NORTH CAROLINA
Natural Heritage Program
SCIENCE GUIDING CONSERVATION

Eno River Diabase Sill Photo: Justin Robinson

SURVEY OF **PIEDMONT PRAIRIES AND SAVANNAS** OF DURHAM COUNTY NORTH CAROLINA

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EXECUTIVE SUMMARY

The North Carolina Natural Heritage Program (NHP) is a nonregulatory state agency in the Department of Natural and Cultural Resources. Our biologists, data managers, and stewardship specialists assist landowners and managers in assessing and managing properties for the preservation of North Carolina's natural heritage. At the request of Durham County Open Space, NHP conducted a customized review of rare plant species and natural communities associated with the Piedmont Savanna ecosystem. The survey was conducted in August and September 2023.

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INTRODUCTION

In North Carolina, Piedmont Prairies and savannas are open woodlands and grasslands occurring in patches throughout the central region of the state. The term "Piedmont Prairie" generally includes both human-influenced landscapes that have an open canopy as well as rare glade-like natural communities associated with outcrops of mafic rock and hardpan soils. Naturally occurring Piedmont Prairies are classified by NC Natural Heritage Program as Piedmont Acidic Glade, Piedmont Basic Glade, Xeric Hardpan Forest, Dry Oak-Hickory Forest, and Dry-Basic Oak-Hickory Forest (Schafale 2023 in prep.), depending on the soils and vegetation naturally occurring at a given site.

Some publications suggest that human-influenced Piedmont Prairies once predominated the Piedmont regions of Virginia, the Carolinas, and Georgia prior to European settlement. Much like the 'derived savannas' of West Africa (Salako et al., 2006) these ecosystems have been shaped over the last 18,000 years through burning, grazing, agriculture and foraging by the first residents of these areas. Without the intervention of human management, most of these ecosystems revert to closed canopy systems that are not as diverse as savannas and prairie systems. These systems are defined by 1) canopies that are not closed or canopies that are altogether absent, 2) fire-tolerant or fire dependent tree species and 3) warm-season grasses and asters at the herb layer. Warm-season grasses like Indian-grass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Eastern gamagrass (*Tripsacum dactyloides*), and purple lovegrass (*Eragrostis spectabilis*) dominate the ground layer in these systems. While prairie and savanna systems are currently mostly confined to dry and/or rocky conditions, many people believe that historically they were found across various soil moisture gradients.

Some of the most biologically significant natural areas in the North Carolina Piedmont occur at Diabase Glades in association with mafic rock (Oakley et al. 1995). Mafic rocks contain high amounts of magnesium, iron, and other minerals which generally produce soils that are less acidic (having a pH of 6.5 – 7.0), compared with most soils in the North Carolina Piedmont. These are relatively uncommon soils in North Carolina. Soils derived from mafic rocks frequently have physical properties that are conducive to clay hardpan formation. These natural glades are believed to be maintained primarily by shallow soil and high rock content. Drought may be important in maintaining the open vegetation in the long term by killing established trees as well as limiting seedling establishment. Fires are especially important in maintaining open conditions in marginal areas with less extreme soils. Many of the rarest plants and natural communities of the NC Piedmont are strictly associated with soils derived from mafic rock.

The purpose of this study was to visit sites that have not previously been surveyed to find new examples of Piedmont Prairies or savannas in Durham County.

PIEDMONT PRAIRIES AND SAVANNAS DURING INDIGENOUS MANAGEMENT

Like humans everywhere, the ancestors of the modern-day Occaneechi Band of Saponi Nation, Sappony Nation, and Haliwa-Saponi worked with and shaped their environment to suit the needs of their towns and communities. Historically, Piedmont Prairies and savannas were managed for mast-producing trees like hickories and oaks, leafy greens like lamb's quarters, cutleaf coneflower, spiderwort, and pokeweed (Hudson 1990). They were also managed for many fruits, grains, root vegetables, fiber, and dyes for textile production, grasses for thatching and insulation of homes, as well as for ceremonial objects and medicines. Prairies and savannas were also managed as forage for American bison (*Bison bison*), white-tail deer, and the now extinct eastern elk and heath hen. Periodic prescribed fire, tree felling, and grazing were timed to stimulate production of grasses and to provide natural resources for the production of goods in the society.

UNDER EUROPEAN MANAGEMENT

The arrival of Europeans signaled the end of the Piedmont Prairie and savanna ecosystems. As Europeans began settling North Carolina, land conversion usually followed a series of patterns. Fertile floodplains formerly cultivated by Indigenous citizens were converted to tobacco and corn production, prairie uplands were converted to wheat, tobacco, and cotton production, and savannas and mesic prairies were largely used as forage for free-range cattle and hogs (Brickell, Lawson 1737). By the mid-1800s, these ecosystems had already undergone dramatic changes that would leave them vulnerable to further conversion. Grasses like tall fescue, orchardgrass, and crabgrass as well as legumes like white clover, crown vetch, and alfalfa were planted extensively across the landscape as forage for livestock, largely replacing native flora.

PIEDMONT PRAIRIES AND SAVANNAS IN DURHAM COUNTY

Durham County has several large Piedmont Prairie sites which provide a glimpse into Durham's geological past. Durham's high-base soils, unlike the high-base soils found in other parts of the Piedmont, which are found on toe and foot slopes near streams (Schmidt; Barnwell 2002), occur around diorite, diabase, or gabbro outcrops. These outcrops (geologic dikes and sills) are associated with streams and rivers along the geological border between the Carolina Slate Belt and the Triassic Basin. The steepness and rocky surfaces of these outcrops and the influence of the mineralogy of the surrounding Triassic Basin soils make these areas completely unsuitable for plowing for agriculture, for conversion to pasturelands or for suburban residential development. Therefore, these outcrops represent the rarest condition in the Piedmont, that is, a relatively large area that has never been plowed, pastured, or converted to residential housing – all associated with uncommon soils. Even when these rare geological conditions are present, except in the most extreme examples, without human intervention to prevent canopy closure, these areas revert to closed canopy systems.

The soils in and around the Triassic Basin represent some of the most extreme soil conditions to be found in the Piedmont. Iredell soils, known for their elevated levels of basic elements such as calcium and magnesium and their ability to shrink and swell, are associated with the geologic boundary between the Carolina Slate Belt and the Triassic Basin. Commonly found in Durham County, White Store soils also have elevated proportions of basic elements, shrink-swell mineralogy, but have a high aluminum content that renders these soils some of the most acidic in the Piedmont (Ragland; Coleman 1959). Both of these soils, while not suitable for plantation-style agriculture, have long provided a refuge for plants and animals where other more fertile soils have long since lost their native vegetation.

Careful observation of these sites over time has revealed many rare plants, including US and NC Threatened smooth coneflower (*Echinacea laevigata*), NC Threatened hoary puccoon (*Lithospermum canescens*), and prairie blue wild indigo (*Baptisia aberrans*), and Significantly Rare glade wild quinine (*Parthenium auriculatum*), with some populations being the largest in the world. Many of these sites are under federal, state, or municipal protection and are managed to maintain the prairie and savanna conditions that these species require to complete their life cycles.

This report is divided into two sections: 1) known Piedmont Prairie sites, and 2) new locations first surveyed in 2023 for this project.

PART 1: KNOWN PIEDMONT PRAIRIES IN DURHAM

DURHAM PIEDMONT PRAIRIE AND SAVANNA NATURAL AREAS

Durham County has a relatively high number of well-studied Piedmont Prairie remnants located on the most extreme soil conditions and geologic features in the county. The six best known Piedmont Prairie sites are described in this report to provide examples for study and reference. The locations are shown in Figure 1. Studying the geology and soil conditions of these sites can allow us to predict where remnant prairies may be located. Four of the most important sites are located on a diabase sill that spans the northern and southern banks of the Eno River as it crosses Old Oxford Road. Five of the six natural areas included here are located on diabase sills at the geological boundary between the Triassic Basin and the Carolina Slate Belt.

*Large-flower aster (*Symphyotrichum grandiflorum*)*
Photo: Justin Robinson

1. SITE NAME: CATSBURG NATURAL AREA (124 ACRES)

Catsburg Natural Area is bounded by the Eno River on its northern edge and by Old Oxford Road on its western edge. Located on the rocky outcrop of plow-defying diabase, this site contains a Basic Mesic Forest on the slopes above the river, and Dry-Basic Oak-Hickory Forest on the flat uplands away from the river. This natural area supports a portion of one of the largest populations of Federally Threatened smooth coneflower (*Echinacea laevigata*) in North Carolina; and a large collection of 13 different types of rare species and natural communities. This stretch of the Eno River also provides critical habitat for multiple federally protected aquatic animal species. In addition to the Piedmont Prairie rare species listed, diabase indicator plants present include fragrant sumac (*Rhus aromatica*).

CONSERVATION

The site is partially protected and managed by multiple state agencies: North Carolina Plant Conservation Program (NC Dept of Agriculture) – Eno River Diabase Sill Plant Conservation Preserve Dedicated Nature Preserve; NC Wildlife Resources Commission and US Army Corps of Engineers – Butner-Falls of Neuse Game Land Catsburg Registered Heritage Area. The Plant Conservation Preserve is managed with prescribed fire in coordination with the North Carolina Botanical Garden. The Mountains-to-Sea Trail runs through the Game Land along the crest of the river bluffs. An important portion of the natural area (15 acres) is still privately owned and not formally protected. This area is a high priority for conservation, as it supports a handful of rare species including smooth coneflower, Michaux's sumac, and Earle's blazing-star.

