

Biological Diversity of the Tyger River Watershed
BOTANICAL REPORT
July 2006

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on behalf of the South Carolina Native Plant Society



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INTRODUCTION

The construction of a lake along the Tyger River within the Union County is under consideration. If the plan is implemented, the dam would most likely be constructed just east of the confluence of Fairforest Creek and the Tyger River which is located about 1.5 air miles west of where the Tyger River passes under SC Hwy 176. The subsequent lake (Patriot Lake) would flood about 5,300 acres of the watershed, including portions of both the Tyger River and a tributary, Fairforest Creek.

The Tyger River has its origins in Spartanburg County, flows through Union County, and merges with the Enoree River along the Union – Newberry County line. Within this watershed the elevation varies from 340 feet along the Tyger River at the confluence of Fairforest Creek to about 645 feet in the area of the Sedalia Lookout Tower. The proposed lake, at capacity level, would flood all land up to about 400 feet elevation. A majority of the potentially flooded land lies within the Sumter National Forest (SNF). However, significant private property is found within the western end of the impacted area.

It is the concern of several conservation groups in South Carolina that this project is not in the best interest of the natural flora and fauna of the watershed. The concerned groups include the South Carolina Wildlife Federation (SCWF) and the South Carolina Native Plant Society (SCNPS). Previous field trips to the watershed by the author and canoe trips by members of the SCWF, SCNPS and the Sierra Club have provided anecdotal data suggesting mature and diverse wetland forests along the Tyger River.

However, as of May 2006 a problem was that little scientifically collected data was available on the biological diversity of the Tyger River watershed. The United States Forest Service (USFS) does not have detailed data on community structure for forest property. But, the USFS does have information on community structure that is part of its multiple use forest management plan, including the designation of acreage for potential logging. However, it is important that significant portions of the watershed are not part of the logging plan. Community designations have been established by the USFS and are based on the dominant canopy species. For example, a floodplain forest may be designated as a “river birch – sycamore” forest type, with no additional information being available relative to additional species presence or abundance. The USFS also keeps record of rare plants within their property, yet only federally listed species are tracked (as designated by the Endangered Species Act).

As a result of a lack of detailed community structure and a lack of surveys for state listed rare species (as designated by the South Carolina Department of Natural Resources), the SCNPS initiated a survey of the watershed, asking two questions:

- 1) What is the botanical diversity of the watershed?
- 2) Is the botanical diversity of the area unique, or at least unusual, in comparison to typical forests of the region?

The botanical survey was initiated to survey for plant species and to describe the plant communities that have naturally developed within the watershed. It is beyond the scope of this project to survey for the diversity of animals. It is also realized that a comprehensive survey of the watershed will take much more than 45 days to complete. Detailed and complete botanical

surveys generally require a full calendar year to complete, so that a community may be studied during all seasons.

METHODS

The delineation of plant species and communities was accomplished during May, June and early July 2006. Work was concentrated within the SNF portion of the watershed simply due to ease of access for the study (forest service property is open to all visitors, no permission needed). A majority of the work was completed by PhD botanists, including John Brubaker (retired), Jeff Glitzenstein (Tall Timbers Research Station, Tallahassee, Florida), Charles Horn (Newberry College, Newberry, South Carolina), Doug Rayner (Wofford University, Spartanburg, South Carolina), and John Schmidt (Winthrop University, Rock Hill, South Carolina). In addition, amateur botanists affiliated with SCNPS assisted with the project on several dates.

Sites were first selected by obtaining compartment and stand maps from the Tyger Ranger District office of the SNF. As the maps were reviewed, emphasis was made to select stands which contained over 20 acres of hardwood forests. Hardwood forests are considered to be older, more mature, and less common type of plant communities within a forest ecosystem, especially in the piedmont region of southeastern United States. These communities were variously labeled on the USFS maps. The selected forest types included numbers 53 (white oak, red oak, hickory), 56 (yellow poplar, white oak, red oak), 58 (sweet gum – yellow poplar), 62 (sweet gum – Nuttall oak - willow), and 72 (river birch - sycamore).

Additional selection of sites for field observation was based on topographic slope. This data was obtained from United States Geological Survey (USGS) topographic maps. The watershed area can be found on the 7.5 minute topographic maps Cross Anchor, Sedalia, Union East, Union West, and Whitmore North. Special attention was made to study sites with steep slopes. These were selected mainly because historically they usually have not logged, thus mature tress commonly are present.

