

To the Graduate Council:

I am submitting herewith a thesis written by Joey Thomas Shaw entitled "The Woody Plants of the Big South Fork National River and Recreation Area." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Science, with a major in Botany.

  
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Dean of the Graduate School

**The Woody Plants of the Big South Fork National River and  
Recreation Area (BSFNRR).**

**A Thesis Presented for the  
Master of Science Degree**

**The University of Tennessee,  
Knoxville**

**Joey Thomas Shaw  
May 2001**

*No one can be a botanist without collecting plants, and making up an herbarium with his own hands.*  
--A letter from C.W. Short (1833) to a young colleague.

## **Dedication**

This work is dedicated to M, Hydro, Girl, Truck, Chad, Boz & Flier, Tara & Q, Erin & Bart, Mommy, Phil, J.J., Dad & Deb, Ryan, Brett, Mama & Pop Pop, Ninnie & Uncle Ted, Travis & Suzy, Brianna, Austin, Jill, Brigg, Alyssa, Tyler, Uncle & Aunt Joy, Brittany, Thomas, Molly, Abby, Aunt Glenda & Uncle Frank, Tracey, Trent, Troy, and my best friends Mitch, Celeste, Beck, Planetmelbahead, A.Wilson, Makaulkie, Slippy, Chip, and Uncle Salamander.

## **Acknowledgements**

With great sincerity, I would like to thank Dr. B. Eugene Wofford for serving as my major professor. I would like to thank him for his friendship, patient leadership, good advice, knowledge, an excellent work environment, and most of all for many good laughs over the last two and a half years, which to me are worth so very much.

I would like to thank the other members of my graduate committee, Dr. David K. Smith and Dr. Pat Cox for their leadership, advice, and friendship.

For helping me become a better science teacher and guiding me through the GTA experience, I want to thank Dr. Ken McFarland.

Special thanks goes to the secretaries, Eunice Turner and Eileen Hunley for their tireless help in everything that I asked them for, especially in turning in motor pool requests at a moments notice and never failing to get me a car when I needed one.

I will forever be grateful to the Botany Department for accepting me and funding my education through a Graduate Teaching Assistantship.

I would also like to thank Chris Fleming, James Beck, Ed Lickey, Randy Small, Paul Durr, Vern McNeilus, and Greg Schmidt for their friendship, aiding in my botanical education, and accompanying me on many of my field trips.

My gratitude is extended to Mike Dennis for more than adequate funding of my floristic inquiry and education. I would also like to thank him on behalf of the aforementioned others, who 'learned a few plants' by coming with me.

To the other graduate students, whom I did not mention above, I am happy to have had you as comrades during my time here and hope that we keep in touch, even if its just for a beer (or several) at annual meetings.

Gene Van Horn, Ross Clark, Felix Coe, and John Beck also helped by aiding in my botanical education, or in some other way helping me with this project.

Lastly, I would like to thank my adored wife Emily, along with the rest of my family, because without their full support I would not have had the opportunity, nor the illuminating experience, of communication and subsequent education that I have enjoyed.

## Abstract

The woody flora of the Big South Fork National River and Recreation Area was collected during two growing seasons from 1999 to 2000. The 123,000 acre study area lies on the Cumberland Plateau in Tennessee and Kentucky. Seven hundred and sixty accessions yielded 51 families, 100 genera, and 183 species. County records totaled 128. *Magnolia fraseri* was collected for the first time from the Cumberland Plateau in Tennessee. Fourteen Federal or State listed taxa were collected including *Comptonia peregrina*, which has only been collected two other times dating back to 1842. Voucher specimens were deposited in the herbarium of the University of Tennessee, Knoxville.

Comparisons were drawn between the BSFNRRRA and several other floras in the surrounding southern Appalachians. The BSFNRRRA is also directly compared to the epitome of richness for the eastern USA, the Great Smoky Mountains National Park. These comparisons yielded unexpected results in that the BSFNRRRA contains more woody families than does the GSMNP and is the richest among all of the natural areas of the Cumberland Plateau.

An artificial key to the known and expected woody plants of the BSFNRRRA was created and accompanies the great amount of data compiled in this study, all of which is available on the companion CD.

With this work, I hope to elevate public awareness of this national land and help to secure its preservation for future biological entities.

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## **List of Abbreviations**

|                     |                                                                              |
|---------------------|------------------------------------------------------------------------------|
| <b>BFM .....</b>    | <b>Big Frog Mountain, Polk County, Tennessee</b>                             |
| <b>b.p.....</b>     | <b>before present</b>                                                        |
| <b>BSFNRRA ....</b> | <b>Big South Fork National River and Recreation Area, Tennessee/Kentucky</b> |
| <b>CFR .....</b>    | <b>Clear Fork River</b>                                                      |
| <b>CU .....</b>     | <b>Cumberland Plateau, Physiographic Province</b>                            |
| <b>E .....</b>      | <b>Endangered</b>                                                            |
| <b>F .....</b>      | <b>Fentress County, TN</b>                                                   |
| <b>FCF .....</b>    | <b>Fall Creek Falls, Tennessee</b>                                           |
| <b>FG .....</b>     | <b>Fiery Gizzard Gorges, Marion &amp; Grundy counties, Tennessee</b>         |
| <b>GC .....</b>     | <b>Gee Creek Wilderness Area, Cherokee National Forest, Tennessee</b>        |
| <b>GSMNP .....</b>  | <b>Great Smoky Mountain National Park</b>                                    |
| <b>HS .....</b>     | <b>Historic Species</b>                                                      |
| <b>LBL .....</b>    | <b>Land Between the Lakes, Tennessee/Kentucky</b>                            |
| <b>LC .....</b>     | <b>Lilly Cornett Woods, Letcher County, Kentucky</b>                         |
| <b>M .....</b>      | <b>Morgan County, TN</b>                                                     |
| <b>m.y.a.....</b>   | <b>million years ago</b>                                                     |
| <b>Mc .....</b>     | <b>McCreary County, KY</b>                                                   |
| <b>N.....</b>       | <b>No</b>                                                                    |
| <b>NA.....</b>      | <b>Not Applicable</b>                                                        |
| <b>NPS .....</b>    | <b>National Parks Service</b>                                                |
| <b>NR .....</b>     | <b>New River</b>                                                             |

NWOC ..... North White Oak Creek Watershed as defined by Allawos (1994)  
 Obed ..... Obed Wild and Scenic River, Morgan County, Tennessee  
 P ..... Pickett County, TN  
 PC..... Prentice Cooper State Forest and Wildlife Management Area, Tennessee  
 S ..... Scott County, TN  
 SCS ..... Special Concern Species  
 SFR ..... South Fork of the Cumberland River  
 SG ..... Savage Gulf, Tennessee  
 T ..... Threatened  
 U..... Unaka, Physiographic Province  
 WC..... Wolf Cove, Franklin County, Tennessee  
 WHR ..... Western Highland Rim, Physiographic Province  
 Y..... Yes  
 y.a..... years ago

## **Introduction**

*"The first step in science is to know one thing from another" Linnaeus, 1750.*

As we multiply and use more for our purposes, we need to remember to leave or set aside some for the other biological entities that, along with our species, coexist in this relatively thin, fragile biosphere. If we are to preserve, in the truest sense of the word, then we need to know what we are safeguarding. Since plants, or photosynthetic life forms, are the foundation for most life, it seems imperative that we survey protected areas so that we may:

1. Protect as many species as possible.
2. Gauge those areas that are "biologically more important",  
unique, or diverse for future delineation of protected areas.
3. Know, in the future, if we fulfilled our goals of preservation.

The Big South Fork National River and Recreation Area (BSFNRRRA) is an astonishing tract of land with much biological curiosities, breathtaking vistas, lush vegetation, astounding rock formations, and countless whitewater marvels including several falls. It is part of a large government land holding that includes itself, Scott State Forest (within the BSFNRRRA), Pickett State Park to the west in Tennessee and Daniel Boone National Forest to the north in Kentucky. This mass of government land contains approximately 820,000 acres and is used for outdoor recreation of every kind including horseback riding, rappelling, whitewater rafting, off-road driving, recreational boating,

hunting, and fishing. The land within the BSFNRRA boundaries is owned by the government, with the exception of a few privately owned tracts, some of which are still under acquisition. After acquisition, the BSFNRRA will contain 123,000 acres. The BSFNRRA is a well-kept secret and oftentimes one will not see a single other person while on an excursion. Public visitation within the BSFNRRA has increased since its inception, but has leveled off at a little more than 850,000 people annually (Knox. News Sentinel 2000).

The BSFNRRA is on the Cumberland Plateau (*sensu* Fenneman 1938), which has long proven to have unique vegetation (Schmalzer 1978; Wofford *et al.* 1979; and Clark 1966). Braun (1950) also realized the uniqueness of this area as she stated that few other temperate regions in the world rival its floristic richness. The BSFNRRA watershed is not only biologically important in terms of vegetation, there are many other unique organisms found there. An analysis by the Kentucky State Nature Preserves Commission listed the Big South Fork of the Cumberland River as third in the top ten Kentucky streams based on the number of imperiled fishes and mussels they support (Cicerello *et al.* 1999). Even though this area has long been considered special, there have been many destructive forces that have had impact on the plateau environment (Patrick 1979). These are outlined by DeSelm and Clark (1975) for the Cumberland Plateau and included by Patrick (1979):

1. Suburban development and industrialization
2. Secondary home establishment

3. Strip mining activities
4. Pine monoculture
5. Flooding of flood plain habitat
6. Channelization
7. Digging of endangered plants by nurseries and individuals

With the negative forces listed above, and others not mentioned, these connected protected lands may serve as a vast refugium for the plants, fungi, and animals of the temperate region of the southeastern USA.

Scott, Morgan, Fentress, and Pickett counties in Tennessee have attracted botanists since the beginning of the 19<sup>th</sup> century, although useful recent botanical study of this area has only begun in the last 60 years. A.J. Sharp, R.E. Shanks, and E.E.C. Clebsch made many excursions throughout the 1940's; they deposited many plants in the University of Tennessee Herbarium from the vicinity of No Business Creek, Scott County. Allawos (1994) added to the University of Tennessee collections with his flora of North White Oak Creek (one of many tributaries of the South Fork of the Cumberland River), and therefore to the floristic knowledge of the BSFNNRA. After initiation of this project, I learned that three other floras within a selected part of the BSFNNRA were in progress. These are the works of Bailey (1998) "The Vascular Flora of the Riparian Zones of the Clear Fork and New River in the Big South Fork National River and Recreation Area", Goodson (2000) "The Vascular Flora of the Clear Fork and New River Gorges of the Big South Fork National River and Recreation Area", and Emmott (in

preparation), a flora of the uplands of this same area of the park. These projects are under the direction of Dr. Felix Coe (Tennessee Technological Institute), which all together will adequately represent the flora south, or upstream, of the confluence of Clear Fork River (CFR) and the New River (NR) (at their confluence begins the South Fork of the Cumberland River). Despite these works, this is the first woody plant floristic study of the entire area.

Floristic studies are becoming more important for regional biological inventories, impact assessment, research, management decisions, and policy formulation (Palmer *et al.* 1995). A baseline floristic investigation should be *a priori* to other investigations due to the ecological significance of dominant plant life. In a large area, a woody plant flora is an extremely useful tool for gross interpretation of floristic richness and ecology; this is because much more is known about the biogeography of trees than other types of plant life (Little 1970). The upper canopy vegetation is an efficient predictor of the understory vegetation; results from woody plant floristics may apply to other plants with similar distributional patterns (Little 1970). Braun (1950) also realized that the interdependence between the canopy and herbaceous layer is strongly marked. As a baseline floristic investigation, a woody plant flora of the entire park will be invaluable to future investigations of the area. In addition to a woody plant flora, this work attempts to show the value or importance of the BSFNNRA, with respect to its floristic natural heritage. One way to illustrate floristic importance, or uniqueness, is by comparison with other regional floristic studies. Finally, as this investigation is intended to be of use to the National Park Service, especially for those areas within and surrounding the BSFNNRA,

it includes an artificial key to the woody plants of the BSFNRRA, along with an annotated checklist containing information on exotic and state or federally listed plants.

Hopefully this study will aid, guide, and/or contribute to the goals of the National Park Service in order to help those involved protect and preserve all life forms, especially those plants and animals that are less abundant and therefore unique.

## **Chapter 1: Location**

### **Location**

A woody plants floristic inventory was conducted in the BSFNRRA. This National River and Recreation Area is shared by Tennessee and Kentucky in the southeastern USA (Figure 1) and is completely within the Cumberland Plateau physiographic province (Figure 2). The BSFNRRA lies between 36°19'30'' (just south of Peters Bridge, TN) and 36°47'48'' (just north of Big Creek, KY) N latitude and 84°30'10'' (just east of Bear Creek, KY) and 84°50'45'' W (Darrow Ridge Rd., TN). Although the park operates using Eastern Time, the Eastern/Central timeline longitudinally divides the park. The BSFNRRA is mapped on 12 quadrangle maps of the United States Geological Survey 7.5 minute Topographic Map Series; these are Nevelsville, Barthell, and Bell Farm, KY and Oneida North, Barthell SW, Sharp Place, Oneida South (formerly Helenwood), Honey Creek, Stockton, Robbins, Rugby, and Burrville, TN. Often the boundaries of the BSFNRRA are marked with an orange blaze on the trees, except for where the terrain inhibits this practice.

Most of the project area lies within Scott County, Tennessee and McCreary County, Kentucky; however, portions of the park are within Fentress, Morgan, and Pickett counties, Tennessee (Figure 3). The nearest communities are Oneida and Jamestown, Tennessee and Whitley City and Stearns, Kentucky. The largest major city to the BSFNRRA is Knoxville, Tennessee, which is approximately a 1.5-hour drive from the park. Other major population centers within 150-mile radius of the BSFNRRA

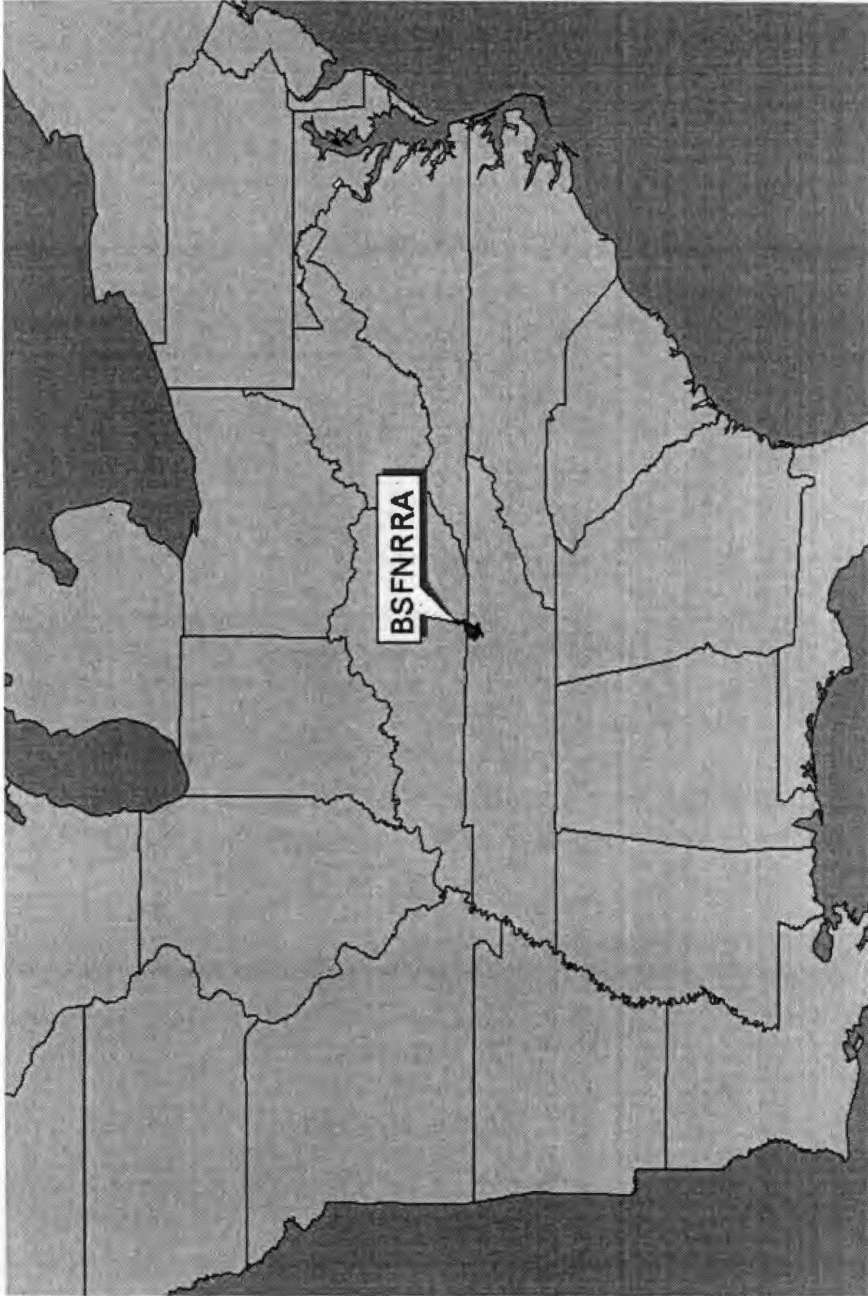


**Figure 1.**  
**Location of the BSNRRA Within the Eastern USA.**

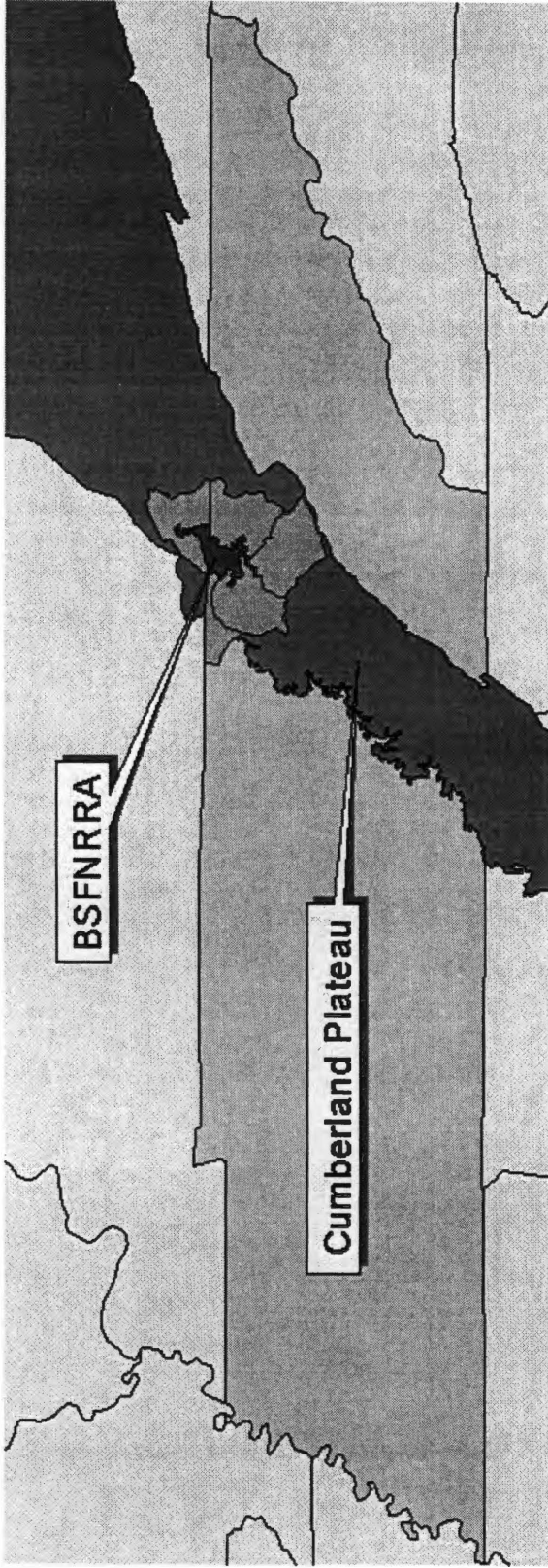


**Figure 2.**  
**BSFNRRA Within its Counties and Physiographic Province.**

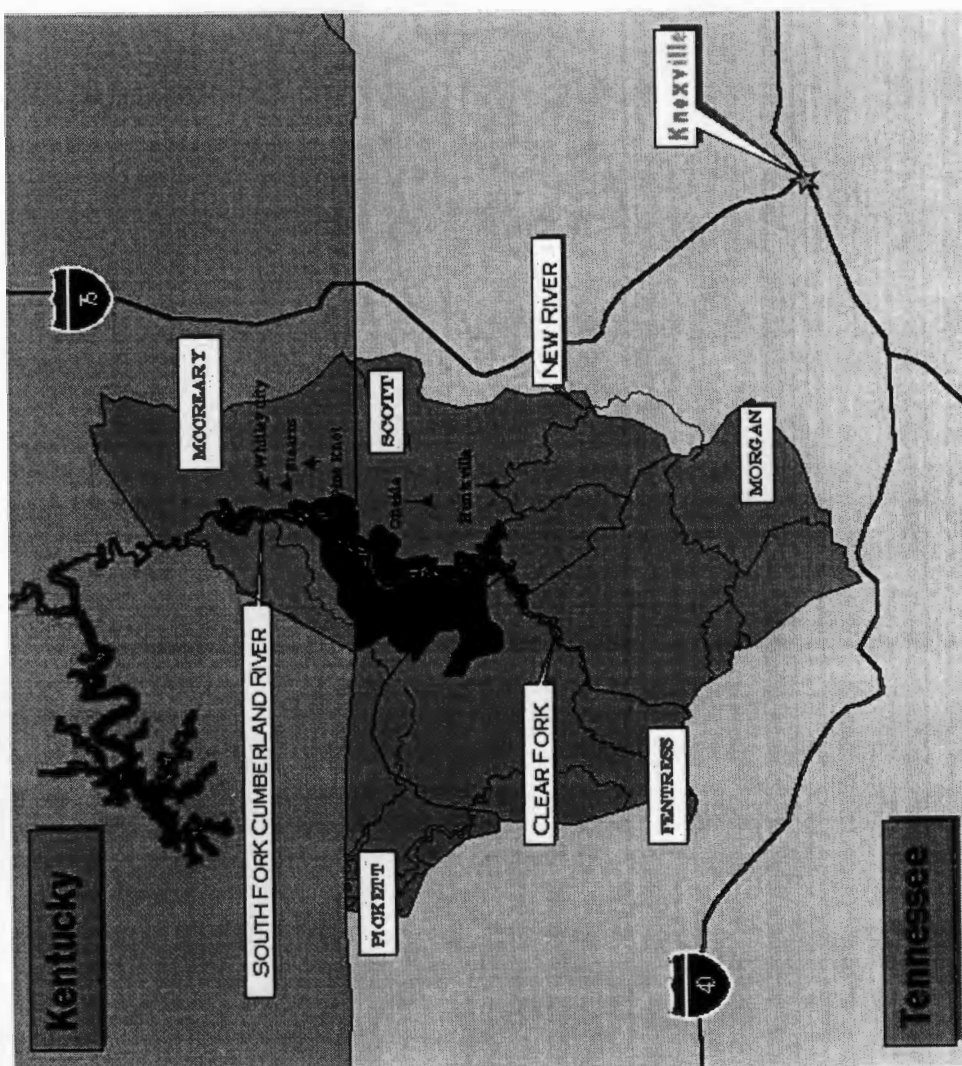


**Figure 3.**  
**BSNFRRRA: Detailed County Map.**

boundaries are Ashville, NC, Chattanooga and Nashville, Tennessee, and Louisville and Lexington, Kentucky.

Many navigable roads are mapped on the National Geographic Maps Trails Illustrated series for the BSFNNRRA. Some older roads are not depicted on this map but may be navigated following the USGS maps. The only major road that goes through a large amount of the park is Highway 297, Leatherwood Ford Rd. (Figure 4). Other major roads such as highways 52 and 92 perpendicularly intersect the park in very narrow places and are not useful in traversing large areas within the boundaries of the area. Numerous secondary roads (chip and tar, gravel, or dirt) dissect portions of the park and many have deteriorated to yield horse, ATV, or hiking trails. Since the park is long and narrow, and there are few major roads, other means of transportation are necessary. These include the use of hiking trails, four-wheel drive vehicles, canoes, rafts, and boats.

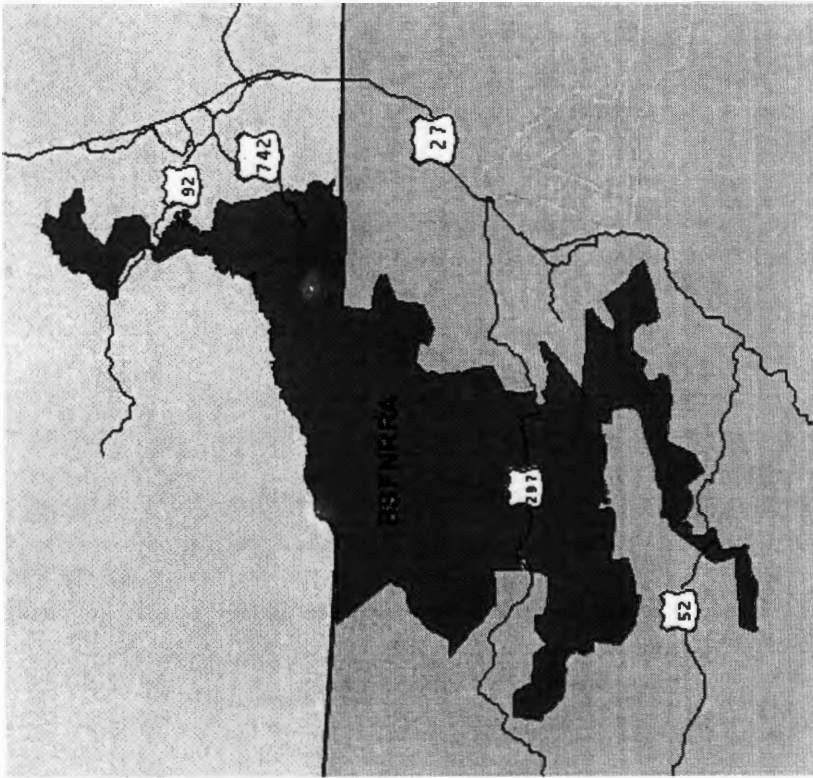


**Figure 4.**  
**Major Roads Within and Around the BSEFNRRA.**

## **Chapter 2: History**

### **Human History**

Prehistoric peoples certainly found the rockhouses near what is now the BSFNRRA to be suitable permanent or seasonal habitations. Although Paleo-Indian occupation is not thought to have been extensive, artifacts from 10,000 years ago have been found in the area (Howell 1981). The most intensive human population of the area is thought to have been from 3000 to 8000 years before present. Five hundred to 1000 years ago cultivation of maize may have occurred on such rich floodplains as No Business, Station Camp, and Parchcorn creeks. At the time of European settlement, the area was used as hunting grounds by a few tribes of Native Americans including the Shawnee and Cherokee (Howell 1981; Manning 1994).

White men came to this area as early as 1692 when a Canadian, Martin Chartier, and a band of Shawnee Indians traveled along what was probably the Cumberland River (Williams 1937). During the winter-spring of 1749-1750, Dr. Thomas Walker officially discovered the Cumberland River (Howell 1981). In 1764, the Richard Henderson Land Company, interested in attracting settlers to this area, hired Daniel Boone to explore it. The first recorded permanent settler in Scott County was Michael Lowe, 1776 (Howell 1981). Overall, the topography of this area slowed emigration and the early settlers passed up this area for better farmlands in middle Tennessee and the bluegrass of Kentucky (Sanderson 1976).

Through the 18<sup>th</sup> century, French and English hunters and trappers (long hunters) traveled throughout the area on extended hunting trips in search of pelts. Many elk, bear, buffalo, deer, squirrels, raccoons, turkeys, opossums, wolves, panthers, and bobcats were present and were supported by abundant masts of chestnuts, acorns, beechnuts, hickory nuts, huckleberries, and persimmons. By the later part of the 18<sup>th</sup> century permanent Euro-American settlers moved into the area (Howell 1981). Physical constraints imposed by the gorge, low agricultural potential of the area, abundance of game, and presence of mineral and timber resources have determined the ways in which this land has been impacted by humanity. The early settlers cleared the rich-soiled bottomlands and raised hogs, cattle, and sheep in the ridge woods. Even the rich bottomland soils needed improvement as it was suggested that settlers pen cattle in a field until it became fertilized (Killbrew & Safford 1874). Historically, the area has been sparsely populated due to soils poorly suited for agriculture. Despite this fact, the 1850 census recorded 126 people living along Station Camp Creek. The population of the area around what is now the BSFNRRA rose so that by 1850 most of the present day counties that encompass the park had already been established.

Among the earliest historical settlements of the area is Rugby, founded in 1880 by Thomas Hughes as an outlet for younger sons of English gentry who were customarily excluded from any inheritance.

Completion of the Cincinnati Southern Railroad through the BSFNRRA region in 1880 was the impetus for the intense exploitation of timber and mineral resources. In

1902, the Michigan-based Stearns Coal and Lumber Company was the dominant economic force driving the exploitation. By 1910, it owned vast areas of the counties that today encompass the BSFNRRA. Most of the lumber company's easily accessible timber had been logged out by 1935, by 1950 the logging railroad had been abandoned. Other important economic settlements were the mining towns of Blue Heron, Whorley, and Zenith; however, the depletion of accessible mineral resources and the legal protection of the timber have left the area in its present economically depressed state.

Around the 1930's, people again looked to exploit the area surrounding the Big South Fork River. Various proposals were made to construct a dam near Devil's Jump in Kentucky. However, opposition by public interest groups (naturalists and river enthusiasts), led to the establishment of the BSFNRRA.

Beginning in 1950, the census figures reflect a high rate of emigration from Fentress, Scott, and McCreary counties; the exodus was stimulated by the closing of logging and mining operations. Fewer than 35 year-round households remained within the BSFNRRA when land acquisition began (Howell 1981) and the last resident of No Business Creek left in 1960 (Coleman & Smith 1996).

Today, most of the park is reforested; however, coalmines, oil wells, and clear cutting certainly affected the landscape and there are many enfeebled remains of these different operations. The counties encompassing the BSFNRRA, Pickett State Park, and Daniel Boone National Forest seem to be in the early stages of developing a tourist-

related economy centered on their natural endowment of beautiful scenery and natural attractions. For example, private land on the western boundary of the BSFNRRA is currently being carved up into upper class “horse ranch” communities.

## **Park Establishment**

March 7, 1974, Public Law 93-251, Sec. 108 of the Water Resources Act reserved the Big South Fork of the Cumberland River, along with major portions of the Clear Fork and New River feeders and various other tributaries, as a natural, free-flowing system. In 1990, jurisdiction of the area was transferred from the US Army Corps of Engineers to the National Park Service. As of about February, 2000, the park has been trying to come up with a management system or “mission” that will allow it to find and follow guidelines in terms of land management (Knoxville News Sentinel 2000).

The BSFNRRA is an important part of the Cumberland River drainage. It directly encompasses the South Fork of the Cumberland River (SFR) and its two major tributaries, the Clear Fork River (CFR) and the New River (NR). The SFR is the third largest tributary of the Cumberland River, having a total drainage area of 1382 square miles (358,000 ha). The Big South Fork of the Cumberland River system extends 77 miles (124 km) northward through McCreary County Kentucky to Lake Cumberland (Figure 3). The main channel of the SFR descends to the north about four feet per mile (1.2 m / km) (Coleman & Smith 1996). Fourteen percent of the drainage area is within the park boundaries. There is an unusually high amount of surface run-off due to the

impermeability of exposed rocks, steepness of the slopes, and thinness of the soils causing great variability of stream flow.

Beginning at the confluence of the CFR and NR, the SFR is at the bottom of a narrow gorge cut into the plateau. The gorge slowly widens northward to reveal river benches and eventually floodplains and a broadening bottomland; this area is now artificially flooded. The artificially flooded areas become apparent as the river approaches the area just south of Blue Heron; north of there, water inundation conceals much of the land that would be considered floodplain.

The BSFNRRA was set aside for “the benefit and enjoyment of future generations, the preservation of the natural integrity of the scenic gorges and valleys, and the development of the area’s potential for healthful outdoor recreation” (USACOE 1980). This land was chosen for conservation because the area contains unique cultural, historic, geologic, fish and wildlife, archaeological, scenic, and recreational values. The BSFNRRA was one of the first attempts to combine the concept of a National River with that of a National Recreation Area. The “National River” status has been used by Congress to legislate an area into being, and therefore protection, when that area is near a flowing river. The “National Recreation Area” status was conceived in 1962 by Executive Order 11017 and designates the areas to be more responsive to outdoor recreation of natural and historical resources with the stipulation that the areas set aside must be “naturally endowed” and within a 250 mile driving distance of urban population centers. As the BSFNRRA is a unique merger of a National River and a National

Recreation Area, the park has been divided into two zones with different, complementary management goals. The river and area within the gorge and rim is maintained as a natural area where there is minimal impact on the environmental character of the land. The plateau and adjacent areas are managed in a way to provide various forms of outdoor recreation.

The US Army Corps of Engineers was responsible for most of the land acquisition and land development since the inception of the park in 1974. However, since management was officially transferred to the National Park Service (NPS) in 1990 (Manning 1994), the NPS has been in control of the park's upkeep and use.

Throughout the park, camping, rafting, canoeing, hunting, fishing, horseback riding, hiking (with leashed dogs!), and mountain bike riding are available to the outdoors-person. There are over 200 miles (322 km) of trails including part of the 254-mile Sheltopee Trace Trail (409 km).

### **History of (Woody) Botanical Exploration of the Cumberland Plateau**

John Lyon (d. 1814), a nurseryman from Scotland, and later a Philadelphian, traveled widely in the southeastern USA and was the first person to make a list of the flora of the area surrounding what is now the BSFNRRRA. He collected plants from the vicinity of the Cumberland Plateau from 1799 to 1814. However, surviving herbarium records are fragmentary at best; as far as record keeping, only his journal remains and this does not well document the location of his collections (Ewan & Ewan 1963).

Killbrew and Safford (1874) in their "Introduction to the Resources of Tennessee" reported on the many natural resources of Tennessee. Upon exploration of the Cumberland Plateau in Morgan County, they reported an enormous walnut stand. In addition, they noted that the gorges and ravines of this area were heavily wooded with chestnut, tuliptree, maple, walnut, buckeye, cherry, basswood, and beech.

Gattinger's (1901) The Flora of Tennessee and a Philosophy of Botany was the first, and most comprehensive, botanical work for Tennessee. Although he noted that the Cumberland Plateau has a distinctive flora, he used Lookout Mountain (vic. Chattanooga) as the type location of his Cumberland Plateau studies. This work cannot be used to extrapolate floristic elements once present along the SFR, because even the floras of more closely related areas on this physiographic region have marked differences (See Table 2).

Svenson (1941), in his notes on the Tennessee flora, alluded to the significance of the vegetation when he wrote that the Cumberland Plateau might be a place of origin of plants of the Atlantic Coastal Plain (to my knowledge he was thinking of the migration of plants southward after Tertiary marine inundation).

Shanks (1958) examined the floristic regions of Tennessee and correlated them with the physiographic provinces developed by Fenneman (1938). He developed these regions based on coincidence of concentration of a number of species and a general agreement in their range limits and listed 20 species of Appalachian distribution, eight

species with restricted ranges centering in the Cumberland Plateau: (*Aronia arbutifolia*, *Buxella brachycera*, *Conradina verticillata*, *Cornus stolonifera*, *Hypericum crux-andrae*, *Magnolia macrophylla*, *Ribes curvatum*, and *Spiraea tomentosa*), and seven whose distributions extend from the Appalachians through the Cumberland Plateau onto the Western Highland Rim: (*Dirca palustris*, *Itea virginica*, *Kalmia latifolia*, *Magnolia acuminata*, *M. macrophylla*, *M. tripetala*, and *Pinus virginiana*).

Sherman (1958) studied the vegetation and major community types of five gorges on the Cumberland Plateau from northern Georgia and Alabama to northern Tennessee. Among the gorges studied, the gorge closest to the BSFNRRA is Buffalo Cove in Fentress County. He found that the major community types occurring in all of the gorges include (1) mixed mesophytic stands in the most favorable sites, (2) the chestnut-oak community on dry, upper slopes, and (3) oak-hickory in intermediate habitats. He also listed 126 woody species as occurring in the gorges. However, he did not recognize subshrubs, such as *Chimaphila maculata*, *Mitchella repens*, *Epigaea repens*, or *Gaultheria procumbens*, therefore his work is not directly comparable here.

Braun (1950), in her work concerning the eastern forests, described this part of the Cumberland Plateau as a Mixed Mesophytic Forest, characterized by the predominance of many different tree species. She concluded that Appalachian deciduous forests had their beginnings in the Cumberland Mountains of central Kentucky. Her study sites, which include noted woody taxa near or within the present boundaries of the BSFNRRA include: Rock Creek, Pickett Co., Tennessee; No Business Creek, Scott Co.,

Tennessee; and Yahoo Creek, McCreary Co., Kentucky. Later, Küchler (1964) expanded on her work and delineated the area within the conterminous United States that would potentially climax as a Mixed Mesophytic Forest.

Clark (1966) worked on “The Vascular Flora of the Fiery Gizzard Gorges in South Central Tennessee” and that same year Thomas (1966) completed the first comparison between the GSMNP and the Cumberland Plateau in his dissertation entitled “Vegetation and Flora of Chilhowee Mountain”. Thomas (1966) suggested that the flora of Chilhowee Mountain, which is in the Ridge and Valley physiographic province adjacent to the GSMNP (Blue Ridge), more closely resembles the flora of the Cumberland Plateau rather than that of the GSMNP. His efforts did not confirm nor disprove his hypothesis; however, a quick comparison of woody genera in this study revealed that all of the genera present in the Chilhowee Mountain flora are present in the flora of the GSMNP and three taxa *Ampelopsis*, *Gleditsia*, and *Halesia* known from Chilhowee Mountain are not known, or are rare on the Cumberland Plateau in Tennessee (See Appendix 2).

A.J. Sharp (1970) dealt with the interesting flora of the upper Cumberland Plateau in Tennessee. He noted that the southern Appalachians must have served as a refugium or “source of inoculum” for plants of both “northern” (*Thuja occidentalis*) and “southern” (*Polygonella americana*) distribution. He also wrote that the southern Appalachians have been available for occupancy since the advent of the Angiosperms.

Safley (1970) studied the vegetation in the basin surrounding the Big South Fork of the Cumberland River and described 22 forest types based on aspect, drainage, slope, and ridge-draw location. The vegetative communities described are primarily white oak dominated, except for where shallow soils were occupied by pines and in protected coves where hemlock was prevalent.

The virgin Mixed Mesophytic Forest of Savage Gulf, Tennessee was analyzed by Quarterman *et al.* (1972); they concluded that the forest of Savage Gulf appears to be the only virgin tract of Mixed Mesophytic Forest remaining in Tennessee, closely resembling the forests of the Cumberland Mountains in Kentucky.

Caplenor's (1955; 1965; 1978; & 1979) "The Woody Plants of the Gorges of the Cumberland Plateau and Adjacent Highland Rim", showed that the gorges of the Cumberland Plateau harbor remnants of Mixed Mesophytic Forest because they have been protected by their inaccessibility; he also noted that the gorges contain the most climatically attuned terrestrial communities of the region. His earlier work in Fall Creek Falls State Park (1955) provided one of the first checklists of the Cumberland Plateau in Tennessee.

Patrick (1979) contains gathered botanical data "designed to expedite the finding of factual information for both sites and plants". He and others visited many sites within the present boundaries of the BSFNRRA as well as other localities on the northern Cumberland Plateau in Tennessee to formulate a report on the Upper Cumberland River

Flora Project. It seems that an objective of the study was to document the presence of some rare taxa that had been rumored to exist on the plateau (*Buckleya distichophylla*, *Comptonia peregrina*, and *Styrax americana*). Collecting trips to the BSFNRRA included a canoe trip from Peters Bridge to Brewster Bridge along the CFR and day trips to North White Oak Creek, the Brewster Bridge Area, Peters Bridge Rock house, Twin Arches, Big Island, Honey Creek, Leatherwood Ford, No Business Creek, and White Oak Creek (vic. of Rugby). They documented the presence of several rare plants at some of these sites (*Conradina verticillata*, *Fothergilla major*, and many herbaceous plants including *Eupatorium luciae-brauniae*).

Smalley (1982) studied and classified forest sites on the Mid-Cumberland Plateau. Although the mid-Plateau only extends as far north as Oneida, Tennessee and does not incorporate all of the BSFNRRA, it does contain some. According to Smalley (1982), the BSFNRRA is mapped within the True Plateau subregion on the Weakley Dissected and Moderately Dissected landtype associations. His land type associations of the area surrounding the BSFNRRA contain 15 landtypes, and although their descriptions are beyond the scope of this brief review, some that he described that are pertinent to the BSFNRRA include Broad Undulating Sandstone Uplands, Broad Sandstone Ridges—North Aspect, Broad Sandstone Ridges—South Aspect, Narrow Sandstone Ridges, and Convex Upper Slopes.