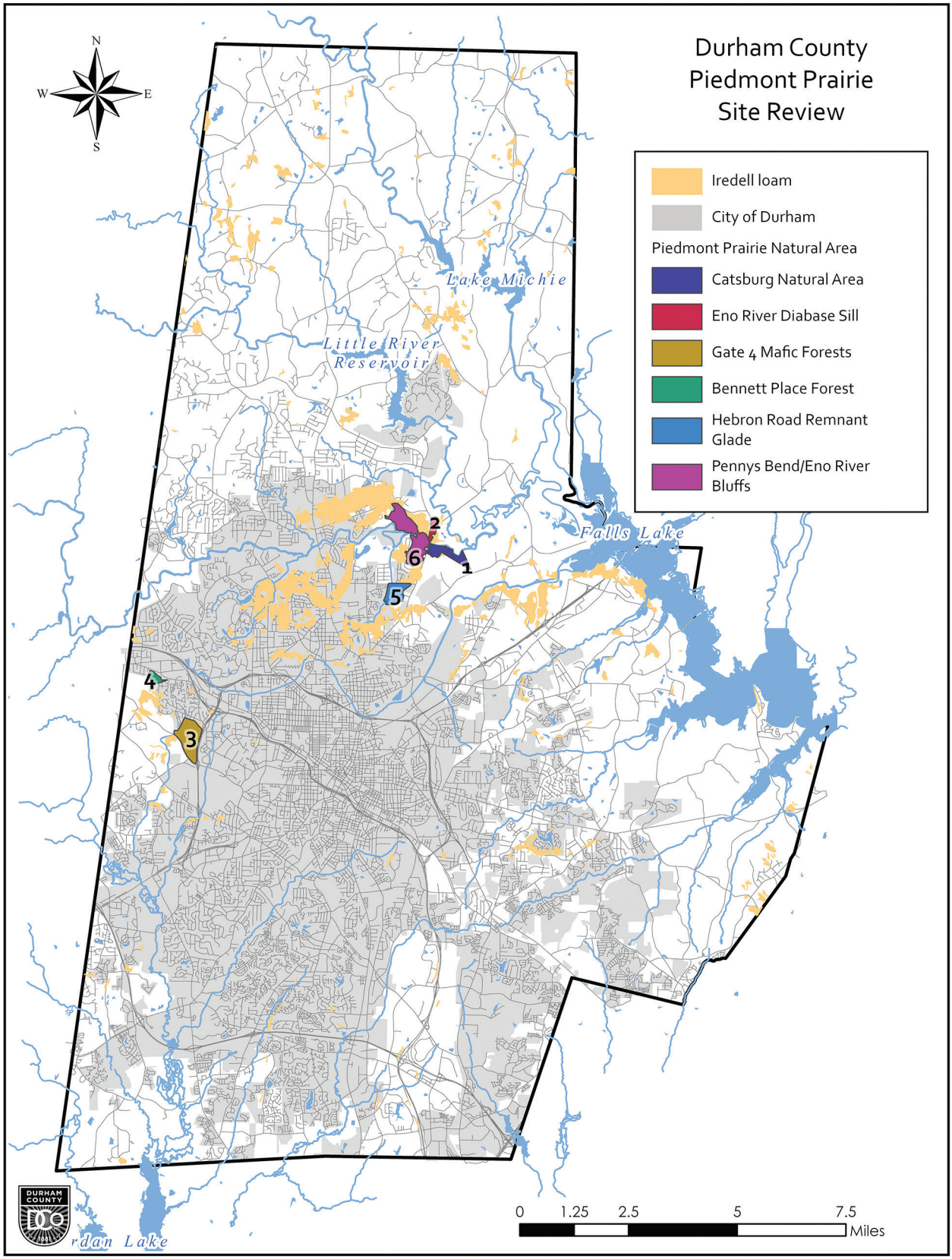


Figure 1: Durham County Piedmont Prairie Natural Areas
Iredell soils (yellow), Durham City (gray), and major waterways (blue). Numbered areas indicate locations of known prairie sites surveyed for this report.

PIEDMONT PRAIRIE RARE SPECIES*

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Agastache nepetoides	Giant Yellow Hyssop	-	Significantly Rare-Peripheral	G5	S1
Echinacea laevigata	Smooth Coneflower	Threatened	Threatened	G2G3	S1S2
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	S2	G4G5
Rhus michauxii	Michaux's Sumac	Endangered	Endangered	G2G3	S2
Ruellia purshiana	Pursh's Wild Petunia	-	Special Concern-Vulnerable	G3	S2
Scutellaria leonardii	Leonard's Skullcap	-	Endangered	G4T4	S2
Symphyotrichum concinnum	Narrow-leaved Smooth Aster	-	Endangered	G4T5	S2

**Additional rare species associated with the river and slope are not listed here.*

Red ring milkweed (Asclepias variegata)
at Catsburg Natural Area
Photo: Justin Robinson

Vegetative smooth coneflower (Echinacea laevigata) *at Catsburg Natural Area*
Photo: NHP Staff

Vegetative fragrant sumac (Rhus aromatica) *at Catsburg Natural Area*
Photo: NHP Staff

Vegetative Michaux's sumac (Rhus michauxii) *at Catsburg Natural Area*
Photo: NHP Staff

2. SITE NAME: ENO RIVER DIABASE SILL (44 ACRES)

The Eno River Diabase Sill Natural Area is located between Snow Hill Road and Old Oxford Road. With a combination of Iredell and Roanoke soils, this tract has both bottomland and upland which contributes to the species diversity. This natural area supports a portion of one of North Carolina's largest populations of both Federally and State Threatened smooth coneflower (*Echinacea laevigata*) and State Endangered prairie blue wild indigo (*Baptisia aberrans*), and one of the best known examples of Xeric Hardpan Forest (Northern Prairie Barren Subtype); as well as a large collection of 16 different types of rare species and natural communities. Natural communities include Xeric Hardpan Forest (Northern Prairie Barren Subtype) and Upland Depression Swamp Forest, both strongly influenced by the shrink-swell properties of diabase soils. In addition to the Piedmont Prairie rare species listed, diabase indicator plants present include curlyheads (*Clematis ochroleuca*).

CONSERVATION

The majority of the site is protected and managed by the North Carolina Plant Conservation Program (NC Dept. of Agriculture) as part of the Eno River Diabase Sill Plant Conservation Preserve Dedicated Nature Preserve. Durham County holds conservation easements on several privately owned parcels to add additional protection. The Plant Conservation preserve is managed with prescribed fire in coordination with the North Carolina Botanical Garden and members of the Penny's Bend Management Advisory Committee.

Eno River Diabase Sill
Photo: Justin Robinson

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Baptisia aberrans	Prairie Blue Wild Indigo	-	Endangered	G5T2	S2
Berberis canadensis	American Barberry	-	Special Concern-Vulnerable	G3G4	S2
Delphinium exaltatum	Tall Larkspur	-	Threatened	G3	S2
Dichanthelium annulum	Ringed Witchgrass	-	Endangered	G4	S1
Echinacea laevigata	Smooth Coneflower	Threatened	Threatened	G2G3	S1S2
Fleischmannia incarnata	Pink Thoroughwort	-	Significantly Rare-Other	G5	S2
Hexalectris spicata	Crested Coralroot	-	Significantly Rare-Peripheral	G5	S2
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	G4G5	S2
Lithospermum canescens	Hoary Puccoon	-	Threatened	G5	S2
Parthenium auriculatum	Glade Wild Quinine	-	Significantly Rare–Throughout	G3G4	S3
Polygala senega	Seneca Snakeroot	-	Special Concern-Vulnerable	G4G5	S2
Ruellia humilis	Low Wild-Petunia	-	Special Concern-Vulnerable	G3	S2
Scutellaria leonardii	Leonard's Skullcap	-	Endangered	G4T4	S2
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2
Symphyotrichum concinnum	Narrow-leaved Smooth Aster	-	Endangered	G4T5	S2

*Earle's Blazing Star (*Liatris squarrulosa*)*
Photo: Johnny Randall

*Curlyheads (*Clematis ochroleuca*) seedhead*
Photo: Michael Schafale

*Crested Coralroot (*Hexalectric spicata*)*
Photo: Andy Walker

*Smooth Coneflower (*Echinacea laevigata*)*
Photo: Michael Schafale

3. SITE NAME: GATE 4 MAFIC FOREST (241 ACRES)

This site is bounded on its western edge by Hwy 751 and by Hwy 15-501 on its eastern edge. Located on a smaller diabase sill than Eno River Diabase Sill and Catsburg Natural Areas, this tract is largely forested and supports mature examples of Dry-Basic Oak-Hickory Forest (with rare plant species) and Dry-Mesic Basic Oak-Hickory Forest. This site has both Iredell and White Store soils which can often result in high species diversity. This natural area is notable for supporting viable populations of Earle's blazing-star (*Liatris squarrulosa*) and prairie dock (*Silphium terebinthinaceum*); and a collection of 5 different types of rare species and natural communities. In addition to the known rare species listed, a specimen of smooth coneflower was collected from the Duke Forest area in 1931 but has not been found since; the exact location is unknown but it is likely to have been associated with diabase soils such as those found at this site.

CONSERVATION

The entire natural area is owned and managed by Duke University. The most mature areas and forest containing rare species are protected by a voluntary Registered Heritage Area agreement between Duke University and the NC Natural Heritage Program.

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	G4G5	S2
Parthenium auriculatum	Glade Wild Quinine	-	Significantly Rare–Throughout	G3G4	S3
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2

Gate 4 Mafic Forest
Photo: Justin Robinson

Gate 4 Mafic Forest
Photo: Misty Buchanan

*Whorled Milkweed (*Asclepias verticillata*)*
Photo: Misty Buchanan

*Prairie Dock (*Silphium terebinthinaceum*)*
Photo: Stephanie Horton

4. SITE NAME: BENNETT PLACE FOREST (46 ACRES)

This site differs from the other Piedmont Prairies in this report in that it is not located on a diabase sill and no rare plants have been reported here. The natural area has uncommon soil conditions for Durham County - Helena soil, sometimes called “sandy land”. Included within this soil are areas of nearly level, somewhat poorly drained soils. These soils are often saturated for parts of the year even when located in uplands. These conditions make these soils more like some Coastal plain soils, wet and sandy. This natural area is notable for the presence of Upland Depression Swamp Forest embedded within Xeric Hardpan Forest (Basic Hardpan Subtype); and supports a small collection of 3 different types of rare species and natural communities. Dry locations within the site are dominated by large shortleaf pines (*Pinus echinata*), upland oaks (*Quercus* spp.) and blueberry (*Vaccinium* spp.) and huckleberry (*Gaylussacia* spp.). This site once contained dwarf sundew (*Drosera brevifolia*). A population of State Special Concern four-toed salamander (*Hemidactylium scutatum*) is associated with the upland depressions (isolated wetlands) and the surrounding forest, extending into Duke Forest.

CONSERVATION

Approximately 2/3 of the natural heritage area is within Bennett Place State Historic Site and protected by a voluntary Registered Heritage Area agreement between NC Historic Sites and the NC Natural Heritage Program. Duke University owns 2 acres of the site. This area of Duke Forest remains a high priority for additional inventory and protection efforts. The remaining 12 acres of the natural area is owned by one private landowner and is a high priority for conservation as it is believed to be important for the four-toed salamander population.

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Hexastylis lewisii	Lewis’s Heartleaf	-	Watch List	G3	S3

Bennett Place Forest
Photo: Justin Robinson

5. SITE NAME: HEBRON ROAD REMNANT GLADE (90 ACRES)

This site is bounded on its northern edge by Hebron Road and on its southern edge by Carver Street. Located on the same diabase sill shared by Eno River Diabase Sill and Catsburg Natural Areas, it thus shares many of the same rare and endangered species. This natural area is notable for the presence one of North Carolina's largest populations of each of four plant species: Federally and State Threatened smooth coneflower (*Echinacea laevigata*), State Endangered prairie blue wild indigo (*Baptisia aberrans*), Significantly Rare Atlantic mud-plantain (*Heteranthera multiflora*), and narrow-leaved smooth aster (*Symphyotrichum concinnum*); and supports a large collection of 8 different types of rare species. The natural communities where the rare plants are found are fairly young hardwood forests recovering from past land use. The NC Plant Conservation Program uses prescribed fire to restore the natural open canopy conditions that are necessary for vigorous growth and reproduction of the sun-loving rare plants. Mechanical thinning of loblolly pines, sweetgum, and red maple would also be beneficial in areas with densest tree cover.

CONSERVATION

The majority of the site is protected and managed by the North Carolina Plant Conservation Program (NC Dept. of Agriculture) as part of the Hebron Road Plant Conservation Preserve Dedicated Nature Preserve. Additional private land to the south, extending as far as E. Carver Street, historically supported several patches of the rare plant populations listed here as well as State Special Concern American barberry (*Berberis canadensis*), and remains a high priority for conservation. Acquisition of this land would be beneficial for restoring rare plant habitat and would provide a natural buffer around the nature preserve that would help land managers plan prescribed burns within the nature preserve.