Also, simply due to ease of access, a group surveyed the Tyger River by canoe. Putting in at the boat ramp on county route 16 and floating downstream to the boat landing at US Hwy 176. The boaters landed and surveyed the floodplain at various points along their travel.

Using the above selection criteria, sites were selected for detailed community structure analysis. Due to limited time available, only nine such sites (plots) were selected, all within USFS property. Information was gathered using the data entry form developed by NatureServe, an internationally recognized research branch of The Nature Conservancy. At each of the nine sites, 20 by 50 meter plots were established and detailed information was recorded within the plot relative to plant species presence and abundance. The data collection sheets (4 pages in length) allow for recording of information on general community description, topographic features, geology, extent of anthropogenic disturbance, canopy species, subcanopy and herbaceous species composition, and other details. At each of the sites, the specific locations were selected so as to allow the plots to be within one community type.

From the data collected on community structure, community descriptions were developed. As is typical of ecological descriptions, community structure is most commonly based on the largest plants present, the trees. NatureServe has established an extensive list of ecological classifications within the eastern United States and in 2004 they published the report: *International Ecological Classification Standard: Terrestrial Ecological Classifications, Sumter National Forest Final Report*. Unfortunately, the report work was not based on extensive field work (Milo Payne, NatureServe Senior Ecologist, personal communication).

In addition to the community structure, 15 additional sites were selected for delineation of species composition (see Appendix 1 for sites). This was accomplished by hiking at selected locations which varied from floodplains adjacent to the Tyger River and Fairforest Creek (elevations of 340-360 feet) to upland sites at some of the highest elevations within the watershed (around 500 feet). Sites were selected which allowed for walking along a ravine, slope, or upland for an extended distance, hence traversing a variation of a particular community type. During these hikes of 2-6 miles each, a species list was generated and voucher plant specimens were collected for verification, as needed. The collected plant material was pressed and dried, then subsequently processed to generate museum quality specimens. These specimens are glued on 11 x 17 inch sheets of paper along with an identification label. Most specimens will be deposited into the herbarium at Newberry College, Newberry, SC.

Rare plants are of special interest and concern. For this study a rare plant is defined as one that has been placed on either the federal or state list of rare species. The federal list is as established by the Endangered Species Act of 1973, with several levels being recognized: threatened, endangered, and extinct. Knowingly collecting or destroying a federally listed species is a federal crime. A state list of rare plants is maintained by the South Carolina Department of Natural Resources (DNR). State species are recognized at several levels of abundance by a numbering system, S1, S2, S3 and S4 with S1 being used to recognize the rarest species and S4 being used to classify common species. Typically, only S1 and S2 species are tracked by DNR, but a species may be common in South Carolina (S3 or S4), but not known elsewhere. One such example is the May-white Azalea (*Rhododendron eastmanii*), which is common within the Broad River basin, but has yet to be seen in any other state. The state list carries no legal status relative to knowingly collecting or destroying of such listed species. For any rare plant discovered, the exact location and population size was recorded. This information will be forward to DNR for placement in their database.

SPECIES DIVERSITY

A total of 381 species of vascular plants were recognized as growing within the watersheds of the Tyger River and Fairforest Creek. This data is presented in Appendix 2. Species are listed by common name, as well as taxonomically by family and scientific name.

It is common to categorize species by growth form. The most common segregation produces four categories: herbs, woody vines, shrubs, and trees. Of the species found within the study area, there were 272 herbs, 15 woody vines, 37 shrubs, and 57 trees. This diversity is as would be expected for a mature forest ecosystem. Even within these forested communities, the number of herbaceous species is much greater than trees.

We can also compare the number of species relative to the three basic topographic land forms found within the watershed study area: floodplains, slopes and uplands. A review of the topographic maps of the watershed clearly shows that slopes cover much more of the total study area. The upland areas are the second most common, while the floodplains least common. Yet, the greatest diversity of species was found on the floodplains (233 species). There were 178 species found on the slopes and only 100 species in the uplands. This data was easily realized visually in the field, as it was common to see a large number of floodplain herbs, while in the upland sites leaf litter covered or bare soils conditions were common. In looking at the trees alone, 37 species of trees were on floodplains, 33 species on the slopes, and 23 species were in the uplands. Even though the differences were not as evident here, there are still more species on floodplains.