A few other floristic works from areas confined to the Cumberland Plateau have been done over the years and woody plant information was extrapolated from these: "Oak

Ridge, Tennessee, Flora”, [including Morgan Co.] (Olson *et al.*, 1966), “The Vascular Flora of Savage Gulf, Tennessee” (Wofford *et al.*, 1979), “The Vascular Flora of the Obed Wild and Scenic River, Tennessee” (Schmalzer *et al.*, 1985), and the “Vascular Flora of Wolf Cove, Franklin County, Tennessee” (Clements 1991).

Most significantly, a few recent floras of restricted areas within the park have contributed greatly to our floristic knowledge of the BSFNRRA. They are: Allawos (1994) “The Vascular Flora of North White Oak Creek Gorge, Scott and Fentress Counties, Tennessee”, Bailey (1998) “The Vascular Flora of the Riparian Zones of the Clear Fork and New River in the Big South Fork National River and Recreation Area”, and Goodson (2000) “The Vascular Flora of the Clear Fork and New River Gorges of the Big South Fork National River and Recreation Area”.

Currently, John T. Beck, University of Tennessee at Chattanooga, under the supervision of Dr. Gene VanHorn, has nearly completed “The Vascular Flora of Prentice Cooper State Forest and Wildlife Management Area, Tennessee”. This work will certainly add much needed information to the floristic knowledge of the Cumberland Plateau, as it will include the southernmost portion of the plateau in Tennessee.

In Tennessee, the Cumberland Plateau has not received the floristic attention that has been given to the Blue Ridge (Clark 1966; Thomas 1966). As of 1966, Clark wrote “Very little (*sensu* methodical) study of the flora of this portion [Cumberland Plateau] of Tennessee has been undertaken”. However, the floristic knowledge of the plateau has

been greatly increasing throughout the last 50 years. Along with the works scattered around the mid-plateau, which were mentioned above, John T. Beck's data of the southern extremity, and the data herein compiled from the northern extremity, we may begin to give an understanding to the importance, uniqueness, and value of the flora of one of the oldest vegetated landmasses in the eastern United States, the Cumberland Plateau in Tennessee. It is suggested by this author that future works of this type be directed toward the northwestern escarpments, bordering the Highland Rim and the entire eastern escarpment, for it may be there that we find new additions to the flora of the plateau in Tennessee. Lastly, Fall Creek Falls recently acquired large tracts of land and Caplenor's lists (1955; 1965; 1978; & 1979) are very limited and therefore floristically incomplete for the entire park.

### **Chapter 3: Geology, Physiology, Topology, Soils, and Climate**

#### **Geology**

The Appalachians, Ozarks, and Ouachita mountains were created by the Allegheny orogeny near the end of the Pennsylvanian period. Before these rocks were thrust in the mountain building event, they were formed in a shallow, fluctuating, inland sea (approximate 350 million years ago). Since the mountain forming event, erosion by running water has been the dominant geologic process--no doubt with the help of several glacial events.

The Appalachian plateau is a region of relatively unfolded, unmetamorphosed, coal bearing rocks that, during the Paleozoic, were lushly vegetated wetlands adjacent to the rising Appalachian Mountains (Chernicoff 1995). When it was first created, the plateau was at least 15 miles wider, to the west, than it is today. Erosion/weathering has reduced the western boundary and carved the great valleys (Sequatchie, Browns, and Big Wills) and large gorges (Cumberland River drainage in BSFNRRRA) that exist today. The Cumberland Plateau is capped by Pennsylvanian Age sandstone and shale, and lesser amounts of siltstone, conglomerate, and coal. This coal formation, although it rarely is naturally exposed, contains the principal bituminous coal-bearing strata of eastern North America (McLaughlin, manuscript). The SFR and its tributaries have cut into the horizontally bedded layers of sedimentary rocks of the Pennsylvanian, including the Breathitt and Lee formations and rarely into the Mississippian age Pennington formation (USACOE 1980).

## **Physiography & Topography**

The physiography and topography of the plateau are directly related to its geology (Wilson *et al.* 1958). The Cumberland Plateau is the southernmost and least dissected part of the distinctive Appalachian Plateau physiographic province of the eastern USA (Fenneman 1938) that extends from central AL and GA northeastward, across TN, KY, and VA, to OH, WV, and PA. The Cumberland Plateau extends from the Coastal Plain of northeastern AL and northwestern GA to southern KY, approximately to the Kentucky River. Both the northern and the southern boundaries are somewhat arbitrary (Fenneman 1938). The BSFNRRA lies completely within the “Cliff Section” of the Cumberland Plateau (Braun 1950). According to Smalley (1982), the BSFNRRA lies on the border between the Mid-Cumberland Plateau and the northern Cumberland Plateau. The line between the two regions is approximately the latitude of Oneida, Tennessee. To the northeast of the park are the Cumberland Mountains, west, the eastern Highland Rim of the Interior Low Plateau, and to the east is the Ridge and Valley province. Elevations, above mean sea level, of the uplands range from approximately 1400 ft. (430 m) to 1800 ft. (550 m) and the major waterways within the BSFNRRA have entrenched from approximately 1000 ft. (305 m) to 700 ft. (210 m).

Differential erosion of the sedimentary layers has created many areas strewn with gravels, cobbles, and/or boulders, and many promontories, overhanging cliffs, bluffs, or rockhouses as well as some of the areas attractions (Twin Arches, Needle Arch, Betty Branch, and the Chimneys at Station Camp). No true caves exist in the BSFNRRA; on the Cumberland Plateau, caves are the result of weathered limestone seams, and as any

limestone present near this area of the plateau is only recently exposed, cave formation has not yet occurred. However, rockhouses are prevalent throughout the park and give refuge to some peculiar endemics that were observed during this study including: *Arenaria cumberlandense* and *Eupatorium luciae-brauniae*. In some places, the gorge slope is nearly vertical; these steep gorge slopes, some of which are in excess of 150 m (Devil's Jump Overlook), yield very few areas that resemble flood plains at their bases. More often, narrow river benches persist, although these are still only occasionally found. Many streams drop suddenly from the plateau surface into deeply entrenched valleys, *e.g.* those near Yahoo Falls (Braun 1950). The gorge bottoms range from being flat, sandy, and almost beach-like to having extremely large boulder beds, which create much white-water. It is the gorge bottoms where the flora is recognizably unique.

The uplands are relatively flat with minor topographic fluctuations, however the topography is extremely dissected along water routes of even temporally wet tributaries. Since topography influences water run-off, and the flow of the ground and surface waters, and because sandstones cannot retain much water, the riparian areas are prone to extreme flash flooding. As well as affecting ground-water relations, topography influences climate (Dickson 1960), therefore a region of high relief is climatically different from that with low relief, given that the areas are similar geographically. The myriad highly dissected, steep walled gorges, with a continuum of different aspects, provide great microclimate variation.

Ponds are extremely rare, where present they are probably not natural, and to my knowledge there are no natural glade areas within the park boundary; however, there are formations resembling ponds or newly forming glades adjacent to many of the oil wells as this was a contingency intended to pool water containing pollutants. These areas are beginning to develop wetland vegetation, as is evidence by *Carex*, *Sagittaria*, and *Typha*. One other notable area that may be beginning wetland succession is the gorge valley along No Business Creek. This area is strewn with the remains of several old homesteads, the inhabitants of which must have stacked the countless large rocks forming the long rows that are there, probably for irrigation. As this area is no longer home to humans, beavers have built dams, effectively using the irrigative walls to greatly flood this valley.

## Soils

According to Braun (1950), the BSFNRRRA is within the Melanized zonal soil group, which includes the dark, anion absorbing, most highly productive soils of the continent; these are the soils that support the central deciduous forests. These soils occupy the geographic position between the northern podzolized soils and the southern lateritic soils. This soil type geographically aligns with the Mixed Mesophytic Forest and the Western Mesophytic Forest Region (Braun 1950).

Since soil derivation comes chiefly from the parent bedrock, which is geologically layered and thus horizontally stratified, different soils are present at different elevations. The soils vary from a sandy to a clay loam and, at the lowermost elevations, the riverbed has been scoured to reveal limestone bedrock. Limestone soils are rare within the

BSFNRRRA; there is a limestone-based tributary entering the SFR, approximately 1 mile south of Station Camp parking area along the East River trail. Adjacent to this tributary is a short limestone ridge that runs parallel to the river. Most soils are derived from the sandstone, conglomeritic, and shale bedrock. Limestone is only found in the park at the bottoms of the gorges, mostly to the northern extremities of the park, and, in general, is still under water or prone to flooding and destructive riparian forces through much of the year. It is likely that this is the reason that many calciphiles are rare in this area of the plateau.

The upland soils of the Cumberland Plateau are formed from Pottsville sandstone, shale, silt, and rarely clay; they are shallow, severely leached, loamy in texture, typically low in fertility with respect to phosphorus, and predominantly classified as Ultisols and Inceptisols (Jared 1973). These include the following soil types: Clarkrange, Dekalb, Gilpin, Hartsells, Lonewood, Muse, and Wellston. The sloping areas also tend to have shallow soils, often with coarse fragments projecting through the profile. These are a gravelly or silty, rarely clayey loams. Slope soil types are: Trappist, Tate, Shelocta, Ramsey, and Jefferson. Lastly, the riverine or floodplain soils are sandy, often friable, loams of the Sequatchie or Pope types (USACOE 1980).

## **Climate**

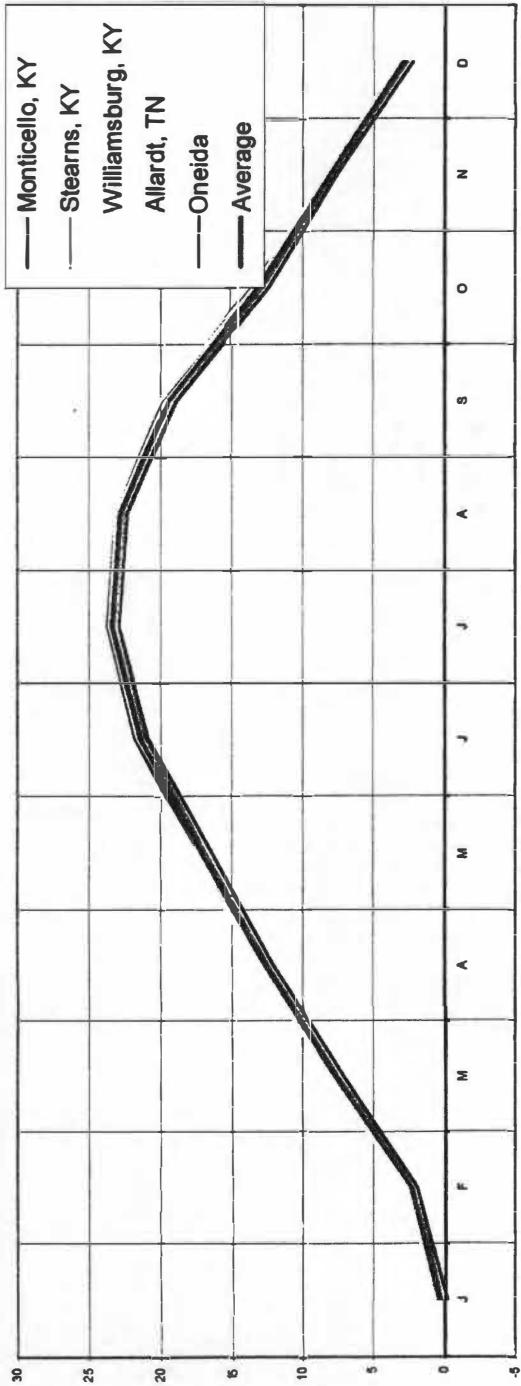
The BSFNRRRA lies in a portion of the southeastern USA that has mild winters and humid, warm to hot summers. There is marked microclimate variability, especially in north facing cool air drainages along tributaries, in and around rockhouses, and at the

bottoms of the gorges. The average annual temperature is 55° F (13° C); the mean maximum and minimum temperatures in January are 50° F (10° C) and 29° F (-2° C), respectively. The mean maximum and minimum temperatures in July are 88° F (31° C) and 65° F (18° C), respectively (Dickson 1960). The growing season is 170 days. In Tennessee, the average decrease in temperature, as a result of increase in elevation is 3° F for every 1000 ft. (305 m). Figure 5 illustrates the average monthly temperature of five weather stations (Monticello, KY; Stearns, KY; Williamsburg, KY; Allardt, TN; and Oneida, TN) near the BSFNRRRA; weather station distribution is also included in the table. The data are from: Climatology of the United States, National Oceanic and Atmospheric Administration:

(<http://www5.ncdc.noaa.gov/pubs/publications.html#CLIM81>)

Prevailing winds from the south and southwest bring warm, moist air from the Gulf of Mexico up through this area of the country. The average annual precipitation is 50-55 inches (133 cm) with flooding most likely from December through March, although summer flash flooding is common. Figure 6 illustrates the average monthly precipitation of five weather stations (Monticello, KY; Stearns, KY; Williamsburg, KY; Allardt, TN; and Oneida, TN) near the BSFNRRRA; weather station distribution is also included in the table. The data are from: Climatology of the United States National Oceanic and Atmospheric Administration:

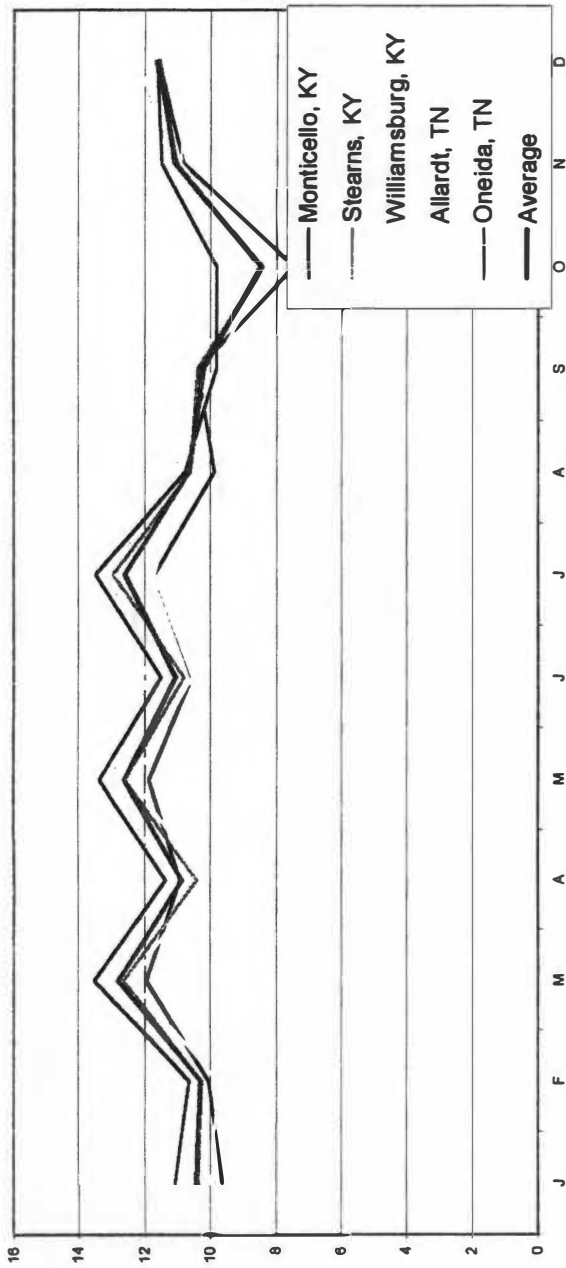
(<http://www5.ncdc.noaa.gov/pubs/publications.html#CLIM81>)



| Station         | State | Longitude | Latitude | Elevation |
|-----------------|-------|-----------|----------|-----------|
| MONTICELLO 3 NE | KY    | -84.83    | 36.87    | 298.4     |
| STEARNS         | KY    | -84.48    | 36.67    | 371.86    |
| WILLIAMSBURG    | KY    | -84.15    | 36.73    | 304.8     |
| ALLARDT         | TN    | -84.87    | 36.38    | 510.54    |
| ONEIDA          | TN    | -84.53    | 36.5     | 438.91    |

**Figure 5.**  
**Average Monthly Temperature for Five Weather Stations.**  
**X-axis, Monthly Average Temperature (Celsius); Y-axis, Month**

Climatology of the US Nat.Oceanic and Atmospheric Admin. (<http://www5.ncdc.noaa.gov/pubs/publications.html#CLIM81>)



| Station         | State | Longitude | Latitude | Elevation |
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| ALLARDT         | TN    | -84.87    | 36.38    | 510.54    |
| ONEIDA          | TN    | -84.53    | 36.5     | 438.91    |

**Figure 6.**

**Average Monthly Precipitation for Five Weather Stations.**

**X-axis, Monthly Average Precipitation (cm); Y-axis, Month**

Climatology of the US Nat.Oceanic and Atmospheric Admin. (<http://www5.ncdc.noaa.gov/pubs/publications.html#CLIM81>)

The northern part of the SFR is somewhat calmed by pooling because of Lake Cumberland, however the southern parts of the river show considerable variation associated with amount of rainfall. The lightest precipitation occurs in late summer through the fall. Snowfall is intermittent and is usually greater than 10 inches per year; since the winter temperatures are mild, snow does not remain on the ground for more than a few days.

With adiabatic pressure increasing the amount of rain, and general cooling associated with a rise in elevation, the Cumberland Plateau physiographic province has a lower average temperature and a higher average rainfall than adjacent areas with lower elevations, therefore the BSFNRRA is generally a little wetter and few degrees cooler than adjacent areas in the Ridge and Valley and western Highland Rim physiographic provinces.

## Chapter 4: Forests and Vegetation

### Forests

Although plants have certainly occupied the southern Appalachians since the Allegheny orogeny in the late Carboniferous or early Permian [~250 m.y.a.], broad-leaved forests in eastern North America had become dominant by the Cretaceous period [146-65 m.y.a.]. Ancient genera, many of which are still common in the southeastern USA, were present including: *Acer*, *Celtis*, *Diospyros*, *Fagus*, *Juglans*, *Liriodendron*, *Magnolia*, *Pinus*, *Populus*, *Quercus*, *Salix*, and *Thuja*. However, Tertiary [65-1.8 m.y.a.] floras were more modern in generic composition than those of the Cretaceous and are the supposed ancestral type of the present Mixed Mesophytic Forest association of the Cumberland Plateau (Braun 1950). The deciduous forest developed from the ancestral forests as the last glaciers retreated at the close of the Pleistocene (8000 y.a.), which allowed the climate to become warmer and drier (Braun 1950). Chaney (1944) hypothesized that forest communities shifted, intact, to habitats that are more suitable. Therefore, modern deciduous forests are relics of the older Arcto-Tertiary Geoflora. This hypothesis was also supported by Braun (1950). Recent evidence from the Quaternary pollen record (Davis 1983) leads us to believe that during the many glacial-interglacial cycles, the eastern North American forest was modified many times; since interglacial intervals were geologically brief, rapid changes in forest location and composition took place. Wolfe (1976; 1978) believes that a number of major climatic changes during the Tertiary led to local changes in abundances of various components of the Tertiary flora and that climatic changes caused local adaptations rather than migrations of intact plant communities. It is likely that the deciduous tree species growing in our forests that have

persisted since the Tertiary are aggressive species that have been able to move rapidly onto de-glaciated territory. With this in mind, one may consider that any species that has not been able to disperse its seeds easily, to extend its range, and penetrate forest communities, has become rare (Davis 1983).

The southern Appalachians, including the Cumberland Plateau, are unique in that they represent the oldest landmass in eastern North America unaffected by either marine waters of the Tertiary or glaciation of the Pleistocene (Sharp 1970). Some think that the southern Appalachians, due to their longevity, served as an “inoculum” for the present northern and coastal plain vegetation types (Sharp 1970; Little 1970; Braun 1950). Davis (1983) claims that the fossil record of the deciduous forest shows it completely displaced from the Appalachian Mountains. She thinks that the deciduous forest communities of eastern North America are a grab bag of species with characteristics that have enabled them to survive the unstable environments of the Quaternary (species with rapid dispersal and colonization abilities would have been highly selected). She writes that during the Quaternary, deciduous angiosperms were displaced from the Appalachian Mountains surviving in small populations in the lower Mississippi Valley or the southern Coastal Plain and that even throughout the Holocene species ranges and distributions have changed. This is in agreement with Comes and Kadereit (1998) who recognize that plant communities are impertinent and non-recurring over a long period of time due to (1) species specific rates and directions of spread, (2) an inability of some taxa to invade areas already populated by other taxa, and (3) differential rates of extinction in refugial areas.

Apart from the inception of the eastern deciduous forest, the age of the Cumberland Plateau vegetation may be realized with respect to the number and abundance of phylogenetically primitive genera such as *Aristolochia*, *Asimina*, *Calycanthus*, *Lindera*, *Liriodendron*, *Magnolia*, and *Pyrularia* which suggests that the region has been continually vegetated since before the last period of glaciation.

Braun (1950) placed the area encompassing what is now the BSFNRRA in the Mixed Mesophytic Forest region. This is the most complex and the oldest association of the Deciduous Forest Formation, which occupies the central position of the deciduous forest. This forest association is also among the most biologically rich systems of the temperate regions of the world (Hinkle *et al.* 1993). Climax forest associations are typically designated based on a number of upper canopy species (Braun 1950). Little (1970) gives us insight as to why:

“Trees have obvious advantages as examples in studies of plant geography. They are an artificial group with representatives from many plant families. As large conspicuous plants, they are easily seen and, with few exceptions, readily identified. Their economic value has made them important. Lastly, the number of species is small enough for convenient study. As a result, trees and their ranges are relatively well known. Moreover, they have a better fossil record than herbaceous plants.”

Upper canopy species that Braun (1950) used to delimit a mixed mesophytic community include: *Acer saccharum*, *Castanea dentata*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Quercus alba*, *Q. rubra*, several species of *Tilia* (except *T. americana*), and *Tsuga canadensis*. Subcanopy species include *Acer pensylvanicum*, *Amelanchier arborea*, *Carpinus caroliniana*, *Cercis canadensis*, *Cornus florida*, *Ilex opaca*, *Magnolia fraseri*, *M. tripetala*, *M. macrophylla*, *Ostrya virginiana*, and *Oxydendrum arboreum*. Small trees, shrubs, and vines present in this climax community include: *Aralia spinosa*, *Aristolochia macrophylla*, *Asimina triloba*, *Celastrus scandens*, *Clethra acuminata*, *Cornus alternifolia*, *Euonymus americanus*, *E. atropurpureus*, *Hamamelis virginiana*, *Hydrangea arborescens*, *Lindera benzoin*, *Parthenocissus quinquefolia*, *Pyrularia pubera*, *Ribes cynosbati*, *Sambucus canadensis*, *Smilax tamnoides*, *Stewartia ovata*, *Viburnum acerifolium*, and *Vitis* spp. According to Braun (1950), this climax forest is not universally present within its predicted area, which may have pre-climax vegetation that resembles the climax vegetation of other regions. Her ideas are further addressed by Smalley (1982) who more accurately gives insight to the vegetational patterns present on the plateau surface.

“Braun (1950) assigned the Cumberland Plateau in Tennessee and northern Alabama to the Cliff Section of the Mixed Mesophytic Forest Region, although mixed-oak and oak-hickory communities were dominant and mixed mesophytic communities were restricted to coves and gorges. This assignment was made on the supposition that mixed mesophytic communities would be

dominant when the Plateau became maturely dissected. It would have been more meaningful to classify and map existing vegetation patterns, not those which may develop millennia from now.”

In a regional study of plateau vegetation in Tennessee, Hinkle (1978; 1989) concluded that Mixed Mesophytic forests were generally lacking. He also suggested that the term oak-hickory should not be applied to the plateau uplands because hickories do not account for much of the importance value of oak dominated communities (hickories show stronger importance values on gorge slopes). Hinkle (1989) also wrote that *Pinus virginiana* dominates cliff edges, narrow ridges, and places with shallow soil. With respect to the Uplands, he concluded that mixed-oak forests are the dominant vegetative association. Lastly, Hinkle (1989) found that the Mixed Mesophytic communities of Braun (1950) were restricted to protected sites with deep, nutrient rich soils of escarpment slopes, coves, and deeper ravines, and although oftentimes Mixed Mesophytic indicator species were present, their importance values were often secondary to oak and hickory species.

With increased distance from the Cumberland Mountains, the Mixed Mesophytic Forest is progressively restricted to valleys, coves, or north facing, or protected slopes. Caplenor (1965) found Mixed Mesophytic Forest communities within the gorges of Fall Creek Falls State Park and Quarterman (1972) described the only large virgin tract of the Mixed Mesophytic community in Tennessee (Savage Gulf).

Deciduous forests originally covered much of the land surface of the USA east of the 98<sup>th</sup> meridian (approximately Dallas, Texas). This area, although sufficiently similar throughout to permit one great vegetation type, is far from uniform in climate, soil, topography, stage of erosion cycle, and age of the land surface (Braun 1950). Presently, most of the land area of the BSFNRRA is forested, but the forests are not virgin; before becoming protected, most of the land was heavily exploited for its timber and mineral resources—the Stearns Mining & Timber Company owned more than 200,000 acres. Appendix C of the BSFNRRA Final Environmental Impact Statement (U.S. Army Corps of Engineers, 1976) lists more than fifty trees indigenous to this area, many of which were highly sought. Selective logging occurred in the BSFNRRA in stages, as it did in most places. *Acer*, *Betula*, *Carpinus*, *Carya*, *Castanea*, *Fagus*, *Quercus*, *Prunus*, and *Tilia* species were important hardwoods that were cut from this area. Among the softwoods, *Liriodendron tulipifera* was highly desired, but *Pinus strobus* and *Juniperus virginiana* were also logged. Building the Southern Railway between Cincinnati, Ohio and Chattanooga, Tennessee in the 1870's created a demand for railroad ties and gave the logging industry an initial boost toward eventual deforestation of the area. Many years of both coalmining and clear-cutting have had great effects on the land. The heavy exploitation ended around 1950 when the land was almost completely deforested and the last people moved out of what is now the BSFNRRA in the 1960's (Coleman & Smith 1996).

Baer (1982) claims that approximately three-fourths of the land surface of the Appalachian Plateaus region is covered with secondary-growth. He states that the

majority of today's forest stands represent successional stages in the natural return to the regional climax associations or primary forest types described by Braun (1950) and Kuchler (1964).

Under the best conditions, a Mixed Mesophytic community will return to an area after a single clear-cutting due to rapid growth of the trees of the lower layers. However, many second-growth stands form oak-hickory and/or scrub pine (*Pinus virginiana*) - based communities because of drier local conditions created by the destruction of the original forest. Braun (1950) describes the aforementioned communities as seral stages of the mixed mesophytic community. However, one may argue that since we live in a period of man-altered environments, the forests may never return to their "original" or virgin state.

## **Vegetation**

Investigators have described many different plant communities for associative vegetative types on the Cumberland Plateau. Safley (1970) distinguished twenty-two forest community types, Schmalzer (1978) differentiated ten community types, Allawos (1994) delineated seven broad habitat types and six major forest communities within the gorge woodland habitat, Bailey (1998) described six broad habitats within the riparian habitat alone, and even Walck (1996) distinguished 3 habitats within a rockhouse. Other Cumberland Plateau vegetative communities are described in Sherman (1958), Caplenor (1965), Smalley (1982), and Hinkle (1989). The myriad different habitats or communities, described by different investigators, are often difficult to distinguish and

oftentimes are continuous from one to another. Goodson (2000) noted that the five broad forest types that were recognized by the US Dept. of the Army (USACOE 1976) are similar to those described by Safley (1970) and Allawos (1994). These are as follows: (1) *Acer saccharum*-*Fagus grandifolia*-*Betula allegheniensis*, (2) mixed oak, (3) mixed pine, (4) *Platanus occidentalis*-*Betula nigra*, and (5) *Tsuga canadensis*. Four extremely broad vegetative generalizations can be made without having to survey an area to place it in a vegetative community. Topology alone may allow differentiation between Upland Plateau, Gorge Slopes, Alluvial Woods, and Riparian habitats; however, even these are difficult to delineate. A brief vegetative characterization by other authors follows.

The Alluvial Woods, which extend from the bottoms of the gorges to the gorge slopes, are characterized by the presence of *Betula nigra*, *Carpinus caroliniana*, *Fraxinus pensylvanica*, *Lindera benzoin*, *Liquidambar styraciflua*, *Magnolia macrophylla*, and *Platanus occidentalis*. Directly adjacent to the riverbank, in the riparian habitat are populations of *Alnus serrulata*, *Cephalanthus occidentalis*, *Conradina verticillata*, *Cornus amomum*, and *Salix nigra*, which dominate the vegetative landscape (Safley 1970; Allawos 1994; Bailey 1998).

Gorge slopes often show a high degree of vegetative variability due to their many different soil conditions, slopes, and aspects (Goodson 2000). Although the following species are not found in all slope habitats, they are often dominant in many. *Acer pensylvanicum*, *A. rubrum*, *A. saccharum*, *Aesculus flava*, *Betula allegheniensis*, *Carya* spp., *Fagus grandifolia*, *Liriodendron tulipifera*, *Nyssa sylvatica*, *Quercus* spp., and

*Tsuga canadensis* dominate the overstory while such species as *Calycanthus floridus*, *Cornus florida*, *Kalmia latifolia*, *Pyrularia pubera*, *Rhododendron* spp., and *Viburnum acerifolium* typify the understory. In contrast to most other gorge slope communities, hemlock dominated communities have a very sparse understory consisting mainly of *Rhododendron maximum* and *Mitchella repens* (Safley 1970; Allawos 1994; Bailey 1998).

The Upland Plateau, surrounding the Gorge Slopes, is typically xeric and dominated by a mixed oak forest consisting of: *Quercus alba*, *Q. coccinea*, *Q. montana*, *Q. velutina*, and *Q. rubra* (Hinkle 1989). Other species sometimes present, depending on edaphic factors, are: *Buxella brachycera*, *Gaultheria procumbens*, *Gaylussacia baccata*, *Pinus echinata*, *P. virginiana*, *Kalmia latifolia*, and *Vaccinium* spp. (Safley 1970; Allawos 1994; Bailey 1998).

Worth mentioning here, are rockhouses, which are common and contain specialized microhabitats found throughout this section of the Cumberland Plateau; these shallow depressions in the vertical cliffs, caused by differential erosion, support unique floras. Rockhouses are typically characterized by herbaceous species such as *Arenaria cumberlandense* and *Eupatorium luciae-brauniae*, but they are a source of unusual woody species such as *Vaccinium erythrocarpum*.

As was mentioned in the section on topography and physiography, there are many different moisture regimes, soil types, light intensities, exposures, and slope gradients.

With all of these variants, the vegetation of the BSFNRRA is extremely diverse (USACOE 1980). The most obvious constraint causing the absence of some taxa that are typically present in areas surrounding, or near to the BSFNRRA, is the lack of limestone-based soil. This matter will be addressed more thoroughly in the following Discussion section.

### **Vegetational Distributions beyond the BSFNRRA**

As stated above, the Southern Appalachians are a relatively ancient landmass, harboring many phylogenetically ancient genera. A brief summary of the interesting extended vegetational distributions for woody plants of the BSFNRRA may help illuminate the importance and age of the vegetation of this area. The information gathered below is from Little (1970) and Sharp (1955; 1970) and only contains those taxa that are present in the study area (or just beyond).

1. Genera that are endemic to the eastern United States: *Asimina* and *Oxydendrum*.
2. Tree species endemic to the Southern Appalachians: *Aesculus flava*, *Clethra acuminata*, *Magnolia fraseri*, *Rhododendron catawbiense*, *Robinia hispida*, and *Stewartia ovata*.
3. Northern tree species continuous to the Southern Appalachians: *Acer pensylvanicum*, *Amelanchier laevis*, *Betula allegheniensis*, *Castanea dentata*, *Ilex montana*, *Malus*

*coronaria*, *Pinus strobus*, *Rhododendron maximum*, and *Tsuga canadensis*.

4. Northern tree species disjunct in the Southern Appalachians:  
*Populus grandidentata* and *Thuja occidentalis*.
5. Taxa of the entire United States: *Acer negundo*, *Cephalanthus occidentalis*, *Dirca*, *Calycanthus*, *Corylus*, and *Rhododendron*.
6. A taxon that is restricted to the Appalachians and the Ozarkian highlands is *Magnolia tripetala*.
7. Genera restricted to eastern Asia and eastern North America:  
*Carya*, *Catalpa*, *Chionanthus*, *Cladrastis*, *Hamamelis*,  
*Liriodendron*, *Magnolia*, *Nyssa*, *Sassafras*, and *Stewartia*.
8. Taxa restricted to eastern North America and the highlands of Mexico and Central America: *Chimaphila maculata*, *Cornus florida*, and *Pinus strobus*.
9. Taxa with a tricentric distribution in eastern North America, northern Latin America, and eastern Asia: *Liquidambar*,  
*Mitchella repens*, and *Hamamelis*.

Although many different interesting explanations for the disjunct and/or vicarious distributions may be offered (long-range dispersal, the Bering Land Bridge, continental drift, or even a “hop” from Europe to Greenland to North America), it remains that the southern Appalachian (including the Cumberland Plateau) flora is an extremely complex and unique system, especially with respect to other North American or northern

temperate floras. Sharp (1955) believed that the Tennessee flora, which has many tropical and subtropical affinities is a depauperate remnant of a richer Tertiary forest and that the loss of taxa from Tennessee has not been compensated for by migration or evolution. He came up with this idea when comparing Tennessee to Guatemala, which have approximately the same area, yet Tennessee is much less rich. This seems very insightful in light of the ideas presented by Wolfe (1979) and Davis (1983), mentioned above, that those species that are not able to adapt or disperse will become less dominant or extinct. He thought that as a whole these forests are dynamic remnants, in decline (geologically speaking), with ever evolving communities, and worthy of or best efforts toward their protection.

## Chapter 5: Methods

### Methods

Approximately 50 collection trips (some of which were 2 days) were made over two growing seasons from March 7, 1999 to September 11, 2000. On many occasions, excellent field botanists accompanied me during forays; these people are noted in the Acknowledgements section of this work. For most of the collecting trips, a UT motor pool vehicle was used; however, access to other localities was via my personal four-wheel drive vehicle, Kawasaki "Mule", boat, canoe, or the UT Canoeing and Hiking Club whitewater rafts.

The first year was an attempt to collect as many species as possible while visiting as many different habitats as may be present in the collecting area. Very few localities were visited more than once due to the size of the study area. Those localities that were visited more than once include Honey Creek, Burnt Mill Bridge, Blue Heron, Yahoo Falls, and Leatherwood Ford due to the obvious richness of the forests surrounding these areas. The winter interim provided time to compose a list of all of the possible woody plants from the northern Cumberland Plateau in Tennessee (Chester *et al.* 1993; 1997) and those from McCreary County, Kentucky (Ron Jones, Atlas of Kentucky in progress). This list was generated by examining all of the counties that include, or are adjacent to, the study area (on the Cumberland Plateau in TN). The list was used to try to generate focused collecting trips to habitats where elusive taxa may be present.

Due to the large land area that makes up the BSFNRRA, no vegetative sampling methods were performed, however, the author believes that all of the unique habitats represented by the physiography were adequately examined.

Collections were tentatively identified in the field and carried back to the herbarium where they were prepared according to standard herbarium procedures using the equipment in the University of Tennessee Herbarium. It is worth noting that, due to the thickness of the stems of most woody plants or their cones or fruits, the plant press contained polyurethane foam in the manner described in Chmielewski and Ringius (1986). This method is recommended by the author for the preservation of specimens with thick parts because it kept the leaves from wrinkling in the gaps usually created by thick stems or fruits.

Various sources were used for identification of plant specimens including: Core & Ammons (1958), Gleason & Cronquist (1991), Duncan (1967), Duncan & Duncan (1988), Godfrey (1988), Fernald (1950), Holmgren *et al.* (1998), Kron (1987), Radford *et al.* (1968), Swanson (1994), Wofford (1989), and Wofford & Chester (in manuscript). After identification, all specimens were checked against those in the University of Tennessee Herbarium (TENN).

Voucher specimens for each taxon are deposited in the University of Tennessee Herbarium (TENN) and the collections at the BSFNRRA; other specimens may be

deposited elsewhere at a later date. At least one digital image of each species collected is contained on a companion CD deposited at TENN and at the BSFNRRRA.

Population status reports for federal or state (TN and KY) listed species were prepared for each listed taxon and given to the National Park Service at the request of Robert Emmott, BSFNRRRA. These reports include information on location, approximate number of individuals, associated taxa, and possible threats to survival.

Field records for collected specimens were immediately transferred to a computerized database file in the Microsoft Access 2000 format. Data fields for this database include collection number, family, genus, species, intraspecific unit, introduced status, authority, synonyms, common names, location, quadrangle map name, county, state, collection date, accompanying collectors, plant notes (presence or absence of flowers or fruits, their color, *etc.*). This database is present on the companion CD deposited at TENN and the BSFNRRRA.

### **Checklist Format**

The genera, keys to species, and annotations are arranged alphabetically by genus and then species following the artificial key to the genera. If there is more than one species present in a genus then the key to species follows the genus name, which is in bold text. If only one species is present or exists for the genus in this area, then the scientific name follows the bold heading for the genus. Following the scientific name and authority is/are the common name(s). This information is followed by common habit,

range, and additional identifying characters if needed. Distribution or the author's perception of abundance was recorded according to Murrell (1987), which is a modification of White's (1982) categories of abundance. Allawos (1994) also used these categories:

|            |                                                   |
|------------|---------------------------------------------------|
| Very rare  | A single location with a few individuals.         |
| Rare       | One or two locations in small populations.        |
| Scarce     | Several locations or scattered small populations. |
| Infrequent | Scattered locations throughout.                   |
| Occasional | Well distributed but not abundant.                |
| Frequent   | Generally encountered.                            |
| Common     | Characteristic and dominant.                      |

If the plant is very rare, listed, or exotic, additional notes or recommendations are also included. Lastly, invasive exotic rank, or federal or state listing information is included for TN, KY, or both. Exotic species are noted by having an asterisk before the scientific name. A few genera or species are included in the annotated checklist but were not in the key to genera or species due to their rarity or unlikelihood to become naturalized. These taxa are precluded by a double-asterisk. Finally, at the end of the keys and annotations are notes for three categories of species.

1. Taxa included in the key to genera, but not known from  
BSFNRRRA (they may be there).

2. Taxa collected in the BSFNRRA but excluded from the keys because they were introduced, are probably not going to spread, and are very rare to rare in terms of abundance.
3. Taxa that may be present or were reported from the area but for which vouchers are not available. Based on known records for these taxa, they are probably not present in the BSFNRRA.

It is worth mentioning here that oftentimes coordinates were taken in the field using a handheld GPS unit. These coordinates are available for most collections in the field notes provided on the companion CD accompanying this work. However, records of elevation and geographical coordinates for specimens collected during the first collecting season are not as accurate as those records made during the second collecting season. This is due to the government-introduced error, which until early Spring 2000 was inserted into the timing of the satellite based signals since the inception of the government sanctioned Global Positional System (GPS). This error certainly affected horizontal positioning and greatly affected vertical positioning.

### **Listed and Invasive Ranks**

Following each taxon, in the Key and Annotated Checklist, is the listed or invasive rank. State or Federal listings for Tennessee were extrapolated from Wofford & Chester (in manuscript) and invasive information was taken from the Tennessee Exotic Pest Plant Council (1996). Kentucky State listings and invasive plant information was extrapolated from the KY State Nature Preserve ([www.kynaturepreserves.org](http://www.kynaturepreserves.org)).

## **Distribution**

Methods of distribution analysis were adapted from Allawos (1994), which were adapted from Clements (1991) and Oxendine (1971). The following definitions are those used by Allawos (1994):

1. **Intraneous taxa:** taxa for which the study area is well within the natural extent of the range.
2. **Extraneous taxa:** taxa for which the study area approximately marks the extent of the range.
3. **Endemic taxa:** distributions are restricted to the Appalachian Plateau and Blue Ridge physiographic provinces (Fenneman 1938).
4. **Introduced taxa:** exotic species whose native range is well beyond the study area (often from another country or continent).

Taxa were characterized as either intraneous, extraneous, or endemic; they were also assigned to either a “northern”, “southern”, or “central” distributional category (Allawos 1994). Distribution was assigned using distribution information from Little (1971; 1977), VanderKloet (1988), USDA NRCS (1999), and Fernald (1950).

