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43 -ECOLOGICAL SUSTAINABILITY – Terrestrial Ecosystems 1/26/2007

The ecological sustainability analysis for the Uwharrie National Forest (UWNF) Plan revision follows the outline and section numbering in Forest Service Handbook 1909.12 (Land Management Planning Handbook Chapter 40 – Science and Sustainability). The primary focus of this analysis is on ecosystem diversity to develop plan components for a framework that provides characteristics of ecosystem diversity and contributes to the diversity of native plant and animal species (36 CFR 219.10 (b)). A complementary and necessary species-specific approach (FSM 1921.7) then focuses on evaluating if additional provisions are needed for specific federally listed species, species-of-concern, and species-of-interest (36 CFR 219.10 (b)(2)).

43.1 – Ecosystem Diversity

Ecosystem diversity is defined as the variety and relative extent of ecosystem types including their composition, structure, and processes (36 CFR 219.16). NatureServe's ecological systems (2004) were used as a starting point to define ecosystem types on the UWNF. Ecological systems are groups of plant associations or "plant communities of definite floristic composition, presenting a uniform physiognomy, and growing in uniform habitat conditions" (Flahault 1910) that occur in regions of similar physical conditions and biological potential. Sites within ecological systems may be characterized by geologic formation, landform, aspect, and other physical attributes that interact to create unique environments controlled by temperature, moisture, and fertility.

An environmental variable-based model was used to approximate and map the <u>potential</u> extent of the more common ecological systems or plant associations on a 622,000 acre area centered on the UWNF to better evaluate the site capability of the varied landscapes in and around the plan area (Appendix A). The <u>existing</u> extent of these systems was determined by intersecting map units from the environmental model with map units from the continuous inventory of stand conditions (CISC) database and evaluating how well the two classifications "fit". Through a collaborative effort by botanists, ecologists, and silviculturists, CISC forest types were cross-walked with their equivalent ecological systems by comparing descriptions of the individual classifications (**Table 1**). Information from the North Carolina Natural Heritage Program was used to map the extent of rare ecological systems. We identified the following 14 ecological systems that are roughly equivalent to The Nature Conservancy's "conservation targets" (NatureServe 2004, TNC 2003).

- Xeric Oak Forest
- Dry Oak-Hickory felsic Forest
- Dry Oak-Hickory mafic Forest
- Dry-mesic Oak-Hickory felsic Forest
- Dry-mesic Oak-Hickory mafic Forest
- Southern Piedmont Mesic Forest
- Southeastern Interior Longleaf Pine Woodland
- Shortleaf Pine-Oak Woodland
- Succesional and planted Forests (Loblolly and Shortleaf pine)

- Streamside Forest
- Southern Piedmont Glade and Barrens
- Southern Piedmont Mafic Hardpan Woodland
- Piedmont Seepage Wetland
- Southern Piedmont / Ridge and Valley Upland Depression Swamp

The following table describes the results of intersecting the map of potential ecological systems and existing forest types and cross-walking type descriptions. The first column lists the broader NatureServe ecological system name and the second column lists the corresponding names of potential ecological system map units, i.e. "potential vegetation" on the UWNF. The last column lists the rules used to map the corresponding existing ecological system based on the match between CISC and NatureServe types. For example, there are approximately 1,750 acres on the UWNF where oak dominated CISC forest types occur in the driest modeled environments, i.e, xeric oak. Map units where these two conditions intersect were labeled "Xeric Oak Forest" (see first table entry). However, the potential extent of Xeric Oak Forest as derived from environmental modeling is 2,900 acres indicating a departure from the potential vegetation composition on 1,050 acres and perhaps a restoration opportunity.

Table 1: Relationship between NatureServe's ecological systems and potential and existing ecological systems on the UWNF

ECOLOCICAL SYSTEM (NatureServe 2004)	**POTENTIAL ECOLOGICAL SYSTEMS ON THE UWNF - from environmental modeling - (potential extent in acres)**	**EXISTING ECOLOGICAL SYSTEMS ON THE UWNF – cross-walk between Potential Ecological Systems and CISC Forest Type (FT) (existing extent in acres)**
Southern Piedmont Dry Oak – (Pine) Forest	Xeric Oak Forest (2,900 ac.) Dry Oak-Hickory-felsic Forest (19,200 ac.) Dry Oak-Hickory-mafic Forest (2,200 ac.) Dry-mesic Oak-Hickory-felsic Forest (9,600 ac.) Dry-mesic Oak-Hickory-mafic Forest (830 ac.)	Xeric Oak potential intersecting with CISC FT *44,45,47,51-55,60* = (1,750 ac.) Dry Oak-Hickory-felsic potential intersecting with CISC FT *44,45,47,51-55,60* = (10,370 ac.) outside Streamside Forest Dry Oak-Hickory-mafic potential intersecting with CISC FT *44,45,47,51-55,60* = (1,300 ac.) outside Streamside Forest Dry-mesic Oak-Hickory-felsic potential intersecting with CISC FT *44,45,47,51-55,60* = (6,670 ac.) outside Streamside Forest Dry-mesic Oak-Hickory-mafic potential intersecting with CISC FT *44,45,47,51-55,60* = (625 ac.) outside Streamside Forest
Southern Piedmont Mesic Forest	Southern Piedmont Mesic Forest (950 ac.) = (Mesic / Alluvial Forests plus Hardwood Slope Forest environmental models)	Southern Piedmont Mesic Forest potential intersecting with all CISC FT but *12,13,16,21,31,32,33* = (320 ac.) outside Streamside Forest
Southeastern Interior Longleaf Pine Woodland	Southeastern Interior Longleaf Pine Woodland (8,200 ac.)	CISC FT = 21 outside Streamside Forest
Southern Piedmont Glade and Barrens	Shortleaf Pine-Oak Woodland (28 ac.)	Shortleaf Pine-Oak Woodland potential
	UWNF Ecological Systems listed below were not derived from environmental modeling	
	Southern Piedmont Glade and Barrens (< 100 ac., 19 sites)	NC Natural Heritage Program Community Element Occurrences 2006 (< 100 ac., 19 sites)
Southern Piedmont Mafic Hardpan Woodland	Southern Piedmont Mafic Hardpan Woodland (30 ac., 9 sites)	NC Natural Heritage Program Community Element Occurrences 2006 (30 ac., 9 sites)
Piedmont Seepage Wetland	Piedmont Seepage Wetland (200 ac., 50 sites)	NC Natural Heritage Program Community Element Occurrences 2006 (200 ac., 50 sites) outside Streamside Forest
Southern Piedmont / Ridge	Southern Piedmont / Ridge and Valley Upland Depression Swamp (15 ac., 11 sites)	NC Natural Heritage Program Community Element Occurrences 2006 (15 acres, 11 sites)

and Valley Upland Depression Swamp		
Southern Piedmont Large Floodplain, Southern Piedmont Small Floodplain and Riparian Forest, Southern Piedmont Dry Oak – (Pine) Forests	Streamside Forest (7,000 ac.) One-hundred foot zone adjacent to perennial streams plus adjacent floodplain / alluvial soils. Perennial streams derived from 1:24,000 scale topographic maps plus hydrologically modeled streams below 19 acre catchment area (ESRI 2002)	Streamside Forest (7,000 ac.) One-hundred foot zone adjacent to perennial streams plus adjacent floodplain / alluvial soils. Perennial streams derived from 1:24,000 scale topographic maps plus hydrologically modeled streams below 19 acre catchment area (ESRI 2002)
Cultivated Forest, Semi-natural Forest	Successional and planted Forest (**acres are included in above types**)	Successional Forest (20,525 ac.) (**acres not included in above types**) Loblolly Pine (11,335 ac.) = CISC FT 31, 13 Shortleaf Pine (9,200 ac.) CISC FT 32, 12, 33, 16

[1/] See Appendix A for explanation of ecological modeling methods and results

In general, environmental modeling and geologic substrate facilitated the mapping of existing ecological systems on the UWNF by:

1. Separating oak-dominated CISC forest types 44 (Southern Red Oak -Yellow Pine – 1,043 ac.), 45 (Chestnut Oak-Scarlet Oak-Yellow Pine – 1,629 ac.), 47 (White Oak-Black Oak-Yellow Pine – 2,583 ac.), 51 (Post Oak-Black Oak – 14 ac.), 52 (Chestnut Oak – 716 ac.), 53 (White Oak-Red Oak-Hickory- 14,670 ac), 54 (White Oak – 292 ac.), 55 (Northern Red Oak – 155 ac.), and 60 (Chestnut Oak-Scarlet Oak – 308 ac.) into ecological systems based upon temperature, moisture, and fertility (geology) gradients,
2. Separating pine-dominated CISC forest types 12 (Shortleaf Pine), 13 (Loblolly Pine-Hardwood), 16 (Virginia pine-Oak), 31 (Loblolly Pine), 32 (Shortleaf Pine), and 33 (Virginia Pine) into Successional Forest ecological systems or Southern Piedmont Mesic Forest ecological systems, and
3. Identifying pine-dominated CISC forest types that could potentially support Oak, Oak-Hickory or Longleaf Pine ecological systems.

Information developed in the following sections is used to evaluate and interpret the status of ecological systems on the UWNF. Each section is summarized in a subsection titled "***Evaluation***". Proposed plan components that provide for characteristics of ecosystem diversity that address these evaluations are listed in section 43.15.

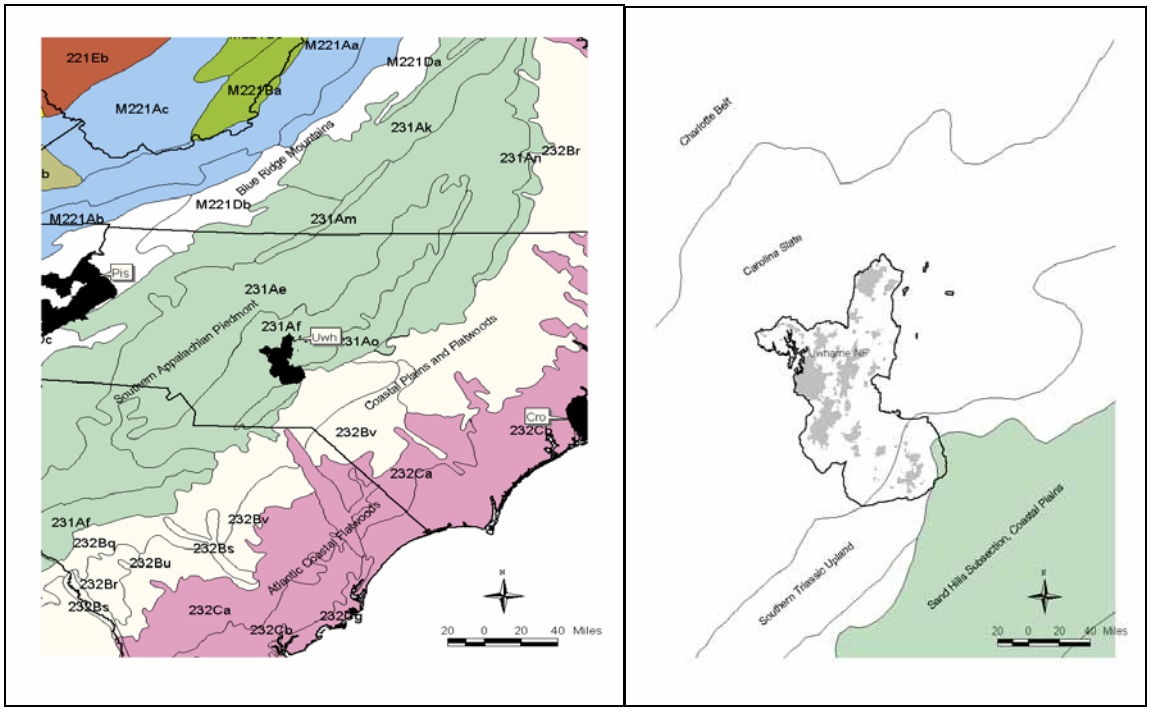
43.11 – Spatial Scales for Ecosystem Diversity

The spatial scales for considering ecosystem diversity on the UWNF were selected to address the administrative plan area and its role in the broader ecological context. Essentially we looked at ecological subsections from the National Hierarchical Framework of Ecological Units (USDA 1997) and at the landscape-level environmental model area for context and national forest roles in providing for ecosystem diversity. Ecological system characteristics on the UWNF were evaluated in detail to better understand opportunities and limitations for national forest lands to contribute to the sustainability of ecological systems.

The UWNF is located within the Southern Appalachian Piedmont Ecological Section, a broad area over 42 million acres in size that lies between the Coastal Plain and Blue Ridge Mountains. The proclaimed boundary of the UWNF is within a portion of the Sand Hills Ecological Section, and two Ecological Subsections within the Piedmont: the Carolina Slate Belt and Southern Triassic Uplands (**Figure 1**). No land is managed within the Sand Hills Section, an area that is dominated by longleaf pine and pond pine ecological systems and very unlike the UWNF. The Carolina Slate Belt and Southern Triassic Uplands therefore provide the bounds on the area of analysis (36 CFR 219.16) to evaluate and understand the environmental context and opportunities and limitation for NFS lands to contribute to the diversity of native plant and animal communities.

The Carolina Slate Belt is approximately 5.8 million acres in size and extends from southern Virginia to eastern Georgia. In North Carolina, it covers approximately 2.8 million acres. This extensive subregion is comprised of irregular plains with relatively low relief (< 500 ft.) derived from quaternary or tertiary silty to clayey saprolite. Potential vegetation, at its broadest level, is described as White Oak-Red Oak-Hickory and Pine-Oak-Yellow Poplar (Keys 1996). The Southern Triassic Uplands, confined primarily to North Carolina, are approximately 1.1 million acres in size and extend from southern Virginia to northern South Carolina. This subregion is comprised of irregular plains with relatively low relief (< 300 ft.) derived from quaternary red silty sand to silty clay decomposition residuum and silty to clayey sandy saprolite. Potential vegetation is described as Southern Red Oak -White Oak-Red Oak-Hickory and Shortleaf Pine-Oak.

Figure 1. Ecological Subregions in and adjacent to the Uwharrie National Forest in NC



The total area within the Carolina Slate Belt and Southern Triassic Uplands is approximately 6.9 million acres or about 16% of the Southern Appalachian Piedmont. Between 1982 and 1992, the percent of area in forests in the Southern Appalachian Piedmont declined by 1.12% and is projected to decline by an additional 7.95% from 1992 to 2020 (USDA 2002). This is the largest projected decline in the entire 13 state Southern Region where about 50% of the land is forested and where it is forecasted that 12 million forest acres will be lost to developed uses between 1992 and 2020. In areas where forest cover is relatively high but highly fragmented, such as the UWNF, it is anticipated that even marginal changes in forest cover may have disproportionate impacts on the connectivity of forested habitats (USDA 2002). The UWNF is approximately 51,000 acres in size and just a fraction of both the total extent of the Carolina Slate Belt and Southern Triassic Uplands (UWNF is 0.7% of this area) and the extent of these Subregions in North Carolina (UWNF is 1.3% of this area). Total federal land within the Carolina Slate Belt and Southern Triassic Uplands includes the UWNF, Sumter NF, Pee Dee National Wildlife Refuge, and Carolina Sandhills National Wildlife Refuge and is less than 200,000 acres or less than 3% of this area.

The environmental model was used to approximate the extent of potential ecological systems on a 622,000 acre area bounded by the extent of 16 - USGS 7 ½ minute quadrangles centered on the UWNF (**Figure 2**). This area includes both public and private lands and covers 497,440 acres within Montgomery, Randolph, Davidson, and Stanly counties (**Table 2**). The potential extent of ecological systems within this 4-county area on private lands was approximated using results of modeling (**Appendix A**) and the proportion of total counties identified as forested (Brown 2003) to evaluate the opportunities and limitations for NFS lands to contribute to the sustainability of ecological systems in the plan area (**Table 2**).

The UWNF includes about 10% of the total land but roughly 15% of the forested land within this analysis area. Similarly, the potential extent of at least 4 ecological systems is disproportionately greater on the UWNF, i.e. although the UWNF is only 15% of the total forest area, it could support nearly 30% of Xeric Oak Forests, 21% of Dry-mesic Oak-Hickory felsic Forests, 19% of Dry Oak-Hickory felsic Forests, and 18% of all Dry Oak-Hickory mafic Forests in the 4-County modeled area. Potential for several ecological systems are also underrepresented on the UWNF including Southern Piedmont Mesic Forests, Streamside Forests, and Longleaf Pine Woodlands (**Table 2**).

Figure 2. Area of the environmental variable-based model (hatched) used to map potential ecological systems centered on the UWNF (shaded) and Montgomery, Davidson, Randolph, and Stanley Counties

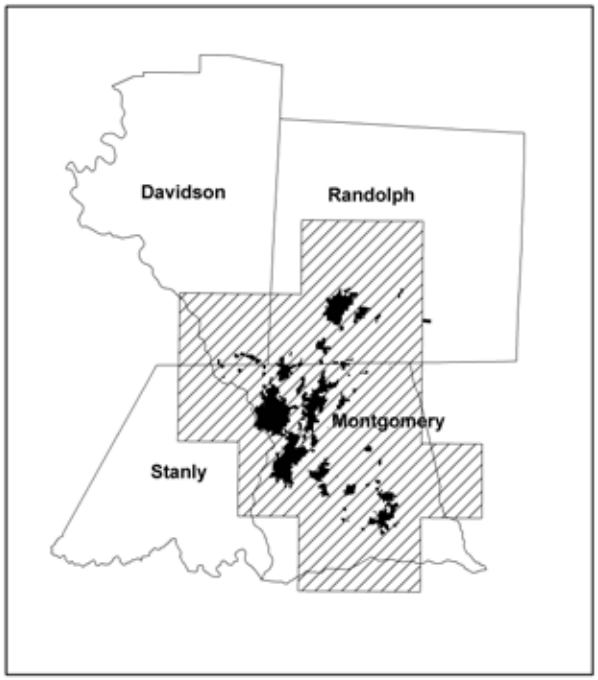


Table 2. Potential extent of ecological systems in the 4-County modeled area.

Ecological System	UWNF (acres)	UWNF % of Modeled Area	Total Modeled Area (acres)	Modeled Area by County			
				David. (acres)	Mont. (acres)	Rand. (acres)	Stan. (acres)
Total area	51,000	10.3%	497,440	41,720	239,130	159,320	57,270
% forest [1/]	98%		67%	56%	78%	62%	43%
Xeric Oak Forest	2,900	29.9%	9,685	1,925	1,710	5,130	920
D.Oak-Hickory felsic	19,200	18.7%	102,755	10,735	34,030	51,820	6,170
D.Oak-Hickory mafic	2,200	18.0%	12,220	890	3,660	1,970	5,700
DM.Oak-Hickory fels	9,600	20.7%	46,280	4,180	23,380	16,520	2,200
DM.Oak-Hickory maf	830	16.6%	4,985	360	1,635	700	2,290
S.Piedmont Mesic	950	6.5%	14,530	580	9,550	2,280	2,120
Longleaf Pine Woodld.	7,600	10.4%	73,321	0	73,141	180	0
Streamside Forest	7,000	9.9%	70,405	4,690	39,375	21,150	5,190
Total Forested	**49,980**	**15.0%**	**333,289**	**23,363**	**186,521**	**98,778**	**24,626**

[1/] Private land figures exclude forests on the UWNF

The proportion of forested land in the 4-county modeled area (67% forested) surrounding the UWNF is higher than the 52% estimated in 2002 for the North Carolina Piedmont (USFS Forest Survey, Brown 2003). Montgomery County, where most of the UWNF is located, is about 80% forested, more than any other county in the 35-county Piedmont of North Carolina. The extent of forest land in the 4-county area during the past 20 years has been relatively static although increasing about 19% in Davidson County and

decreasing by nearly the same amount in Stanly County (Brown 1990, 2003, Hutchins 1984).

Evaluation

Because of its small size relative to the Carolina Slate Belt and Southern Triassic Uplands, it would appear that the UWNF has very limited opportunities to contribute to the sustainability of ecological systems and the species they support. However, ecological systems on private lands have greatly departed from their natural range of variation due to urban development, farming, and short-rotation timber production within these Subregions and future trends in urbanization and loss of forest habitat is anticipated. Still, unless the UWNF provides the majority of known occurrences of specific rare ecosystems or rare species throughout this subregion, its contribution to ecological sustainability will probably always be limited by its size and fragmented condition (see section 43.14a).

At a more local level focused on the plan area, the UWNF could contribute greatly to sustaining ecological systems and the species they support. This contribution is due primarily to the diversity of habitats available on the UWNF, the relative amount of intact forests that occur on mafic rock that support a variety of locally rare species, and the potential for restoration of rare ecological systems such as Southeastern Interior Longleaf Pine Woodlands. Continued loss of forest acres to developed uses on private lands is likely to make the UWNF's conservation contribution even more meaningful in the not too distant future.

43.12a – Characteristics of Ecosystem Diversity

In order to evaluate ecological sustainability, we must identify the ecological processes, ecosystem composition, and structural characteristics that are important to the long term persistence of ecological systems on the UWNF. Three general characteristics are evaluated for each ecological system: (1) the abundance of each ecological system, i.e., the area supporting characteristic dominant vegetation of the system on ecologically appropriate sites, (2) forest density expressed in terms of percent overstory closure and size of canopy gaps, and (3) fire regime and its role in maintaining subcanopy and understory species composition and structure. Two additional characteristics are evaluated for specific ecological systems where they are important factors affecting composition and processes: (1) the abundance of non-native invasive species, and (2) hydrologic regime. All of these characteristics are measurable, have been significantly influenced by past management actions, and are subject to management control in the future. Therefore, they are important factors to consider when establishing (or evaluating) plan components. To quantify the status of these characteristics, the following indicators have been developed and specifically applied to each of the 14 ecological systems (**Appendix B**) where they are appropriate:

Key Factor	Indicator
Species Landscape Composition	*The percent of NFS acreage dominated by species characteristic of the ecological system on ecologically appropriate sites.* This indicator is used to evaluate the abundance and distribution of the system on the landscape, i.e., the proportion of the total acreage dominated by plant communities and species composition characteristic of ecological systems best adapted to the site, regardless of their successional stage.
Species Composition	*The percent of NFS acreage for a given ecological systems with less than 10% non-native invasives species (NNIS) cover.* This indicator is used to evaluate the degree of competition from non-native species and their effect on the long-term persistence of native species best adapted to the site.
Canopy Structure	*The percent of NFS acreage at the desired canopy closure for a given ecological system approximated by the number of acres thinned or having basal area reduced through natural disturbance within the last decade*. This indicator is used to evaluate the proportion of forests that have the structure, i.e., canopy closure that facilitates the development and maintenance of species characteristic of the system
Canopy Structure	*The percent of NFS acreage in canopy gaps of the appropriate size for a given ecological system.* This indicator is used to evaluate the proportion of the forest with habitat conditions that favor light-loving species and natural regeneration of tree species characteristic of the type.
Fire Regime	*The percent of NFS acreage prescribed burned on multiple occasions within the last 15, 20, or 30 years (time period specific to system) under appropriate conditions for a given ecological system.* This indicator is used to evaluate the condition of subcanopy and understory tree, shrub, herb, and grass species and the role of disturbance regimes that allow periodic perturbations to maintain canopy gaps and thin midcanopy trees to favor species best adapted to the site.
Hydrologic Regime	*The percent of NFS acreage within a given ecological system with unaltered natural hydrology (undrained)* . This indicator is used to evaluate the status of wetland systems, i.e., their ability to persist and provide conditions for wetland dependent species.

For each ecological system, benchmarks were developed for each appropriate indicator based on proportions of the optimal extent of the system on the landscape. Optimal extent is defined as the total potential acres that could be occupied by the ecological system. Four qualitative categories were used to rate each indicator: "Very Good", "Good", "Fair" and "Poor". An additional indicator rates the combined condition of each key factor on the same site and is used to evaluate departure from overall reference condition (see section 43.14.2). The qualitative categories are defined as follows:

- **Very Good:** The key factor (characteristic) is functioning at an ecologically desirable status, i.e., is self-maintaining and requires little management action.
- **Good:** The key factor if functioning within its natural range of variation and may require some management action.
- **Fair:** The key factor lies outside of its natural range of variation and requires management action. If unchecked, the ecological system will be vulnerable to degradation.
- **Poor:** Allowing the key factor to remain in this condition for an extended period of time may make ecological system restoration or preventing species loss impractical or not economically feasible.

Category percentages vary by potential abundance (% of national forest acreage) of the ecological system (**Table 3**) on the UWNF. The benchmarks provide an important

context to evaluate the current and desired conditions within each ecological system and can be used for monitoring progress related to the key factors. However, they may not necessarily be used as the desired condition itself. Given the climatic, cultural, and ecological changes that have occurred over time, it might not be possible to achieve "optimal" conditions.

Table 3. Values used to calculate benchmarks representing "very good", "good", "fair", and "poor" indicator condition. Percentages vary by potential abundance (% of national forest acreage) of an ecological system. Benchmarks are higher for indicators in rarer ecological systems, and lower for indicators in more common ecological systems. Benchmarks are also adjusted higher by 10-30% for the combined indicator used to evaluate departure from overall reference condition (not shown in this table – see section 43.12b).

	Percent of "Optimal" extent of ecological systems			
Percent of national forest acreage potentially occupied by the ecological system	**"Very Good"**	**"Good"**	**"Fair"**	**"Poor"**
> 10%	> 75%	55%-75%	30%-55%	< 30%
1% to 10%	> 85%	70%-85%	50%-70%	> 50%
< 1%	> 95%	85%-95%	70%-85%	> 70%

These benchmarks are based on expert opinion and standard percentages consistent with R8 guidelines. They should be viewed as coarse estimates, not hard thresholds, but as planning tools that are useful for assessing ecological outcomes and for evaluating management performance during monitoring of plan implementation.

43.13 – Range of Variation

The range of variation under historic disturbance regimes is also a necessary context to evaluate current and desired conditions on the UWNF. Following the approach described in recent Forest Service Handbook (FSH) direction, natural variation of ecosystem characteristics (section 43.12a) can be evaluated in the context of a reference period having relative climatic and ecological stability, i.e. the period of indigenous settlement, but prior to the influence of European-American settlement, or "pre-settlement" period (FSH 1909.12.43.13). These selected ecosystem characteristics then serve as descriptors of habitats for species selected for consideration during planning.

It is difficult to accurately determine the historic range of variation in disturbance regimes in the ecologically diverse Eastern United States. This is especially true in the highly fragmented land ownership of the Southern Piedmont where hurricanes, tornadoes, fire, insects, drought, and disease interacting with a 12,000+ year history of human disturbance (pre-settlement Indian influences, clearing for European settlements, historic agricultural use, and current urban sprawl) has masked reference period vegetation patterns. Furthermore, unlike the Western United States, few intact ecological systems at or near pre-European settlement conditions still exist in the Southern Piedmont to define and study a reference condition. However, we can approximate the abundance and distribution of ecological systems for a reference period prior to European settlement through the use of environmental modeling based on remnant vegetation and site features. We can also estimate other important ecological characteristics such as canopy

closure and composition by evaluating current habitat requirements for plant communities or species in decline due to habitat loss or degradation. Finally, we can evaluate the disturbance processes that affect or have affected ecological systems in the Southern Piedmont and use ecological understanding of how the structure and composition of vegetation on the UWNF have been influenced by these disturbance regimes.

Disturbance processes

Hurricanes and Tornadoes: Over the 107-year period 1871 through 1977, a total of 651 tropical cyclones (tropical storms and hurricanes) of various intensities have been recorded over the Atlantic cyclone basin (NOAA 1978). A total of 257 or about 40 percent have crossed or passed immediately adjacent to the United States mainland. About 140 of these were of hurricane strength and 21 occurred in North Carolina. Eight of the hurricanes in North Carolina during this period were considered major hurricanes (≥ category 3) "capable of blowing large trees down" and therefore capable of altering the composition and structure of forests. Only Florida had a greater number (50) of hurricanes than North Carolina during this same period and 21 of these were considered major.

During the past 28 years (1978-2005) 13 additional hurricanes have been recorded in North Carolina. Of the total 33 hurricanes recorded in North Carolina from 1871 to 2005, 11 (33 percent) have passed within 100 miles of the UWNF or were recorded as producing damage in the surrounding 4 county area (**Table 4**). However, only three of these – Hazel, Hugo, and Fran were major hurricanes. By comparison, 7 major hurricanes have occurred on the North Carolina coast during this 134 year period where hurricane frequency averaged 1 per 6 years versus 1 per 20 years for the UWNF area. The year 2005 was the most active year on record for hurricanes in the Atlantic cyclone basin and this trend in heightened activity is expected to continue for at least a decade.

Table 4. Hurricanes recorded in North Carolina from 1871 to 2005

Hurricane Number or Name	Category [1/]	Date	Vicinity of the Uwharrie NF
2	3	August 18, 1889	No – on coast
6	**1**	**September 24, 1889**	**Yes – directly over**
4	3	September 18, 1906	No – in mountains
3	1	July 11, 1901	No – on coast
2	1	July 31, 1908	No – on coast
13	2	September 16, 1933	No – on coast
2	**1**	**September 4, 1913**	**Yes – directly over**
3	**1**	**September 23, 1920**	**Yes – directly over**
13	1	September 18, 1926	No – on coast
3	**1**	**August 1, 1944**	**Yes < 100 miles E**
7	3	September 14, 1944	No – on coast
1	1	August 24, 1949	No – on coast
Barbara	1	August 13, 1953	No – on coast
Carol	3	August 31, 1954	No – on coast
Hazel	**4**	**October 15, 1954**	**Yes < 100 miles E**
Connie	3	August 12, 1955	No – on coast

Diana	1	August 17, 1955	No - > 100 miles E
Ione	3	September 19, 1955	No – on coast
Donna	4	September 11, 1960	No – on coast
Ginger	**1**	**September 9, 1971**	**Yes – < 100 miles E**
Diana	1	September 9, 1984	No – on coast
Gloria	2	September 26, 1985	No – on coast
Charley	1	August 18, 1986	No – on coast
Hugo	**4**	**September 22, 1989**	**Yes > 100 miles SE**
Bertha	**2**	**July 13, 1996**	**Yes – but minor**
Fran	**3**	**September 6, 1996**	**Yes < 60 miles E**
Bonnie	3	August 26, 1998	No – on coast
Dennis	**1**	**August 4, 1999**	**Yes – but minor**
Floyd	**2**	**September 16, 1999**	**Yes – but minor**
Isabel	2	September 18, 2003	No – on coast
Charley	1	August 14, 2004	No – on coast
Cindy	1	July 5, 2005	No – in mountains
Ophelia	1	September 15, 2005	No – on coast

[1/] Saffir-Simpson hurricane scale: Category 1 = Winds of 74 to 95 miles per hour – damage primarily to shrubbery, trees, foliage, Category 2 = Winds of 96 to 110 miles per hour – considerable damage to shrubbery and tree foliage; some trees blown down, Category 3 = 110-130 miles per hour, Category 4 = 131-155 miles per hour, Category 5 = 156+ miles per hour.

Moderate damage (partial tree blowdown up to 10 acres in size) on the UWNF occurred from Hazel, Hugo, and Fran but was not widespread. The greatest damage was from Hugo (Carter 2006).

Although hurricane frequency declines from coastlines to the interior Piedmont, tornadoes are more frequent in interior areas. Nearly 10 violent tornadoes per year have occurred over the last 100 years (Grazulis 1984; Martin and Boyce 1993) in the Piedmont region. Since 1950, 39 tornadoes (or about 4 per decade) have been recorded in the four counties surrounding the UWNF. Most of these were considered weak tornadoes (F0-F1) with winds less than 112 mph, but 7 (nearly one per decade) were strong tornadoes (F2) with winds exceeding 112 mph. Damage on the UWNF has likely been greater from tornadoes, in the long term, than from hurricanes; damage to stands nearly 100 acres in size have been documented on the UWNF (Carter 2006) although this damage resulted in only partial loss of the tree overstory.

Insects: The Southern Pine Beetle (*Dendroctonus frontalis* Zimmermann) is the most destructive pine bark beetle in the southern United States (USDA Handbook #575). They are indigenous, occurring in small numbers, but populations are cyclic and occasionally increase dramatically to epidemic proportions over wide areas. Pine trees are killed singly, in small groups, or in large numbers over hundreds of acres. An epidemic cycle may last 3-5 years. Environmental factors and/or natural predators will eventually cause a population collapse, ending the epidemic.

Infestations can develop into epidemic levels when pine forests are stressed by crowded growing conditions or drought, trees are damaged from ice or wind, or when stands are considered biologically mature. Once beetle populations develop in weakened trees, they may spread to healthy trees that normally would resist attack. When beetle populations become large, they can successfully attack healthy, vigorous trees, resulting in

widespread mortality. Natural enemies, including diseases, parasites, and predators, can help maintain beetle populations at normal levels; however, these forces seem to have relatively little effect during epidemics. Most major outbreaks last from three to five years and occur in irregular cycles of about seven to 10 years.

Southern Pine Beetle activity on the UWNF has largely been confined to loblolly and shortleaf pine stands, but could impact all pine species in pine and mixed pine and hardwood forest types if populations increase to epidemic proportions. Southern pine beetle infestations can cause a shift in community composition in mixed pine-hardwood or pine-oak stands and a shift in forest-wide age-class distribution in pine dominated stands. Shade tolerant species such as blackgum, red maple, sourwood, and dogwood may increase in abundance in pine-hardwood stands and oaks are likely to become more dominant in mixed pine-oak stands. Pine dominated forests may experience a 30+% increase in seedling-aged stands (USDA 2003).