An analysis of species composition relative to those native and those which have been introduced revealed that only 32 species (8.4%) are introduced. This percentage of introduced species within the study area is much lower than the same number for the entire state flora (18%). This is most likely due to much of the area being relatively undisturbed and distant from residential areas. An inclusion of residential and agricultural lands potentially being impacted by the proposed lake may increase the percentage of introduced species. But, it is impressive to realize the large area of forest not severely influenced by alien species.

In addition to species diversity, one must also admire the size of some of the trees within the watershed. On the floodplain, several of the cottonwood (*Populus deltoides*) trees were about 65 inches (5.4 feet) in diameter. On the slopes several white oaks (*Quercus alba*) were measured at over 50 inches (4.3 feet) in diameter. Other notable large trees included red oaks (*Quercus rubra*), and beech (*Fagus grandiflora*). Even though these trees are not state records, they do represent substantial time for their growth, in some cases well over 100 years.

RARE SPECIES

Survey work revealed eleven rare species within the watershed study area (see Appendix 3). Three species were considered common: drooping sedge (*Carex prasina*) was found at four sites), Southern Adder's tongue (*Ophioglossum pycnostichum*) was seen at four sites, and May-white azalea (*Rhododendron eastmanii*) was found at eight sites. The other eight species were found at only one or two locations and typically in small numbers.

Of these rare species, six have affinities to the southern Appalachian Mountains. The Tyger River in Union County represents some of the eastern most extensions of their sporadic distributions. One such species is the drooping sedges (*Carex prasina*), which is known from the Appalachian mountains from Canada south to South Carolina. Yet it is very rarely found outside the mountains within Virginia, North Carolina or South Carolina. The locations in Union County represent the southeastern most extension of the species.

Four of the species are endemic to the piedmont (not found elsewhere). One of these endemics, *Eurybia mirabilis*, is a federal "species of concern." Even though it is not listed as endangered or threatened, it is being followed at the federal level. It is historically known from South

Carolina from a series of seven collections in the late 1950s (data from the University of North Carolina herbarium database). Recent data show this species existing at only two locations, one in Newberry County (where it was found in 2002), and the second along the Tyger River.

The May-white azalea (*Rhododendron eastmanii*) deserves a species note. This species has only recently (1999) been described as new to science. At that time it was known from only two locations, one in Richland County and one in Orangeburg County. Extensive work by Horn and others have shown that the species is indeed more common, but was still only known to grow at about 25 sites in 10 South Carolina Counties, and nowhere else on the planet. The eight locations within the watershed study area add significantly to the known locations of this species. The greatest abundance of this species appears to be along the Enoree and Tyger River watersheds in Laurens and Union Counties.

PLOT STUDIES

Nine plots were established to survey plant existence in more detail. Appendix 4 summarizes data of the findings. Five of the plots were on floodplain of the Tyger River or Fairforest Creek and four plots were on adjacent slopes. At all the sites the numbers of herb species is clearly greater than that of shrub or tree species. This parallels the overall species list, where many more species of herbs are present than other growth forms.

The floodplain canopy is commonly dominated by sweet gum (*Liquidambar styraciflua*) and ash (*Fraxinus sp.*). Other common canopy trees include hackberry (*Celtis laevigata*), river birch (*Betula nigra*), and cottonwood (*Populus deltoides*). Some of the plots are elevated (on levees) and probably are not flooded often. These sites include American beech (*Fagus grandifolia*), shagbark hickory (*Carya ovata*), and several species of oaks (*Quercus sp.*). Ironwood (*Carpinus caroliniana*) is a common subcanopy tree throughout the floodplains.

The slopes have a distinctly different flora. All slopes have an abundance of white oak (*Quercus alba*). Beyond that, each site had a unique assemblage of canopy species. The subcanopy commonly includes hop hornbeam (*Ostrya caroliniana*) and chalk maple (*Acer leucoderme*).

COMMUNITY DESCRIPTIONS

The outcome of the study revealed five distinct, but generalized community types. Vegetation within each community has been shaped by topography (slope of the land) and moisture. These communities were dominated by a series of tree species. Communities produced by the result of clearcutting (such as along a powerline cut) or catastrophic natural events (openings within the floodplain due to beaver activity) were not included. Study plots were mostly located on floodplains (8 of the 9). The other areas were based on observational data and visually collected data on relative abundance of species.