## Floristic Comparisons

Floristic comparisons, based on presence and absence data, were made between selected regional floras that the author felt were in some way comparable to the BSFNRRA. The data (Appendix 2) for all of the woody taxa in Tennessee as recognized by Wofford & Chester (in manuscript) and those known from the North Carolina section of the GSMNP (recognized by Radford 1969) were compiled from literative reports. Taxa that were recognized by various authors, but not recognized by either Wofford & Chester (in manuscript) or Radford (1969) were omitted from the list as possible misidentifications or specimens in need of identification verification (*i.e. Amelanchier stolonifera*, *Cornus stolonifera*, *Crataegus flava*, and *Crataegus pinetorum*). This was the case only if synonymy did not reveal current nomenclature for the taxon. Synonymy was checked according to Wofford & Chester (in manuscript) and Kartesz (1994). Since different investigators did not recognize the same intraspecific taxa, the varieties or subspecies were omitted in most cases (*Calycanthus floridus* var. *floridus* & *Calycanthus floridus* var. *glaucus*). Taxa that were collected in particular areas but are not native to those areas are designated by a "0" in Appendix 2. For example, *Albizia julibrissin*, which is not native to this country, was collected in the BSFNRRA, SG, PC, GSMNP, LBL, and LC. In addition, species like *Symphoricarpos orbicularis* that are native to some parts of Tennessee (BSFNRRA & PC) are not considered native to other parts (GSMNP).

## Definitions

Since this flora is restricted to the woody plants of the BSFNRRA and the floristic comparisons were made from woody taxa extrapolated from other works, some definitions are in order.

Due to the diversity of plants, it may be difficult to give absolute parameters to the definition of a woody plant in forests of the Temperate Zone. Although Clark (1972) recognizes that a strict definition for woody plant delimitation is certainly contestable, he offers the following definition: plants considered woody are those that do not die back approximately to ground level during the winter. Most of these also display secondary growth, although some (*Chimaphila maculata*, *Clematis virginiana*, and *Hypericum stragulum*) do not. Clark's (1972) definition of a woody plant and those species recognized as woody in the "The Trees, Shrubs, and Woody Vines of Tennessee" (Wofford & Chester in manuscript), are the criteria used here. Shanks' (1952) checklist, although listing woody plants, does not give a formal definition for the term. Duncan & Duncan (1988) give the following useful definitions for trees and shrubs. A tree is a plant with a perennial trunk, a minimum height of 13 ft (4m), and a diameter at breast height of at least 3 inches (7.5cm) (*Carya* spp., *Fraxinus* spp., and *Quercus* spp.). A shrub is a woody plant smaller than tree size, frequently with several branches at or near the base (*Cephalanthus americanus*, *Spiraea virginiana*, and *Vaccinium* spp.); shrubs are distinguishable from woody vines in that they do not require support from another plant or object (*Clematis virginiana*, *Vitis* spp., and *Wisteria frutescens*). Small trees are those that are of the secondary canopy and genetically incapable of reaching the upper canopy

(*Acer pensylvanicum*, *Cercis canadensis*, and *Cornus florida*). This habit category was also used by White (1982); he did not offer a formal definition. Lastly, a subshrub is a plant that is commonly either procumbent or generally shorter than 20 cm tall (*Chimaphila maculata*, *Epigaea repens*, and *Mitchella repens*). Habit designations in the database and in the annotated checklist are not those that the specimen was displaying at the time of collection, but rather of what the specimen is genetically capable (for example, a broken over *Cornus florida* might be shrubby due to injury, but it is commonly a small tree).

## Chapter 6: Results

### Floristic Summary

Altogether, 762 woody plant accessions to the database were made from the BSFNRRA. Additions to these field collections from existing herbarium vouchers and reported taxa from Allawos (1994), Bailey (1998), and Goodson (2000) yielded, 209 (183 native) species and lesser taxa in 111 (100 native) genera and 55 (51 native) families (Appendices 1 & 2). One hundred twenty-eight taxa were determined to be county records and *Magnolia fraseri*, collected in Scott County, is a physiographic record for the Cumberland Plateau in Tennessee. First time collections resulted in 64 county records in Scott County, 4 records in Fentress County, 19 records in Morgan County, and 6 records in Pickett County (Table 1). To my knowledge, the records from McCreary County are correct, although this is difficult to verify due to the incomplete Kentucky Atlas (Ron Jones, manuscript for Kentucky Atlas). Ninety-three county records were collected in Tennessee and 35 in Kentucky. This data is summarized in Table 1.

The BSFNRRA contains 67% of the species known from the Cumberland Plateau in Tennessee, which contains 271 native woody species (Table 2). The park also contains 84% of the native woody genera from the Cumberland Plateau in Tennessee, which contains 119 native woody genera (Table 2). Finally, the BSFNRRA contains 86% of the families known from the Cumberland Plateau in Tennessee (Table 2).

**Table 1.**  
**County Records.**

|                | Scott | Morgan | Fentress | Pickett | McCreary | TOTAL |
|----------------|-------|--------|----------|---------|----------|-------|
| County Records | 64    | 19     | 4        | 6       | 35       | 128   |

**Table 2.**  
**Comparison of Selected Regional Floras.**

|                                    | BSFNRRRA | Obed | SG   | FG   | WC   | FCF+ | PC   | GSMNP | GC   | BFM  | CM   | LBL  | LC   | TN     |
|------------------------------------|----------|------|------|------|------|------|------|-------|------|------|------|------|------|--------|
| <b>Families</b>                    | 51       | 49   | 44   | 48   | 45   | 39   | 48   | 48    | 44   | 37   | 45   | 46   | 35   | 84     |
| % of total from TN                 | 80       | 77   | 69   | 75   | 70   | 61   | 75   | 75    | 69   | 58   | 70   | 72   | -    | -      |
| # known from respective P.P.       | 59       | 59   | 59   | 59   | 59   | 59   | 59   | 55    | 55   | 55   | 55   | 52   | -    | -      |
| % of total from respective P.P.    | 86       | 83   | 75   | 81   | 76   | 66   | 81   | 87    | 80   | 67   | 82   | 88   | -    | -      |
| <b>Genera</b>                      | 100      | 94   | 82   | 86   | 75   | 71   | 96   | 105   | 75   | 69   | 86   | 80   | 66   | 143    |
| % of total from TN                 | 70       | 66   | 58   | 61   | 53   | 50   | 68   | 74    | 53   | 49   | 61   | 56   | -    | -      |
| # known from respective P.P.       | 119      | 119  | 119  | 119  | 119  | 119  | 119  | 122   | 122  | 122  | 122  | 122  | -    | -      |
| % of total from respective P.P.    | 84       | 79   | 69   | 72   | 63   | 60   | 81   | 86    | 61   | 57   | 70   | 66   | -    | -      |
| <b>Species</b>                     | 181      | 150  | 136  | 136  | 105  | 100  | 167  | 206   | 109  | 110  | 152  | 141  | 99   | 358    |
| % of total from TN                 | 51       | 42   | 38   | 38   | 29   | 28   | 47   | 58    | 31   | 31   | 43   | 39   | -    | -      |
| # known from respective P.P.       | 271      | 271  | 271  | 271  | 271  | 271  | 271  | 285   | 285  | 285  | 285  | 285  | -    | -      |
| % of total from respective P.P.    | 67       | 55   | 50   | 50   | 39   | 37   | 62   | 72    | 38   | 39   | 53   | 49   | -    | -      |
| S/G Ratio                          | 1.6      | 1.6  | 1.7  | 1.6  | 1.4  | 1.4  | 1.7  | 2.0   | 1.5  | 1.6  | 1.8  | 1.8  | 1.5  | 2.50   |
| S/G Ratio for P.P.                 | 2.3      | 2.3  | 2.3  | 2.3  | 2.3  | 2.3  | 2.3  | 2.3   | 2.3  | 2.3  | 2.3  | 2.3  | -    | -      |
| S/F Ratio                          | 3.5      | 3.1  | 3.1  | 2.8  | 2.3  | 2.6  | 3.5  | 4.3   | 2.5  | 3.0  | 3.4  | 3.1  | 2.8  | 5.59   |
| S/F Ratio for P.P.                 | 4.6      | 4.6  | 4.6  | 4.6  | 4.6  | 4.6  | 4.6  | 5.2   | 5.2  | 5.2  | 5.2  | 5.5  | -    | -      |
| G/F Ratio                          | 2.0      | 1.9  | 1.9  | 1.8  | 1.7  | 1.8  | 2.0  | 2.2   | 1.7  | 1.9  | 1.9  | 1.7  | 1.9  | 2.23   |
| G/F Ratio for P.P.                 | 2.0      | 2.0  | 2.0  | 2.0  | 2.0  | 2.0  | 2.0  | 2.2   | 2.2  | 2.2  | 2.2  | 2.3  | -    | -      |
| Area km <sup>2</sup>               | 498      | 40   | 26   | ?    | 10   | 63   | 108  | 2104  | 10   | 20   | 20   | 688  | 2.2  | 109411 |
| F/Area                             | 0.1      | 1.2  | 1.7  | NA   | 4.5  | 0.6  | 0.4  | 0.0   | 4.4  | 1.9  | 2.3  | 0.1  | 15.9 | 0.0006 |
| G/Area                             | 0.2      | 2.4  | 3.2  | NA   | 7.5  | 1.1  | 0.9  | 0.0   | 7.5  | 3.5  | 4.3  | 0.1  | 30.0 | 0.0013 |
| S/Area                             | 0.4      | 3.8  | 5.2  | NA   | 10.5 | 1.6  | 1.5  | 0.1   | 10.9 | 5.5  | 7.6  | 0.2  | 45.0 | 0.0033 |
| G Similarity Index (with BSFNRRRA) | -        | 90.7 | 89.0 | 88.2 | 81.1 | 81.9 | 85.7 | 87.8  | 81.1 | 75.7 | 88.2 | 78.9 | 82.6 | -      |

P.P. = physiographic province

+ = Probably an incomplete floristic study

S,G,F = species, genera, families

Large native genera, based on the number of species and lesser taxa are *Quercus* (10 taxa); *Acer* and *Viburnum* (6 each); *Carya*, *Crataegus*, *Hypericum*, *Rhododendron*, *Rubus*, *Vaccinium*, and *Vitis* (5 each); and *Magnolia*, *Prunus*, *Smilax*, and *Ulmus* (4 each). In addition, there are 7 genera with 3 taxa, 10 genera with 2 taxa, and 69 monospecific genera. Stated differently, 69% of the genera are monospecific and 83% have three or fewer species.

Large families, based on the number of species and lesser taxa are the Rosaceae (25 taxa), Ericaceae (18), Fagaceae (13), Caprifoliaceae (9), Betulaceae, Juglandaceae, and Ulmaceae (7 each), Aceraceae and Vitaceae (6 each), Clusiaceae, Fabaceae, Magnoliaceae, and Salicaceae (5 each), and Pinaceae (4 taxa). In addition, there are six families with three taxa, nine families with two taxa, and twenty-one families with only one taxon. Forty-one percent of the families are monospecific and 71% have three or fewer species.

Of the natural and naturalized species, angiosperms greatly outnumber gymnosperms, 97.5% to 2.5%, respectively. Within the angiosperms, dicots greatly outnumber monocots, the dicots accounting for 95% of the angiosperms, with the remaining 2.5% being monocots (Table 3).

**Table 3.**  
**Broad Floristic Summary in Percent of Total.**

| Dicots | Monocots | Gymnosperms |
|--------|----------|-------------|
| 95     | 2.5      | 2.5         |

## Life Forms

Excluding those collected species that are not capable, or do not appear to be spreading (*Magnolia grandiflora* and *Salix babylonica*), the tree life form is the most abundant including 49% of the taxa. Considered separately, as trees and small trees, the shrub life form is the most abundant with 36.5% of the total. Trees account for 36%, small trees 13%, vines 10%, subshrubs 3.5%, and epiphytic shrubs .5% (Table 4).

## Listed Taxa

Federal or State listed taxa found in either Kentucky or Tennessee are *Berberis canadensis*, *Calycanthus floridus* var. *glaucus*, *Castanea dentata*, *Comptonia peregrina*, *Conradina verticillata*, *Fothergilla major*, *Juglans cinerea*, *Malus angustifolia*, *Populus grandidentata*, and *Spiraea virginiana* (Table 5). Since these taxa are differentially listed between states, and not all listed taxa were collected in each state, a summary may be more easily read from the table.

## Distribution Characteristics

Distribution analysis reveals that the majority of the woody species in the BSFNRRA are well within their absolute ranges. Forty-four percent are centrally located, or well within their natural range, which is only slightly “northerly” or “southerly”. Northern species and lesser taxa account for a greater percentage of the woody flora than do southern species, 27% and 14%, respectively. Five percent of the flora is endemic to the Southern Appalachians. (Table 6)

**Table 4.**  
**Life Form Summary in Percent of Total.**

| <b>Vines</b> | <b>Epiphytic Shrubs</b> | <b>Subshrubs</b> | <b>Shrubs</b> | <b>Small Trees</b> | <b>Trees</b> |
|--------------|-------------------------|------------------|---------------|--------------------|--------------|
| <b>10.3</b>  | <b>0.5</b>              | <b>3.4</b>       | <b>36.5</b>   | <b>13.3</b>        | <b>36</b>    |

**Table 5.**

**Federal and State Listed Taxa Within the BSNRRA for TN & KY.**

| Species                                  | Federal | State TN | State KY |
|------------------------------------------|---------|----------|----------|
| <i>Berberis canadensis</i>               | -       | SPS*     | E        |
| <i>Calycanthus floridus var. glaucus</i> | -       | - *      | T*       |
| <i>Castanea dentata</i>                  | -       | SPS*     | E        |
| <i>Castanea pumila</i>                   | -       | - *      | T        |
| <i>Comptonia peregrina</i>               | -       | E*       | E*       |
| <i>Conradina verticillata</i>            | T*      | T*       | E*       |
| <i>Fothergilla major</i>                 | -       | T*       | -        |
| <i>Hypericum prolificum</i>              | -       | - *      | HS       |
| <i>Juglans cinerea</i>                   | -       | T*       | SPS      |
| <i>Malus angustifolia</i>                | -       | -        | SPS*     |
| <i>Populus grandidentata</i>             | -       | SPS      | - *      |
| <i>Spiraea virginiana</i>                | T*      | E*       | T        |
| <i>Thuja occidentalis</i>                | -       | SPS*     | T*       |
| <i>Viburnum nudum</i>                    | -       | - *      | E        |

SPS : Special Concern Species

E : Endangered

T : Threatened

HS : Historical Species

- : Not Listed

\* : Voucher specimen present at TENN

Table 6.

Distributional Summary in Percent of Total.

| ENDEMIC |
|---------|
| 5       |

| EXOTIC |
|--------|
| 9      |

| INTRANEOUS |         |          |  |
|------------|---------|----------|--|
| NORTHERN   | CENTRAL | SOUTHERN |  |
| 17         | 42      | 6        |  |
|            |         |          |  |
| EXTRANEOUS |         |          |  |
| NORTHERN   | CENTRAL | SOUTHERN |  |
| 10         | 2       | 8        |  |
|            |         |          |  |
| 27         | 44      | 14       |  |

TOTAL

## **Introduced Taxa**

Introduced taxa account for 12% of the entire woody flora of the park. This number is slightly misleading because several of those introduced taxa are not apparently spreading. Elimination of those taxa that were planted and do not appear to be spreading reveals that 9% of the flora is exotic. These are: *Deutzia scabra*, *Euonymus alata*, *Hedera helix*, *Magnolia grandiflora*, *Picea* sp., *Prunus persica*, and *Salix babylonica* (Tables 6 & 7). This is in contrast to those rapidly spreading exotic plants that, to date, have become naturalized and are a distinct part of the flora, such as *Elaeagnus umbellata*, *Lonicera japonica*, and the out-of-control *Spiraea japonica*.

## **Key**

The key and annotated checklist (Appendix 1) is a compilation of the woody plants that were collected in all four complete floristic studies within the BSFNRRA (Allawos 1994; Bailey 1998; Goodson 2000; Shaw 2001) and those plants that, from existing distributions, may be there (some were reported from within the boundaries but vouchers do not exist, *e.g.* *Buckleya distichophylla* & *Styrax grandifolia*).

## **Floristic Comparison of Richness**

A woody plant comparison (Table 2, Figure 7) was made between the BSFNRRA, the Obed Wild and Scenic River (Obed), Savage Gulf (SG), Fall Creek Falls State Park (FCF), Fiery Gizzard Gorges (FG), Gee Creek Wilderness Area Cherokee National Forest (GC), Land Between the Lakes (LBL), Wolf Cove (WC), Prentice Cooper State Forest and Wildlife Management Area (PC), the Great Smoky Mountain National Park

**Table 7.**  
**A Summary of the Ranked Exotic Taxa.**

|                                            |    |
|--------------------------------------------|----|
| <i>Ailanthus altissima</i>                 | R1 |
| <i>Albizia julibrissin</i>                 | R2 |
| <i>Berberis thunbergii</i>                 | R2 |
| <i>Elaeagnus umbellata</i>                 | R1 |
| <i>Lespedeza bicolor</i>                   | R2 |
| <i>Ligustrum sinense</i>                   | R1 |
| <i>Lonicera japonica</i>                   | R1 |
| <i>Paulownia tomentosa</i>                 | R1 |
| <i>Populus alba</i>                        | R3 |
| <i>Pueraria montana</i> var. <i>lobata</i> | R1 |
| <i>Rosa multiflora</i>                     | R1 |
| <i>Rubus phoenocolasius</i>                | R3 |
| <i>Spiraea japonica</i>                    | R2 |
| <i>Vinca minor</i>                         | R2 |

R1: Rank 1, Severe Threat

R2: Rank 2, Significant Threat

R3: Rank 3, Lesser Threat

Ranks are according to the Tennessee Exotic Plant Management Manual (1996).

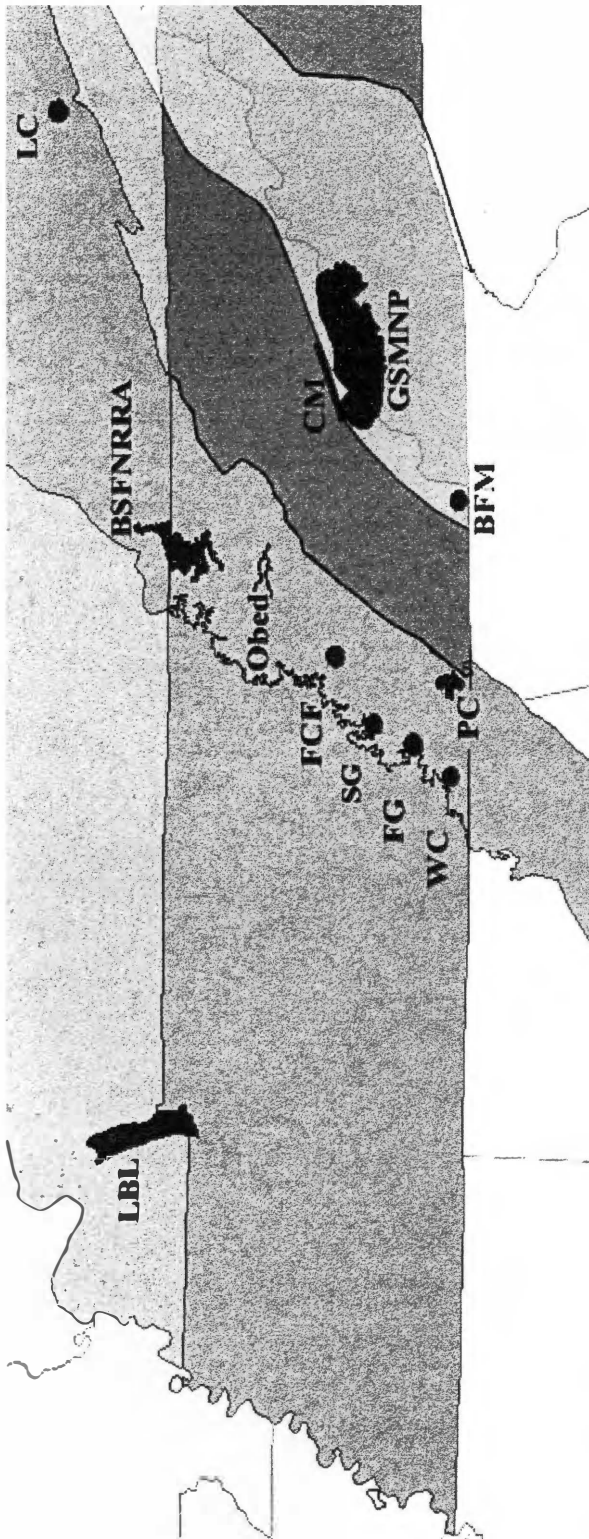


**Figure 7.**  
**Location of Selected Regional Floras for Floristic Comparison.**

| Big South Fork National River & Recreation Area |       | Prentice Cooper State Forest & Wildlife Management Area |
|-------------------------------------------------|-------|---------------------------------------------------------|
| BSFNRRA                                         | PC    | LC                                                      |
| Obed                                            | LBL   | Land Between the Lakes                                  |
| FCF                                             | LC    | Lilly Cornett Woods                                     |
| SG                                              | CM    | Chilhowee Mountain                                      |
| FG                                              | GSMNP | Great Smoky Mountain National Park                      |
| WC                                              | BFM   | Big Frog Mountain                                       |

(GSMNP), Big Frog Mountain (BFM), Chilhowee Mountain (CM), and Lilly Cornett Woods, Fletcher County, Kentucky (LC). These areas (Figure 7) were chosen based on their proximity to the BSFNRRA or placement on the Cumberland Plateau. The areas differ greatly with respect to area with the GSMNP being the largest by far at 2104 km<sup>2</sup>. This is four times larger than the BSFNRRA (498 km<sup>2</sup>), which is about 5 times larger than PC (108 km<sup>2</sup>). One thing to note is that the Fall Creek Falls study (Caplenor 1955; 1965; 1978) is incomplete floristically since it is restricted to the gorge slopes; however, it is in the comparison due to its proximity to the BSFNRRA.

In terms of richness, the work in this comparison confirmed the longstanding belief that the GSMNP is the most floristically rich natural reserve in this area. After adjustments due to synonymy, the GSMNP has 206 species in 105 genera in 48 families. Nevertheless, the BSFNRRA certainly rivals this, and at the familial level surpasses the richness of the GSMNP having 181 species in 100 genera in 51 families. The third richest area is PC with 167 species in 96 genera in 48 families. These and other values may be read from Table 2.

In comparing the natural area to its respective physiographic province, the GSMNP protects the most taxa; 87% of the families, 86% of the genera, and 72% of the species from the Blue Ridge physiographic province in TN and NC are protected within the boundaries of the GSMNP. Again, the BSFNRRA ranks just behind the GSMNP; it protects 86% of the families, 84 % of the genera, and 67% of the species known from the Cumberland Plateau in TN. Prentice Cooper is again ranked third protecting 81% of the

families, 81% of the genera, and 62% of the species from the Cumberland Plateau in TN.

These and other values may be read from Table 2.

Not all of the genera known from the Cumberland Plateau are protected within a natural reserve. Combining the floras of BSFNRRA, Obed, and PC reveals that 116 out of 120 genera are protected. Adding the other floras (SG, FG, WC, and FCF) does not improve this number. *Cotinus*, *Forestiera*, *Symplocos*, and *Taxus* are not known from any of these studies (*Symplocos* and *Taxus* are protected within Pickett State Park, TN). Interestingly, combining the floras of the BSFNRRA and the Obed yields an area comparable to, and numbers of taxa similar to those found in the GSMNP (BSFNRRA + Obed; 192 spp. in 105 genera) and if a couple of known taxa from Pickett State Park are also added (*Symplocos* and *Taxus*), the number of genera is also above that of the GSMNP.

The flora of the BSFNRRA is similar to other floras that are in this comparison. Similarity was calculated using  $S = (2C/(A+B)*100)$  where:

S = index of similarity

A = total genera of the BSFNRRA

B = total genera of comparison study area

C = total genera present in both areas

In calculating generic similarity, the Obed is the reserve found to be most similar to the BSFNRRA, which is not surprising since it is the closest. Other values may be observed in Table 2.

### **Companion Disc**

A companion CD, which contains all of the information contained herein, including my field notes, tables, figures, appendices, and digital images of at least one example of each collected taxon will be deposited in the University of Tennessee Herbarium (TENN) and the BSFNRRA.

### **Interesting Herbaceous Plants (and an alga) Observed**

The following plants were seen within the boundaries of the BSFNRRA, however most were not collected by the author. The number following each of the taxa below is the number of populations noted.

*Arenaria cumberlandensis* Wofford & Kral (2)

*Boldia erythrosiphon* (1)

*Cyperipedium acaule* Ait. (2)

*Eupatorium luciae-brauniae* Fern. (2)

*Marshallia grandiflora* Beadl. & Boynt (1)

*Monotropsis odorata* Schwein. (1)

*Panax quinquefolium* L. (3)

*Senecio pauperculus* Michx. (1)

*Solidago simplex* Kunth ssp. *randii* (Porter) Ringius var. *racemosa* (Greene) Ringius (2)

*Spigelia marilandica* L. (2)

## Chapter 7: Comparison

### Comparison

A woody plant comparison was made between the BSFNRRA, the Obed Wild and Scenic River (Obed), Schmalzer *et al.* (1985); Savage Gulf (SG), Wofford *et al.* (1979); Fall Creek Falls State Park (FCF), Caplenor (1955; 1965; 1978; 1979); Fiery Gizzard Gorges (FG), Clark (1966); Gee Creek Wilderness Area Cherokee National Forest (GC), Wyrick (1996); Land Between the Lakes (LBL), Chester *et al.* (1976); Wolf Cove (WC), Clements (1991); Prentice Cooper State Forest and Wildlife Management Area (PC), Beck (2000); the Great Smoky Mountain National Park (GSMNP), White (1982); Big Frog Mountain (BFM), Murrell (1987); Chilhowee Mountain (CM), Thomas (1966); and Lilly Cornett Woods, Fletcher County, Kentucky (LC), Sole *et al.* (1983) (See Table 2 & Figure 7). These areas were chosen based on their proximity to the BSFNRRA, their area, or their placement on the Cumberland Plateau. To my knowledge, this is the first comparison among these floras with exception of the initial comparison of Chilhowee Mountain to both the Cumberland Plateau and the GSMNP (Thomas 1966). Thomas initially believed that the Chilhowee Mountain flora would most closely resemble that of the Cumberland Plateau. His numbers showed the opposite, although he contended that if the flora of the Cumberland Plateau were better known the results might be different.

Other works that were initially considered, but omitted for various reasons are: (1) The Vegetation and Floristics of Five Gorges of the Cumberland Plateau (Sherman 1958), which could not be used in this comparison because the work was too restricted,

limited to those areas enclosed by steep, overhanging cliffs or the upper limits of the talus slopes. Another reason is that subshrubs such as *Chimaphila*, *Gaultheria*, and *Mitchella* were excluded. (2) Carpenter and Rumsey (1976) studied Robinson Forest in Breathitt County, KY; however, they too only collected trees and shrubs, omitting sub-shrubs and woody vines.

Botanical investigators have attempted to compare floras for decades. Floristic richness is most often evaluated in terms of sheer number of taxa in a given study. Others have attempted to use species-area curves or taxonomic ratios (See discussion below). However, all of these methods are in some way confounded with area and ecological heterogeneity. Below, I address problems with species-area and taxonomic ratio models and in-so-doing show why sheer numbers of taxa are not comparable. Lastly, I have proposed an alternative method for measuring the floristic richness of a natural area. A note of caution: with interpretation of the data compared herein, one should not forget to consider the effect of man-made taxonomic labels on the comparison; it is very possible that all genera may not be equal in terms of the evolutionary level that they represent.

### **Island Theory as Related to Preserves**

Because the methods described below are adapted from studies of island biogeography and nature preserves are in a sense “islands of refuge” in “seas” of disturbance, the following discussion is necessary.

Miller & White (1986) list many authors who have used an analogy between oceanic islands and nature preserves (*i.e.*, as development proceeds around the preserves, they become more isolated). A main point of disagreement comes from whether fewer large preserves or several smaller preserves totaling the same area is a better managerial or economic way to protect the greatest number of species; experimental work shows that each has its merits depending on the scale of the reserve as compared to the population pool that it is intended to protect (Higgs 1981). For example, if the population pool is very large, due to many differing habitats in a region, then fewer, smaller, scattered reserves may better protect the majority of the taxa in the pool. It should be noted that the terms population pool and reserve size are relative. Using the model of island biogeography, described by MacArthur and Wilson (1967), we can predict that preserve size is a prime determinant of both short-term and long-term species survival and thus reserve success (Miller & White 1986), although we need to realize a key distinction between islands and natural reserves. The richness within an area, whether it is an island or a nature reserve, is strongly influenced by the richness of the surrounding area and insular richness is not as influenced by contiguous species pools. White *et al.* (1984) stated that small islands cannot support as many species as similar sized reserves on a continent presumably because extinction rates increase with a decrease in total area; also, richness decreases as a function of distance from the population pool (Diamond 1975). With this in mind, it is not difficult to imagine that as development occurs around a preserved area (making it more “island-like”), the richness within the reserve is fated to decline. This may be reason alone to realize the importance of larger reserves like the BSFNRR, LBL, PC, and the GSMNP. Also, since richness of smaller islands is

determined by such factors as richness of, and proximity to the population pool, smaller reserves [*e.g.* Obed] that are near larger ones [*e.g.* BSFNRRRA] are expected to maintain a higher richness than if they stood alone (Diamond 1975).

### **The Species-Area Relation**

The species-area relationship has been used by ecologists, biogeographers, and life scientists to describe the positive relationship between species richness and geographic area (Kilburn 1966; Haas 1975; Sole *et al.* 1983; Miller & White 1986; Wade & Thompson 1991; Bennett 1997; Riklefs & Lovette 1999; Rey Benayas *et al.* 1999; and Lomolino 2000). In fact, it was fundamental to MacArthur & Wilson's equilibrium theory, which became the paradigm of island biogeography theory (Lomolino 2000). Although this relationship is broadly accepted, according to some its usefulness has been overlooked for evaluation of regional, county, and local floras (Sole *et al.* 1983 and Wade & Thompson 1991). The most simple model used is  $S = CA^z$ , where  $S$  = taxon richness,  $A$  = geographical area,  $C$  = a poorly understood constant, supposed to represent the expected richness of the area, which varies among habitats and ecosystems (Lomolino 2000), and  $z$  = the asymptote representative of increasing richness according to area. There are several variations on the simple model that attempt to make it linear, including taking the log of one side of the equation or the other or both (Wade & Thompson 1991). Kilburn (1966) suggests that a species-log area model gives the best fit for plants. However, there is quite a lot of controversy over what the  $C$  and  $z$  values truly mean. Haas (1975) alluded to the possible error associated with  $C$  and  $z$  when he wrote that they are fitted to the species and area data, and in-so-doing there is bound to be some error that

may produce uncertainty in the conclusions based on the model. Further complicating the use of the model is that both variables vary in natural communities (Brown & Lomolino 1998). As a rule of thumb, Diamond (1975) wrote that a tenfold increase in area results in a twofold increase in the number of taxa ( $z = .30$ ). Wade & Thompson (1991) suggested that the species-area model might be effective in comparison of floristic richness of different sized natural areas (commonly, sheer numbers of taxa are compared with disregard to areas that are significantly different). They reasoned that species-area curves could be used to compare “found” species richness to “expected” species richness of an area and objectively identify areas with exceptionally rich floras. Comparing several floras within the Mixed Mesophytic Forest Region, they found that the species-area curve explains 80% of the variation in number of species among study areas. This method would not work well with data collected in this study because, among other reasons described below, not all of the preserves are in the same forest type.

Discounting the discrepancy in the constant  $C$ , and focusing on the  $z$  value, which represents the slope of the line or the rate at which species increase with increasing area, I will further address the model in terms of island biogeography and then relate this to natural preserves.

Theoretically, very small islands do not conform to the model of increasing richness with increasing area (Figure 8). This is because of the “small island effect”

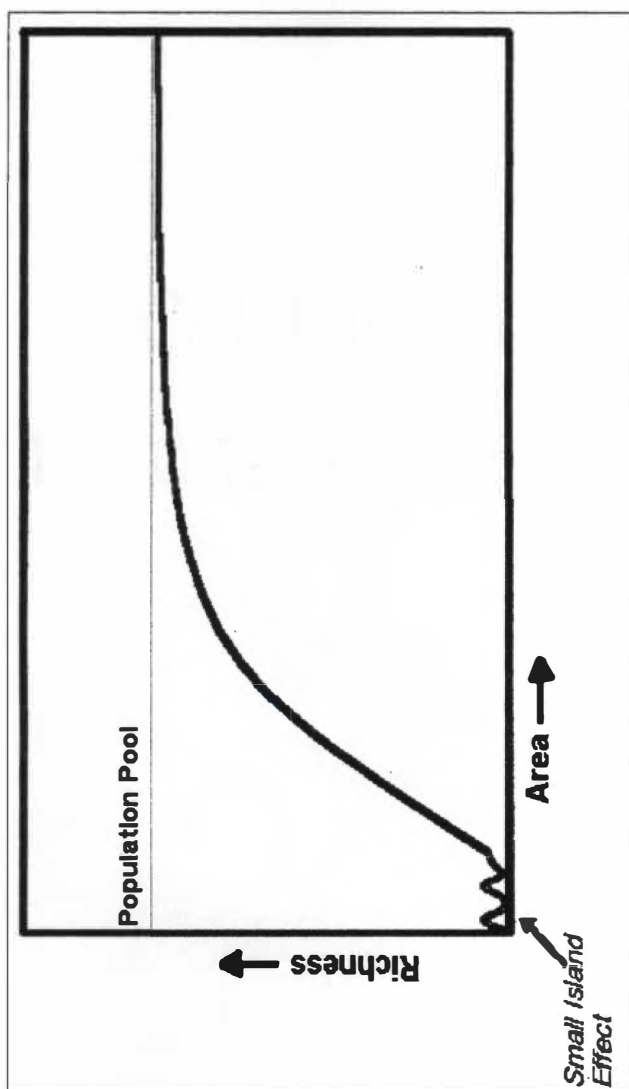


**Figure 8.**  
**Hypothetical Model For Species-Area Curve.**

(another problem with the species-area model), which, simply put, states that within a small area stochastic events are more likely to control richness values than are deterministic ecological or evolutionary trends. However, as island area increases, the probability of a random event having an effect on richness becomes less likely (and the model has a better fit). With further increase in island size, there is an associated increase in ecological heterogeneity resulting in greater richness until richness asymptotically approaches the value associated with the population pool (total population pool of the region, nearby continent, or the total number of taxa in the world). Another way of interpreting the model, from a collection or sampling perspective, is that for a relatively small area, less than 10 ha (Preston 1960, 1962), sampling may yield a small number of species simply based on the selected area, which is likely to only incorporate a single association type (the reverse is also true in that a relatively large richness value may be the result of the selected plot). As the sampling area is increased, the slope becomes steeper due to the higher probability of collecting different common taxa. However, the curve will finally become more gradual as the common species in that area are all collected and rarer taxa are collected at a much slower rate. This is in agreement with White *et al.* (1984) who found that rare plant species richness increased significantly faster than total vascular plant species richness with increasing area in the southern Appalachians.

Regardless of interpretation, it seems that on a large scale the model would be repeated within itself several times (each time approaching a numerically greater asymptote) as different habitats are incorporated with the increasing area. Eventually forming a “step-like” pattern, because richness will eventually increase again as the

geographic region becomes large enough to incorporate other or different factors such as: (1) overlap of floristic or physiographic regions, (2) a high rate of speciation for an area, (3) high rate of or recent disturbance, (4) introduction of ruderal and/or exotic taxa, (5) different edaphic factors, (6) or a different moisture regime. Monk (1971) summed this up when he wrote, "area acts as an environmental integrator". Anytime any of the above conditions are met, a new suite of common taxa would be illustrated as an increase in richness per area. Although intuitive to most biologists, this idea may be realized with an example from Miller & White (1986). Using known populations and theoretical modeling [for rare taxa] they showed that the GSMNP could be expanded towards Chilhowee Mountain, crossing over into a new physiographic province, and thus the GSMNP would gain "a number of distinct species characteristic of this biogeographic transition" (Miller & White 1986).

Areas found to have high species-area ratios are not necessarily to be interpreted as rich. This may be an exaggeration due to a relatively young flora. If an island lies above the species-area regression, the equilibrium interpretation is that the island is supersaturated and that it will eventually relax to its equilibrium number (Boecklen & Gotelli 1984). The number of taxa that an area can hold at equilibrium is a function of its area and isolation; larger reserves, and reserves located close to other reserves, can hold more taxa (Diamond 1975). Diamond (1975) further explains, "If most of the area of a habitat is destroyed, and a fraction of the area is saved as a reserve, the reserve will initially contain more species than it can hold at equilibrium. The excess will gradually go extinct. The smaller the reserve, the higher will be the extinction rate". However, a

statistical interpretation is that the island has a positive error, which may also be due to the abovementioned situation, habitat heterogeneity, resource availability, *etc.*; in which case the area will then show high richness values (Boecklen & Gotelli 1984).

Worth mentioning here are reasons for lower than expected species richness values (Wade & Thompson 1991): (1) low habitat diversity, (2) species data derived from plot sampling, (3) under collection, (4) restricted environments with a reduced flora, and (5) incomplete floristic invasion after disturbance.

Patterns of richness have also been associated with available environmental energy. Currie and Paquin (1987) contend that tree species richness in North America is attributed to available environmental energy as measured by annual levels of evapotranspiration. This species-energy model is just an extension of the species-area model (Qian 1998). In addition, taxonomic richness has been positively correlated with soil wetness, topographic slope, and variation (Rey Benayas 1999).

Because of the many intricacies, complications, and uncertainties described above, the species-area model is not applicable to a comparison between many natural areas. Future work on the data collected in this study may include regressions to compare reserves within like physiographic provinces of Tennessee and Kentucky.

## Taxonomic Ratios

Another measure of richness that has been used in floristic comparison is that of taxonomic diversity, which may be measured by taxonomic ratios: species/genus (S/G), species/family (S/F), and genera/family (G/F). Fenner *et al.* (1997) suggest that a flora in which species are distributed among numerous genera or higher taxa is likely to contain more genetic, character, and feature diversity than one in which the same number of species are concentrated into fewer larger genera. Taxonomic ratios have more often been used in biogeography, despite the likelihood that patterns in the ratios are a statistical artifact (Jarvinen 1982). Although ratios are tempting to use in floristic comparison (White 1983; Allawos 1994; and Fenner *et al.* 1997), there are at least three main problems with this as a metric of floristic measure. (1) The ratios of S/G, G/F, and S/F increase with an increase in area, with the taxa spanning the greatest hierarchical range having the steepest slope (Bennett 1997; Fenner *et al.* 1997). This was alluded to by White (1983) who recorded 1.9 S/G for North American disjunct taxa and 1.5 S/G for those represented in the GSMNP; simply put, his explanation for the difference was that on a continental scale there are additional taxa. (2) The G/S ratio may be similar in small study plots and in extensive rural districts (Jarvinen 1982 translated Palmgren 1925), and (3) the G/S ratios seem to be directly proportional to species numbers and therefore low numbers of species result in low G/S ratios for statistical reasons (Jarvinen 1982 translated Palmgren 1925; Fenner *et al.* 1997). Complicating the issue, G/S ratios are not only dependant on area but also other factors such as latitude (Jarvinen & Sammalisto 1976). Elton (1946) found decreasing richness within taxa with decreasing size of the habitat and community; he found that average S/G ratios were 1.22 for individual plant

communities and 4.2 for the data available on communities grouped together (Strong 1980), which he interpreted as an example of competitive exclusion. However, Williams (1947) found a contrasting pattern by comparing null communities with actual plant communities. He used random draws of species without consideration of the combinations or communities in which they normally exist. He found that S/G ratios in real communities on islands are higher than expected due to related species being aggregated in similar habitats rather than competitively excluding one another. The interpretation of observed versus modeled data might best be realized from the following segment of Strong (1980):

Grant (1966) and MacArthur & Wilson (1967)

rediscovered Elton's pattern, respectively among birds and other oceanic biotas. Cook (1969) found a 'related biogeographic pattern' between species richness and S/F ratios in the birds of North America. Ratios of S/F are correlated with local numbers of species. All three authors inferred interspecific competition as the cause of their patterns. Greenwood (1968) cautioned Grant by recalling Williams' work, which Simberloff (1970) generalized. Both Williams (1947) and Simberloff (1970) believe that the actual numbers of coexisting congeners are more than expected rather than fewer (in birds of the *Tres Marias* Islands).

As with the species-area measures, regardless of interpretation of the data, it is apparent that this measure cannot be used for direct floristic comparison. Problems with S/G and S/F ratios being confounded with area are clearly reason enough not to use this as a measurement of floristic comparison, notwithstanding the controversies in interpretation of observed versus modeled data lending to opposing lines of thought.

### **Natural Reserve Value**

Most botanists have compared floras based on sheer numbers of taxa, and most would agree that it is a weak measure of comparison. The species-area relationship, although genuinely observed, is a model with too many assumptions and inconsistent variables to be used in floristic comparisons that are commonly between floras having many ecological distinctions. Taxonomic ratios have also been used and this measure along with the species-area measure is confounded with area lending to difficult interpretation.