The most recent Southern Pine Beetle outbreaks on the UWNF occurred in the mid 1990's and in 2002. During the first infestation suppression actions were taken on approximately 120 acres over a 5-year period from 1992 to 1996. Monitoring by the Forest Service-Forest Health Protection Unit indicated low but increasing SPB populations from 2001 and 2002. The North Carolina Department of Forest Resources predicted the North Carolina piedmont would have an increasing population trend in 2003, and possibly in 2004. In 2003, up to 5,000 acres of Southern Pine Beetle suppression treatments were authorized to suppress infestation on the UWNF.

Lightning-Caused Fires: Lightning storms, which can lead to fire ignition in forests, are more frequent in the Southeast than in any other part of the United States. Historic records indicate an average lightning-caused wildfire interval of 2-3 (Cowell 1992) or 3-5 (Hughes 1966) years in the Southeast Coastal Plain where fire compartments are large and lightning is frequent. A fire compartment is defined as an element of the landscape with continuous fuel and no natural firebreaks, such that an ignition in one part would be likely to burn the whole (Frost 1998). Fire danger may remain high in the Coastal Plain even when heavy rain is associated with lightning storms because of the drying effects in the commonly open-canopied pine savannas and their associated sandy and therefore droughty soils (Juras 1997). In the Piedmont, the landscape is more frequently dissected by drainages that create fire compartments that may be too small to allow fires to burn large areas as frequently as they do in the Coastal Plain. Furthermore, fire danger in the more closed canopied forests of the Piedmont decreases as vegetation "greens up" during the summer season when lightning storm frequencies are at their maximum.

We might conclude that lightning–caused fires, based on their lack of extensive documentation in the Piedmont, may have played an infrequent role in changing the composition and structure of terrestrial ecological systems on the UWNF just prior to European settlement. However, this does not explain the persistence of longleaf pine woodlands or a flora more adapted to open, prairie-like conditions that currently exist only on managed rights-of-way (roadsides, field margins, railway embankments, and power lines) on the UWNF. Some of these species are not widespread outside the

Piedmont, and a few, such Schweintiz's Sunflower, are restricted to the region (Barden 2002). The persistence of these species and of longleaf pine woodlands is evidence that presettlement conditions on the UWNF included more open landscapes than we see today.

American Indian-Caused Fire: There has been much debate on causes and effects of fire in the presettlement Piedmont (Juras 1997). However, the preponderance of anecdotal (Stewart 1963, Williams 1992), archeological (Dobyns 1966, 1983; Jacobs 1974), ecological (Delcourt and Delcourt 1997, 1998; Hamel and Buckner 1998), and meteorological evidence supports the conclusion that fire was a widespread occurrence in the pre-European landscape. Furthermore, more recent studies of "fire signatures" in Antarctic ice-cores indicate almost a 40% reduction in biomass burning emissions from about 1000 A.D. to 1700 A.D. and that from 1500 to 1700 A.D., regional human population variations are the most likely cause of these reduced emissions (Ferretti et.al. 2005). This is the time period when Native American populations severely declined as a result of Old World diseases brought by Europeans explorers.

It is likely that many of the Piedmont ecological systems developed under a regime of Native American-caused fires over a period of thousands of years. Native Americans have lived in the Piedmont region for 12,000 years and they burned the forest to improve hunting, to facilitate travel, and, for 1500 years before European settlement, to clear fields for agriculture (Merrell 1989). The wealth of independent historical reports of large prairie-like openings suggests that they were an important component of the landscape in the Carolina Piedmont region and that these "prairies" were created or at least maintained by Native Americans using fire (Barden 1997, 2002).

From 1540 to 1750, European explorers and traders in the Piedmont region of North and South Carolina reported many prairie-like openings they called "prairies," "savannas," "plains," or "old fields," ranging in size up to 40 km across. Historical and meteorological evidence suggests that these prairies were primarily the products of Native American burning and agriculture. There are more than a dozen historical accounts beginning with Hernando DeSoto's 1540 expedition describing similar open conditions across the presettlement Piedmont (Barden 1997). More specific to the UWNF, these historical accounts include:

1) John Lederer, who in 1670 traveled from the James River in Virginia, to the Charlotte, North Carolina area, reported before reaching the Charlotte area that "The country here, by industry of these Indians, is very open, and clear of wood" and that the forests "where inhabited by Indians .. lay open in spacious plains" (Rostlund 1957). He included a map in the record of his travels that shows a very large area of the Piedmont east of the Appalachians labeled "savanae." A rough approximation of the area traversed by early Piedmont explorers indicates that Lederer likely traveled through the southern portion of the present day UWNF in Montgomery county (Juras 1997).
2) John Lawson in 1701 traveled from Charleston South Carolina to the Piedmont near Charlotte, NC, and then northeast to the Pamlico Sound. He documents a dozen references to "large savannas" and "the woods being newly burnt and on

> fire in many places." Near Charlotte he observed abandoned croplands that had become "spread with grass and strawberry vines." Near Salisbury, NC, which is less than 50 miles west of the UWNF he journeyed "about 25 miles over pleasant savanna ground, high and dry, having very few trees upon it, and those standing at a great distance apart". A rough approximation of areas traversed by Piedmont explorers indicates that Lawson likely traveled through the present day UWNF near Asheboro and Troy in Montgomery, Randolph, and Stanley counties (Juras 1997).

Further evidence of the importance of Indian-caused fire may come from historical observation of actual fires. Most of these observations were made during the dormant season (Lawson 1701, Catesby 1720, and Byrd 1728) when lightning-caused fires are extremely uncommon. However, because early explorers primarily traveled along established trails through regions inhabited by Native Americans and probably extensively cultivated, their observations may give a false impression and exaggerate the importance of fires and frequency of openings in the broader landscape.

The documented presence of bison in the early historic record is also given as evidence of significant Indian alteration of the forest ecosystems in the Southeast; a large-scale program of burning by Indians converting large tract of forests to grasslands, thereby providing habitat for this grazing species (Rostlund, 1957, 1960). An inspection of the archaeological and historic record, however, does not support this interpretation (Bass 2002). Of the thousands of archaeological sites representing the Indian occupation for the Southeast and dating from the late historic period to at least 8,000 B.C. that have been excavated, only one bison specimen is attributable to this period and it was a bison horn covered in copper and undoubtedly a ceremonial object (Bass 2002).

Still, it is likely that the historical Carolina Piedmont had some prairies which were open medium to large-size gaps among the mixed oak forests we see today. These prairies were able to establish where abundant rainfall would otherwise lead to forest because of droughty soil and frequent fire (Barden 2002). It is also likely that extensive clearings occurred along productive bottomlands and alluvial terraces following the wide use of maize as a staple crop during the period of maximum cultivation in the Mississippian Period (1,200 to 500 years B.P). In this period, there was extensive clearing for cropland and large settlements were created whose influence included the harvest of wood for fuel and building materials in peripheral areas (Delcourt et al. 1993). During this period, Indians used fires to annually burn cereal grasses, to burn basket grasses and nut trees every 3 years, and the grassy savanna hunting areas annually (Pyne 1997).

Williams (1992) estimated that the cleared land needed to support a person before European settlement ranged from about 2 acres to 30 to 40 acres for all cleared and burned land. Although Indian population levels prior to European settlement are still debated (Snedeker 2006), assuming that 6 million Indians were part of the eastern woodland culture, and each person represented 10 to 20 burned acres, then 60 million to 120 million acres would have been affected by clearing and burning (Williams 1992). This is about 22 to 44 percent of the cropland acreage farmed in the 31 Eastern States in

1990. Although these exact figures can be refuted (Snedeker 2006), they were presented by Williams (1992) to reflect the importance of Native American impacts on the landscape through the use of fire.

Regardless of the role of Indian-caused fire in the Piedmont, Frost (1998) makes the case that fire-adapted and fire-dependent species in the U.S. have evolved over a much longer period of time than humans have occupied North America. Therefore, lightening would have been responsible for most fires historically and for the fire adapted species we see today. As Frost (1998) explains: "*Since any dependency on fire must involve evolutionary time, it seems unlikely that any rare species in the U.S. were dependent upon Native American burning. Native Americans have occupied North America only since the last glaciation – a relatively short time in evolutionary terms. The remarkable adaptations of extreme frequent-fire species like longleaf pine and Venus's flytrap are unlikely to have appeared in the 10,000 years since the end of the Wisconsin glaciation, and would have taken hundreds of thousands of years to evolve during previous interglacial periods….*" however "*The relative importance of Native American fires should be expected to increase in topographically complex areas where fire compartments are smaller, and in regions with infrequent lightning ignitions".*

Although the adaptations of individual species are <u>not</u> likely the result of Native American burning, anthropogenic fire is very likely responsible for the sorting of species distributions and development of the plant communities (i.e. ecological systems) and distributions we know today. It is this distribution of communities that we address in this analysis for conservation planning, not only the adaptations of individual species.

As a result of Old World diseases brought by Europeans explorers, during the 16th and 17th Centuries, Native American populations severely declined. The Piedmont became "the object of emigration" in the mid-1700's as "the extent and fertility of the beautiful prairies became known" (Foote 1846). When these European settlers moved into the Piedmont, they settled the open areas first because they did not have to clear the land of trees and converted the prairies to fields and pastures. By the 1800's the Piedmont prairie community, including the elk, had disappeared from the Carolina landscape (Barden 1997).

Historic Fire Frequency on the UWNF: Frost (1998) developed a map of the United States that represents fire frequency in the most fire-exposed parts of each landscape during the era of European settlement (a window ranging from around 1565 to around 1890) using a synthesis of physiographic factors such as topography and land surface form, along with fire compartment size, historical vegetation records, fire frequency indicator species, lightning ignition data, and remnant natural vegetation. Native American burning was included in the estimate. The fire return interval in the Piedmont is estimated between 7-12 years for the most fire-exposed parts of the landscape, especially flats, dry uplands, and south slopes. Portions of the land within this area are naturally protected from fire such as wet areas, sparsely vegetated areas with insufficient fuels to carry fire, and fire-sheltered sites such as north-facing slopes, coves, ravines, steep-sided stream valleys.

The fire return interval is more likely at the low end of Frost's Piedmont range for portions of the UWNF south of Lovejoy because fire compartments are larger due to more rolling topography and smaller streams and because of its proximity to the Sandhills Section where Frost estimates a higher fire frequency of 4-6 years. Fire compartments are smaller outside of this area because they are restricted by the Uwharrie Mountains, and other mountains such as Morris Mountain, Walker Mountain, and the Birkheads.

Evaluation

Hurricanes and tornadoes have and will continue to impact forests on the UWNF and result in shifts in species composition and stand structure. These periodic disturbances, unlike in areas of the Southeastern Coastal Plain, are not likely to result in widespread alteration of ecological systems or loss of the species they support because major storm incidence declines from coastlines to the interior Piedmont. Widespread damage would be even less likely in portions of ecological systems on the UWNF where composition, structure, and ecological processes are ranked as being in "good" to "very good" ecological condition. Forests in these conditions are more resilient than forests whose ecological characteristics are outside the natural range of variation. However, few acres have been ranked in these categories on the UWNF (**Appendix B**); therefore, to reduce risks to biological diversity, plan components should be developed that improve the current ecological condition of forest composition and structure.

Similarly, Southern Pine Beetle outbreaks have and will periodically cause damage to trees and result in shifts in species composition and stand structure on the UWNF. These outbreaks have the potential to develop into epidemic levels that could result in extensive damage to pines. Plan components should be developed that emphasize reducing overcrowded conditions in pine stands, managing for species best adapted to the site, and continuing the suppression of Southern Pine Beetle infestations using Integrated Pest Management practices.

The influence of fire on the composition and structure of ecological systems on the UWNF has probably been greater than from any other source of disturbance. The extent of species and plant communities adapted to fire has been significantly reduced on the UWNF, and flora more adapted to open, prairie-like conditions currently exists only on managed rights-of-way. Plan components should be developed to emphasize reintroducing fire on most landscapes on the UWNF using fire return intervals appropriate to the ecological system, and the restoration of plant communities that are fire-adapted such as Southeastern Interior Longleaf Pine Woodlands.

43.14 – Current Condition and Trend of Ecosystem Characteristics and Status of Ecosystem Diversity

In this section current condition of the selected ecosystem diversity characteristics (overstory composition, canopy structure, and subcanopy / structure and composition) are described and evaluated. The purpose of this evaluation is to determine:

1. The parts of the system that are functioning and will likely continue to function in a way that contributes to ecosystem resiliency and diversity over time.
2. Those parts that may need adjustment through future management actions.

The current condition of ecosystem characteristics for each ecological system is evaluated in Appendix B. along with a full description of each ecological system.

Current Condition and Trend in Forest type Composition

Approximately two-thirds of the 51,000 acre UWNF is dominated by pine or pine-hardwood and about one-third is dominated by hardwood (Continuous Inventory of Stand Condition database - CISC) (**Table 5**). Loblolly pine and shortleaf pine are the most common pines; chestnut oak, white oak, and southern red oak are the most common hardwoods. There are 22 forest types on the UWNF identified in CISC. The most extensive forest types are white oak- red oak-hickory and loblolly pine and together they cover one-half of the UWNF. Other common types include (in order of decreasing importance): shortleaf pine, white oak-black oak-yellow pine, shortleaf pine-oak, longleaf pine, and chestnut oak-scarlet oak-yellow pine. About 1000 acres are non-forested openings or have not been inventoried to determine forest type.

Forests on the UWNF are young (< 100 years in age) but mostly older than forests on the surrounding private land. Approximately one-third of the UWNF forests are 40 years or less in age and about one-third are greater than 80 years in age (**Table 5; Figure 3**); the average age (weighted by area) is 66 years. Hardwood dominated forest types are generally older than mixed pine-hardwood or pine dominated forest types. Hardwoods average 88 years in age, mixed pine-hardwood average 82 years, while pine averages only 44 years in age. The most extensive older stands are mapped as white oak-red oak-hickory and they represent about 10% of the land base.

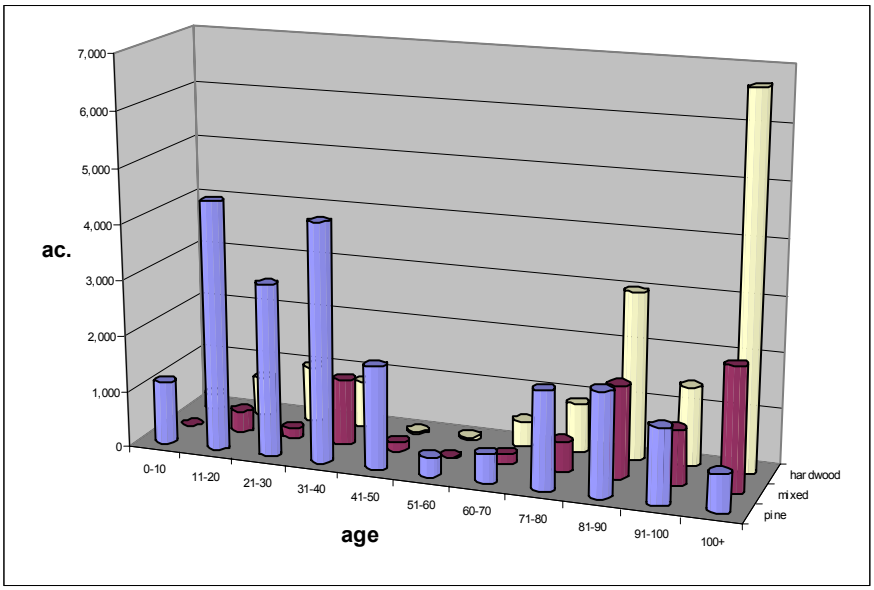
Table 5. Current Forest Composition and Age Class Distribution on the Uwharrie National Forest within all management types.

Forest Type /age class	Total	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	90-100	100+
Longleaf Pine	2,241	429	144	47	596	70	0	17	45	123	423	127
Loblolly Pine	12,057	185	2,634	1,990	3,396	1,734	261	254	235	995	77	0
Shortleaf Pine	7,903	517	1,627	1,057	285	44	70	253	1,331	693	854	553
Virginia Pine	303	0	71	0	10	0	17	0	151	55	0	0
Virginia Pine-Oak	62	0	0	0	0	0	0	0	0	33	0	29
Shortleaf Pine-Oak	2,224	0	205	91	237	0	17	50	91	317	113	581
Loblolly Pine-Hardwood	712	0	0	16	446	166	0	0	12	0	12	0
Southern Red Oak-Yellow Pine	1,043	0	0	0	61	0	0	0	0	326	80	374
Chestnut Oak-Scarlet Oak-Yellow Pine	1,629	0	0	45	174	0	0	0	243	365	76	654
Bottomland Hwoods-Yellow Pine	535	0	0	5	234	0	0	39	0	78	132	47
White Oak-Black Oak-Yellow Pine	2,583	0	176	31	43	0	0	96	188	533	578	530
Post Oak-Black Oak	14	0	0	0	0	0	0	0	0	0	0	14
Chestnut Oak-Scarlet Oak	308	0	0	0	0	0	0	0	0	0	0	308
Chestnut Oak	716	0	0	0	0	0	0	0	0	0	9	707
White Oak-Red Oak-Hickory	14,670	236	660	1,018	684	33	48	331	791	2,644	1,348	5,241

White Oak	292	42	0	0	0	0	0	0	0	0	0	251
Northern Red Oak	155	0	0	0	0	0	0	0	80	75	0	0
Yellow Poplar-White Oak-Red Oak	986	0	49	5	169	0	0	125	28	266	71	151
Laurel Oak-Willow Oak	27	0	0	0	0	0	0	0	0	27	0	0
Yellow Poplar	53	0	0	0	53	0	0	0	0	0	0	0
Sweet Gum-Yellow Poplar	81	0	0	0	0	0	0	8	16	0	35	22
Elm-Ash-Sugarberry	18	0	0	0	0	0	18	0	0	0	0	0
not classified	990	7	0	0	0	0	0	0	0	0	0	0

Overall, the ageclass distribution of forests on the UWNF is "U-shaped" (**Figure 3**), i.e., average-aged stands (age 50-70) are underrepresented while younger and older stands are over-represented. The large number of stands less than 50 years in age and narrow range of average-aged stands is likely due to the period when active forest management began on the UWNF in 1961 – the year the Forest was established. Since this time, about 8,200 acres of loblolly pine and about 3,500 acres of shortleaf pine have been planted and/or young stands have been acquired (**Tables 5-6**). This trend, however, has decreased greatly in the past decade and is consistent with nationwide trends that resulted from a move away from intensive timber production on national forests to a more integrated resource approach to managing the landscape (Uwharrie National Forest – A Strategic View, 2005).

Figure 3. Stand age by Forest Type group within all management types



Along with the downward trend in timber harvest on the UWNF is a reduction of acres managed for loblolly pine or shortleaf pine that could support longleaf pine or oak-hickory forests. From 1966 to 1986, about 26% of land capable of supporting forests in the longleaf pine ecological system was managed for loblolly pine. This is evident by examining the percent of current loblolly pine stands 21-40 years old that occur on longleaf pine sites (**Table 6).** During this same period about 30% of land capable of supporting forests in oak-hickory ecological systems was managed for loblolly pine. Similarly, shortleaf pine was favored over longleaf pine and oak-hickory forests in these

same ecological systems. A change in this trend is evident beginning in the 1990s (1-10 and 11-20 year age classes). Fewer regeneration areas were managed for loblolly pine, which is reflected in the small percentage (0% to 2.1%) of acres of potential longleaf or oak-hickory sites that are currently dominated by loblolly pine in the 1-10 year age-class (**Table 6**). During this same period shortleaf pine was still managed on sites more suitable for longleaf pine (114 acres) or oak-hickory forests (902 acres), but longleaf pine was planted on over twice as many acres (429) as during the previous two decades (**Table 5**).

Table 6. Trends in the preference of species managed on the UWNF from 1966 to 2006 evident from the age class distribution of loblolly and shortleaf pine forest types that occupy longleaf and oak-hickory sites.

Age Class (years)	Longleaf Pine sites		Oak-Hickory sites			Longleaf Pine sites		Oak-Hickory sites	
	Existing Forest Type (acres)		Existing Forest Type (acres)			Existing Forest Type (% of potential longleaf pine)		Existing Forest Type (% of potential oak-hickory)	
	Loblolly pine	Shortleaf pine	Loblolly pine	Shortleaf pine		Loblolly pine	Shortleaf pine	Loblolly pine	Shortleaf pine
1-10	0	114	148	902		0.0%	13.6%	2.1%	11.1%
11-20	864	120	1,289	1,578		22.1%	14.4%	18.1%	19.5%
21-30	438	66	1,150	975		11.2%	8.0%	16.1%	12.0%
31-40	1,138	45	1,905	833		29.1%	5.3%	26.7%	10.3%
0-20	864	234	1,437	2,480		11.1%	20.8%	11.1%	20.9%
21-40	1,576	111	3,055	1,808		25.8%	10.7%	29.5%	17.2%
41-50	713	7	1,570	19		18.3%	0.8%	22.0%	0.2%
51-60	170	15	318	83		4.3%	1.8%	4.5%	1.0%
61-70	71	59	139	107		1.8%	7.1%	1.9%	1.3%
71-80	47	141	132	991		1.2%	17.0%	1.9%	12.2%
81-90	220	141	291	801		5.6%	17.0%	4.1%	9.9%
91-100	236	87	158	684		6.0%	10.4%	2.2%	8.4%
100+	7	39	32	1,130		0.2%	4.6%	0.5%	14.0%
	3,904	834	7,132	8,103					

Condition and Trend in Canopy Structure based on the extent of thinning

About 2,200 acres of thinning has occurred on the UWNF in the past 10 years; 1,571 acres in loblolly pine stands, 571 acres in longleaf pine stands, and 63 acres in shortleaf pine stands (**Table 7**). During the past 5 years, however, thinning activities have accelerated from an average of 220 acres per year for the decade to 370 acres per year.

Table 7. Stands thinned on the UWNF from 1996 to 2006

Comp.-Stand	Name	Acres	Year	Existing Forest Type	Ageclass (years)	Potential Ecological System NAME[1/] (acres)
16-15	West Branch	9	1996	loblolly	61-70	DOH(6), DMOH(3)
36-1	Roberdo	80	1996	loblolly	31-40	LL(60), DMOH(14), SS(6)
11-12	Beaverdam	51	1998	loblolly	31-40	DOH(29), DMOH (11), SS(11)
31-20	Dutchman	20	1998	shortleaf	61-70	LL(10), DOH(10)
31-24	Wood Run	29	1998	loblolly	41-50	DOH(29)
31-17	Wood Run	30	1998	loblolly	41-50	DOH(10),DMOH(10),LL(10)
33-33	Wood Run	43	1998	shortleaf	21-30	DOH(28),DMOH(12),SS(3)

34-19	Wood Run	62	1998	loblolly	31-40	DMOH(27),DOH(25),SS(10)
35-15	Wood Run	19	1998	loblolly	41-50	DOH(10),DMOH(19)
19-2	East Morris Mt	53	2004	loblolly	31-40	DMOH(25), LL(27)
6-13	Abner	96	2004	loblolly	41-50	DOH(60),DMOH(36)
6-10	Abner	30	2004	loblolly	41-50	DOH(25),DMOH(5)
6-11	Abner	75	2005	loblolly	41-50	LL(40),DMOH(20),DOH(15)
6-16	Abner	38	2005	loblolly	41-50	DMOH(21),DOH(17)
30,32-7,20	Yates Place	170	2005	loblolly	31-40	LL(120),DMOH(50)
32-6	Yates Place	56	2005	loblolly	41-50	DMOH(20),LL(20),DOH(16)
26-2	Yates Place	17	2005	loblolly	41-50	DMOH(10),LL(7)
32-5	Yates Place	63	2006	loblolly	41-50	LL(50),DMOH(13)
28-10	Yates Place	53	2006	longleaf	91-100	LL(53)
8-3	Yates Place	20	2006	longleaf	41-50	LL(20)
38-16	South Rocky Ck	57	2006	loblolly	31-40	DOH(26),DMOH(12),LL(19)
38-24	South Rocky Ck	13	2006	loblolly	91-100	LL(13)
39-1	South Rocky Ck	54	2006	loblolly	61-70	LL(30),DMOH(24)
39-5	South Rocky Ck	64	2006	loblolly	31-40	LL(47),DMOH(17)
39-3	South Rocky Ck	90	2006	longleaf	91-100	LL(96)
37-1&2	North Rocky Ck	290	2006	loblolly	31-40	LL(140),DMOH(110),DOH(40)
37-12	North Rocky Ck	49	2006	loblolly	41-50	DMOH(19),LL(30)
36-3	Clarks Grove	144	2006	longleaf	31-40	LL(144)
36-2	Clarks Grove	65	2006	loblolly	51-60	LL(40),DMOH(25)
36-3	Roberdo	264	2006	longleaf	31-40	LL(264)
36-5	Roberdo	88	2006	loblolly	51-60	LL(50),DMOH(30),SS(8)
36-12	Roberdo	13	2006	loblolly	41-50	LL(13)
TOTAL		2,205	10 year average = 220 acres, 5 year average = 370 acres			

[1/] DOH (Dry Oak-Hickory felsic Forest), DMOH (Dry-mesic Oak-Hickory felsic Forest), LL (Longleaf pine Woodland), SS (Streamside Forest)

Current Fire Frequency and trends in prescribed burning

Nearly 9,800 acres (about 20% of the Forest) have been prescribed burned at least once on the UWNF during the last 30 years (**Table 8,** column 3, last row "total for all types"). About 2,800 acres have been burned more than once in the last 10 years and 5,200 acres have been burned more than once in the last 20 years. Over one-half of the acres burned were dominated by loblolly or shortleaf pine occurring on sites capable of supporting longleaf pine forests, oak-hickory, or other types. The most frequent burning has occurred on sites capable of supporting longleaf pine; about one-half was dominated by longleaf pine at the time of burning. About 40% of the potential acres that could support forests in the Southeastern Interior Longleaf Pine Woodland ecological system have been burned at least once in the last 30 years (**Table 8**, 3rd row, 4th column). By contrast, only 13% of Oak-Hickory felsic Forest sites and about 11% of Xeric Oak sites have been burned during this period.

Table 8. Prescribed fire frequency from 1986 to 2006 on the UWNF within ecological systems (potential acres)

Ecological System	Potential acres	Prescribe fire frequency				
		at least once in last 30 years		> once in last 10 years	> once in last 15 years	> once in last 20 years
		acres	% of type	acres	acres	acres
Xeric Oak Forest	2,900	306	10.6	75	148	165
Shortleaf Pine-Oak Woodland	< 100	5	5.0	0	0	0
Southeastern Interior Longleaf Pine Woodland	8,300	3,316	40.0	1,310	1,783	2,162
Dry Oak-Hickory (felsic)	19,200	2,558	13.3	450	728	962
Dry Oak-Hickory (mafic)	2,200	387	17.5	19	176	209
Dry-mesic Oak-Hickory (felsic)	9,150	1,611	17.6	475	667	856
Dry-mesic Oak-Hickory (mafic)	820	134	16.3	16	76	85
Southern Piedmont Mesic Forest	920	204	22.2	52	87	97
Streamside Forests	6,900	1,265	18.3	380	569	681
Total for all types		9,786 [1/]	20.0	2,777	4,234	5,217

[1/] Over ½ of prescribed burning occurred in forests not at their "potential" but dominated by shortleaf and loblolly pine

Evaluation

The current **composition** of forests on the UWNF has departed to a large degree from what we have approximated and the literature has suggested for the pre-European settlement forest. Approximately two-thirds of the UWNF is dominated by pine and pine-hardwood forest types but composition in many of these forests lies outside of the natural range of variation based on our ecological condition rating (**Appendix B**). Although fewer acres have been planted to "offsite" species during the last 10 years, over 10,000 acres (25%) of the UWNF is still dominated by young to mid-age loblolly pine on sites better adapted to oak-hickory forests or longleaf pine. Many of these forests are inherently more vulnerable to natural disturbance events (hurricane, tornadoes, single disease or insect epidemics, fast moving wildfire) because many are intensively managed, even-aged stands approaching monoculture conditions.

The current **structure** of forests on the UWNF is variable but mostly outside the historic of variation. This is due primarily to the abundance of even-aged pine plantations on the Forest. About 2,200 acres of pine have been thinned in the past 10 years and thinning activities have accelerated during the last 5 years. Although thinning is the first step in restoring composition and structure for potential ecological systems on these sites, this is just 10% of the total 22,000 acres of pine dominated stands on the UWNF.

The current **fire regime** on most of the UWNF is outside the historic range of variation. Only about 20% of the UWNF has been prescribed burned during the last 30 years and less than 10% have been burned more than once during this period. Although a significant proportion of some ecological systems have been burned on multiple occasions (e.g. longleaf pine) only 13% of the most extensive ecological system (Dry-Oak-Hickory felsic) on the UWNF has been burned during this period.

During the past 5 years there has been an upward trend in management to improve the composition and structure of forests and increase the role of fire as an ecological process on the UWNF. Therefore, the 1986 plan has allowed a shift away from activities that did not contribute to ecosystem resiliency and diversity (such as pine site conversion) and toward those that improve these key factors. However, under the existing plan guidance, the future trend in the ecological condition for most key factors is likely to remain only poor to fair. This expectation is primarily because thinning and prescribed burning objectives are not high enough to reduce the backlog of forests needing management, and because there are no objectives for restoring native plant communities. Ecological systems would therefore continue to be vulnerable to degradation. This is especially true for those rare systems not mentioned in the current plan, such as Southern Piedmont Glade and Barrens, Shortleaf Pine-Oak Woodland, Southern Piedmont Mafic Hardpan Woodland, Piedmont Seepage Wetland, and Southern Piedmont / Ridge and Valley Upland Depression Swamps. In addition, ecological systems that have declined in the past, such as Southeastern Interior Longleaf Pine Woodlands, would show little improvement.

The current ecological condition for most indicators on the UWNF is only "poor" to "fair" using the above benchmark categories (**Table 9**). Only 5 of the 14 ecological systems have "good" ratings for species composition, only one system has a "good" rating for canopy structure, and no ecological system has a "good" rating for subcanopy / understory composition and structure for fire processes. These low ratings are partially due to the ranking methodology used which calculates benchmarks relative to the potential (optimal) extent of an ecological system. As indicated previously, given the climatic, cultural, and ecological changes that have occurred over time, it might not be possible to achieve "optimal" conditions and therefore benchmark levels could be adjusted downward. However, it is not likely that this would change the results of the evaluation of ecosystem diversity needs because roughly one-third of the forests on the UWNF are dominated by species that are not best suited for the site, e.g. loblolly pine on upland oak or longleaf sites. In addition, thinning and prescribed fire, although used increasingly in recent years to reduce canopy closure and midcanopy cover, has not kept up in the past to the management needs. The fragmented condition of the UWNF also contributes to the low ecological condition ratings by increasing the complexity of implementing management practices such as prescribed burning and timber harvest. This may further indicate the need to adjust the levels estimated for the potential extent of ecological systems.

Table 9. Current ecological condition rankings for Ecological systems on the UWNF

Ecological System	Species Composition	Canopy Structure	Fire Regime	Hydro. Regime
Southern Interior Longleaf Pine Woodland	Poor	Poor	Poor	N/A
Xeric Oak Forest	Poor	Poor	Poor	N/A
Dry Oak-Hickory Forest (felsic)	Good	Fair	Poor	N/A
Dry Oak-Hickory Forest (mafic)	Fair	Poor	Poor	N/A
Dry-mesic Oak-Hickory Forest (felsic)	Good	Fair	Poor	N/A
Dry-mesic Oak-Hickory Forest (mafic)	Good	Fair	Poor	N/A
Mesic Forest	Poor	Fair	Fair	N/A
Streamside Forest (directly influenced by alluvial processes)	Poor	Fair	Poor	N/A
Streamside Forest (not directly influenced by alluvial processes)	Good	Fair	Poor	N/A

Successional Forest (Shortleaf and Loblolly)	Poor	Fair	Poor	N/A
Shortleaf Pine-Oak Woodland	Poor	Poor	Poor	N/A
Glade and Barrens	unknown	unknown	Poor	N/A
Mafic Hardpan Woodland	Poor	Poor	Poor	N/A
Upland Depression Swamp	Good	Good	N/A	Fair
Piedmont Seepage Wetlands	Fair	Fair	N/A	Fair

43.14a – Risks to Selected Characteristics of Ecosystem Diversity

The following threats or stresses have been identified for ecological systems and the diversity of native plant and animal species on the UWNF:

1) Habitat vulnerability: Sun-loving species that were once more widespread in open woodland habitats that currently exist only on managed rights-of-way (roadsides, railway embankments, power lines, or field margins) are at risk from damage due to mowing during the improper season or herbicide use which could lead to reduced viability or total loss of populations. These species include one T&E species, Schweinitz's Sunflower.
2) Altered fire regime: Disruption of natural, historical fire return intervals, fire intensity, severity, and extent in ecological systems that changes the composition, structure and abundance of characteristic, fire-influenced species and communities. This includes communities and rare species that occur in nearly all of the ecological systems that occur on the UWNF.
3) Direct and indirect habitat disturbance: This threat includes primarily severe disturbance from unmanaged recreation (unauthorized roads in the OHV area) and risks from adjacent private land, i.e., wildfires originating from private land.
4) Altered conditions for insect infestations: This threat includes the risk of total loss of forests that are stressed by crowded growing conditions, (canopy closure outside its natural range of variation) and potential loss of more resistant species such as longleaf pine due to increases in tree density in loblolly plantations and the increase in pine beetle populations to epidemic proportions.
5) Competition for resources: This process includes the displacement of native species by non-native, invasive species that are capable of out-competing native species and communities for resources such as light, nutrients, and water. This threat is primarily a concern in Mesic Forests and where wildlife openings have been planted to non-native, and at times, invasive species.