The NatureServe classification system makes use of two levels of classification. The association concept is the most detailed level of plant community descriptions. They commonly are names with multiple species components. The Alliance concept is a larger level of classification taking into account a group of associations with similar species. This report will include Alliance information.

Overall, it was observed that five basic ecological habitats were present: river floodplain forest, stream floodplain forest, hardwood slopes, hardwood uplands and pine uplands. Each of these is listed below with the appropriate associations being listed under each.

River Floodplain Forest. Along the Tyger River and Fairforest Creek are many acres of mature forests within the floodplain. These forests commonly are saturated a portion of the year and have rich organic soils. At one point during the last week of June there was a heavy rain storm. This resulted in standing water being present in portions of the floodplain for up to a week afterwards. Ash (*Fraxinus* sp) is clearly the dominant at many locations. However, much variation is seen and other dominant species may include cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), and river birch (*Betula nigra*). The subcanopy is dominated by several species, box elder (*Acer negundo*), and ironwood (*Carpinus caroliniana*). In a few locations, groves of pawpaw (*Asimina triloba*) are present. The herbaceous vegetation varies, based on the elevation above water level. Much of the floodplain area is covered by river oats (*Chasmanthium latifolium*). Saturated soils allow for a variety of sedges (*Carex*) and grasses to thrive.

The NatureServe Alliances which fit into the Tyger River watershed include:

- Ash – American Elm – Hackberry Temporarily Flooded Forest
- River birch – Sycamore / Smooth Alder / False Nettle Forest
- Sycamore – Sweetgum / Common pawpaw Forest

Stream Floodplain. Forests in this category are rarely flooded and are found along streams and ephemeral tributaries to Tyger River and Fairforest Creek. The streambed is typically less than 2 meters (6 feet) across and the floodplain itself may be up to 50 feet wide, but is commonly not as wide. A variety of canopy trees are present, including tuliptree (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), river birch (*Betula nigra*), water oak (*Quercus nigra*), loblolly pine (*Pinus taeda*), and American beech (*Fagus grandifolia*).

Some of the floodplain locations, especially to the southwest (Isaacs Creek and Sparks Creek) have historically been influenced by massive erosion. In these areas the soils are a silty sand and are very deep. The result is a flat flood plain 6-10 feet above the streambed. These areas are commonly dominated by tuliptree (*Liriodendron tulipifera*).

The sub canopy is not dominated by any one or two species. Much variation is present in hydrology, thus influencing which trees grow well. Species present include ironwood (*Carpinus caroliniana*), hop hornbeam (*Ostrya virginiana*), dogwood (*Cornus florida*), and other species.

NatureServe Alliances associated with these stream floodplains are not clearly defined, but may fit into:

- Loblolly Pine – Tuliptree / Northern Spicebush / Fringed sedge Forest (however, the spicebush is generally missing)

Hardwood Slopes. Slopes above the floodplains vary in angle between nearly flat to near cliffs. The canopy is highly variable. Commonly, we encountered locations dominated by several

species of oaks, especially white oak (*Quercus alba*), black oak (*Quercus velutina*) and northern red oak (*Quercus rubra*). Also among the canopy species present are tuliptree (*Liriodendron tulipifera*), mockernut hickory (*Carya alba*), and American beech (*Fagus grandifolia*).

Microhabitat variation is well known on slopes, as dictated by direction of exposure. North-facing slopes are cooler and moister, while south and west –facing slopes are warmer and drier. Differences in species composition were evident. Northern slopes were most evident by the presence of a number of smaller subcanopy trees, including chalk maple (*Acer leucoderme*), redbud (*Cercis canadensis*), American storax (*Styrax grandifolius*), Hop-hornbeam (*Ostrya caroliniana*), and May-white azalea (*Rhododendron eastmanii*). Interestingly enough, if the chalk maple was abundant, the May-white azalea was absent. The drier south and west facing slopes tended to have American dogwood (*Cornus florida*), painted buckeye (*Aesculus sylvatica*), sparkleberry (*Vaccinium arboreum*) and in some locations buckthorn (*Sideroxylon lycoides*) and red cedar (*Juniperus virginiana*).