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Baptisia aberrans	Prairie Blue Wild Indigo	-	Endangered	G5T2	S2
Echinacea laevigata	Smooth Coneflower	Threatened	Threatened	G2G3	S1S2
Fleischmannia incarnata	Pink Thoroughwort	-	Significantly Rare-Other	G5	S2
Heteranthera pauciflora	Atlantic Mud-plantain	-	Significantly Rare-Peripheral	G3	S1
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	G4G5	S2
Lithospermum canescens	Hoary Puccoon	-	Threatened	G5	S2
Parthenium auriculatum	Glade Wild Quinine	-	Significantly Rare–Throughout	G3G4	S3
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2
Symphyotrichum concinnum	Narrow-leaved Smooth Aster	-	Endangered	G4T5	S2

Prairie dock at Hebron Road Remnant Glade
Photo: Justin Robinson

Flowering: Prairie Blue Wild Indigo flowering and Hoary Puccoon (orange), with leaves of Glade Wild Quinine (foreground)
Photo: Misty Buchanan

6. SITE NAME: PENNYS BEND/ENO RIVER BLUFFS (329 ACRES)

This site is the largest of the diabase sill sites in Durham and is bound on the eastern edge by Old Oxford Road, by Infinity Road on the northern edge, and the site spans both sides of the Eno River to the south. This natural area is notable for the presence of one of North Carolina's largest populations of State Endangered prairie blue wild indigo (*Baptisia aberrans*); and supports a large collection of 10 different types of rare species and natural communities. This natural area is a patchwork of mature forests, open fields, and roadsides, reflecting the past land use. Rare plants are scattered in clumps throughout the site, including some natural occurrences, some transplanted (rescued) from roadsides nearby, and some augmented with plants grown from seeds collected on-site. Augmented populations are considered experimental and are monitored closely to allow researchers to study best methods for rescue and transplanting these rare species. Mature natural communities include Basic Mesic Forest (Piedmont Subtype) and Upland Depression Swamp Forest. The stretch of Eno River in this area also supports critical habitat for multiple species of Federally protected aquatic animals. The Mountains-to-Sea Trail traverses this natural area along the Eno River.

CONSERVATION

This site is owned and managed by several agencies working cooperatively under the Pennys Bend Management Advisory Committee. Federal, state, local, and private organizations work together to manage the open areas with prescribed fire, remove invasive exotic species, and monitor rare plants. The Pennys Bend Nature Preserve, which is accessible to the public at a parking lot on Snow Hill Road near the intersection with Old Oxford Road, is protected with several layers of conservation agreements. The area owned by US Army Corps of Engineers as part of Falls Lake is a Registered Heritage Area, leased to the NC Department of Environmental Quality, and is subleased to the NC Botanical Garden for management. The Eno River Diabase Sill Plant Conservation Preserve Dedicated Nature Preserve protects some large parcels spanning the south side of Infinity Road to the Eno River. These lands are open to the public only through guided hikes led by the Friends of Plant Conservation. The Eno River Association Blue Indigo Slopes Registered Heritage Area and Rocky Branch Conservation Area protect several parcels on the south and north sides of the Eno River, respectively. Durham County and the City of Durham also protect several parcels in this area. Even with this incredible network of nature preserves, there are still privately owned parcels in this area that are considered high-priority for further conservation acquisitions. Given the landscape context within rapidly urbanizing northern Durham, conserving additional land here will be especially beneficial for providing connectivity for wildlife and pollinators and for managing the nature preserves with prescribed fire.

PIEDMONT PRAIRIE RARE SPECIES*

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Baptisia aberrans	Prairie Blue Wild Indigo	-	Endangered	G5T2	S2
Echinacea laevigata	Smooth Coneflower	Threatened	Threatened	G2G3	S1S2
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	G4G5	S2
Lithospermum canescens	Hoary Puccoon	-	Threatened	G5	S2
Matelea decipiens	Glade Milkvine	-	Watch List	G5	S3
Parthenium auriculatum	Glade Wild Quinine	-	Significantly Rare–Throughout	G3G4	S3
Ruellia humilis	Low Wild-Petunia	-	Special Concern-Vulnerable	G3	S2
Scutellaria leonardii	Leonard's Skullcap	-	Endangered	G4T4	S2
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2

Pennys Bend Site
Photo: Justin Robinson

*Glade Milkvine (*Matelea decipiens*)*
Photo: Misty Buchanan

*Hoary Puccoon (*Lithospermum canescens*)*
Photo: NHP Staff

*Prairie Blue Wild Indigo (*Baptisia aberrans*)*
Photo: Johnny Randall

DESCRIBING PIEDMONT PRAIRIES AND SAVANNAS

Piedmont Prairie natural communities, also referred to as Piedmont Savannas or Piedmont Woodlands, are formally classified by the Natural Heritage Program as Piedmont Basic Glade, Piedmont Acidic Glade, Diabase Glade, and Xeric Hardpan Forest (Schafale 2023, in prep.). Some Dry Oak-Hickory Forests and Dry-Basic Oak-Hickory Forests also display Piedmont Prairie-like tendencies, especially in openings caused by prescribed fire or windthrow. These types of open natural communities are rare in North Carolina's Piedmont, and intact, high quality examples are even more rare. Intact examples not previously known are very rarely discovered in current times. For this report, the sites visited are presented according to the prairie affinities noted during surveys, namely: presence of Iredell soils and presence of species considered to be indicators of open conditions which do not readily colonize new areas (non-ruderal sun-loving species). Although none were surveyed during this study, Piedmont Acidic Glades are a type of Piedmont Prairie community that is not associated with Iredell or basic soil. Acidic prairie sites are also quite rare in North Carolina and typically occur on shallow soil and associated xeric conditions.

Savannas are characterized by their open canopies and by being dominated by tree species that have natural adaptations that make them fire-tolerant or fire-dependent stilt grass. Bark thickness, specific density, crown width and density, and growth rate are examples of such adaptations (Hoffman et al. 2012). NC native tree species displaying these tendencies include white oak (Quercus alba), Spanish red oak (Quercus falcata), post oak (Quercus stellata), chestnut oak (Quercus montana), mockernut hickory (Carya tomentosa), and shortleaf pine (Pinus echinata).

Under pre-colonial indigenous management and currently in parts of the Midwest, savanna intergrades into prairie and vice versa. Since savannas are defined by their canopy cover and prairies are defined by their lack of canopy cover, it can be difficult to make clear and consistent distinctions between prairie and savannas given the fact that tree cover can be manipulated relatively quickly by humans. Because most prairies and savannas in the Piedmont that are not associated with extreme soils and rock outcrops are derived ecosystems in North Carolina, it must be remembered that any community that is designated as prairie or savanna is most likely an artifact of time and human management and should not be thought of as a permanent or a so-called natural state. Only the most extreme environments promote conditions that would not become closed canopy over time without the influence of prescribed fire or mechanical opening such as mowing.

The open sites reported here that have no prairie affinities typically have some evidence of recent soil disturbance (such as plowing for agriculture). These communities often have many early successional and invasive exotic species. We might expect to see ruderal species such as ragweed, Small's goldenrod (Solidago pinetorum), Small's ragwort (Packera anonyma), Carolina elephant's foot (Elephantophus carolinianus), blackberry (Rubus spp.), and broomsedge (Andropogon virginicus) and exotic species such as Japanese honeysuckle (Lonicera japonica), Japanese stiltgrass (Microstegium vimineum), and Brazilian vervain (Verbena brasiliensis). These communities may be dominated by a combination of blackberry thickets, young pines, and/or sweetgum, which makes them impassable, or may be maintained as open pastures with exotic grasses.

The sites reported as having moderate prairie affinities contain many of the same species as ruderal sites, and also may include species like blackseed needlegrass (*Piptochaetium avenaceum*), purple lovegrass (*Eragrostis spectabilis*), little bluestem (*Schizachyrium scoparium*), splitbeard bluestem (*Andropogon ternarius*), roundleaf thoroughwort (*Eupatorium pubescens*), woodland sunflower (*Helianthus divaricatus*), and wild quinine (*Parthenium integrifolium*). Trees include scattered shortleaf pine (*Pinus echinata*), post oak (*Quercus stellata*), and Spanish red oak (*Quercus*

falcata). Invasive exotic species are fewer. These communities represent some of the best potential sites for restoration.

The communities with strong prairie affinities are the most species-rich of the examples reported here. These sites typically include some ruderal species, as well as moderate prairie affiliates, and also include more conservative species (species that do not readily disperse into new locations). On acidic soils, plants like Michaux's lily (*Lilium michauxi*i), Eastern wild indigo (*Baptisia tinctoria*), Carolina silkgrass (*Pityopsis aspera*), flax-leaf aster (*Ionactis linariifolia*) and rattlesnake master (*Eryngium yuccifolium*) are encountered. On high-base soils, plants like glade wild indigo (*Baptisia aberrans*), fragrant sumac (*Rhus aromatica*), eastern false aloe (*Manfreda virginica*), big bluestem (*Andropogon gerardii*) and curlyheads (*Clematis ochroleuca*) may be encountered, as well as the rare prairie dock (*Silphium terebinthinaceum*), Earle's blazing-star (*Liatris squarrulosa*), and glade wild quinine (*Parthenium auriculatum*). These communities are often on rocky outcrops or along roadsides or railroads in rural parts of the county and have likely not experienced soil disturbance for more than 150 years.

PART 2: NEW PIEDMONT PRAIRIES IN DURHAM

A major goal of this survey was to identify previously unknown Piedmont Prairie sites that might be used for reference, restoration, and/or conservation. Potential survey sites were selected by North Carolina Natural Heritage Program and Durham County Open Space staff, with input from local botanists and conservationists. Sites were selected primarily on the basis of proximity to known sun-loving rare plant populations, presence of Iredell and other mafic soils, and natural conditions seen in aerial photos. Durham County staff contacted landowners and received permission to survey all sites included within this report. Eleven new sites were sur-veyed by the author during the summer of 2023. The locations are shown in Figure 2. It is possible that additional rare species and more common sun-loving prairie-affiliates may be discovered at these locations if surveys may be conducted at other times of the year. Table 1 shows the sites sur-veyed for this report and provides information about Piedmont Prairie affinities found at each site. The report and subsequent site descriptions are organized by prairie affinities (strong, moderate, none), and then alphabetically by site name.