Proposed herein is a method for evaluation of floristic richness based on similar ecological factors, thus evaluating floras without discounting large ecological differences. Many investigators have long recognized the physiographic regions of Tennessee as distinct floristic entities (Shanks 1958; Chester *et al.* 1993; 1997; and Braun 1950); therefore, it seems counterintuitive to compare various floras across physiographic provinces. This comparison of selected regional floras is based on the reserve's value in terms of protection of percentage of taxa known from the physiographic province in which it lies. Wofford & Chester (in manuscript) summarized the woody taxa known

from each physiographic region of Tennessee. Since their work is restricted to TN, the values for the GSMNP, BFM, CM, and GC were inflated because the Blue Ridge physiographic province is only slightly represented in Tennessee. Additional taxa that are added to the list from the Blue Ridge physiographic province, as created by Wofford & Chester (in manuscript) (distribution data are from Radford 1968; Wofford 1989; and Kron 1993), that are known from the Blue Ridge physiographic province in NC (which represents about the same amount of latitudinal distance as the state of TN) are listed in Table 8. With this adjustment, all of the natural reserves could be compared to their respective physiographic provinces as a measure of percentage of the total flora from that province. Additionally, some taxa that were included in a couple of the aforementioned investigations were omitted here as according to Wofford & Chester (in manuscript) they do not exist in Tennessee, and therefore, without further investigation of each of these vouchers, they are considered to be misidentifications (i.e. *Cornus stolonifera*, *Crataegus* spp. and *Rubus* spp.). Lastly, all selected regional floras were synonymized according to Kartesz (1994) and Wofford & Chester (in manuscript) and some lesser taxa were not included unless they were included by all investigators.

With this type of comparison, area is still significant, however this comparison is not intended to pit one reserve's floristic richness directly against another, but rather to compare each natural area in terms of its value for protection of those taxa that it was created to protect.

**Table 8.**

**Taxa Present in the Blue Ridge From North Carolina Only.**

|                              |                                  |
|------------------------------|----------------------------------|
| <i>Amelanchier sanguinea</i> | <i>Lonicera flava</i>            |
| <i>Betula populifolia</i>    | <i>Prunus pumila</i>             |
| <i>Comptonia peregrina</i>   | <i>Quercus ilicifolia</i>        |
| <i>Crataegus collina</i>     | <i>Quercus prinoides</i>         |
| <i>Crataegus marshalli</i>   | <i>Rhododendron prinophyllum</i> |
| <i>Crataegus phaenopyrum</i> | <i>Rhododendron vaseyi</i>       |
| <i>Crataegus spathulata</i>  | <i>Robinia viscosa</i>           |
| <i>Crataegus uniflora</i>    | <i>Stewartia malcodendron</i>    |
| <i>Gaylussacia dumosa</i>    | <i>Taxus canadensis</i>          |
| <i>Hypericum buckleyi</i>    | <i>Viburnum nudum</i>            |
| <i>Juniperus communis</i>    | <i>Myrica gale</i>               |
| <i>Leucothoe racemosa</i>    | <i>Chamaedaphne calyculata</i>   |

Taxa not added to list because they were not recognized by R. Lance  
(Contr. To Trees, Shrubs, and Woody Vines of Tennessee)

|                             |
|-----------------------------|
| <i>Crataegus aprica</i>     |
| <i>Crataegus basilica</i>   |
| <i>Crataegus flava</i>      |
| <i>Crataegus iracunda</i>   |
| <i>Crataegus succulenta</i> |

The results are summarized in Table 2. Wofford & Chester (in manuscript) found that there are more species known from the Cumberland Plateau than from the Blue Ridge (Unaka) physiographic province in Tennessee, 271 and 261 respectively. After allowing for those species known from the Blue Ridge in NC, the total for the Blue Ridge was increased to 285 species. This is still probably a low estimate due to the conservative decisions of all borderline distributions; also, several *Crataegus* spp. that were not recognized by R. Lance in his contribution to Wofford & Chester (in manuscript) were omitted. Additionally, Wofford & Chester recorded 122 genera for the Blue Ridge physiographic province; with the additions from NC, the numbers of genera and families known from the Blue Ridge physiographic province are increased to 125 and 55 respectively.

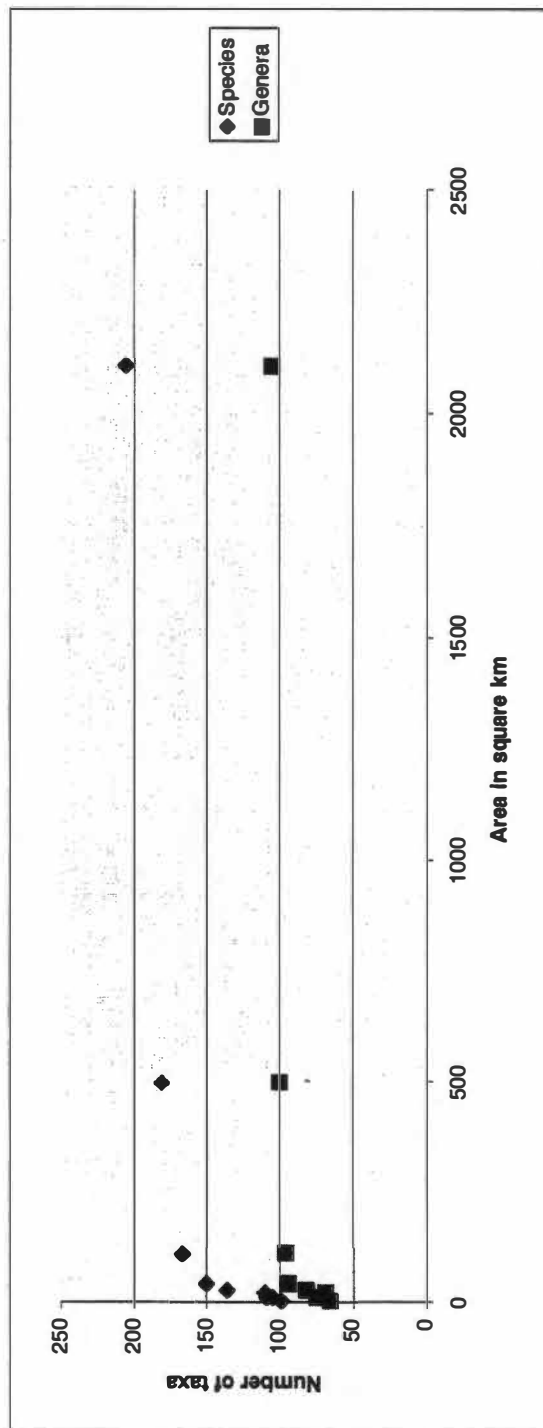
The BSFNRRA is clearly the highest-ranking reserve on the Cumberland Plateau in terms of protection of those species of that unique physiographic province in Tennessee. Of the 271 native woody species and lesser taxa known from the Cumberland Plateau in Tennessee, the BSFNRRA protects 181 or 67% of them. Second to the BSFNRRA, PC protects 62% of the woody species known from the Cumberland Plateau in Tennessee. The smaller reserves in between these two account for lesser percentages of the total, but they contain different floristic elements and most likely allow for gene flow, for some taxa, between the larger reserves. I suspect that if the Fall Creek Falls study were more complete, this natural area, especially after recent land acquisition, would rival the floristic richness found in BSFNRRA and PC.

In terms of richness, this comparison confirmed the longstanding belief that the GSMNP is the most floristically rich natural reserve in the southern Appalachian region. After adjustments due to synonymy, the GSMNP has 206 species in 105 genera in 48 families. Nevertheless, the BSFNRRA certainly rivals this, and at the familial level surpasses the richness of the GSMNP having 181 species in 100 genera in 51 families. The third richest area is PC with 167 species in 96 genera in 48 families (Table 2).

In comparing the natural areas to their respective physiographic provinces, the GSMNP protects the most taxa; 87% of the families, 86% of the genera, and 72% of the species from the Blue Ridge physiographic province in TN and NC are protected within its boundaries. Again, the BSFNRRA is just behind the GSMNP; it protects 86% of the families, 84% of the genera, and 67% of the species known from the Cumberland Plateau in TN. A surprising find in this comparison is that both the BSFNRRA and the GSMNP protect similar percentages of taxa known from their respective physiographic provinces, the Blue Ridge containing only three more genera than the Cumberland Plateau. Prentice Cooper is again ranked third protecting 81% of the families, 81% of the genera, and 62% of the species from the Cumberland Plateau in TN. In agreement with the richness-area discussion above, alignment of these natural areas with respect to their size nearly parallels their alignment with respect to richness. Exempting FCF as an incomplete study, and LBL as the only study area outside of the southern Appalachians, the area and richness values exactly parallel: GSMNP (208 spp.); BSFNRRA (181 spp.); PC (167 spp.); Obed (150 spp.); SG (136 spp.); BFM (110 spp.); GC (109 spp.); WC (105 spp.); LC (99 spp.). See Tables 2 & 9.

**Table 9.**  
**Summary of Area and Richness per Natural Reserve.**

| Reserve | Area km2 | Species | Genera |
|---------|----------|---------|--------|
| GSMNP   | 2104     | 206     | 105    |
| BSFNRRA | 498      | 181     | 100    |
| PC      | 108      | 167     | 96     |
| Obed    | 40       | 150     | 94     |
| SG      | 26       | 136     | 82     |
| BFM     | 20       | 110     | 69     |
| GC      | 10       | 109     | 75     |
| WC      | 10       | 105     | 75     |
| LC      | 2.2      | 99      | 66     |



Interestingly, superposition of the GSMNP over the BSFNRRA and the Obed, as if these two areas on the Cumberland Plateau were combined within the same geometric shape as the GSMNP, yields numbers very similar to those found in the GSMNP (BSFNRRA + Obed; 192 spp. in 105 genera in 53 families vs. 208 spp. in 106 genera in 48 families). Two additional families and genera would also be added to this because *Symplocos tinctoria* and *Taxus canadensis* are known from a location in Pickett State Park not far from the BFNRRRA/Pickett State Park boundary, which would also be included under the geometric shape of the GSMNP (*Taxus* is less than a .5 miles away from the BSFNRRA/Pickett State Park boundary).

Additional tables include (1) those taxa that are known from all of the natural areas in this study, most of which are widespread common taxa in this area (Table 10) and (2) those taxa that are only known from a single reserve, although this information may be slightly misleading since those taxa present in unique habitats (cobble bars) in the northern Cumberland Plateau would cancel one another out while the high elevation flora of the GSMNP is not shared with any other area (Table 11).

Tables 12 and 13 are a direct comparison between the BSFNRRA and the GSMNP in terms of those taxa that are known from one reserve and not the other.

In spite of the Cumberland Plateau having several natural areas, not all of the genera known from the Cumberland Plateau are protected within a natural reserve.

**Table 10.**  
**Taxa Common to All Reserves in the Comparison.**

|                                      |                                    |
|--------------------------------------|------------------------------------|
| <i>Acer rubrum</i>                   | <i>Nyssa sylvatica</i>             |
| <i>Acer saccharum</i>                | <i>Ostrya virginiana</i>           |
| <i>Alnus serrulata</i>               | <i>Oxydendrum arboreum</i>         |
| <i>Amelanchier arborea</i>           | <i>Parthenocissus quinquefolia</i> |
| <i>Bignonia capreolata</i>           | <i>Platanus occidentalis</i>       |
| <i>Carya glabra</i>                  | <i>Prunus serotina</i>             |
| <i>Carya ovata</i> var. <i>ovata</i> | <i>Quercus alba</i>                |
| <i>Carya tomentosa</i>               | <i>Quercus montana</i>             |
| <i>Castanea dentata</i>              | <i>Quercus velutina</i>            |
| <i>Cornus florida</i>                | <i>Robinia pseudoacacia</i>        |
| <i>Euonymus americanus</i>           | <i>Sassafras albidum</i>           |
| <i>Fagus grandifolia</i>             | <i>Smilax glauca</i>               |
| <i>Fraxinus americana</i>            | <i>Smilax rotundifolia</i>         |
| <i>Ilex opaca</i>                    | <i>Tilia americana</i>             |
| <i>Juglans cinerea</i>               | <i>Toxicodendron radicans</i>      |
| <i>Kalmia latifolia</i>              | <i>Ulmus rubra</i>                 |
| <i>Lindera benzoin</i>               | <i>Vaccinium pallidum</i>          |
| <i>Liquidambar styraciflua</i>       | <i>Vaccinium stamineum</i>         |
| <i>Liriodendron tulipifera</i>       | <i>Vitis aestivalis</i>            |

**Table 11.**

**Taxa Only Present in One Reserve in the Comparison.**

|                               |          |                                       |       |
|-------------------------------|----------|---------------------------------------|-------|
| <i>Abies fraseri</i>          | GSMNP    | <i>Pieris floribunda</i>              | GSMNP |
| <i>Aesculus glabra</i>        | LBL      | <i>Pinus pungens</i>                  | GSMNP |
| <i>Amorpha glabra</i>         | GSMNP    | <i>Pinus rigida</i>                   | GSMNP |
| <i>Ampelopsis arborea</i>     | LBL      | <i>Polygonella americana</i>          | Obed  |
| <i>Brunnichia ovata</i>       | LBL      | <i>Prunus alleghaniensis</i>          | LC    |
| <i>Carya illinoensis</i>      | LBL      | <i>Prunus mexicana</i>                | FG    |
| <i>Comptonia peregrina</i>    | BSFNRRRA | <i>Prunus pennsylvanica</i>           | GSMNP |
| <i>Crataegus phaenopyrum</i>  | LBL      | <i>Quercus pagoda</i>                 | PC    |
| <i>Crataegus punctata</i>     | BSFNRRRA | <i>Quercus palustris</i>              | LBL   |
| <i>Crataegus spatulata</i>    | PC       | <i>Rhododendron alabamense</i>        | WC    |
| <i>Gelsemium sempervirens</i> | PC       | <i>Rhododendron canescens</i>         | PC    |
| <i>Hydrangea quercifolia</i>  | GC       | <i>Ribes glandulosum</i>              | GSMNP |
| <i>Hypericum crux-andreae</i> | Obed     | <i>Ribes rotundifolium</i>            | GSMNP |
| <i>Hypericum frondosum</i>    | PC       | <i>Rosa virginiana</i>                | LC    |
| <i>Leiophyllum buxifolium</i> | GSMNP    | <i>Rubus idaeus ssp. strigosus</i>    | GSMNP |
| <i>Leucothoe racemosa</i>     | Obed     | <i>Salix exigua</i>                   | LBL   |
| <i>Leucothoe recurva</i>      | GSMNP    | <i>Salix humilis var. microphylla</i> | BFM   |
| <i>Lonicera canadensis</i>    | GSMNP    | <i>Sorbus americana</i>               | GSMNP |
| <i>Lonicera dioica</i>        | BFM      | <i>Styrax americana</i>               | LBL   |
| <i>Menziesia pilosa</i>       | GSMNP    | <i>Taxodium distichum</i>             | LBL   |
| <i>Nyssa aquatica</i>         | LBL      | <i>Viburnum molle</i>                 | LBL   |
| <i>Philadelphus pubescens</i> | LBL      | <i>Yucca flaccida</i>                 | GSMNP |
| <i>Picea rubens</i>           | GSMNP    |                                       |       |

Note: This is very subject to the area and geography of the available floras.

**Table 12.**  
**Families Present in Either the BSFNRRRA or the GSMNP (not common to both).**

|               | <b>BSFNRRRA</b> | <b>GSMNP</b> |
|---------------|-----------------|--------------|
| Berberidaceae | +               |              |
| Lamiaceae     | +               |              |
| Myricaceae    | +               |              |
| Rutaceae      | +               |              |
| Styracaceae   |                 | +            |
| Thymeleaceae  | +               |              |
| Verbenaceae   |                 | +            |
| <b>Total</b>  | <b>5</b>        | <b>2</b>     |

**Table 13.**

**Genera Present in Either the BSFNRRA or GSMNP (not common to both).**

|                       | BSFNRRA   | GSMNP     |
|-----------------------|-----------|-----------|
| <i>Abies</i>          |           | +         |
| <i>Amorpha</i>        |           | +         |
| <i>Ampelopsis</i>     |           | +         |
| <i>Berberis</i>       | +         |           |
| <i>Buxella</i>        | +         |           |
| <i>Callicarpa</i>     |           | +         |
| <i>Comptonia</i>      | +         |           |
| <i>Conradina</i>      | +         |           |
| <i>Decumaria</i>      |           | +         |
| <i>Diervilla</i>      |           | +         |
| <i>Dirca</i>          | +         |           |
| <i>Fothergilla</i>    | +         |           |
| <i>Halesia</i>        |           | +         |
| <i>Leiophyllum</i>    |           | +         |
| <i>Leucothoe</i>      |           | +         |
| <i>Menziesia</i>      |           | +         |
| <i>Nemopanthus</i>    |           | +         |
| <i>Picea</i>          |           | +         |
| <i>Pieris</i>         |           | +         |
| <i>Populus</i>        | +         |           |
| <i>Ptelea</i>         | +         |           |
| <i>Ribes</i>          |           | +         |
| <i>Sorbus</i>         |           | +         |
| <i>Symphoricarpos</i> | +         |           |
| <i>Thuja</i>          | +         |           |
| <b>Total</b>          | <b>10</b> | <b>15</b> |

Combining the floras of BSFNRRA, Obed, and PC reveals that 116 out of 120 genera are protected. Adding the other floras (SG, FG, WC, and FCF) does not improve this number. *Cotinus*, *Forestiera*, *Symplocos*, and *Taxus* are not known from any of these studies (*Taxus* and *Symplocos* are protected within Pickett State Park, TN).

From the above discussion and the pattern of agreement displayed in the data with respect to area and richness, it is apparent that larger natural areas protect a greater percentage of the flora of the respective physiographic region. Larger natural areas may better withstand the key factors determining taxon vulnerability, which are the size and number of viable populations in the preserve, individual taxon recolonization ability, the dynamics of habitat or habitat requirements, disturbance regimes, social and economic constraints of the region, and human impact (Boecklen & Gotelli 1984, Miller & White 1986). For these reasons we need to be concerned with the fate of rare taxa in the BSFNRRA in Tennessee such as *Comptonia peregrina* and *Thuja occidentalis*. These species only grow in the extremely unstable riparian habitat, they are very low population numbers, and *Comptonia peregrina* is not known to exist outside of the preserved area in Tennessee and is therefore unlikely to be reintroduced. Larger natural areas have more of a “buffer” against external forces such as stochastic events (floods, fires, or tornados), invading exotics, or rates of extinction within an area due to initial super-saturation of taxa with respect to the reserves creation or disproportionate reinvasions of the native species from human-altered population pools. This is not to say that smaller natural areas are insignificant; because of species composition differences among park units, small parks add considerable numbers of endemic species to regional species lists (Falkner

1997). The Obed is a good example of a smaller natural area containing unique floristic elements that are not present in a nearby larger natural area (*i.e. Leucothoe racemosa*, *Polygonella americana*, and *Ribes cynosbati*).

The information compiled in this thesis clearly shows that the BSFNRRRA is among the most floristically rich areas in this region. However, one needs to realize that each of the larger natural areas (GSMNP, BSFNRRRA, PC, and LBL) harbor unique species that are not found in any of the other natural areas (*i.e. Abies fraseri*, *Conradina verticillata*, *Rhododendron canescens*, and *Viburnum molle*, respectively). This fact is further exemplified by looking at the Federally Listed taxa within each of the natural areas. The BSFNRRRA protects two Federally Threatened species, *Spiraea virginiana*, and *Conradina verticillata*, while the GSMNP protects one threatened species, *Spiraea virginiana*. The many unique habitats that are found throughout the parks of the Cumberland Plateau harbor distinct taxa that are not found in other physiographic provinces and vice versa.

With all of the information presented above, it is apparent that there is a need for a greater number of larger natural areas because so many people flock to these areas and as each new trail is cut or as surrounding land is developed, the threat of extinction looms. In practice the area available for reserves represents a compromise between competing social and political interests (Diamond 1975) and as development proceeds, so too will the difficulty of land acquisition.

## Chapter 8: The Cumberland Plateau

### The Cumberland Plateau

The Cumberland Plateau has long been noted for having great biodiversity. A query of the database of county distribution at the Herbarium, University of Tennessee revealed that 13 species are only known in Tennessee from Scott, Morgan, Fentress, or Pickett counties (Table 14). Of the 13 species, four are woody (*Buxella brachycera*, *Comptonia peregrina*, *Polygonella americana*, and *Taxus canadensis*). Three out of four of these species are listed (at some level) and the one that is not listed, *Buxella brachycera*, is a southern Appalachian endemic.

The Cumberland Plateau in Tennessee is a physiographic region for which floristic investigations have not kept pace, especially when compared to the Blue Ridge (Clark 1966; Thomas 1966; Wofford pers. comm.). Clark's study was among the first in this region. Since then, several investigations have greatly enhanced our botanical knowledge of this unique province, however the Cumberland Plateau is still greatly understudied. Before this investigation, the genus *Quercus* was not documented in Pickett County, Tennessee. With such obvious exemptions from the records, and the ease of which the 128 county records in this study were collected, there is little argument against the usefulness of this and future investigations in the Cumberland Plateau.

The highly dissected topography of this area contains many unique, therefore interesting habitats. A continuum of microclimatic variability certainly exists on slopes of all aspects, let alone those that are extreme (*i.e.* steep north- and south-facing). Shanks &

**Table 14.**  
**Taxa Only Known in Tennessee From At Least One of Either**  
**Scott, Morgan, Fentress, or Pickett Counties.**

|                                                   |
|---------------------------------------------------|
| <i>Arenaria cumberlandensis</i>                   |
| <i>Arrhenatherum elatius</i> var. <i>bulbosum</i> |
| <i>Aster laevis</i> var. <i>concinus</i>          |
| <i>Aster saxicastellii</i>                        |
| <i>Carex sterilis</i>                             |
| <b><i>Comptonia peregrina</i></b>                 |
| <b><i>Buxella brachycera</i></b>                  |
| <i>Helenium brevifolium</i>                       |
| <b><i>Polygonella americana</i></b>               |
| <i>Solidago simplex</i> ssp. <i>randii</i>        |
| <i>Sporobolus junceus</i>                         |
| <b><i>Taxus canadensis</i></b>                    |
| <i>Utricularia inflata</i>                        |

NOTE: Those not in bold are herbaceous taxa.

Norris (1950) showed significant differences in microhabitats in a shallow valley in east Tennessee; therefore, certainly there is much habitat variation in the deep, steep-walled gorges that are present in the BSFNRRRA. Clark (1966) described a “rim to rim” temperature gradient, modified by slope exposure that accounts for much diversity among gorge slopes of the plateau. In general, northern facing slopes tend to be cooler and wetter than south facing slopes and therefore they tend to be dominated by *Tsuga canadensis* and members of the Ericaceae, whereas southern facing slopes tend to be dominated by *Quercus* and *Carya* species. Gorges are presumed to be refugia to northern species because they have an extraordinarily wet and cool environment, which lowers evapotranspiration and protects from fire (Caplenor 1979). Caplenor (1979) noted that because the gorges of the Cumberland Plateau were somewhat protected by their inaccessibility, they contain the least disturbed and therefore the most climatically attuned terrestrial communities of the area. Rockhouses are an extreme example of microhabitat variance within the Cumberland Plateau; they are semicircular recesses extending back under cliff overhangs, which are warmer during the winter and cooler during the summer, and have lower evaporation rates and higher humidities. Typically, they are extremely damp due to water seepage and most of the time they are sandstone, however, often there are nutrient seams present (e.g. saltpeter). Because of the microclimatic variability, they harbor many unique and endemic species. Walck *et al.* (1996) documented 2080 rockhouses in the 1642 ha Big South Fork Archaeological Project on the Cumberland Plateau that harbor eleven plant taxa, which are endemic or nearly so to this unique habitat (none are woody).

## Distributions

The BSFNRRRA, situated on the Tennessee-Kentucky border, is located near the climatic midpoint of eastern floristic distributions. Having both northern and southern floristic affinities, this area is particularly generically rich. Following the distribution strategy of Allawos (1994); Clements (1987); and Oxendine (1971), which are derived from Fernald (1950), each taxon was labeled either “northern”, “central”, or “southern” and either “intraeous” or “extraneous”. For the majority of the species and lesser taxa, 42%, the BSFNRRRA is well within their range, which is centrally located in the eastern USA, and therefore they were labeled “intraeous” and “central” with respect to their distribution. Two percent were “extraneous” and “central”, meaning that these taxa have narrow longitudinal ranges to the east or the west of the BSFNRRRA (*Ilex opaca* and *Populus deltoids*, respectively). “Northern” taxa account for nearly twice that of “southern” taxa, 27% and 14% respectively, which means that most of the taxa (that are not within the “central” distribution designation) have ranges to the north. Five percent of the species are endemic to the southern Appalachians. Lastly, nine percent of the flora is exotic (Tables 6 & 7).

The persistence of northern floristic affinities (*Acer pensylvanicum*, *Comptonia peregrina*, *Populus grandidentata*, and *Thuja occidentalis*) is in conjunction with known North American glaciation patterns. During periods of cooler climate, these northern species dichotomously migrated southward along more highly elevated routes such as the Blue Ridge and Cumberland Plateau physiographic provinces. Consequently, during interglacial events, some northern taxa remained in gorges within the abovementioned

physiographic regions. During warmer geological periods, the northern species seceded and southern species (*Conradina verticillata*, *Fothergilla major*, *Liquidambar styraciflua*, and *Pyrularia pubera*) migrated northward, probably along lower, less topographically diverse avenues like the Sequatchie Valley. Harvill (1984) noted that, for Coastal Plain taxa, Alabama offers relatively easy access to the Cumberland Plateau in Tennessee since the Cumberland Plateau plunges downward into northern Alabama. Because Fenneman (1938) wrote that there is no demarcation between the Cumberland Plateau and the Coastal Plain in northern Alabama and Shinnars (1964) mentioned that the close of the Pleistocene was a time of vast flooding and erosion, Harvill (1984) contended that Coastal Plain taxa rapidly invaded places like the Cumberland Plateau and the Mississippi Valley. Lastly, Harvill (1984) noted that their rarity today is the result of their replacement in succession in all but the most favorable habitats.

### **Introduced Species**

Considering all of the woody plants collected from the BSFNRRRA, 12% percent of the total are exotic. However, several of these exotic plants were planted and do not appear to be becoming naturalized. Discounting these plants, the exotic flora of the BSFNRRRA is nine percent of the total. This is the same number reported by Allawos (1994) for the entire flora of the NWOC watershed and is very similar to the seven percent reported by Bailey (1998) for the entire riparian flora of the CFR and NR, and nearly eight percent of the entire flora of the slopes of those same two watersheds (Goodson 2000). The considerable portion of the flora that is introduced, the majority of

which exist in ruderal habitats, indicates a high degree of human disturbance within the BSFNRRRA.

Goodson (2000) wrote that “unlike this situation in a number of other national parks and natural areas, in which exotic plant and animal species pose a serious problem, invasive species appear to be having little impact on the native vegetation. This situation is generally true for the BSFNRRRA (R. Emmott pers. comm.).” I tend to disagree with this statement based on the tremendous aggression displayed by such species as *Albizia julibrissin*, *Elaeagnus umbellata*, *Lonicera japonica*, *Rosa multiflora*, and *Spiraea japonica* (not to mention *Microstegium vimineum*). In the northern portions of the park, especially along the SFR from Station Camp northward, *Spiraea japonica* has formed substantial thickets through the riparian zone up onto the gorge slopes and is considerably choking the natural vegetation for an enormous portion of the river near Beatty Oil Well. In my opinion, this woody plant is the greatest invasive threat. However, other species like *Albizia julibrissin*, *Elaeagnus umbellata*, *Lonicera japonica*, and *Rosa multiflora* will probably become more of a problem as time passes. Lastly, *Pueraria montana* exists in a small population just west of the Middle Creek Equestrian Trailhead. Presently, this population is exceeding a level of manageability and its removal should be a top priority because the aggressiveness of this species is without question.

The following list of plants are those considered to be exotic within the boundaries of the BSFNRRRA (those precluded by an “~” are those that do not appear to be spreading): *Ailanthus altissima*, *Albizia julibrissin*, *Berberis thunbergii*, *Catalpa*

*bignonioides*, *Catalpa speciosa*, ~*Duetzia scabra*, *Elaeagnus umbellata*, ~*Euonymus alata*, ~*Hedera helix*, *Kerria japonica* (locally spreading), *Lespedeza bicolor*, *Ligustrum sinense*, *Lonicera japonica*, ~*Magnolia grandiflora*, ~*Magnolia denudata*, *Malus pumila*, *Paulownia tomentosa*, ~*Picea* sp., *Populus alba*, *Prunus persica*, *Pueraria montana* var. *lobata*, *Rosa multiflora*, *Rosa wichuraiana*, *Rubus phoenicolasius*, ~*Salix babylonica*, *Spiraea japonica*, and *Vinca minor*. Information on individual exotic species may be found in Appendix 1.

### Conspicuously Absent Species

During the winter interim, between collecting seasons, plant distributions were analyzed from existing county records to determine which species, not collected during the first season, may be present. This research allowed me to target habitats for probable uncollected species. This method was successful in that *Catalpa speciosa*, *Celastrus scandens*, *Hypericum hypericoides*, *Malus angustifolia*, *Philadelphus hirsutus*, *Phoradendron serotinum*, *Prunus angustifolia*, *Rhamnus caroliniana*, *Staphylea trifoliata*, *Thuja occidentalis* were added to the checklist of species. However, not all of the purposed species were found the second year. Species such as *Amorpha fruticosa*, *Ampelopsis cordata*, *Callicarpa americana*, *Calycocarpum lyonii*, *Euonymus atropurpurea*, *Gleditsia triacanthos*, *Leucothoe fontanesiana*, *L. racemosa*, *Opuntia humifusa*, *Styrax grandifolia*, and *Taxus canadensis* are seemingly absent. Some of these taxa are more conspicuously absent than others; a major reason that some taxa are rare or lacking is the absence or scarcity of limestone. *Celastrus* and *Philadelphus*, for example are very rare within the BSFNRRRA while they are more abundant to the south where the

gorges cut deeper into limestone. Notes on each of these conspicuously missing taxa are at the end of the Key and Annotated Checklists (Appendix 1).

### Species of Special Concern

Unusual habitats or ecosystems are the basis for nearly all of the plants of special concern. The boulder and cobble bars along the SFR River in the center portion of the park are of utmost importance in these terms. Many listed genera and species are only known from this unique habitat including *Berberis canadensis*, *Conradina verticillata*, *Comptonia peregrina*, *Fothergilla major*, *Spiraea virginiana*, and *Thuja occidentalis*. Big Island contains the largest known population of *Conradina verticillata* (Patrick 1979). To date, other taxa that may share this habitat within the BSFNNRA are *Leucothoe racemosa* and *Polygonella americana*; these taxa are known from the Obed Wild Scenic River just south of the BSFNNRA. In describing this habitat, Patrick (1979) wrote: [Site 65; Big Island] “the site must be recognized as botanically significant. In fact, the SFR [South Fork River] from its confluence with White Oak Creek all the way to the Kentucky line is an interesting stretch of river habitat.” “Two rare species that have not been found along the SFR in TN, but remotely expected with additional study, are *Comptonia peregrina* and *Leucothoe racemosa*.” Since then two distinct populations of *Comptonia peregrina* have been documented (Appendix 1).

Based on information from the Tennessee Natural Heritage Program (1999) and information from the Kentucky division, fourteen listed taxa were documented within the BSFNNRA. Of these, two are Federally Threatened (*Conradina verticillata* and *Spiraea*

*virginiana*). All of the listed taxa documented in this study include: *Berberis canadensis*, *Calycanthus floridus* var. *glaucus*, *Castanea dentata*, *Castanea pumila*, *Comptonia peregrina*, *Conradina verticillata*, *Fothergilla major*, *Hypericum prolificum*, *Juglans cinerea*, *Malus angustifolia*, *Populus grandidentata*, *Spiraea virginiana*, *Thuja occidentalis*, and *Viburnum nudum*. Some of the aforementioned taxa are listed in one state but were collected from the other state (Table 5). For some, although they were documented in a state that does not list them, documentation within the other state within the BSFNRRA at least shows nearby populations.

### **The Changing Forest**

“The landscape of North America is in the midst of rapid change which will leave it in a state profoundly altered from its original condition. America’s eastern deciduous forests are in the midst of a tremendously accelerating trend that will lead to the permanent destruction of their integrity” (Clark 1996). Many highly invasive exotic woody plants have become naturalized in the eastern deciduous forests. Within the BSFNRRA, the riparian zone is rapidly being colonized by *Spiraea japonica* and *Albizia julibrissin*. More recent introductions to the forests in the BSFNRRA, this statement being based on their aggressiveness and restricted presence, are *Ailanthus altissima* and *Paulownia tomentosa*, which have extensively colonized other places in the region. The aforementioned taxa along with *Albizia julibrissin*, *Elaeagnus umbellata*, and *Lonicera japonica* are the most highly problematic invasive woody taxa in the BSFNRRA. With the exception of *Spiraea japonica*, these invasive taxa seem to be mostly confined to ruderal habitats.

Invasive exotic taxa are not the entire threat to the eastern deciduous forests within the BSFNRRRA. Several species of fungi have changed, are changing, or have the possibility of changing the forest composition through affliction to their hosts. *Endothea parasitica* (*Cryphonectria parasitica*) has nearly completely decimated *Castanea dentata* populations throughout the eastern USA. Near the top of the stairs at the Twin Arches trail, I observed a young stem, approximately 5 years old, with many pustules erupting through the bark. This fungus is ubiquitous throughout this region; a study was done where birds were shot while resting in chestnut trees. Of 36 birds shot, 19 were carrying spores of the pathogenic fungus (Heald & Studhalter, 1914). Dogwood anthracnose (*Discula destructiva*) is rapidly spreading throughout the southeastern USA, *Sirococcus clavigignenti-juglandacearum*, currently known from the northern Cumberland Plateau in Tennessee is killing off *Juglans cinerea*, and American elm populations have been decimated by Dutch elm disease (*Ophiostoma ulmi* and *O. nova-ulmi*).

Introduced insects may also play a role in changing the forest composition. The hemlock woolly adelgid (*Adelges tsugae*) currently exists from New England, south to the northern tier of counties in North Carolina and from range maps it seems possible that it could spread west to other areas since it has made it this far south.

## Key

In order to gain greater knowledge of the woody plants of this region, I created a key to the trees, shrubs, and woody vines present or possible in the BSFNRRRA. It is my intent that the National Park Service and possibly those visitors with the desire to become

more intimate with the natural history of this and surrounding areas will find this a valuable reference. It was written for those with some, but not requiring great botanical knowledge. This is an artificial key and does not discriminate taxa based on purposed evolutionary lineages. Oftentimes the reader may be asked to measure part of a specimen or view it with at least a 10X magnifying lens. As any naturalist will attest, there is great variation in nature, therefore, undoubtedly specimens will be collected that do not “conform” to the written keys. The definitive characters used to discriminate between taxa are reflective of observations made by previous investigators and myself and are “average” morphological observations.

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## **Appendices**

**Appendix 1**  
**Key and Annotated Checklist to the Woody Plants**  
**of the BSFNRRA**

## **Key to the Woody Plants of the BSFNRRRA and Annotated Checklist**

### **Key to Keys**

- 1 Evergreen ..... **KEY A**
- 1 Deciduous or tardily so ..... 2
- 2 Vine ..... **Key B**
- 2 Tree, shrub, or subshrub ..... 3
- 3 Lvs compound ..... **Key C**
- 3 Lvs simple ..... 4
- 4 Lvs opposite, sub-opposite, or whorled ..... **Key D**
- 4 Lvs alternate ..... 5
- 5 Lvs palmately veined or pinnipalmate  
( > 1 predominant vein arising from the attachment point of petiole  
and blade) ..... **Key E**
- 5 Lvs pinnately veined  
(1 predominant vein) ..... **Key F**

\* = Introduced species

\*\* = Introduced species that are not included in the above key to genera.

Gray genera with their specific epithets, in the generic keys, were not found in this study and are not known from within the BSFNRRRA boundary; these plants may be present, either because they were noted as being close to the BSFNRRRA boundary by the author or because there are previous records from proximal locations (adjoining counties).