There were a number of NatureServe Alliances associated with the Tyger River watershed slopes:

- Southern Red Oak – White Oak – Mockernut Hickory / Sourwood / Deerberry Forest
- White Oak – Shagbark Hickory / Redbud Forest
- American Beech = Northern Red Oak / Eastern Hop-hornbeam – (Chalk Maple) / Black Cohosh – Bloodroot Forest
- American beech – Northern Red Oak / Flowering dogwood / Christmas Fern – Virginia Heartleaf Forest

Upland Hardwood Forest. This community type is rare and only found on a few of the ridges within the Sumter National Forest. The best communities were found on ridges between County route 136 and the Tyger River. These areas are dominated by drought-resistant species of hickory, including mockernut hickory (*Carya alba*), pignut hickory (*Carya glabra*), and shagbark hickory (*Carya ovata*). Also within in the are several oaks, including post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*) and white oak (*Quercus alba*).

These woodlands were commonly quite open below the canopy with very few shrubs and few herbs. Sourwood (*Oxydendron arboreum*) and flowering dogwood (*Cornus florida*) are scattered. Most common among the shrubs was sparkleberry (*Vaccinium arboreum*) and the woody vine muscadine (*Vitis rotundifolia*) was occasionally a ground cover. On some of the upper slopes clumps of witch grass (*Dichanthelium sp*) were encountered.

None of the NatureServe Alliances fit well; one is close:

- Rock Chestnut Oak – (Northern Red Oak) – Hickory species / Sourwood – Flowering Dogwood Forest

Upland Pine Forests. Due to the historical USFS management plan over the last 50 years, much of the upland area in the region is of pine. Loblolly pine (*Pinus taeda*) has been the tree of choice and is the dominant. Associated with it is another common canopy tree, sweet gum (*Liquidamber styraciflua*). Numerous other trees were present as seedlings and sapling, including dogwood (*Cornus florida*), and sourwood (*Oxydendron arboreum*).

This clearly fits into one Alliance described by NatureServe.

- Loblolly Pine Planted Forest

CONCLUSIONS

A. Specific conclusions on data collected from field trips:

- The areas with the greatest plant diversity are on the floodplains (63%); these are the areas that will be greatest impacted by the construction of a dam.
- The slopes are very diverse and species composition change dramatically from one site to another, partly as a result of variation in soil moisture and direction of exposure.
- Most of the upland forest is dominated by loblolly pine, but some is hardwood forest, a community type which is rare in South Carolina. These areas need to be further studied, as impact of the non-flooded area could also be significant, depending on land use.
- The low percentage of introduced species (8.4%) indicated that the ecosystems of the watershed are relatively undisturbed.
- Eleven species of state-listed rare plants were found within the watershed area. Some of the species are surprisingly common within the watershed, most are quite rare.

B. General Conclusions about study area:

- The Tyger River watershed is a very diverse region that includes floodplains, slopes and uplands forests.
- Most of the floodplain acreage within the Sumter National Forest is of mature hardwood forest.
- Additional species will be discovered with additional field work during other seasons of the year.
- Disturbed areas, such as roadsides are numerous, yet they were not studied, as unusual natural communities are typically not present. These need to be studied further, as several rare plant species are known to grow in Union County, such as *Symphyotrichum georgianum* (Georgia aster).
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Appendix 1: List of sites visited as part of the botanical surveys.