Many of these threats are directly caused or at least aggravated by the fragmented nature of the UWNF. There are 61separate land parcels or patches on this 51,000 acre Forest of which only 25% (15 total) are greater than 500 acres in size (**Table 10**). These larger patches are further fragmented by internal private land holdings. The largest contiguous patch (no private in holdings) of NFS lands is located in the Pekin area and is only 4,200 acres in size but due to its irregular configuration provides a 30-mile perimeter with private lands. This perimeter is nearly 10% of the over 350 mile NFS and private land boundary that is managed on the UWNF. Furthermore, ownership fragmentation on the UWNF only worsens the effect of the decrease in natural fire compartment size within the proclamation boundary (Langley 2000) and increases the difficulty in restoring pre-settlement vegetation pattern.

Table 10. Patch size and Frequency on the UWNF

Patch size (acres)	Frequency	Additional Edge effects
4,000-10,500	5	4 with multiple inholdings
1,000-2,000	4	3 with multiple inholdings
500-800	6	1 with in holding
100-400	23	3 outside proclaimed boundary
25-100	15	
4-25	8	1 outside proclaimed boundary

The greatest uncertainty in this risk assessment is from the unpredictability of how natural disturbances (hurricanes, tornadoes, natural lightening fire ignition, drought, and the current warming of the earth's atmosphere) may interact. A prolonged drought could increase the risk of a pine beetle epidemic which, given a natural lightening fire ignition, could lead to widespread loss of forest cover. Widespread loss of forest cover could also result from a severe hurricane in the interior Piedmont centered on the UWNF, not recorded historically, but not discountable given the increased hurricane activity in 2005. Although these natural disturbances are beyond our control, the suggested plan components should lessen these impacts especially if land acquisition and land consolidation occurs. Furthermore, those species more adapted to open conditions may, in fact, benefit from these uncertain disturbances.

43.15 – Plan Components for Ecosystem Diversity

Based on the evaluation of spatial scales, existing conditions, range or variability, condition of ecological characteristics, and risks, the following plan components should be used as part of the framework that provides characteristics of ecosystem diversity on the UWNF:

Desired Conditions:

- Woodlands and open forests with small canopy gaps, interspersed with glades and Piedmont prairies, occupy portions of the forest where they occurred historically. These forests contain mixed ages with old trees and old forest conditions.
- Plant communities more common in the past are reestablished on appropriate sites across the forest. Examples include longleaf pine woodlands, shortleaf pine woodlands, and oak-hickory forests.
- Non-native invasive species are at low levels that do not interfere with native plant reproduction and distribution. New outbreaks are not spreading.
- There is increasing evidence of prescribed fire used to restore the structure, composition and ecosystem processes in ecological systems.
- Biological diversity is evident across the forest, and is further enhanced by a system of botanical special areas. Rare plant communities are represented in this system.
- Regenerating hardwoods are evident following disturbances in tree canopies (canopy gaps) in multi-age deciduous forests and mixed pine-hardwood forests.

- The forest is in a healthy condition. Most trees are in good health, well-formed, and with little evidence of widespread insect and/or disease damage. A healthy forest includes some dead and dying trees as well as den trees that contribute to wildlife habitat. A healthy forest also contains patches of disturbance that provide habitat components desired by a variety of wildlife, and space and light for young trees ("regeneration").
- Ephemeral pools, ponds, swamps, seeps, bogs, and other wetlands are frequent throughout the Forest and conditions are secure for animals such as amphibians that use these habitats for reproducing.
- Streamsides are dominated by native riparian vegetation.
- Bogs and seeps are maintaining or increasing their size through natural hydrologic processes.
- Ecological conditions (composition, structure, fire regime) are improving. Canopy closures are approaching the following levels:

Table 11. Desired canopy closures within Ecological Systems

Ecological System	Desired Canopy Closure
Southern Interior Longleaf Pine Woodland	25%-60%
Xeric Oak Forest	60%-80%
Dry Oak-Hickory Forest (felsic)	60%-80%
Dry Oak-Hickory Forest (mafic)	60%-80%
Dry-mesic Oak-Hickory Forest (felsic)	60%-90%
Dry-mesic Oak-Hickory Forest (mafic)	60%-90%
Mesic Forest	80%-100%
Streamside Forest	60-80%, 80%-100%
Successional Forest	60-80%
Shortleaf Pine-Oak Woodland	25%-60%
Glade and Barrens	5%-25%
Mafic Hardpan Woodland	25%-60%
Upland Depression Swamp	60%-100%
Seepage Wetlands	25%-100%

Objectives:

- Maintain 2,200 acres of existing longleaf pine as pine woodlands.
- Implement restoration activities each year on an average 200 acres of oak-hickory and 100 acres of longleaf pine on sites where they occurred historically. This would amount to restoration activities on a minimum of 4500 acres over the fifteen year planning period.

Table 12. Restoration objectives for Ecological Systems

Ecological System	Total Acres restored in 15 years
Southern Interior Longleaf Pine Woodland	[1/] 1,500
Xeric Oak Forest	0
Dry Oak-Hickory Forest (felsic)	[2/] 1,850-2,200
Dry Oak-Hickory Forest (mafic)	[2/] 150-180
Dry-mesic Oak-Hickory Forest (felsic)	[2/] 950-1,100
Dry-mesic Oak-Hickory Forest (mafic)	[2/] 50
Mesic Forest	0

Streamside Forest	0
Successional Forest (Shortleaf pine) On potential Longleaf sites On potential Oak-Hickory sites	 0 0
Successional Forest (Loblolly pine) On potential Longleaf sites On potential Oak-Hickory sites	 0 0
Glade and Barrens	0
Mafic Hardpan Woodland	0
Upland Depression Swamp	0
Seepage Wetlands	0

[1/] existing loblolly and shortleaf pine stands on longleaf pine sites > 40 years in age
[2/] existing loblolly and shortleaf pine stands on oak-hickory sites > 50 years in age outside Wilderness areas

- Over the planning period, relocate at risk populations of Schweinitz's sunflower adjacent to roads or railroads to sites more appropriate for long-term maintenance of the populations.
- Thin stands of trees as needed to maintain room for growth and to discourage insect and disease infestation. Thin an average of 400 acres per year, or approximately 6,000 over the fifteen-year planning period.

Table 13. Thinning objectives for Ecological Systems

Ecological System	Total Acres thinned in 15 years
Southern Interior Longleaf Pine Woodland	[1/] 375
Xeric Oak Forest	0
Dry Oak-Hickory Forest (felsic)	[2/] 175
Dry Oak-Hickory Forest (mafic)	[2/] 50
Dry-mesic Oak-Hickory Forest (felsic)	[2/] 100
Dry-mesic Oak-Hickory Forest (mafic)	[2/] 50
Mesic Forest	0
Streamside Forest	[3/] 950
Successional Forest (Shortleaf pine) On potential Longleaf sites On potential Oak-Hickory sites	[4/] 200 1,075
Successional Forest (Loblolly pine) On potential Longleaf sites On potential Oak-Hickory sites	[4/] 1,150 1,850
Glade and Barrens	0
Mafic Hardpan Woodland	0
Upland Depression Swamp	0
Seepage Wetlands	0

[1/] all existing longleaf pine > 50 years in age,
[2/] 5% of all oak forests > 80 years in age outside the wilderness
[3/] only loblolly and shortleaf stands < 50 years in age outside the wilderness and more than 30 ft. from streams
[4/] 2/3s of all loblolly or shortleaf pine stands > 20 years in age outside the wilderness not planned for restoration to longleaf pine or oak-hickory

- Apply prescribed fire to an average of 2,000 to 5,000 acres per year.

Table 14. Prescribed burning objectives for Ecological Systems

Ecological System	Average annual (acres)	Total in 15 years (acres)
Southern Interior Longleaf Pine Woodland	350-800	[1/] 3,200
Xeric Oak Forest	50-200	[2/] 1,200
Dry Oak-Hickory Forest (felsic)	300-800	[2/] 5,000
Dry Oak-Hickory Forest (mafic)	50-100	[2/] 500
Dry-mesic Oak-Hickory Forest (felsic)	100-300	[2/] 2,000-4300
Dry-mesic Oak-Hickory Forest (mafic)	50-100	[2/] 500
Streamside Forest	50-200	[3/] 1,500-4000
Successional Forest (Shortleaf pine) On potential Longleaf sites On potential Oak-Hickory sites	 50-150 350-800	[4/] 600 4,500
Successional Forest (Loblolly pine) On potential Longleaf sites On potential Oak-Hickory sites	 300-800 350-900	[4/] 3,000 5,000
Shortleaf Pine-Oak Woodland	20	[5/] 90
Glade and Barrens	15	100
Mafic Hardpan Woodland	10	30
Upland Depression Swamp	No target	No target
Seepage Wetlands	No target	No target

[1/] all current longleaf pine PLUS 1,500 acres restoration
[2/] all current oak forests burned at least once – PLUS all current oak forests > 50 years in age outside the wilderness
[3/] all current mesic or streamside forest burned at least once – PLUS all mesic or streamside forest > 70 years in age outside the wilderness
[4/] all loblolly or shortleaf pine forest burned at least once – PLUS all loblolly or shortleaf pine forest > 20 years in age outside the wilderness
[5/] all potential Shortleaf Pine-Oak Woodland

- Each year treat an average of 20 acres to eliminate non-native invasive plants.

Guidelines:

- When implementing prescribed burning, at least every third entry should be a growing season burn, and fire should be allowed to burn in a mosaic pattern.
- An average fire return interval that is specific to each ecological system should be used when planning prescribed burns.

Table 15. Recommended Fire Return Interval for Ecological Systems

Ecological System	Average Fire Return Interval
Southern Interior Longleaf Pine Woodland	3-5 years
Xeric Oak Forest	5-7 years
Dry Oak-Hickory Forest (felsic)	5-7 years
Dry Oak-Hickory Forest (mafic)	5-7 years
Dry-mesic Oak-Hickory Forest (felsic)	7-20 years
Dry-mesic Oak-Hickory Forest (mafic)	7-20 years
Mesic Forest	12-20 years
Streamside Forest	12-20 years
Successional Forest (Shortleaf and Loblolly) On potential Longleaf sites	 3-5 years

On potential Oak-Hickory sites	5-7 years
Shortleaf Pine-Oak Woodland	3-5 years
Glade and Barrens	5-7 years
Mafic Hardpan Woodland	3-5 years
Upland Depression Swamp	Ignitions should originate outside these areas - interval dependent upon seasonal and yearly water fluctuations
Seepage Wetlands	Ignitions should originate outside these areas - interval dependent upon seasonal and yearly water fluctuations

- Emphasize thinning in predominantly pine stands where the stem density is so high that it presents a risk of southern pine beetle infestation or where dying trees are creating high risk of catastrophic wildfire.
- Thinning stands within the Longleaf Pine Ecological System should emphasize reducing competition between adjacent dominant trees as much as meeting the average per acre canopy closure objectives.
- Vegetation should not be cut, and mechanized ground disturbing equipment should not be used within 30 feet of a perennial stream unless needed for riparian wildlife habitat, stream channel stability, or to provide access for recreation or stream crossings. If portions of trees felled in the outer 70 feet of the streamside forest fall into the 30-foot no-cut zone, that portion within 30 feet of the perennial stream should not be removed.
- A 30-foot no-mechanized equipment zone should serve as protective strips along each side of all intermittent streams. It may consist of understory vegetation. Refer to North Carolina Division of Forest Resources *Forestry Best Management Practices Manual* for additional guidance.
- Following extensive damage to trees from wind, water, insects or disease, restoration activities should restore the ecological system appropriate to the site.
- The following priority should be used to select areas for treating non-native invasive plants:
    - Schweinitz's sunflower habitat management areas;
    - Botanical special areas;
    - Streamside Forest;
    - General Forest
- New ground disturbing activities should be located away from rare Ecological Systems (Glades and Barrens, Mafic Hardpan Woodland, Depression Swamps, and Seepage Wetlands) to avoid direct and indirect impacts to surface soil erosion or displacement and alteration of natural hydrologic functioning.
- New occurrences of rare Ecological Systems (Glades and Barrens, Mafic Hardpan Woodland, Depression Swamps, and Seepage Wetlands) should be documented with a GPS or similar technology, and coordinates entered in a GIS.
- All bogs, swamps, and wetlands should be protected from all activities that would alter natural hydrologic function.
- When restoring longleaf pine, design activities to mimic conditions historically suitable for red-cockaded woodpecker on at least 700 restoration acres.

Suitable Uses

- Identify up to 15% of common ecological systems and 100% of rare ecological systems as Botanical Special Interest Areas and manage as not suitable for timber production.

43.2 – Species Diversity

43.21 – Ecosystem Context for Species

Ecological conditions that provide for ecosystem diversity are the context for the evaluation of species diversity. The spatial scales for considering ecosystem diversity on the UWNF were selected to address the administrative plan area and its role in the broader ecological context (**Section 43.11**). The Carolina Slate Belt and Southern Triassic Uplands provided the upper bounds on the area of analysis to evaluate and understand the environmental context and opportunities and limitations for NFS lands to contribute to the diversity of native plant and animal species. These ecological subregions include the geographic ranges and habitats of federally listed threatened and endangered species, species-of-concern, and species-of interest (CFR 219.10(b)(2)) that occur or could occur on the UWNF. The following analysis is used to determine if additional species-specific plan components may be necessary to sustain species diversity in addition to those identified for maintaining ecosystem diversity.

43.22 – Identification and Screening of Species

As directed (FSH 1909.12.43.2)), we have identified 298 federally threatened and endangered species, potential species-of-concern, and potential species-of-interest whose ranges include the UWNF plan area and/or are found within the ecological subregions that include the UWNF. We used the following steps to identify these species:

1. Included all species from a comprehensive list of species found, or potentially found, on the UWNF that are (a) listed as proposed, threatened, or endangered under the federal Endangered Species Act, (b) listed on the Regional Forester's Sensitive Species list, (c), identified as locally rare on national forest within the ecoregion by Forest Service biologists, (d) are birds of conservation concern identified by the U.S. Fish and Wildlife Service, and (e) declining species of high public interest (Southern Appalachian Forest Environmental Impact Statement – R8 - Mersmann -2003),
2. To update the list compiled in # 1, added all species that the U.S. Fish and Wildlife Service identified on their most recent list of Birds of Conservation Concern National Priority,
3. To update the list compiled in # 1, added all species identified as species of conservation concern in the NC State Comprehensive Wildlife Strategy, and as a final check on species that occur in similar ecoregions,
4. Added all species (not in the above list) from the North Carolina, South Carolina, and Virginia Natural Heritage program Element Occurrence GIS coverage that occur within the Carolina Slate Belt and Triassic Basin Ecological Subsections.

Our first screen excluded 92 species from the above list whose ranges do not include the UWNF; all of these species were identified after step 4 above.

43.22a – Federally Listed Species

There are 5 species listed by the Department of Interior, U.S. Fish and Wildlife Service as threatened or endangered whose ranges include the UWNF plan area (**Appendix C**). They are the bald eagle, red-cockaded woodpecker, eastern cougar, Schweinitz's Sunflower, and Michaux's Sumac. The Eastern Cougar was dropped from further analysis because the species has been extirpated from the Southern Piedmont and the UWNF does not have sufficient contiguous habitat to support this wide-ranging species. Three of the remaining four species have been documented on the UWNF. They are the bald eagle, red-cockaded woodpecker, and Schweinitz's sunflower.

43.22b – Species-of-Concern

Species-of-concern are species that may require management actions to prevent listing under the Endangered Species Act. They were tentatively identified as species with ranks of G-1 through G-3 or T-1 through T-3. There are 27 potential species-of-concern whose ranges include the UWNF plan area (**Appendix C**). They include 1 mammal, 1 bird, 1 beetle, 1 grasshopper, 1 moth, 1 butterfly, and 21 vascular plants. Only six of these species (all vascular plants) are known to occur on the UWNF.

43.22c – Species-of-Interest

Species-of-interest are species that management actions may be needed or desirable to achieve ecological or other multiple-use objectives. We reviewed the following sources for potential species-of-interest:

1. Species with ranks of S-1, S-2, N1, or N2 on the NatureServe ranking system,
2. State listed threatened and endangered species that do not meet the criteria for species-of-concern,
3. Species identified as species of conservation concern in the North Carolina Wildlife Action Plan by the NC Wildlife Resources Commission,
4. Bird species on the U.S. Fish and Wildlife Service Birds of Conservation Concern National Priority list, and
5. Species that are hunted and of public interest.

We identified 174 potential species-of-interest whose ranges include the UWNF plan area (**Appendix C**). They include 11 mammals, 40 birds, 12 amphibians, 20 reptiles, 2 beetles, 1 grasshopper, 18 moths, 14 butterflies, and 55 vascular plant species. Only 38of these species (2 amphibians, 1 butterfly, 23 birds, and 12 vascular plants) are known to occur on the UWNF.

43.22d – Screening Species-of-Concern and Species-of-Interest for Further Consideration in the Planning Process

We used the following criteria to screen species from further consideration in the planning process **(Appendix C):**

1. Species is secure in North Carolina and Globally, i.e. S4,S5 or S3S4, and not G1-G3 and likely secure within the plan area (63 species).
2. No records of species in the 4 county area, and data on species is insufficient to fully discern habitat preferences or develop management guidelines, i.e., 45 species have no records in North Carolina within the Carolina Slate Belt or Southern Triassic Uplands Subsections, 2 species have been extirpated in North Carolina and their historical distribution is unknown or vague, and the panel of experts developing the comprehensive species list described at # 1 in section 43.22 above were undecided if the remaining 6 species were likely to occur on the UWNF: a total of 53 species were screened using these criteria.
3. Management action not necessary to prevent federally listing (7 species); 6 species are G5 ranked, 1 species habitat preference is too vague and broad ranging.
4. Species occurs in the 4-county area, is not known from the UWNF, but if it occurred would not be affected by management practices (6 species): all mobile species (5 snakes and 1 butterfly) capable of avoiding direct impacts.
5. Species is fairly widespread, i.e., occurring in more than one ecological section (Piedmont, Mountains, Coastal Plain) in North Carolina, and / or the UWNF does not include a significant portion of the species range to contribute to conservation (6 species).

Following this screening, we identified 65 species that met one or all of the following factors important for identifying species-of-concern and species-of-interest:

1. Species and its habitats are not well-distributed in the plan area.
2. Species population numbers are low in the plan area.
3. Species is dependent on a specialized and/or limited habitat in the plan area.
4. Species is subject to some imminent threat (e.g., disturbance due to road systems).
5. Species is of high public interest.

43.23 – Information Collection

Information on habitat relationships, threats, distribution, status, quality of information, and the relationship of the UWNF to contribute to conservation was collected and synthesized for the 65 species considered species-of-concern or species-of-interest following the above screening process. Information for these species and the five threatened and endangered species is summarized in the following tables (**16-20**).

Table 16. Habitat relationships and key ecosystem characteristics important to sustain threatened, endangered, species-of-concern, and species of interest on the UWNF.

On UWNF	Scientific Name (Common Name)	Habitat relationship - Ecological system or other habitat features (G-rank)[1/]	Key ecological characteristics
Threatened or Endangered Birds			
yes	*Haliaeetus leucocephalus* (Bald eagle)	mature forests near large bodies of water for nesting	canopy structure, i.e., presence of supercanopy trees
yes historic	*Picoides borealis* (Red-cockaded woodpecker)	Southeastern interior longleaf pine woodland (G2)	species composition, canopy structure (open), midcanopy structure (open), fire return interval
Threatened or Endangered Vascular Plants			
no	*Echinacea laevigata* (Smooth coneflower)	Southern piedmont glade and barrens (G2?) over mafic or calcareous substrate	canopy structure (open), geologic substrate
yes	*Helianthus schweinitzii*	Southeastern interior longleaf pine woodlands	canopy structure (open or with gaps), fire

	(Schweinitz's sunflower)	(G2), Southern piedmont glade and barrens (G2?), Southern piedmont mafic hardpan woodlands (G2), roadsides, and rights-of-ways	return interval
no	*Rhus michauxii* (Michaux's sumac)	Southern piedmont hardpan woodlands (G2) on mafic slates	geologic substrate, canopy structure (open)
Bird Species of Concern			
no	*Aimophila aestivalis* (Bachman's sparrow)	Southeastern interior longleaf pine woodland (G2), and open fields	canopy structure (open), fire return interval
Vascular Plant Species of Concern			
no	*Baptisia australis var. aberrans* (Prairie blue wild indigo)	Southern piedmont glade and barrens (G2?), Southern piedmont mafic hardpan woodlands (G2), and Xeric oak forests over calcareous rock (G2?)	canopy structure (open), geologic substrate, fire return interval
no	*Berberis canadensis* (American barberry)	Southern piedmont mafic hardpan woodlands (G2), and Xeric oak forests over calcareous rock (G2?)	canopy structure (open), geologic substrate, fire return interval
yes	*Carex impressinervia* (Ravine sedge)	Southern Piedmont mesic forests (G3G4), and Streamside forests (G2G4)	canopy structure (closed), competition from non-native invasive species
yes	*Eurybia mirabilis* (Piedmont aster)	Southern Piedmont mesic forests (G3G4)	competition from non-native invasive species
yes	*Fothergilla major* (Large witch-alder)	Dry oak-hickory forests (felsic) (G4G5), Dry-mesic oak-hickory forests (felsic) (G4G5), and Xeric oak forests (G2G4)	species composition
no	*Heuchera caroliniana* (Carolina alumroot)	Dry-mesic oak-hickory forests (felsic) (G4G5) and Southern Piedmont mesic forests (G3G4)	canopy structure (closed)
no	*Lindera subcoriacea* (Bog spicebush)	Piedmont seepage wetlands (G2G3)	hydrologic function
no	*Lotus helleri* (Carolina birdfoot-trefoil)	open forest, woodlands, and roadsides excluding Mesic forests and Streamside forests	canopy structure (open or with gaps)
yes	*Parthenium auriculatum* (Glade wild quinine)	Southern Piedmont mafic hardpan woodlands (G2)	geologic substrate, canopy structure (open), fire return interval
yes	*Ruellia purshiana* (Pursh's wild-petunia)	Dry-mesic oak-hickory forests (mafic) (G2G3)	geologic substrate, fire return interval
no	*Solidago plumosa* (Yadkin river goldenrod)	mafic rock outcrops adjacent to rivers in Streamside forests (G2G4 – G?)	geologic substrate, hydrologic function
yes	*Symphyotrichum georgianum* (Georgia aster)	Southern Piedmont glade and barrens (G2?), Southern Piedmont mafic hardpan woodlands (G2), and Xeric oak forests (G2G4)	canopy structure (open), fire return interval
no	*Tridens chapmanii* (Chapman's redtop)	Shortleaf pine-oak woodlands (G2), Xeric oak forests (G2G4), Southeastern interior longleaf pine woodlands (G2), and roadsides	canopy structure (open or with gaps)
Mammal Species of Interest			
no	*Corynorhinus rafinesquii* (Rafinesque's big-eared bat)	hollow trees, old buildings, beneath bridges – near water in Streamside forests (G2G4 – G?)	species composition and canopy structure (species capable of providing long-lived snags), hydrologic function
no	*Lasionycteris noctivagans* (Silver-haired bat)	Streamside forests, near water in tree cavities, clumps of leaves, crevices (G2G4 – G?)	species composition and canopy structure (species capable of providing long-lived snags), hydrologic function
no	*Myotis austroriparius* (Southeastern myotis)	buildings, hollow trees, forages near water in Streamside forests (G2G4 – G?)	species composition and canopy structure (species capable of providing long-lived snags), hydrologic function
no	*Sciurus niger* (Eastern fox squirrel)	Southeastern interior longleaf pine woodlands (G2)	canopy composition and structure (open), understory composition (herbaceous)
Amphibian Species of Interest			
yes	*Ambystoma talpoideum* (Mole salamander)	Piedmont seepage wetlands (G2G3), Streamside forests (G2G4), Southern Piedmont / Ridge and Valley upland depression swamps (G1G3), and fishless ponds	hydrologic function
no	*Ambystoma tigrinum tigrinum* (Eastern tiger salamander)	Piedmont seepage wetlands (G2G3), Streamside forests (G2G4), Southern Piedmont / Ridge and Valley upland depression swamps (G1G3), and fishless ponds	hydrologic function
no	*Eurycea quadridigitata* (Dwarf salamander)	Seepage wetlands in Southeastern interior longleaf pine woodlands and Streamside forests (G?)	hydrologic function
yes	*Hemidactylium scutatum* (Four-toed salamander)	Piedmont seepage wetlands (G2G3), Southern Piedmont / Ridge and Valley upland depression swamps (G1G2), Streamside forests (G2G4),	hydrologic function

		pools, and ponds	
Bird Species of Interest			
no	*Accipiter striatus* (Sharp-shinned hawk)	a variety of coniferous, mixed, or deciduous forests & woodlands	canopy structure, i.e. a forest or woodland. key characteristics unknown
no	*Ammodramus savannarum* (Grasshopper sparrow)	grasslands with clumped vegetation, possibly wildlife fields and openings	canopy structure, i.e. treeless, understory species composition, i.e. grasses
yes	*Colinus virginianus* (Northern bobwhite)	Southeastern interior longleaf pine woodlands (G2), cropland, grassland, and pastures, wildlife openings	canopy structure (open), fire return interval
yes	*Contopus virens* (Eastern wood pewee)	Southeastern interior longleaf pine woodlands (G2), Dry-oak hickory forests (all) (G2G5), Shortleaf pine-oak woodlands (G1)	canopy structure (open), fire return interval
yes	*Dendroica discolor* (Prairie warbler)	Southeastern interior longleaf pine woodlands (G2), Shortleaf pine-oak woodlands (G1), Late successional shortleaf pine forests (G?), Southern piedmont mafic hardpan woodland (G2)	canopy structure (open), fire return interval
yes	*Lanius ludovicianus lucovicianus* (Loggerhead shrike)	fields, pastures, wildlife fields, and wildlife openings	canopy structure, i.e. treeless
yes	*Melanerpes erythrocephalus* (Red-headed woodpecker)	snags in Dry oak-hickory forests (all) (G2G5), late successional shortleaf pine forests (G?)	canopy structure (open)
yes	*Sitta pusilla* (Brown-headed nuthatch)	Southeastern interior longleaf pine woodlands (G2), late successional shortleaf pine forests (G?)	canopy structure (open), fire return interval
Insect Species of Interest			
yes	*Erynnis martialis* (Mottled duskywing)	a variety of coniferous, mixed, or deciduous forests & woodlands and woodland edges; host plant = ceanothus	canopy structure (gaps)
Vascular Plant Species of Interest			
yes	*Amorpha schwerinii* (Piedmont Indigo-bush)	a variety of forests & woodlands, primarily xeric to dry but not usually on mafic or calcareous substrates	Unknown; reproductive and establishment biology is poorly understood
yes	*Anemone berlandieri* (Southern Anemone)	Southern piedmont glade and barrens (G2?) in thin, circumneutral soils around rock outcrops	geologic substrate, canopy structure (open)
no	*Arabis missouriensis* (Missouri rockcress)	Southern piedmont glade and barrens (G2?) in thin, circumneutral soils around rock outcrops	geologic substrate, canopy structure (open)
no	*Baptisia alba var alba* (Thick-pod white wild indigo)	Southern piedmont glade and barrens (G2?), Southern piedmont mafic hardpan forests (G2), Xeric oak forests (G2?), and roadsides	canopy structure (open or with gaps), fire return interval
yes	*Baptisia albescens* (Thin-pod white wild indigo)	Southern piedmont glade and barrens (G2?), Southern piedmont mafic hardpan forests (G2), Southeastern interior longleaf pine woodlands (G2), roadsides, and rights-of-ways	canopy structure (open or with gaps), fire return interval
yes	*Cardamine dissecta* (Dissected toothwort)	Southern piedmont mesic forests (G3G4)	species composition, canopy structure (closed)
no	*Celastrus scandens* (American bittersweet)	Southern piedmont mesic forests (G3G4)	species composition, canopy structure (closed)
yes	*Cirsium carolinianum* (Carolina thistle)	Southern piedmont glade and barrens (G2?), Southern piedmont mafic hardpan forests (G2), Xeric oak forests (G2G4), Southeastern interior longleaf pine woodlands (G2), and Dry-mesic oak-hickory forest over mafic or calcareous rock (G2G3)	canopy structure (open), geologic substrate, fire return interval
yes	*Collinsonia tuberosa* (Piedmont horsebalm)	Southern piedmont mesic forests (G3G4), Streamside forests (G2G4), and Dry-mesic oak-hickory forests over calcareous or mafic substrates (G2G3)	geologic substrate, canopy structure (closed or with gaps)
no	*Danthonia epilis* (Bog oatgrass)	Piedmont seepage wetlands around rock outcrops (G2G3)	hydrologic function
no	*Dichanthelium annulum* (Ringed witchgrass)	Southern piedmont glade and barrens (G2?), and Dry oak-hickory forests (mafic) on calcareous substrates (G2G3)	geologic substrate
no	*Dodecatheon meadia var. meadia* (Eastern shooting star)	Southern piedmont mesic forests (G3G4), and Dry-mesic oak-hickory forest (mafic) on rocky sites over mafic or calcareous subsrates (G2G3)	geologic substrate
yes	*Gnaphalium helleri* (Heller's rabbit tobacco)	Southern piedmont mafic hardpan woodlands (G2), and Southern piedmont glade and barrens	geologic substrate, fire return interval, canopy structure (open)

		over mafic rock G2?)	
no	*Helenium brevifolium* (Littleleaf sneezeweed)	Piedmont seepage wetlands (G2G3), Southern piedmont / ridge and valley upland depression swamps (G1G3), and Streamside forests (G2G4)	geologic substrate, canopy structure (closed or with gaps)
yes	*Helianthus laevigatus* (Smooth sunflower)	Southeastern interior longleaf pine woodlands (G2), Dry oak-hickory forests (felsic) (G4G5), Dry-mesic oak-hickory forests (felsic) (G4G5), and roadsides	canopy structure (open) and fire return interval
no	*Hexalectris spicata* (Crested coralroot)	Xeric oak forests (G2?), Dry oak-hickory forests (mafic) (G2?), and Dry-mesic oak-hickory forests (mafic) (G2G3)	geologic substrate, canopy structure (closed or with gaps)
no	*Lilium canadense ssp. Editor* (Red Canada lily)	Piedmont seepage wetlands (G2G3)	hydrologic function
no	*Matelea decipiens* (Glade milkvine)	Southern piedmont glade and barrens over mafic rock (G2?), and Southern piedmont mafic hardpan woodlands (G2)	geologic substrate, canopy structure (open)
no	*Oligoneuron album* (Prairie goldenrod)	Southern piedmont glade and barrens over mafic, ultramafic, or calcareous rock (G2?), and Southern piedmont mafic hardpan woodlands (G2)	geologic substrate, canopy structure (open)
no	*Oligoneuron rigidum ssp. glabratum* (Southeastern bold goldenrod)	Southern piedmont glade and barrens over mafic, ultramafic, or calcareous rock (G2?), and Southern piedmont mafic hardpan woodlands (G2)	geologic substrate, canopy structure (open)
no	*Pellaea wrightiana* (Wright's cliffbrake)	Southern piedmont glade and barrens over calcareous rock (G2?)	geologic substrate, canopy structure (open)
no	*Plantago cordata* (Heartleaf plantain)	slate-bottomed perennial stream beds in Streamside forests (G?)	hydrologic function
no	*Porteranthus stipulatus* (Indian physic)	Dry oak-hickory forests (mafic) (G2?) and Xeric oak forests on mafic rock (G2?)	geologic substrate, canopy structure (open or with gaps)
yes	*Quercus austrina* (Bluff oak)	river bluffs and levees of brown water streams in Streamside forests over mafic rk (G?)	hydrologic function, geologic substrate
no	*Quercus bicolor* (Swamp white oak)	Southern piedmont / ridge and valley upland depression swamps over mafic or calcareous substrates (G1G3)	hydrologic function, geologic substrate
no	Schoenoplectus etuberculatus (Canby's bulrush)	blackwater creeks in Streamside forests (G2G4?)	hydrologic function
no	*Silphium terebinthinaceum* (Prairie dock)	Southern piedmont mafic hardpan woodlands (G2), and Southern piedmont glade and barrens over mafic rock (G2?)	geologic substrate, fire return interval, canopy structure (open)
no	*Solidago radula* (Western rough goldenrod)	Southern piedmont mafic hardpan woodlands (G2), and Southern piedmont glade and barrens (G2?)	geologic substrate, fire return interval, canopy structure (open)
no	*Stachys sp. 1* (a Hedge nettle)	sandy alluvium in Streamside forests (G2G4?)	hydrologic function
yes	*Stewartia ovata* (Mountain camellia)	Southern piedmont mesic forests (G3G4) especially with beech and rhododendron	species composition, canopy structure (closed)
no	*Symphyotrichum laeve var. concinnum* (Narrow-leaf aster)	Southern piedmont mafic hardpan woodlands (G2), and Southern piedmont glade and barrens (G2?) or Xeric oak forests over mafic rock (G2?)	geologic substrate, fire return interval, canopy structure (open or with gaps)
yes	*Tradescantia virginiana* (Virginia spiderwort)	Southern piedmont mesic forests (G3G4	canopy structure (closed)
no	*Trichostema brachiatum* (Glade bluecurls)	Southern piedmont mafic hardpan woodlands (G2), and Southern piedmont glade and barrens over mafic rock (G2?), and prairies	geologic substrate, fire return interval
yes	*Viola Walteri* (Prostrate Blue Violet)	Southern piedmont mesic forest (G3G4)	species composition, canopy structure (closed)

[1/] G-rank of ecological system: combined ranks from plant associations within the ecological system.