## Key to Genera

### Key A (Evergreen Plants)

- 1 Lf veins parallel, many veins running the length of the leaf (monocot) ..... 2
  - 2 Plant with very short internodes, stem obscure or hidden; the edges of the  
lvs fraying into stiff, twisted fibers ..... *Yucca*
  - 2 Plant with distinct internodes; stem present; lvs not fraying ..... *Arundinaria*
- 1 Lf veins otherwise, not distinctly parallel (dicot) ..... 3
  - 3 Plant a gymnosperm (cone bearing); lvs needle-like, scale-like, or awl-like ..... 4
    - 4 Lvs > 3 cm long; lvs in fascicles ..... *Pinus*
    - 4 Lvs < 2.5 cm long; lvs not in fascicles ..... 5
      - 5 Lvs needle-like, linear and flat ..... *Tsuga*
      - 5 Lvs scale or awl-like ..... 6
        - 6 Lvs scale-like, the ends slightly rounded; the leafy twigs  
strongly flattened, appearing in 1 plane; rare, naturally occurring in  
riparian habitat ..... *Thuja*
        - 6 Lvs tapering, awl-shaped with sharply pointed ends when  
juvenile; leafy twigs not arranged in planer "sprays"; common  
upland, but also found in some riparian habitats ..... *Juniperus*
  - 3 Plant an angiosperm (fruit bearing); lvs broad, not as above ..... 7
    - 7 Plant with sharp spines from stem or leaf margin ..... 8
      - 8 Plant succulent; without lvs or lvs forming spines; Cactus ... *Opuntia humifusa*
      - 8 Plant not as above; tree with spines along lf margins ..... *Ilex*
    - 7 Plant not spiny ..... 9
      - 9 Lvs opposite or whorled .....
        - 10 Plant strictly epiphytic ..... *Phoradendron*
        - 10 Plant not epiphytic ..... 11
          - 11 Lf blades about as long as wide ..... *Mitchella*
          - 11 Lf blades longer than wide ..... 12
            - 12 Lvs linear, dotted with glands (10X); restricted to riparian  
zone ..... *Conradina*
            - 12 Lvs lanceolate ..... 13
              - 13 Lvs serrate with variegated lighter color following the  
pattern of venation; plant erect ..... *Chimaphila*
              - 13 Lvs entire or essentially so; plant trailing, spreading by  
creeping stems ..... *Vinca*
    - 9 Lvs alternate ..... 14
      - 14 Plants > 3dm tall ..... 15
        - 15 Stipules or their scars encircling the twig ..... *Magnolia*
        - 15 Stipules or their scars absent ..... 16
          - 16 Lf buds 2 scaled; lvs averaging < 11 cm long ..... *Kalmia*
          - 16 Lf buds with > 5 scales; lvs averaging > 11 cm long .... *Rhododendron*
      - 14 Plants < 3dm tall ..... 17

- 17 Lf surfaces scabrous and/or consistently setose or pilose,  
the hairs brownish; lf margins not thickened ..... *Epigaea*
- 17 Lf surfaces glabrous or barely puberulent; lf margins thickened ..... 18
- 18 Lvs with scent of wintergreen, clustered at tip of twig;  
stems without ridges, brown, sometimes reddish ..... *Gaultheria*
- 18 Lvs without odor, scattered along the branches; stems  
angular or having ridges running lengthwise, greenish ..... *Buxella*

## KEY B (Vines)

|                                                                                                              |                           |
|--------------------------------------------------------------------------------------------------------------|---------------------------|
| 1 Lvs simple                                                                                                 | 2                         |
| 2 Lvs peltate, 3-5-lobed and mucronate                                                                       | <i>Menispermum</i>        |
| 2 Lvs not peltate                                                                                            | 3                         |
| 3 Plants usually armed with prickles; pith absent (monocot)                                                  | <i>Smilax</i>             |
| 3 Plants unarmed; pith present (dicot)                                                                       | 4                         |
| 4 Tendrils present                                                                                           | 5                         |
| 5 Pith white; bark with lenticels; Heart-Leafed Peppervine                                                   | <i>Ampelopsis cordata</i> |
| 5 Pith tan-brown; bark without lenticels or they may be inconspicuous<br>(except in <i>V. rotundifolia</i> ) | <i>Vitis</i>              |
| 4 Tendrils absent                                                                                            | 6                         |
| 6 Lvs opposite                                                                                               | <i>Lonicera</i>           |
| 6 Lvs alternate                                                                                              | 7                         |
| 7 Lvs pinnately veined; margins serrate with inward curling, gland-tipped teeth                              | <i>Celastrus</i>          |
| 7 Lvs palmately veined, margins entire                                                                       | 8                         |
| 8 Lvs softly pubescent beneath; blade margin ciliate                                                         | <i>Cocculus</i>           |
| 8 Lvs glabrous or essentially so; blade margin not ciliate                                                   | <i>Aristolochia</i>       |
| 1 Lvs compound                                                                                               | 9                         |
| 9 Lvs opposite                                                                                               | 10                        |
| 10 Lvs bifoliolate (superficially appearing 4-foliolate); tendrils present                                   | <i>Bignonia</i>           |
| 10 Lvs 3-11 foliolate; tendrils absent                                                                       | 11                        |
| 11 Lvs trifoliolate (rarely 5)                                                                               | <i>Clematis</i>           |
| 11 Lvs 7-11 foliolate                                                                                        | <i>Campsis</i>            |
| 9 Lvs alternate                                                                                              | 12                        |
| 12 Lvs with > 3 leaflets                                                                                     | 13                        |
| 13 Lvs palmately compound                                                                                    | <i>Parthenocissus</i>     |
| 13 Lvs pinnately compound                                                                                    | <i>Wisteria</i>           |
| 12 Lvs trifoliolate                                                                                          | 14                        |
| 14 Stipules and stipels absent; plant climbing by brown<br>aerial roots                                      | <i>Toxicodendron</i>      |
| 14 Stipules and stipels present; plant twining, without<br>aerial roots                                      | <i>Pueraria*</i>          |

## KEY C (Trees or Shrubs with Compound Leaves)

- 1 Lvs opposite ..... 2
  - 2 Lvs palmately compound ..... *Aesculus*
  - 2 Lvs ternately or pinnately compound ..... 3
    - 3 Lflts < 6 ..... 4
      - 4 Lflts 3-5, coarsely serrate to shallowly lobed; petiole bases of opposing lvs (or their scars) connected by a transverse line or ridge ..... *Acer*
      - 4 Lflts always 3, finely serrate; petiole bases of opposing lvs not connected by a transverse line or ridge, but stipule scars large and possibly coming together ..... *Staphylea*
    - 3 Lflts usually 7 (5-11) ..... 5
      - 5 Pith > half the diameter of the twig; lf scars almost meeting around the twig ..... *Sambucus*
      - 5 Pith < half the diameter of the twig; lf scars not as above ..... *Fraxinus*
- 1 Lvs alternate ..... 6
  - 6 Plants armed with spines or thorns ..... 7
    - 7 Lflts < 10 ..... 8
      - 8 Lvs pinnately compound; stipules adnate to the petiole for > ½ of their length ..... *Rosa*
      - 8 Lvs ternately compound; stipules free or adnate < ½ their length ..... *Rubus*
    - 7 Lflts > 10 ..... 9
      - 9 Thorns usually > 2 cm long and often branched (some 3-forked); Honey Locust ..... *Gleditsia triacanthos*
      - 9 Spines < 2 cm long simple (if absent then the stems hispid) ..... 10
        - 10 No prickles present on the lf surfaces; lvs mostly once-pinnate; .... *Robinia*
        - 10 Prickles present on undersurface of the lflts; lvs tripinnate when mature (sometimes bipinnate) ..... *Aralia*
  - 6 Plants without thorns (unarmed) ..... 11
    - 11 Lvs trifoliolate ..... 12
      - 12 Upper lf surfaces with glandular dots; lower surface sparsely pubescent *Ptelea*
      - 12 Upper lf surfaces without glandular dots; lvs pubescent on lower surface ..... *Lespedeza\**
    - 11 Lvs with > 3 lflts ..... 13
      - 13 Lvs twice-pinnate, lflts strongly asymmetrical ..... *Albizia\**
      - 13 Lvs once-pinnate ..... 14
        - 14 Lflts alternate to subopposite; lf petiole concealing the axillary bud ..... *Cladrastis*
        - 14 Lflts opposite; lf petiole not concealing the axillary bud ..... 15
          - 15 Wood bright yellow; plant < 1 m tall ..... *Xanthorrhiza*
          - 15 Wood not bright yellow; mature plants > 1m tall ..... 16
            - 16 Lflts < 11 (3-9) ..... *Carya*
            - 16 Lflts > 11 ..... 17

- 17 Lvs strongly odoriferous ..... 18
- 18 Lvs with "burned" odor; lflets with a distinct, round,  
gland at the basal corners ..... *Ailanthus\**
- 18 Lvs with odor of green walnuts; lflets without round gland at basal  
corners ..... *Juglans*
- 17 Lvs not scented ..... 19
- 19 Lflets oval; sap not milky; Indigo Bush ..... *Amorpha fruticosa*
- 19 Lflets lanceolate; sap milky ..... *Rhus*

## KEY D (Trees or Shrubs with Opposite Simple Leaves)

- 1 Lvs whorled (usually 3 lvs per node, but occasionally only 2); tree ..... *Catalpa*
- 1 Lvs opposite (sometimes 3 lvs at a node in the shrub *Cephalanthus*); shrub or tree ... 2
  - 2 Lvs palmately or pinnipalmately veined ..... 3
    - 3 Lf blade deeply lobed and toothed; maple-like ..... 4
    - 4 Linear stipules present; undersurface of lvs with stellate pubescence . *Viburnum*
    - 4 Stipules absent; undersurface of lvs glabrous or not as above ..... *Acer*
  - 3 Lf blade not lobed or very shallowly lobed; toothed or not ..... 5
    - 5 Tree; bark gray, smooth, not peeling; lvs > 10 cm long ..... *Paulownia\**
    - 5 Shrub; bark brownish red and peeling; lvs < 10 cm long ..... *Philadelphus*
- 2 Lvs pinnately veined or without evident lateral veins ..... 5
  - 6 Lvs entire or irregularly very shallowly undulate ..... 7
    - 7 Lateral veins strongly and obviously arching toward the lf apex; lf hairs inconspicuously forked, and therefore T-shaped, just above the lf surface and somewhat aligned in rows (10X) ..... *Cornus*
    - 7 Lateral veins not arching and trichomes not forked and T-shaped ..... 8
      - 8 Lvs or twigs spicy aromatic; jointed between twigs of different years growth ..... *Calycanthus*
      - 8 Lvs or twigs not spicy aromatic and the different years' twig growth not strongly jointed ..... 9
        - 9 Lvs glandular dotted beneath (10X), the dots semi-translucent ..... 10
          - 10 Lvs sessile ..... *Hypericum*
          - 10 Lvs short petiolate ..... *Ligustrum\**
        - 9 Lvs not glandular dotted beneath ..... 11
          - 11 Lvs with white pubescence; lvs mostly < 4cm long .... *Symphoricarpos*
          - 11 Lvs glabrous or scantily brown pubescent; lvs > 4cm long ..... 12
            - 12 Lf scars connected around the stem by a transverse line ..... 13
              - 13 Lf blades glabrous or essentially so ..... *Cephalanthus*
              - 13 Lf blades, petioles and young twigs with rusty brown pubescence, sometimes also having similar colored dots (10X) ..... *Viburnum*
            - 12 Lf scars not connected around the stem by a transverse line; lf scars raised ..... *Chionanthus*
    - 6 Lvs not entire; serrate or dentate ..... 14
      - 14 Stems green, slightly angled or with a structural thickening running the length of the stem ..... *Euonymus*
      - 14 Stems not as above ..... 15
        - 15 Lvs with both stellate trichomes and with shiny, golden, glandular excretions on the undersurface of the lf; American Beautyberry ..... *Callicarpa americana*
        - 15 Lvs without stellate trichomes and shiny golden glandular excretions .... 16

- 16 Lateral veins anastomosing before reaching the serrate  
lf margin ..... *Hydrangea*
- 16 Lateral veins terminating and mucronating the tips of the lf  
teeth; margins dentate ..... *Viburnum*

**KEY E** (Trees or Shrubs with Palmately Veined, Alternate, Simple Leaves)

- 1 Lvs palmately star-shaped, with 5 acute lf tips, young branches sometimes corky-winged ..... *Liquidambar*
- 1 Lvs not star-shaped with 5 distinct lf tips; young branches not corky-winged ..... 2
  - 2 Lf bases not cordate, either truncate, cuneate, or otherwise ..... 3
    - 3 Lf surface rough to the touch due to stout hairs and pustules (10X); sap milky ..... *Morus*
    - 3 Lf surface smooth, lacking stout hair and pustules; sap not milky ..... 4
      - 4 All lvs deeply and sharply lobed, the lobes having large sometimes remote teeth; bark peeling in large brittle plates, leaving the trunk smooth and very light colored ..... *Platanus*
      - 4 Lvs either not lobed or smoothly lobed; teeth absent; bark not peeling in large, brittle plates ..... 5
        - 5 Lvs, at least some of them lobed (possibly shallowly) ..... 6
          - 6 Crushed lvs spicy aromatic, especially when young; some lvs elliptical and not lobed, others mitten-like, and others 3-lobed and glove-like ..... *Sassafras*
          - 6 Lvs not spicy aromatic; lvs, if lobed, shallowly ..... 7
            - 7 Trichomes stellate ..... *Physocarpus*
            - 7 Trichomes not branched ..... *Malus*
          - 5 Lvs not lobed ..... 8
            - 8 Lf teeth tipped with dark glands; lf bases symmetric ..... *Ceanothus*
            - 8 Lf teeth eglandular; the lvs often asymmetrically curved to one side .. *Celtis*
      - 2 Lf bases cordate to sometimes oblique ..... 9
        - 9 Lvs entire ..... *Cercis*
        - 9 Lvs toothed ..... 10
          - 10 Lvs scabrous with stout hairs and pustules (10X); the lvs often lobed with either 2 or 3 lobes; sap milky; 5-6 exposed bud scales ..... *Morus*
          - 10 Lvs smooth, never lobed; sap not milky; 1-2 exposed bud scales ..... *Tilia*

**KEY F** (Trees or Shrubs with Pinnately veined, Alternate, Simple Leaves)

- 1 Plants with spines or prickles ..... 2
  - 2 Shrub with spines < 1 cm long, wood yellowish ..... *Berberis*
- 2 Small tree or shrub with thorns or thorn-like spur branches > 1 cm ..... 3
  - 3 Thorn-like spur branches present (at least some of them, lf bearing) ..... 4
    - 4 Fresh twigs with odor of almonds; no minute dark glands present on upper midrib ..... *Prunus*
    - 4 Fresh twigs without the odor of almonds; minute dark glands present on upper midrib ..... *Malus*
  - 3 Thorns present (never lf bearing) ..... *Crataegus*
- 1 Plants without spines ..... 5
  - 5 Lvs silvery beneath with many small scales (10X) ..... *Elaeagnus\**
  - 5 Lf undersurfaces green, greenish-tan, whitened, or glaucous, but not silvery ..... 6
    - 6 Lvs lobed (excluding auriculate bases) ..... 7
      - 7 Lf tips truncate, emarginate; stipule scars encircling the twig ..... *Liriodendron*
      - 7 Lf tips not truncate; stipule scars not present or if present not encircling the twig ..... 8
        - 8 Lvs pinnatifid, < 2 cm wide ..... *Comptonia*
        - 8 Lvs shallowly or deeply lobed, not pinnatifid, much wider than 2 cm . *Quercus*
    - 6 Lvs not lobed (excluding auriculate or cordate bases) ..... 9
      - 9 Stipules or their scars encircling the twigs; bark smooth and light gray *Magnolia*
      - 9 Stipules or their scars not present or if present not encircling the twig ..... 10
        - 10 Lf margins toothed, serrate, or undulate AND the lateral veins prominent, parallel or nearly so and directly terminating in the lf teeth ..... 11
          - 11 Lvs doubly serrate AND usually asymmetric at the base ..... *Ulmus*
          - 11 Lvs not doubly serrate AND asymmetric at the base ..... 12
            - 12 Stipules or their scars almost encircling the twig; bark smooth and light gray ..... *Fagus*
            - 12 Stipules or their scars absent or not as above ..... 13
              - 13 Mature lvs with < 4 marginal teeth or lobes / cm ..... 14
                - 14 Lf teeth irregularly spaced ..... 15
                  - 15 Basal margin of lf blade attached to one or both lowermost lateral vein(s) ..... *Fothergilla*
                  - 15 Basal margin of lf blade attached to the petiole .. *Hamamelis*
                - 14 Lf teeth at regular intervals, evenly spaced ..... 16
                  - 16 Lf teeth bristle tipped; lvs arranged in one plane along the twigs (2 dimensional) ..... *Castanea*
                  - 16 Lf teeth not bristle tipped; lvs arranged in > 2 dimensions mostly at the tips of the twigs ..... *Quercus*
          - 13 Mature lvs with > 4 marginal teeth / cm ..... 17
            - 17 Buds distinctly stalked ..... *Alnus*
            - 17 Buds not stalked ..... 18
              - 18 Petioles and young twigs with gland-tipped hairs ... *Corylus*

- 18 Petioles and young twigs without gland-tipped hairs ..... 19
  - 19 Twigs with many short spurs regularly producing
    - 2 lvs and often with the odor of wintergreen; bark peeling horizontally in either small, dark gray, curling or large grayish or reddish-brown sheets ... *Betula*
  - 19 Twigs and bark not as above ..... 20
    - 20 Lvs with many lateral veins forking before reaching the lf margin; bark typically vertically furrowed *Ostrya*
    - 20 Lvs not or very rarely forking before reaching the margin; bark smooth, sinewy or muscular in appearance ..... *Carpinus*
- 10 Lvs entire, very slightly undulate or ciliate or lf toothed then the lateral veins anastomosing and not terminating in a tooth ..... 21
  - 21 Lvs strictly entire ..... 22
    - 22 Lvs spicy aromatic with a strong, pleasant, lemony odor; lf scars slightly raised ..... *Lindera*
    - 22 Lvs without odor ..... 23
      - 23 Most mature lvs > 15 cm long; bud scales absent ..... *Asimina*
      - 23 Mature lvs < 15 cm; bud scales present ..... 24
        - 24 Base of lf petiole surrounding the buds; twigs swollen at the nodes, appearing jointed; twigs very pliable and leathery ..... *Dirca*
        - 24 Not as above ..... 25
          - 25 Lf surfaces, especially the undersurface, dotted with shiny yellow glands (10X) ..... *Gaylussacia*
          - 25 Lf surfaces without shiny yellow glands ..... 26
            - 26 Midvein extending past the tip of the lf and, in some species, appearing glandular ..... 27
              - 27 Lvs usually > 8 cm long, the margins ciliate, with small glandular teeth; buds silky, silvery pubescent ..... *Stewartia*
              - 27 Lvs usually < 7.5 cm long; margins and buds not as above ..... 28
                - 28 Hairs on the lf surface stout and appressed, the hairs being < 10X as long as wide ..... *Lyonia*
                - 28 Lvs glabrous or with hairs > 10X as long as wide ..... 29
                  - 29 Lvs or buds clustered toward the tips of the twigs; lf margins often ciliate ..... *Rhododendron*
                  - 29 Lvs or buds not clustered toward the tips of the twigs; lf margins possibly with long, narrowly, delicate teeth, lf margins not ciliate ..... *Vaccinium*

|                                                                                                                                                        |                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 26 Midvein not extending past the tip of the lf                                                                                                        | 30                 |
| 30 Lf veins very prominent; twigs commonly self pruning leaving a twig scar                                                                            | <i>Pyrularia</i>   |
| 30 Lf veins easily apparent but not prominent; twigs not self pruning                                                                                  | 31                 |
| 31 Lvs rounded at the base; lvs and twigs appearing "inky"; terminal bud absent and lateral buds dark, also appearing "inky"                           | <i>Diospyros</i>   |
| 31 Lvs cuneate or wedge-shaped at the base                                                                                                             | 32                 |
| 32 Lvs narrow, (> 4X as long as wide), oblanceolate and glaucous beneath; shrub                                                                        | <i>Salix</i>       |
| 32 Lvs elliptical to obovate, the lf tips with 1 to several acute to acuminate tips; tree                                                              | <i>Nyssa</i>       |
| 21 Lvs toothed, even slightly due to marginate glands that may be hidden in ciliate trichomes                                                          | 33                 |
| 33 Lvs > 5X as long as wide                                                                                                                            | <i>Salix</i>       |
| 33 Lvs < 5X as long as wide                                                                                                                            | 34                 |
| 34 Lf base cordate and lvs longer than wide; terminal bud long and slender either early or late in the growing season with pinkish-greenish bud scales | <i>Amelanchier</i> |
| 34 Lf bases not cordate or if cordate then the lvs about as long as wide; terminal bud not as above either early or late in the growing season         | 35                 |
| 35 Primary lateral veins curving toward the apex and ending in a very shallow angle at the lf margin (attempting to parallel the lf margin)            | <i>Rhamnus</i>     |
| 35 Lateral veins not strongly curving toward the lf margin (not attempting to parallel the lf margin)                                                  | 36                 |
| 36 Lvs with minute dark glands along the upper surface of the midrib                                                                                   | <i>Aronia</i>      |
| 36 Lvs without minute dark glands along the upper surface of the midrib                                                                                | 37                 |
| 37 Stipules long and arising from the lf petiole; the petioles and undersurface of the lvs densely pubescent; fruit an apple                           | <i>Malus</i>       |
| 37 Stipules or their scars not arising from the lf petiole, lvs, petioles, and fruit not as above                                                      | 38                 |
| 38 Pith white; petioles always < 2.5 cm                                                                                                                | 39                 |
| 39 Pith chambered                                                                                                                                      | <i>Itea</i>        |
| 39 Pith continuous                                                                                                                                     | 40                 |
| 40 Lvs glaucous beneath                                                                                                                                | <i>Spiraea</i>     |
| 40 Lvs green or tan beneath                                                                                                                            | 41                 |

- 41 Young twigs with stellate pubescence; the bark of the older twigs  
reddish-brown and sometimes peeling off in strips ..... *Clethra*
- 41 Young twigs without stellate pubescence and bark not peeling ..... 42
- 42 Lvs 10-25 cm long; lvs with sour or acidic taste;  
stipules or scars absent ..... *Oxydendrum*
- 42 Lvs mostly < 10 (12) cm long; lvs not sour or acid  
tasting; stipules very small, triangular, and dark colored ..... *Ilex*
- 38 Pith brown, tan, or light green or if white then petioles > 3 cm ..... 43
- 43 Petioles > 2.5 cm; lvs slightly triangular ..... *Populus*
- 43 Petioles < 2.5 cm; lvs ellipsoid ..... 44
- 44 Petioles with small glands on or near the base of the lf blade; twigs  
possibly with thorn-like spur shoots; bundle scars 3 ..... *Prunus*
- 44 Petioles without glands; twigs never thorny; bundle scars 1 ..... 45
- 45 Young stems green; common in dry upland woods  
(one species restricted to rock houses) to mesic woods ..... *Vaccinium*
- 45 Young stems tan or brown, never green; very rare on gravel  
or cobble bars along rivers and streams and possibly the larger  
tributaries ..... *Spiraea*

## Generic Keys to the Species and Annotation

### Acer

- 1 Lvs compound ..... *A. negundo*
- 1 Lvs simple ..... 2
- 2 Bud scales 2; small tree with dark gray and light gray striped bark; lvs shaped like a "goose foot" ..... *A. pensylvanicum*
- 2 Bud scales more than 2, imbricate; larger trees with variable bark ..... 3
- 3 Lvs with 7 fairly prominent veins arising from the, often shallowly cordate, base of the lf blade ..... *A. saccharum* ssp. *saccharum*
- 3 Lvs with 3-5 prominent veins arising from the, rarely cordate, base of the lf blade ..... 4
- 4 Lf sinuses U-shaped ..... *A. saccharum* ssp. *nigrum*
- 4 Lf sinuses V-shaped ..... 5
- 5 Terminal lobe of the lf blade < ½ the length of the entire blade .... *A. rubrum*
- 5 Terminal lobe of the lf blade > ½ the length of the entire blade *A. saccharinum*

***Acer negundo* L.** Box Elder, Ash-Leaved Maple, Whistlewood

Tree, throughout the USA. Twigs bright green, glabrous; lflets 3-5 (-7).

Frequent; riparian habitats, especially along the SFR and wider parts of the CFR.

Rarely found in higher elevations.

***Acer pensylvanicum* L.** Moosewood, Striped Maple, Goosefoot Maple

Small tree, eastern USA, southernmost range in the higher elevations and cooler microclimates of TN and GA. Lvs 3-lobed, doubly serrate.

Occasional; cool rich woods, places of cool air drainage, or northern facing slopes.

***Acer rubrum* L.** Red Maple, Soft Maple, Scarlet Maple, Swamp Maple

Tree, eastern USA. Branchlets smooth, often red; flowers dark red to scarlet.

Frequent throughout; most often in mesic woods.

***Acer saccharinum* L.** Silver Maple, White maple, Soft Maple, River Maple

Tree, eastern and middle USA. Lvs deeply 5 lobed, jagged, and silvery white beneath.

Scarce; few very large trees and several other smaller trees on the N side of the road leading to Bear Creek Horse Camp. Larger trees were probably planted many years ago as they are approximately 2 ft in diameter. A natural population exists along the SFR, N of Alum Ford (several were quite large).

***Acer saccharum* Marsh. ssp. *nigrum* (F. Michx.) Desmarais.** Black Maple

Tree, eastern USA from northern GA and AL to MN to VT. Very similar to *A. saccharum* Marsh. ssp. *saccharum*, but much more common N of the BSFNNRA. Bark dark gray to black; branches mottled in dark gray; lvs deep green with "weak", somewhat drooping margins; petioles

permanently pubescent (rarely glabrous); lf blades mostly 3-lobed unlike ssp. *saccharum*, which is mostly 5 lobed.

Very rare; only one tree observed in this study on Cat Ridge road in McCreary county; however, previously collected in Scott Co.: South Fork River. River Bench near No Business Creek., June 1947, A. J. Sharp, R. E. Shanks, and E. E. C. Clebsch 3953.

[*A. nigrum* F. Michx.]

***Acer saccharum* Marsh. ssp. *saccharum*.** Sugar Maple, Rock Maple

Tree, eastern USA. Lvs typically 5-lobed, dark green above, glabrous to pale or somewhat glaucous beneath.

Frequent in rich woods; generally encountered on the gorge slopes and lowlands not prone to extreme flooding.

### **Aesculus**

***Aesculus flava* Sol.** Yellow Buckeye, Sweet Buckeye

Tree, mid-eastern USA. Lflts 5, oblanceolate. Most trees encountered are very small; although this species may grow to be very large.

Infrequent; rich woods and gorge slopes.

[*A. octandra* Marsh.]

### **Ailanthus**

**\**Ailanthus altissima* (Mill.) Swingle.** Tree of Heaven, Chinese Sumac

Tree, native of Asia and Australia; a problematic weed of the USA since its introduction in about 1874. Lvs odd pinnate and 1 to 3 ft long and foul smelling when damaged; each lfl with distinct round glands at the base. Flowers small, green or yellowish in terminal panicles. The yellow-reddish fruit is samaroid.

**Scarce**; repeatedly disturbed areas such as parking areas (Blue Heron), roadsides (Charit Creek), and camp-grounds, and along railroad tracks. However, without population control it is expected to spread rapidly due to its quick growth and maturation rate (8 ft tall in the 1<sup>st</sup> yr). It is especially aggressive in the southeastern USA and forms dense colonies due to root sucker formation and highly viable, wind dispersed seeds.

**TN: Invasive Exotic Pest Plant Rank 1; Severe Threat**

### **Albizia**

**\**Albizia julibrissin* Duraz.** Silk Tree, Mimosa, Silky Acacia

Small tree, introduced from Mexico, Africa, Australia, and Asia; a noxious weed S of a line from NY to CA. Flowers pink or lilac in tassel-like globular clusters; fruit a tan colored, flattened legume.

**Scarce** to infrequent throughout; but frequent along the main water routes in the riparian habitat along the SFR. It is expected to become more frequent as the seeds are very viable and the brittle wood readily forms sprouts if cut or broken. It will be increasingly problematic within the BSFNRRRA if efforts are not made to limit its persistence and/or spread.

**TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

## **Alnus**

***Alnus serrulata* (Ait.) Willd.** Common Alder

Shrub or small tree, eastern USA. Lvs simple, obovate or obovate-elliptic, and serrulate to undulate. Male flowers in staminate aments; female aments ovoid to ellipsoid with persistent, fleshy bracts turning woody at maturity.

Common; along the river and tributary margins, typically where terrain is flat (where the water is mostly slow moving and steady) and/or rocky.

[*A. serrulata* var. *subelliptica* Fern.]

## **Amelanchier**

NOTE: Taxonomy of this group is difficult, and without flowers, fruit, and lvs of the same tree or shrub, determination at the specific level may be very difficult. It is advised that several authors be consulted before identification determination. This may influence the abundance notes below as identification in the field is nearly impossible.

- 1 Racemes erect; sepals irregularly recurving ..... *A. canadensis*
- 1 Racemes pendent; sepals tightly reflexed ..... 2
- 2 Lvs densely white tomentose at anthesis; fruits insipid, red-purple ..... *A. arborea*
- 2 Lvs glabrous; fruits sweet, purple-black ..... *A. laevis*

***Amelanchier arborea* (Michx.) Fern.** Juneberry, Downy Serviceberry, "Sarvis Berry"

Tree or shrub, middle and eastern USA.

Frequent; throughout most wooded sites from submesic to subxeric communities.

***Amelanchier canadensis* (L.) Medic.** Canadian Serviceberry

Tree or shrub, eastern USA.

Scarce; found in upland woods.

***Amelanchier laevis* Wieg.** Smooth Serviceberry

Small tree or shrub, USA from ME to GA to MN.

Occasional; along rivers in moist woods.

[*A. arborea* (F. Michx. Fernald var. *laevis* (Wiegand) H.E. Ahles]

Not collected in this study but reported by Bailey (1998) and Goodson (2000).

## **Aralia**

***Aralia spinosa* L.** Angelica Tree, Hercules'-Club, Devil's Walking Stick, Prickly Ash

Small tree or shrub, eastern USA. May be shrub or tree-like, but usually consists of one or few stems about a meter tall (up to 10 m tall); stems and parts of the decompose lvs coarsely prickly; lflets ovate, pointed to acuminate, and serrate; the largest compound lf in BSFNRRA.

Infrequent; trail side in rich, damp woods.

## Aristolochia

### *Aristolochia macrophylla* Lam. Dutchman's Pipe

Vine, eastern USA. "Pipe-shaped", green or maroon calyx tube; capsule ribbed and about 6.5 cm long, shaped like a "watermelon"; seeds flattened and 1 cm in diameter.

Infrequent; rich mesic to moist woods, trail side and creek side.

[*A. durior* Hill]

## Aronia

1 Young twigs and abaxial lf surfaces pubescent ..... *A. arbutifolia*

1 Young twigs and abaxial lf surfaces glabrous or nearly so ..... *A. melanocarpa*

### *Aronia arbutifolia* (L.) Pers. Red Chokeberry

Shrub, USA S of a line from southern ME to TX. Stems few, < 1 m tall. Fruit a red pome; terminal bud distinctly flattened and sharp pointed.

Scarce; low woodland thicket-like areas, generally at the bottom of the gorge. Rarely on top of the plateau.

[*A. arbutifolia* var. *glabra* Ell.]

[Newly proposed name: *Photinia pyrifolia* (Lam.) Robertson & Phipps]

### *Aronia melanocarpa* (Michx.) Elliott. Purple Chokeberry, Black Chokeberry

Shrub, eastern USA. Stems few, < 1 m tall. Fruit a black or purple pome; terminal bud distinctly flattened and sharp pointed.

Scarce; low woodland thicket-like areas generally at the bottom of the gorge. Rarely on top of the plateau.

[newly proposed name: *Photinia melanocarpa* (Michx.) Robertson & Phipps]

## Arundinaria

### *Arundinaria gigantea* (Walter) Muhl. Large or Giant Cane

Shrub-like rhizomatous grass; eastern, except for extreme northern, USA. Approximately 1.5 m tall, but may be several meters in height; lf blades linear-lanceolate and up to 30 cm long.

Frequent; riparian habitats where it forms extensive stands along portions of the SFR and wider parts of the NR and CFR.

Several subspecies have been the subject of taxonomic controversy and none are recognized here.

## Asimina

### *Asimina triloba* (L.) Dunal. Pawpaw

Small tree or shrub, middle and eastern USA. Lvs oblong or oblanceolate and malodorous, 15-30 cm long with an acute to acuminate apex; young twigs and naked buds rusty pubescent; bark smooth and gray-brown; pith chambered. Grows in rhizomatous "patches" of many short (< 2 m) stems.

Frequent; rich mesic woodlands where soils tend to be moist.

## Berberis

- 1 Lvs toothed; prickles compound forming a 3-pronged barb . . . . . *B. canadensis*  
1 Lvs entire; prickles simple . . . . . *B. thunbergii*

***Berberis canadensis*** Mill. Canadian Barberry, American or Allegheny Barberry  
Shrub, mid-eastern states from northern AL and GA to southern PA and IL (making Canadian Barberry a misnomer). Plant < 1 m tall; yellow inner bark and wood.

Rare; collected once each collecting year at two different locations (near both Burnt Mill and Peters Bridges) on sandy river benches.

**TN: SPECIAL CONCERN SPECIES**

**KY: ENDANGERED** (Not collected in KY)

**\**Berberis thunbergii*** DC. Japanese Barberry

Shrub, introduced from eastern Asia around 1864, spread in USA from ME to ND and GA to KS. Yellow wood as in *B. canadensis*, but lvs spatulate and entire. Berries bright red, disseminated by birds including ruffed grouse, bobwhite, and turkey. It is shade tolerant and avoided by browsing animals (deer), therefore this species should be monitored and/or eliminated.

Rare; medium sized plant exists in 1 location across from the Blue Heron boat ramp.

**TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

## Betula

- 1 Bark and twigs odorless; bark mottled in pink, white, gray, and brown and shaggily exfoliating in large pieces (young specimens may not be exfoliating) *B. nigra*  
1 Bark and twigs with sweet-mint odor like wintergreen; bark exfoliating or not . . . . . 2  
2 Bark silvery-bronze to gray, exfoliating in large pieces; buds not sharp pointed; stems mildly aromatic . . . . . *B. alleghaniensis*  
2 Bark dark brown, almost black, horizontally curling; buds sharp pointed; stems very aromatic . . . . . *B. lenta*

***Betula alleghaniensis*** Britt. Yellow Birch, Gray Birch

Tree, USA from ME to MN to GA. Bark almost intermediary between the two described species below; margin of fruiting bracts ciliate.

Occasional; damp, rich woods, especially toward the lower parts of the gorge slopes.

[*B. lutea* F. Michx.]

***Betula lenta*** L. Sweet Birch, Cherry Birch, Black Birch, Mountain Mahogany

Tree, eastern USA, all states east of the Mississippi River except for FL. Bark dark gray to bronze and peeling in very small tight curls; margin of fruiting bracts glabrous or with very few hairs.

Frequent; rich woods of the gorge slopes.

***Betula nigra* L.** River Birch, Black Birch, Red Birch

Tree, eastern USA. Bark peeling in large, papery brown, tan, or gray pieces.

Common; along the SFR and the wider parts of the CFR and NR [completely lining the SFR river for miles S (upriver) of the northern border of the park].

**Bignonia**

***Bignonia capreolata* L.** Crossvine

Vine, primarily of southeastern USA. Lvs opposite, pinnate but reduced to two basal lflets, with a tendril arising from between them; flowers tubular deep orange to red with a yellowish throat.

Frequent throughout.

[*Anisostichus capreolata* (L.) Bureau]

**Buxella**

***Buxella brachycera* (Michx.) Small.** Box Huckleberry

Subshrub, present in 9 counties surrounding the BSFNRRA, also present in scattered counties up through PA. Forming dense mats, mostly < 3 dm tall.

Frequent; sandy wooded slopes of the gorge.

[*Gaylussacia brachycera* A.Gray]

**Calycanthus**

1 Lower lf surfaces, petioles, and young twigs pubescent . . . . . *C. floridus* var. *floridus*

1 Lower lf surfaces, petioles, and young twigs either glabrous

or with scattered hairs . . . . . *C. floridus* var. *glaucus*

***Calycanthus floridus* L.** Sweetshrub, Spicebush, Carolina Allspice

Shrub, eastern USA from FL to NY and W to IL and LA.

Frequent to common along the rivers, stream banks, and clearings around the bottom of the gorge.

var. *glaucus* (Willd.) Torr. & A.Gray is much more common and has a broader distribution in the eastern USA, extending northward to N.Y., whereas var. *floridus* only reaches northward to PA. Both varieties were collected.

[*C. fertilis* Walt., *C. floridus* var. *laevigatus* (Willd.) Torr. & A.Gray, *C. floridus* var. *oblongifolius* (Nutt.) D. E. Boufford & Spongberg, *C. nanus* Loisel]

**KY: THREATENED SPECIES (VARIETY)**

var. *floridus* [*C. mohrii*]

**Campsis**

***Campsis radicans* (L.) Seem. ex Bureau.** Trumpet Creeper, Trumpet Vine, Cow-Itch

Vine, middle and eastern USA with long, tubular orange to red flowers and light brown or tan bark.

Occasional; often climbing the trees near the rivers and around parking lots and fence rows.

## **Carpinus**

***Carpinus caroliniana*** Walter. Ironwood, Musclemwood, Blue Beech, Hornbeam  
Tree, eastern USA. Stems "sinewy" or "muscular" in appearance; bark smooth, gray.  
Frequent; along rivers and larger creeks, typically present in low rich woods.

## **Carya**

- 1 Scales of overwintering buds paired and valvate, permanently yellow  
scurfy; lflets 5-9 (11); husk only splitting to halfway ..... *C. cordiformis*
- 1 Scales of overwintering buds imbricate; lflets 3-9 ..... 2
- 2 Lvs and young stems glabrous or sparsely pubescent on lf veins,  
axils, and bud scale margins and tips ..... *C. glabra*
- 2 Lvs and young stems pubescent ..... 4
- 4 Twigs stout; terminal buds > 1.2 cm long; terminal bud with some, but  
certainly not covered with yellow or white scales ..... 5
- 5 Lflets 7-9 (rarely 5); bark not exfoliating ..... *C. tomentosa*
- 5 Lflets 5 (rarely 7); bark exfoliating ..... *C. ovata*
- 4 Twigs slender; terminal bud < 1.2 cm; terminal bud more or less covered  
with yellow or sometimes white scales ..... *C. pallida*

***Carya cordiformis*** (Wangenh.) K. Koch. Bitternut, Swamp, or Pignut Hickory  
Tree, eastern USA with yellow sulfury naked buds; lflets 5-9.  
Infrequent; trail side in mesic woods.

***Carya glabra*** (Mill.) Sweet. Pignut Hickory, Red Hickory  
Tree, USA S of a line from NH to TX except for FL. Lflets 5 (rarely 7).  
Frequent; dry uplands and sloped woods.  
[*Carya ovalis* (Wangenh.) Sarg., *C. glabra* (Mill.) Sweet var. *odorata* (Marshall) Little]

***Carya ovata*** (P. Mill.) K. Koch. Shagbark Hickory  
Tree, middle and eastern USA.  
Infrequent; bottoms of gorge slopes just up from the riparian zone in the rich woods.

***Carya pallida*** (Ashe) Engl. & Graebn. Sand Hickory, Pale Hickory  
Tree, primarily of southeastern USA. Buds with a very silvery or gold lepidote scales nearly  
covering the entirety of the scales.  
Frequent; dry woods of the plateau and drier slopes of the gorge.

***Carya tomentosa*** (Poir.) Nutt. Mockernut Hickory  
Tree, eastern USA. Lvs tomentose and pale orange to brown beneath.  
Common; a characteristic and dominant tree of the upland plateau, generally encountered  
on the drier slopes of the gorge.

## **Castanea**

1 Lvs glabrous on both surfaces; spines on the fruit glabrous; usually

2 or 3 nuts that are flattened on one side . . . . . *C. dentata*

1 Lvs pubescent beneath; spines on the fruit pubescent; solitary nut round . . . *C. pumila*

*Castanea dentata* (Marsh.) Borkh. American Chestnut

Tree, although now often reduced to a few, small suckers due to the chestnut blight (*Cryphonectria parasitica*). Still found in the eastern USA, this tree was once characteristic and dominant.

Scarce; only a few stems were seen and one of those was less than 2 meters tall and erupting with the rusty brown to red fungal pustules. The infected stem was seen at the top of the long stairway leading to the top of the arch on the Twin Arches Trail. A dry, sandy, rocky, upland habitat.

**TN: SPECIAL CONCERN SPECIES**

**KY: ENDANGERED** (Not collected in KY)

*Castanea pumila* (L.) Mill. Chinquapin

Small tree, although often shrub-like, eastern and southern middle USA.

Occasional; along dry roadsides (including old skid roads) and thicket-like areas.

**KY: THREATENED** (Not collected in KY)

## **Catalpa**

1 Lvs long tapering at the apex; lower floral lobe notched . . . . . *C. speciosa*

1 Lvs abruptly short acuminate; lower floral lobe not notched . . . . . *C. bignonioides*

*Catalpa bignonioides* Walt. Southern Catalpa, Indian Bean Tree

Tree, southern USA, naturalized throughout the east and parts of the W.

Very rare; not found during this study. Allawos (1994) reported this species from the NWOC drainage area in Scott county.

[*C. catalpa* (L.) Karst.]

*Catalpa speciosa* (Warder ex Barney) Engelm. Northern Catalpa, Catawba Tree, Cigar Tree Tree, middle and eastern USA.

Scarce; along rivers and creeks in disturbed habitats. There is a tree just S of Leatherwood Ford on the eastern margin of the river. There are a couple more trees along the railroad tracks, by the trestle at Blue Heron.

*Catalpa* sp. planted at the park headquarters on Leatherwood Rd, two more are across the street from the White Pine Baptist Church.

## **Ceanothus**

*Ceanothus americanus* L. New Jersey Tea

Shrub, eastern and middle USA. Generally < 1 m tall. Lvs serrate with three prominent veins, more or less pilose beneath.

Infrequent; dry open woods and gravelly or rocky banks of the SFR.

[*C. americanus* var. *intermedius* (Pursh) Torr. & Gray, *C. americanus* var. *pitcheri* Torr. & Gray]

## **Celastrus**

*Celastrus scandens* L. American Bittersweet, Waxwork

Vine or twining shrub, eastern and middle (extending westward) USA.

Rare, only a few plants were seen along the Rock Creek trail on a creek bench on the BSFNRRA side of the creek (TN) and again upriver from Beatty Oil Well along the N side of the SFR on the trail heading to Troublesome Creek (KY). All of the plants seen were juvenile.

## **Celtis**

1 Lvs entire or with very few, usually interspersed, teeth ..... *C. laevigata*

1 Lvs more or less regularly toothed (at least the top half of each lf) ..... 2

2 Lf blades serrate almost to the base ..... *C. occidentalis*

2 Lf blades serrate < halfway to the base ..... *C. tenuifolia*

*Celtis laevigata* Willd. Southern Hackberry

Tree or shrub, southern USA.

Rare; few plants upriver from Beatty Oil Well along the N side of the SFR trail side on the way to Troublesome Creek, KY. Also rarely present along No Business Cr.

*Celtis occidentalis* L. Northern Hackberry

Tree, middle and eastern USA, although in the BSFNRRA only observed as a shrub as this species is known to vary greatly in response to habitat. Variability also comes from hybridization with other members of the genus (*C. tenuifolia*).

Scarce; in varying habitats from the dry, sandy mouths of rock houses to damp rich river benches. One large tree, W bank of SFR between Station Camp and Big Island.

*Celtis tenuifolia* Nutt. Dwarf Hackberry

Small tree or shrub, middle and eastern, except for extreme northern, USA.

Rare; collected near Station Camp, Troublesome Creek, and previously in Scott Co.: Near No Business Creek., June 1947, A. J. Sharp, R. E. Shanks, and E. E. C. Clebsch 3872.

## **Cephalanthus**

*Cephalanthus occidentalis* L. Buttonbush

Shrub, eastern and middle USA. Lvs attenuate, cuneate, and opposite, but often whorled with 3 lvs at a node (rarely 4).

Common; along the SFR and the wider parts of the CFR and NR, extending throughout the riparian zone. Many large, healthy plants may be seen around Brewster Bridge.

[*C. occidentalis* var. *californicus* Benth., *C. occidentalis* var. *pubescens* Raf.]

## **Cercis**

*Cercis canadensis* L. Redbud, Judas Tree

Small tree, eastern and middle USA. Brown to black leguminous fruits, or at least their short peduncles, are persistent on the twigs throughout most of the year.

Occasional; roadside, also in rich woods and along trails near ravines.

## **Chimaphila**

*Chimaphila maculata* (L.) Pursh. Spotted Wintergreen, Pipsissewa, Waxflower

Subshrub, eastern USA. Generally < 1 dm tall; lvs dark green and variegated with white; peduncles erect from the top of the vegetative portion and typically contain 1-3 (< 5) waxy, white flowers.

Frequent; in heath-hemlock forests.

## **Chionanthus**

*Chionanthus virginicus* L. Fringe Tree, Old-Man's Beard

Small tree or large shrub, USA S of a line from NY to TX. Flowers in thick clusters with long cream-colored petals, at anthesis appearing fringe-like.