TABLE 1: TRACTS SURVEYED AND PRAIRIE INDICATORS NOTED

SITE	SITE NAME	PRAIRIE AFFINITIES	MAPPED IREDELL SOILS	PRAIRIE INDICATORS	NOTES
1	Hebron Road	Strong	On Tracts	Glade Wild Quinine, Prairie Dock, Wild Quinine, Woodland Sunflower	Rare and common sun-loving species with basic affinities
2	Red Mill Road	Strong	On Tracts	Carolina Rose, Earle's Blazing-star, Little Bluestem, Prairie Dock, Slender Bush-Clover, Southeastern Bold Goldenrod	Rare and common sun-loving species with basic affinities
3	Hamlin Road	Moderate	On Tracts	Blackseed Needlegrass, Noseburn, Purple Lovegrass, Slender Bush-Clover, Southern Shagbark Hickory, Spanish Red Oak	Common dry site and sun-loving species with slight basic affinities.
4	Hollow Rock	Moderate	None	Blackseed Needlegrass, Shortleaf Pine, Southern Shagbark Hickory, Southern Sugar Maple	Common dry site and sun-loving species with slight basic affinities.
5	Old Oxford Road	Moderate	Nearby	Black Oak, Tall Ironweed, Shortleaf Pine, Willow Oak	Clay Hardpan Indicators
6	Santee Road	Moderate	None	Blackseed Needlegrass, Grass-leaf Blazing-Star, Maryland Golden-aster, Noseburn, Post Oak, Southern Shagbark Hickory, Spanish Red Oak	Common dry site and sun-loving species with slight basic affinities.
7	Scott King Road	Moderate	None	Little Bluestem, Maryland Golden-aster, Plumegrass, Swamp Vervain, Sumpweed	Common and uncommon sun-loving species of dry sites and wet meadows

SITE	SITE NAME	PRAIRIE AFFINITIES	MAPPED IREDELL SOILS	PRAIRIE INDICATORS	NOTES
8	Wanderlust Lane	Moderate	On tracts	Godfrey's Thoroughwort (Watch List), Shortleaf Pine, Spanish Red Oak, Woodland Sunflower	Common and Watch List dry site and sun-loving species with slight basic affinities.
9	Fayetteville Road	None	None	None	None
10	South Lowell Road	None	None	None	None
11	Stadium Drive	None	None	None	None

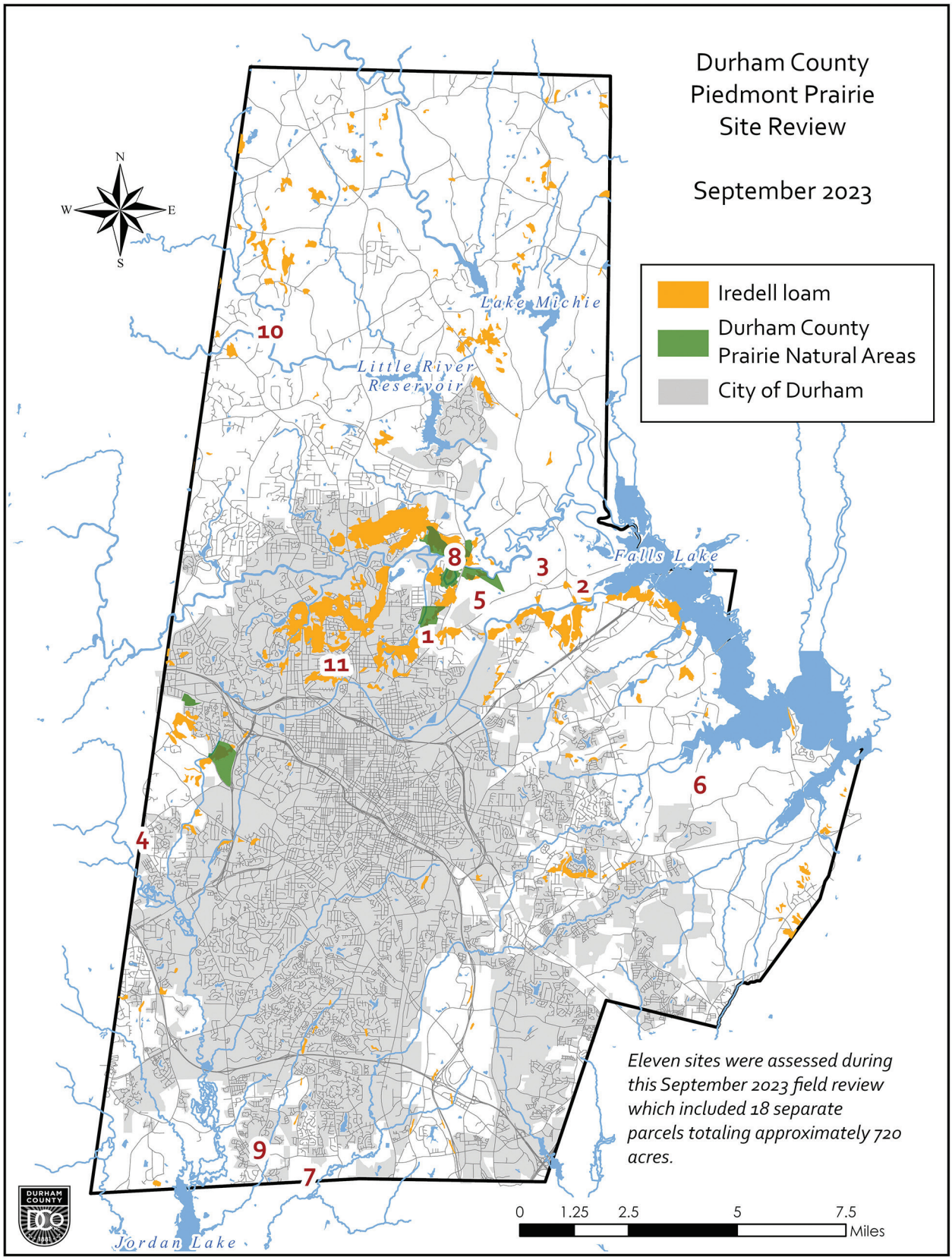


Figure 2: Durham County Piedmont Prairies

Iredell soils (yellow), NHP Natural Areas with Piedmont Prairies (green), Durham City (gray), and major waterways (blue). Numbered areas indicate approximate locations of sites surveyed for this report (described in Part 2).

1. SITE NAME: HEBRON ROAD REMNANT GLADE

OWNER Private

GENERAL DESCRIPTON Overall, this tract has strong prairie affinities, containing degraded savanna on foot slopes, shoulder slopes and uplands flat at the corner of Old Oxford Road and Carver Street. Due to the diverse soil conditions, this has likely not been plowed in the recent past. Historical aerial photography reveals that the high-base soils on the tract were largely left forested and semi-open, while the adjacent soils were converted to pastureland and then later planted in pine. The tract was likely last logged approximately 30 years ago. There has been recent construction of a stormwater pond on the tract's southwestern corner in advance of planned residential development.

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Parthenium auriculatum	Glade Wild Quinine	-	Significantly Rare–Throughout	G3G4	S3
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2

GEOLOGY This tract straddles a diabase sill along the boundary of the Triassic Basin.

SOIL The soils on this tract are primarily Iredell (*Oxyaquic Hapludalfs*) with inclusions of Creedmoor (*Aquic Hapludalfs*), Wilkes (*Typic Hapludalfs*), Mayodan (*Typic Hapludults*) and White Store (*Oxyaquic Hapludalfs*).

EXOTIC/WEEDY SPECIES Japanese stilt-grass (*Microstegium vimineum*) and Chinese bush-clover (*Lespedeza cuneata*) are abundant in some areas.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The northern portion of this tract is part of the Hebron Road Remnant Glade Natural Area, and the tract is adjacent to the Hebron Road Plant Conservation Preserve Dedicated Nature Preserve.

COMMUNITY DESCRIPTION The tract is a combination of both acidic and basic degraded prairie/savanna with moderate prairie affinities. The majority of the tract has a closed canopy. Small numbers of prairie/savanna species, such as Small's goldenrod (*Solidago pinetorum*), helmet skullcap (*Scutellaria integrifolia*), and roundleaf thoroughwort (*Eupatorium pubescens*), were observed in small openings or along footpaths. In the areas closest to the stormwater pond, rare species such as glade wild quinine (*Parthenium auriculatum*) and prairie dock (*Silphium terebinthinaceum*) were observed. Due to the recent disturbance of the area, the vegetation is a combination of weedy exotics like Chinese bush-clover (*Lespedeza cuneata*) and conservative species like woodland sunflower (*Helianthus divaricatus*), wild quinine (*Parthenium integrifolium*) and New York ironweed (*Vernonia noveboracensis*).

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS Due to the geologic and soil conditions, this tract has the possibility for high species richness. Careful thinning of unwanted tree species, removal of exotic invasive species, and prescribed fire would provide the appropriate conditions for the growth and reproduction of rare and non-rare prairie/savanna species. This tract would be a high priority for conservation if the opportunity arises.

*Glade wild quinine (*Parthenium auriculatum*) at Hebron Road Remnant Glade*
Photo: Justin Robinson

2. SITE NAME: RED MILL ROAD POWER LINE EASEMENT

OWNER Duke Energy Corporation

GENERAL DESCRIPTON Overall, this tract has strong prairie affinities, and is located on upland flats and shoulder slopes of Ellerbee Creek. According to 1940 – 1972 aerial photos, the western spur and the northern portion of the tract were in row crop agriculture. The southern third of the tract was largely forested, due to its steepness, until the electrical substation was constructed between 1972 and 1988, at which time it was cleared of trees along the power line easement. This land use pattern is reflected in the plant species observed.

PIEDMONT PRAIRIE RARE SPECIES

SCIENTIFIC NAME	COMMON NAME	US STATUS	NC STATUS	GLOBAL RANK	NC RANK
Liatris squarrulosa	Earle's Blazing-star	-	Significantly Rare-Peripheral	G4G5	S2
Oligoneuron jacksonii	Southeastern Bold Goldenrod	-	Significantly Rare-Peripheral	G5T4	S2
Silphium terebinthinaceum	Prairie Dock	-	Significantly Rare-Peripheral	G4G5	S2

GEOLOGY This tract straddles a diabase sill within the Triassic Basin.

SOILS Soils on this tract are Creedmoor (*Aquic Hapludults*), White Store (*Oxyaquic Vertic Hapludalfs*) on upland flats, Iredell (*Oxyaquic Vertic Hapludalfs*) on shoulder and foot slopes, and Chewacla and Wehadkee (*Fluvaquentic Dystrudepts*) along floodplains.

EXOTIC/WEEDY SPECIES Chinese bush-clover (*Lespedeza cuneata*), Japanese stilt grass (*Microstegium vimineum*), Bradford pear (*Pyrus calleryana*), and Japanese honeysuckle (*Lonicera japonica*) were observed in areas of recent soil disturbance throughout the tract.

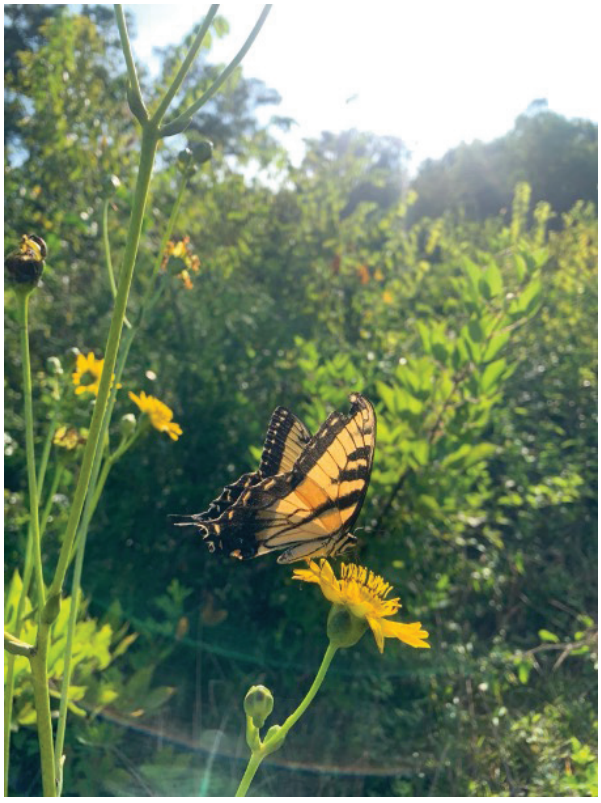
RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The eastern and southern edges of the tract are within the Falls Lake Shoreline and Tributaries Natural Area, including a collection of rare Piedmont Prairie species at the eastern boundary. Along the eastern and southern property lines, the tract is adjacent to Falls Lake land owned by US Army Corps of Engineers and managed by NC Wildlife Resources Commissions as part of Butner-Falls of Neuse Game Land.