G1 = CRITICALLY IMPERILED, generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout it range due to other factor(s).

G2 = IMPERILED, generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).

G3 = VULNERABLE, generally 21-100 occurrences. Either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout it range due to specific factors.

G4 = APPARENTLY SECURE, uncommon, but not rare (although it may be quite rare in parts of its range, especially at the periphery). Apparently not vulnerable in most of its range.

G5 = SECURE, common, widespread, and abundant (though it may be quire rare in parts of its range, especially at the periphery). Not vulnerable in most of its range.
G? = UNRANKED, status has not yet been determined.

Modifies and Rank Ranges

? = uncertainty about the rank in the range of 1 either way on the 1-5 scale. For example, a G2? Rank indicates that the rank is thought to be a G2, but could be a G1 or G3.
G#G# = greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate. For example, a G2G4 rank indicates the rank could be a G2, G3, or G4.
Q = questionable taxonomy. It modifies the degree of imperilment and is *only* used in cases where the type would have a less imperiled rank, if it were not recognized as a valid type (i.e., if it were combined with a more common type).

Table 17. Limiting factors [1/] to threatened, endangered, species-of-concern, and species of interest on the UWNF and rangewide. Source of information for rangewide limiting factors = Southern Appalachian Species Viability Project 2002; source of information for limiting factors on the UWNF = local knowledge.

On UWNF ?	SCIENTIFIC NAME (Common Name)	Rangewide limiting factors	Limiting factors on the UWNF
	Threatened or Endangered Birds		
yes	*Haliaeetus leucocephalus* (Bald eagle)	habitat loss & fragmentation, human disturbance, pesticides	lack of mature forest structure, human disturbance
yes historic	*Picoides borealis* (Red-cockaded woodpecker)	habitat loss & fragmentation, lack of open habitat, lack of fire, lack of mature forest structure	lack of open habitat, lack of mature forest structure, lack of fire
	Threatened or Endangered Vascular Plants		
no	*Echinacea laevigata* (Smooth coneflower)	habitat loss & fragmentation, lack of open habitat, habitat vulnerability.	lack of open habitat, lack of fire
yes	*Helianthus schweinitzii* (Schweinitz's sunflower)	habitat loss and fragmentation, lack of open habitat, habitat vulnerability, lack of fire	lack of open habitat, habitat vulnerability, lack of fire
no	*Rhus michauxii* (Michaux's sumac)	habitat loss and fragmentation, lack of fire, population distribution, habitat vulnerability.	lack of open habitat, lack of fire
	Bird Species of Concern		
no	*Aimophila aestivalis* (Bachman's sparrow)	lack of mature (pine) forest structure, lack of fire	lack of mature (pine) forest structure, lack of fire, lack of open habitat
	Vascular Plant Species of Concern		
no	*Baptisia australis var. aberrans* (Prairie blue wild indigo)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat, lack of open habitat, lack of fire
no	*Berberis canadensis* (American barberry)	lack of open habitat, eradication programs, lack of fire, fire suppression, non-native invasive species, naturally limited habitat	lack of open habitat, lack of fire, naturally limited habitat
yes	*Carex impressinervia* (Ravine sedge)	habitat loss and fragmentation, lack of mature forest structure, hydrologic modification, non-native invasive species	lack of mature forest structure, non-native invasive species
yes	*Eurybia mirabilis* (Piedmont aster)	habitat loss and fragmentation, population distribution, unknown	distribution of populations, naturally limited habitat, unknown
yes	*Fothergilla major* (Large witch-alder)	habitat loss and fragmentation, population distribution	habitat vulnerability, unknown
no	*Heuchera caroliniana* (Carolina alumroot)	habitat loss and fragmentation, forest management	unknown, (NC watch list species not tracked by State)
no	*Lindera subcoriacea* (Bog spicebush)	naturally limited habitat, hydrologic modification, prescribed fire (plowlines)	naturally limited habitat
no	*Lotus helleri* (Carolina birdfoot-trefoil)	habitat loss and fragmentation, unknown	lack of open habitat, unknown
yes	*Parthenium auriculatum* (Glade wild quinine)	naturally limited habitat, habitat loss and fragmentation, lack of open habitat	distribution of populations, naturally limited habitat
yes	*Ruellia purshiana* (Pursh's wild-petunia)	lack of open habitat, habitat vulnerability, lack of fire	distribution of populations, lack of open habitat, habitat vulnerability, lack of fire
no	*Solidago plumosa* (Yadkin river goldenrod)	naturally limited habitat, habitat loss and fragmentation, human disturbance, non-native invasive species, population distribution	naturally limited habitat, unknown
yes	*Symphyotrichum georgianum* (Georgia aster)	lack of open habitat, habitat vulnerability lack of fire	lack of open habitat, habitat vulnerability lack of fire
no	*Tridens chapmanii*	habitat loss and fragmentation, lack of	lack of open habitat, lack of fire

	(Chapman's redtop)	open habitat, lack of fire	
Mammal Species of Interest			
no	*Corynorhinus rafinesquii* (Rafinesque's big-eared bat)	habitat loss and fragmentation (loss of forest habitat, hollow tree removal, decreased availability of abandoned buildings, vandalism of caves and mines), human disturbance	lack of mature forest structure
no	*Lasionycteris noctivagans* (Silver-haired bat)	[2/] lack of mature forest structure (insufficient recruitment of preferred roosts 33 feet above the ground in large snags, pesticides, habitat loss and fragmentation, human disturbance (wind farms)	lack of mature forest structure
no	*Myotis austroriparius* (Southeastern myotis)	human disturbance (destruction of cave hibernacula, habitat vulnerability	habitat vulnerability, unknown
no	*Sciurus niger* (Eastern fox squirrel)	lack of mature forest structure, lack of open conditions, lack of fire	lack of mature forest structure, lack of open conditions, lack of fire
Amphibian Species of Interest			
yes	*Ambystoma talpoideum* (Mole salamander)	naturally limited habitat, hydrologic modification, forest management	distribution of populations, naturally limited habitat
no	*Ambystoma tigrinum tigrinum* (Eastern tiger salamander)	naturally limited habitat, habitat loss and fragmentation, hydrologic modification	naturally limited habitat
no	*Eurycea quadridigitata* (Dwarf salamander)	habitat loss and fragmentation, naturally limited habitat, hydrologic modification	naturally limited habitat
yes	*Hemidactylium scutatum* (Four-toed salamander)	habitat loss and fragmentation, naturally limited habitat, hydrologic modification, human disturbance (development of intervening uplands inhibiting dispersal and colonization of new habitats)	distribution of populations, naturally limited habitat
Bird Species of Interest			
no	*Accipiter striatus* (Sharp-shinned hawk)	naturally limited habitat (in the southern periphery of breeding range), pesticides, human disturbance	unknown
no	*Ammodramus savannarum* (Grasshopper sparrow)	habitat loss and fragmentation, lack of open habitat	lack of open habitat, habitat vulnerability (potential)
yes	*Colinus virginianus* (Northern bobwhite)	habitat loss and fragmentation , lack of open habitat, pests (fire ants) interspecific factors	lack of open habitat, lack of fire
yes	*Contopus virens* (Eastern wood pewee)	habitat loss and fragmentation, interspecific factors, pesticides, human disturbance (communication towers)	habitat loss and fragmentation, interspecific factors
yes	*Dendroica discolor* (Prairie warbler)	habitat loss and fragmentation, interspecific factors, lack of open habitat, lack of fire	lack of open habitat, lack of fire
yes	*Lanius ludovicianus lucovicianus* (Loggerhead shrike)	habitat loss and fragmentation, lack of fire	distribution of populations, lack of open habitat, lack of fire
yes	*Melanerpes erythrocephalus* (Red-headed woodpecker)	habitat loss and fragmentation, lack of open habitat, lack of fire	lack of open habitat, lack of fire
yes	*Sitta pusilla* (Brown-headed nuthatch)	habitat loss and fragmentation, forest management, interspecific factors, lack of fire	forest management (decrease in native pine communities)
Insect Species of Interest			
yes	*Erynnis martialis* (Mottled duskywing)	eradication programs (gypsy moth spraying), non-native invasive species (cheetgrass in west), lack of fire	distribution of populations, lack of open habitat, lack of fire
Vascular Plant Species of Interest			
yes	*Amorpha schwerinii* (Piedmont Indigo-bush)	forest management, hydrologic modification, human disturbance (military operations), lack of fire	lack of fire, human disturbance (illegal OHV and horse use)
yes	*Anemone berlandieri* (Southern Anemone)	habitat loss and fragmentation, human disturbance (OHV, quarrying for limestone), naturally limited habitat	distribution of populations, naturally limited habitat, human disturbance (illegal OHV use)
no	*Arabis missouriensis* (Missouri rockcress)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Baptisia alba var alba* (Thick-pod white wild	lack of open habitat, habitat vulnerability, lack of fire	lack of open habitat, lack of fire

	indigo)		
yes	*Baptisia albescens* (Thin-pod white wild indigo)	lack of open habitat, habitat vulnerability, lack of fire	lack of open habitat, habitat vulnerability, lack of fire
yes	*Cardamine dissecta* (Dissected toothwort)	forest management, lack of mature forest structure	distribution of populations, naturally limited habitat
no	*Celastrus scandens* (American bittersweet)	habitat loss and fragmentation, forest management, non-native invasive species, lack of mature forest structure	non-native invasive species, lack of mature forest structure
yes	*Cirsium carolinianum* (Carolina thistle)	naturally limited habitat, lack of open habitat, lack of fire	naturally limited habitat, lack of open habitat, lack of fire
yes	Collinsonia tuberosa (Piedmont horsebalm)	habitat loss and fragmentation	distribution of populations, unknown
no	Danthonia epilis (Bog oatgrass)	habitat loss and fragmentation, naturally limited habitat, hydrologic modification	distribution of populations, naturally limited populations
no	*Dichanthelium annulum* (Ringed witchgrass)	habitat loss and fragmentation, unknown	unknown
no	*Dodecatheon meadia var. meadia* (Eastern shooting star)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
yes	*Gnaphalium helleri* (Heller's rabbit tobacco)	habitat loss and fragmentation, naturally limited habitat	distribution of populations, naturally limited habitat
no	*Helenium brevifolium* (Littleleaf sneezeweed)	habitat loss and fragmentation, forest management, naturally limited habitat	naturally limited habitat
yes	*Helianthus laevigatus* (Smooth sunflower)	lack of open habitat, lack of fire, non-native invasive species	lack of open habitat, lack of fire, non-native invasive species
no	*Hexalectris spicata* (Crested coralroot)	habitat loss and fragmentation, forest management, naturally limited habitat	naturally limited habitat
no	*Lilium canadense ssp. Editor* (Red Canada lily)	habitat loss and fragmentation, hydrologic modification, forest management practices, naturally limited habitat	naturally limited habitat
no	*Matelea decipiens* (Glade milkvine)	habitat loss and fragmentation, naturally limited habitat	distribution of populations, naturally limited habitat
no	*Oligoneuron album* (Prairie goldenrod)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Oligoneuron rigidum ssp. glabratum* (Southeastern bold goldenrod)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Pellaea wrightiana* (Wright's cliffbrake)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Plantago cordata* (Heartleaf plantain)	habitat loss and fragmentation, hydrologic modification (altered streamflow, enrichment of streams from agricultural fertilizers)	unknown
no	*Porteranthus stipulatus* (Indian physic)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Quercus austrina* (Bluff oak)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Quercus bicolor* (Swamp white oak)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	Schoenoplectus etuberculatus (Canby's bulrush)	habitat loss and fragmentation, naturally limited habitat, hydrologic modification	distribution of populations, naturally limited habitat
no	*Silphium terebinthinaceum* (Prairie dock)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Solidago radula* (Western rough goldenrod)	habitat loss and fragmentation, naturally limited habitat	naturally limited habitat
no	*Stachys sp. 1* (a Hedge nettle)	naturally limited habitat, unknown	naturally limited habitat, unknown
yes	*Stewartia ovata* (Mountain camellia)	habitat loss and fragmentation, interspecific factors.	distribution of populations
no	*Symphyotrichum laeve var. concinnum* (Narrow-leaf aster)	habitat loss (conversion of sites to limestone quarries) and fragmentation, human disturbance (illegal OHV, horse use), lack of fire.	lack of open habitat, lack of fire, naturally limited habitat
yes	*Tradescantia virginiana* (Virginia spiderwort)	lack of mature forest structure	distribution of populations

no	*Trichostema brachiatum* (Glade bluecurls)	habitat loss and fragmentation, forest management practices, naturally limited habitat	naturally limited habitat
yes	*Viola Walteri* (Prostrate Blue Violet)	habitat loss and fragmentation, non-native invasive species	distribution of populations

[1/] **Limiting Factor Category**	**Limiting Factor Description**
Habitat loss & fragmentation	Limited by habitat loss or fragmentation caused by land use conversion. In the case of UWNF Limiting Factors, this may include conversions on in holdings or surrounding private land.
Lack of open habitat	Limited by habitat degradation resulting from canopy closure and / or midcanopy tree and shrub development
Lack of mature forest structure	Limited by lack of mature deciduous forest structure that may include abundant snags, down wood and den trees or mature pine forest structure that includes open park-like conditions.
Lack of fire	Limited by habitat modification resulting from lack of regular fire
Naturally limited habitat	Limited by naturally restricted abundance or distribution of potential habitat, such environmental conditions associated with mafic or calcareous substrates, rock outcrops, or wetlands.
Distribution of populations	Limited by poorly distributed populations including single isolated occurrences
Habitat vulnerability	Limited by susceptibility of roadsides or rights-of-ways to periodic direct and indirect impacts from herbicide use, improper mowing, or vehicle accidents – or vulnerability of habitat components, e.g., snags
Interspecific factors	Limited by interactions with other native species through competition, predation, hybridization, or nest parasitism
Non-native invasive species	Limited by interaction / competition with non-native species
Disease or pests	Limited by diseases or pests
Hydrologic modification	Limited by modification of hydrology associated with wetlands and other aquatic systems.
Forest management	Limited by habitat modification or direct effects to individuals resulting from a variety of common forest management practices
Prescribed fire	Limited by habitat modification or direct effects to individuals resulting from the use of prescribed burning especially fire plowline creation
Human disturbance	Limited by human presence that results in disruption of animal behavior or trampling of plants, including impacts from recreation uses.
Pesticides/Toxins/Eradication programs	Limited by environmental toxins resulting from pollution or pesticides or eradication programs such as gypsy moth control or control of alternate hosts (barberry) for black stem rust of wheat
Unknown	Limiting factors are obviously at work due to evidence or rarity or declines, but they are largely unknown.

[2/] from: http://www.dnr.state.wi.us/org/land/er/wwap/plan/pdfs/Mammals_SilverhairedBat.pdf

Table 18. Range wide distribution and state ranks for Threatened, Endangered (T&E), Species-of-Concern (SOC), and Species-of-Interest (SOI) on the UWNF.

Species Scientific Name	Rangewide Distribution and state rank[1]														
		Piedmont					Remainder of Southern Region								OTHER STATES
	G	NC	SC	VA	GA	AL	AR	FL	LA	MS	TN	KY	TX	OK	
T&E Birds															
Haliaeetus leucocephalus	G5	S3	S2	S2	S2	S3	S2	S3	S3	S1	S2	S3			Plus all other States
Picoides borealis	G3	S2	S2	S1	S2	S2	S2	S2	S2	S1	SX		S3	S1	
T&E Vascular Plants															
Echinacea laevigata	G2	S1	S1	S2	S2										PN(SX)
Helianthus schweinitzii	G3	S3	S1												
Rhus michauxii	G2	S2	SX	S1	S1										
SOC Birds															
Aimophila aestivalis	G3	S2	S3	S1	S3	S3	S3	S3	S3	S3	S2	S1	S3	S2	Plus 9 more (6 extirpated)
SOC Vascular Plants															
Baptisia australis aberrans	T2	S2			S2						NR				
Berberis canadensis	G3	S2	NR	S3	S1	SH					S2	S1			MY(SH),MO(S2),OH(NR),PN(SX),WVA(S1), IL(S1)
Carex impressinervia	G12	S1	S1			S1				S1					
Eurybia mirabilis	G23	S2	NR												
Fothergilla major	G3	S2	S1		S1	S2	S1				S2				
Heuchera caroliniana	G3	S3	NR												
Lindera subcoriacea	G2	S2	NR	SU	S1	S1		S1	S1	S2					
Lotus helleri	T3	S3	NR	S1	S1										
Parthenium auriculatum	G3	S1		NR							NR				MD(NR), WVA(SH)
Ruellia purshiana	G3	S2	NR	NR	S3	NR					S1				MD(S1),WVA(SH)
Solidago plumosa	G1	S1													
Symphyotrichum georgianum	G23	S2	NR		SE	S2		SU							
SOI Mammals															
Corynorhinus rafinesquii	G34	S3	S2	S2	S3	S2	S2	S2	S3	S3	S3	S3	S3		MO(Su),OK(S1),IL(S1),WVA(S1),IN(SH)
Lasionycteris noctivagans	G5	S2	NR	SU	S5	NR	S2	NR	S1		S4	NR	S4	S2	Plus 38 more states
Myotis austroriparius	G34	S3	S1	S3	S3	S2	S2	S3	S4	S1	S3	S1	S3	S1	MO(SU), IL(S1), IN(S1)
Sciurus niger	G5	S3	S4	S4	S5	S3	S4	S5	S5	S5	S5	S5	S5	S5	Plus 27 additional states
SOI Amphibians															
Ambystoma talpoideum	G5	S2	NR	S1	S5	S5	S3	NR	S5	S5	S3	S3	S3	S1	MO(S2), IL(S3), IN(NR)
Ambystoma tigrinum tigrinum	G5	S2	NR	S1	S3	S3	S3	S3	S1	S1	S5	S4	S5	S4	Plus 27 additional states
Eurycea quadridigitata	G5	S2	NR		S5	S5	S3	NR	S5	S5			S5		
Hemidactylium scutatum	G5	S3	NR	S5	S3	S3	S3	S2	S1	S1	S3	S4		S1	CN(S4),DL(S1),DC(SH),MA) + 14 more
SOI Birds															
Accipiter striatus	G5	S2	S2	S3	S4	S3	S1	NR	S1	S1	S3	S3	S2	S4	Plus 39 additional states
Ammodramus savannarum	G5	S3	NR	S4	S4	S3	S3	NR	S3	NA	S4	S4	S3	S4	Plus 35 additional states
Colinus virginianus	G5	S5	S4	S5	S5	S5	S5	NR	S5	S5	S2	S5	S4	S5	Plus 31 additional states mostly S4-S5
Melanerpes erythrocephalus	G5	S4	NR	S4	S4	S5	S4	NR	S4	S4	S4	S4	S3	NR	Plus 27 additional states
Dendroica discolor	G5	S5	S4	S5	S5	S5	S4	NR	S4	S5	S3	S5	S3	S3	Plus 22 additional states
Lanius ludovicianus migrans	G4	SU	NR	S1	NR		S3				S3		S4	S4	Plus 17 northern States
Sitta pusilla	G5	S5	S4	S4	S5	S5	S4	NR	S5	S4	S2		S4	S1	DE(S2),MD(S3),MO(SX)
SOI Insects															
Erynnis martialis	G34	S3	NR	S1	SU	SU	S2	NR	SU	SU	S3	S3	NR	NR	Plus 24 additional states
SOI Vascular Plants															
Amorpha schwerinii	G34	S3	S1		S2	NR				NR					
Anemone berlandieri	G4?	S1	NR	S1	S1	S3	NR	NR	S2				NR	NR	KS(S2)
Arabis missouriensis	G45	S1	S1		S2		NR					SH			Plus 15 northern & Midwestern States
Baptisia alba alba	T35	S2	NR	NR	NR	NR									
Baptisia albescens	G4	S2	NR	S1	NR	NR	NR				NR				
Cardamine dissecta	G4?	S2	NR	S1	S3	NR	S1				S4	S5			OH(S3),WVA(NR), IN(S1)
Celastrus scandens	G5	S2	NR	NR	S2	S2	NR		S2	S2	NR	S5	S1	NR	Plus 27 additional states, mostly northern
Cirsium carolinianum	G5	S1	NR	S1	S3	NR	NR		NR	NR	NR	S3	NR	NR	MO(NR),OH(S2),(NR),IN(S2),IL(S2)
Collinsonia tuberosa	G34	S1	NR		S3	NR			NR	NR	NR				
Danthonia epilis	G3?	S2	NR	SU	S1						S1				NJ(S4)
Dichanthelium annulum	G23	SH													
Dodecatheon meadia meadia	G5	S2		NR	NR			NR				NR			NY(SX),OK(SU),WVA(S4), IN(NR)
Gnaphalium helleri	634	S3	NR	S1	NR	NR	NR	NR	NR	NR	S2	SH	S2	NR	Plus 12 additional states – mostly northern
Helenium brevifolium	G34	S1	S1	S2	S1	S1		NR	S1	S4	S1				
Helianthus laevigatus	G4	S2	NR	S4											MD(S1),PN(NR)WVA(S2)

Hexalectris spicata	G5	S2	NR	S3	S3	S3	S2	S3	S2	S2	NR	S4	NR	S1	AZ(S3), KS(NR),MD(SH),MO(NR) + 3 states
Lilium canadense editorum	T4	S1	NR	NR	NR	NR					NR	NR			DC(NR),IN(NR)MD(NR)NY(NR) + 4 states
Matelea decipiens	G5	S2	NR	S1	NR		NR		NR	NR	NR	S4	NR	NR	AR(NR),KS(S1),MD(SH),MO(NR),IL(NR),IN(S1)
Oligoneuron album	G5	S1	NR		S3		S1				S1		NR	S2	Plus 16 additional states – mostly northern
Oligoneuron rigidum glabratum	T5	S2	NR	S1	S3	NR	NR		NR	NR	NR	S4			AR(NR),MO(NR),OH(NR),TX(NR)
Pellaea wrightiana	G5	S1	NR												AZ(S3),CO(S2),NM(NR),OK(NR)TX(NR),UT(S1)
Plantago cordata	G4	S1	NR	SH	S4	S1	S2	SH		S1	S1	SH			DC(SH),IO(SH),MD(SH),NY(S3),OH(S1) + 5 others
Porteranthus stipulatus	G5	S2		S1	S3	NR	NR		NR	NR	NR	S5	NR	NR	KS(S2),MD(SH),MH(NR)MO(NR),NY(SX) + 5 other
Quercus austrina	G4	S1	NR		S3	NR		NR		NR					
Quercus bicolor	G5	S2	S1	NR		NR					NR	S5			Plus 23 additional states – mostly northern
Schoenoplectus etuberculatus	G34	S3	NR	SH	S1	NR		NR	S1	S3					DE(S1),MD(S1),MO(S1),RD(S1),TX(S1)
Silphium terebinthinaceum	G45	S2	S1	S1	S3	NR	NR			S4	S2	S4	NR	NR	AR(NR),DC(NR),IO(SU),MO(NR),OH(NR),WI(NR)
Solidago radula	G5?	S1	NR		NR		NR		NR			S1	NR	NR	KS(S1),MO(NR)
Stachys sp. 1	NR	S1													
Stewartia ovata	G4	S2	S2	S2	S3	S2		NR		S1	NR	S3			
Symphyotrichum laeve	T4	S2	NR	S3	S3	S1				S4	SN	S3			DE(NR),DC(NR),MD(SH),NY(SH),OH(NR),PE(NR)
Tradescantia virginiana	G5	S1	NR	NR	NR	NR	NR		NR	NR	NR	S5			Plus 21 additional states – mostly northern
Trichostema brachiatum	G5	S1	NR	NR	NR	NR	NR	NR		NR	NR	NR	NR	NR	Plus 23 additional states – mostly northern
Tridens chapmanii	T3	NR	NR	NR	S3	NR	NR	NR	NR	NR	S1		NR	NR	DE(NR),KS(S1),MD(NR),MO(S2),NJ(SH)
Viola walteri	G45	S1	NR	S2	NR	NR	NR	NR	NR	NR	NR	S2	NR		OH(S2),WVA(NR)

[1/]State Rank: (lowest State ranking identified, e.g. S1S2 = S1, S2S3 = S2, etc.)

- S1= Critically imperiled in State because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state (1-5 extant populations)
- S2= Imperiled in State because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (6-20 extant populations).
- S3 = Rare or uncommon in State (21-100 extant populations)
- S4 = Apparently secure in State (100-1000 extant populations)
- S5 = Demonstrably secure in State (1000+ extant populations)
- NR = unranked, or rank uncertain
- SH = Of historical occurrence in State, perhaps not having been verified in the past 20 years, and suspected to be still extant.
- SN = Rank of non-breeding population in the State
- SRs = Significantly Rare in State (1-20 populations)
- SU = Possibly in peril in State but status uncertain; need more information
- SX = apparently extirpated from State

SZ = Population is not of significant conservation concern

Table 19. Quality of information used to determine the relative importance of the UWNF in sustaining threatened, endangered, species-of-concern, and species-of-interest.

Scientific Name (Common Name)	Habitat Relationships[1]/	Limiting Factors [2/]	Status & Inventory [3/]	Comment
Threatened and Endangered Birds				
Haliaeetus leucocephalus (Bald eagle)	high	high	high	
Picoides borealis (Red-cockaded woodpecker)	high	high	very high	
Echinacea laevigata (Smooth coneflower)	high	high	high	
Threatened or Endangered Vascular Plants				
Helianthus schweinitzii (Schweinitz's sunflower)	high	high	very high	
Rhus michauxii (Michaux's sumac)	high	moderate	very high	
Bird Species of Concern				
Aimophila aestivalis (Bachman's sparrow)	high	high	moderate	
Vascular Plant Species of Concern				
Baptisia australis var. aberrans (Prairie blue wild indigo)	high	low-moderate	low	
Berberis canadensis (American barberry)	high	high	very low	
Carex impressinervia (Ravine sedge)	moderate	high	moderate	
Eurybia mirabilis (Piedmont aster)	moderate	low moderate	moderate	

Fothergilla major (Large witch-alder)	low	high	low	
Heuchera caroliniana (Carolina alumroot)	low	moderate, low on UWNF	very low	NC Heritage does not track this "watch list" species
Lindera subcoriacea (Bog spicebush)	high	moderate	moderate	
Lotus helleri (Carolina birdfoot-trefoil)	low	moderate	low	
Parthenium auriculatum (Glade wild quinine)	high	moderate	moderate	
Ruellia purshiana (Pursh's wild-petunia)	moderate	moderate	low	
Solidago plumosa (Yadkin river goldenrod)	moderate	high	low	
Symphyotrichum georgianum (Georgia aster)	high	high	low-moderate	
Tridens chapmanii (Chapman's redtop)	moderate	low-moderate	low	
Mammal Species of Interest				
Corynorhinus rafinesquii (Rafinesque's big-eared bat)	moderate	high	low	
Lasionycteris noctivagans (Silver-haired bat)	moderate	moderate	low	not evaluated in The Southern App. Spp. Viability Project
Myotis austroriparius (Southeastern myotis)	moderate	moderate	low	
Sciurus niger (Eastern fox squirrel)	high	high	low	
Amphibian Species of Interest				
Ambystoma talpoideum (Mole salamander)	high	high	low	
Ambystoma tigrinum tigrinum (Eastern tiger salamander)	high	low-moderate	low	
Eurycea quadridigitata (Dwarf salamander)	high	moderate	low	
Hemidactylium scutatum (Four-toed salamander)	high	moderate	low	
Bird Species of Interest				
Accipiter striatus (Sharp-shinned hawk)	moderate	moderate	moderate	
Ammodramus savannarum (Grasshopper sparrow)	moderate	high	moderate	
Colinus virginianus (Northern bobwhite)	high	high	moderate	
Contopus virens (Eastern wood pewee)	high	moderate	moderate	
Dendroica discolor (Prairie warbler)	moderate	high	moderate	
Lanius ludovicianus lucovicianus (Loggerhead shrike)	high	low	low	decline beyond what can be explained by habitat loss
Melanerpes erythrocephalus (Red-headed woodpecker)	high	high	moderate	
Sitta pusilla (Brown-headed nuthatch)	high	high	moderate	
Insect Species of Interest				
Erynnis martialis (Mottled duskywing)	low	low-moderate	very low	unreliable records, magnitude of loss is not clear.
Vascular Species of Interest				
Amorpha schwerinii (Piedmont Indigo-bush)	moderate	moderate	low	reproductive and establishment biology poorly understood
Anemone berlandieri (Southern Anemone)	high	moderate	moderate	
Arabis missouriensis (Missouri rockcress)	high	low-moderate	moderate	
Baptisia alba var alba (Thick-pod white wild indigo)	moderate	low-moderate	low	
Baptisia albescens (Thin-pod white wild indigo)	high	low-moderate	low	
Cardamine dissecta	high	low-moderate	moderate	

(Dissected toothwort)				
Celastrus scandens (American bittersweet)	moderate	low-moderate	moderate	
Cirsium carolinianum (Carolina thistle)	moderate	high	low	light loving species not associated with roadsides
Collinsonia tuberosa (Piedmont horsebalm)	moderate	high	low	
Danthonia epilis (Bog oatgrass)	moderate	high	low	
Dichanthelium annulum (Ringed witchgrass)	high	low-moderate	low	
Dodecatheon meadia var. meadia (Eastern shooting star)	moderate	moderate	low	
Gnaphalium helleri (Heller's rabbit tobacco)	high	low-moderate	moderate	
Helenium brevifolium (Littleleaf sneezeweed)	high	moderate	low	
Helianthus laevigatus (Smooth sunflower)	high	high	low	
Hexalectris spicata (Crested coralroot)	moderate	moderate	low	
Lilium canadense ssp. editor (Red Canada lily)	high	high	moderate	
Matelea decipiens (Glade milkvine)	high	low-moderate	moderate	
Oligoneuron album (Prairie goldenrod)	high	low-moderate	moderate	
Oligoneuron rigidum ssp. glabratum (Southeastern bold goldenrod)	high	low-moderate	moderate	
Pellaea wrightiana (Wright's cliffbrake)	high	low-moderate	moderate	
Plantago cordata (Heartleaf plantain)	moderate	low-moderate	low	
Porteranthus stipulatus (Indian physic)	moderate	low-moderate	low	
Quercus austrina (Bluff oak)	moderate	low-moderate	low	
Quercus bicolor (Swamp white oak)	high	low-moderate	low	
Schoenoplectus etuberculatus (Canby's bulrush)	moderate	high	low	
Silphium terebinthinaceum (Prairie dock)	high	moderate	moderate	
Solidago radula (Western rough goldenrod)	high	low-moderate	moderate	
Stachys sp. 1 (a Hedge nettle)	moderate	low-moderate	low	
Stewartia ovata (Mountain camellia)	moderate	high	low	
Symphyotrichum laeve var. concinnum (Narrow-leaf aster)	high	moderate	low	
Tradescantia virginiana (Virginia spiderwort)	moderate	moderate	low	
Trichostema brachiatum (Glade bluecurls)	moderate	moderate	moderate	
Viola Walteri (Prostrate Blue Violet)	high	moderate	low	

[1/] **Habitat Information Quality**	**Habitat Information Quality Definition**
High	Species habitat requirements are well known, well documented, and generally detailed and / or the species is wholly or primarily associated with unique, easily identifiable environments (mafic substrates, wetlands, old growth).
Moderate	Species habitat requirements are moderately well known but often not detailed and / or the species occurs in a variety of ecological systems that share some similar but only broad environmental conditions

Low	Species habitat requirements are poorly understood and / or the species appears to be a generalist based on the variety of ecological systems and habitats in which it is found.

[2]/Limiting Factor Quality	Limiting Factor Quality Definition
High	Information on limiting factors is adequate; the species was evaluated in The Southern Appalachian Species Viability Project 2002 and / or other reliable source.
Moderate	Information on limiting factors is moderately adequate; the species *was* evaluated in The Southern Appalachian Species Viability Project 2002 and / or other reliable source.
Low-Moderate	Information on limiting factors is moderately adequate; the species *was not* evaluated in The Southern Appalachian Species Viability Project 2002.
Low	Information on limiting factors is inadequate, e.g., the species was not addressed in The Southern Appalachian Species Viability Project 2002 and no other source of information on limiting factors could be located – *or* – declines in population numbers remain unexplained.

[1] Inventory Quality	Quality Definition
Very High	Information on occurrences or occupied and unoccupied habitat are very nearly complete--it is likely that a very high proportion (approx. >90%) of existing occurrences or occupied habitat on the NF unit are known; uncertainty about distribution and abundance of the species on the NF unit is very low.
High	Information on occurrences or occupied and unoccupied habitat are predominately complete--it is likely that a high proportion (approx. 75-90%) of existing occurrences or occupied habitat on the NF unit are known; uncertainty about distribution and abundance of the species on the NF unit is low.
Moderate	Information on occurrences or occupied and unoccupied habitat are of moderate completeness--it is likely that a moderate proportion (approx 50-75%) of existing occurrences or occupied habitat on the NF unit are known; uncertainty about distribution and abundance on the NF unit is moderate.
Low	Information on occurrences or occupied and unoccupied habitat are of incomplete--it is likely that a low proportion (approx 25-50%) of existing occurrences or occupied habitat on the NF unit are known; uncertainty about distribution and abundance on the NF unit is high.
Very Low	Data on occurrences or occupied and unoccupied habitat are of very incomplete--it is likely that a very low proportion (<25%) of existing occurrences or occupied habitat on the NF unit are known; uncertainty about distribution and abundance on the NF unit is very high.