Infrequent; along the wider parts of the rivers.

## **Cladrastis**

*Cladrastis kentukea* (Dum. Cours.) Rudd. Yellow Wood

Tree, USA scattered populations from AK to AL to NC to KY. Petiole base enclosing lf buds of the next year; lflets alternate to sub-opposite.

Scarce; although locally abundant near Yahoo Falls.

[*C. lutea* (F. MICHX.) K. Koch]

## **Clematis**

*Clematis virginiana* L. Clematis, Virgin's Bower, Devil's Darning Needle

Vine, eastern and middle USA. Lvs 3-foliolate, thin, and sometimes slightly lobed.

Scarce; thicket-like margins of the SFR and swampy homesteads near No Business Cr.

[*C. virginiana* var. *missouriensis* (Rydb.) Palmer & Steyermark]

*C. viorna* was also collected and was considered woody by Peter White (1982); however, this species is not considered woody by other authors including Wofford & Chester ("Trees, Shrubs, and Woody Vines of Tennessee" in manuscript), therefore it is not included.

## **Clethra**

*Clethra acuminata* Michx. Sweet Pepper Bush, Mountain White Alder

Shrub, sometimes a small tree, southeastern USA, northward to PA. Racemes solitary; flowers white or cream-colored.

Frequent; rich woods of gorge slopes and small, bouldery rock outcrops.

## Cocculus

*Cocculus carolinus* (L.) DC. Coralbeads, Snailseed

Vine, USA from VA to NE to TX to FL. Flowers greenish; drupes red, the size of a pea.

Very rare; known from 1 location along the SFR in KY, just down river from the confluence with Troublesome Creek. Also, from Scott Co.: South Fork Piney Creek. River bench near No Business Cr., 22 June 1947, A. J. Sharp, R. E. Shanks, and E. E. C. Clebsch 3951.

## Comptonia

*Comptonia peregrina* (L.) Coult. Sweet Fern

Shrub, USA from Wisconsin to Maine to a couple of northeastern counties of GA.

Very rare; only known from Scott county TN and McCreary and Laurel counties KY. Although many stems, approximately 75 to 100 were documented in one small location in the park, this species is considered to be very rare in abundance because of the instability of the riparian habitat in which this species was found. This is the only the third collection location of this species in Tennessee; the first was made in Scott Co.: Near Montgomery Junction, June 1842, Rugel 140; and the second in Scott Co.: Open, W facing bouldery bank of the SFR, .2 miles N of Williams Creek, about 1 mi. S of the KY border. Scarce, hidden among shrubs and small trees, 5 plants seen, June 1980, T. S. Patrick, W. M. Dennis, B. E. Wofford, D. K. Smith, and R. Holton 1265.

[*C. peregrina* var. *aspleniifolia* (L.) Fern.]

**TN: ENDANGERED SPECIES**

**KY: ENDANGERED SPECIES** (Not collected in KY)

## Conradina

*Conradina verticillata* Jennison. Cumberland Rosemary

Shrub, Only known from 5 counties in TN and McCreary county KY—the counties surrounding the BSFNRRRA. Aside from the SFR, NR, CFR, and WOC this species is only known from the Caney Fork, Obed River, Daddy's Creek, Clear Creek, and the Emory River in TN. Usually less than 2 dm tall; lower branches rooting; bark finely exfoliating; lvs somewhat needle-like, glandular pitted above; corolla lavender, spotted. Patrick (1979) noted that Big Island contains the largest known population to date and Roulston (1994) documented the largest population of this species along the SFR.

Scarce, found only on the sandy, cobble or gravel bars of the SFR and wider parts of the CFR. [*C. montana* Small]

**FEDERAL LISTED THREATENED SPECIES**

**TN: THREATENED SPECIES**

**KY: ENDANGERED SPECIES** (Not collected in KY)

## Cornus

1 Lvs alternate; low growing shrub usually < 1m tall ..... *C. alternifolia*

1 Lvs opposite; medium size shrub or small tree ..... 2

2 Pith lighter brown and spongy; fruits red, in dense clusters ..... *C. florida*

2 Pith deep tan and solid; thick; fruits blue, in loose clusters ..... *C. amomum*

***Cornus alternifolia*** L.f. Alternate-leaved Dogwood, Pagoda Dogwood, Green Osier  
Shrub, eastern USA. Branches usually grouped into irregular platforms.  
Scarce; rich damp woods, many plants scattered around the Yahoo Falls area.

***Cornus amomum*** Mill. Silky Dogwood, Red Willow, Knob-styled Dogwood  
Shrub, eastern USA. Up to 3 m tall with reddish brown to gray bark and deep blue-pearly fruits.  
Frequent; along rivers and damp thickets of riparian habitats.

***Cornus florida*** L. Flowering Dogwood  
Small tree, USA S of a line from MN through MI and W to TX. Large, white or slightly greenish, showy bracts. This species should be watched closely for the fungal pathogen *Discula destructiva*, which causes dogwood anthracnose. First noticed in this country in the late 1970's it is a disease that is spreading rapidly in the southern USA.  
Common; subcanopy tree of submesic to xeric woods.

## Corylus

***Corylus americana*** Walter. American Hazelnut  
Shrub, eastern and middle USA. Up to 3 m tall; twigs, petioles, and involucre have gland-tipped hairs.  
Occasional; wooded slopes of the gorge and trail margins throughout.

## Crataegus

(Modified from R. L. Lance contribution to Wofford & Chester "Trees, Shrubs, and Woody Vines of Tennessee")

- 1 Petioles and lowermost margins of blades distinctly glandular, especially early in the season ..... *C. intricata*
- 1 Petioles and lower blade eglandular or with only a few remote glands in the spring ..... 2
- 2 Lf bases rounded, flattened, or cordate, occasionally abruptly narrowed . *C. pruinosa*
- 2 Lf bases cuneate or wedge-shaped ..... 3
- 3 Lf veins impressed above, prominent beneath ..... *C. punctata*
- 3 Lf veins not as above, often obscure ..... 4
- 4 Lvs shallowly lobed, widest at or near middle ..... *C. viridis*
- 4 Lvs rarely lobed, widest above the middle ..... *C. crus-galli*

***Crataegus crus-galli*** L. Cock-Spur Hawthorn  
Small tree, often shrubby, eastern and middle USA.  
Very rare, collected once on the peninsula of the confluence of the CFR and NR.

***Crataegus intricata*** Lange. Entangled Hawthorn, Copenhagen Hawthorn  
Small tree, often shrubby, eastern USA.  
Occasional; along the SFR and CFR in mesic woods, often along the rivers.

***Crataegus pruinosa*** (H. L. Wendl.) K. Koch. Frosted Hawthorn

Small tree, often shrubby, eastern USA.

Very rare, I have not found this species in the BSFNNRA, reported by Bailey (1998).

***Crataegus punctata*** Jacq. Dotted Hawthorn

Small tree, often shrubby, eastern USA.

Very rare, known from a single location approximately .5 miles down river of the confluence of the NR and CFR.

***Crataegus viridis*** L. Green Hawthorn

Small tree, often shrubby, eastern USA from FL to PA to TX to KS.

Rare; collected a couple of times along the SFR, once near Angel Falls.

### **Diospyros**

***Diospyros virginiana*** L. Common Persimmon

Tree, eastern USA. Lvs thick and ovate-oblong, commonly with dark bluish-blackish places that appear "inky". Fruit is plum-like and very astringent before ripe, but it turns very sweet.

Frequent; xeric woods and drier, elevated cobble or boulder bars along the main rivers.

### **Dirca**

***Dirca palustris*** L. Leatherwood, Wicopy, Rope Bark

Shrub, eastern USA. Flowers light yellow and white; wood is soft and brittle and surrounded by very tough fibrous bark. Twigs conspicuously jointed and usually tan.

Infrequent; in or adjacent to riparian habitats within the flood zone. This species is more commonly found near the area of the park that bares its name, and may be easily seen when walking the boardwalk at Leatherwood Ford.

### **Elaeagnus**

**\**Elaeagnus umbellata*** Thunb. Oleaster, Autumn Olive, Silverberry

Shrub, introduced from eastern Asia around 1830. A problematic weed that is now present from ME to FL and W to NE. The flowers are axillary and the young fruits are silvery, turning red-speckled at maturity.

Infrequent to occasional throughout the park. However, in several locations (Bear Creek Overlook and Joe Branch) there are large populations. Disturbed, dry habitats, abandoned cultivated fields, field margins, thickets, and roadsides.

Actively promoted by federal agencies for erosion control, strip mine reclamation, and wildlife habitat. It also has N-fixing capability and is capable of blooming as early as 3 years after germination and each plant produces many fruits which are eaten by birds and other wildlife.

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

## **Epigaea**

***Epigaea repens* L.** Trailing Arbutus, Ground Laurel, Mayflower

Subshrub, eastern USA. Trailing plant with evergreen, oval lvs. Flowers light pink to white with a spicy fragrance.

Occasional; xeric sandy to rocky open woods and rock outcrops, bases of the rock cliffs that are often present at the gorge rim.

[*E. repens* var. *glabrifolia* Fern.]

## **Euonymus**

***Euonymus americanus* L.** Strawberry-bush, American Burning Bush

Shrub, eastern USA. Erect or straggling shrub to 2 m tall; twigs green, angled; lvs short-petiolate, lanceolate to elliptical. Flowers yellowish or greenish; capsules rough, warty, and deep red when mature.

Frequent; rich woods, especially along trails. Heavily browsed (deer), the tops are often missing.

## **Fagus**

***Fagus grandifolia* Ehrh.** American Beech, Large-leaved Beech

Tree, eastern USA. Lvs with conspicuous teeth and parallel lateral veins, silky on the undersurface, lvs (dead) persistent through winter; buds very long, slender; bark light gray and smooth, commonly with scarification, as North American primates tend to engrave their passion and deface the tree simultaneously.

Frequent; rich upland to mesic woods and gorge slopes. Some trees of this species are very large since they were overlooked and not harvested for timber.

## **Fothergilla**

***Fothergilla major* (Sims) Lodd.** Witch Alder

Shrub, only known from a few counties in TN, KY, NC, SC, GA, AL, and AR (although the AK specimen may be introduced because all of the others are centered around eastern TN). Flowers in spikes, apetalous, appear before the lvs.

Very rare, only a few plants were seen, and of those only one or two appeared large and healthy. A widely scattered population exists in the vicinity of O&W Bridge.

**TN: THREATENED**

## **Fraxinus**

1 Lflts pale green beneath to slightly glaucous; the buds are large and brown to rust colored (appearing like a "chocolate chip"); the fruit wings are

only decurrent along the upper 1/3 of the fruit body ..... ***F. americana***

1 Lflts green beneath; buds not as above; the fruit wings decurrent to

near the middle of the fruit body ..... ***F. pennsylvanica***

***Fraxinus americana* L.** American Ash, White Ash

Tree, eastern and middle USA. Some taxonomists recognize the var. *biltmoreana* (Beadle) J. W. Wright ex Fernald which is similar to the typical variety except that the young

branches, petioles, and lf rachises are velvety pubescent. Both forms of this species have been collected in the BSFNRRA.

Frequent; along the SFR margins and benches at the bottom of the gorge.

***Fraxinus pennsylvanica* Marsh.** Green Ash, Red Ash

Tree, eastern USA, W to MT and TX.

Occasional; locally abundant on the margin or peripheral flood zone of the SFR N of Yamacraw bridge.

### **Gaultheria**

***Gaultheria procumbens* L.** Wintergreen, Teaberry, Mountain Tea, Checkerberry

Subshrub, USA east of a line from MN to AL. Lvs aromatic with the smell of wintergreen, elliptic to slightly obovate and coriaceous; corolla pinkish-white.

Infrequent; xeric to mesic sandy or rocky woods, gorge slopes.

### **Gaylussacia**

***Gaylussacia baccata* (Wangenh.) K. Koch** Black Huckleberry

Shrub, eastern USA with the countenance of *Vaccinium* except for the lvs being covered with shiny resinous droplets.

Infrequent; dry or moist woods, trail side, margins of thicket-like areas and clearings.

### **Hamamelis**

***Hamamelis virginiana* L.** Witch Hazel

Shrub or small tree, USA east of a line from MN to TX. Yellow flowers appear over the winter (or late fall).

Frequent throughout; an understory component of the plateau surface and gorge slopes.

### **Hydrangea**

***Hydrangea arborescens* L.** Wild Hydrangea, Seven Bark.

Shrub, USA present from NY to OK to FL. Up to 3 m tall; lvs long petiolate; cymes persistent.

Frequent; rich mesic slopes, rocky damp slopes, and mixed woods.

### **Hypericum**

1 Stems decumbent, forming dense mats < 3 dm tall ..... ***H. stragulum***

1 Stems erect; plants usually > 3 dm tall ..... 2

2 Lvs < 2.5 cm long ..... ***H. hypericoides***

2 Lvs > 2.5 cm long ..... 3

3 Lf blades with a hyaline margin and without a line of articulation

at base of lf and stem ..... ***H. nudiflorum***

3 Lf blades without a hyaline margin and with a line of articulation at

the base of lf and stem ..... 3

4 Lvs linear, < 7 mm wide; mature capsules < 6 mm long ..... ***H. densiflorum***

4 Lvs oblong, > 7 mm wide; mature capsules > 6 mm long ..... ***H. prolificum***

***Hypericum densiflorum*** Pursh. Dense-Flowered St. Johnswort, Bushy St. Johnswort  
Shrub, eastern USA from NY through TN to TX and FL.

Very rare, reported by. Bailey (1998). Not known from the plateau in TN but rather from ridge and valley counties and eastern highland rim counties.

***Hypericum hypericoides*** (L.) Crantz. St. Andrew's Cross

Shrub, eastern USA from NY to TX to FL.

Very rare, known from 1 location along the trail to Slave Falls from the Sawmill trail head.

***Hypericum nudiflorum*** Michx. Early St. Johnswort

Shrub, southeastern USA to TX.

Very rare, only known from a single collection in Scott Co.: Clear Fork River, ca. 100 yds. Above Burnt Mill Bridge, terraces along northeast side of river, 3 Aug. 1989, B.E. Wofford 89-46.

***Hypericum prolificum*** L. Shrubby St. Johnswort

Shrub, eastern USA.

Occasional; along rivers and damped roadside ditches.

**KY: HISTORIC SPECIES** (Not collected in KY)

***Hypericum stragulum*** W. P. Adams & N. Robson

Shrub, eastern, except for the extreme N, USA.

Occasional; dry upland woods, especially along roads and skid roads.

[*Ascyrum hypericoides* L. var. *multicaule* (Michx. ex Willd.) Fernald; *H. hypericoides* L. var. *multicaule* (Michx. ex Willd.) Fosberg]

## **Ilex**

1 Lvs evergreen with spiny, rarely entire margin ..... *I. opaca*

1 Lvs deciduous; margins entire, serrate, or crenate ..... 2

2 Lvs mostly borne on spur shoots; endocarps with  
bony ridges ..... *I. ambigua*

2 Lvs never borne on spur shoots; endocarps smooth ..... *I. verticillata*

***Ilex ambigua*** (Michx.) Torr. var. *ambigua*

Carolina Hemlock

Small tree or shrub, eastern USA.

Infrequent; mesic woods of the upper plateau.

***Ilex opaca*** Ait. American Holly

Tree, USA S of a line from ME to TX, often small and even shrub-like.

Frequent; along cliff bases and gorge woodlands.

***Ilex verticillata*** (L.) A. Gray. Winterberry, Black Alder, Apalanche

Shrub, eastern USA. Up to 4 m tall, may be tree-like.

Infrequent; along streambanks of the SFR and CFR.

### **Itea**

*Itea virginica* L. Virginia Willow, Virginia Sweetspire, Tassel-White

Shrub, USA from PA to TX to FL. Flowers white, in a loose raceme; fruits 2-parted.

Common; riparian zone of all major rivers and creeks, including the SFR, CFR, and NR.

### **Juglans**

1 Lf scars with a hairy fringe present along the upper margin; stellate trichomes present on the undersurface of the lf blade that are not restricted to the veins;

pith of older twigs dark brown ..... *J. cinerea*

1 Lf scars without hairy fringe along the upper margin; stellate trichomes on the undersurface of the lvs absent or few and restricted to the veins; pith of

older twigs light brown ..... *J. nigra*

*Juglans cinerea* L. White Walnut, Butternut

Tree, eastern USA except for FL and LA. Often odd-pinnate (terminal lfl present).

Rare; rich damp woods and river benches. This species is being killed throughout its range by a fungal pathogen (*Sirococcus clavigignenti-juglandacearum*) that was first discovered in this country in 1967 in WI.

**TN: THREATENED SPECIES**

**KY: SPECIAL CONCERN SPECIES** (Not collected in KY)

*Juglans nigra* L. Black Walnut

Tree, middle and eastern USA. Often even pinnate (terminal lfl missing).

Infrequent; rich mixed woods of gorge slopes, and disturbed habitats. One notably large population of young (5 to 20 yrs. old?) trees is at Joe Branch, just up the dirt road from the picnic area.

### **Juniperus**

*Juniperus virginiana* L. Eastern Red Cedar, Savin

Tree, middle and eastern USA.

Infrequent; disturbed, dry habitats, old field margins, fence rows, and along the boulder bars from the confluence of the CFR & NR to the Honey Creek area.

### **Kalmia**

*Kalmia latifolia* L. Mountain Laurel, Calico-Bush, Spoonwood, "Ivy"-Bush

Shrub, eastern USA. Flower buds naked; flowers showy white-pink.

Common throughout most habitats of the gorge slopes from dry rocky outcrops through damp woods and hemlock associations to dry, frequently flooded cobble or boulder bars.

## **Lespedeza**

### **\**Lespedeza bicolor* Turcz. Bush Clover**

Shrub, introduced from eastern Asia and spread throughout the eastern USA, except for New England.

Scarce; found along roadsides, parking lots, and field margins. There is one large population, probably planted for erosion control was seen in the cut over fields adjacent to an unnamed road near Panther Creek.

**TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

## **Ligustrum**

### **\**Ligustrum sinense* Lour. Chinese Privet**

Shrub, introduced from eastern Asia, spread S of a line from MA to TX. Flowers white, sweet-fragrant. An invasive weed that should be monitored by the park service.

Scarce; damp habitats of roadsides and river benches, planted in old fields of homesteads, but also escaped to heavily disturbed areas of the park, like frequently mowed roads of campgrounds (Blue Heron). This species may become problematic in the BSFNRRRA as it has in other places because the seeds are eaten by wildlife, primarily birds, and it readily forms root and stump sprouts. It must be pulled out by the roots and destroyed; if plowed or cut off above ground the plant comes back with increased vigor (Ken McFarland, pers. comm.)

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

## **Lindera**

### ***Lindera benzoin* (L.) Blume. Spicebush, Wild Allspice, Benjamin-Bush, Fever-Bush**

Shrub, eastern and southern middle USA. Typically 1-3 meters tall with spicy-fragrant lvs and twigs.

Frequent; along water routes, in damp woods, especially forested river benches.

## **Liquidambar**

### ***Liquidambar styraciflua* L. Sweet Gum**

Tree, USA S of a line from NY to TX. Persistent pistillate flowers pendant in globose heads or "sweetgum balls".

Occasional; along the rivers, in wet habitats such as roadside ditches. Many trees have been seen along the rivers, some of which are fairly large and wounded with oozing sap as they seem to be preferentially eaten by beavers.

## **Liriodendron**

### ***Liriodendron tulipifera* L. Tulip-Tree, Tulip Poplar, Yellow Poplar**

Tree, eastern USA. Tulip-like flowers produced in spring. Lvs distinctly truncate with a shallow notch; bark light to medium gray. This is the state tree of both TN and KY (and probably a few others).

Common throughout.

## Lonicera

- 1 Lvs connate below the inflorescence; flowers red ..... *L. sempervirens*  
1 Lvs not connate; flowers yellow or white ..... *L. japonica*

### *\*Lonicera japonica* Thunb. Japanese Honeysuckle

Vine, introduced from Asia around 1806, a severe problem in parts of the USA S of a line from southern ME to northern CA.

Occasional; generally encountered along roadsides, thickets, old home sites, and field margins. Seems to be very aggressive in some places within the BSFNRRRA where it has thoroughly destroyed the native vegetation (Along the road to Blue Heron and the old fields near Jakes Place). Eradication or attempts to control the spread of this species should be a priority. Seeds are dispersed by birds and germinate immediately in an array of light conditions.

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

### *Lonicera sempervirens* L. Coral Honeysuckle, Trumpet Honeysuckle

Vine or twining shrub, eastern and middle USA.

Very rare, only known from a single location in Scott Co.: Gravel bars and terraces in the vicinity of confluence of Pine Creek and SFR about 1 mile above Jakes Hole, 4 May 1989, B.E. Wofford 89-44.

## Lyonia

### *Lyonia ligustrina* (L.) DC. Maleberry, Male Blueberry

Shrub, USA S of a line from ME to TX. Persistent, globose, often striped capsule.

Occasional; along the gravel, cobble, and boulder bars of the SFR, CFR, and NR.

## Magnolia

- 1 Lvs evergreen, rusty-pubescent beneath ..... *M. grandiflora\**  
1 Lvs deciduous, not rusty-pubescent beneath ..... 2  
2 Lf bases cuneate, or nearly so ..... 3  
3 Lvs clustered at the tips of the twigs, > 3 dm long ..... *M. tripetala*  
3 Lvs somewhat scattered along the branches, < 3 dm long ..... *M. acuminata*  
2 Lf bases auriculate ..... 4  
4 Buds, stipules, and twigs hairy; lvs glaucous beneath, 3.0-9.0  
dm long ..... *M. macrophylla*  
4 Buds and stipules glabrous or glabrate; lvs green beneath, 2.0-5.0  
dm long ..... *M. fraseri*

### *Magnolia acuminata* (L.) L. Cucumber-Tree

Tree, USA from ME to OK to FL.

Occasional; mesic to xeric woods on the plateau gorge slopes.

### *Magnolia fraseri* Walt. Fraser Magnolia, Ear-Leaved Umbrella Tree

Tree, eastern USA from OH to NC to AL and NY.

Rare; collected a couple of times in KY, and once in TN up Rob Watson Rd. The TN collection is a record for the Cumberland Plateau province in TN.

**\**Magnolia grandiflora* L.** Southern or Evergreen Magnolia, Bull Bay  
Tree, southeastern USA coastal plain, which has been planted widely around the country.  
Very rare; planted at the Ranger's Station on the east side of the park along Leatherwood Ford Road.

***Magnolia macrophylla* Michx.** Big- or Great-Leaved Magnolia  
Tree, eastern USA from OH to NC to LA. Lvs extremely large (largest simple lvs in flora of BSFNRRRA).  
Common; ravines, damp rich woods, and stream and river banks of the gorge slopes and less frequently, in dampened upland habitats.

***Magnolia tripetala* L.** Umbrella Magnolia  
Tree, eastern USA from NY S with very large lvs.  
Occasional; rich woods of gorge slopes.

## Malus

- 1 Lvs hairy beneath at maturity; stems never with thorny spur branches . . . . *M. pumila*
- 1 Lvs glabrous at maturity; stems often with thorny spur branches . . . . . 2
- 2 Lf blades often < 4 cm long and always elliptical and cuneate  
at the base . . . . . *M. angustifolia*
- 2 Lf blades often > 4 cm long and the bases rounded to cordate . . . . . *M. coronaria*

***Malus angustifolia* (Ait.) Michx.** Southern Wild Crabapple  
Small tree, primarily of southeastern USA, N to PA.  
Rare; one large population in field near the Horse Camp at Bear Creek overlook.  
**KY: SPECIAL CONCERN SPECIES**

***Malus coronaria* (L.) Mill.** Sweet Wild Crabapple  
Small tree, eastern USA. Lvs often slightly lobed near the base.  
Very rare; single small population close to Panther Creek on the top of the plateau.

**\**Malus pumila* Mill.** Common Apple  
Small tree, introduced from Eurasia and naturalized throughout the USA.  
Scarce; many trees present around almost all of the old home sites. It seems that there are many varieties of apple trees planted around the park  
[*Pyrus malus* L.]

## Menispermum

***Menispermum canadense* L.** Moonseed, Yellow Parilla  
Vine, eastern and middle USA. Delicate in appearance; lvs peltate and usually 3-lobed.

Occasional; rich river benches and tributaries. A large population is across the river from the Blue Heron parking area.

### **Mitchella**

*Mitchella repens* L. Partridge-Berry, Two-Eyed-Berry, Running Box

Subshrub, eastern and middle USA. Orbicular or ovoid lvs that may be variegated along the midrib with a whitish line. A few red fruits often persistent through much of the year.

Common; found in moist to dry woods, on boulders and hanging from rock faces.

### **Morus**

*Morus rubra* L. Red Mulberry

Tree, middle and eastern USA. Fruits red, turning purple; lvs often lobed but some are not and then may be confused with *Tilia*.

Infrequent; disturbed, damp habitats such as river benches, parking areas, fence rows, and field margins.

### **Nyssa**

*Nyssa sylvatica* Marsh. Black Gum, Black Tupelo

Tree, eastern and southern middle USA. Extremely variable foliage, usually obovate or elliptical, simple lvs that may be small or large and may be "crowned" with several large teeth at the apex or the apex may be acute to acuminate. Typically a small to medium sized tree, may be shrub-like in disturbed (trail side or riparian) habitats.

Common throughout; upland woods through the drier slopes of the gorge to the bouldery river banks.

### **Ostrya**

*Ostrya virginiana* (Mill.) K. Koch. Hop-Hornbeam, Ironwood

Tree, eastern and middle USA. Very sharply doubly serrate lvs; bark brownish and furrowed. May be confused with *Carpinus* or *Betula*.

Occasional; rich mesic woods of upland and gorge slopes.

### **Oxydendrum**

*Oxydendrum arboreum* (L.) DC. Sourwood, Sorrel-Tree

Tree, eastern USA. One-sided, persistent racemes that upon senescence remain somewhat intact on the ground below the tree; lvs sour tasting.

Frequent; secondary canopy tree of mesic to xeric woods (rarely reaching primary canopy height).

### **Parthenocissus**

*Parthenocissus quinquefolia* (L.) Planch. Virginia Creeper

Vine, middle and eastern USA. Tendrils with adhesive disks.

Common; rocky woods, cliffs, trail side, parking lots, and roadsides.

## Paulownia

**\**Paulownia tomentosa* (Thunb.) Steud.** Empress or Princess-Tree, Karri-Tree  
Tree, introduced from western and central China around 1830, escaped, invasive weed S of a line from MA to TX. Bark gray; young branches with prominent white lenticels; lvs large, cordate, entire or shallowly lobed and tomentose beneath. May be confused with *Catalpa* spp.

Scarce; along roadsides, on river benches, and may immigrate to any frequently disturbed habitat. Found at Charit Creek, near the lodge, and several trees were seen growing from the limestone boulders between the parking lot and the river at Blue Heron.

It may easily become more abundant as it has a fast growth rate and can reproduce by either root sprouts or seeds that may be wind or water borne and germinate immediately.

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

## Philadelphus

***Philadelphus hirsutus* Nutt.** Cumberland Mock Orange, Streambank Mock Orange  
Shrub, southeastern USA. Lvs sharply serrate; styles persistent and united; capsules 3-4 locular.

Rare; several healthy plants found in 1 location, approximately < 1 mile south of Station Camp parking area along the East River trail growing on the low, limestone ridge running parallel to the river where a limestone creek enters the river. Notably, probably the only place in the park with this soil type.

## Phoradendron

***Phoradendron leucarpum* (Raf.) Reveal & M. C. Johnston.** Mistletoe  
Shrub, USA, south of a line from NY to NM. Stems jointed, much-branched.  
Scarce; obligate hemiparasitic shrub of various deciduous trees.

## Physocarpus

***Physocarpus opulifolius* (L.) Maxim.** Ninebark  
Shrub, middle and eastern USA. Mostly < 3 m tall with reddish, loose fitting, peeling bark.  
Occasional; river benches, moist bottomland woods.

## Pinus

1 Lvs 5/fascicle; cone scales without prickles ..... *P. strobus*  
1 Lvs 2-3/ fascicle; cone scales with a prickle (possibly small) ..... 2  
2 Lvs in 2's, 4-8 cm long; cone scales tipped with a stout prickle ..... *P. virginiana*  
2 Lvs in 2's or 3's, 7-13 cm long; cone scales tipped with a small prickle . *P. echinata*

***Pinus echinata* Mill.** Shortleaf Pine, Yellow Pine  
Tree, USA S of a line from NY to TX.  
Occasional; xeric to mesic woods, such as ridge tops.

***Pinus strobus* L. Eastern White Pine**

Tree, USA from N GA to ME to MN. Needles often with blue hue.

Frequent; mesic woods, throughout most uplands and wooded gorge slopes.

***Pinus virginiana* Mill. Virginia Pine, Scrub Pine**

Tree, USA from southern NY to northern MS.

Frequent; mesic to subxeric woods, S facing ridge tops, upland field margins and bluffs.

**Platanus**

***Platanus occidentalis* L. Sycamore, Buttonwood, Plane Tree**

Tree, middle and eastern USA. Very characteristic peeling bark; petioles enclose bud of next season.

Common; characteristic and dominant along the SFR. After Birch and Ash this is the third most common tree along the major water routes.

**Populus**

1 Lvs with dense white pubescence on the lower surface; some of the

teeth being very large and appearing as lobes ..... *P. alba*

1 Lvs without white pubescence on the bottom; never appearing lobed ..... 2

2 Lvs generally with < 15 large teeth on each side of the midrib .... *P. grandidentata*

2 Lvs with > 15 teeth on each side of the midrib ..... *P. deltoides*

**\**Populus alba* L. White or Silver-Leaved Poplar**

Tree, introduced from Europe, naturalized throughout the USA. Bark light gray, smooth; lvs heavily white felted.

Rare; a large population near old home site, just above Reed Bottoms. Also, a few small trees near Jakes Place. However, this species has been seen several times just outside the park boundary and should be monitored as it forms dense thickets from root sprouts and grows rapidly.

**TN: Invasive Exotic Pest Plant Rank 3; Lesser Threat**

***Populus deltoides* Bartr. ex Marsh. Cottonwood, Necklace Poplar**

Tree, eastern and middle USA. Lvs subtruncate, triangular.

Rare; 1 extremely large tree (possibly the largest dbh of any tree seen in the park) near the Alum Ford boat put-in. Although the canopy appeared to be healthy, beavers stripped the bark from a large portion of the base of the trunk. A few small stems are along the road to Station Camp.

***Populus grandidentata* Michx. Large or Big-Tooth Aspen**

Tree, USA from ME to ND to TN and NC.

Very rare; several small trees are along the road to the Alum Ford boat put-in. However this species was seen several times outside of the park boundary in TN.

**TN: SPECIAL CONCERN SPECIES (Not found in TN)**

## **Prunus**

- 1 Buds densely wooly ..... *P. persica*
- 1 Buds not densely wooly ..... 2
  - 2 Twigs never thorny; lf midvein often with dense rusty hairs along the undersurface of the lf blade; bud scales glossy brown ..... *P. serotina*
  - 2 Twigs with thorn-like spur branches; lf midvein not as above; bud scales dull brown, gray, or black ..... 3
- 3 Lvs folded lengthwise along the midrib, mostly < 7 cm long .... *P. angustifolia*
- 3 Lvs not folded lengthwise along the midrib, mostly > 7 cm long ..... (Also see *P. mexicana*) *P. americana*

### ***Prunus americana* Marsh. Wild Plum**

Tree, middle and eastern USA. Bark dark; lvs often doubly serrate.  
Infrequent; thicket-like areas, woodland borders, trail side and along skid roads.

### ***Prunus angustifolia* Marsh. Chickasaw Plum**

Small tree or shrub, USA S of a line from PA to CO.  
Rare, dry thicket-like area, a large population along John Muir trail, near No Business Cr.

### ***Prunus mexicana* S. Wats. Mexican Plum**

Tree, USA from ND to NC to TX.

*P. mexicana* may not exist in the park although at one point Goodson (2000) thought that she had collected it (pers. comm.) Although she did not report it in her finished work; different investigators may disagree on the identification of the 'middle-of-the-road' degree of pubescence found in some varieties of both species in couplet 3.

### **\**Prunus persica* (L.) Batsch. Peach**

Tree, introduced from Asia, cultivated in the USA from ME to FL to TX and in a few western states including CA.

Rare; single, young, specimen found near the Middle Creek trail head. Previously collected in Fentress Co: Sandy bank of O&W road. 0.1 mi. ne. of Zenith crossing, 17 April 1993, J. G. Allawos 598.

### ***Prunus serotina* Ehrend. Wild Cherry, Black Cherry, Rum Cherry**

Tree, middle and eastern USA. Aromatic inner bark; lvs with villous midrib.  
Occasional; scattered in mesic woods, along trails, roads, and woodland margins.

## **Ptelea**

### ***Ptelea trifoliata* L. Hop-Tree, Wafer Ash, Stinking Ash, Shrubby Trefoil**

Small tree or shrub, USA from ME to MN to AZ to FL. Lvs trifoliate; fruits winged, with the countenance of those of elm.

Very rare, found in one location along the CFR near the Burnt Mill Bridge.

## \**Pueraria*

\**Pueraria montana* (Lour.) Merrill var. *lobata* (Willd.) Maesen & S. M. Almeida

Kudzu

Vine, introduced from Asia in 1876 as an inexpensive livestock forage and later used by the Soil Conservation Service to prevent soil erosion. Present south of a line from MA to TX. Inflorescence purple and with odor of grape soda.

Rare, but may become excessively abundant if population management is not effective immediately, as this species aggressively roots at the nodes wherever the stem comes in contact with the soil. Stems may grow 50 ft through the course of one growing season. Only one population seen within the park along the road to the Middle Creek Equestrian trail (toward the Charit Creek overlook parking area).

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

## *Pyrularia*

*Pyrularia pubera* Michx. Buffalo-Nut, Oilnut

Shrub, restricted to the Appalachians in USA, northern GA and AL to NY. Hemiparasitic on the roots of deciduous trees and shrubs with soft, strongly veined lvs. Whole plant produces a poisonous oil.

Frequent; damp woods of river benches and surrounding creeks or brooks.

## *Quercus* (Key modified from Godfrey, 1988)

- 1 Lower lf surfaces of mature lvs glabrous (very few scattered stellate hairs), sometimes slightly glaucous ..... *Q. alba*
- 1 Lower lf surfaces pubescent, even if only slightly in the axils ..... 2
- 2 Lateral veins parallel and terminating in the marginal lf teeth ..... 3
- 3 Lf teeth acute, pointed and mucronate; lvs thin; hairs, if present, evenly distributed ..... *Q. muhlenbergii*
- 3 Lf teeth rounded and not ending in a papilla; lvs thick and coriaceous; lower lf surface with tufts of hairs ..... *Q. montana*
- 2 Lateral veins not parallel ..... 4
- 4 Average sinuses very shallow, not extending even 1/4 of the way to the midrib ..... *Q. marilandica*
- 4 Average sinuses between major lobes approximately extending halfway or more to the midrib ..... 5
- 5 Lf lobes not bristle-tipped ..... *Q. stellata*
- 5 Lf lobes bristle-tipped ..... 6
- 6 Lower lf surfaces with a mat of stellate hairs concealing the lower lf surface ..... *Q. falcata*
- 6 Lower lf surface not densely matted with stellate hairs ..... 7
- 7 Longest lobes of lf shorter than to about equaling (never 2X as long as) the breadth of the broadish median part of the blade ..... 8
- 8 Buds strongly angled, densely hairy; lvs glossy above ..... *Q. velutina*
- 8 Buds not strongly angled, glabrous or only hairy at the tip; lvs dull green above ..... *Q. rubra*

- 7 Longest lobes of lvs 2-6 X as long as the breadth of the narrower median portion of the blade ..... 9
- 9 Acorn cups brown, glabrate and lustrous at maturity, acorns with concentric rings near the apex ..... *Q. coccinea*
- 9 Acorn cups ashy with persistent dull pubescence and without concentric rings near the apex ..... *Q. shumardii*

***Quercus alba* L. White Oak**

Tree, middle and eastern USA. Bark light-colored and flaky.

Common; dominant and characteristic of dry upland woods and dry S facing slopes (mesic to subxeric forest communities).

***Quercus coccinea* Münchh. Scarlet Oak**

Tree, eastern USA. Bark light gray or brown bark, the inner bark reddish.

Infrequent; plateau upland woods.

***Quercus falcata* Michx. Southern Red Oak, Spanish Oak**

Tree, primarily of southeastern USA. Bark smooth, shallowly furrowed, or flaky and gray.

Infrequent; dry upland plateau woods (especially in the margin between field or scrub and woods).

***Quercus marilandica* Münchh. Black Jack Oak, Jack Oak**

Tree, although often very small, coarse and shrub-like, middle and eastern (except for the extreme northern) USA. Rectangular looking bark soon divided into scaly blocks; lvs broadly obovate and often very shallowly lobed.

Occasional; dry upland woods.

***Quercus montana* Willd. Chestnut Oak, Rock Chestnut Oak, Mountain Oak**

Tree, eastern USA. Lvs with 10-16 pairs of teeth.

Frequent; dominant species of the dry uplands and S facing slopes of the gorge.

May be confused with *Q. muhlenbergii*.

[*Q. prinus* L.]

***Quercus muhlenbergii* Engelm. Chinquapin Oak, Yellow Chestnut Oak**

Tree, eastern and middle USA. Bark thin, eventually flaky; lvs with 8-13 pairs of teeth.

May be confused with *Q. montana*.

Rare, riparian or adjacent mesic habitats. Also collected in Scott Co.: Near No Business Creek., 22 June 1947, A. J. Sharp, R. E. Shanks, and E. E. C. Clebsch 3859.

***Quercus rubra* L. Northern Red Oak**

Tree, middle and eastern USA. Bark hard, deeply furrowed and often with a pink or reddish hue around the terminal bud and petioles.

Common; most dry forest communities.

***Quercus shumardii* Buckl. Shumard's Red Oak**

Tree, southeastern and middle USA. Bark deeply furrowed bark, often broken into plates; often confused with *Q. coccinea*, however, the lf sinuses often less broadly rounded than in *Q. coccinea*.

Rare or otherwise mistaken for *Q. coccinea* and undersampled early in this study. However, there is a previous collection from Scott Co.: South Fork River. River Bench near No Business Creek., June 1947, A. J. Sharp, R. E. Shanks, and E. E. C. Clebsch 3948.

***Quercus stellata* Wangenh. Post Oak**

Tree, middle and eastern (except for the extreme northern) USA. Lvs very short petiolate; branchlets tomentose.

Occasional; dry upland sites, especially along dry roadbeds and slopes.

***Quercus velutina* Lam. Black Oak, Yellow-Barked Oak**

Tree, middle and eastern USA. Bark dark (the inner bark yellow-orange) .

Frequent; dry upland woods and dry slopes throughout.

**Rhamnus**

***Rhamnus caroliniana* Walt. Carolina Buckthorn, Indian Cherry**

Small tree or shrub, primarily of southeastern USA.

Rare, 1 tree located along the John Muir trail near No Business Cr., known from a previous collection from Morgan Co.: Sandy bank of CFR. 1 mi. n. of Rugby, May 1933, J. K. Underwood 13. Several small stems seen just across rock creek in Pickett County.

**Rhododendron**

- 1 Lvs evergreen ..... 2
- 2 Lvs 12-30 cm long, wedge-shaped at the base and narrowed to acute at apex ..... *R. maximum*
- 2 Lvs 8-15 cm long, rounded at the base and rounded to obtuse at the apex ..... *R. catawbiense*
- 1 Lvs deciduous ..... 3
- 3 Undersurface of lvs glabrous or with a few setose hairs along the midvein; lvs coriaceous, lustrous above and green to glaucous beneath ..... *R. arborescens*
- 3 Undersurface of lvs setose, especially along the midvein; lvs thin, green to dull green ..... 4
- 4 Flowers white-pink and appearing before the lvs; lvs green .. *R. periclymenoides*
- 4 Flowers red-orange-yellow, appearing after the lvs; lvs dark green ..... *R. cumberlandense*

***Rhododendron arborescens* (Pursh) Torr. Smooth Azalea, Sweet Azalea**

Shrub, mid-eastern USA.

Occasional; throughout the park along open riparian sites.

***Rhododendron catawbiense*** Michx. Mountain Rosebay, Purple Laurel, Catawba Rosebay  
Shrub, USA in the southern Appalachians, commonly cultivated and therefore found throughout the eastern USA. Flowers purple.

Infrequent, found on rocky slopes and bluffs. One large population may be found at the top of the ladders on the Honey Creek Loop Trail.

***Rhododendron cumberlandense*** E. L. Braun. Cumberland Azalea  
Shrub, southeastern USA.  
Scarce; scattered throughout.

***Rhododendron maximum*** L. Great Laurel, Rosebay  
Shrub, eastern USA.  
Common; rich damp wooded slopes, river and stream margins, and bases of bluffs.