COMMUNITY DESCRIPTION Prairie and savanna species were found in all areas of the tract where sunlight is sufficient. Within the power line right-of-way is an area with acidic soils and, while a few semi-conservative species like slender bush-clover (*Lespedeza virginica*), eastern gamagrass (*Tripsacum dactyloides*) and little bluestem (*Schizachyrium scoparium*) were observed, the majority of power line contains ruderal species such as ragweed (*Ambrosia artemisiifolia*), pineweed *(Hypericum gentianoides*), late boneset (*Eupatorium serotinum*), blackberry (*Rubus* spp.), and sensitive pea (*Chamaecrista nictitans*). This part of the site corresponds to the areas that had formerly been plowed for row crop cultivation prior to 1988.

This prairie remnant on the eastern property boundary is typical of other higher quality Piedmont Prairie remnants in the area. Species observed in this portion of the site are indicative of high-base soils. The site has likely not been plowed or converted to pasture in the past. The rare plants prairie dock (*Silphium terebinthinaceum*), southeastern bold goldenrod (*Oligoneuron jacksoni*), glade wild quinine (*Parthenium auriculatum*), and Earle's blazing star (*Liatris squarrulosa*) have been observed here and into the adjacent public land. Other uncommon species such as tall thimbleweed (*Anemone virginiana*), downy woodmint (*Blephilia ciliata*), and leatherflower (*Clematis viorna*) were also observed just south of the tract boundary. Conservative species like starry rosinweed (*Silphium asteriscus*), cutleaf coneflower (*Rudbeckia laciniata*), Carolina rose (*Rosa carolina*), and white vervain (*Verbena urticifolia*) also are found here.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS As this tract is owned and managed by Duke Energy Corporation, there is little danger of canopy closure if current management practices are continued. This site would benefit greatly from prescribed fire and careful removal of exotic, invasive species. Management of the powerline and open areas with mowing and prescribed fire would be recommended instead of herbicide application. This tract would be a high priority for a formal conservation agreement.

*Bumblebee and Maryland senna (*Senna marilandica*) at Red Mill Road site*
Photo: Justin Robinson



*Tiger swallowtail on prairie dock (*Silphium terebinthinaceum*) at Red Mill Road site*
Photo: Justin Robinson

3. SITE NAME: HAMLIN ROAD

OWNER Private

GENERAL DESCRIPTON This tract is located on toe, foot, and shoulder slopes as well as on uplands flats. This tract is a combination of open fields, Dry Oak-Hickory Forest, small stream terraces, and a power line right-of-way. The southeastern portion of the tract is used for growing grapes. The site is bounded on its southern edge by Hamlin Road.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY The tract is underlain by sedimentary rock located within the Triassic Basin in the Chatham Group.

SOIL Soils on this tract are primarily White Store (*Oxyaquic Vertic Hapludalfs*) with small inclusions of Iredell (*Oxyaquic Vertic Hapludalfs*), Helena (*Aquic Hapludults*), Mayodan (*Typic Hapludults*), and Chewacla and Wehadkee (*Fluvaquentic Dystrudepts*).

EXOTIC/WEEDY SPECIES Bahia grass (*Paspalum notatum*), Japanese stilt grass (*Microstegium vimineum*), and Japanese honeysuckle (*Lonicera japonica*) were observed throughout the tract.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The northwestern portion of the tract is part of the Lower Eno River/Little River Bottomlands Natural Area, including a population of Significantly Rare Douglass's bittercress (*Cardamine douglassii*) at the northern boundary. Along the northern and western property lines, the tract is adjacent to Falls Lake land owned by US Army Corps of Engineers and managed by NC Wildlife Resources Commissions as part of Butner-Falls of Neuse Game Land. South of the tract, 0.3 mile of sparse residential development separates the tract from Falls Lake Shoreline and Tributary natural area within another area of Butner-Falls of Neuse Game Land. The Red Mill Road Power Line Easement included in this report is approximately 0.5 miles southeast.

COMMUNITY DESCRIPTION This tract has moderate Piedmont Prairie affinities. Prairie and savanna species were found in all areas of the tract where sunlight was sufficient. Within the power line easement, a broad array of semi-conservative species with moderate prairie affinities were observed such as rose pink (*Sabatia angularis*), nettle-leaf noseburn (*Tragia urticifolia*), purple lovegrass (*Eragrostis spectabilis*), slender bush-clover (*Lespedeza virginica*), and New York ironweed (*Vernonia noveboracensis*). The forested portion of the tract supports a Dry Oak-Hickory Forest with American dittany (*Cunila origanoides*), blackseed needlegrass (*Piptochaetium avenaceum*), oak-leech (*Aureolaria* sp.), beardtongue (*Penstemon* sp.), and spotted St. John's- wort (*Hypericum punctatum*) in the herb layer. Tree species include post oak (*Quercus stellata*), white oak (*Quercus alba*), Spanish red oak (*Quercus falcata*), southern shagbark hickory (*Carya carolinae-septenrionalis*), and white ash (*Fraxinus americana*). The open fields are maintained as pasture and support a suite of native weedy species like horse-nettle (*Solanum carolinense*), Indian-hemp (*Apocynum cannabinum*), broom-straw (*Andropogon virginicus*) and exotic grasses planted for forage like Bahia grass (*Paspalum notatum*) and Bermuda grass (*Cynodon* sp).

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS Due to the geologic and soil conditions, this tract has the possibility for high species richness. Careful thinning of unwanted tree species, removal of exotic invasive species, and prescribed fire would provide the appropriate conditions for the growth and reproduction of rare and non-rare prairie/savanna species. The non-agricultural portions of the tract would be a high priority for conservation if the opportunity arises.

*Rose pink (*Sabatia angularis*) at Hamlin Road site power line right-of-way*
Photo: Justin Robinson

4. SITE NAME: HOLLOW ROCK

OWNER Durham County Open Space

GENERAL DESCRIPTON The western edge of this tract forms the boundary between Durham and Orange County. The northern and eastern sides are surrounded by dense residential development. The tract is a mixture of bottomlands, toe, foot, and shoulder slopes. The tract is largely a closed canopy system that was likely once part of a larger savanna system.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY The tract is underlain by sedimentary rock located within the Triassic Basin in the Chatham Group.

SOIL This tract is located on White Store (*Oxyaquic Hapludalfs*).

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES This tract is protected by Durham County as part of a larger effort to conserve land along New Hope Creek. Located 0.25 mile east of New Hope Creek Slopes terrestrial natural area and New Hope Creek aquatic habitat, public conservation land here provides an upland wildlife habitat. The tract is also 0.4 mile north of the Dry Creek/Mount Moriah Bottomland Natural Area.

COMMUNITY DESCRIPTION This tract has moderate Piedmont Prairie affinities. This tract is a closed canopy system in which shortleaf pine (*Pinus echinata*), pignut hickory (*Carya glabra*), southern shagbark hickory (*Carya carolinae-septentrionalis*) and white oak (*Quercus alba*) dominate the canopy and southern sugar maple (*Acer floridanum*), ironwood (*Carpinus caroliniana*), American hop-hornbeam (*Ostrya virginana*), sweetgum (*Liquidambar styraciflua*), and blackgum (*Nyssa sylvatica*) are found in the understory. The herb layer consists of species associated with deep shade like partridge-berry (*Mitchella repens*), wild yam (*Dioscorea villosa*), muscadine (*Muscadinia rotundifolia*) and strawberry-bush (*Euonymus americanus*). Blackseed needlegrass (*Piptochaetium avenaceum*) and blueberry (*Vaccinium* spp.) were also observed occasionally.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS Lack of prescribed fire and recovery from past land use may be contributing to a more closed canopy at this tract than historically would have been found here. The presence of blackseed needlegrass suggests a more open canopy in the past. Prescribed fire and thinning of non-target canopy species will encourage the diversification of the herb layer and promote the reproduction of grasses and sedges.

Trail in Hollow Rock Site
Photo: Justin Robinson

5. SITE NAME: OLD OXFORD ROAD

OWNER Private

GENERAL DESCRIPTON This tract is located on shoulder slopes and upland flats. The property is bounded on its western edge by Old Oxford Road. Homes and outbuildings are located near the center of the tract. The northern portion of the tract is forested while the remainder of the tract has been cleared since at least 1940.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY This tract straddles a diabase sill within the Triassic Basin.

SOIL Soils on this tract include Mecklenburg (*Typic Hapludalfs*), White Store (*Oxyaquic Hapludalfs*), Mayodan (*Typic Hapludults*), and Chewacla and Wehadkee (*Fluvaquentic Dystrudepts*).

EXOTIC/WEEDY SPECIES Exotic pasture grasses including Bahia grass (*Paspalum notatum*) and Bermuda grass (*Cynodon* sp.) were observed in mown areas.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The extreme northern portion of this tract is a part of the Catsburg Natural Area, and the northern property boundary is adjacent to Eno River Diabase Sill Plant Conservation Preserve.

COMMUNITY DESCRIPTION This tract has moderate Piedmont Prairie affinities, though it was converted to European pasture/lawn many decades ago. Therefore, much of the native vegetation has been excluded. Within the 0.5-acre forested portion, a mixture of wetland and upland species suggestive of a clay hardpan was observed, including black oak (*Quercus velutina*), willow oak (*Quercus phellos*), white oak (*Quercus alba*), and shortleaf pine (*Pinus echinata*). Along the northeast border of the tract, species such as tall ironweed (*Vernonia gigantea*), swamp mallow (*Hibiscus moscheutos*) and eastern gamagrass (*Tripsacum dactyloides*) suggest that this area may have once supported a mesic prairie.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS No recommendations at this time. Conservation of the tract (bordering on the Plant Conservation Preserve) would be desirable to provide a vegetated buffer for rare plant populations to expand, and to aid in nature preserve management with prescribed fire.

*Tall ironweed (*Vernonia gigantea*) at Old Oxford Road site*
Photo: Justin Robinson

6. SITE NAME: SANTEE ROAD

OWNER Durham County Open Space

GENERAL DESCRIPTON This tract supports a Dry Oak-Hickory Forest that has been timbered in the last 30-40 years and is a combination of naturally regenerated stands and power line rights-of-way that have been managed to prevent to growth of tree species along its length. According to the 1940 – 1988 aerial photos, this tract has been largely forested. This is likely due to the fact that the soils are generally unsuitable for row crop agriculture.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY The tract is underlain by sedimentary rocks in the Triassic Basin in the Chatham group.

SOILS Most soils on this tract are Creedmoor (*Aquic Hapludults*) on the uplands and Cartecay and Chewacla (*Aquic Udifluvents*) soils on floodplains. Triassic Basin soils represent some of the most challenging soils in the state for row crop agriculture, septic systems, and house constructions due to their shrink-swell mineralogy.

EXOTIC/WEEDY SPECIES Japanese honeysuckle (*Lonicera japonica*) and Japanese stilt grass (*Microstegium vimineum*) were observed along creeks and along pathways.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES Parts of this tract are within the Falls Lake Shoreline and Tributaries Natural Area. The Durham parcel forms a boundary with

Falls Lake land owned by US Army Corps of Engineers and managed by NC Wildlife Resources Commission as part of Butner-Falls of Neuse Game Land, and surrounds game land on 3 sides near the center of the subject tract.