Table 20. Relative importance of the UWNF in sustaining threatened, endangered, species-of-concern, and species-of-interest in North Carolina, across the Carolina Slate Belt and Southern Triassic Uplands ecoregions, and rangewide based on species habitat relationships, species and habitat rarity, and threats.

Scientific Name (Common Name)	Species G-rank, S-rank	Habitat G-rank	Potential suitable[1/] habitat abundance on UWNF	EOs on UWNF	% of total EOs in Eco-region	Relative importance [2/] of UWNF in sustaining species		
						State	Ecoregion	Rangewide
Threatened or Endangered Birds								
Haliaeetus leucocephalus (Bald eagle)	G5, S3	G5	uncommon	1	1%	very low	very low	very low
Picoides borealis (Red-cockaded woodpecker)	G3, S2	G2	common	0	0	low	very low	very low
Threatened or Endangered Vascular Plants								
Echinacea laevigata (Smooth coneflower)	G2, S1	G2?	very rare	0	0	low	low	very low
Helianthus schweinitzii	G3, S3	G2, G2?	common	29	15%	high	high	high

(Schweinitz's sunflower)								
Rhus michauxii (Michaux's sumac)	G2, S2	G2	very rare	0	0	low	very low	very low
Bird Species of Concern								
Aimophila aestivalis (Bachman's sparrow)	G3, S3B S2N	G2	common	0	0	low	very low	very low
Vascular Plant Species of Concern								
Baptisia australis var. aberrans (Prairie blue wild indigo)	G5T2, S2	G2, G2?	uncommon	0	0	moderate	moderate	moderate
Berberis canadensis (American barberry)	G3, S2	G2, G2?	uncommon	0	0	moderate	low	very low
Carex impressinervia (Ravine sedge)	G1G2, S1	G2G4	uncommon	5	71%	high	high	high
Eurybia mirabilis (Piedmont aster)	G2G3, S2	G3G5	rare	1	5%	low	low	low
Fothergilla major (Large witch-alder)	G3, S3	G4G5 G2G4	abundant	7	70%	high	high	low
Heuchera caroliniana (Carolina alumroot)	G3, S3	G3G4 G4G5	common	0	0	moderate	low	low
Lindera subcoriacea (Bog spicebush)	G2, S2	G2G3	rare	0	0	low	very low	very low
Lotus helleri (Carolina birdfoot-trefoil)	G3, S3	G4G5?	abundant	0	0	moderate	low	low
Parthenium auriculatum (Glade wild quinine)	G3?, S2	G2	very rare	5	18%	low	low	low
Ruellia purshiana (Pursh's wild-petunia)	G3, S2	G2G3	rare	1	14%	moderate	moderate	low
Solidago plumosa (Yadkin river goldenrod)	G1, S1	G2G4, G?	very rare	0	0	low	low	low
Symphyotrichum georgianum (Georgia aster)	G2G3, S2	G2?,G2 G2G4	uncommon	5	11%	moderate	moderate	low
Tridens chapmanii (Chapman's redtop)	G3, S1S2	G2, G2G4	abundant	0	0	moderate	very low	very low
Mammal Species of Interest								
Corynorhinus rafinesquii (Rafinesque's big-eared bat)	G3G4T?, S2	G2G4	common	0	0	moderate	very low	very low
Lasionycteris noctivagans (Silver-haired bat)	G5, S2?B 24N	G2G4	common	0	0	moderate	very low	very low
Myotis austroriparius (Southeastern myotis)	G3G4, S3	G2G4	common	0	0	moderate	very low	very low
Sciurus niger (Eastern fox squirrel)	G5, S3	G2	common	0	0	low	very low	very low
Amphibian Species of Interest								
Ambystoma talpoideum (Mole salamander)	G5, S2	G1G3 G2G4	common	2	66%	high	high	very low
Ambystoma tigrinum tigrinum (Eastern tiger salamander)	G5, S2	G1G3 G2G4	common	0	0	moderate	very low	very low
Eurycea quadridigitata (Dwarf salamander)	G5, S2	G?	rare	0	0	low	very low	very low
Hemidactylium scutatum (Four-toed salamander)	G5, S3	G1G3 G2G4	common	1	5%	moderate	very low	very low
Bird Species of Interest								
Accipiter striatus (Sharp-shinned hawk)	G5, S2B S4N	G5	abundant	0	0	low	very low	very low
Ammodramus savannarum (Grasshopper sparrow)	G5, S3B S1N	G?	rare	0	0	very low	very low	very low
Colinus virginianus (Northern bobwhite)	G5, S5	G2, G5	common	5+	?	low	very low	very low
Contopus virens (Eastern wood pewee)	G5, S5B	G2G5	abundant	10	?	low	very low	very low
Dendroica discolor (Prairie warbler)	G5, S5B S1N	G1G2	common	15	?	low	very low	very low
Lanius ludovicianus lucovicianus (Loggerhead shrike)	G4T4, S3B S3N	G5	rare	1	?	very low	very low	very low
Melanerpes erythrocephalus (Red-headed woodpecker)	G5, S4	G2G5 G?	abundant	9	?	low	very low	very low
Sitta pusilla	G5, S5	G2, G?	common	1	?	low	very low	very low

(Brown-headed nuthatch)								
Insect Species of Interest								
Erynnis martialis (Mottled duskywing)	G3G4, S3	G2G5	very rare	1	33%	low	very low	very low
Vascular Plant Species of Interest								
Amorpha schwerinii (Piedmont Indigo-bush)	G3G4, S3	G?	rare	62	61%	high	high	moderate
Anemone berlandieri (Southern Anemone)	G4?, S2	G2?	very rare	1	14%	low	low	very low
Arabis missouriensis (Missouri rockcress)	G5?Q, S1	G2?	very rare	0	0	low	low	very low
Baptisia alba var alba (Thick-pod white wild indigo)	G5T3T5, S2	G2, G2?	uncommon	0	0	moderate	low	very low
Baptisia albescens (Thin-pod white wild indigo)	G4, S2	G2, G2?	common	9	30%	moderate	moderate	very low
Cardamine dissecta (Dissected toothwort)	G4?, S2	G3G4	rare	2	22%	moderate	moderate	low
Celastrus scandens (American bittersweet)	G5, S2	G3G4	rare	0	0	low	very low	very low
Cirsium carolinianum (Carolina thistle)	G5, S2	G2, G2? G2G4	abundant	11	79%	high	high	low
Collinsonia tuberosa (Piedmont horsebalm)	G3G4, S1	G2G4	common	1	20%	moderate	low	low
Danthonia epilis (Bog oatgrass)	G3G4, 2?	G2G3	rare	0	0	low	very low	very low
Dichanthelium annulum (Ringed witchgrass)	GNR, SH	G2? G2G3	rare	1	?	unknown	unknown	unknown
Dodecatheon meadia var. meadia (Eastern shooting star)	G5T5, S2	G3G4 G2G3	uncommon	0	0	moderate	low	very low
Gnaphalium helleri (Heller's rabbit tobacco)	G3G4, S3	G2, G2?	very rare	1	8%	low	low	very low
Helenium brevifolium (Littleleaf sneezeweed)	G4, S2	G2G4 G1G3	common	0	0	moderate	low	very low
Helianthus laevigatus (Smooth sunflower)	G4, S2	G2 G4G5	abundant	16	32%	moderate	moderate	low
Hexalectris spicata (Crested coralroot)	G5, S2	G2? G2G3	common	0	0	moderate	very low	very low
Lilium canadense ssp. editor (Red Canada lily)	G5T4, S1	G2G4	rare	0	0	low	very low	low
Matelea decipiens (Glade milkvine)	G5, S2	G2?, G2	very rare	0	0	low	low	very low
Oligoneuron album (Prairie goldenrod)	G5, S1	G2?, G2	very rare	0	0	low	low	very low
Oligoneuron rigidum ssp. glabratum (Southeastern bold goldenrod)	G5T4, S2	G2?, G2	very rare	0	0	low	low	very low
Pellaea wrightiana (Wright's cliffbrake)	G5, S1	G2	very rare	0	0	low	low	very low
Plantago cordata (Heartleaf plantain)	G4, S1	G?	rare	0	0	low	very low	very low
Porteranthus stipulatus (Indian physic)	G5, S2	G2?	uncommon	0	0	moderate	very low	very low
Quercus austrina (Bluff oak)	G4, S1	G?	very rare	1	0	low	low	very low
Quercus bicolor (Swamp white oak)	G5, S2	G1G3	very rare	0	0	low	low	very low
Schoenoplectus etuberculatus (Canby's bulrush)	G3G4, S3	G2G4?	very rare	0	0	low	very low	very low
Silphium terebinthinaceum (Prairie dock)	G4G5, S2	G2, G2?	very rare	0	0	low	low	very low
Solidago radula (Western rough goldenrod)	G5?, S1	G2G2?	very rare	0	0	low	low	very low
Stachys sp. 1 (a Hedge nettle)	GNR, S1	G2G4?	very rare	0	0	low	low	low
Stewartia ovata (Mountain camellia)	G4, S2	G3G4	rare	1	33%	moderate	low	low
Symphyotrichum laeve var. concinnum (Narrow-leaf aster)	G4T4, S2	G2, G2?	uncommon	0	0	moderate	low	very low

Tradescantia virginiana (Virginia spiderwort)	G5, S1	G3G4	rare	1	25%	moderate	Low	very low
Trichostema brachiatum (Glade bluecurls)	G5, S1	G2, G2?	very rare	0	0	low	low	very low
Viola Walteri (Prostrate Blue Violet)	G4G5, S1	G3G4	rare	1	100%	moderate	moderate	moderate

[1] The potential extent of ecological systems, i.e., environments, that could provide habitat conditions to support the species; multiple entries indicate multiple ecological systems that could provide suitable habitat conditions.

Habitat Abundance Category	**Habitat Abundance Definition**
abundant	Environments that could support suitable habitat conditions for the species are abundant (> 10,000 acres on the UWNF).
common	Environments that could support suitable habitat conditions for the species are common (3,000 – 10,000 acres on the UWNF).
uncommon	Environments that could support suitable habitat conditions for the species are uncommon (1,000 – 3,000 acres on the UWNF).
rare	Environments that could support suitable habitat conditions for the species are rare (150-1,000 acres on the UWNF.
very rare	Environments that could support suitable habitat conditions for the species are very rare (< 150 acres).

[2/] Importance Category	**Importance Category Definition**
high	A high proportion (generally more than 50%) of *secure* populations and/or habitat is on the UWNF; species significantly depends on the UWNF populations and / or habitat
moderate	A moderate proportion (20-50%) of *secure* populations and/or habitat is on the UWNF; species moderately depends on the UWNF populations and / or habitat
low	A low proportion (generally 5-20%) of *secure* populations and/or habitat is on the UWNF; species has low dependence on the UWNF populations and / or habitat
very low	A very low proportion (generally < 5%) of *secure* populations and/or habitat is on the UWNF; species has very low dependence on the UWNF populations and / or habitat
unknown	Information is insufficient to assess the importance of populations and habitat on the UWNF for this species

43.24 – Species Groups and Surrogate Species

All federally listed species, species of concern, and species of interest, and those species that quality but do not occur on the UWNF, can be grouped into 5 categories:

1) species that occur in rare habitats associated with mafic or calcareous substrates and open canopy conditions,
2) species associated with rare wetland habitats,
3) sun-loving species not in the above categories that occur in woodlands and openings,
4) species that occur in mesic forests, and
5) species dependent on habitats close to wetlands or open water bodies.

This includes 70 species; 31 have been documented on the UWNF and 29 have not been documented but suitable habitat exists on the Forest. Species documented on the UWNF include: 3 T&E species, 6 species-of-concern and 22 species-of-interest (**Tables 21-23**).

Instead of choosing one species as a surrogate or "indicator" species for the group, the species group will be considered further in the planning process to evaluate if plan components for ecosystems will be sufficient to sustain the species they contain. In addition, nearly one-half of these species are documented at less than 5 locations on the UWNF (**Tables 21-23**) indicating an additional category of species to be evaluated.

Table 21. Number of species within species habitat groups by status and rarity. T&E = federally listed as threatened or endangered (5 total) , SOC = species of concern (14 total), SOI = species of interest (51 total)

Species Habitat Group (species that occur in the following habitats)	Number of species							
	total	documented on the UWNF			not documented on the UWNF			Very rare on the UWNF (< 5 occurrences)
		T&E	SOC	SOI	T&E	SOC	SOI	
Rare Communities on mafic or calcareous substrates requiring open canopy conditions	24		2	5	2	3	12	5
Rare Communities in wetlands: seeps, bogs, other hydric types	7			2		1	4	2
Woodlands and openings; includes sun-loving species and species that hunt in open habitats	21	2	2	10		3	4	3
Mesic forests or microhabitats within mesic forests	11		2	5		1	3	6
Species that require wetlands or water for a portion of their lifecycle	7	1					6	1
Total	70	3	6	22	2	8	29	17
Very rare species: species included in the above groups documented at < 5 locations on the UWNF		1	2	14				17

Table 22. Number of species element occurrences on the UWNF within species habitat groups by status (T&E = federally listed as threatened or endangered, SOC = species of concern, SOI = species of interest)

Species Habitat Group (species that occur in the following habitats)	# of Spp.	documented occurrences			
		total	T&E	SOC	SOI
Rare Communities on mafic or calcareous substrates requiring open canopy conditions	7	21	0	6	15
Rare Communities in wetlands: seeps, bogs, other hydric types	2	2	0	0	2
Woodlands and forest openings	14	100+	30	9	100+
Mesic forests or microhabitats within mesic forests	7	12	0	6	6
Species that require wetlands or water for a portion of their lifecycle	1	1	1	0	0
Total documented occurrences	33	100+	31	21	100+

Table 23. Species that occur within the Species Groups (species in bold have been documented on the UWNF). Underlined species have been documented at < 5 locations on the UWNF.

Rare Communities associated with	**T&E:** smooth coneflower, Michaux's sumac **SOC:** **<u>Pursh's wild petunia</u>, glade wild quinine**, prairie blue wild indigo, American barberry, Yadkin river goldenrod

mafic or calc. rock and open canopy conditions	**SOI: Southern anemone, Heller's rabbit tobacco, bluff oak, ringed witch grass, Carolina thistle,** Missouri rockcress, , crested coralroot, glade milkvine, prairie goldenrod, Southeastern bold goldenrod, Wright's cliff-brake, Indian physic, swamp white oak, prairie dock, Western rough goldenrod, narrow-leaf aster, glade bluecurls
Rare wetland Communities	**SOC:** bog spicebush **SOI: mole salamander, four-toed salamander,** bog oatgrass, littleleaf sneezeweed, Red Canada lily, Canby's bulrush
Woodlands / openings (includes spp. that hunt in openings)	**T&E: red-cockaded woodpecker, Schweinitz's sunflower** **SOC: large witch hazel, Georgia aster,** Bachman's sparrow, Carolina birdfoot-trefoil, Chapman's redtop **SOI: loggerhead shrike, mottled duskywing, brown-headed nuthatch, Northern bobwhite, Eastern wood pewee, prairie warbler, red-headed woodpecker, thin-pod white wild indigo, smooth sunflower, piedmont indigo-bush,** Eastern fox squirrel, sharp-shinned hawk, grasshopper sparrow, thick-pod white wild indigo,
Mesic forests	**SOC: piedmont aster, ravine sedge,** Carolina alumroot **SOI: dissected toothwort, piedmont horsebalm, mountain camellia, Virginia spiderwort, prostrate blue violet,** American bittersweet, Eastern shooting-star, Yadkin hedge nettle
Near Wetlands	**T&E: bald eagle (T&E),** Eastern tiger salamander, dwarf salamander, Rafinesque's big-eared bat, silver-haired bat, southeastern myotis, heart-leaf plaintain

43.25 – Plan Components for Species Diversity & 43.26 – Evaluation of Plan Components on Species Diversity

The UWNF provides habitat for a significant portion of all known occurrences of several species-of-concern and species-of-interest and is at the center of the range and supports multiple populations of one Federally-listed species (Section 4.3) – the Schweinitz's sunflower. Therefore, although the UWNF represents only a fraction of the Carolina Slate Belt and Southern Triassic Uplands, its contribution to the sustainability of these species may be considerable. For example:

- documented occurrences of 3 species-of-concern and 1 species-of-interest on the UWNF account for > 50% of the total occurrences in the 2 subsections; they include:
    - *Cirsium carolinianum* (79% of 14 occurrences) G5, S1
    - *Carex impressinervia* (71% of 7 occurrences) G1G2, S1 FSC
    - *Fothergilla major* (70% of 10 occurrences) G3, S2
    - *Amorpha schwerinii* (61% of 102 occurrences) G3, S3
- documented occurrences of 5 species-of-interest on the UWNF account for 25-40% of the total occurrences in the 2 subsections; they include:
    - *Ambystoma talpoideum* (40% of 5 occurrences) G5, S2
    - *Helenium brevifolium* (33% of 3 occurrences) G3G4, S1
    - *Helianthus laevigatus* (32% of 50 occurrences) G4, S2
    - *Baptisia albescens* (30% of 30 occurrences) G4, S2
    - *Tradescantia virginiana* (25% of 4 occurrences) G5, S1

Plan components for ecosystem diversity identified in section 43.15 should satisfy most species diversity objectives on the UWNF. Thinning, prescribed burning, and ecosystem restoration objectives will improve and maintain habitat conditions and habitat

connections for the species habitat groups and will maintain suitable habitat that is not currently occupied but has a likelihood of being occupied in the future by species identified as potential species-of-concern or species-of-interest. However, additional plan components are needed to contribute to the diversity of several native plant and animal species on the UWNF:

- Species within the rare community and open woodlands habitat groups, and
- Species with less than 5 documented occurrences on the UWNF.

Most rare communities (those on mafic or calcareous substrates or in wetland conditions) are imbedded within broader ecological systems and will therefore benefit from management in those Systems following plan components directed at improving composition, structure, and ecological processes. Rare communities have a disproportionately large number of documented T&E, SOC, or SOI species (7 total) and an even larger number of SOC or SOI species (17 total) not documented but likely to occur on the UWNF based on their habitat preference. Rare communities, because of their small size or because they are often difficult to recognize, are often overlooked or misidentified in the field. Therefore, beyond provisions providing characteristics of ecosystem diversity, the following program management emphasis is needed to help ensure self-sustaining rare species populations within rare communities:

Program management emphasis:

- Coordinate with the NC Natural Heritage Program in providing field training to identify rare Ecological Systems (Glade and Barrens, Mafic Hardpan Woodlands, Depression Swamps, and Seepage Wetlands) for all District employees especially Forester's, Forest Technicians, and other Resource Technicians at least every 3 years.

Plan components for ecosystem diversity should especially benefit species in the Woodlands habitat group. Species in this group are sun-loving and have declined in the past due to competition from other vegetation; competition that should be reduced following ecosystem diversity objectives for prescribed burning and thinning. However, some of these species are at risk because they are found primarily in roadside habitats prone to mowing or herbicide damage or in Southeastern Interior Longleaf Pine Woodlands that have significantly declined from historic levels. Therefore, the following additional provisions, beyond those for providing characteristics of ecosystem diversity, are needed to ensure self-sustaining species populations for some species found in Woodland habitats:

Desired Condition

- Schweinitz's sunflower is restored throughout the plant's historical range across the forest.

Objectives

- Restore or reintroduce 5 to13 subpopulations of Schweinitz's sunflower in woodlands or openings in forests over the next fifteen years.

- Over the planning period, relocate at risk populations of Schweinitz's sunflower adjacent to roads or railroads to sites more appropriate for long-term maintenance of the populations.
- Create prairie-like openings of ½ to 2 acres in size within longleaf pine and oak-hickory restoration areas that are within the Schweinitz's sunflower HMA.

Guidelines

- Roadside banks should not be mowed before flowering and seed development where Threatened, Endangered, Species of Concern, or Species of Interest occur.

Species-of-concern and species-of-interest that have been documented on less than 5 sites on the UWNF occur in all five species habitat groups (**Tables 21-23**). Although these species will benefit from plan components for ecosystem diversity, their risk of extirpation is aggravated by their extreme rarity and small population size. Therefore, the following additional provisions, beyond those for providing characteristics of ecosystem diversity, are needed to ensure self-sustaining species populations for these very rare species:

Guideline

- Reduce impacts from all activities that might affect rare species having less than 5 known occurrences on the UWNF and maintain existing self-sustaining populations.

Monitoring

- Visit all documented locations of T&E species and species-of-concern having less than 5 known occurrences on the UWNF within the first 3 years of plan implementation (2007-2010) and at least once every 3 years thereafter. Visit all documented locations of species-of-interest within the first 5 years of plan implementation (2007-2010) and at least once every 3 years thereafter. Document each visit using the standard North Carolina Natural Heritage Program rare species element occurrence forms and include documentation on habitat maintenance and improvement needs. These species include:
    - 1 federally listed bird: the Bald Eagle
    - 2 species-of-concern: Piedmont Aster, Pursh's Wild-petunia
    - 12 species-of-interest: Southern Anemone, Piedmont Horsebalm, Heller's Rabbit-Tobacco, Virginia Spiderwort, Dissected Toothwort, Mole Salamander, Four-toed Salamander, Loggerhead Shrike, Mottled Duskywing, Bluff Oak, Mountain Camellia, and Prostrate Blue Violet.

- Visit all documented locations of T&E species, species-of-concern, and species of interest, except G4G5 species, during implementation of plan (2007-2022) and determine the condition of each element occurrence.

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Appendix A. Mapping Ecological Systems and Potential Plant Communities on the Uwharrie National Forest: First Approximation

Introduction

The purpose of this mapping effort is to quantify the distribution and abundance of potential plant communities relative to environments on the Uwharrie National Forest in order to provide a mid-level map useful for Forest Planning. Ecological systems (NatureServe 2004), groups of plant associations occurring in regions of similar physical conditions and biological potential, are numerous and varied on the Uwharrie National Forest. Sites within ecological systems may be characterized by geologic formation, landform, aspect and other physical variables that combine to form environments of varying temperature, moisture, and fertility, which are suitable to support characteristic species and forests. Using NatureServe ecological systems as a framework, we have developed a map of potential plant communities using environmental variable-based models that we believe can provide insight on the "capability" of land and can assist land managers and planners in implementing ecosystem management policies.

Methods

Map Area

The mapped area consists of a 16-USGS quad area centered on the Uwharrie National Forest (the Forest). This area includes the following 1:24,000 scale quads: Asheboro, Badin, Biscoe, Candor, Eleazer, Farmer, Handy, Harrisville, Highrock, Lovejoy, Morrow Mountain, Mt. Gilead East, New London, Seagrove, Star, and Troy.

Field Data

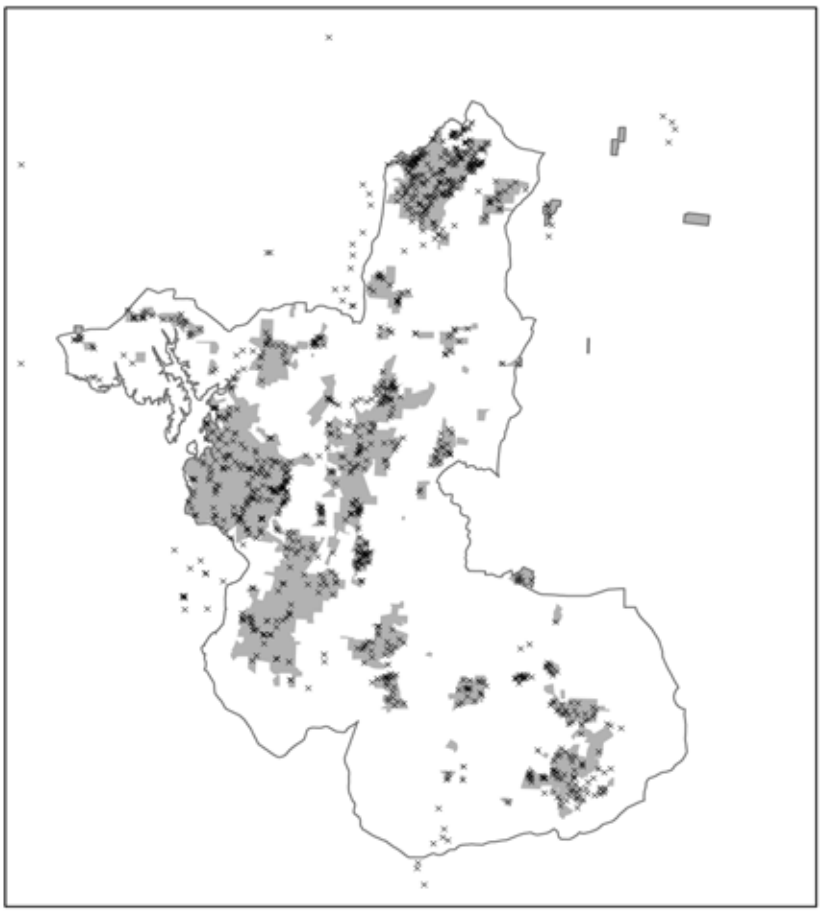
Much of the vegetation field data was obtained in 2004 from a U.S. Forest Service (USFS) contract with Alan and Allison Weakley. Briefly, the contract included: 1) the collection of species presence and abundance data from reference sites used to characterize all major and important minor plant community types on the Forest, 2) the collection of location (latitude & longitude) data on a larger number of areas to identify the range of sites that support or could potentially support plant community types on the Forest, and 3) location data for rare plant species. After visiting a sample of the Weakley's field sites, additional field data were obtained during the summer of 2005 by Gary Kauffman (USFS botanist) and Steve Simon (USFS plant ecologist). They collected additional location data for community types and / or potential community types to augment information on site potential across the Forest. All vegetation plots were located using a global positioning system (GPS).

Grouping of Plant Communities

The 15 common plant community types identified by the Weakley's were logically grouped into 8 ecological systems / plant community groups by comparing field classifications and descriptions to those described by NatureServe (2004). Some of these groups are combinations of NatureServe ecological systems while other groups split ecological systems into their component plant associations. These groups, and the

number of field plots associated with each, are listed in table 1 (following the text); plot locations are shown on Figure 1.

Figure 1. Location of vegetation field data points (x) on the Uwharrie National Forest (outlined) (shaded areas are administered by the USFS)



Database Creation and Model Application

Application of the environmental variable-based plant community models required development of a spatial database for the study area. Source data were acquired from U.S. Geological Survey 10-m resolution DEMs. Edge matching and smoothing procedures were applied to all DEMs using the ArcGrid GIS to produce a seamless grid of elevations for the entire study area. This elevation grid was processed using algorithms from various sources (table 2) to produce estimates of derived terrain and environmental variables; e.g. aspect, slope gradient, landform index.

Table 2: Variables used in the Uwharrie Plant Community Models 1st Approximation (12/28/2005)

Elevation: **elevation above sea level in feet derived from a 10 meter DEM with sinks filled. Source: ESRI**

Aspect: Beers transformation of land surface aspect from azimuth (0-360) to cosine representation [0.00-2.00]. (Beers et.al. 1966). Source: TopoMetrix (1999)

Solar radiation: a pseudo-solar radiation derived from shaded relief represented by values ranging from 0 to 255, with 0 representing the darkest areas and 255 the brightest. The azimuth angle of the light source is set on 200 and the angle set at 45. Source: ESRI (solar radiation = HILLSHADE (elevation-grid, 200, #,shade).

Slope steepness: the percent rise in elevation from the adjacent land area. Calculated as the maximum rate of change in z value from each 10 m grid cell. Source: ESRI**.**

Surface curvature profile: the curvature of the ground surface in the direction of slope. Source: ESRI

Surface curvature planiform: the curvature of the ground surface perpendicular to the slope direction. Source: ESRI

Terrain shape index: the average curvature of the ground surface. A positive curvature indicates that the surface is upwardly convex. Source: ESRI

Landform Index: (LFI): An index of landform shape (site protection) and macro-scale landform. Larger number = more concave shape, more protected landform. From: *McNab, W.H. 1996. Classification of local- and landscape-scale ecological types in the Southern Appalachian Mountains. Environmental Monitoring and Assessment 39:215-229.* Source: TopoMetrix

Relative Slope position: a measure of the cell position along a slope in relationship to the nearest ridge and drainage. Relative slope position (Wilds 1996) uses (1) a threshold level of flow accumulation to represent slope bottom, (2) the difference between mean elevation and highest elevation in a moving window to represent ridges, and (3) flowlength to calculate distance. Values range from 0 to 1: ridges = 1, valley bottoms = 0. Source: Stephanie Wilds

Topographic Relative Moisture Index (TRMI): Based on the weighted scalar developed by Parker (1982). TRMI combines aspect, slope, slope configuration (curvature) and relative slope position. Source: Stephanie Wilds

Distance to Stream: Euclidian distance to the nearest modeled stream, regardless of stream order. Source: ESRI

A GIS was used to assign each vegetative plot to the appropriate cell in the DEMs. Environmental variables were determined for each plot by merging the location with the 10-m resolution digital elevation and environment grids. In total, 11 grids were merged with an ARC point coverage that contained approximately 1100 plot locations. A database was created that included the plot number, plant community type (Weakley's), plant community group, and the 11 environmental characterization variables listed above.

Vegetation and Environment Relationships

We selected logistic regression for developing models to predict the probability of occurrence of plant communities in differing environments. We used ordinary multiple logistic regression to determine environmental variables associated with the presence or absence of the 8 plant community groups at field sample plot locations. Both presence and absence data characterized environmental limits of occurrence. Model accuracy was evaluated using several standard measures of logistic regression performance, which included classification tables, receiver operating characteristic (ROC) curves, and selection of probability cut points using sensitivity and specificity.

Each of the 8 logistic plant community models was applied to the DEMs representing environmental, variables. The resulting 8 map layers represent the probability of occurrence, ranging from zero to 1, of each plant community group in each 10-m (33-foot, 0.2 acre) cell of the DEM grid for the 16-quad, 660,000 - acre mapped area. Typically, the centers of areas of highest probabilities were at sample plot locations, where environmental data were obtained to generate the plant community group model. Clusters of cells where the plant community group was classified as present represent regions of probabilities.

Incorporating Geologic Formation, a surrogate for Fertility, into Model Predictions

One of our interests in this mapping effort was to determine the historic distribution of longleaf pine plant communities across the Forest in order to address plant community restoration needs. Additional effort was made in the field to examine forests at the edge of the current distribution of longleaf pine on the Forest and surrounding areas. The relationship between longleaf pine, soil type, and geologic formation was evaluated at field locations where longleaf pine was found and in map features where longleaf pine was described in the USFS continuous inventory of stand condition (CISC) GIS coverage. It was clear from this analysis that longleaf pine almost never occurs in areas with high base rocks, i.e. mafic areas, and that it is most often associated with only 1 soil type – the Herndon series. The map area was therefore divided into two model sections using the break between the metamudstone – metaargillite geologic formation and the felsic metavolcanic geologic formation to define the western extent of longleaf pine, and the pattern of Herndon soil map unit abundance to define the northern extent of longleaf pine. We refer to the two model sections as the northwest section and the southeast section.

Creating a single map of Plant Community Groups

Mapping of plant community groups involved combining individual models to form a single GIS coverage and establishing a boundary in the transition area between adjacent plant community groups. The boundaries often are broad and usually support more than one system. We used the stacking order feature in ArcGrid to resolve classification conflicts in areas where multiple plant community groups were predicted. All plant community group models were arranged in vertical sequence from highest, on top of the stack, to lowest predictive power. Themes in ArcGrid at the top of the stack take precedence over those below, so in areas of overlap, the upper themes in descending order obstruct the view of those below. Using an iterative process, stacking order and probability cut points were adjusted until the pattern of plant community groups appeared reasonable and closely matched classifications made at field plots. The minimum map unit was set at 1 acre. This process was used twice – once for the southeast section with all eight-plant community groups being included, and once for the northwest section with only seven plant community groups being included, i.e. the longleaf pine model was not included in the northwest section. A single map of plant community groups was created by joining together the northwest and southeast sections.

Results

We identified 8 common plant community groups on the Forest that could be modeled using environmental variables and 4 rare plant communities that we represented by points based on field inventories. The map of plant community groups is an approximation of the distribution and abundance of pre-settlement plant communities. Statistics and significant variables associated with development of the models are presented in Table 3. The areas under the ROC curves all exceed 0.70, which suggests the models have acceptable to excellent discrimination capability (Hosmer and Lemeshow 2000). The high ROC values of most logistic models suggest that ecological systems described by NatureServe, some of which were combined or disaggregated for this study, are associated with sites having unique environmental characteristics.

The map of plant community groups illustrates the strong influence of topography on the distribution of site potentials and plant species on the Forest. For example, Xeric Oak communities that are characterized by chestnut oak dominance (NatureServe) are mapped only on exposed ridges, especially at higher elevations; dry oak-hickory characterized by southern red oak is distributed along the convex portions of hillsides and low ridges and occur adjacent to Dry-mesic oak-hickory in the concave draws. Similarly, shortleaf pine-oak is distributed predominantly on steep slopes with a southerly exposure while mesic hardwood slopes are on more protected steep slopes. Finally, alluvial and mesic forests are mapped along streams and toe slopes and longleaf pine occupies topography similar to dry-oak hickory but is restricted primarily to the southeastern portion of the Forest.

Discussion

This product is a mid-level map for use in Forest Planning and should therefore be evaluated in the context of the intended analysis application and the management decision the data and analysis are intended to support, e.g. ecological sustainability analysis. This evaluation should consider the needs of the desired level of precision (i.e., the level of thematic detail) with the desired level of accuracy and should provide the basis for evaluating the level of uncertainty that is acceptable to support particular management decisions at the forest planning level.