Date	Location	Site description
June 3	Northeast of Rose Hill Plantation, off of County route 16	Slopes, tributary and floodplain of Tyger River
June 3	Tyger River between County route 16 and US 176	Canoe trip along river, stopping at several floodplain sites
June 10	West of County route 16 and south of Tyger River	Floodplain and adjacent slopes
June 12	Unnamed stream that flows into Tyger River west of Forest Service road 325.	Slopes and stream floodplain
June 15	South of Fairforest Creek and east of County route 16	Floodplain and adjacent slopes of ravine closest to road
June 17	North of Fairforest Creek beyond end of Forest Service road 329	Floodplain of the creek and adjacent slopes
June 17	East of Fairforest Creek beyond end of Forest Service road 331	Floodplain and adjacent slopes
June 18	South of Tyger River and west of County route 16	Floodplain adjacent to boat ramp
June 18	North of Tyger River and west of County route 16	Floodplain on north side of river
June 19	North of Tyger River and west of US 176	Floodplain adjacent to Beatty's boat landing west of US 176
June 19	South of Fairforest Creek and east of County route 16	Floodplain and adjacent slopes of stream 0.2 mi east of road
June 20	South of Fairforest Creek beyond end of Forest Service road 320B	Slope adjacent to floodplain of creek
June 21	South of Fairforest Creek and east of County route 16	Floodplain and adjacent slopes of creek about 0.5 mi east of road
June 22	Tyger River north of Forest Service road 320B	Floodplain of Tyger River and adjacent slopes
June 22	Stream south of Tyger River and east of County route 481	Floodplain and slopes above stream
June 29	Stream north of Tyger River south of jct of County routes 16 & 44	Slopes to south of stream
June 29	South of Fairforest Creek and west of County route 16	Floodplain and slopes of stream 0.1 mi to west of road
July 1	Ravine north of County route 136 just east of jct with County route 16	Steep west-facing slopes from upland down to floodplain
July 3	South of Tyger River beyond end of Forest Service road 372	Floodplain and adjacent slopes
July 3	Along Forest Service road 327, north of County route 136	Upland pine forest and roadside

Appendix 2: Tyger River watershed species list. Each species is listed with common name, scientific family and scientific (latin) species name. In addition, information is provided on growth form (Form), if is it native or introduced (Nat?). The collection number for voucher specimens (Vouch). The last five columns represent the potential habitat in which each species may grow: river floodplain (Fpl), stream floodplain (Str), Slopes (Sl), Uplands (Up), and disturbed sites (Dist).

Appendix 3: State listed rare plants within the Tyger River Watershed, either previously known to exist or located during the June and July 2006 survey field trips. Latitude and longitude coordinates were obtained from topographic maps on the website www.TopoZone.com.

Species	Common Name	Location	Lat / Long	Elevation	Ecology	Abundance
<i>Amorpha glabra</i>	Indigo bush	Slope east of Co. rt 16 at Tyger River	34o36'40"N 81o39'50"W	350-360 ft	Near river on steep north-facing slope; scattered on slope	2-3 plants
<i>Amorpha schwinerii</i>	Indigo bush	Woodland east of FS 325	34o36'53"N 81o41'34"W	500 ft	Ridge above creek, west-facing	175 stems
<i>Carex prasina</i>	drooping sedge	Sparks Creek, west of FS 323	34o37'52"N 81o43'20"W	400-410 ft	Streambed of creek	
		Tributary to Isaacs Creek, south of Co rt 481	34o38'50"N 81o44'15"W	390-400 ft	Streambed of creek	
		Stream east of FS 323	34o37'50"N 81o42'22"W	400-420 ft	Streambed of creek	
		Fairforest Creek, downstream from Co rt 16	34o38'41"N 81o39'27"W	380-400 ft	Streambed of creek	20 clumps
<i>Dirca palustris</i>	leatherwood	Fairforest Creek, downstream from Co rt 16	34o38'43"N 81o39'15"W	390 ft	Steep north-facing slope	15 plants
<i>Eurybia mirabilis</i> (not state listed)	Piedmont aster	Along Tyger River downstream from Co. rt 16	34o36'25"N 81o39'46"W	350 ft	Base of steep north facing slope	20 plants
<i>Liparis liliifolia</i>	Lily-leaf twayblade	Tributary to Tyger River west of Co. rt 16	34o36'48"N 81o40'11"W	370 ft	East-facing slope above floodplain	12 plants
<i>Monotropsis odorata</i>	Sweet pinesap	Slope east of FS 325	34o36'53"N 81o41'34"W	500 ft	Ridge above creek, west-facing	1 clump
<i>Ophioglossum pycnostichum</i>	Southern Adder's-tongue	Flood plain of Tyger River north of Rose Hill Park	34o36'40"N 81o39'35"W	350 ft	At base of north-facing slope on floodplain	8 plants
		Tributary to Tyger River north of Co rt 136	34o35'38"N 81o39'32"W	380 ft	Adjacent to ephemeral creek	10 plants
		Tributary to Tyger River west of Co rt 16.	34o36'41"N 81o40'14"W	370 ft	Near bas of east-facing slope	5 plants
		Tributary to Fairforest Creek east of Co rt 16	34o38'41"N 81o39'28"W		Adjacent to ephemeral creek	10 plants
<i>Panax quinquefolia</i>	ginseng	Fairforest Creek, downstream from Co rt 16	34o38'43"N 81o39'15"W	390 ft	Steep north-facing slope	1 plant