COMMUNITY DESCRIPTION This tract has moderate Piedmont Prairie affinities. Prairie and savanna species were found in all areas of the tract where sunlight was sufficient. Within the power line easement, a broad array of semi-conservative species with moderate prairie affinities were observed including northern sea-oats (*Chasmanthium latifolium*), nettle-leaf noseburn (*Tragia urticifolia*), grass-leaf blazing-star (*Liatris graminifolia*), Maryland golden-aster (*Chrysopsis mariana*), and butterfly-pea (*Clitoria mariana*). Within the Dry Oak-Hickory Forest, two-flowered melic grass (*Melica mutica*), blackseed needlegrass (*Piptochaetium avenaceum*), spotted St. John's-wort (*Hypericum punctatum*), beardtongue (*Penstemon* sp.), camphorweed (*Pluchea camphorata*), and Maryland senna (*Senna marilandica*) were observed. Tree species include post oak (*Quercus stellata*), white oak (*Quercus alba*), Spanish red oak (*Quercus falcata*), southern shagbark hickory (*Carya carolinae-septentrionalis*), and white ash (*Fraxinus americana*).

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS This tract would be a prime candidate for regular prescribed burning and thinning of early-successional tree species. Trees such as red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), and winged elm (*Ulmus alata*) can be removed to allow more light to reach the forest floor, creating savanna conditions.

*Lynx Paw mushroom (*Pleurorus levis*) on hickory at Santee Road site*
Photo: Justin Robinson

*Butterfly-pea (*Clitoria mariana*) at Santee Road site*
Photo: Justin Robinson

7. SITE NAME: SCOTT KING ROAD POWER LINE EASEMENT

OWNER Duke Energy Corporation

GENERAL DESCRIPTON This tract is located on shoulder slopes and upland flats of Northeast Creek. The tract's southern border forms part of the boundary between Durham and Chatham counties. The tract is bisected by the American Tobacco Trail, which is a former rail line that connected the American Tobacco Company in downtown Durham to Chatham County. Most of the tract has been cleared for the substation. The adjoining power line easements are kept free from encroaching trees. The substation was built between 1972 and 1988 in an area that was forested before its construction. The tract contains a closed canopy stand of mixed loblolly and hardwood species that likely regenerated naturally.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY The tract is underlain by sedimentary rocks in the Triassic Basin in the Chatham group.

SOIL This tract is located on White Store (*Oxyaquic Hapludalfs*).

EXOTIC/WEEDY SPECIES Chinese bush-clover (*Lespedeza bicolor*) was observed.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The eastern edge of this tract is a part of Northeast Creek Floodplain Forest Natural Area. The eastern boundary of the parcel is adjacent to the Northeast Creek Floodplain Forest Registered Heritage Area within B. Everett Jordan Dam and Lake, owned by the US Army Corps of Engineers.

COMMUNITY DESCRIPTION This tract has moderate Piedmont Prairie affinities. Prairie and

savanna species were found in all areas of the tract where sunlight is sufficient. Within the power line easement, a broad array of semi-conservative species with moderate prairie affinities was observed such as plumegrass (*Saccharum* sp.), pencilflower (*Stylosanthes biflora*), maypops (*Passiflora incarnata*), little bluestem (*Schizachryium scoparium*), Maryland goldenaster (*Chrysopsis mariana*), and roundleaf thoroughwort (*Eupatorium pubescens*). Two uncommon species were also observed: Watch List swamp vervain (*Verbena hastata*), a species associated with open wetlands, and sumpweed (*Iva annua*), which is generally believed to be native of the US west of the Appalachian Mountains and not native to North Carolina. Within the forested portion of the tract, species such as white oak (*Quercus alba*), black oak (*Quercus velutina*), loblolly pine (*Pinus taeda*), and Spanish red oak (*Quercus falcata*) were observed. Red maple (*Acer rubrum*), possumhaw (*Ilex decidua*), flowering dogwood (*Cornus florida*) and honey locust (*Gleditsia triacanthos*) were observed in the understory.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS This tract would benefit greatly from prescribed fire. Conservation of the forested area east and south of the substation (adjacent to US Army Corps of Engineers land) would be desirable.

Scott King Road Powerline Easement
Photo: Justin Robinson

*Swamp Verbena (*Verbena hastata*) at Scott King Road Site*
Photo: Justin Robinson

8. SITE NAME: WANDERLUST LANE

OWNERS Private

GENERAL DESCRIPTON This survey area is comprised of three separate tracts totaling approximately 3.5 acres with three owners located on or near Wanderlust Lane. Two tracts are on the foot and shoulder slopes of the Eno River while the third tract is located at the summit. All tracts have been forested since 1940. One tract has been burned in the recent past. Details have been provided separately, but specific landowner names have been omitted here to protect privacy.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY This tract straddles a diabase sill along the boundary of the Triassic Basin.

SOIL The soils on this tract are Iredell (*Oxyaquic Hapludalfs*).

EXOTIC/WEEDY SPECIES None observed.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES Two tracts are within the Penny's Bend/Eno River Bluffs Natural Area.

COMMUNITY DESCRIPTION This area has moderate Piedmont Prairie affinities. The survey area is comprised of forested areas (possibly former savanna or woodland) that has had fire excluded for many years. In areas where canopies are closed, the herb layer is sparse. Along the Wanderlust Road right-of-way that bounds the one of the tracts, sun-loving native plants with moderate prairie affinities include Watch List Godfrey's thoroughwort (*Eupatorium godfreyanum*), tall boneset (*Eupatorium altissimum*), greater tickseed (*Coreopsis major*), woodland sunflower (*Helianthus divaricatus*) and white snakeroot (*Ageratina aromatica*). Spanish red oak (*Quercus falcata*), red oak (*Quercus rubra*), white oak (*Quercus alba*), and shortleaf pine (*Pinus echinata*) were observed within the forested portions. Within one tract, species associated with mesic soils were observed, like willow oak (*Quercus phellos*), black walnut (*Juglans nigra*), and cherrybark oak (*Quercus pagoda*).

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS No additional management recommendations at this time. Due to proximity to existing nature preserves, the parcel along Wanderlust and the southern parcel along Skyline would be espeially desirable for conservation.

*Tall Boneset (*Eupatorium altissimum*) in the road right-of-way of Wanderlust Lane*

9. SITE NAME: FAYETTEVILLE ROAD

OWNER Private

GENERAL DESCRIPTON This tract is on the nearly level toe slopes of Crooked Creek in southern Durham County. The tract is a combination of young floodplain hardwood species and upland hardwoods. The condition of this tract has likely been the result of repeated timber harvests that have been allowed to regenerate naturally or have been planted in loblolly pine (*Pinus taeda*).

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY The tract is underlain by sedimentary rocks in the Triassic Basin in the Chatham group.

SOIL This tract is located on White Store (*Oxyaquic Hapludalfs*).

EXOTIC/WEEDY SPECIES Exotic pasture grasses including Bahia grass (*Paspalum notatum*) and Bermuda grass (*Cynodon* sp.) were observed in mown areas.

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES This tract is less than 1 air mile east of the Lower New Hope Creek Floodplain Forest and Slopes Natural Area, separated by dense development. The southern parcel boundary is only 500 feet north of an arm of B. Everett Jordan Dam and Lake lands along Crooked Creek, owned by US Army Corps of Engineers.

COMMUNITY DESCRIPTION Overall, this tract does not display Piedmont Prairie affinities. In the areas closest to Crooked Creek, early successional tree species such as loblolly pine (*Pinus taeda*) and sweetgum (*Liquidambar styraciflua*) make up the canopy while red maple (*Acer rubrum*), tulip-poplar (*Liriodendron tulipifera*), and water oak (*Quercus nigra*) make up the understory. Also found here are white oak (*Quercus alba*), Spanish red oak (*Quercus falcata*), and sourwood (*Oxydendrum arboreum*). In the herb layer, ruderal plants like cinquefoil (*Potentilla* sp.), open-flower witchgrass (*Dichanthelium laxiflorum*), elephant's foot (*Elephantophus tomentosus*), and lyre-leaf sage (*Salvia lyrata*) were observed.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS This site would benefit greatly from prescribed fire and removal of exotic, invasive species.

*Southern lady fern (*Athryrium asplenioides*) at Fayetteville Road site*
Photo: Justin Robinson

10. SITE NAME: SOUTH LOWELL ROAD

OWNER Private

GENERAL DESCRIPTON This tract is bounded by S Lowell Road along its western edge and by the South Little River along its southern edge. The confluence of the South Fork and North Fork of the Little River occurs along the eastern boundary. This tract contains bottomlands and gentle slopes. The residence and outbuildings are closest to the road. The northwestern portion of the tract has been cleared and is under management as a pasture/lawn with non-native species, while the areas along the river are forested. The tract has been managed in the same pattern since at least 1940.

PIEDMONT PRAIRIE RARE SPECIES None observed. Several protected aquatic animal species occur within the Little River at this tract, including USFWS Critical Habitat.

GEOLOGY This tract is located within the Carolina Slate Belt composed of intermediate metavolcanic rock.

SOIL Soils on this tract include Mecklenburg (*Typic Hapludalfs*), Chewacla and Wehadkee (Fluvaquentic Dystrudepts) and Nason (Typic Hapludalfs).

EXOTIC/WEEDY SPECIES Johnson Grass (*Sorghum halepense*), Foxtail (*Setaria* sp).

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES The forested area of the tract is within Little River Uplands Natural Area. The Little River (including North and South Forks) is within the Little River Aquatic Habitat.

COMMUNITY DESCRIPTION Overall, this tract does not display Piedmont Prairie affinities. This tract has been converted to Eurasian pasture/lawn for many decades. Therefore, much of the native vegetation has been excluded. In areas where pasture/lawn has been allowed to grow, common milkweed (*Asclepias syriaca*), maypops (*Passiflora incarnata*), and fleabane (*Erigeron*) were observed. Within the upland forested portion, Spanish red oak (*Quercus falcata*), red oak (*Quercus rubra*), white oak (*Quercus alba*), and shortleaf pine (*Pinus echinata*) were observed.

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS No recommendations at this time. The forested area of the tract, up to 300 feet from the Little River, is of interest for conservation for protecting wildlife habitat and water quality supporting rare aquatic animal species.

*Maypops (*Passiflora incarnata*) in Riverlea open field*
Photo: Justin Robinson

*Canada goldenrod (*Solidago canadensis*) at Stadium Drive*
Photo: Justin Robinson

11. SITE NAME: STADIUM DRIVE POWER LINE EASEMENT

OWNER Duke Energy Corporation and private

GENERAL DESCRIPTON These tracts are located on shoulder slopes and uplands flats. They are bounded on their western edge by Stadium Drive and on their northern edge by Carver Street. This land was under row crop agriculture in 1940.

PIEDMONT PRAIRIE RARE SPECIES None observed.

GEOLOGY This site is close to a diabase sill however it is located on Triassic Basin geology.

SOIL The soils on these tracts are Creedmoor (Aquic Hapludults), Mayodan (Typic Hapludults) and White Store (Oxyaquic Hapludalfs).

EXOTIC/WEEDY SPECIES Shrubby bush-clover (*Lespedeza bicolor*), Chinese bush-clover (*Lespedeza cuneata*), Himalayan blackberry (*Rubus bifrons*).

RELATION/CONNECTION TO OTHER SITES AND HABITAT PATCHES This tract is approximately 2 air miles from the Hebron Road Remnant Glade, not in the immediate vicinity of other natural areas. Duke Homestead State Historic Site is approximately 0.3 mile south.

COMMUNITY DESCRIPTION Overall, this tract does not display Piedmont Prairie affinities. Historically, much of the native vegetation was eradicated over many decades through plantation row crop agriculture. Therefore, many exotic, invasive species were observed. Native species include sun-loving plants that readily spread into open areas, such as plumegrass (*Saccharum* sp.), splitbeard bluestem (*Andropogon ternarius*), sensitive-pea (*Chamaecrista nictitans*) and Canada goldenrod (*Solidago canadensis*). The southern portion of the survey area is dominated by Himalayan blackberry (*Rubus bifrons*).

