of scattered individuals of *Asplenium montanum*, *Silene rotundifolia*, and other species rooted in crevices and erosion pockets. In some parts its range, this community is the primary or sole habitat for rare endemic species, such as *Minuartia cumberlandensis*. The vegetation is generally very sparse, owing to rock characteristics. Occasional well-developed crevices and seepages with more moisture and soil development are the primary locations where most vascular plants occur. *Heuchera parviflora* var. *parviflora*, *Silene rotundifolia*, *Asplenium montanum*, *Asplenium bradleyi*, *Mitchella repens*, *Kalmia latifolia*, and *Decumaria barbara* are primary species present.

ENVIRONMENTAL DESCRIPTION

USFWS WETLAND SYSTEM:

RUSSELL CAVE NATIONAL MONUMENT ENVIRONMENT: This association occupies vertical, east-facing sandstone cliffs near the summit of Montague Mountain, where cliffs assume various height dimensions extending from approximately 1.5 m (5 feet) near the monument's southern border to greater than 9 m (30 feet) along the northern boundary. Although generally dry and sparsely vegetated (about 80% unvegetated), crevices and the undersides of ledges often have higher moisture-retention capacities lending themselves to support a greater prominence of flora, most notably nonvascular plants. As intimated, throughout the region, these cliffs are typically shaded by a mixture of hardwoods and pine, with minimal exposure to the sun.

GLOBAL ENVIRONMENT: This community occurs on relatively dry, exposed portions of vertical sandstone cliffs in the Cumberland Plateau of Tennessee, Kentucky, Virginia, Georgia, and Alabama. These cliffs tend to be

massive, but largely shaded by tall trees rooted at their bases and may be exposed to full sun for a maximum of 30-40% of days. On a given cliff this community may be considered the matrix type that typically develops along the upper 1/3 of the vertical surface and lower if seepage is lacking; it is far more common than related moist cliff communities of the region (A. Schotz pers. comm.). The cliff's geometry (few crevices capable of accumulating soil), chemistry (generally highly acid), and erosion (cementing compounds being dissolved and sand particles eroding) create harsh growing conditions; vascular plants, lichens, and nonvascular plants are all infrequent.

VEGETATION DESCRIPTION

RUSSELL CAVE NATIONAL MONUMENT VEGETATION: Because of harsh growing conditions, the vegetation is often very sparse, covering approximately 20% of the rock surface. Vascular vegetation is restricted to rock shelves and crevices where soil accumulation is sufficient to sustain a low diversity of shrubs and herbs. *Kalmia latifolia*, *Heuchera parviflora* var. *parviflora*, *Mitchella repens*, and *Dichantheium dichotomum* serve as principal species, while *Vaccinium pallidum*, *Hydrangea cinerea*, *Parthenocissus quinquefolia*, *Porteranthus trifoliatum*, and *Carex virescens* occur in lesser abundance and are therefore recognized as of secondary importance. Nonvascular plants attain their greatest development in crevices and along the undersides of ledges where favorable moisture conditions allow several species to flourish.

GLOBAL VEGETATION: The vegetation is generally very sparse, owing to rock characteristics. Occasional well-developed crevices and seepages with more moisture and soil development are the primary locations where most vascular plants occur. *Heuchera parviflora* var. *parviflora*, *Silene rotundifolia*, *Asplenium montanum*, *Asplenium bradleyi*, *Mitchella repens*, *Kalmia latifolia*, *Decumaria barbara* are primary species present (NatureServe Ecology unpubl. data). Locally, seepages may support *Osmunda cinnamomea*, *Woodwardia areolata*, and *Itea virginica*. Because these seepage areas are of very small size, they are included within the concept of this type. *Asplenium montanum* is a characteristic species in stands of this type, although it may not have high cover and will not necessarily even be present. *Heuchera parviflora* and *Silene rotundifolia* are equally characteristic and diagnostic.

MOST ABUNDANT SPECIES

RUSSELL CAVE NATIONAL MONUMENT

<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>
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Global		
<u>Stratum</u>	<u>Lifeform</u>	<u>Species</u>

CHARACTERISTIC SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL:

OTHER NOTEWORTHY SPECIES

RUSSELL CAVE NATIONAL MONUMENT:

GLOBAL: *Cheilolejeunea evansii*, *Hymenophyllum tayloriae*, *Radula sullivantii*, *Silene rotundifolia*, *Tetradontium brownianum*, *Thalictrum mirabile*, *Thelypteris pilosa* var. *alabamensis*, *Trichomanes intricatum*

CONSERVATION STATUS RANK

GLOBAL RANK & REASONS: G3G4 (2-Feb-2001). This association occurs in a limited area of the Cumberland Plateau of northern Alabama, northwestern Georgia, eastern Kentucky, eastern Tennessee, and southwestern Virginia. Sites are of small extent, being associated with sandstone cliffs. There are few known threats, and the imperilment of this association is presumably relatively stable. There are thousands of miles of potential habitat, and threats are limited; the imperilment of this association is presumably limited, and its status somewhat stable.

CLASSIFICATION

STATUS: Standard

CLASSIFICATION CONFIDENCE: 2 - Moderate

RUSSELL CAVE NATIONAL MONUMENT COMMENTS:

GLOBAL COMMENTS: This type can co-occur with CEG008432 on a given cliff. In general CEG004392 occurs at the uppermost 1/3 of the cliff exposures, while CEG008432 occurs at lower, more shaded portions.

GLOBAL SIMILAR ASSOCIATIONS:

Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)

Heuchera parviflora var. *parviflora* - *Trichomanes boschianum* - *Thalictrum mirabile* - (*Ageratina luciae-brauniae*, *Solidago albopilosa*) Herbaceous Vegetation (CEGL004301)--a wetter seepage type.

Osmunda cinnamomea - *Rhynchospora capitellata* - *Thalictrum mirabile* Cumberland Seepage Cliff Herbaceous Vegetation (CEGL008432)

GLOBAL RELATED CONCEPTS:

Sandstone Cliffs and Rockhouses (Schmalzer and DeSelm 1982) =

OTHER COMMENTS

OTHER COMMENTS:

ELEMENT DISTRIBUTION

RUSSELL CAVE NATIONAL MONUMENT RANGE: This association occupies the crest and upper slopes of Montague Mountain in the western portion of the monument.

GLOBAL RANGE: This association occurs in a limited area of the Cumberland Plateau of northern Alabama, northwestern Georgia, eastern Kentucky, eastern Tennessee, and possibly southwestern Virginia

NATIONS: US

STATES/PROVINCES: AL, GA, KY, TN, VA?

USFS ECOREGIONS: 221Hc:CCC, 221He:CCC, 222Eb:CCC, 222En:CCC, 222Eo:CCC, 231Cd:CCC

FEDERAL LANDS: NPS (Big South Fork, Chickamauga-Chattanooga, Obed, Russell Cave); USFS (Bankhead, Daniel Boone)

ELEMENT SOURCES

RUSSELL CAVE NATIONAL MONUMENT INVENTORY NOTES:

RUSSELL CAVE NATIONAL MONUMENT PLOTS: none.

LOCAL DESCRIPTION AUTHORS: A. Schotz

GLOBAL DESCRIPTION AUTHORS: Evans (1991)

REFERENCES: Evans 1991, NatureServe Ecology - Southeastern U.S. unpubl. data, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

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