***Rhododendron periclymenoides*** (Michx.) Shinn. Wild Azalea, Pinxterflower, Purple Honeysuckle  
Shrub, eastern USA.  
Infrequent; riparian zone of the SFR, major tributaries and associated damp woods.  
[*R. nudiflorum* (L.) Torr.]

## **Rhus**

1 Lf rachis winged; lflets entire or slightly toothed ..... ***R. copallinum***  
1 Lf rachis not winged; lflets sharply serrate ..... ***R. glabra***

***Rhus copallinum*** L. Winged Sumac, Dwarf or Shining Sumac, Flame-Leafed Sumac  
Small tree or shrub, middle and eastern USA. Branches, petioles and rachises ashy-puberulent.  
Infrequent; disturbed or successional, hot, dry abandoned fields (Bear Creek Overlook—an extremely large population), roadsides, parking lot margins, and trail heads.

***Rhus glabra*** L. Smooth Sumac  
Small tree or shrub, conterminous USA. Branches, petioles, and rachises glabrous-glaucous.  
Scarce; disturbed or successional, hot, dry sites along field margins, roadsides and parking lots.

## **Robinia**

1 Branchlets and peduncles with long reddish bristles; flowers red or pink to purple ..... ***R. hispida***  
1 Branchlets and peduncles glabrous or promptly glabrate; flowers white ..... ***R. pseudoacacia***

***Robinia hispida*** L. Bristly Locust, Rose Acacia  
Shrub or small tree, eastern and middle USA. Stoloniferous; branchlets and peduncles with many brown bristles.

Rare; dry disturbed habitats along roadsides (Peters Bridge).

***Robinia pseudoacacia* L. Black Locust, False Acacia**

Tree, although often shrubby, entire USA. Bark coarse; spines present.

Occasional throughout; mesic woods, thickets, and scattered along the SFR and major tributaries.

**Rosa**

1 Stipules entire ..... *R. carolina*

1 Stipules pectinately fringed ..... 2

2 Corolla a single whorl of white petals ..... *R. multiflora*

2 Corolla "doubled" and pink ..... *R. wichuraiana*

***Rosa carolina* L. Carolina Rose, Pasture Rose**

Shrub, middle and eastern USA with large pink flowers.

Scarce; one or two plants were seen in several locations along the river benches from Peters Bridge to Blue Heron. None of the noted plants were vigorous.

**\**Rosa multiflora* Thunb. ex Murr. Multiflowered Rose**

Shrub, introduced from eastern Asia, naturalized in the middle, eastern, and northwestern USA.

Occasional; disturbed habitats, old fields, road margins, clearings, and thickets. A few, especially large, populations exist at Joe Branch. This species reproduces by seed, root sprouts and layering. Since the seeds are dispersed by wildlife and they are viable for upwards of 20 years, this species should be monitored by the park service to control spreading.

**TN: Invasive Exotic Pest Plant: Rank 1; Severe Threat**

**\**Rosa wichuraiana* Crepin. Memorial Rose**

Shrub, native of Asia and introduced to the eastern USA.

Rare; abandoned fields and/or old home sites, roadside.

**Rubus**

1 Lflts whitish tomentose beneath (raspberries) ..... 2

2 Stems glandular bristly and not glaucous ..... *R. phoenicolasius*

2 Stems not glandular bristly and usually glaucous ..... *R. occidentalis*

1 Lflts green beneath, may be pubescent, but not whitened  
(blackberries & dewberries) ..... 3

3 Stems trailing (dewberries) ..... 4

4 Prickles nearly absent, slender or bristle-like ..... *R. hispidus*

4 Prickles prominent, stout and thickened at the base, not bristle-like . *R. flagellaris*

3 Stems erect or arching (blackberries) ..... 5

- 5 Gland-tipped hairs present on branchlets, pedicels, and peduncles;  
lvs glabrous or sparsely pubescent ..... *R. alleghaniensis*
- 5 Gland-tipped hairs not present; lvs pubescent beneath ..... *R. argutus*

***Rubus alleghaniensis*** Porter ex L. H. Bailey. Allegheny Blackberry, Sow-Teat Blackberry  
Shrub, middle and eastern USA.

Frequent; around nearly every disturbed site, roadsides, parking lots, trail heads, old fields,  
etc., the most abundant blackberry in the park.

***Rubus argutus*** Link. Southern Blackberry, Sawtooth Blackberry

Shrub, eastern USA.

Occasional; disturbed sites.

***Rubus flagellaris*** Willd. Northern Dewberry

Shrub (trailing), middle and eastern USA.

Scarce; around disturbed sites, especially along skid roads and trails.

[*R. enslenii* Tratt.]

***Rubus hispidus*** L. Bristly Dewberry, Swamp Dewberry

Shrub (trailing), northeastern USA S to TN and SC.

Infrequent; around disturbed sites, especially along skid roads and trails.

***Rubus occidentalis*** L. Black Raspberry , Thimbleberry

Shrub, eastern and middle, except for extreme southern, USA.

Rare; Fentress Co.: Large open field at Zenith, July 1992, J. G. Allawos 311 and Scott Co.:  
Above No Business Creek, along sandy ridge., June 1947, A. J. Sharp, R. E. Shanks, and  
E. E. C. Clebsch 3939.

**\**Rubus phoenicolasius*** Maxim. Wineberry, Wine Raspberry

Shrub, introduced from eastern Asia. Now present throughout the eastern USA.

Rare; disturbed habitats. One population is along the railroad tracks, N of the trestle, at Blue  
Heron and again at the Charit Creek Hostel. Although not exceptionally aggressive this  
species should be monitored and controlled due to the nature of the members of this genus  
to spread through layering.

**TN: Invasive Exotic Pest Plant Rank 3; Lesser Threat**

## Salix

- 1 Lvs green beneath, approximately the same shade-color as the upper surface . *S. nigra*
- 1 Lvs glaucous beneath ..... 2
- 2 Lvs mostly entire, although some lvs undulate or wavy margined, not serrate;  
shrub of dry habitats (scarce) ..... *S. humilis*
- 2 Lvs serrate-serrulate, especially on the upper half; shrub of wet  
(riparian) habitats ..... *S. caroliniana*

**\*\**Salix babylonica* L. Weeping Willow**

Tree, introduced from China. Branches long, pendulous. Although not extremely aggressive, commonly escaping to riverbanks and wet ditches.

Very rare; one tree planted at Ranger Station on Leatherwood Ford Rd.

***Salix caroliniana* Michx. Carolina Willow, Coastal Plain Willow, Ward's Willow**

Shrub, USA S of a line from PA to NE.

Occasional; along riverbanks of SFR and larger parts of the CFR.

***Salix humilis* Marsh. var. *humilis* Small Pussy Willow, Prairie Willow**

Shrub, eastern and middle USA.

Rare; dry margins of (dirt) road cuts near in a couple of locations N of the NR.

***Salix nigra* Marsh. Black Willow**

Tree, although often shrubby, eastern and middle USA., Bark flaky, dark brown.

Occasional; rich low woods, along rivers, particularly on seepy benches.

**Sambucus**

***Sambucus canadensis* L. Common Elder**

Shrub, USA in all but northwestern and desert states. Pith large, white; flowers fragrant; fruits purple-black.

Infrequent; moist sites along roads, rivers, creeks, ponded areas, seeps and campgrounds.

[*S. canadensis* var. *laciniata* Gray, *S. canadensis* var. *submollis* Rehd.]

**Sassafras**

***Sassafras albidum* (Nutt.) Nees. Sassafras**

Tree, eastern USA. Bark, twigs, and lvs spicy-aromatic. Lvs typically of 3 shapes, unlobed, 2-lobed (with unequal lobes), and 3 lobes (the middle lobe larger than the outer lobes).

Common; understory component of mesic woods.

**Smilax**

1 Lvs glaucous (and abaxially densely papillose, especially on the veins 40X) *S. glauca*

1 Lvs not glaucous beneath, light or dark green; not papillose beneath ..... 2

2 Stems hispid with black (green to brown to black with age) prickles,  
their lengths variable; stems terete, although young stems may have angles,  
but if angled then there are many small angles; lf margins often slightly  
white-erose (15X) ..... *S. tamnoides*

2 Stems not hispid, but prickles stout and the change in size among prickles on  
a stem gradual; young stems angled and the prickles arising from the edges of  
the angles; lf margins strictly entire, or with prickles ..... 3

- 3 Lvs often strongly pandurate, but shape may be variable; the lf margins thickened (more evident when lvs have been dried) and prickles coming from the margins and midrib . . . . . *S. bona-nox*
- 3 Lvs round, elliptical, or reniform; lf margins not thickened (may be tightly revolute, thus appearing falsely thickened); prickles never arising from the lvs . . . . . *S. rotundifolia*

***Smilax bona-nox* L.** China-Briar, Bull-Briar, Tramp's Trouble

Vine, USA S of NJ and east of TX. Fruits black, usually 1-seeded; lvs sometimes mottled with white. Often confused with *S. rotundifolia*, which is itself variable in shape. Infrequent; mesic to xeric woods, along trails, roads, old skid roads, and field margins.

***Smilax glauca* Walt.** Saw-Briar, Wild Sarsaparilla

Vine, USA S of a line from NY to TX. Fruits blue (sometimes black). Infrequent; dry to moist, sandy, thicket-like areas of roadsides, trail sides, and skid roads.

***Smilax rotundifolia* L.** Common Green-Briar, Common Cat-Briar, Horse-Briar

Vine, middle and eastern USA. Fruit blue-black, 2 seeded. Common; mesic to xeric woods, thickets, and roadsides (disturbed areas). May be confused with *S. bona-nox*, but lvs are never pandurate, nor ever have prickles. Lvs generally bright green and lustrous on both sides.

***Smilax tamnoides* L.** China-Root, Hellfetter

Vine, middle and eastern USA. Fruit black, 1-seeded. Rare; mesic woods, roadside. [*S. hispida* Muhl.]

**Spiraea**

- 1 Lower lf surface concealed with tan-colored tomentum . . . . . *S. tomentosa*
- 1 Lower lf surface not concealed with hairs . . . . . 2
- 2 Pith white; lvs usually glaucous beneath and toothed along the entire margin . . . . . *S. japonica*
- 2 Pith tan; lvs not glaucous beneath and only toothed above the middle . *S. virginiana*

**\**Spiraea japonica* L.f.** Japanese Spiraea, Japanese Meadowsweet

Shrub, introduced from Asia around 1870, spread in the USA from TN and GA to ME. Flowers pink, compound corymbose. Frequent; riparian and adjacent mesic disturbed, damp, shady woods. All of the rivers of the park are rapidly being inhabited with this species. Each plant produces hundreds of water dispersed seeds that are rapidly deposited along riverbanks. It is the opinion of the author that this species is the most abundant exotic woody species within the boundaries of the BSFNRR. Large populations exist along the CFR, near the confluence and (an especially large population) from the road to and along the SFR from the Troublesome Creek train in KY. Also, along the East River Trail, south of Station Camp.

## **TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

***Spiraea tomentosa*** L. Hardhack, Steeple-Bush

Shrub, eastern USA.

Very rare; one location within the NWOC watershed by Allawos, 1994 (specimen voucher misplaced?).

***Spiraea virginiana*** Britt. Virginia Spiraea, Appalachian Spiraea

Shrub, USA from northwestern GA and AL N to PA.

Rare; same habitats as *S. japonica* and according to Chester & Wofford (in manuscript) may be being displaced by the introduced species. One individual was seen during the course of this study in the vicinity of the O&W bridge. Although in 1994, Jaime Estill documented 16 populations along the SFR, CFR, and WOC. If these populations are still intact, the abundance of this species may be infrequent. Vouchers for his collections are at Western Kentucky University (Jaime Estill, pers. comm.).

**FEDERAL; LISTED THREATENED SPECIES**

**TN: ENDANGERED SPECIES**

**KY: THREATENED SPECIES** (Not collected in KY)

## **Staphylea**

***Staphylea trifolia*** L. Bladder Nut, Possum Cods

Shrub or small tree, extended eastern USA. Bark with greenish stripes; fruit a bladder-like sac.

Infrequent; rich woods along riverbanks, especially benches.

## **Stewartia**

***Stewartia ovata*** (Cav.) Weath. Mountain Camellia, Stewartia

Small tree, southeastern USA. Flowers large, conspicuous, and white; seeds winged.

Infrequent; rich woods, along creeks, and near river benches.

[*S. pentagyna* L'Her.]

## **Symphoricarpos**

***Symphoricarpos orbiculatus*** Moench. Coralberry, Indian Currant

Shrub, middle and eastern USA. Fruits persistent through the winter, coral (pink).

Infrequent; disturbed habitats, field margins, along trails (Charit Creek), under bridges (Yamacraw), and cemeteries.

## **Thuja**

***Thuja occidentalis*** L. White Cedar, Arbor Vitae

Tree, eastern USA from ME to MN and S to TN and GA.

Very rare; only one population of approximately 8 to 10 stems was seen during the duration of this study. Only one other population of this species has been collected in the BSFNNRA in Scott Co.: Sandy areas along woods margin of Big South Fork, Honey Creek Pocket Wilderness Area; only a few plants seen, September 1984, B.E. Wofford 84-61.

There is one planted tree at the park headquarters on Leatherwood Rd.

**TN: SPECIAL CONCERN SPECIES**

**KY: THREATENED SPECIES** (Not collected in KY)

### **Tilia**

*Tilia americana* L. American Basswood, Linden, Whitewood

Tree, eastern USA. Lvs 2-ranked, unlobed, serrated with 3-5 principal veins arising from the base. Often confused with *Morus rubra*.

There is much confusion between the varieties of this species. Some authors recognize *T. americana* var. *americana* and *T. americana* var. *heterophylla* (Vent.) J. W. Loudon. Duncan & Duncan (1988) write that current data indicate that it is best to recognize all of the varieties as one species until further research resolves this problem.

Occasional; rich, damp woods, mesic slopes. Few large trees between Blue Heron Rd. and the SFR, on the river bench.

### **Toxicodendron**

*Toxicodendron radicans* (L.) Kuntze. Poison Ivy, Cow-Itch, Mercury

Vine, middle and eastern USA. Lvs trifoliolate; roots rusty brown and aerial. Often growing in colonies of single stems less than 4 dm tall.

Common; everywhere, characteristic and dominant along the rivers, in mesic disturbed habitats such as gorge and upland trails, sandy or rocky woods, fence rows, and old skid roads.

### **Tsuga**

*Tsuga canadensis* (L.) Carr. Eastern or Canadian Hemlock

Tree, eastern USA N to MN. Lvs flattened with 2 white stripes beneath.

Frequent; dominant in moist, shaded habitats such as N facing mesic slopes of the gorge and tributary ravines.

### **Ulmus**

- 1 Corky wings or ridges present on some twigs, especially on young, but not present year's, growth ..... 2
- 2 Lvs < 4 cm wide (average) ..... *U. alata*
- 2 Lvs > 4 cm wide (average) ..... *U. thomasi*
- 1 Corky wings or ridges not present ..... 3
- 3 Lvs and young twigs very scabrous; small tree, often shrub-like ..... *U. rubra*
- 3 Lvs and young twigs smooth to the touch; often large trees ..... *U. americana*

*Ulmus alata* Michx. Winged Elm, Wahoo

Tree, southeastern and middle USA. Buds and branchlets nearly glabrous. Often a small tree, < 2 m tall.

Infrequent; along rivers, creeks, and their tributaries.

***Ulmus americana* L. American Elm, White Elm**

Tree, USA east of a line from MT to TX. Lvs usually > 8 cm long and glabrous; bud scales glabrous (few hairs may be present).

Scarce; few trees were seen along the SFR and one large tree was seen in the abandoned field near Bear Creek Overlook.

[*U. floridana* Chapman, *U. americana* var. *floridana* (Chapman) Little.]

***Ulmus rubra* Muhl. Slippery Elm, Red Elm**

Tree, often small, middle and eastern USA. Winter buds downy rusty.

Occasional; along roads, in ditches, at the bottom of the gorge on the damped river benches, and along fence rows.

[*U. fulva* Michx.]

***Ulmus thomasi* Sarg. Rock Elm, Cork Elm**

Tree, northern middle and eastern USA. Buds downy-ciliate; branchlets pubescent; the twigs often with corky ridges, but not winged.

Very rare; single collection from Scott Co.: No Business Creek near South Fork River. Slope with White Oak., June 1947, A. J. Sharp and R. E. Shanks 3861. The identification of this specimen was confirmed in annotation by Kenneth A. Nicely (1974).

**Vaccinium**

- 1 Lvs coriaceous ..... *V. arboreum*
- 1 Lvs decidedly deciduous ..... 2
- 2 Buds as thick as long; lvs glaucous beneath, new growth densely pubescent ..... *V. stamineum*
- 2 Buds longer than thick; lvs not as above ..... 3
- 3 Buds appressed to stem, with 2 bilaterally valvate scales; lf teeth extending into long narrow hair-like tips ..... *V. erythrocarpum*
- 3 Buds not completely appressed to the stem, scales imbricate; lvs not as above .. 4
- 4 Pubescence present on the twigs extending up the petiole and onto the undersurface of the lf, mostly restricted to the midvein; plants > .8 meters tall ..... *V. corymbosum*
- 4 Pubescence from twigs not extending to the midvein or undersurface of the lf; plants < .8 meters tall ..... *V. pallidum*

***Vaccinium arboreum* Marsh. Farkleberry, Sparkleberry**

Shrub, southeastern USA. Lvs obovate to oblong, thick and lustrous above.

Occasional; xeric sites, upper plateau rock outcrops, open areas around parking lots, and on dry cobble or boulder bars of the SFR and major tributaries.

***Vaccinium corymbosum* L. Highbush Blueberry**

Shrub, eastern USA W to TX in the S.

Occasional; open sites within mesic woodlands such as along trails and skid roads.

[*V. constablaei* A.Gray]

***Vaccinium erythrocarpum*** Michx. Mountain Cranberry, Bearberry

Shrub, southern Appalachians.

Scarce-rare; sandstone ledges and mouths of rock houses.

***Vaccinium pallidum*** Ait. Lowbush Blueberry, Blue Ridge Blueberry

Shrub, eastern USA.

Frequent; mesic to xeric woods throughout.

[*V. vacillans* Kalm ex Torr.]

***Vaccinium stamineum*** L. Deerberry, Squaw Huckleberry

Shrub, USA S of a line from ME to TX.

Occasional; open sites along mesic woodland margins, trails and skid roads.

## **Viburnum**

1 Lvs deeply lobed, maple-like ..... *V. acerifolium*

1 Lvs not lobed, either entire, serrate, crenate, or undulate ..... 2

2 Lateral veins NOT branching and anastomosing before reaching  
the margin ..... *V. dentatum*

2 Lateral veins branching and anastomosing before reaching the margin ..... 4

4 Lvs with small reddish-brown hairs or glands beneath ..... 5

5 Lvs usually widest near the middle, entire or irregularly undulate-  
serrate ..... *V. nudum*

5 Lvs usually widest below the middle, usually not entire but slightly  
serrate ..... *V. cassinoides*

4 Lvs without small reddish-brown hairs or glands beneath, lvs glabrous  
or with reddish pubescence present mostly along the midvein ..... 6

6 Undersurface of lvs, petioles, and/or young twigs and buds covered  
with red tomentum; petioles often winged; buds not as below .... *V. rufidulum*

6 Red tomentum present or absent; buds dark, shiny, bumpy, and/or  
glabrous; petioles narrowly winged or not at all ..... *V. prunifolium*

***Viburnum acerifolium*** L. Maple-Leafed Viburnum, Dockmackie, Arrow-wood

Shrub, eastern USA. To 2 m tall.

Frequent; mesic to xeric wooded slopes of the gorge, especially trail side.

***Viburnum cassinoides*** L. Withe-Rod, Wild Raisin

Shrub, eastern USA. To 4 m tall.

Occasional; riparian habitats, along the SFR, NR, and CFR along with their larger  
tributaries, on rich slopes and river benches.

***Viburnum dentatum*** L. Arrow-wood

Shrub, eastern USA.

Occasional; wooded mesic slopes, along rivers, open habitats like clearings or thickets.

***Viburnum nudum* L.** Possum Haw, Swamp Haw

Shrub, eastern USA, the coastal states, from NY to TX and inland to TN, KY, and AR.

Very rare; one location along the SFR between the confluence of the CFR & NR and the O&W bridge.

**KY: ENDANGERED SPECIES** (Not collected in KY)

***Viburnum prunifolium* L.** Plum-Leafed Viburnum, Stagbush, Black or Sweet Haw, Nanny-Berry

Shrub, eastern USA.

Scarce; wet thicket-like areas close to the rivers.

***Viburnum rufidulum* Raf.** Southern Black Haw, Rusty Nanny-Berry

Shrub, primarily of southeastern USA. Dark, blocky bark.

Scarce; roadside near Station Camp; trail side along John Muir Tr; both of which are dry, disturbed sites.

## **Vinca**

**\**Vinca minor* L.** Common Periwinkle, Myrtle, Graveyard Plant

Subshrub, introduced from Europe, escaped and spread through middle and eastern USA.

Scarce; old cemeteries (Terry), along roadside banks (Joe Branch) and old homesteads (Jakes Place).

**TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

## **Vitis**

1 Tendrils simple; bark tight, not shredding ..... ***V. rotundifolia***

1 Tendrils at least bifurcated, bark loose, often shredding ..... 2

2 Tendrils or inflorescences present at almost each node; undersurface of lvs often reddish or brownish tomentose ..... ***V. labrusca***

2 Tendrils or inflorescences not present on more than 2 consecutive nodes ..... 3

3 Short, spreading hairs present on undersurface of lf, especially when young (not cobwebby), branchlets glabrous ..... ***V. vulpina***

3 Lvs pubescent beneath, especially when young, with long cobwebby hairs; branchlets often pubescent ..... 4

4 Lvs glaucous beneath ..... ***V. aestivalis* var. *aestivalis***

4 Lvs green beneath; nodes often with red coloration . ***V. cinerea* var. *baileyana***

***Vitis aestivalis* Michx. var. *aestivalis*** Summer Grape, Pigeon Grape

Vine, middle and eastern, except for extreme northern, USA. Thick (3-4 mm) diaphragm dividing the pith at the nodes.

Frequent; mesic woods commonly twining up to great heights.

*Vitis cinerea* (Engelm. in A. Gray) Engelm. ex Millardet var. *baileyana* (Munson) Comeaux. Possum Grape  
Vine, middle eastern USA. Branchlets angled or striate.  
Occasional; growing on other vegetation in mesic woods.

*Vitis labrusca* L. Foxgrape

Vine, eastern USA.

Scarce; disturbed thicket-like sites, one large population exists underneath and along the side of Peters Bridge.

*Vitis rotundifolia* Michx. Muscadine, Scuppernong, Bullace-Grape

Vine, USA S of a line from DE to TX.

Frequent; most mesic woodlands.

*Vitis vulpina* L. Frost Grape, Winter Grape, Chicken Grape

Vine, middle and eastern, except for extreme northern, USA. Lvs coarsely and sharply toothed.

Very rare; one location, roadside near Brewster Bridge.

## **Wisteria**

*Wisteria frutescens* (L.) Poir. American Wisteria

Vine, often shrubby, eastern USA. Flowers light purple.

Occasional; growing upon the vegetation in riparian habitats along the SFR.

[*W. frutescens* var. *macrostachya* Torr. & Gray, *W. macrostachya* (Torr. & Gray) Nutt. ex B. L. Robins. & Fern.]

## **Xanthorhiza**

*Xanthorhiza simplicissima* Marsh. Yellowroot

Shrub, eastern USA. Single, unbranched stem; wood bright yellow; < 1 m tall.

Common; riverbanks and benches along all major water routes and tributaries.

## **Yucca**

*Yucca filamentosa* L. Yucca, Bear Grass, Spanish Bayonet, Silk Grass

Shrub, eastern USA. Lvs many, stout, arising from a central location; peduncle and panicle persistent and felling woody.

Scarce; around old home sites (Laura Blevins) and roadside (just past the Bear Creek Overlook area).

[*Y. flaccida* Haw., *Y. filamentosa* var. *smalliana* (Fern.) Ahles, *Y. filamentosa* var. *concava* (Haw.) Baker]

## **Taxa Included in the Key but not known from BSFNRRRA:**

(Locality data are for the closest known county to the BSFNRRRA in TN.)

***Amorpha fruticosa*** L. False indigo, Lead Plant. Known from Morgan, Anderson counties TN and McCreary County, KY. Branching shrub to 4m found along moist woods and stream banks.

***Ampelopsis cordata*** Michx. Raccoon Grape. Known from Anderson County, TN. High-climbing vine with few to no tendrils. Alluvial woods, coastal plain spp.

***Callicarpa americana*** L. Beauty Berry. Known in TN across the southern tier of counties, north to White and Knox counties.

***Gleditsia triacanthos*** L. Honey Locust. Known from Cumberland County, TN. Rich moist woods.

***Opuntia humifusa*** (Raf.) Raf. Eastern Prickly Pear. Known from Fentress County, TN.

## Taxa Collected but Excluded from the Keys:

**\**Deutzia scabra*** Thunb. Horticultural species seen in cemetery at Rugby. Species sometimes escapes cultivation. Appearance of *Philadelphus*, however the inflorescences are paniculate and lvs are scabrous and have remarkable stellate pubescence beneath. Introduced from e. Asia.

**\**Euonymus alata*** (Thunb.) Sieb. Winged Strawberry Bush. Persistent after planting near Jakes Place (along with *Populus alba*, *Lonicera japonica*, and *Vinca minor*). Branches opposite and corky winged. Introduced from e. Asia.

**\**Hedera helix*** L. English Ivy. Single location in cemetery at Rugby. Lvs 3-5-lobed and dark green. Introduced and naturalized from Europe. According to the Tennessee Atlas of Vascular Plants (Chester, Wofford, and Kral 1997), this species is only present in 8 counties in Tennessee. However it is probably much undercollected and present in many more counties than are illustrated.

**TN: Invasive Exotic Pest Plant Rank 2; Significant Threat**

**\**Juniperus communis*** L. Common Juniper. Single tree planted in cemetery at Rugby. Native of North America, north of the BSFNRRA.

**\**Kerria japonica*** (L.) DC. Japanese Rose

Shrub, introduced from eastern Asia, escaped to scattered states throughout the eastern USA from NY to AL. Stems green, arching; flowers yellow.

Very rare; known only from a single location that seems to be reproducing. The population was fairly large and on both sides of the trail to Terry Cemetery.

**\**Magnolia denudata*** Desr. Yulan Magnolia. Single location in cemetery at Rugby. Cultivated, non-invasive and introduced from e. Asia.

**\**Picea*** sp. Sarg. Spruce

Tree, planted at the Ranger Station on Leatherwood Ford Rd.

**\**Spiraea thunbergii*** Sieb. Thunberg's Spiraea. Single location in cemetery at Rugby. Cultivated, non-invasive and introduced from e. Asia.

## **Taxa Not Included in the Key and Not Known from BSFNRRA: (but possibly there)**

***Buckleya distichophylla*** (Nutt.) Torr. Pirate Bush, Sapsuck

Not collected in this investigation. Listed in table 4-2 in the USACOE 1980 Master Plan which is a listing of those species that are known from the area or will likely be found,

***Calycocarpum lyonii*** (Pursh.) A.Gray. Cupseed. Known from Pickett County, TN and northern counties west; known also from the southern plateau. Woody twining vine, flowers without petals. Moist woods and swamps.

***Crataegus macrosperma*** Ashe. Fanleafed Hawthorn [*C. flabellata*]  
Reported by Goodson (2000). Rare on Cumberland plateau.

***Leucothoe racemosa*** (L.) A. Gray. Fetter Bush. Known from Morgan and Roane counties. Swamps, bogs, stream banks, and savannahs; chiefly coastal plains and lower Piedmont. Patrick (1979) wrote: "Two rare species that have not been found along the SFR in TN, but remotely expected with additional study, are *Comptonia peregrina* [which has been collected twice now] and *Leucothoe racemosa*."

***Styrax grandifolia*** Ait. Voucher specimen from Scott, Cumberland, and Marion counties, TN, although more common in the Central Basin of TN.

***Taxus canadensis*** Marsh. Canadian Yew

Not collected in the BSFNRRA in this investigation. Listed in table 4-2 in the USACOE 1980 Master Plan, which is a listing of those species that are known from the area or will likely be found. This species is known from Pickett County in Pickett State Park. From the known location on USGS topographic maps, this species is approximately .5 miles from the boundary between the two parks.

**Appendix 2**  
**Presence/Absence Tabular Data for the**  
**Woody Plants of Selected Regional Floras**

## Appendix 2; Family Comparison

|                  | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|------------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Aceraceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Agavaceae        | 1        | 1    |    | 1  |    |      | 1  | 1     |    |     |    |     |    |
| Anacardiaceae    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Annonaceae       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| Aquifoliaceae    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Araliaceae       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Aristolochiaceae | 1        | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Berberidaceae    | 1        | 1    |    |    |    |      |    | 0     |    |     |    |     |    |
| Betulaceae       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Bignoniaceae     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Cactaceae        |          | 1    |    |    |    |      |    |       |    |     |    |     |    |
| Calycanthaceae   | 1        | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| Caprifoliaceae   | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Celastraceae     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Clethraceae      | 1        | 1    |    |    |    |      |    | 1     |    |     | 1  |     |    |
| Clusiaceae       | 1        | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Cornaceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Cupressaceae     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Ebenaceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   |    |
| Ericaceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Fabaceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Fagaceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Hamamelidaceae   | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Hippocastanaceae | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Juglandaceae     | 1        |      | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Lamiaceae        | 1        | 1    |    |    |    |      |    |       |    |     |    |     |    |
| Lauraceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |

**Appendix 2; Family Comparison**

|                  | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|------------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Loganiaceae      |          |      |    |    |    |      | 1  |       |    |     |    |     |    |
| Magnoliaceae     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Malvaceae        |          |      | 0  |    |    |      |    | 0     |    |     |    | 0   |    |
| Menispermaceae   | 1        | 1    |    | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   | 1  |
| Moraceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| Myricaceae       | 1        |      |    |    |    |      |    |       |    |     |    |     |    |
| Nyssaceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Oleaceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Pinaceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Platanaceae      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Poaceae          | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| Polygonaceae     |          | 1    |    |    |    |      |    |       |    |     |    | 1   |    |
| Ranunculaceae    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rhamnaceae       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   |    |
| Rosaceae         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rubiaceae        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rutaceae         | 1        | 1    |    |    | 1  |      | 0  | 0     | 1  | 1   | 1  | 1   |    |
| Salicaceae       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Santalaceae      | 1        | 1    | 1  |    |    |      |    | 1     | 1  |     | 1  |     | 1  |
| Sapotaceae       |          |      | 1  | 1  |    |      | 1  |       |    |     |    | 1   |    |
| Saxifragaceae    | 1        |      | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Scrophulariaceae | 0        | 0    | 0  |    | 0  |      | 0  | 0     |    |     |    | 0   |    |
| Simaroubaceae    | 0        | 0    | 0  | 0  |    |      | 0  | 0     |    |     |    | 0   |    |
| Smilacaceae      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Staphyleaceae    | 1        | 1    |    | 1  | 1  | 1    | 1  | 1     | 1  |     |    | 1   |    |
| Styracaceae      |          |      |    | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Symplocaceae     |          |      |    |    |    |      |    |       |    |     |    |     |    |

**Appendix 2; Family Comparison**

|                       | BSFN | RRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|-----------------------|------|------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Taxodiaceae           |      |      |      |    |    |    |      | 0  |       |    |     |    | 1   |    |
| Theaceae              | 1    |      | 1    | 1  | 1  | 1  | 1    |    | 1     |    | 1   | 1  |     |    |
| Thymelaeaceae         | 1    |      | 1    | 1  | 1  | 1  |      | 1  |       |    |     |    |     |    |
| Tiliaceae             | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Ulmaceae              | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Verbenaceae           |      |      |      |    | 1  | 1  |      | 1  | 1     | 1  |     |    |     |    |
| Viscaceae             | 1    |      |      | 1  | 1  |    |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Vitaceae              | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Total Native Families | 51   |      | 49   | 44 | 48 | 45 | 39   | 48 | 48    | 44 | 37  | 45 | 46  | 35 |

# Appendix 2; Genus Comparison

|              | BSFNRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|--------------|---------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Abies        |         |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Acer         | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Aesculus     | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Ailanthus    | 0       | 0    | 0  | 0  |    |      | 0  | 0     |    |     |    | 0   |    |
| Albizia      | 0       |      | 0  |    |    |      | 0  | 0     |    |     |    | 0   | 1  |
| Alnus        | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Amelanchier  | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Amorpha      |         | 1    |    | 1  |    |      | 1  | 1     |    |     |    | 1   |    |
| Ampelopsis   |         |      |    |    |    |      | 1  | 1     |    |     | 1  | 1   |    |
| Aralia       | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Aristolochia | 1       | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Aronia       | 1       | 1    | 1  |    | 1  |      | 1  | 1     | 1  |     |    |     |    |
| Arundinaria  | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     |    | 1   | 1  |
| Asimina      | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Berberis     | 1       | 1    |    |    |    |      |    | 0     |    |     |    |     |    |
| Berchemia    |         |      |    |    | 1  |      | 1  |       |    |     |    |     |    |
| Betula       | 1       | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Bignonia     | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Broussonetia |         |      |    |    |    |      |    |       |    |     |    | 0   |    |
| Brunnichia   |         |      |    |    |    |      |    |       |    |     |    | 1   |    |
| Buckleya     |         |      |    |    |    |      |    |       |    |     |    |     |    |
| Bumelia      |         |      | 1  | 1  |    |      | 1  |       |    |     |    | 1   |    |
| Buxella      | 1       |      |    |    |    |      |    |       |    |     |    |     |    |
| Callicarpa   |         |      |    | 1  | 1  |      | 1  | 1     | 1  |     |    |     |    |
| Calycanthus  | 1       | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| Calycocarpum |         |      |    |    |    |      | 1  |       |    |     |    | 1   |    |
| Campsis      | 1       | 1    | 1  | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   | 1  |
| Carpinus     | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    | 1   | 1  | 1   | 1  |
| Carya        | 1       | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |

Appendix 2; Genus Comparison

|              | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|--------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Castanea     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Catalpa      | 0        |      |    | 0  |    |      | 0  | 0     |    |     |    | 0   |    |
| Ceanothus    | 1        | 1    | 1  | 1  |    |      | 1  | 1     | 1  |     | 1  | 1   |    |
| Celastrus    | 1        | 1    |    | 1  |    |      | 0  | 1     |    |     | 1  |     |    |
| Celtis       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| Cephalanthus | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   |    |
| Cercis       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| Chimaphila   | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| Chionanthus  | 1        | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  |     | 1  |     |    |
| Cladrastis   | 1        |      | 1  | 1  |    | 1    | 1  | 1     |    | 1   | 1  |     |    |
| Clematis     | 1        | 1    | 1  | 1  |    | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| Clethra      | 1        | 1    |    |    |    |      |    | 1     |    |     | 1  |     |    |
| Cocculus     | 1        |      |    | 1  |    |      | 1  | 1     |    |     | 1  | 1   |    |
| Comptonia    | 1        |      |    |    |    |      |    |       |    |     |    |     |    |
| Conradina    | 1        | 1    |    |    |    |      |    |       |    |     |    |     |    |
| Cornus       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Corylus      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    | 1   | 1  | 1   | 1  |
| Cotinus      |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Crataegus    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Decodon      |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Decumaria    |          |      |    |    |    |      | 1  | 1     | 1  | 1   |    |     |    |
| Diervilla    |          |      |    |    |    |      | 1  | 1     |    | 1   |    |     |    |
| Diospyros    | 1        | 1    | 1  | 1  | 1  | 1    |    | 1     | 1  |     | 1  | 1   |    |
| Dirca        | 1        | 1    | 1  | 1  | 1  |      | 1  |       |    |     |    |     |    |
| Elaeagnus    | 0        | 0    |    |    |    |      | 0  |       | 0  | 0   |    |     | 0  |
| Epigaea      | 1        | 1    | 1  | 1  |    | 1    |    | 1     | 1  | 1   | 1  |     | 1  |
| Euonymus     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Fagus        | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Forestiera   |          |      |    |    |    |      |    |       |    |     |    |     |    |

Appendix 2: Genus Comparison

|              | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|--------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Forsythia    |          |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| Fothergilla  | 1        |      |    |    |    |      | 1  |       |    |     |    |     |    |
| Fraxinus     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Gaultheria   | 1        | 1    |    |    |    | 1    |    | 1     | 1  | 1   | 1  |     | 1  |
| Gaylussacia  | 1        | 1    |    |    |    | 1    |    | 1     | 1  | 1   | 1  | 1   | 1  |
| Gelsemium    |          |      |    |    |    |      | 1  |       |    |     |    |     |    |
| Gleditsia    |          |      |    |    | 1  |      | 1  | 0     |    |     | 1  | 1   |    |
| Gymnocladus  |          |      |    |    |    |      |    | 0     |    |     |    |     |    |
| Halesia      |          |      |    |    |    |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Hamamelis    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| Hedera       | 0        |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| Hibiscus     |          |      | 0  |    |    |      |    | 0     |    |     |    | 0   |    |
| Hydrangea    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Hypericum    | 1        | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Ilex         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Itea         | 1        | 1    | 1  | 1  |    | 1    | 1  | 1     |    |     |    |     |    |
| Juglans      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Juniperus    | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Kalmia       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Leiophyllum  |          |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Lepedeza     | 0        | 0    | 0  |    |    |      | 0  | 0     |    |     |    | 0   |    |
| Leucothoe    |          | 1    |    |    |    |      |    | 1     | 1  | 1   | 1  |     |    |
| Ligustrum    | 0        |      | 0  | 0  | 0  |      |    | 0     |    |     |    | 0   |    |
| Lindera      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Linnaea      |          |      |    |    |    |      |    | 0     |    |     |    |     |    |
| Liquidambar  | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Liriodendron | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Lonicera     | 1        | 0    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   |    | 1   | 0  |
| Lyonia       | 1        | 1    | 1  |    | 1  |      | 1  | 1     |    | 1   | 1  |     | 1  |

**Appendix 2; Genus Comparison**

|                | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|----------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Maclura        |          |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| Magnolia       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| Malus          | 1        |      | 1  |    |    |      | 1  | 1     | 1  |     | 1  | 1   |    |
| Menispermum    | 1        | 1    |    | 1  | 1  |      | 1  | 1     |    |     |    | 1   | 1  |
| Menziesia      |          |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Mitchella      | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| Morus          | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| Nemopanthus    |          |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Nestronia      |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Neviusia       |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Nyssa          | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Opuntia        |          | 1    |    |    |    |      |    |       |    |     |    |     |    |
| Ostrya         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Oxydendrum     | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Parthenocissus | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Paulownia      | 0        | 0    | 1  |    | 0  |      | 0  | 0     |    |     |    | 0   |    |
| Paxistima      |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Philadelphus   | 1        | 1    |    | 1  | 1  |      | 1  | 1     | 1  |     | 1  | 1   |    |
| Phoradendron   | 1        |      | 1  | 1  |    |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Physocarpus    | 1        | 1    | 1  |    |    |      |    | 1     |    |     | 1  |     |    |
| Picea          | 0        |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Pieris         |          |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Pinus          | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| Planera        |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Platanus       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Polygonella    |          | 1    |    |    |    |      |    |       |    |     |    |     |    |
| Populus        | 1        | 1    |    |    |    |      | 1  | 0     |    |     | 0  | 1   |    |
| Potentilla     |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Prunus         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |

# Appendix 2; Genus Comparison

|                | BSF | NRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|----------------|-----|------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Ptelea         | 1   |      | 1    |    |    | 1  |      |    |       | 1  | 1   | 1  | 1   |    |
| Pueraria       | 0   |      |      |    |    |    |      | 0  | 0     |    |     |    | 0   | 1  |
| Pyrularia      | 1   |      | 1    | 1  |    |    |      |    | 1     | 1  | 1   | 1  |     | 1  |
| Pyrus          |     |      |      |    |    |    |      |    | 0     |    |     |    | 0   |    |
| Quercus        | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rhamnus        | 1   |      |      | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   |    |
| Rhododendron   | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| Rhus           | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Ribes          |     |      | 1    |    | 1  |    | 1    |    | 1     |    | 1   | 1  |     |    |
| Robinia        | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rosa           | 1   |      | 1    | 1  |    |    |      | 1  | 1     | 1  | 1   |    | 1   | 1  |
| Rubus          | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Salix          | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Sambucus       | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Sassafras      | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Schisandra     |     |      |      |    |    |    |      |    |       |    |     |    |     |    |
| Smilax         | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Sorbus         |     |      |      |    |    |    |      |    | 1     |    |     |    |     |    |
| Spiraea        | 1   |      | 1    | 0  |    |    | 1    | 0  | 1     |    |     |    |     | 1  |
| Staphylea      | 1   |      | 1    |    | 1  | 1  | 1    | 1  | 1     | 1  |     |    | 1   |    |
| Stewartia      | 1   |      | 1    | 1  | 1  | 1  | 1    |    | 1     |    | 1   | 1  |     |    |
| Styrax         |     |      |      |    | 1  | 1  |      | 1  |       |    |     |    | 1   |    |
| Symphoricarpos | 1   |      |      |    | 1  |    |      | 1  | 0     |    |     |    | 1   |    |
| Symplocos      |     |      |      |    |    |    |      |    | 0     |    |     |    |     |    |
| Tamarix        |     |      |      |    |    |    |      |    |       |    |     |    |     |    |
| Taxodium       |     |      |      |    |    |    |      | 0  |       |    |     |    | 1   |    |
| Taxus          |     |      |      |    |    |    |      |    |       |    |     |    |     |    |
| Thuja          | 1   |      |      |    |    |    | 1    |    | 0     |    |     |    |     |    |
| Tilia          | 1   |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |

**Appendix 2; Genus Comparison**

|                     | BSFNRRRA | Obed | SG | FG | WC | FCF* | PC | GSMNP | GC | BFM | CM | LBL | LC |
|---------------------|----------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| Toxicodendron       | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Trachelospermum     |          |      |    |    |    |      |    |       |    |     |    |     |    |
| Tsuga               | 1        | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| Ulmus               | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Vaccinium           | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Viburnum            | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Vinca               | 0        |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| Vitis               | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Wisteria            | 1        | 1    |    |    |    |      | 1  | 1     |    |     |    | 1   |    |
| Xanthorhiza         | 1        | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| Yucca               | 1        | 1    |    | 1  |    |      | 1  | 1     |    |     |    |     |    |
| Zanthoxylum         |          |      |    |    |    |      |    | 0     |    |     |    |     |    |
| Total Native Genera | 100      | 94   | 82 | 86 | 75 | 71   | 96 | 105   | 75 | 69  | 86 | 80  | 66 |

Appendix 2; Species Comparison

|                                  | BSFN | RR | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|----------------------------------|------|----|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Abies fraseri</i>             |      |    |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Acer drummondii</i>           |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Acer negundo</i>              | 1    |    | 1    | 1  | 1  |    |      | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Acer pensylvanicum</i>        | 1    |    | 1    | 1  | 1  |    | 1    | 1  | 1     |    |     | 1  |     | 1  |
| <i>Acer rubrum</i>               | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Acer saccharinum</i>          | 1    |    |      |    |    |    |      | 1  |       |    |     | 1  | 1   |    |
| <i>Acer saccharum</i>            | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Acer spicatum</i>             |      |    |      |    |    |    |      |    | 1     |    | 1   |    |     |    |
| <i>Aesculus flava</i>            | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| <i>Aesculus glabra</i>           |      |    |      |    |    |    |      |    |       |    |     | 1  | 1   |    |
| <i>Aesculus pavia</i>            |      |    |      |    | 1  |    |      | 1  |       |    |     |    | 1   |    |
| <i>Aesculus sylvatica</i>        |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Ailanthus altissima</i> *     | 0    |    | 0    | 0  | 0  |    |      | 0  | 0     |    |     |    | 0   |    |
| <i>Albizia julibrissin</i> *     | 0    |    |      | 0  |    |    |      | 0  | 0     |    |     |    | 0   | 0  |
| <i>Alnus serrulata</i>           | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| <i>Alnus viridis ssp. crispa</i> |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Amelanchier arborea</i>       | 1    |    | 1    |    | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Amelanchier canadensis</i>    | 1    |    |      | 1  |    |    |      |    |       |    |     |    |     |    |
| <i>Amelanchier laevis</i>        | 1    |    | 1    |    |    |    |      |    | 1     |    |     | 1  |     |    |
| <i>Amelanchier sanguinea</i>     |      |    | 1    |    |    |    |      |    | 1     | 1  |     |    |     |    |
| <i>Amorpha fruticosa</i>         |      |    | 1    |    | 1  |    |      | 1  | 1     |    |     |    | 1   |    |
| <i>Amorpha glabra</i>            |      |    |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Ampelopsis arborea</i>        |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Ampelopsis cordata</i>        |      |    |      |    |    |    |      |    | 0     |    |     |    | 1   |    |
| <i>Aralia spinosa</i>            |      |    |      |    |    |    |      | 1  | 1     |    |     | 1  | 1   |    |
| <i>Aristolochia macrophylla</i>  | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| <i>Aristolochia tomentosa</i>    |      |    |      |    |    |    |      | 1  |       |    |     |    | 1   | 1  |
| <i>Aronia arbutifolia</i>        | 1    |    | 1    | 1  |    | 1  |      |    | 1     | 1  |     |    |     |    |
| <i>Aronia melanocarpa</i>        | 1    |    | 1    | 1  |    |    |      | 1  | 1     |    |     |    |     |    |

Appendix 2; Species Comparison

|                                          | BSFN | RR | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | OM | LBL | LC |
|------------------------------------------|------|----|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Arundinaria gigantea</i>              | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     |    | 1   | 1  |
| <i>Asimina triloba</i>                   | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| <i>Berberis canadensis</i>               | 1    |    | 1    |    |    |    |      |    |       |    |     |    |     |    |
| <i>Berchemia scandens</i>                |      |    |      |    |    | 1  |      | 1  |       |    |     |    |     |    |
| <i>Betula alleghaniensis</i>             | 1    |    | 1    | 1  | 1  |    | 1    |    | 1     |    | 1   | 1  |     | 1  |
| <i>Betula lenta</i>                      | 1    |    | 1    |    |    |    |      | 1  | 1     | 1  | 1   | 1  |     | 1  |
| <i>Betula nigra</i>                      | 1    |    | 1    | 1  |    |    |      | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Betula cordifolia</i>                 |      |    |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Bignonia capreolata</i>               | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Brunnichia ovata</i>                  |      |    |      |    |    |    |      |    |       |    |     |    | 1   |    |
| <i>Buckleya distichophylla</i>           |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Bumelia lycioides</i>                 |      |    |      | 1  | 1  |    |      | 1  |       |    |     |    | 1   |    |
| <i>Buxella brachycera</i>                | 1    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Callicarpa americana</i>              |      |    |      |    | 1  | 1  |      | 1  | 1     | 1  |     |    |     |    |
| <i>Calycanthus floridus</i>              | 1    |    | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| <i>Calycocarpum lyonii</i>               |      |    |      |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Campsis radicans</i>                  | 1    |    | 1    | 1  | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Carpinus caroliniana</i>              | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    | 1   | 1  | 1   | 1  |
| <i>Carya aquatica</i>                    |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Carya ovata</i> var. <i>australis</i> |      |    |      |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Carya cordiformis</i>                 | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    | 1   | 1  | 1   | 1  |
| <i>Carya glabra</i>                      | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Carya illinoensis</i>                 |      |    |      |    |    |    |      |    | 0     |    |     |    | 1   |    |
| <i>Carya laciniosa</i>                   |      |    |      |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Carya ovata</i> var. <i>ovata</i>     | 1    |    | 1    | 1  | 1  | 1  | 1    |    | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Carya pallida</i>                     | 1    |    | 1    | 1  |    | 1  |      | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Carya tomentosa</i>                   | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    | 1   | 1  | 1   | 1  |
| <i>Castanea dentata</i>                  | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Castanea pumila</i>                   | 1    |    | 1    |    | 1  |    |      |    | 1     |    | 1   | 1  |     |    |

Appendix 2; Species Comparison

|                                  | BSFN | RR | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|----------------------------------|------|----|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Catalpa bignonioides*</i>     | 0    |    |      |    |    |    |      | 0  |       |    |     |    |     |    |
| <i>Catalpa speciosa*</i>         | 0    |    |      |    | 0  |    |      |    | 0     |    |     |    | 0   |    |
| <i>Ceanothus americanus</i>      | 1    |    | 1    | 1  | 1  |    |      | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Celastrus orbiculatus</i>     |      |    |      |    |    |    |      | 0  | 0     |    |     |    |     |    |
| <i>Celastrus scandens</i>        | 1    |    | 1    |    | 1  |    |      |    | 1     |    |     | 1  |     |    |
| <i>Celtis laevigata</i>          | 1    |    |      |    | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   |    |
| <i>Celtis occidentalis</i>       | 1    |    |      | 1  | 1  |    | 1    |    | 1     |    |     | 1  | 1   | 1  |
| <i>Celtis tenuifolia</i>         | 1    |    | 1    |    |    | 1  |      | 1  | 1     |    |     |    |     |    |
| <i>Cephalanthus occidentalis</i> | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   |    |
| <i>Cercis canadensis</i>         | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   | 1  |
| <i>Chimaphila maculata</i>       | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| <i>Chionanthus virginicus</i>    | 1    |    | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  |     | 1  |     |    |
| <i>Cladrastis kentukea</i>       | 1    |    |      | 1  | 1  |    | 1    | 1  | 1     |    | 1   | 1  |     |    |
| <i>Clematis catesbyana</i>       |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Clematis virginiana</i>       | 1    |    | 1    | 1  | 1  |    | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Clethra acuminata</i>         | 1    |    | 1    |    |    |    |      |    | 1     |    |     | 1  |     |    |
| <i>Clethra alnifolia</i>         |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Cocculus carolinus</i>        | 1    |    |      |    | 1  |    |      | 1  | 1     |    |     | 1  | 1   |    |
| <i>Comptonia peregrina</i>       | 1    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Conradina verticillata</i>    | 1    |    | 1    |    |    |    |      |    |       |    |     |    |     |    |
| <i>Cornus alternifolia</i>       | 1    |    | 1    | 1  | 1  | 1  | 1    |    | 1     | 1  | 1   | 1  |     | 1  |
| <i>Cornus amomum</i>             | 1    |    | 1    | 1  |    |    |      | 1  | 1     |    | 1   | 1  | 1   |    |
| <i>Cornus drummondii</i>         |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Cornus florida</i>            | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Cornus foemina</i>            |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Corylus americana</i>         | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Corylus cornuta</i>           |      |    |      |    |    |    |      |    | 1     |    | 1   | 1  |     |    |
| <i>Cotinus obovatus</i>          |      |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus calpodendron</i>    |      |    |      |    |    |    |      |    | 1     |    |     |    | 1   |    |

Appendix 2; Species Comparison

|                               | BSF | NRR | A | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|-------------------------------|-----|-----|---|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Crataegus collina</i>      |     |     |   |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Crataegus crus-galli</i>   | 1   |     |   |      | 1  |    | 1  |      | 1  | 1     |    |     |    | 1   |    |
| <i>Crataegus harbisonii</i>   |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus intricata</i>    | 1   |     |   |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Crataegus macrosperma</i>  |     |     |   | 1    | 1  |    |    |      |    | 1     | 1  |     |    |     |    |
| <i>Crataegus marshallii</i>   |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus mollis</i>       |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus phaenopyrum</i>  |     |     |   |      |    |    |    |      |    |       |    |     |    | 1   |    |
| <i>Crataegus pruinosa</i>     | 1   |     |   |      |    |    |    |      |    | 1     |    |     |    |     | 1  |
| <i>Crataegus punctata</i>     | 1   |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus sp.</i>          |     |     |   |      |    |    | 1  |      |    |       |    | 1   | 1  |     |    |
| <i>Crataegus spathulata</i>   |     |     |   |      |    |    |    | 1    |    |       |    |     |    |     |    |
| <i>Crataegus uniflora</i>     |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Crataegus viridis</i>      | 1   |     |   |      | 1  |    |    |      |    |       |    |     |    |     |    |
| <i>Croton alabamensis</i>     |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Decodon verticillatus</i>  |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Decumaria barbara</i>      |     |     |   |      |    |    |    |      | 1  | 1     | 1  | 1   |    |     |    |
| <i>Diervilla lonicera</i>     |     |     |   |      |    |    |    |      | 1  |       |    | 1   |    |     |    |
| <i>Diervilla rivularis</i>    |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Diervilla sessilifolia</i> |     |     |   |      |    |    |    |      | 1  | 1     |    |     |    |     |    |
| <i>Diospyros virginiana</i>   | 1   |     |   | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Dirca palustris</i>        | 1   |     |   | 1    | 1  | 1  | 1  | 1    | 1  |       |    |     |    |     |    |
| <i>Elaeagnus umbellata*</i>   | 0   |     |   | 0    |    |    |    |      | 0  |       | 0  | 0   |    |     | 0  |
| <i>Epigaea repens</i>         | 1   |     |   | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     | 1  |
| <i>Euonymus americanus</i>    | 1   |     |   | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Euonymus atropurpureus</i> |     |     |   |      | 1  | 1  |    |      |    | 1     |    |     |    | 1   |    |
| <i>Euonymus obovatus</i>      |     |     |   |      |    |    |    |      |    | 1     |    | 1   | 1  |     |    |
| <i>Fagus grandifolia</i>      | 1   |     |   | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Forestiera acuminata</i>   |     |     |   |      |    |    |    |      |    |       |    |     |    |     |    |

Appendix 2; Species Comparison

|                               | BSF | NR | RA | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|-------------------------------|-----|----|----|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Forestiera ligustrina</i>  |     |    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Fothergilla major</i>      | 1   |    |    |      |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Fraxinus americana</i>     | 1   |    | 1  | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Fraxinus pennsylvanica</i> | 1   |    |    |      |    |    | 1  | 1    | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Fraxinus profunda</i>      |     |    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Fraxinus quadrangulata</i> |     |    |    |      | 1  |    |    |      |    |       |    |     |    | 1   |    |
| <i>Gaultheria procumbens</i>  | 1   |    | 1  |      |    |    |    | 1    |    | 1     | 1  | 1   | 1  |     | 1  |
| <i>Gaylussacia baccata</i>    | 1   |    | 1  |      |    |    |    | 1    |    | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Gaylussacia dumosa</i>     |     |    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Gaylussacia ursina</i>     |     |    |    |      |    |    |    |      |    | 1     |    | 1   |    |     |    |
| <i>Gelsemium sempervirens</i> |     |    |    |      |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Gleditsia aquatica</i>     |     |    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Gleditsia triacanthos</i>  |     |    |    |      |    |    | 1  |      | 1  | 0     |    |     | 1  | 1   |    |
| <i>Gymnocladus dioica</i> *   |     |    |    |      |    |    |    |      |    | 0     |    |     |    |     |    |
| <i>Halesia tetraptera</i>     |     |    |    |      |    |    |    |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| <i>Hamamelis virginiana</i>   | 1   |    | 1  | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Hedera helix</i> *         | 0   |    |    |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| <i>Hydrangea arborescens</i>  | 1   |    | 1  | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Hydrangea cinerea</i>      |     |    |    |      |    | 1  |    | 1    | 1  | 1     | 1  |     | 1  |     |    |
| <i>Hydrangea quercifolia</i>  |     |    |    |      |    |    |    |      |    |       | 1  |     |    |     |    |
| <i>Hydrangea radiata</i>      |     |    |    |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Hypericum crux-andreae</i> |     |    | 1  |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Hypericum densiflorum</i>  | 1   |    |    |      |    |    |    |      |    | 0     |    |     |    | 1   |    |
| <i>Hypericum frondosum</i>    |     |    |    |      |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Hypericum hypericoides</i> | 1   |    | 1  | 1    |    |    |    |      | 1  |       | 1  |     | 1  | 1   | 1  |
| <i>Hypericum lobocarpum</i>   |     |    |    |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Hypericum nudiflorum</i>   | 1   |    |    | 1    | 1  | 1  |    |      |    |       |    |     |    |     |    |
| <i>Hypericum prolificum</i>   | 1   |    | 1  | 1    |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Hypericum stragulum</i>    | 1   |    |    | 1    | 1  | 1  | 1  |      | 1  |       | 1  | 1   |    | 1   |    |

## Appendix 2; Species Comparison

|                                                    | BSFN | RR | RA | Obed | SG | FG | WC | IFCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|----------------------------------------------------|------|----|----|------|----|----|----|-------|----|-------|----|-----|----|-----|----|
| <i>Ilex ambigua</i>                                | 1    |    |    | 1    | 1  | 1  | 1  |       | 1  | 1     | 1  | 1   | 1  |     |    |
| <i>Ilex decidua</i> var <i>longipes</i>            |      |    |    |      | 1  | 1  | 1  |       | 1  | 1     |    |     |    | 1   |    |
| <i>Ilex opaca</i>                                  | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Ilex verticillata</i>                           | 1    |    |    | 1    |    |    |    |       | 1  | 1     |    |     |    |     |    |
| <i>Itea virginica</i>                              | 1    |    |    | 1    | 1  | 1  |    | 1     | 1  | 1     |    |     |    |     |    |
| <i>Juglans cinerea</i>                             | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Juglans nigra</i>                               | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     |    |     | 1  | 1   | 1  |
| <i>Juniperus virginiana</i>                        | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Kalmia angustifolia</i> var. <i>caroliniana</i> |      |    |    |      |    |    |    |       |    |       |    |     |    |     |    |
| <i>Kalmia latifolia</i>                            | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Leiophyllum buxifolium</i>                      |      |    |    |      |    |    |    |       |    | 1     |    |     |    |     |    |
| <i>Lepedeza bicolor</i>                            | 0    |    |    | 0    | 0  |    |    |       | 0  | 0     |    |     |    | 0   |    |
| <i>Leucothoe fontanesiana</i>                      |      |    |    | 1    |    |    |    |       |    | 1     | 1  | 1   | 1  |     |    |
| <i>Leucothoe racemosa</i>                          |      |    |    | 1    |    |    |    |       |    |       |    |     |    |     |    |
| <i>Leucothoe recurva</i>                           |      |    |    |      |    |    |    |       |    | 1     |    |     |    |     |    |
| <i>Ligustrum</i> sp. *                             | 0    |    |    |      | 0  | 0  | 0  |       | 0  | 0     |    |     |    | 0   |    |
| <i>Lindera benzoin</i>                             | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Linnaea borealis</i>                            |      |    |    |      |    |    |    |       |    | 0     |    |     |    |     |    |
| <i>Liquidambar styraciflua</i>                     | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Liriodendron tulipifera</i>                     | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Lonicera canadensis</i>                         |      |    |    |      |    |    |    |       |    | 1     |    |     |    |     |    |
| <i>Lonicera dioica</i>                             |      |    |    |      |    |    |    |       |    |       |    | 1   |    |     |    |
| <i>Lonicera flava</i>                              |      |    |    |      |    |    |    |       |    |       |    |     |    |     |    |
| <i>Lonicera japonica</i> *                         | 0    |    |    | 0    | 0  | 0  | 0  |       | 0  | 0     | 0  | 0   |    | 0   | 0  |
| <i>Lonicera sempervirens</i>                       | 1    |    |    |      | 1  | 1  | 1  |       | 1  | 0     | 1  |     |    | 1   |    |
| <i>Lyonia ligustrina</i>                           | 1    |    |    | 1    | 1  |    | 1  |       | 1  | 1     |    | 1   | 1  |     | 1  |
| <i>Magnolia acuminata</i>                          | 1    |    |    | 1    | 1  | 1  | 1  | 1     | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Magnolia fraseri</i>                            | 1    |    |    |      |    |    |    |       |    | 1     |    | 1   | 1  |     |    |
| <i>Magnolia grandiflora</i>                        | 0    |    |    |      |    |    |    |       |    | 0     |    |     |    |     |    |

## Appendix 2: Species Comparison

|                                    | BSFN | RR | Obed | SG | FG | WC | FCF+ | PC | GSM | NP | GC | BFM | CM | LBL | LC |
|------------------------------------|------|----|------|----|----|----|------|----|-----|----|----|-----|----|-----|----|
| <i>Magnolia macrophylla</i>        | 1    |    | 1    |    | 1  |    | 1    | 1  | 1   | 1  |    |     |    |     | 1  |
| <i>Magnolia tripetala</i>          | 1    |    | 1    | 1  | 1  |    | 1    | 1  | 1   | 1  | 1  | 1   | 1  |     | 1  |
| <i>Magnolia virginiana</i>         |      |    |      |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Malus angustifolia</i>          | 1    |    |      | 1  |    |    |      | 1  | 1   | 1  | 1  |     | 1  | 1   |    |
| <i>Malus coronaria</i>             | 1    |    |      |    |    |    |      | 1  |     |    |    |     |    |     |    |
| <i>Malus pumila*</i>               | 0    |    |      |    |    |    |      |    | 0   |    |    |     |    | 0   |    |
| <i>Menispermum canadense</i>       | 1    |    | 1    |    | 1  | 1  |      | 1  | 1   | 1  |    |     |    | 1   | 1  |
| <i>Menziesia pilosa</i>            |      |    |      |    |    |    |      |    | 1   |    |    |     |    |     |    |
| <i>Mitchella repens</i>            | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  | 1  | 1   | 1  |     | 1  |
| <i>Morus alba*</i>                 |      |    |      |    |    | 0  |      |    | 0   |    |    |     |    | 0   | 0  |
| <i>Morus rubra</i>                 | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  |    |     | 1  | 1   | 1  |
| <i>Nemopanthus collinus</i>        |      |    |      |    |    |    |      |    | 1   |    |    |     |    |     |    |
| <i>Nestronia umbellula</i>         |      |    |      |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Neviusia alabamensis</i>        |      |    |      |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Nyssia aquatica</i>             |      |    |      |    |    |    |      |    |     |    |    |     |    | 1   |    |
| <i>Nyssia biflora</i>              |      |    |      |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Nyssia sylvatica</i>            | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  | 1  | 1   | 1  | 1   | 1  |
| <i>Opuntia humifusa</i>            |      |    | 1    |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Ostrya virginiana</i>           | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  | 1  | 1   | 1  | 1   | 1  |
| <i>Oxydendrum arboreum</i>         | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  | 1  | 1   | 1  | 1   | 1  |
| <i>Parthenocissus quinquefolia</i> | 1    |    | 1    | 1  | 1  | 1  | 1    | 1  | 1   | 1  | 1  | 1   | 1  | 1   | 1  |
| <i>Paulownia tomentosa</i>         | 0    |    | 0    | 0  |    | 0  |      | 0  | 0   | 0  |    |     |    | 0   |    |
| <i>Paxistima canbyi</i>            |      |    |      |    |    |    |      |    |     |    |    |     |    |     |    |
| <i>Philadelphus hirsutus</i>       | 1    |    | 1    |    | 1  | 1  |      | 1  | 1   | 1  | 1  |     | 1  |     |    |
| <i>Philadelphus inodorus</i>       |      |    |      |    |    |    |      | 1  |     |    | 1  |     |    |     |    |
| <i>Philadelphus pubescens</i>      |      |    |      |    |    |    |      |    |     |    |    |     | 1  | 1   |    |
| <i>Phoradendron leucarpum</i>      | 1    |    |      | 1  | 1  |    |      | 1  | 1   | 1  | 1  | 1   | 1  | 1   | 1  |
| <i>Physocarpus opulifolius</i>     | 1    |    | 1    | 1  |    |    |      |    | 1   | 1  |    |     | 1  |     |    |
| <i>Picea rubens</i>                |      |    |      |    |    |    |      |    | 1   |    |    |     |    |     |    |

## Appendix 2; Species Comparison

|                              | BSFN | RR | A | O | b | e | d | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|------------------------------|------|----|---|---|---|---|---|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Pieris floribunda</i>     |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Pinus echinata</i>        | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Pinus pungens</i>         |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     | 1  |     |    |
| <i>Pinus rigida</i>          |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     | 1  |     |    |
| <i>Pinus strobus</i>         | 1    |    |   | 1 |   |   |   |    |    |    |      | 1  | 1     | 1  | 1   | 1  | 0   |    |
| <i>Pinus taeda *</i>         |      |    |   | 0 | 0 |   |   | 0  |    | 0  |      | 1  |       |    |     | 1  | 0   |    |
| <i>Pinus virginiana</i>      | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   |    |
| <i>Planera aquatica</i>      |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Platanus occidentalis</i> | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Polygonella americana</i> |      |    |   | 1 |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Populus alba</i>          | 0    |    |   |   |   |   |   |    |    |    |      |    | 0     |    |     |    | 0   |    |
| <i>Populus deltoides</i>     | 1    |    |   | 1 |   |   |   |    |    |    | 1    |    | 0     |    |     |    | 1   |    |
| <i>Populus grandidentata</i> | 1    |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Populus heterophylla</i>  |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Potentilla tridentata</i> |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Prunus alleghaniensis</i> |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     | 1  |
| <i>Prunus americana</i>      | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   |    |
| <i>Prunus angustifolia</i>   | 1    |    |   | 1 |   |   |   |    |    |    |      |    | 1     |    |     |    | 1   |    |
| <i>Prunus hortulana</i>      |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     | 1  |
| <i>Prunus mexicana</i>       |      |    |   |   |   |   |   |    | 1  |    |      |    |       |    |     |    |     |    |
| <i>Prunus munsoniana</i>     |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Prunus pensylvanica</i>   |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Prunus persica</i>        | 0    |    |   |   |   |   |   |    |    |    |      | 0  | 0     |    | 0   |    | 0   | 0  |
| <i>Prunus pumila</i>         |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Prunus serotina</i>       | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Prunus umbellata</i>      | 1    |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Prunus virginiana</i>     |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     | 1  |     |    |
| <i>Ptelea trifoliata</i>     | 1    |    |   | 1 |   |   |   |    |    | 1  |      |    |       | 1  | 1   | 1  | 1   |    |
| <i>Pueraria montana *</i>    | 0    |    |   |   |   |   |   |    |    |    |      | 0  | 0     |    |     |    | 0   | 0  |

## Appendix 2; Species Comparison

|                                   | BSF | N | R | R | A | O | B | e | d | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|-----------------------------------|-----|---|---|---|---|---|---|---|---|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Pyralia pubera</i>             | 1   |   |   |   |   | 1 | 1 |   |   |    |    |    |      |    | 1     | 1  | 1   | 1  |     | 1  |
| <i>Pyrus communis*</i>            |     |   |   |   |   |   |   |   |   |    |    |    |      |    | 0     |    |     |    | 0   |    |
| <i>Quercus alba</i>               | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus bicolor</i>            |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Quercus coccinea</i>           | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus falcata</i>            | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus imbricaria</i>         |     |   |   |   |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    | 1   |    |
| <i>Quercus lyrata</i>             |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Quercus macrocarpa</i>         |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Quercus marilandica</i>        | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus michauxii</i>          |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Quercus montana</i>            | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus muhlenbergii</i>       | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus nigra</i>              |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Quercus pagoda</i>             |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Quercus palustris</i>          |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Quercus phellos</i>            |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    | 1   |    |
| <i>Quercus rubra</i>              | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus shumardii</i>          | 1   |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    | 1   |    |
| <i>Quercus stellata</i>           | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Quercus texana</i>             |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Quercus velutina</i>           | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Rhamnus alnifolia</i>          |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Rhamnus caroliniana</i>        | 1   |   |   |   |   |   |   |   |   |    |    |    |      | 1  | 1     |    |     | 1  | 1   |    |
| <i>Rhododendron alabamense</i>    |     |   |   |   |   |   |   |   |   |    |    | 1  |      |    |       |    |     |    |     |    |
| <i>Rhododendron arborescens</i>   | 1   |   |   |   |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Rhododendron calendulaceum</i> |     |   |   |   |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| <i>Rhododendron canescens</i>     |     |   |   |   |   |   |   |   |   |    |    |    |      | 1  |       |    |     |    |     |    |
| <i>Rhododendron catawbiense</i>   | 1   |   |   |   |   |   |   |   |   |    |    |    |      | 1  | 1     |    | 1   | 1  |     |    |

## Appendix 2; Species Comparison

|                              | BSFN | RR | A | O | b | e | d | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|------------------------------|------|----|---|---|---|---|---|----|----|----|------|----|-------|----|-----|----|-----|----|
| Rhododendron cumberlandense  | 1    |    |   | 1 | 1 |   |   | 1  |    |    |      | 1  | 1     | 1  |     |    |     | 1  |
| Rhododendron maximum         | 1    |    |   | 1 | 1 |   |   |    |    |    | 1    |    | 1     | 1  | 1   | 1  |     | 1  |
| Rhododendron minus           |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    | 1   |    |     |    |
| Rhododendron periclymenoides | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  |     | 1  |     |    |
| Rhododendron viscosum        |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    | 1   | 1  |     |    |
| Rhus aromatica               |      |    |   |   |   |   |   |    | 1  | 1  |      | 1  |       |    |     |    |     |    |
| Rhus copallinum              | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rhus glabra                  | 1    |    |   |   | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     |    |     | 1  | 1   | 1  |
| Rhus hirta                   |      |    |   | 1 |   | 1 | 1 |    | 1  |    |      |    | 1     |    |     | 1  |     |    |
| Ribes curvatum               |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| Ribes cynosbati              |      |    |   | 1 |   |   |   |    | 1  | 1  |      |    | 1     |    | 1   | 1  |     |    |
| Ribes glandulosum            |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     |    |
| Ribes odoratum               |      |    |   |   |   |   |   |    |    |    |      |    | 0     |    |     |    |     |    |
| Ribes rotundifolium          |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     |    |
| Robinia hispida              | 1    |    |   | 1 |   |   |   |    |    |    |      | 1  | 1     |    | 1   | 1  | 1   |    |
| Robinia pseudoacacia         | 1    |    |   | 1 | 1 | 1 | 1 | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rosa arkansana               |      |    |   |   |   |   |   |    |    |    |      |    | 0     |    |     |    |     |    |
| Rosa carolina                | 1    |    |   | 1 | 1 | 1 |   |    |    |    |      | 1  | 1     | 1  | 1   |    | 1   | 1  |
| Rosa multiflora              | 0    |    |   | 0 | 0 |   |   |    |    |    |      | 0  | 0     |    |     |    | 0   | 0  |
| Rosa palustris               |      |    |   | 1 |   |   |   |    |    |    |      | 1  | 1     |    |     | 1  |     |    |
| Rosa setigera                |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    | 1   |    |
| Rosa virginiana              |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     | 1  |
| Rubus allegheniensis         | 1    |    |   | 1 |   |   |   |    | 1  |    |      | 1  | 1     | 1  | 1   | 1  |     |    |
| Rubus argutus                | 1    |    |   |   | 1 | 1 | 1 | 1  | 1  | 1  |      | 1  | 1     | 1  |     | 1  | 1   | 1  |
| Rubus betulifolius           |      |    |   |   | 1 |   |   |    |    |    |      |    |       |    | 1   |    |     |    |
| Rubus canadensis             |      |    |   |   |   |   |   |    |    |    |      |    |       |    |     |    |     |    |
| Rubus flagellaris            | 1    |    |   | 1 |   |   |   |    | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| Rubus hispidus               | 1    |    |   | 1 | 1 | 1 | 1 |    |    |    |      |    | 1     |    |     |    |     | 1  |
| Rubus idaeus ssp. strigosus  |      |    |   |   |   |   |   |    |    |    |      |    | 1     |    |     |    |     |    |

**Appendix 2: Species Comparison**

|                                      | BSFN | RRRA | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|--------------------------------------|------|------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Rubus occidentalis</i>            | 1    |      |      | 1  | 1  |    | 1    | 1  | 1     |    |     | 1  | 1   |    |
| <i>Rubus odoratus</i>                |      |      |      |    | 1  |    |      |    | 1     |    | 1   | 1  |     |    |
| <i>Rubus phoenicolasius</i>          | 0    |      |      | 0  |    |    | 0    | 0  | 0     |    |     |    | 0   |    |
| <i>Rubus trivialis</i>               |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Salix babylonica</i>              | 0    |      |      |    |    |    |      | 0  | 0     |    |     |    | 0   |    |
| <i>Salix caroliniana</i>             | 1    |      | 1    |    | 1  |    | 1    | 1  | 1     |    |     |    |     |    |
| <i>Salix eriocephala</i>             |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Salix exigua</i>                  |      |      |      |    |    |    |      |    |       |    |     |    | 1   |    |
| <i>Salix humilis</i>                 | 1    |      |      | 1  |    | 1  |      |    | 1     |    | 1   | 1  | 1   |    |
| <i>Salix nigra</i>                   | 1    |      | 1    | 1  | 1  |    |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Salix sericea</i>                 |      |      |      |    |    |    |      |    | 1     |    |     | 1  |     | 1  |
| <i>Sambucus canadensis</i>           | 1    |      | 1    | 1  | 1  | 1  |      | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Sambucus racemosa ssp. pubens</i> |      |      |      | 1  |    |    | 1    |    | 1     |    | 1   |    |     |    |
| <i>Sassafras albidum</i>             | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Schisandra glabra</i>             |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Smilax bona-nox</i>               | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Smilax glauca</i>                 | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Smilax rotundifolia</i>           | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Smilax tamnoides</i>              | 1    |      | 1    | 1  | 1  |    | 1    |    | 1     |    |     | 1  | 1   | 1  |
| <i>Sorbus americana</i>              |      |      |      |    |    |    |      |    | 1     |    |     |    |     |    |
| <i>Spiraea alba</i>                  |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Spiraea japonica</i>              | 0    |      | 0    | 0  |    |    |      |    |       |    |     |    |     |    |
| <i>Spiraea prunifolia</i>            |      |      | 0    |    |    |    |      | 0  | 0     |    |     |    |     |    |
| <i>Spiraea tomentosa</i>             | 1    |      | 1    |    |    |    |      |    |       |    |     |    |     | 1  |
| <i>Spiraea virginiana</i>            | 1    |      |      |    |    |    | 1    |    | 1     |    |     |    |     |    |
| <i>Staphylea trifolia</i>            | 1    |      | 1    |    | 1  | 1  | 1    | 1  | 1     | 1  |     |    | 1   |    |
| <i>Stewartia ovata</i>               | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| <i>Styrax americana</i>              |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Styrax grandifolia</i>            |      |      |      |    | 1  | 1  |      | 1  |       |    |     |    | 1   |    |

Appendix 2: Species Comparison

|                                   | BSFN | RRRA | Obed | SG | FG | WC | FCF+ | PC | GSMNP | GC | BFM | CM | LBL | LC |
|-----------------------------------|------|------|------|----|----|----|------|----|-------|----|-----|----|-----|----|
| <i>Symphoricarpos orbiculatus</i> | 1    |      |      |    | 1  |    |      | 1  | 0     |    |     |    | 1   |    |
| <i>Symplocos tinctoria</i>        |      |      |      |    |    |    |      |    | 0     |    |     |    |     |    |
| <i>Taxodium distichum</i>         |      |      |      |    |    |    |      | 0  |       |    |     |    | 1   |    |
| <i>Taxus canadensis</i>           |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Thuja occidentalis</i>         | 1    |      |      |    |    |    | 1    |    | 0     |    |     |    |     |    |
| <i>Tilia americana</i>            | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Toxicodendron radicans</i>     | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Toxicodendron vernix</i>       |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Trachelospermum difforme</i>   |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Tsuga canadensis</i>           | 1    |      | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  | 1   | 1  |     |    |
| <i>Tsuga caroliniana</i>          |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Ulmus alata</i>                | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  |     | 1  | 1   |    |
| <i>Ulmus americana</i>            | 1    |      | 1    | 1  | 1  |    | 1    | 1  | 1     | 1  |     |    | 1   | 1  |
| <i>Ulmus crassifolia</i>          |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Ulmus rubra</i>                | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Ulmus serotina</i>             |      |      |      |    | 1  |    |      |    |       |    |     |    |     |    |
| <i>Ulmus thomasii</i>             | 1    |      |      |    |    |    | 1    |    |       |    |     |    |     |    |
| <i>Vaccinium arboreum</i>         | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   |    |
| <i>Vaccinium corymbosum</i>       | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   |    |     | 1  |
| <i>Vaccinium elliotii</i>         |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Vaccinium erythrocarpum</i>    | 1    |      |      |    | 1  |    |      |    | 1     |    | 1   |    |     |    |
| <i>Vaccinium fuscum</i>           |      |      | 1    |    |    |    |      |    |       |    |     |    |     |    |
| <i>Vaccinium hirsutum</i>         |      |      |      |    |    |    |      |    | 1     | 1  | 1   | 1  |     |    |
| <i>Vaccinium macrocarpon</i>      |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Vaccinium pallidum</i>         | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Vaccinium stamineum</i>        | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Viburnum acerifolium</i>       | 1    |      | 1    | 1  | 1  | 1  | 1    | 1  | 1     | 1  | 1   | 1  | 1   | 1  |
| <i>Viburnum bracteatum</i>        |      |      |      |    |    |    |      |    |       |    |     |    |     |    |
| <i>Viburnum cassinoides</i>       | 1    |      | 1    | 1  | 1  |    |      |    | 1     | 1  | 1   |    |     |    |

**Appendix 2; Species Comparison**

|                                                                                          | BSFN | RR | A | O   | B   | SG  | FG  | WC  | FCF+ | PC  | GSMNP | GC  | BFM | CM  | LBL | LC |
|------------------------------------------------------------------------------------------|------|----|---|-----|-----|-----|-----|-----|------|-----|-------|-----|-----|-----|-----|----|
| <i>Viburnum dentatum</i>                                                                 | 1    |    |   | 1   |     | 1   |     |     | 1    |     | 1     |     | 1   |     |     |    |
| <i>Viburnum lantanoides</i>                                                              |      |    |   |     |     |     |     |     |      |     | 1     |     |     |     |     |    |
| <i>Viburnum molle</i>                                                                    |      |    |   |     |     |     |     |     |      |     |       |     |     |     | 1   |    |
| <i>Viburnum nudum</i>                                                                    | 1    |    |   |     | 1   |     |     |     |      |     |       |     | 1   |     |     |    |
| <i>Viburnum prunifolium</i>                                                              | 1    |    |   |     |     |     | 1   |     |      |     | 1     |     |     | 1   | 1   |    |
| <i>Viburnum rafinesquianum</i>                                                           |      |    |   |     |     |     |     |     |      |     |       |     |     |     |     |    |
| <i>Viburnum rufidulum</i>                                                                | 1    |    |   |     | 1   | 1   | 1   | 1   | 1    | 1   | 1     |     |     | 1   | 1   |    |
| <i>Vinca minor</i>                                                                       | 0    |    |   |     |     |     |     |     |      | 0   | 0     |     |     |     | 0   |    |
| <i>Vitis aestivalis</i>                                                                  | 1    |    |   | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1     | 1   | 1   | 1   | 1   | 1  |
| <i>Vitis cinerea</i>                                                                     | 1    |    |   | 1   |     |     |     |     |      |     | 1     |     |     | 1   |     |    |
| <i>Vitis labrusca</i>                                                                    | 1    |    |   |     |     |     |     |     |      | 1   | 1     |     |     |     |     |    |
| <i>Vitis palmata</i>                                                                     |      |    |   |     |     |     |     |     |      | 1   |       |     |     |     | 1   |    |
| <i>Vitis riparia</i>                                                                     |      |    |   |     |     |     |     |     |      |     |       |     |     |     |     |    |
| <i>Vitis rotundifolia</i>                                                                | 1    |    |   | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1     | 1   |     | 1   | 1   |    |
| <i>Vitis rupestris</i>                                                                   |      |    |   |     |     |     |     |     |      |     |       |     |     |     |     |    |
| <i>Vitis vulpina</i>                                                                     | 1    |    |   |     |     |     |     | 1   |      | 1   | 1     |     | 1   | 1   | 1   |    |
| <i>Wisteria frutescens</i>                                                               | 1    |    |   | 1   |     |     |     |     |      | 1   | 1     |     |     |     | 1   |    |
| <i>Xanthorhiza simplicissima</i>                                                         | 1    |    |   | 1   | 1   | 1   | 1   | 1   | 1    | 1   | 1     | 1   | 1   | 1   |     |    |
| <i>Yucca filamentosa</i>                                                                 | 1    |    |   | 1   |     |     | 1   |     |      | 1   |       |     |     |     |     |    |
| <i>Yucca flaccida</i>                                                                    |      |    |   |     |     |     |     |     |      |     | 1     |     |     |     |     |    |
| <i>Zanthoxylum americanum</i>                                                            |      |    |   |     |     |     |     |     |      |     | 0     |     |     |     |     |    |
| Total Native Spp. and Lesser Taxa                                                        | 181  |    |   | 150 | 136 | 136 | 105 | 100 | 167  | 206 | 109   | 110 | 152 | 141 | 99  |    |
| (+) = probably an incomplete study; missing several genera/species that should be there. |      |    |   |     |     |     |     |     |      |     |       |     |     |     |     |    |

## Vita

So far, Joey has lived a good life. He was borne July 23, 1970 in Smithtown NY and lived there until the age of 10. From 10 to 15 years of age he lived in Boxboro, MA and Birmingham AL. He and his family moved to Chattanooga, Tennessee in 1986.

After coasting through High School, he did construction work for a while installing heating and air conditioning units, apprenticing as a commercial electrician, remodeling a few houses, and when new construction fell on hard times in the early 1990's, began work in an oppressive factory. In 1992, he started to attend Chattanooga State Technical Community College part-time where he reacquainted himself with the life sciences that he thought were cool as a kid. After graduating from the University of Tennessee, Chattanooga in 1998 with a degree in General Biology, Joey applied and was accepted to the Botany Department at the University of Tennessee, Knoxville. Currently, as he is finishing this M.S. Thesis he has been accepted to the Ph.D. program at UTK.

Currently, he and M have a couple of dogs ...