MANAGEMENT RECOMMENDATIONS AND RESTORATION NEEDS No recommendations at this time.

CONCLUSIONS

This survey adds to our understanding of the locations and rarity of Piedmont Prairies and savannas and provides more data for predicting where high-base prairie and savanna remnants might be located.

Remnants in Durham County are:

1. Located along the geological boundary of the Triassic Basin,
2. Located on steep slopes, outcrops or other uneven terrains that have not been plowed for agriculture,
3. Located on roadsides, sewer easements, and power line easements where open canopy conditions have been maintained over many decades, and
4. Open woodlands and cleared rights-of-way most frequently associated with Iredell soils.

It must be noted that in the search for Piedmont Prairie remnants, we are often looking in the areas that represent the most extreme soil conditions like hardpans, rocky outcrops, shrink-swell soils, and other conditions that excluded these locations from plowing for agriculture. These areas escaped wide-scale conversion of these ecosystems starting in the 1600s. More study is needed to find and describe good examples of acidic prairie and savanna remnants.

This study represents a relatively small sample size of Durham's Iredell soils. Known natural heritage areas that had been previously surveyed were not surveyed for this report. Instead, surveys focused on new sites that had not been previously surveyed. Access to sites depended on landowner permission; some high priority tracts where landowners denied permission or where the authors were unable to establish contact were not surveyed. The number of tracts visited was also constrained by funding availability and timing of surveys. If opportunities arise in the future, Natural Heritage Program and Durham County staff biologists would welcome the opportunity to continue to inventory Durham's potential Piedmont Prairies.

From the limited sampling in this study, all of the new survey sites that display strong Piedmont Prairie affinities – those that harbor sun-loving rare plant species - occur in areas with Iredell soil, and none of the sites that display no prairie indicator species have Iredell soil. Of the six sites with weak prairie indicators such as sun-loving common species, upland species, and plants typically associated with basic soils, three have Iredell soils, either on the tract or nearby, and three have no known Iredell soils nearby. Two of the three with no known Iredell soils nearby have large electric utility lines bisecting the tracts, which led to maintenance of a large area that has been open over many decades. The surveyed sites that do not have Iredell soils typically have more weedy species with introduced grasses and other early successional species that readily colonize open ground. We have almost no examples of prairie and savanna vegetation from the fertile agriculture soils like Appling, Cecil, and Cullen and very little information about what might have been present prior to disturbance. Although it may be possible to restore Piedmont Prairies and savanna on non-Iredell soils, maintaining an open canopy on more fertile soils will require careful management and regular prescribed fire.

CONSERVATION OPTIONS

Protection of Durham County's natural areas and its landscape connections can only be achieved through conservation efforts by landowners, with support from land trusts, local governments, and other agencies. Property owners have various conservation incentives at their disposal to protect and promote the natural character of their land. Conservation easements and management plans can yield financial benefits, e.g., tax credits, and resources can be made available through local, state, and federal conservation funds to help offset transaction costs or to provide

additional conservation incentives. These conservation tools can often reduce the cost of land ownership and can help relieve some of the financial burden of land ownership.

The Durham County Open Space and Real Estate Division is responsible for implementing the County Open Space and Farmland Protection program. This program guides the County's acquisition of forests and grasslands, streams and rivers, farms, and parks, with a focus on watershed and farmland protection. The program focuses on acquiring properties located in County adopted Open Space Plan Areas including the New Hope Creek Corridor, the Little River Corridor, Eastern Durham, and Urban areas. Staff work with landowners, non-profit agencies, public agencies, and other stakeholders to protect identified lands that improve the quality of life for all Durham County residents. Staff seeks interested landowners for protection of lands by fee simple purchase, conservation easements and other voluntary land protection methods. Staff works with interested farmers to create farmland conservation easements. To date Durham County has permanently protected 1,293 acres of land through fee-simple ownership and 2,499 acres with County-held conservation easements. The Division also assists with the implementation of the Durham Open Space and Trails Commission Matching Grants Program. This program is designed to assist non-profit organizations in Durham County in preserving open space and promoting recreational opportunities. More information can be found at the Durham County Open Space and Real Estate Division website or 919-560-7956.

Conservation easements are recognized as an effective means of land protection. An easement is a flexible option to permanently conserve land for natural, aesthetic, or agricultural values. Conservation easements can be sold or donated, they confer state and federal tax benefits to the owner, and they are affixed to the property deed "in perpetuity." Conservation easements are agreements entered into with a recognized conservation organization or government. They allow the owner to retain the title/deed to their land and to maintain a negotiated property right. Certain rights, such as development rights, are deeded over to the conservation entity. The Eno River Association, Ellerbe Creek Watershed Association, Durham County's Open Space Program, Triangle Land Conservancy, The Conservation Trust for North Carolina, and The Nature Conservancy all serve Durham and its neighboring counties. They work with a variety of landowners, including farmers, homeowners, and developers to achieve conservation goals. Contact information for these organizations is provided below:

- Ellerbe Creek Watershed Association, P.O. Box 2679, Durham, NC 27715, 919-698-9729, ellerbecreek.org
- Eno River Association, 4404 Guess Rd., Durham, NC 27712, 919-620-9099, enoriver.org
- Durham County's Open Space Program, 201 East Main Street, 5th Floor, Durham, NC 27701, 919-560-7956, dconc.gov
- Triangle Land Conservancy, P.O. Box 1848, Durham, NC 27702, 919-908-8809, triangleland.org

Assistance in identifying conservation organizations in North Carolina can also be obtained by contacting the N.C. Natural Heritage Program of the Division of Land and Water Stewardship by telephone at: (919) 707-9382, by mail at: N.C. Natural Heritage Program, 1651 MSC, Raleigh, NC 27699-1651, or on the internet at: http://www.ncnhp.org.

Property owners and farmers who are interested in land management can explore various cost-share programs that are available through the Natural Resources Conservation Services of the United States Department of Agriculture and the Durham County Soil and Water Conservation District. Various programs are available for soil and water protection, reforestation, erosion control, wildlife enhancement, and for stream restoration and riverbank stabilization. For more information contact the Durham County NC Soil & Water Conservation District, 201 E. Main Street, Durham, NC 27701, 919-560-0558.

Landowners who are seeking advice on management of forest lands can access cost-sharing

programs through the NC Forest Stewardship Program. The Forest Stewardship Program is supported by state and federal resource agencies and works with landowners to develop management plans for controlled burning, reforestation with natural vegetation, restoration of riparian buffer strips, and wildlife enhancement. For more information, contact: N.C. Forest Service Durham County Office, 201 East Main Street, Suite 550, Durham, NC 27701, 919-560-0562.

One final option for landowners who want to recognize the natural heritage value of their land and wish to preserve it in a natural state is to register their natural area with the North Carolina Registry of Natural Areas. This program is administered by the N.C. Natural Heritage Program and recognizes natural areas on both private and public land. The program relies on voluntary agreements with landowners and can provide management prescriptions, some degree of statutory protection, and public recognition of the natural heritage site, if desired. For more information, contact the N.C. Natural Heritage Program of the Division of Land and Water Stewardship by telephone at: (919) 707-9382, or by mail at: N.C. Natural Heritage Program, 1651 MSC, Raleigh, NC 27699-1651.

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APPENDIX 1. CONSERVATION RANKINGS

STATE RANK DEFINITIONS

Natural Heritage Programs, Conservation Data Centers, NatureServe, and The Nature Conservancy (TNC) have developed a consistent method for evaluating the relative imperilment of both species and ecological communities. These assessments lead to the designation of a conservation rank. For plant and animal species these ranks provide an estimate of extinction risk. Conservation rank values have been assigned over the past 30 years by the N.C. Natural Heritage Program, NatureServe, and a large number of collaborators in government agencies, universities, natural history museums, botanical gardens, and other conservation organizations. The information has been developed primarily to help in guiding conservation and informing environmental planning and management. Conservation ranks are based on a one-to-five scale, ranging from critically imperiled (S1) to demonstrably secure (S5). These ranks are based on the best available information, considering a variety of factors such as abundance, distribution, population trends, and threats.

S1 Critically imperiled in North Carolina because of extreme rarity or otherwise very vulnerable to extirpation in the state. Typically five or fewer occurrences or very few remaining individuals (<1,000)

S2 Imperiled in North Carolina because of rarity or otherwise vulnerable to extirpation in the state. Typically six to 20 occurrences or few remaining individuals (1,000 to 3,000)

S3 Rare or uncommon in North Carolina. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

S4 Apparently secure and widespread in North Carolina usually with more than 100 occurrences and more than 10,000 individuals.

S5 Common, widespread, and abundant in North Carolina. Essentially ineradicable under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

SH Of historical occurrence in North Carolina, perhaps not having been verified in the past 25 years, and suspected to be still extant in the state. Upon verification of an extant occurrence, SH ranked elements would typically receive an S1 rank. Note: an element is not automatically assigned an SH (or SX) rank if it has not been verified in the past 20 years; some effort must have been made to locate or relocate occurrences.

S? Unranked, or rank uncertain.

GLOBAL RANK DEFINITIONS

Similar to North Carolina ranks, global ranks are assigned by a consensus of scientific experts, Natural Heritage Programs, Conservation Data Centers, NatureServe, and The Nature Conservancy. They apply to the status of a species throughout its range. This system is widely used by other agencies and organizations, as the best available scientific and objective assessment of a species' rarity throughout its range.

G1 Critically Imperiled - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically five or fewer occur-

rences or very few remaining individuals (<1,000) or acres (<2,000) or linear miles (<10).

G2 Imperiled - Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).

G3 Vulnerable - Vulnerable globally either because very rare throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 Apparently Secure - Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery) and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 Secure - Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

? Unranked, or rank uncertain numeric rank.

Q Questionable Taxonomy that may reduce conservation priority. Distinctiveness of this entity as a taxon at the current level is questionable. Resolution of this uncertainty may result in change from a species to a subspecies or inclusion of this taxon in another taxon, with the resulting element having a lower-priority conservation status rank.

T_ The rank of a subspecies or variety. As an example, G4T1 would apply to a subspecies of a species with an overall rank of G4, but the subspecies warranting a rank of G1.