Map units were further divided by incorporating important differences in soil chemistry that may affect site fertility. The Wynot, Enon, and Cullen soils formed in clayey residuum weathered from mafic rocks or mixed mafic and felsic crystalline rocks are less acidic than other more common soils on the Forest. This characteristic was used to differentiate between the "basic" oak hickory communities that could likely support chalk maple, shagbark hickory, redbud, and cedar and those oak-hickory communities where these species are not likely to occur. This was done only for those areas where soil mapping was complete and map units digitized, i.e. lands administered by the USFS on the Uwharrie National Forest.

Table 3 – Environmental variables included in plant community group models

Environmental variable	Xeric Oak	SL Pine-Oak	Dry Oak-Hick.	D.mesic Oak-Hick.	Mesic HW slope	Mesic-Alluvial	Small Stream	Longleaf Pine
Elevation	2 +	3 -	-	-	2 -	2 -	4 +	-
Aspect	4 -	-	5 +	4 +	5 -	-	-	5 +
Solar radiation	-	-	4 -	-	-	6 -	2 +	6 -
Slope steepness	-	-	-	5 +	1 +	1 -	5 +	2 -
Surface curvature profile	-	-	-	-	-	-	-	-
Surface curvature planiform	-	-	-	-	4 -	-	-	-
Terrain shape index	-	-	-	-	-	-	-	-
Landform index	3 +	2 +	6 -	2 -	-	4 +	-	1 -
Relative slope position	-	-	3 +	3 -	-	5 +	3 -	7 -

Terrain moisture index	-	1 -	1 -	-	3 +	-	-	3 -
Distance to stream	1 +		2 -	1 -	-	3 -	1 -	4 -
ROC	0.97	0.99	0.82	0.77	0.92	0.94	0.93	0.84

Whole numbers in columns indicate the relative level of importance of significant variables in each plant community group model and sign of the coefficient. ROC, or receiver operating characteristic, is a plot of sensitivity over 1 minus specificity: sensitivity is a measure of accuracy of predicting on occurrence and specificity is a measure of predicting nonoccurrence. A model with an area under the ROC curve > 0.7 is considered to have acceptable discrimination capability; models with ROC values > 0.8 are considered to be excellent (Hosmer and Lemeshow 2000).

Table 4 – Plant community groups on the Uwharrie National Forest and Vicinity

Plant Community Group	Total area		Federal land	
	no. acres	*percent*	*no. acres*	*percent*
Xeric Oak Forest	20,500	3.3	3,050	6.0
Shortleaf Pine-Oak Woodland	172	0.04	94	0.2
Dry Oak-Hickory	217,800	35.0	21,480	41.9
Dry-mesic Oak-Hickory	188,400	30.3	16,200	31.6
Mesic Hardwood Slope	3,655	0.6	44	0.3
Small Stream Forest	1,915	0.3	140	0.3
Alluvial & Mesic Forest	50,480	8.1	2,560	5.0
Longleaf Pine Woodland	138,600	22.3	7,700	15.1
Total	621,600		51,270	8.2

Table 1. Point data used to develop Uwharrie Plant Community models

PLANT COMMUNITY GROUP MAP UNIT	ECOLOGICAL SYSTEM	PLANT COMMUNITY (Weakley')	Weakley's field plots	Simon/ Kauffman Plots 1/	Total Data Pts. 2/
Xeric Oak Forest	Southern Piedmont Dry Oak-(Pine) Forest	Piedmont Monadnock Forest	45	195	240
Shortleaf Pine-Oak Woodland	Southern Piedmont Dry Oak-(Pine) Forest	Shortleaf Pine-Oak Savanna	6	0	6
Dry Oak-Hickory Forest	Southern Piedmont Dry Oak-(Pine) Forest	Dry Oak-Hickory	96	124	240
		Dry Basic Oak-Hickory	16		
Dry-Mesic Oak-Hickory Forest	Southern Piedmont Dry Oak-(Pine) Forest	Dry-Mesic Oak-Hickory	55	140	221
		Dry-Mesic Basic Oak-Hickory	26		
Mesic Hardwood Slope Forest	Southern Piedmont Mesic Forest	Basic Mesic Forest	6	20	26
Mesic and Alluvial Forest	Southern Piedmont Mesic Forest	Mesic Mixed Hardwood Forest	9	143	182
	Southern Piedmont Large Floodplain Forest	Piedmont Alluvial Forest	27		
		Piedmont Bottomland Forest	1		
		Piedmont Levee Forest	2		
Small Stream Forest	Southern Piedmont Small Floodplain and Riparian Forest	Piedmont Small Stream Forest	22	47	70
		Piedmont/Coastal Plain Heath	1		
Longleaf Pine Woodland	Southeastern Interior Longleaf Pine Woodland	Piedmont Longleaf Pine Forest	20	66	89
		Piedmont LL Pine Seepage Bog	3		
NOT MODELED					
Represented by points	Southern Piedmont Glade and Barren	Basic Piedmont Bluff Glade	1	1	19
Represented by points	Southern Piedmont Mafic Hardpan Woodland	Xeric Hardpan Forest	8	1	9
Represented by points	Southern Piedmont/Ridge and Valley Upland Depression Swamp	Upland Depression Swamp Forest	6	2	11
Represented by points	Southern Piedmont Seepage Wetland	Piedmont Boggy Streamhead	6	5	50

1/ field plots (GPS and veg. Type), GPS and veg. Type derived from soils (alluvial only), NC Heritage community EOs, and extrapolations. 2/ includes additional data points from NC Natural Heritage Program Community Element Occurrences

Appendix B: Ecological System descriptions and ecological condition evaluations

Format of write-up

Derivation: The data source used to define the reference condition.
Environment: Topographic setting, slope position and steepness, soil drainage class and texture, geologic substrate, temperature-moisture-fertility relative to other types.
Disturbance regime: Natural disturbance processes and fire regime.
Abundance and distribution on the Uwharrie NF: The approximate number of acres that could occur on the UWNF derived from environmental modeling, total existing acres, and primary location.
Potential abundance relative to potential in the surrounding 4 counties: The proportion of the potential acres on the UWNF relative to potential acres within Montgomery, Randolph, Stanley, and Davidson counties.
Composition and structure (reference condition): A description of the overstory, midcanopy, and understory tree, shrub, and herb structure (canopy closure and gap size) and composition (dominant and characteristic species) based primarily on NatureServe (2004) and/or Schafale and Weakley (1990). Species common and scientific names are listed in **Table 2** following all descriptions. These descriptions are considered an approximation of composition and structure before European settlement and include the effects of natural and Indian-caused disturbances such as fire.
Rare species documented in this ecological system: Federally listed threatened or endangered species, potential species-of-concern, and species-of-interest that occur or may occur in this ecological system based upon habitat preference. Habitat preference is defined as one of the following:

- obligate – species is documented in only one ecological system and is likely self-sustaining only in habitat conditions found in this type – or species is wetland dependent and self-sustaining in only 2 ecological systems
- optimal – preferred habitat for a species that is self-sustaining in this and 1-2 other ecological systems
- suitable – species is self-sustaining in this and other ecological systems
- marginal – species can occur but habitat conditions are more suitable in other ecological systems

Ecological condition benchmarks within the potential extent of this system: format described in section 43.12. For this analysis, the potential extent is considered optimal.

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Southeastern Interior Longleaf Pine Woodland

Derivation: Piedmont Longleaf Pine Forest (Schafale and Weakley 1990). Southeastern Interior Longleaf Pine Woodland Ecological System (NatureServe 2004).
Environment: Flats and slopes of low, rolling topography over felsic rock on very deep, often very stony, well-drained soils with moderate permeability. Occasionally on steeper, south-facing slopes. Some of the drier sites on the Uwharrie NF and similar to sites supporting Dry Oak-Hickory ecological systems.
Disturbance regime: Exposed low ridges and flats somewhat susceptible to disturbance by high winds and limited lightening. Disturbance by fire highly variable from pre-European settlement till present day. Extensive burning by American Indians before European settlement likely continued by early settlers and augmented by a moderately dense herbaceous herb layer and continuity of landscapes or "fire compartments." Lack of fire, conversion of land to agriculture, and old-field abandonment, has occurred since this period. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside forests approximately 8,300 acres potential, 1,730 acres currently dominated by longleaf pine. Primarily in the southeastern and south-central portion of the Forest. Common near Troy, NC.
Abundance relative to the potential in the surrounding 4 counties: 10.4% of 73,300 potential acres.
Composition and structure (reference condition): Multi-aged woodland (25%-60% tree cover) with treeless canopy gaps occasionally as large as 1/4 acre in size; ½ to 2 acres in size on sites suitable for Schweinitz's sunflower. Canopy dominated by longleaf pine with occasional shortleaf pine and oaks or codominated by longleaf and shortleaf pine with occasional oaks. Characteristic hardwood associates may include: post oak, southern red oak and blackjack oak. Open (< 10% cover) midcanopy and shrub layer; characteristic species would include hillside blueberry, New Jersey tea, and common chinquapin. The herb layer is nearly continuous, diverse and includes characteristic species such as little bluestem, splitbeard bluestem, Virginia goat's-rue, yellow Indiangrass, poverty oat-grass, silky oat-grass, southern bracken, licorice goldenrod, Maryland goldenaster, leafy elephant's-foot, hyssopleaf eupatorium, late eupatorium, threadleaf coreopsis, common stargrass, helmet flower, starved witch grass, and forked witch grass.
Rare species documented in this Ecological System:

Name	Status [1/]	Habitat preference
red-cockaded woodpecker	Federally Endangered	optimal habitat in system
Schweinitz's sunflower	Federally Endangered	optimal habitat in system
smooth sunflower	potential SOI	optimal habitat in system , obligate?
thin-pod white wild indigo	potential SOI	suitable habitat in system
Carolina thistle	potential SOI	suitable habitat in system

[1/] SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by longleaf pine	> 75%	55%-75%	30%-55%	< 30%	23%	Poor
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 75%	55%-75%	30%-55%	< 30%	7% [2/]	Poor
Canopy Structure	Percent of acreage with canopy gaps ½ to 2 acres in size	> 75%	55-75%	30-55%	< 30%	unknown	unknown
Fire Regime	Percent of acreage burned at least twice in the last decade	> 75%	55%-75%	30%-55%	< 30%	17%	Poor
Abundance of reference condition	Percent of acreage at desired condition for all three indicators above	> 50%	30%-50%	10%-30%	< 15%	3% [3/]	Poor

[1/] desired canopy closure is 25%-60% [2/] in Botanical SIA or > 80 years in age , [3/] occurs only in Botanical SIA

Xeric Oak Forest

Derivation: Piedmont Monadnock Forest (Schafale and Weakley 1990). Southern Piedmont Dry Oak-(Pine) Forest Ecological System (NatureServe 2004).
Environment: Exposed high ridges and knolls (commonly called Monadnocks), mostly over felsic or other highly resistant rock, on well-drained, moderately permeable, extremely stony and extremely boulder soils. Some of the hottest and driest sites on the Uwharrie NF.
Disturbance regime: Susceptible to disturbance by high winds and lightning but fire does not carry well in the typically sparse herb layer and rocky soil surface. Canopy gaps likely more frequent than other ecological systems. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Approximately 2,900 acres potential, 1,750 acres existing. Most common in the Badin Lake area, Birched Wilderness, and Woods Run area.
Abundance relative to the potential in the surrounding 4 counties: 30% of 9,650 acres potential.
Composition and structure (Reference condition): Patchy canopy dominated by chestnut oak with canopy gaps less than ¼ acre in size. Common associates may include: white oak, post oak, southern red oak, pignut hickory, and shortleaf pine. Patchy and open midcanopy dominated by sourwood, and blackgum. Scattered shrub layer includes characteristic species such as: hillside blueberry, deerberry, and black huckleberry. Sparse (< 30% cover) herb layer includes characteristic species such as pipsissewa, woodland Tick-trefoil, little bluestem, and Virginia goat's rue.
Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Schweinitz's sunflower	Federally Endangered	marginal habitat in system
American barberry	potential SOC	optimal habitat in system
large witch alder	potential SOC	suitable habitat in system
Georgia aster	potential SOC	suitable habitat in system

Indian physic	potential SOI	obligate of system
Piedmont indigo bush	potential SOC	optimal habitat in system
narrow-leaved aster	potential SOI	optimal habitat in system
Chapman's redtop	potential SOI	optimal habitat in system
thin-pod white wild indigo	potential SOI	suitable habitat in system
eastern prairie blue wild indigo	potential SOI	suitable habitat in system
thick-pod white wild indigo	potential SOI	suitable habitat in system
crested coralroot	potential SOI	suitable habitat in system
Carolina thistle	potential SOI	suitable habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by chestnut oak	> 85%	70%-85%	50%-70%	< 50%	15%	Poor
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 85%	70%-85%	50%-70%	< 50%	47% [2/]	Poor
Fire Regime	Percent of acreage burned at least twice in the last 15 years	> 85%	70%-85%	50%-70%	< 50%	15%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	25%-50%	< 25%	3% [3/]	Poor

[1/] desired canopy closure is 60%-80%, [2/] Oak-dominated CISC types > 60 years in age , [3/] occurs only in Botanical SIA

Dry Oak-Hickory Forest (felsic)

Derivation: Dry Oak-Hickory Forest (Schafale and Weakley 1990), *Quercus falcata-Quercus alba - Cary alba / Oxydendroum arboreum / Vaccinium stamineum* Forest (NatureServe 2004).
Environment: Dry topographic positions, (convex upper slopes, mid-slopes, and low ridges) over felsic rock on moderately deep to very deep, well drained, soil with moderate permeability; often very stony, extremely stony, or extremely boulder soils. Some of the drier sites on the Uwharrie NF.
Disturbance regime: Wind disturbance, although not commonly severe, in combination with old tree mortality promotes canopy gaps. Burning by American Indians likely impacted these sites although fire would have been of low impact in the typically sparse herb layer. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside Forests approximately 19,200 acres potential, 10,370 acres existing. This is the most abundant, non-successional ecological system on the Forest and is limited only on the eastern edge of Badin Lake and in the southeastern portion of the Forest where it is replaced by Longleaf Pine Woodlands.
Abundance relative to the potential in the surrounding 4 counties: 19% of 102,700 acres potential.

Composition and structure (desired condition): Relatively open canopy (60%-80% cover) with small (1/2 acre) to large (2 acre) canopy gaps. Forest dominated by dry site oaks or a mixture of oaks and up to 30% cover of shortleaf pine. Southern red oak, white oak, or post oak are the dominant species. Other characteristic trees include: chestnut oak, blackjack oak, black oak, scarlet oak, pignut hickory, mockernut hickory, and red hickory. Typical midcanopy trees include sourwood dogwood, and blackgum. Shrubs range from sparse to moderately dense, and may include hillside blueberry, deerberry, hairy highbush blueberry, and southern blueberry. The herb layer, although generally sparse, can be well developed in canopy gaps. Herbs include: rattlesnake plantain, hyssopleaf eupatorium, inland roundleaf eupatorium, Maryland goldenaster, licorice goldenrod, common stargrass, tick-trefoils, broomsedge, little bluestem, and yellow Indiangrass.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Schweinitz's sunflower	Federally Endangered	suitable habitat in system
witch alder	potential SOC	suitable habitat in system
winged witchgrass	potential SOI	optimal habitat in system
Piedmont indigo bush	potential SOI	optimal habitat in system
thin-pod white wild indigo	potential SOI	suitable habitat in system
smooth sunflower	potential SOI	suitable habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by oaks and hickories or these species codominating with shortleaf pine	> 75%	55%-75%	30%-55%	< 30%	55%	Fair to Good
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 75%	55%-75%	30%-55%	< 30%	42% [2/]	Fair
Canopy Structure	Percent of acreage with canopy gaps ½ to 2 acres in size	> 75%	55%-75%	30%-55%	< 30%	unknown	unknown
Fire Regime	Percent of acreage burned at least twice in the last 15 years	> 75%	55%-75%	30%-55%	< 30%	4%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 50%	30%-50%	10%-30%	< 15%	10% [3/]	Poor

[1/] desired canopy closure is 60%-80% [2/] Oak dominated stands > 40 years in age , [3/] occurs only in Botanical SIA

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Dry Oak-Hickory Forest (mafic)

Derivation: Basic Oak-Hickory Forest (Schafale and Weakley 1990), *Quercus alba - Cary glare - Fraxinus Americana / Acer leucoderme / Vitis rotundifolia* Forest; *Quercus alba - Quercus stellata - Cary carolinae-septentrionalis / Acer leucoderme - Cercis canadensis* Forest (NatureServe 2004).
Environment: Dry topographic positions, (convex upper slopes, mid-slopes, and ridges) over mafic rock on moderately deep to very deep, very stony to more often extremely boulder, well-drained soils. Some of the drier sites on the UWNF and similar to Dry Oak-Hickory felsic, and Longleaf Pine Woodland.
Disturbance regime: Wind disturbance, although not commonly severe, in combination with old tree mortality promotes canopy gaps. Burning by American Indians in low land areas likely impacted these sites although fire would have been of low impact in the typically sparse herb layer and rocky soil surface. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside Forest, approximately 2,200 acres potential, 1,300 acres existing.. Limited primarily to the eastern edge of FS lands at Badin Lake, near Big Creek east of highway 1301 and in the southeastern portion of the Birkheads. Most common in the Badin area.
Abundance relative to the potential in the surrounding 4 counties: 18% of 12,200 acres potential.
Composition and structure (desired condition): Relatively open to closed canopy with small (1/2 acre) to large (2 acre) canopy gaps. White oak is generally the most abundant tree. Other characteristic overstory trees include: chestnut oak, post oak, southern red oak, white ash, and pignut hickory. Other species in the canopy and subcanopy include: Carolina shagbark hickory, shortleaf pine, blackjack oak, chalk maple, redbud, and southern red cedar. The shrub and herb layers are generally sparse and may include the following species: farkleberry, whorled milkweed, northern oak grass, and pipssisiwa. The vine layer may be well-developed, and muscadine is common.
Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Schweinitz's sunflower	Federally Endangered	suitable habitat in system
Piedmont indigo bush	potential SOI	suitable habitat in system
American-ipecac	potential SOI	suitable habitat in system
crested coralroot	potential SOI	suitable habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by oak-hickory	> 85%	70%-85%	50%-70%	< 50%	52%	Fair
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 85%	70%-85%	50%-70%	< 50%	44% [2/]	Poor
Fire Regime	Percent of acreage burned at least twice in the last 15 years	> 85%	70%-85%	50%-70%	< 50%	8%	Poor

All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	25%-50%	< 25%	13% [3/]	Poor

[1/] desired canopy closure is 60%-80%, [2/] Oak-dominated CISC types > 70 years in age , [3/] occurs only in Botanical SIA

Dry-Mesic Oak-Hickory (felsic)

Derivation: Dry-Mesic Oak-Hickory Forest (Schafale and Weakley 1990). Southern Piedmont Dry Oak-(Pine) Forest Ecological System (NatureServe 2004).
Environment: Moderately sheltered topographic positions, (concave mid- and lower slopes, narrow draws) on moderately deep to very deep, often very stony to extremely boulder, well-drained soils with moderate permeability, over felsic rock.
Disturbance regime: Wind disturbance ameliorated over more exposed sites but aids in creation of canopy gaps. Burning by American Indians probably had little impact because fire would have carried quickly through the moderately dense herb layer. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside Forests, approximately 9,150 acres potential, 6,670 acres existing. This is the second most abundant non-successional ecological system on the Forest and is limited only on the eastern edge of Badin Lake.
Abundance relative to the potential in the surrounding 4 counties: 21% of 46,280 acres potential.
Composition and structure (desired condition): Relatively open canopy with small (1/2 acre) to large (2 acre) canopy gaps. Forest dominated by mixtures of oaks and hickories, with white oak the most common species along with northern red oak, black oak, mockernut hickory, red hickory, and pignut hickory. Shortleaf pine may be common but not a dominant component. Red maple, Sweetgum, and tulip poplar present in some stands but not in abundance. Typical midcanopy trees include American holly, sourwood, dogwood, and blackgum. Shrubs range from sparse to moderately dense, and may include downy arrowwood, deerberry, hillside blueberry, blue huckleberry, and American strawberry-bush. The herb layer, although generally sparse, can be well developed in canopy gaps. Herbs include: rattlesnake plantain, woodland tick-trefoil, rattlesnake hawkweed, broomsedge, and little bluestem.
Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
witch alder	potential SOC	suitable habitat in system
winged witchgrass	potential SOI	optimal habitat in system
Piedmont indigo bush	potential SOI	suitable habitat in system
Piedmont horsebalm	potential SOI	suitable habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by oak-hickory	> 75%	55%-75%	30%-55%	< 30%	65%	Good

	forests						
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 75%	55%-75%	30%-55%	< 30%	51% [2/]	Fair
Fire Regime	Percent of acreage burned at least twice in the last 20 years	> 75%	55%-75%	30%-55%	< 30%	9%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 50%	30%-50%	10%-30%	< 15%	11% [3/]	Poor

[1/] desired canopy closure is 60%-90% [2/] Oak dominated stands > 40 years in age , [3/] occurs only in Botanical SIA

Dry-mesic Oak-Hickory (mafic)

Derivation: Basic Oak-Hickory Forest (Schafale and Weakley 1990), *Quercus alba - Cary ovata / Cercis Canadensis* Forest; *Quercus alba - Quercus rubra - Carya glabra / Viburnum rafinesquianum / Viola tripartita* Forest (NatureServe 2004).
Environment: Moderately sheltered topographic positions, (concave mid- and lower slopes, narrow draws) on moderately deep to very deep, very stony to more often extremely boulder, well-drained soils over mafic rock.
Disturbance regime: Wind disturbance ameliorated over more exposed sites but aids in creation of canopy gaps. Burning by American Indians likely impacted these sites but would have little impact because fire would have carried quickly through the moderate herb layer or poorly through the rocky soil surface. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside Forests, approximately 820 acres potential, 625 acres existing. Limited primarily to the eastern edge of FS lands at Badin Lake, near Big Creek east of highway 1301 and in the southeastern portion of the Birkheads. Most common in the Badin area.
Abundance relative to the potential in the surrounding 4 counties: 17% of 4,985 acres potential
Composition and structure (desired condition): Closed canopy with small (1/2 acre) to large (2 acre) canopy gaps and moderately well-developed subcanopy, shrub, and herbaceous layers with about 25% total cover per stratum. Dominated by white oak or white oak and shagbark hickory in combination with other characteristic species of oak and hickory such as: post oak, chestnut oak, black oak, mockernut hickory, and pignut hickory. Red maple, Sweetgum, and tulip poplar may be present but not in abundance. Other species in the canopy and subcanopy include: redbud, winged elm, and shortleaf pine. Herbs include: ebony spleenwort, Carolina supplejack, black-edge sedge, Christmas fern, rattlesnake fern, and common foamflower.
Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Carolina alumroot	potential SOC	optimal habitat in system
Piedmont indigo bush	potential SOI	suitable habitat in system
Pursh's wild petunia	potential SOI	obligate of system
crested coralroot	potential SOI	suitable habitat in system
American-ipecac	potential SOI	suitable habitat in system
Carolina thistle	potential SOI	suitable habitat in system
sharp-shined hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by oak-hickory forests	> 85%	70%-85%	50%-70%	< 50%	74%	Good
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 85%	70%-85%	50%-70%	< 50%	54% [2/]	Fair
Fire Regime	Percent of acreage burned at least twice in the last 20 years	> 85%	70%-85%	50%-70%	< 50%	10%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	25%-50%	< 25%	14% [3/]	Poor

[1/] desired canopy closure is 60%-90%, [2/] Oak-dominated CISC types > 70 years in age , [3/] occurs only in Botanical SIA

Southern Piedmont Mesic Forest

Derivation: Mesic Mixed Hardwood Forest (Schafale and Weakley 1990), Southern Piedmont Mesic Forests (NatureServe 2004).
Environment: Sheltered topographic positions (concave lower slopes, steep north-facing slopes, narrow draws) on moderately deep to very deep, moderately well to well-drained soils, often with higher pH.
Disturbance regime: Severe wind storms, although rare, aid in creation of canopy gaps. Burning of bottomlands by American Indians to maintain open conditions for tending agricultural crops likely impacted sites in lower slope positions. However, because this ecological system occurs in moist and topographically sheltered sites, fire occurred only rarely and with low intensity beginning with European settlement and continuing to the present period. Fire regime condition classes I (0-35 year return interval; surface fires of mixed severity) and V (200 year return interval, stand replacement and mixed severity).
Abundance and distribution on the Uwharrie NF: Outside Streamside Forests, approximately 920 acres potential, 320 acres existing. This ecological system is scattered across the Forest but more common in the Badin area, and near Woods Run, Island Creek, and the Peakin area.
Abundance relative to the potential in the surrounding 4 counties: 6.5% of 14,500 acres potential
Composition and structure (desired condition): Closed, mature (> 70 years in age) canopy dominated by mesophytic trees. American beech is nearly always present. Other characteristic species include northern red oak, tulip poplar and red maple. White ash and shagbark hickory occur on higher pH soils. Typical understory trees include dogwood, and sourwood on more acidic soils and chalk maple, painted buckeye, and hop-hornbeam on more basic soils. The herb layer is dense with indicators of higher pH soils including: black cohosh, wild ginger, maidenhair fern, bloodroot and those indicators of lower pH soils including: Christmas fern, woodland tick-trefoil, common foamflower, common alumroot, fairywand, beechdrops, and rattlesnake fern.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Piedmont aster	potential SOC	obligate of system
ravine sedge	potential SOC	optimal habitat in system
Carolina alumroot	potential SOC	optimal habitat in system
dissected toothwort	potential SOI	obligate of system
American bittersweet	potential SOI	obligate of system
Virginia spiderwort	potential SOI	obligate of system
piedmont indigo bush	potential SOI	optimal habitat in system
silver-haired bat	potential SOI	optimal habitat in system
warbling vireo	potential SOI	optimal habitat in system
Carolina thistle	potential SOI	suitable habitat in system
Piedmont horsebalm	potential SOI	suitable habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by American beech and other trees characteristic of mesic sites	> 85%	70%-85%	50%-70%	< 50%	45%	Poor
Species Composition	Percent of acreage with less than 10% NNIS cover	> 85%	70%-85%	50%-70%	< 50%	68%	Fair
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 85%	70%-85%	50%-70%	< 50%	28% [2/]	Fair
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	25%-50%	< 25%	11% [3/]	Poor

[1/] desired canopy closure is 80%-100%, [2/] Stands > 70 years in age, [3/] one-half of stands in Botanical SIA

Streamside Forest

Derivation: One-hundred foot zone adjacent to perennial streams plus adjacent floodplain / alluvial soils; this is the estimate of the zone of stream influence (humidity, habitat adjacency) on adjacent forests and the influence of adjacent forests on streams i.e. the capability of adjacent forests to provide trees capable of adding large woody debris for hydrologic stability and in stream fish habitat; Piedmont/Mountain Bottomland Forest, Piedmont/Low Mountain Alluvial Forest, Piedmont/Mountain Levee Forest (Schafale and Weakley 1990); Piedmont Small Stream Forest (Schafale and Weakley 2005); Southern Piedmont Large Floodplain Forest Ecological System, Southern Piedmont Small Floodplain and Riparian Forest Ecological Systems. (NatureServe 2004). Also includes concepts from: Dry-mesic Oak-Hickory Forest (mafic and felsic), Mesic Forests, Dry Oak-Hickory Forest, and Longleaf Pine Woodland.
Environment: Topographically sheltered**,** Moist lowlands, adjacent to perennial streams/rivers on moderately deep to very deep, somewhat poorly to well-drained soils; some are very stony to extremely boulder.

Disturbance regime: Many sites frequently to occasionally flooded; most sites are seldom to never flooded but are adjacent to flood zones. Burning of bottomlands by American Indians to maintain open conditions for tending agricultural crops was very likely to have impacted these sites to a great extent, by excluding most tree, shrub, and herb species for many centuries. However, because this ecological system occurs in moist and topographically sheltered sites, fire occurred only rarely and with low intensity beginning with European settlement and continuing to the present period. Fire regime condition classes I (0-35 year return interval; surface fires of mixed severity) and V (200 year return interval, stand replacement and mixed severity).
Abundance and distribution on the Uwharrie NF: Approximately 6,900 acres delineated. This ecological system occurs across the Forest but is most prominent adjacent to the Uwharrie River, Moccasin Creek, upper Little Creek, Cheek Creek, and the upper reaches of the Little River south of Nancy's Mountain.
Abundance relative to the potential in the surrounding 4 counties: 10% of 70,000 acres potential.
Composition and structure (desired condition): Streamside Forests are a complex of 4 ecological systems that are centered on Large Floodplain and Small Floodplain - Riparian Forest ecological systems. These alluvial influenced systems comprise 23% (1,600 acres) of the complex. Dry-Mesic Oak Hickory Forests, which are adjacent to these systems, comprise 74% (5,110 acres) of the Streamside Forest zone but are seldom influenced directly by alluvial processes. Less than 4% (190 acres) of the zone includes Dry Oak Hickory Forests and Longleaf Pine Woodlands. These systems are described in detail at the beginning of this subsection.

In the floodplains of small to medium-sized streams, where flooding and alluvial processes have some, but limited, influence on vegetation, the canopy, subcanopy, shrub, and herbaceous layers are often well-developed. Widespread species such as sweetgum and tulip poplar may be common along with upland species as well as characteristic alluvial species such as sycamore and river birch. Other characteristic species may include: Common spicebush and common jack-in-the-pulpit. These forests may also be dominated by American beech, white oak, red oak, and green ash with a fairly dense, streamside shrub layer that includes ti-ti and mountain laurel, and an herb layer dominated by galax with wood anemone, northern green-and-gold, yellow yam, Christmas fern, and sedges.