Species	Common Name	Location	Lat / Long	Elevation	Ecology	Abundance
<i>Philadelphus hirsutus</i>	Mock orange	Tributary to Tyger River, east of Co rt 481, N of FS 320B	34o38'36"N 81o43'45"W	440 ft	On north facing slope just above stream bed level	1 plant
		Slope above Tyger River SE of end of FS 327A	34o36'00"N 81o38'07"W	370 ft	East-facing slope above river	1 plant
<i>Rhododendron eastmanii</i>	maywhite azalea	Fairforest Creek, downstream from Co rt 16	34o38'33"N 81o39'27"W	390 ft	Steep north-facing slope at headwaters of creek	3 plants
		Fairforest Creek, downstream from Co rt 16	34o38'45"N 81o39'54"W	390 ft	East-facing slopes above tributary to creek	5 plants
		Fairforest Creek, downstream from Co rt 16	34o38'43"N 81o39'15"W	390 ft	Steep north-facing slope above floodplain	2 plants
		Tyger River, E of Co rt 481, north of FS 320B	34o38'36"N 81o43'08"W	400 ft	Steep northwest-facing slope above floodplain	2 plants
		Tributary to Tyger River, east of Co rt 481, N of FS 320B	34o38'34"N 81o43'45"W	490-500 ft	Near summit of steep west-facing slope, headwaters of creek	25 plants
		Tributary to Tyger River, south jct Co rts 16 & 44	34o38'23"N 81o40'11"W	450 ft	Along steep north-facing slope; closer to bottom	14 plants
		Tributary to Tyger River, NE of jct of Co rts 16 & 136	34o38'51"N 81o40'08"W	440-490 ft	Along northwest-facing slopes above tributary	50 plants
		Tributary to Tyger River downstream from Co rt 16	34o36'40"N 81o39'46"W	380 ft	On east-facing slope just east of gas line	1 plant

Appendix 4: Data from plot studies. Information includes the dominant trees as well as the number of tree species and the number of herb species.

Plot location	Dominant trees	# species
#1 – Floodplain of Tyger River near end of Forest Service road 329	Canopy: Sweet gum, Green ash, hackberry Subcanopy: ironwood	Herbs: 30 Shrubs: 2 Trees: 9
#2 – slope above Tyger River near end of Forest Service road 329	Canopy: white oak, sweet gum, pignut hickory Subcanopy: hop hornbeam, red maple	Herbs: 63 Shrubs: 6 Trees: 19
#3 – Floodplain south of Tyger River at County route 16	Canopy: sweet gum, American beech, northern red oak, shagbark hickory Subcanopy: sweet gum, winged elm, slippery elm, American dogwood	Herbs: 48 Shrubs: 2 Trees: 23
#4 – Floodplain of north of Tyger River at County route 16	Canopy: sweet gum, green ash, hackberry Subcanopy: ironwood	Herbs: 35 Shrubs: 0 Trees: 8
#5 – Floodplain north of Tyger River at boat landing west of US 176	Canopy: sweet gum, water oak Subcanopy: ironwood, slippery elm	Herbs: 23 Shrubs: 1 Trees: 8
#6 – slope north of Fairforest Creek and to east of County route 16	Canopy: white oak, green ash, tuliptree, northern red oak Subcanopy: hop hornbeam, sourwood, American beech, chalk maple	Herbs: 43 Shrubs: 2 Trees: 25
#7 - Floodplain of Tyger River beyond end of Forest Service road 320B	Canopy: cottonwood, river birch Subcanopy: box elder, ironwood	Herbs: 38 Shrubs: 2 Trees: 12
#8 - Stream floodplain south of Fairforest Creek and east of County route 16	Canopy: white oak, northern red oak Subcanopy: American beech, chalk maple, hop hornbeam	Herbs: 50 Shrubs: 3 Trees: 22
#9 – Slope above floodplain of Fairforest Creek and 0.4 mi east County route 16	Canopy: white oak, water oak Subcanopy: chalk maple, hop hornbeam	Herbs: 37 Shrubs: 6 Trees: 21