In floodplain terraces and levees along larger streams and rivers the forest canopy is nearly complete to somewhat open and dominated by tulip poplar, sweetgum with water oak, sycamore, river birch, loblolly pine, and cherrybark oak. The understory is dominated by ironwood, silverbell, and common pawpaw. Giant cane often forms dense thickets. Species characteristics in the herb layer include: false nettle, Chrismas fern, Jack-in-the-pulpit, Virginia wild-rye, bluestem goldenrod, and slender spikegrass. Vines are frequently prominent, including poison ivy, Virginia creeper, crossvine, and wild grape. Aquatic and emergent communities of active and abandoned beaver ponds or similar small, man-made impoundments or floodplain pools are imbedded within this ecological system. These areas may contain the following shrubs: button bush, and Swamp rose, or floating or submergent aquatics herbs such as: green arrow-arum, water

lily, cowlily, hornwort, watermilfoil, pondweed, and arrowhead. These communities may be subject to severe disturbance from flooding at irregular intervals.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Yadkin river goldenrod	potential SOC	obligate of system
Rafinesque's big-eared bat	potential SOC	obligate of system
Eastern small-footed myotis	potential SOC	obligate of system
ravine sedge	potential SOC	optimal habitat in system
witch-alder	potential SOC	optimal habitat in system
Piedmont horsebalm	potential SOI	obligate of system
heartleaf plantain	potential SOI	obligate of system
bluff oak	potential SOI	obligate of system
Canby's bulrush	potential SOI	obligate of system
hedge nettle	potential SOI	obligate of system
piedmont indigo bush	potential SOI	optimal habitat in system
silver-haired bat	potential SOI	optimal habitat in system
warbling vireo	potential SOI	optimal habitat in system
sharp-shinned hawk	potential SOI	suitable habitat in system
mountain camellia	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of forests directly influenced by alluvial processes in this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by Sycamore, River birch, Sweetgum, Tulip poplar, Cherrybark oak, or Loblolly Pine	> 85%	70%-85%	50%-70%	< 50%	32%	Poor
Species Composition	Percent of acreage with less than 10% exotic species cover	> 85%	70%-85%	50%-70%	< 50%	32%	Poor
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 85%	70%-85%	50%-70%	< 50%	56% [2/]	Fair
Hydrologic Regime	Percent of acreage with unaltered hydrology	> 85%	70%-85%	50%-70%	< 50%	≈ 75%	Good
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	25%-50%	< 25%	7% [3/]	Poor

[1/] desired canopy closure is 80%-100%, [2/] Stands > 70 years in age, [3/] occurs only in Botanical SIA

Ecological condition benchmarks within the optimal extent of forests not directly influenced by alluvial processes in this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by oaks and hickories	> 75%	55%-75%	30%-55%	< 30%	60%	Good

Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 75%	55%-75%	30%-55%	< 30%	42% [2/]	Fair
Fire Regime	Percent of acreage burned at least twice in the last 20 years	> 75%	55%-75%	30%-55%	< 30%	18%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 50%	30%-50%	10%-30%	< 15%	10% [3/]	Poor

[1/] desired canopy closure is 60%-80% [2/] Oak-hickory CISC types > 70 years in age , [3/] occurs only in Botanical SIA

Shortleaf Pine-Oak Woodland

Derivation: *Pinus echinata-Quercus stellata-Quercus marilandica / Andropogon gyrans –Chrysopsis mariana* Woodland: Southern Piedmont Glade and Barrens Ecological System (NatureServe 2004) and, in part, *Pinus echinata-Quercus marilandica / Kalmia latifolia – Symplocos tinctoria* Woodland: Southern Piedmont Dry Oak-(Pine) Forest Ecological System (NatureServe 2004).
Environment: Exposed, often west to south-facing upper slopes, mostly over felsic rock on deep, well-drained, moderately permeable, and extremely stony and extremely boulder soils or over mafic rock on deep, well drained extremely boulder soils. These are some of the hottest and driest sites on the Uwharrie NF.
Disturbance regime: Susceptible to disturbance by high winds and lightning. Fire regime condition class IV (35-100 year return interval; mostly stand replacement severity).
Abundance and distribution on the Uwharrie NF: Uncommon, < 100 acres potential, 28 acres existing. Most all sites in the Badin Lake area.
Abundance relative to the potential in the surrounding 4 counties: 50% of 170 acres potential.
Composition and structure (Reference condition): Open woodland dominated by shortleaf pine, Virginia pine, and chestnut oak or by shortleaf pine, blackjack oak and chestnut oak. Other characteristic trees include: blackgum, white oak, scarlet oak, black oak on soils derived from felsic rock or Carolina shagbark hickory, persimmon, and white ash on soils derived from mafic rock. On felsic soils mountain laurel, horsesugar, and dwarf huckleberry may form a dense shrub layer with a sparse herb layer that may include: bushy broomsedge, northern oat grass, silky oat grass, and Virginia goat's rue. On mafic soils, characteristic shrub species include: farkleberry, southern blackhaw, redbud, and New Jersey tea with a diverse herb layer that may include: Elliott's broomsedge, butterfly pea, starved witch-grass, sand hills bean and many others.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Chapman's redtop	potential SOI	optimal habitat in system
American-ipecac	potential SOI	suitable habitat in system

[1/] SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by shortleaf pine	> 95%	85%-95%	70%-85%	< 70%	28%	Poor
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 95%	85%-95%	70%-85%	< 70%	68% [2/]	Poor
Fire Regime	Percent of acreage burned at least twice in the last decade	> 95%	85%-95%	70%-85%	< 70%	0%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	35%-50%	< 35%	28% [3/]	Poor

[1/] desired canopy closure is 25-60% [2/] occurs only in Botanical SIA

Southern Piedmont Glade and Barrens

Derivation: Low Elevation Rocky Summit, Piedmont Mafic Cliff, Piedmont Acidic Cliff (Schafale and Weakley 1990). Southern Piedmont Glade and Barrens (NatureServe 2004).
Environment: Rock outcrops on low elevation ridges and peaks, and very steep to vertical cliffs on stream bluffs, lower, or mid slopes. Soil is very shallow over mafic or felsic rock or accumulated in rock crevices.
Disturbance regime: Susceptible to disturbance by high winds in more exposed sites. Soil erosion by wind and water is probably common. Extensive burning by American Indians before European settlement did not likely impact these sites greatly because fire does not carry well in the very sparse herb layer and barren rock. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: This Ecological System is known from only 19 locations and is very limited in extent, occurring on less than 100 acres Forest-wide. Many sites are in the Badin Lake area near Falls Mountain, Shingle Trap Mountain, and above the Uwharrie river. Other prominent occurrences are at Dark Mountain, above Barnes Creek and Poison Fork between Dark Mountain and Long Mountain, at Walker Mountain, upper Wood Run, and Cedar Rock Mountain.
Abundance relative to the potential in the surrounding 4 counties: Unknown
Composition and structure (reference condition): Open woodlands to nearly treeless communities with highly variable composition. Open woodland canopy may be dominated by Virginia red cedar and winged elm with eastern red and Virginia pine. Other woody species include fringetree, pignut hickory, sand hickory, white ash, farkleberry, hillside blueberry, persimmon, and winged sumac. The sparse herb layer may be dominated by little bluestem. Other characteristic herb species include: whorled milkweed, long-stalked aster, ebony spleenwort, crossvine, hairy lipfern, silky oat-grass, starved witch grass, open-flower witch grass, pineweed, rock spikemoss, yellow Indian grass, and shielded-sorus polypody. On more acidic substrates post oak, chestnut oak, and pignut hickory may form an open canopy over little bluestem, oat grass, and needle grass. Many additional woodland plant community types are possible in this system.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
smooth coneflower	Federally Threatened	optimal habitat in system, obligate?
Schweinitz's sunflower	Federally Endangered	marginal habitat in system
Georgia aster	potential SOC	optimal habitat in system
American barberry	potential SOC	optimal habitat in system
southern anemone	potential SOI	obligate of system
Missouri rockcress	potential SOI	obligate of system
Eastern shooting star	potential SOI	obligate of system
glade milkvine	potential SOI	obligate of system
Wright's cliff-brake	potential SOI	obligate of system
thick-pod white wild indigo	potential SOI	optimal habitat in system
thin-pod white wild indigo	potential SOI	optimal habitat in system
Eastern prairie blue wild indigo	potential SOI	optimal habitat in system
ringed witch grass	potential SOI	optimal habitat in system
Heller's rabbit tobacco	potential SOI	optimal habitat in system
narrow-leaved aster	potential SOI	optimal habitat in system
Carolina thistle	potential SOI	suitable habitat in system
crested coralroot	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by characteristic tree species	> 95%	85%-95%	70%-85%	< 70%	unknown	unknown
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 95%	85%-95%	70%-85%	< 70%	unknown	unknown
Fire Regime	Percent of acreage burned at least twice in the last 20 years	> 95%	85%-95%	70%-85%	< 70%	0%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	35%-50%	< 35%	unknown	unknown

[1/] desired canopy closure is 0%-25%

Southern Piedmont Mafic Hardpan Woodland

Derivation: Xeric Hardpan Forest (Schafale and Weakley 1990). Southern Piedmont Mafic Hardpan Woodland Ecological System (NatureServe 2004).
Environment: Upland flats and gentle slopes mostly over mafic rock on moderately deep to very deep, often very stony or boulder, well-drained soils with slow permeability likely due to an impermeable clay subsoil.
Disturbance regime: Extensive burning by American Indians before European settlement likely impacted these sites. Fire regime condition class I (0-35 year return interval; surface fires of mixed severity).
Abundance and distribution on the Uwharrie NF: This Ecological System is known from only 9 locations and is very limited in extent, occurring on less than 30 acres Forest-

wide. The largest site is about 5 acres in size. Most (6) sites are in the Badin Lake area near the Arrowhead campground, West Branch, and above the Badin lake dam. One site is in the southern end of the Forest near the confluence of Cheek Creek and Sand Branch. Two sites occur at the headwaters of South prong of the Little River and Reedy Creek in the northern end of Forest. These are the only sites that do not occur in the Montgomery County Soil Survey on soils derived from mafic rock.

Abundance relative to the potential in the surrounding 4 counties: Unknown

Composition and structure (reference condition): Open woodland canopy dominated by, somewhat stunted, post oak and blackjack oak. A variety of other characteristics overstory tree species may be present including: Carolina shagbark hickory, white ash, pignut hickory, white oak, and black oak. Typical midstory and understory trees include: Virginia red cedar, persimmon, redbud, and winged elm. The understory shrub layer is sparse and may include: deerberry, farkleberry, and hillside blueberry. Characteristic species in the continuous herb layer include: needlegrass, northern oat grass, licorice bedstraw, Carolina jessamine, whip nutrush, saw greenbrier, glaucous greenbriar, and muscadine.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
Schweinitz's sunflower	Federally Endangered	optimal habitat in system
American barberry	potential SOC	optimal habitat in system
Georgia aster	potential SOC	optimal habitat in system
glade wild quinine	potential SOI	obligate of system
Western rough goldenrod	potential SOI	obligate of system
thick-pod white wild indigo	potential SOI	optimal habitat in system
thin-pod white wild indigo	potential SOI	optimal habitat in system
Eastern prairie blue wild indigo	potential SOI	optimal habitat in system
Heller's rabbit tobacco	potential SOI	optimal habitat in system
narrow-leaved aster	potential SOI	optimal habitat in system
Carolina thistle	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by Post oak and Blackjack oak	> 95%	85%-95%	70%-85%	< 70%	13%	Poor
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 95%	85%-95%	70%-85%	< 70%	13%	Poor
Fire Regime	Percent of acreage burned at least twice in the last decade	> 95%	85%-95%	70%-85%	< 70%	10%	Poor
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	35%-50%	< 35%	10%	Poor

[1/] desired canopy closure is 25%-60%

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Southern Piedmont / Ridge and Valley Upland Depression Swamp

Derivation: Upland Depression Swamp Forest (Schafale and Weakley 1990). Southern Piedmont / Ridge and Valley Upland Depression Swamp Ecological System (NatureServe 2004).
Environment: Upland flats, mostly over mafic rock on moderately deep to very deep, often very stony or boulder, well-drained soils with slow permeability.
Disturbance regime: Seasonal to intermittent flooding. Exposed upland susceptible to disturbance by high winds and limited lightening. Extensive burning by American Indians before European settlement likely impacted these sites, and during drought periods may have resulted in stand replacement. However, because this ecological system occurs in sites than may be moist to inundated for much of the year and understory fuels are sparse, fire probably occurred only rarely and with low intensity. Fire regime condition classes I (0-35 year return interval; surface fires of mixed severity) and V (200+ year interval; stand replacement and mixed severity).
Abundance and distribution on the Uwharrie NF: This Ecological System is known from only 11 locations and is very limited in extent, occurring on less than 15 acres Forest-wide. The largest sites are only about 2 acres in size. Most (7) sites are in the Badin Lake area near the Arrowhead campground, Badin Lake group campground, and above the Badin dam. Four sites are also known in upper Reedy Creek in the northern part of the Forest and 1 site is known near Walker Mountain.
Abundance relative to the potential in the surrounding 4 counties: Unknown
Composition and structure (reference condition): Closed forest canopy dominated by willow oak or codominant with or replaced by overcup oak, swamp white oak, swamp chestnut oak, or Sweetgum. Shrubs are sparse but may include: black highbush blueberry, highbush blueberry, buttonbush, inkberry, and arrowwood. Herbs are also sparse but may include: bladder sedge, longleaf spikegrass, and Eastern mannagrass. Mosses are abundant and include: *Climacium americanum* and *Sphagnum lescurii*. Upland pools are also included in this Ecological System; they are known from only two locations on the Forest - at Pleasant Grove Church and northwest of Roberdo. Upland pools lack significant tree cover except on their edge and are thought to be geologically successional to Upland Swamps. Characteristics tree species include: black gum, willow oak, and sweetgum. Characteristic shrub, herb, and moss species include: buttonbush, swamp doghobble, royal fern, lamp rush, sedges, and sphagnum moss.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
mole salamander	potential SOI	obligate of system
four-toed salamander	potential SOI	obligate of system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by Willow oak, Overcup oak, Swamp white oak or other characteristic	> 95%	85%-95%	70%-85%	< 70%	86%	Good

	tree species						
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 95%	85%-95%	70%-85%	< 70%	86%	Good
Hydrologic Regime	Percent of acreage with unaltered natural hydrology	> 95%	85%-95%	70%-85%	< 70%	73%	Fair
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	35%-50%	< 35%	73%	Good

[1/] desired canopy closure is 60%-100%

Piedmont Seepage Wetlands

Derivation: Hillside Seepage Bog, Piedmont Boggy Streamheads, Low Elevation Seep, (Schafale and Weakley 1990). Piedmont Seepage Wetlands (NatureServe 2004).
Environment: Gently sloping wetlands in uplands or edges of bottomlands and wetlands along small intermittent or permanent stream beds. Soils are deep to very deep, often very stony, poorly to somewhat poorly-drained soils with slow permeability. Sites are seasonally to constantly saturated by seepage.
Disturbance regime: Burning by American Indians, especially along bottomlands, to maintain open conditions for tending agricultural crops likely impacted these sites. However, because this ecological system occurs in moist sites, fire occurred only rarely and with low intensity especially after European settlement and continuing to the present period. Fire regime condition classes I (0-35 year return interval; surface fires of mixed severity) and V (200 year return interval, stand replacement and mixed severity).
Abundance and distribution on the Uwharrie NF: Although this Ecological System is known from over 50 locations, it is limited in extent, occurring on less than 200 acres Forest-wide. This ecological system includes sites on the edges of bottomlands and wetlands along small intermittent and perennial stream beds (Piedmont Boggy Streamheads) which account for 2/3s of the locations and over 95% of the total extent of the system. Piedmont Boggy Streamheads are almost entirely imbedded within the Streamside Forests Ecological System but are described here in more detail. Hillside Seepage Bogs and Low Elevation Seeps are the least common components of this system accounting for fewer than 23 sites and are less than three acres in extent. Most prominent along Densons Creek, Haystack Branch, Poison Fork, Sand Branch, and West Branch.
Abundance relative to the potential in the surrounding 4 counties: Unknown
Composition and structure (reference condition): Streamside seepage areas are imbedded within forests and have a scattered tree canopy that may include: sweetgum, black gum, Sweetbay, and persimmon. The understory may contain: American holly, common winterberry, American strawberry bush, Virginia sweetspire, Southern wild raisin, tag alder, and ti-ti. The diverse herb layer is dominated by cinnamon fern, royal fern, skullcap, Southern lady fern, blaspheme-vine, and muscadine. Common spicebush and Yellowroot may occur along more well-developed stream channels. Hillside Seepage Bogs are imbedded in forests and woodlands and have a patchy to open canopy that may include: swamp red maple, tulip poplar, sweetgum, or longleaf pine. Characteristic shrubs include: evergreen bayberry, blue huckleberry, Southern blackhaw, tag alder, and red chokeberry. The herb layer is diverse and may contain: yellow pitcher plant, purple pitcher plant, bushy broomsedge, Pinebarrens sandreed, Northern oatgrass, savanna eupatorium, whip nuthatch, yellow-eyed grass, and *Sphagnum* ssp.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
bog oat-grass	potential SOC	obligate of system
bog spicebush	potential SOC	obligate of system
little sneezeweed	potential SOI	obligate of system
four-toed salamander	potential SOI	obligate of system
mole salamander	potential SOI	obligate of system

[1/] SOC = Species of Concern, SOI = Species of Interest

Ecological condition benchmarks within the optimal extent of this system:

Key Factors Subject to Management Control	Indicator	Ecological Condition Benchmark (Percent of Optimal)				Current Condition	Current Rating
		Very good	Good	Fair	Poor		
Species Composition	Percent of acreage dominated by characteristic wetland species	> 95%	85%-95%	70%-85%	< 70%	70%	Fair
Canopy Structure	Percent of acreage at desired canopy closure [1/]	> 95%	85%-95%	70%-85%	< 70%	75%	Fair
Hydrology	Percent of acreage with unaltered natural hydrology	> 95%	85%-95%	70%-85%	< 70%	80%	Fair
Fire Regime	Percent of acreage within fire compartments burned at least twice in the last 15 years	> 95%	85%-95%	70%-85%	< 70%	75%	Fair
All above on Same site	Percent of acreage at or near reference condition especially understory species	> 75%	50%-75%	35%-50%	< 35%	65%	Good

[1/] desired canopy closure is 25%-100% [2/] only occurs in Botanical SIA

Successional and planted Forest

Derivation: Semi-natural Forest, Cultivated Forest (NatureServe 2004).
Environment: Xeric to mesic topographic positions (ridges, upper slopes, mid slopes, lower slopes), over felsic rock, or less commonly over mafic rock on mostly moderately deep to very deep, well drained, soil with moderate permeability; often very stony, extremely stony, or extremely boulder soils.
Disturbance regime: Variable.
Abundance and distribution on the Uwharrie NF: Approximately 20,500 acres outside the streamside forest zone. This is the most abundant ecological system on the Forest and occurs in nearly every parcel of land. Succesional loblolly pine forests are more common in the southern part and the Forest; successional shortleaf pine forests are more common in the central and northern part of the Forest. Successional forests are less extensive in the Wilderness and Badin Lake area but are still quite common in these areas.
Composition and structure (current condition): Successional Forests represent early- to mid successional pine plantations, and mid- to late-successional forests resulting from other past disturbance such as agricultural or other land clearing. The latter category may

include old fields, old pastures, clearcuts, stands resulting from stand replacement fire, and to a lesser extent, eroded areas. Successional Forests are divided into two groups:

1) Loblolly pine, which includes 10,700 acres of stands identified as Loblolly pine (CISC forest type 31), and 615 acres identified as Loblolly pine-Hardwood (CISC forest type 13), and
2) Shortleaf pine, which includes about 7,000 identified as Shortleaf pine (CISC forest type 32), 1,925 acres identified as Shortleaf pine-Oak (CISC forest type 12), 270 acres of Virginia pine (CISC forest type 33), and 30 acres of Virginia pine-oak (CISC forest type 16).

Young (1-20 years in age) pine plantations may be dominated by an open to near complete canopy of loblolly pine or shortleaf pine with little understory, a subcanopy of red maple, dogwood, and Sweetgum with few oaks. The herbaceous layer is sparse or nearly absent. Pine plantations greater than 20 years in age often have a closed canopy (depending upon past damage by Southern Pine Beetle) of loblolly or shortleaf pine, and a well-developed subcanopy of hardwoods including red maple and sweetgum, scarlet, black and white oak, blackgum, and hickories. The shrub layer may include: hillside blueberry, winged sumac, black huckleberry, and beautyberry. The herb layer is sparse but may the following invasive-exotic species: Japanese honeysuckle and Japanese stilt grass.

Older (>50 years in age) stands resulting from past disturbance are often dominated by loblolly pine and sweetgum (dry-mesic to mesic sites) or shortleaf pine and mixed oaks (xeric to dry-mesic sites). Tree, shrub, and herb species are variable on these sites and may include: willow oak, winged elm, black cherry, muscadine, poison ivy, Southern blackberry, common dog-fennel, hyssopleaf eupatorium, common rough fleabane, smooth goldenrod, common ragweed, and common greenbrier. In the southern part of the Forest, species more common in the coastal plain and sandhills may occur, such as: creeping blueberry, dwarf serviceberry, and sandhill St.-John's-wort.

Rare species documented in this Ecological System:

Species common name	Status [1/]	Habitat preference
red-cockaded woodpecker	Federally Endangered	optimal habitat in system when forests are mature, open, and dominated by shortleaf pine
Eastern small-footed myotis	potential SOC	marginal habitat in system
smooth sunflower	potential SOI	suitable habitat in system

[1/] SOC = Species of Concern, SOI = Species of Interest

Current and Potential Ecological condition:

The Successional Forest Ecological System is found on a wide variety of sites that could support forest communities and species found in at least 5 other Ecological Systems on the Uwharrie National Forest (**Table 1**). Successional Loblolly pine stands occupy approximately 3,905 acres where Longleaf pine forest communities would be better adapted, and nearly 7,000 acres where Oak-Hickory forests could occur (4,355 Dry Oak-Hickory and 2,430 acres of Dry-mesic Oak-Hickory). Successional Shortleaf pine stands occupy approximately 830 acres where Longleaf pine forest communities would be better adapted, and over 7,000 acres where Oak-Hickory forest could occur (5,285 Dry Oak-

Hickory and 2,055 acres of Dry-mesic Oak-Hickory). These areas represent restoration opportunities for Longleaf and Oak-Hickory forests on 19,000 acres.

Table 1. Ageclass distribution of Successional Loblolly and Shortleaf Pine Ecological Systems occurring within other major Ecological Systems on the Uwharrie National Forest

Ageclass (years)	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	100+	All ages
Potential Ecol. System	Existing Ecological System: LOBLOLLY PINE											
Xeric Oak	-	20	40	60	170	10	-	-	-	-	-	300
Longleaf pine	-	860	440	1,140	715	170	70	50	220	235	5	3,905
Dry Oak-Hickory	100	840	730	1,160	885	200	85	75	170	85	25	4,355
Dry-mesic Oak-Hickory	45	425	375	680	515	105	50	50	115	70	-	2,430
Mesic Forests	25	90	25	70	20	5	-	-	45	10	-	290
Total acres (nearest 5 ac.)	175	2,245	1,615	3,110	2,305	490	210	180	555	410	40	11,335
Total proportion (nearest.5)	1.5%	20.0%	14.0%	27.0%	20.0%	4.0%	2.0%	1.5%	5.0%	4.0%	-	
Potential Ecol. System	Existing Ecological System: SHORTLEAF PINE											
Xeric Oak	60	285	180	105	5	-	-	10	30	10	145	830
Longleaf pine	115	120	65	45	5	15	60	140	140	85	40	830
Dry Oak-Hickory	580	980	570	515	10	60	60	720	540	430	720	5,185
Dry-mesic Oak-Hickory	255	310	220	210	-	20	45	260	230	240	265	2,055
Mesic Forests	15	20	20	5	-	5	5	70	50	10	35	235
Total acres (nearest 5 ac.)	1,030	1,725	1,060	890	30	105	170	1,200	990	780	1,215	9,195
Total proportion (nearest.5)	11.0%	19.0%	12.0%	10.0%	-	1.0%	2.0%	13.0%	11.0%	9.0%	13.0%	1

Table 2: Common and scientific names for species in ecological system descriptions

American barberry (*Berberis canadensis*)
American beech (*Fagus grandiflora*)
American bittersweet (*Celastrus scandens*)
American holly (*Ilex opaca* var. *opaca*)
American strawberry bush (*Euonymus Americana*)
American-ipecac (*Gillenia stipulata)*
Arrowhead (*Sagittaria spp.)*
Arrowwood (*Viburnum dentatum*)
Beechdrops (*Epifagus virginiana*)
Black cherry (*Prunus serotina*)
Black cohosh (*Cimicifuga racemosa*)
Black gum (*Nyssa sylvatica*)
Black highbush blueberry (*Vaccinium fuscatum*)
Black huckleberry (*Galussacia baccata*)
Black oak (*Quercus velutina*)
Black-edge sedge (*Carex nigromarginata*)
Blackgum (*Nyssa sylvatica*)
Blackjack oak (*Quercus marilandica)*
Bladder sedge (*Carex intumescens*)
Blaspheme-vine (*Smilax laurifolia*)
Bloodroot (*Sanguinaria canadensis*)
Blue huckleberry (*Gaylussacia frondosa*)
Bluestem goldenrod (*Solidao caesia*)
Bluff oak (*Quercus austrina*)
Bog oat-grass (*Danthonia epilis*)
Bog spicebush (*Lindera subcoriacea*
Broomsedge (*Andropogon virginicus* var. *virginicus*)
Bushy broomsedge (*Andropogon glomeratus*)
Butterfly pea (*Clitoria mariana*)
Buttonbush (*Cephalanthus occidentalis* var. *occidentalis*)
Canby's bulrush (*Schoenoplectus etuberculatus*)
Carolina alumroot (*Heuchera caroliniana*)
Carolina jessamine (*Gelsemium sempervirens*)
Carolina shagbark hickory (*Cary carolinae-septentrionalis*)
Carolina supplejack (*Berchemia scandens*)
Carolina thistle (*Cirsium carolinianum*)
Chalk maple (*Acer leucoderme*)
Chapman's redtop (*Tridens chapmanii*)
Cherrybark oak (*Quercus pagoda*)
Chestnut oak (*Quercus montana*)
Christmas fern (*Polystichum acrostichoides* var. *acrostichoides)*
Cinnamon fern (*Osmunda cinnamomea*)
Common alumroot (*Heuchera americana*)
Common chinquapin (*Castanea pumila* var. *pumila*)
Common dog-fennel (*Eupatorium capillifolium*)
Common foamflower (*Tiarella cordifolia var. collina*)
Common greenbrier (*Smilax spp)*
Common jack-in-the-pulpit (*Arisaema tripyllum ssp. triphyllum*)
Common pawpaw (*Asimina triloba*)
Common ragweed (*Ambrosia artemisiifolia*)
Common rough fleabane (*Erigeron strigosus*)
Common spicebush (*Lindera benzoin*)
Common stargrass (*Hypoxis hirsuta*)
Common winterberry (*Ilex verticillata*)
Cowlily (*Nuphar lutea*)
Creeping blueberry (*Vaccinium crassifolium*)
Crested coralroot (*Hexalectis spicata*)
Crossvine (*Bignonia capreolata*)
Deerberry (*Vaccinium stamineum*)
Dissected toothwort (*Cardamine dissecta*)

Dogwood (*Cornus florida*)
Downy arrowwood (*Viburnum rafinesquianum*)
Dwarf huckleberry (*Gaylussacia dumosa*)
Dwarf serviceberry (Amelanchier stolonifera)
Eastern mannagrass (*Glyceria septentrionalis*)
Eastern prairie blue wild indigo (*Babtisia australis* var. *aberrans*)
Eastern red maple (*Acer rubrum var. rubrum*)
Eastern shooting star (*Dodecatheon media ssp. media*)
Eastern Small-footed myotis (*Myotis leibii*)
Ebony spleenwort (*Asplenium platyneuron* var. *platyneuron*)
Echinacea laevigata (*Smooth coneflower*)
Elliott's Broomsedge (*Andropogon gyrans*)
Evergreen bayberry (*Morella caroliniensis*)
Fairywand (*Chamaelirium luteum*)
False nettle (*Boehmeria cylindrical*)
Farkleberry (*Vaccinium arboretum*)
Four-toed salamander (*Hemidactylium scutatum*)
Fringetree (*Chionanthus virginicus*)
Galax (*Galax urceolata*)
Georgia aster (*Symphyotrichum georgianum*)
Giant cane (*Arundinaria gigantea*)
Glade milkvine (*Matelea decipiens*)
Glade wild quinine (*Parthenium integrifolium* var. *auriculatum*)
Glaucous greenbrier (*Smilax glauca*)
Green Arrow-arum (*Peltandra virginica*)
Green ash (*Fraxinus pennsylvanica*)
Hairy highbush blueberry (*Vaccinium fuscatum*)
Hairy lipfern (*Cheilanthes lanosa*)
Heartleaf plantain (*Plantago cordata*)
Hedge nettle (*Stachy sp. 1*)
Heller's rabbit tobacco (*Pseudognaphalium helleri*)
Helmet flower (*Scutellaria integrifolia*)
Highbush blueberry (*Vaccinium corymbosum*)
Hillside blueberry (*Vaccinium pallidum*)
Hop-hornbeam (*Ostrya virginiana*)
Hornwort (*Ceratophyllum* spp)
Horsesugar (*Symplocos tinctoria*)
Hyssopleaf eupatorium (*Eupatorium hyssopifolium* var. *hyssopifolium*)
Indian physic (*Porteranthus stipulatus*)
Inkberry (*Ilex decidua*)
Inland roundleaf eupatorium (*Eupatorium rotundifolium* var. *ovatum*)
Ironwood (*Carpinus caroliniana ssp caroliniana*)
Jack-in-the-pulpit (*Arisaema triphyllum*)
Japanese honeysuckle (*Lonicera japonica*)
Japanese stilt grass (*Microstegium vimineum*).
Lamp rush (*Juncus effuses*)
Large witch alder (*Fothergilla major*)
Late eupatorium (*Eupatorium serotinum*)
Leafy elephant's-foot (*Elephantopus carolinianus*),
Licorice bedstraw (*Galium circaezans*)
Licorice goldenrod (*Solidago odora* var. *odora*)
Little bluestem (*Schizachyrium scoparium*)
Littleleaf sneezeweed (*Helinium brevifolium*)
Longleaf pine (*Pinus palustris*)
Longleaf spikegrass (*Chasmanthium sessiliflorum*)
Long-stalked aster (*Symphyotrichum dumosum* var. *dumosum*)
Maidenhair fern (*Adiantum pedatum*)
Maryland goldenaster (*Chrysopsis mariana*)
Missouri rockcress (*Arabis missouriensis*)
Mockernut hickory (*Carya alba*)
Mole salamander (*Ambystoma talpoideum*)
Mosses: (*Climacium americanum*)

Mountain camellia (*Stewartia ovata*)
Mountain laurel (*Kalmia latifolia*)
Muscadine (*Vitis rotundifolia*)
Narrow-leaved aster (*Symphyotrichum laeve var. concinnum*)
Needlegrass (*Piptochaetium avenaceum*)
New Jersey tea (*Ceanothus americana*)
Northern green-and-gold (*Chrysogonum virginianum*)
Northern oak grass (*Danthonia spicata*)
Northern red oak (*Quercus rubra*)
Oat grass (*Danthonia spicata*)
Open flower witch grass (*Dichanthelium laxiflorum*)
Overcup oak (*Quercus lyrata*)
Painted buckeye (*Aesculus sylvatica*)
Persimmon (*Diospyros virginina*)
Piedmont aster (*Eurybia mirabilis*)
Piedmont horsebalm (*Collinsonia tuberosa*)
Piedmont indigo bush (*Amorpha schwerinii*)
Pignut hickory (*Carya glabra*)
Pinebarrens sandreed (*Calamovilfa brevipilis*)
Pineweed (*Hypericum gentianoides)*
Pipsissewa (*Chimaphila maculata*)
Poison ivy (*Toxicodendron radicans*)
Pondweed (*Potamogeton* spp)
Post oak (*Quercus stellata*)
Poverty oat-grass (*Danthonia spicata*)
Purple pitcher plant (*Sarracenia purpurea*)
Pursh's wild petunia *(Ruella purshiana)*
Rafinesque's Big-eared bat (*Corynorhinus rafinesquii*)
Rattlesnake fern (*Botrychium virginianum*)
Rattlesnake hawkweed (*Hieracium venosum*)
Rattlesnake plantain (*Chimaphila maculata*)
Ravine sedge (*Carex impressinervia*)
Red chokeberry (*Photinia pyrifolia*)
Red hickory (*Carya ovalis*)
Red maple (*Acer rubrum*)
Redbud (*Cercis canadensis*)
Red-cockaded woodpecker (*Picoides borealis)*
Ringed witch grass (*Dichanthelium annulum*)
River birch (*Betula nigra*)
Rock spikemoss (*Selaginella rupestris*)
Royal fern (*Osmunda regalis* var. *spectabilis*)
Sand hickory (*Cary palida*)
Sand hills bean (*Phaseolus polystachios*)
Savanna eupatorium (*Eupatorium leucolepis*)
Saw greenbrier (*Smilax bona-nox*)
Scarlet oak (*Quercus coccinea* var. *coccinea*)
Schweinitz's sunflower (*Helianthus schweinitzii*)
Sedges (*Carex* spp)
Shagbark hickory (*Carya ovata*)
Sharp-shinned hawk (*Accipiter striatus*)
Shielded-sorus polypody (*Pleopeltis polypodioides* ssp. *michauxiana*)
Shortleaf pine (*Pinus echinata*)
Silky oat-grass (*Danthonia sericea* var. *sericea*),
Silverbell (*Halesia tetraptera var. tetraptera*)
Silver-haired bat (*Lasioncteris noctivagans*)
Skullcap (*Scutellaria integrifolia*)
Slender spikegrass (*Chasmanthium laxum*)
Smooth coneflower (Echinacea laevigata)
Smooth goldenrod (*Solidago gigantea*)
Smooth sunflower (*Helianthus laevigatus*)
Sourwood (*Oxydendrum arboretum*)
Southern anemone (*Anemone berlandieri*)

Southern blackberry (*Rubus argutus*)
Southern blackhaw (*Viburnum rufidulum*)
Southern blueberry (*Vaccinium tenellum*)
Southern bracken (*Pteridium aquilinum* var. *pseudocaudatum*)
Southern lady fern (*Athyrium filix-femina* ssp *asplenioides*)
Southern red cedar (*Juniperus virginiana* var. *virginiana*)
Southern red oak (*Quercus falcata*)
Southern wild raisin (*Viburnum nudum* var. *nudum*)
Sphagnum mosses: (*Sphagnum lescurii)*
Splitbeard bluestem (*Andropogon ternarius var. ternarius*)
St.-John's-wort (*Hypericum lloydii*)
Starved witch grass (*Dichanthelium depauperatum*)
Swamp chestnut oak (*Quercus michauxii*)
Swamp doghobble (*Leucothoe racemosa*)
Swamp red maple (*Acer rubrum* var. *trilobum)*
Swamp rose (*Rosa palustris)*
Swamp white oak (*Quercus bicolor*)
Sweetbay (*Magnolia virginiana)*
Sweetgum (*Liquidambar styraciflua*)
Sycamore (*Platanus occidentalis*)
Tag alder (*Alnus serrulata*)
Thick-pod white wild indigo (*Baptisia alba*)
Thin-pod white wild indigo (*Baptisia albescens*)
Threadleaf coreopsis (*Coreopsis verticillata*)
Tick-trefoils (*Desmodium* spp.)
Ti-ti (*Cyrilla racemiflora*)
Tulip poplar (*Liriodendron tulipifera*)
Virginia creeper (*Parthenocissus quinquefolia*)
Virginia goat's-rue (*Tephrosia virginiana*)
Virginia pine (*Pinus virginiana*)
Virginia red cedar (*Juniperus virginiana var. virginiana*)
Virginia spiderwort (*Tradescantia virginiana*)
Virginia sweetspire (*Itea virginica*)
Virginia wild-rye (*Elymus virginicus*)
Warbling vireo (*Vireo gilvus*)
Water lily (*Nmphaea odorata*)
Water oak (*Quercus nigra*)
Watermilfoil (*Myriophyllum* spp)
Western rough goldenrod (*Solidago radula* var. *radula*)
Whip nutrush (*Scleria triglomerata*)
White ash (*Fraxinus americana*)
White oak (*Quercus alba*)
Whorled milkweed (*Asclepias verticillata*)
Wild ginger (*Asarum canadense*)
Wild grape (*Vitis spp.).*
Willow oak (*Quercus phellos*)
Winged elm (*Ulmus alata*)
Winged witchgrass (*Dichanthelium annulum*)
Witch alder (*Fothergilla major*)
Wood anemone (*Anemone quinquefolia* var. *quenquefolia*)
Woodland tick-trefoil (*Desmodium nudiflorum*)
Wright's cliff-brake (*Pellaea wrightiana*)
Yadkin River goldenrod (*Solidago plumosa)*
Yellow Indian grass (*Sorghastrum nutans*)
Yellow pitcher plant (*Sarracenia flava*)
Yellow yam (*Dioscorea quaternata*)
Yellow-eyed grass (*Xyris ambigua)*
Yellowroot (*Xanthorhiza simplicissima*)

APPENDIX C:

Threatened and Endangered, potential species of concern, and potential species of interest whose ranges include the UWNF <u>and / or</u> are found within the Carolina Slate Belt and Southern Triassic Uplands Ecological Subsections.

Scientific Name	Common Name	Lifeform	Potential Status	Grank	Srank	Frank	Outside Range?	Secure in NC	Screen Criteria	EO [1/] on UWNF	EO in 4 county	EO Ecoreg	EO NC Ecoreg
Haliaeetus leucocephalus	Bald Eagle	Bird	T&E	G4	S3B,S3N	F2			7	1	16	70	35
Mycteria americana	Wood Stork	Bird	T&E	G4	S1N	F0	yes		1				
Picoides borealis	Red-cockaded Woodpecker	Bird	T&E	G3	S2	FH			7	1	4	21	13
Puma concolor couguar	Eastern Cougar	Mammal	T&E	G5TH	SH	FH			5				
Glyptemys muhlenbergii	Bog Turtle	Reptile	T&E	G3	S2		yes		1				
Helianthus schweinitzii	Schweinitz's Sunflower	vas	T&E	G3	S3	F2			7	29	118	200	197
Rhus michauxii	Michaux's Sumac	vas	T&E	G2	S2	F?			8			3	3
Plethodon meridianus	S. MT Gray-cheeked Salam.	Amphibia	SOC	G1G2[G3G	S3S4		yes		1				
Cincindela patruela	Barrens Tiger Beetle	Beetle	SOC	G3	S2?	FP			3				
Aimophila aestivalis	Bachman's sparrow	Bird	SOC	G3	S3B,S2N	FH			8			4	4
Callophrys irus	Frosted Elfin	Butterfl	SOC	G3	S2				4				
Speyeria diana	Diana Fritillary	Butterfl	SOC	G3[G3G4]	S3S4		yes		1				
Melanoplus mirus	a short-winged Melanop.	Grasshop	SOC	G2G3	S2S3				3				
Myotis leibii	Eastern Small-footed	Mammal	SOC	G3	SUB,S2N		yes		1				
Triodopsis fulciden	Dwarf Threetooth	Mollusk	SOC	G1G2	S1S2		yes		1				
Heliomata infulata	Rare Spring Moth	Moth	SOC	G2G4	S2S3				3				
Hygrohypnum closteri	Closter's Brook-hypnu	nonvas	SOC	G3	S1	F0	yes		1			1	1
Nardia lescurii	Liverwort	nonvas	SOC	G3?	S3?	FP		yes	2				
Pellia appalachiana	Liverwort	nonvas	SOC	G2	S1?	F0	yes		1				
Riccardia jugata	Liverwort	nonvas	SOC	G2	S1	F0	yes		1				
Scopelophila cataractae	Agoyan Cataract Moss	nonvas	SOC	G3	S1	F0	yes		1			1	1
Astrabalus michauxii	Sandhills Milkvetch	vas	SOC	G3	S3	F0	yes		1			1	0
Baptisia australis var. aber	Prairie Blue Wild Ind	vas	SOC	G5T2	S2	FP			7		1	16	16
Berberis canadensis	American Barberry	vas	SOC	G3	S2	FP			7		1	8	8
Carex impressinervia	Ravine Sedge	vas	SOC	G1G2	S1	F1			7	5	7	7	7

Cyperus granitophilus	Granite Flatsedge	vas	SOC	G3Q	S2	F0	yes		1			2	1
Delphinium exaltatum	Tall Larkspur	vas	SOC	G3	S2	F0	yes		1			2	2
Draba aprica	Open-Ground Whitlow G	vas	SOC	G3	S0	F0	yes		1			1	0
Echinacea laevigata	Smooth Coneflower	vas	SOC	G2	S1	FP			7		1	20	18
Eurybia mirabilis	Piedmont Aster	vas	SOC	G2G3	S2	F1			7	1	3	21	21
Fothergilla major	Large Witch-alder	vas	SOC	G3	S3	F1			7	4	7	10	10
Gaylussacia brachycera	Box Huckleberry	vas	SOC	G3	S1	F0	yes		1			1	1
Helianthus glaucophyllus	White-leaved Sunflowe	vas	SOC	G3	S3	F0	yes		1			1	0
Heuchera caroliniana	Carolina Alumroot	vas	SOC	G3	S3	F1?		yes	7				
Hymenocallis coronaria	Shoals Spider-lily	vas	SOC	G2Q	S0	F0	yes		1			13	0
Isoetes hyemalis	A Quillwort	vas	SOC	G2G3	S1S2	FP			4			1	0
Isoetes melanospora	Black-spored Quillwor	vas	SOC	G1	S0	F0	yes		1			1	0
Isoetes piedmontana	Piedmont Quillwort	vas	SOC	G3	S1	F?			9			6	2
Isoetes virginica	Virginia Quillwort	vas	SOC	G1	S1	F?			3			3	3
Lindera subcoriacea	Bog Spicebush	vas	SOC	G2	S2	FP			7		1	1	1
Lotus helleri	Carolina Birdfoot-tre	vas	SOC	G3	S3	FP		yes	7		7	26	23
Marshallia sp. 1	Butner Barbara's-butt	vas	SOC	G1	S1	F0	yes		1			3	2
Monotropsis odorata	Sweet Pinesap	vas	SOC	G3	S3	F?		yes	2			12	12
Parthenium auriculatum	Glade Wild Quinine	vas	SOC	G3?	S2	F1			7	5	5	28	28
Phacelia covillei	Buttercup Phacelia	vas	SOC	G2	S3	F0	yes		1			10	10
Phemeranthus mengesii	Large-flowered Famefl	vas	SOC	G3	S1	F0	yes		1			1	1
Portulaca smallii	Small's Portulaca	vas	SOC	G3	S2	F?			9			2	1
Pseudognaphalium micradenium	Small Rabbit-Tobacco	vas	SOC	G3?	S1	F?			3			3	3
Ptilimnium nodosum	Harperella	vas	SOC	G2	S0	F0	yes		1			3	3
Ptilimnium vivparum	Atlantic River Harper	vas	SOC	G2	S1	F0	yes		1				
Pycnanthemum torreyi	Torrey's Mountain-min	vas	SOC	G2	S1	FP	yes		1			6	5
Quercus oglethorpensis	Oglethorpe's Oak	vas	SOC	G3	S0	F0	yes		1			87	0
Ribes echinellum	Miccosukee Gooseberry	vas	SOC	G1	S0	F0	yes		1			3	0
Ruellia purshiana	Pursh's Wild-petunia	vas	SOC	G3	S2	F1			7	1	2	8	8
Sedum pusillum	Puck's Orpine	vas	SOC	G3	S1	F0	yes		1			8	4
Solidago plumosa	Yadkin River Goldenro	vas	SOC	G1	S1	FP			7		3	3	3
Symphyotrichum	Georgia Aster	vas	SOC	G2G3	S2	F1			7	5	13	45	27

georgianum													
Tridens chapmanii	Chapman's Redtop	vas	SOC	G3	S1S2	FP			7				
Trillium discolor	Faded Trillium	vas	SOC	G3	S1	F0	yes		1			32	0
Trillium lancifolium	Narrow-leaved Trilliu	vas	SOC	G3	S0	F0	yes		1			4	0
Trillium rugelii	Southern Nodding Tril	vas	SOC	G3	S2?	F0	yes		1			1	0
Ambystoma maculatum	Spotted Salamander	Amphibia	SOI	G5	S5			yes	2	2	2	5	5
Ambystoma opacum	Marbled Salamander	Amphibia	SOI	G5	S5			yes	2			1	0
Ambystoma talpoideum	Mole Salamander	Amphibia	SOI	G5	S2				7	1			
Ambystoma tigrinum tigrinum	Easter Tiger Salamander	Amphibia	SOI	G5	S2	FP			7				
Eurycea guttolineata	Three-lined Salamander	Amphibia	SOI	G5	S5			yes	2				
Eurycea quadridigitata	Dwarf Salamander	Amphibia	SOI	G5	S2				7				
Hemidactylium scutatum	Four-toed Salamander	Amphibia	SOI	G5	S3				7	1	5	21	21
Hyla gratiosa	Barking Treefrog	Amphibia	SOI	G5	S3S4				2				
Hyla versicolor	Northern Gray Treefrog	Amphibia	SOI	G5	S1?				3				
Plethodon glutinosus sensust	Northern Slimy Salamander	Amphibia	SOI	G5	SU				3				
Plethodon websteri	Webster's Salamander	Amphibia	SOI	G3	Not in N	F0	yes		1			40	0
Plethodon wehrlei	Wehrle's Salamander	Amphibia	SOI	G5	S1		yes		1				
Pseudotriton montanus	Eastern Mud Salamander	Amphibia	SOI	G5	S5	F3		yes	2				
Scaphiopus holbrookii	Eastern Spadefoot	Amphibia	SOI	G5	S5			yes	2				
Vaejovis carolinianus	Carolina scorpion	Arachnid	SOI	G5	S2?				3				
Stenelmis sp nov 2	William's Stenelmis R	Beetle	SOI	G?	S2				3				
Stenelmis sp nov 3	a riffle beetle	Beetle	SOI	G?	S2				3				
Accipiter cooperii	Cooper's Hawk	Bird	SOI	G5	S3S4B,S4			yes	2				
Accipiter striatus	Sharp-shinned Hawk	Bird	SOI	G5	S2B,S4N				7				
Ammodramus henslowii	Henslow's Sparrow	Bird	SOI	G4	S2B,S1N		yes		1				
Ammodramus savannarum	Grasshopper Sparrow	Bird	SOI	G5	S3B,S1N				7				
Bartramia longicauda	Upland Sandpiper	Bird	SOI	G5	SNA		yes		1				
Bombycilla cedrorum	Cedar Waxwing	Bird	SOI	G5	S4B,S5N	F0		yes	2				
Caprimulgus carolinensis	Chuck-wills-widow	Bird	SOI	G5	S5B	F3		yes	2				
Caprimulgus vociferus	Whip-poor-will	Bird	SOI	G5	S5B	F4		yes	2	1			
Chordeiles minor	Common Nighthawk	Bird	SOI	G5	S4B			yes	2	1			

Coccyzus americanus	Yellow-billed Cuckoo	Bird	SOI	G5	S5B	F4		yes	2	24			
Colaptes auratus	Northern Flicker	Bird	SOI	G5	S5B,S5N			yes	2				
Colinus virginianus	Northern Bobwhite	Bird	SOI	G5	S5	F4		yes	7	5+			
Contopus virens	Eastern Wood Pewee	Bird	SOI	G5	S5B	F5		yes	7	10			
Coragyps atratus	Black Vulture	Bird	SOI	G5	S3S4				2				
Corvus corax	Common Raven	Bird	SOI	G5	S3		yes		1	1			
Dendroica cerulea	Cerulean Warbler	Bird	SOI	G4	S2B,SZN	F0	yes		1				
Dendroica discolor	Prairie Warbler	Bird	SOI	G5	S5B,S1N				7	15			
Dendroica dominica	Yellow-throated Warbe	Bird	SOI	G5	S5B	F3		yes	2	12			
Dolichonyx oryzivorus	Bobolink	Bird	SOI	G5	SUB		yes		1				
Empidonax traillii	Willow Flycatcher	Bird	SOI	G5	S3B,S3N		yes		1				
Empidonax virescens	Acadian Flycatcher	Bird	SOI	G5	S5B	F5		yes	2	43			
Euphagus carolinus	Rusty Blackbird	Bird	SOI	G4	S4N			yes	2				
Falco peregrinus	Peregrine Falcon	Bird	SOI	G4	S1B,S2N		yes		1				
Falco sparverius	American Kestrel	Bird	SOI	G5	S3B,S5N	F1			4				
Helmitheros vermivorus	Worm-eating Warbler	Bird	SOI	G5	S4B	F1	yes	yes	2	11			
Hylocichla mustelina	Wood Thrush	Bird	SOI	G5	S5B	F4		yes	2	37			
Icteria virens	Yellow-breasted Chat	Bird	SOI	G5	S5B	F4		yes	2	15			
Icterus galbula	Baltimore Oriole	Bird	SOI	G5	S3B,S3N		yes		1				
Icterus spurius	Orchard Oriole	Bird	SOI	G5	S5B	F3		yes	2				
Ixobrychus exilis	Least Bittern	Bird	SOI	G5	S3B,SZN				3				
Lanius ludovicianus lucovici	Loggerhead Shrike	Bird	SOI	G4T4	S3B,S3N	F1			7	1			
Laterallus jamaicensis	Black Rail	Bird	SOI	G4	S3B,S3N		yes		1				
Limnothlypis swainsonii	Swainson's Warbler	Bird	SOI	G4	S3B,SZN				3				
Lophodytes cucullatus	Hooded Merganser	Bird	SOI	G5	S1B,S4N		yes		1				
Melanerpes erythrocephalus	Red-headed Woodpecker	Bird	SOI	G5	S4B,S4N				7	9			
Myiarchus crinitus	Great-crested Flycatc	Bird	SOI	G5	S5B	F4		yes	2	15			
Nyctanassa violacea	Yellow-crowned Night	Bird	SOI	G5	S3B,SZN		yes		1				
Oporornis formosus	Kentucky Warbler	Bird	SOI	G5	S4B	F3		yes	2	10			
Phalacrocorax auritus	Double-crested Cormor	Bird	SOI	G5	S1B,S5N		yes		1			1	1
Picoides villosus	Hairy Woodpecker	Bird	SOI	G5	S4			yes	2	5			
Protonotaria citrea	Prothonotory Warbler	Bird	SOI	G5	S5B	F2		yes	2	2			
Rallus elegans	King Rail	Bird	SOI	G4G5	S3B,S3N				4				
Riparia riparia	Bank Swallow	Bird	SOI	G5	SUB,SZN		yes		1				
Scolopax minor	American Woodcock	Bird	SOI	G5	S4B,S4N	F3		yes	2				

Seiurus motacilla	Louisiana Waterthrush	Bird	SOI	G5	S4B	F4		yes	2	3			
Sitta pusilla	Brown-headed Nuthatch	Bird	SOI	G5	S5	F4		yes	7	1			
Spiza americana	Dickcissel	Bird	SOI	G5	S2B,SZN		yes		1				
Spizella pusilla	Field Sparrow	Bird	SOI	G5	S5B,S5N	F3		yes	2	6			
Sturnella magna	Eastern Meadowlark	Bird	SOI	G5	S5B,S5N			yes	2				
Tachycineta bicolor	Tree Swallow	Bird	SOI	G5	S2S3B,S4		yes		1				
Thryomanes bewickii	Bewick's Wren	Bird	SOI	G5	SHB		yes		1				
Tyrannus tyrannus	Eastern Kingbird	Bird	SOI	G5	S5B			yes	2	1			
Tyto alba	Barn Owl	Bird	SOI	G5	S3B,S3N				4				
Vireo flavifrons	Yellow-throated Vireo	Bird	SOI	G5	S4B	F4		yes	2	9			
Vireo gilvus	Warbling Vireo	Bird	SOI	G5	S2B,SZN		yes		1			1	1
Vireo griseus	White-eyed Vireo	Bird	SOI	G5	S5B,S1N	F4			2	7			
Wilsonia citrina	Hooded Warbler	Bird	SOI	G5	S5B	F5		yes	2	25			
Amblyscirtes carolina	Carolina Roadside Ski	Butterfl	SOI	G3G4	S3S4				2				
Amblyscirtes reversa	Reversed Roadside-Ski	Butterfl	SOI	G3G4	S3				3				
Autochton cellus	Golden Banded-Skipper	Butterfl	SOI	G4	S1S2				3				
Callophrys augustinus	Brown Elfin	Butterfl	SOI	G5	S3S4				2				
Erynnis martialis	Mottled Duskywing	Butterfl	SOI	G3G4	S3	F1			8	1	1	3	3
Euphyes bimacula	Two-spotted Skipper	Butterfl	SOI	G4	S2				3				
Fixsenia favonius ontarios	Northern Oak Hairstre	Butterfl	SOI	G4T4	S3?				6		1	2	2
Hesperia leonardus	Leonard's Skipper	Butterfl	SOI	G4	S3S4				2				
Hesperia metea	Cobweb Skipper	Butterfl	SOI	G5	S3				3				
Megathymus cofaqui cofaqui	Cofaqui Giant Skipper	Butterfl	SOI	G3G4T3	S1?		yes		1				
Neonympha areaolata	Georgia Satyr	Butterfl	SOI	G4	S3				3				
Papilio cresphontes	Giant Swallowtail	Butterfl	SOI	G5	S2				3				
Pontia protodice	Checkered White	Butterfl	SOI	G4	S3				3				
Satyrium kingi	King's Hairstreak	Butterfl	SOI	G3G4	S2S3				3				
Thorybes confusis	Confused Cloudywing	Butterfl	SOI	G4	S3S4				2				
Romalea guttatus	Eastern Lubber Grassh	Grasshop	SOI	G5	SU				3				
Condylura cristata pop 1	Star-nosed Mole - CP	Mammal	SOI	G5T2Q	S2		yes		1		1	1	1
Corynorhinus rafinesquii	Rafinesque's big-	Mammal	SOI	G3G4T?	S2	F0			7				

	eare												
Cryptotis parva	Least Shrew	Mammal	SOI	G5	S5			yes	2				
Lasionycteris noctivagans	Silver-haired bat	Mammal	SOI	G5	S2?B,S4N				7				
Lasiurus intermedius	Northern yellow bat	Mammal	SOI	G4G5	SU		yes		1				
Lasiurus seminolus	Seminole Bat	Mammal	SOI	G5	S3S4B,SZ				3				
Lontra canadensis	River Otter	Mammal	SOI	G5	S4	F2		yes	2				
Microtus pennsylvanicus	Meadow Vole	Mammal	SOI	G5	S5			yes	2				
Mustela frenata	Long-tailed Weasel	Mammal	SOI	G5	S3S4				2				
Myotis austroriparius	Southeastern Myotis	Mammal	SOI	G3G4	S3				8				
Myotis septentrionalis	Northern long-eared m	Mammal	SOI	G4	S3		yes		1				
Neotoma floridana haematorei	Eastern woodrat-SA po	Mammal	SOI	G5T4Q	S3				3				
Neotoma magister	Appalachian woodrat	Mammal	SOI	G3G4	S2		yes		1				
Peromyscus polionotus	Oldfield mouse	Mammal	SOI	G5	S1?		yes		1				
Scalopus aquaticus	Eastern Mole	Mammal	SOI	G5	S5			yes	2				
Sciurus niger	Eastern fox squirrel	Mammal	SOI	G5	S3	F0			7				
Zapus hudsonius	Meadow Jumping Mouse	Mammal	SOI	G5	S3				3				
Valvata sincera	Mossy Valvata	Mollusk	SOI	G5	S1		yes		1				
Acronicta albarufa	Barrens Daggermoth	Moth	SOI	G3G4	SH				3				
Acronicta hamamelis	Puzzling Dagger Moth	Moth	SOI	G4?	SU				3				
Anticlea multiferata	Many-lined Carpet	Moth	SOI	G5	SU				3				
Arugisa watsoni	Watson's Arugisa	Moth	SOI	G4	S3?				3				
Caripeta aretaria	Southern Pine Looper	Moth	SOI	G4	S3?				3				
Catocala pretiosa texarkana	Texarkana Underwing	Moth	SOI	G4T4	SU				3				
Catocala sappho	Sappho Underwing	Moth	SOI	G4	SU				3				
Chrysanympha formosa	Formosa Looper Moth	Moth	SOI	G5	S3S4				2				
Cycnia inopinatus	Unexpected Cycnia	Moth	SOI	G4	SU				3				
Exyra fax	Purple Pitcher-plant	Moth	SOI	G4	S3?				3				
Exyra ridingsii	a pitcher-plant moth	Moth	SOI	G3G4	S3?				3				
Hemeroplanis sp 1 nr obliqua	an owlet moth	Moth	SOI	G?	S2S3				3				
Lithophane lemmeri	Lemmer's Pinion	Moth	SOI	G3G4	S1S3				3				
Papaipema baptisiae	Wild Indigo Borer Mot	Moth	SOI	G4	SU				3				
Pyreferra pettiti	a sallow moth	Moth	SOI	G?	SU				3				

Schizura sp 1	a new prominent moth	Moth	SOI	G3G4	S1S3				3				
Sphinx franckii	Franck's Sphinx	Moth	SOI	G4	SU				3				
Tripudia quadrifera	an owlet moth	Moth	SOI	G?	SU				3				
Brachythecium rotaeanum	Rota's Feather Moss	nonvas	SOI	G3G4	S1	F0	yes		1			1	1
Anolis carolinensis	Carolina Anole	Reptile	SOI	G5	S5	F3		yes	2				
Apolone spinfera aspera	Gulf Coast Spiny Soft	Reptile	SOI	G5T5	S3				3				
Cemophora coccinea	Scarlet Snake	Reptile	SOI	G5	S3	F1			4				
Clemmys guttata	Spotted Turtle	Reptile	SOI	G5	S3				4				
Crotalus horridus	Timber rattlesnake	Reptile	SOI	G4	S3				6		2	2	2
Elaphe guttata guttata	Corn Snake	Reptile	SOI	G5	S4	F3		yes	2				
Eumeces inexpectatus	Southeastern five-lin	Reptile	SOI	G5	S5	F3		yes	2				
Eumeces laticeps	Broad-headed Skink	Reptile	SOI	G5	S5			yes	2				
Farancia abacura abacura	Eastern Mudsnake	Reptile	SOI	G5	S4			yes	2				
Heterodon platirhinos	Eastern Hog-nosed Sna	Reptile	SOI	G5	S4S5			yes	2				
Kinosternon baurii	Striped Mud Turtle	Reptile	SOI	G5	S3?		yes		1				
Lampropeltis calligaster rho	Mole Kingsnake	Reptile	SOI	G5T5	Not in N				1				
Lampropeltis getula getula	Eastern Kingsnake	Reptile	SOI	G5T5	S5			yes	2				
Lampropeltis traingulum tria	Eastern Milk Snake	Reptile	SOI	G5T5	S2S3		yes		1				
Lampropeltis triangulum elap	Scarlet Kingsnake	Reptile	SOI	G5T5	S3	F2			6				
Masticophis flagellum	Coachwhip	Reptile	SOI	G5	S3				6		1	3	3
Ophisaurus attenuatus	Slender Glass Lizard	Reptile	SOI	G5	S3				3				
Pituophis melanoleucus melan	Northern Pine Snake	Reptile	SOI	G4T4	S3	F0			6		16	1	1
Sistrurus miliarius	Pigmy Rattlesnake	Reptile	SOI	G5	S3				6		1	1	1
Tantilla coronata	Southeastern Crowned	Reptile	SOI	G5	S3S4	F1			2				
Terrapene carolina	Eastern Box Turtle	Reptile	SOI	G5	S5			yes	2				
Thamnophis sauritus sauritus	Eastern Ribbon Snake	Reptile	SOI	G5	S4	F3		yes	2				
Virginia valeriae	Smooth Earth Snake	Reptile	SOI	G5	S3	F2			3				
Acer leucoderme	Chalk Maple	vas	SOI	G5	S3	F3		yes	2				
Allium cernuum var cernuum	Nodding onion	vas	SOI	G5T5	SNR	F2		probabl	2				
Amorpha schwerinii	Piedmont Indigo-bush	vas	SOI	G3G4	S3	F3		yes	7	62	99	102	102

Anemone berlandieri	Southern Anemone	vas	SOI	G4?	S2	F1			7	1	3	7	6
Anemone caroliniana	Carolina Anemone	vas	SOI	G5	S1	F0	yes		1			2	0
Arabis missouriensis	Missouri Rockcress	vas	SOI	G5?Q	S1	FP			7		3	7	5
Asplenium bradleyi	Bradley's Spleenwort	vas	SOI	G4	S1	F0	yes		1			1	1
Baptisia alba var alba	Thick-pod White Wild	vas	SOI	G5T3T5	S2	FP			7		5	13	13
Baptisia albescens	Thin-pod White Wild I	vas	SOI	G4	S2	F2			7	9	23	30	30
Buchnera americana	American Bluehearts	vas	SOI	G5	SH	F?			3			1	1
Campanulastrum americanum	Tall Bellflower	vas	SOI	G5	S4	F?		yes	2			1	0
Cardamine dissecta	Dissected Toothwort	vas	SOI	G4?	S2	F1			7	2	10	9	9
Cardamine douglassii	Douglass's Bittercres	vas	SOI	G5	S2	F0	yes		1			7	7
Carex bushii	Bush's Sedge	vas	SOI	G4	S1	F0	yes		1			2	2
Carex gracillima	Graceful sedge	vas	SOI	G5	S3	FP		yes	2				
Carex jamesii	James's Sedge	vas	SOI	G5	S1	F?			9			5	5
Carex meadii	Mead's Sedge	vas	SOI	G4G5	S1	F0	yes		1			2	2
Carex projecta	Necklace Sedge	vas	SOI	G5	S1	F?			9			1	1
Carex vestita	Velvet Sedge	vas	SOI	G5	SH	F0	yes		1			1	1
Carya laciniosa	Big Shellbark Hickory	vas	SOI	G5	S1	F0	yes		1			1	1
Celastrus scandens	American bittersweet	vas	SOI	G5	S2	FP			7				
Cirsium carolinianum	Carolina Thistle	vas	SOI	G5	S2	F2			7	11	11	14	13
Coelorachis cylindrica	Carolina Jointgrass	vas	SOI	G4G5	SH	FP			3			1	1
Collinsonia tuberosa	Piedmont Horsebalm	vas	SOI	G3G4	S1	F1			7	1	1	5	5
Cyperus houghtonii	Houghton's Flatsedge	vas	SOI	G4?	SH	F0	yes		1				
Cystopteris protrusa	Lowland Brittle Fern	vas	SOI	G5	S5	F1		yes	2			3	0
Danthonia epilis	Bog Oatgrass	vas	SOI	G3G4	S2?	FP			7		2	2	2
Dicentra cucullaria	Dutchman's Breeches	vas	SOI	G5	S4	F1?		yes	2			1	0
Dichanthelium annulum	A Witch Grass	vas	SOI	GNR	SH	FP			7			5	4
Didiplis diandra	Water Purslane	vas	SOI	G5	S1	F0	yes		1			1	1
Dodecatheon meadia var. mead	Eastern Shooting-Star	vas	SOI	G5T5	S2	FP			7		3	9	4
Enemion biternatum	Eastern Isopyrum	vas	SOI	G5	S2	F0	yes		1			12	10
Euonymus atropurpureus	Wahoo	vas	SOI	G5	S2	F?			3			1	0
Eupatorium godfreyanum	Godfrey's Thoroughwor	vas	SOI	G4	S2	F0	yes		1			7	7
Eupatorium incarnatum	Pink Thoroughwort	vas	SOI	G5	S2	F?			3			3	3
Euphorbia mercurialina	Cumberland Spurge	vas	SOI	G4	S2	F0	yes		1			10	10
Helenium brevifolium	Littleleaf Sneezeweed	vas	SOI	G4	S2	FP			7	0	3	3	3

Helianthus laevigatus	Smooth Sunflower	vas	SOI	G4	S2	F2		yes	7	16	37	50	49
Hexalectris spicata	Crested Coralroot	vas	SOI	G5	S2	FP			7		8	11	11
Hexastylis lewisii	Lewis's Heartleaf	vas	SOI	G4	S3	F0	yes		1			40	40
Liatris squarrulosa	Earle's Blazing-star	vas	SOI	G4G5	S2	F?			3			18	18
Lilium canadense ssp. canade	Yellow Canada Lily	vas	SOI	G5T4?	S1	F?		yes	2			1	1
Lilium canadense ssp. editor	Red Canada Lily	vas	SOI	G5T4	S1	F?			8			1	1
Linum sulcatum var. sulcatum	Glade Flax	vas	SOI	G5T5	SH	F0	yes		1			1	1
Lithospermum canescens	Hoary Puccoon	vas	SOI	G5	S2	F?			9			16	16
Lithospermum tuberosum	Tuberous Gromwell	vas	SOI	G4	S0	F0	yes		1			1	0
Matelea decipiens	Glade Milkvine	vas	SOI	G5	S2	FP			7		2	9	7
Minuartia uniflora	Single-flowered Sandw	vas	SOI	G4	S1	F0	yes		1			8	3
Oligoneuron album	Prairie Goldenrod	vas	SOI	G5	S1	F?			8			1	1
Oligoneuron rigidum var. ri	Prairie Goldenrod	vas	SOI	G5	S1	F0	yes		1			1	0
Oligoneuron rigidum var. gla	Southeastern Bold Gol	vas	SOI	G5T4	S2	F?			8			8	8
Osmorihiza claytonii	Hairy Sweet-cicely	vas	SOI	G5	S5	F1?		yes	2			1	0
Panax quinquefolius	American Ginseng	vas	SOI	G3G4	S4	F1?			9			3	0
Panicum flexile	Wiry Panic Grass	vas	SOI	G5	S1	F0	yes		1			4	4
Pellaea wrightiana	Wright's Cliff-brake	vas	SOI	G5	S1	F0	yes		7		1	1	1
Philadelphus hirsutus	Streambank Mock-orang	vas	SOI	G5	S2	F0	yes		1			2	0
Plantago cordata	Heart-leaf Plaintain	vas	SOI	G4	S1	FP			7				
Platanthera peramoena	Purple Fringeless Orc	vas	SOI	G5	S2	F0	yes		1			3	3
Porteranthus stipulatus	Indian Physic	vas	SOI	G5	S2	FP			7		5	33	26
Prunus pumila var. susquehan	Susquehanna Cherry	vas	SOI	G5T4	SH	F0	yes		1			1	1
Pseudognaphalium helleri	Heller's Rabbit-Tobac	vas	SOI	G3G4	S3	F1		yes	7	1	3	13	13
Quercus austrina	Bluff Oak	vas	SOI	G4	S1	F1			7	1		2	2
Quercus bicolor	Swamp White Oak	vas	SOI	G5	S2	F?			8			1	0
Quercus prinoides	Dwarf Chinquapin Oak	vas	SOI	G5	SH	FP			3				
Quercus sinuata	Durand's White Oak	vas	SOI	G4G5	S0	F0	yes		1			16	0
Ranuculus ambigens	Water-plantain Spearw	vas	SOI	G4	SH	F0	yes		1			1	1
Rhododendron eastmanii	May White	vas	SOI	G2	S0	F0	yes		1			1	0

Ruellia humilis	Low Wild-petunia	vas	SOI	G5	S1	F0	yes		1			7	7
Schoenoplectus etuberculatus	Canby's Bulrush	vas	SOI	G3G4	S3	F?		yes	7		1	1	1
Scirpus pendulus	Rufous Bulrush	vas	SOI	G5	S1	F?			1			5	5
Scutellaria australis	Southern Skullcap	vas	SOI	G4?Q	S1	F?			3			1	1
Scutellaria leonardii	Shale-barren Skullcap	vas	SOI	G4	S1	F0	yes		1			10	10
Scutellaria nervosa	Veined Skullcap	vas	SOI	G5	S1	F?			3			4	4
Silphium terebinthinaceum	Prairie Dock	vas	SOI	G4G5	S2	FP			8		1	24	24
Smilax hugeri	Huger's Carrion-flowe	vas	SOI	G4	S2	FO	yes		1			1	1
Solidago radula	Western Rough Goldenr	vas	SOI	G5?Q	S1	FP			7		2	2	2
Solidogo auriculata	Eared Goldenrod	vas	SOI	G4	S0	F0	yes		1			2	0
Stachys sp. 1	Yadkin Hedge Nettle	vas	SOI	GNR	S1	FP			7		1	3	1
Stewartia ovata	Mountain Camellia	vas	SOI	G4	S2	F1			7	1	2	3	3
Symphyotrichum laeve var. co	Narrow-leaf Aster	vas	SOI	G5T4	S2	FP			7		3	7	7
Symphyotrichum parviceps	Glade Aster	vas	SOI	G4?	S1	F0	yes		1			4	4
Thermopsis mollis sensu stri	Appalachian Golden-ba	vas	SOI	G3G4	S2	FP	yes		1			3	3
Tradescantia virginiana	Virginia Spiderwort	vas	SOI	G5	S1	F1			7	1	1	4	2
Trepocarpus aethusae	Aethusa-like Trepocar	vas	SOI	G4G5	S0	F0	yes		1			1	0
Trichostema brachiatum	Glade Bluecurls	vas	SOI	G5	S1	F?			8			3	3
Verbena riparia	Riverbank vervain	vas	SOI	GUGHQ	SH	F0	?		3				
Viola walteri	Prostrate Blue Violet	vas	SOI	G4G5	S1	F1			7	1		1	1

[1/] EOs for more common birds are from R8 Bird points on the Uwharrie, i.e., value is the greatest number of yearly observations made for the species from 1997 to 2005

Potential Status:

T&E = Federal Threatened or Endangered Species
SOC = Species of Concern; G1-G3
SOI = Species of Interest; S1-S3

Screening Criteria:

1 = Outside the range of the UWNF
2 = Secure to mostly secure(S4,S5) in NC and Globally G3,G4,G5
3 = Data on species insufficient, i.e. habitat preference description too broad, species extirpated and historical distribution unknown or vague, and no record in the 4 county area
4 = Management action not necessary to prevent federally listing
5 = Species extipated in area and the UWNF does not have sufficient intact habitat to make conservation contribution

6 = Occurs in 4-county area but will not be affected by management practices
7 = Considered further because of management concerns or opportunities on the UWNF
8 = Considered further because status throughout range and habitat restoration opportunities on the UWNF
9 = Fairly widespread, e.g. occurring in > 1 section: Piedmont, Mountains, Coastal Plain - and/or UWNF not in significant portion of range to contribute significantly to conservation