APPENDIX 2. PLANT LISTS

HEBRON ROAD

LATIN NAME	COMMON NAME	MIXED HARDWOOD	CLEARING
CANOPY		x	
Liquidambar styraciflua	sweetgum	x	
Pinus taeda	Loblolly Pine	x	
Quercus alba	white oak	x	
Acer rubrum	red maple	x	
Oxydendrum arboreum	sourwood	x	
Quercus phellos	willow oak	x	
Carya tomentosa	mockernut hickory	x	
Juniperus virginiana	eastern red-cedar	x	
Acer floridanum	southern sugar maple	x	
Platanus occidentalis	American sycamore	x	
UNDERSTORY			
Cercis canadensis	redbud	x	
Carpinus caroliniana	ironwood	x	
Fraxinus americanus	white ash	x	
SHRUB LAYER			
Ilex decidua	possumhaw	x	
Viburnum rafinesquianum	downy arrowood	x	
HERB LAYER			
Agalinis sp.	false foxglove		x
Andropogon virginicus	broomsedge		x
Campsis radicans	trumpet vine	x	
Chasmanthium laxum	slender wood-oats	x	
Coleataenia anceps	Beaked panicum	x	
Crataegus sp.	hawthorn		x
Elephantophus tomentosus	elephant's foot	x	
Eragrostis spectablis	purple lovegrass		x
Eupatorium pubescens	roundleaf thoroughwort	x	
Eupatorium serotinum	late boneset	x	
Euphorbia corollata	flowering spurge		x
Gelsemium sempervirens	Carolina jessamine	x	
Houstonia longifolia	long-leaved bluets		x
Hypericum hypericoides	St. Andrew's cross	x	
*Lespedeza cuneata**	sericea lespedeza	x	
Lespedeza virginica	slender bush clover	x	x

HEBRON ROAD

LATIN NAME	COMMON NAME	MIXED HARDWOOD	CLEARING
*Lonicera japonica**	Japanese honeysuckle	x	x
Muscadinia rotundifolia	muscadine	x	
Oenothera fructicosa	narrow-leaved sundrops		x
Parthenium auriculatum	feverfew		x
Parthenium integrifolium	wild quinine	x	
Parthenocissus quinquefolia	Virginia creeper	x	x
Paspalum floridanum	Florida paspalum		x
*Paspalum notatum**	Bahia grass	x	
Penstemon sp.	beardtongue		x
Pycnanthemum tenuifolium	narrow-leaf mountain mint	x	
Rhus copallinum	winged sumac		x
Rosa carolina	Carolina rose		x
Ruellia sp.	wild petunia		x
Scutellaria integrifolia	Helmet skullcap	x	
Silphium terebinthinaceum	Prairie dock		x
Solidago nemoralis	field goldenrod	x	
Solidago pinetorum	Small's goldenrod		x
Thyrsanthella difformis	climbing dogbane	x	
Tragia utricifolia	Nettleleaf noseburn		x
Vaccinium sp.	blueberry		x
Vernonia noveboracensis	New York ironweed		x

**exotic species*

RED MILL ROAD

LATIN NAME	COMMON NAME
CANOPY	
Liquidambar styraciflua	sweetgum
Juniperus virginiana	eastern red-cedar
Pyrus calleryana	Callery pear
Ulmus alata	winged elm
HERB LAYER	
Agalinis sp.	false foxglove
Ambrosia artemisiifolia	common ragweed
Andropogon virginicus	broomsedge
Antennaria plantaginifolia	plantain-leaf pussytoes
Apocynum cannabinum	ndian-hemp
Asclepias viridiflora	green comet milkweed
Bidens sp.	beggarticks
Campsis radicans	trumpet vine
Chamaecrista fasciculata	partridge pea
Chamaecrista nicitans	sensitive pea
Chasmanthium latifolium	northern sea-oats
Chrysogonum virginanum	green and gold
Clematis viorna	leatherflower
Coleataenia anceps	Beaked panicum
Cyperus strigosus	straw-colored flatsedge
Desmodium ciliare	little-leaf tick-clover
Desmodium paniculatum	panicled ticktrefoil
Dichantelium laxiflorum	open-flower witchgrass
Elymus virginicus	Virginia wild rye
Eragrostis spectablis	purple lovegrass
Erechtites hieraciifolia	American burnweed
Erigeron canadensis	horseweed
Eupatorium hyssopifolium	hyssopleaf thoroughwort
Eupatorium pubescens	roundleaf thoroughwort
Eupatorium serotinum	late boneset
Euphoria corollata	flowering spurge
Heterotheca subaxillaris	camphorweed
Hypericum drummondii	nits and lice
Hypericum gentianoides	pineweed
Ipomoea pandurata	wild sweet potato vine
*Lespedeza cuneata**	sericea lespedeza
Panicum virgatum	switchgrass
Paspalum floridanum	Florida paspalum
Penstemon sp.	beardtongue
*Prunella vulgaris**	self-heal

RED MILL ROAD

LATIN NAME	COMMON NAME
Pseudognaphalium obtusifolium	sweet everlasting
Pyrrhopappus carolinianus	Carolina desert-chicory
Rosa carolina	carolina rose
Rubus spp.	blackberry
Rudbeckia laciniata	green coneflower
Sabatia angularis	rosepink
Saccharum sp.	plumegrass
Schizachyrium scoparium	little bluestem
Silphium astericus	starry rosinweed
Silphium terebinthinaceum	Prairie dock
Smilax bona-nox	saw greenbrier
Smilax laurifolia	laurel greenbrier
Solanum carolinense	horse-nettle
Solidago altissimum	Canada goldenrod
Solidago nemoralis	field goldenrod
Solidago pinetorum	Small's goldenrod
Sorghastrum nutans	Indiangrass
Spiranthes cernua	noddling ladies' tresses
Tragia utricifolia	Nettleleaf noseburn
Tridens flavus	purpletop
Tripsacum dactyloides	Eastern gamagrass
Verbascum thapsus	great mullein
Verbena brasiliensis	Brazilian vervain
Verbena urticifolia	White vervain
Verbesina occidentalis	yellow crownbeard

HAMLIN ROAD

LATIN NAME	COMMON NAME	STREAM TERRACE	DRY OAK HICKORY	POWER LINE	FIELD
CANOPY					
Carya glabra	pignut hickory		x	x	
Carya ovalis	red hickory		x		
Liquidambar styraciflua	sweetgum	x			
Liriodendron tulipifera	tulip-poplar	x			
Pinus echinata	shortleaf pine		x		
Quercus alba	white oak		x		
UNDERSTORY					
Acer floridanum	southern sugar maple	x			
Acer rubrum	red maple	x			
Carya tomentosa	mockernut hickory		x		
Celtis occidentalis	hackberry	x			
Cercis canadensis	redbud	x			
Fagus grandifolia	American beech	x			
Quercus phellos	willow oak	x			
Rhus copallinum	winged elm			x	
Salix nigra	black willow	x			
HERB LAYER					
Agalinis sp.	false foxglove			x	
Agrimonia parviflora	swamp agrimony		x		
Andropogon virginicus	broomsedge		x		x
Antennaria plantaginifolia	plantain-leaf pussytoes		x	x	
Apocynum cannabinum	Indian-hemp				x
Arundinaria tecta	switch cane	x			
Aureolaria sp.	oak-leech		x		
Bignonia capreolata	crossvine	x			
Boehmeria cyclindrica	false nettle	x			
Chasmanthium latifolium	northern sea-oats	x			
Cunila origanoides	stonemint		x		
Cynodon sp.	Bermuda grass				x
Elymus virginicus	Virginia wild rye			x	
Eragrostis spectablis	purple lovegrass			x	
Euonymus americana	strawberry bush	x			
Eupatorium hyssopifolium	hyssopleaf thoroughwort			x	
Eupatorium pubescens	roundleaf thoroughwort			x	
Eupatorium serotinum	late boneset			x	
Fragaria virginiana	wild strawberry				x

HAMLIN ROAD

LATIN NAME	COMMON NAME	STREAM TERRACE	DRY OAK HICKORY	POWER LINE	FIELD
Hexastylis arifolia	little brown jug	x			
Hypericum drummondii	nits and lice				x
Hypericum punctatum	spotted St. John's-wort		x		
Lespedeza virginica	slender bush clover			x	
*Microstegium vimineum**	Japanese stilt grass	x			
Muscadinia rotundifolia	muscadine	x			
Oenothera fructicosa	narrow-leaved sundrops			x	
*Paspalum notatum**	Bahia grass				x
Penstemon sp.	beardtongue		x		
Physalis sp.	ground-cherry			x	
Piptochaetium avenaceum	blackseed needlegrass		x	x	
Polystichum acrostichoides	Christmas fern	x			
Rhexia mariana	Maryland meadowbeauty			x	x
Rubus spp.	blackberry			x	
Sabatia angularis	rosepink			x	
Saccharum sp.	plumegrass			x	
Scutellaria integrifolia	Helmet skullcap			x	
Solanum carolinense	horse-nettle				x
Solidago altissimum	Canada goldenrod			x	
Solidago nemoralis	field goldenrod		x	x	
Solidago pinetorum	Small's goldenrod		x	x	
Tragia utricifolia	Nettleleaf noseburn			x	
Verbena brasiliensis	Brazilian vervain			x	
Vernonia noveboracensis	New York ironweed			x	
Viola sagittata	arrowleaf violet		x		

**exotic species*

HOLLOW ROCK

LATIN NAME	COMMON NAME
CANOPY	
Carya carolinae-septrionalis	southern shagbark hickory
Carya glabra	pignut hickory
Pinus echinata	shortleaf pine
Quercus alba	white oak
UNDERSTORY	
Acer floridanum	southern sugar maple
Carpinus caroliniana	ironwood
Liquidambar styraciflua	sweetgum
Nyssa sylvatica	blackgum
Ostrya virginiana	American hop-hornbeam
Oxydendrum arboreum	sourwood
HERB LAYER	
Dichanthelium boscii	Bosc's witchgrass
Dioscorea villosa	wild yam
Euonymus americana	strawberry bush
Galium circaezens	Licorice bedstraw
Hexastylis arifolia	little brown jug
Mitchella repens	partridge-berry
Muscadinia rotundifolia	muscadine
Piptochaetium avenaceum	blackseed needlegrass
Polystichum acrostichoides	Christmas fern
Uvularia sessilifolia	sessile-leaf bellwort
Vaccinium sp.	blueberry

SANTEE ROAD

LATIN NAME	COMMON NAME	DRY OAK HICKORY	POWER LINE	BOTTOMLAND
CANOPY				
Quercus alba	white oak	x		
Quercus stellata	post oak	x		
Quercus falcata	Spanish red oak	x		
Carya ovalis	red hickory	x		
Pinus taeda	Loblolly Pine			x
Liquidambar styraciflua	sweetgum			x
Carya carolinae-septrionalis	southern shagbark hickory	x		
UNDERSTORY				
Acer floridanum	southern sugar maple			
Carpinus caroliniana	ironwood			
Carya tomentosa	mockernut hickory	x		
Fagus grandifolia	American beech	x		x
Fraxinus americana	white ash	x		x
Juniperus virginiana	eastern red-cedar	x		x
Ulmus alata	winged elm	x		
SHRUB LAYER				
Elaeagnus pungens	silverberry	x		
Rhus copallinum	winged sumac	x		
HERB LAYER				
Antennaria plantaginifolia	plantain-leaf pussytoes	x		
Apocynum cannabinum	Indian-hemp		x	
Aristilochia serpentaria	Virginia snakeroot	x		
Chasmanthium latifolium	northern sea-oats		x	
Chrysopsis mariana	Maryland goldenaster		x	
Clitoria marinana	pigeonwings		x	
Coleataenia anceps	Beaked panicum	x		
Desmodium ciliare	little-leaf tick-clover			
Desmondium rotundifolium	Round-leaved trailing tick-trefoil	x		
Dichantelium laxiflorum	open-flower witchgrass	x	x	
Eupatorium capillifolium	dog-fennel		x	
Eupatorium pubescens	roundleaf thoroughwort	x		
Galium sp.	bedstraw	x		
Hexastylis arifolia	little brown jug	x		
Houstonia caerulea	Quaker-ladies	x		
Hypericum hypericoides	St. Andrew's cross	x		
Hypericum punctatum	spotted St. John's-wort	x		
Lespedeza procumbems	trailing lespedeza		x	

SANTEE ROAD

LATIN NAME	COMMON NAME	DRY OAK HICKORY	POWER LINE	BOTTOMLAND
Lespedeza virginica	slender bush clover		x	
Liatris graminifolia	grass-leaf gayfeather		x	
Melica mutica	two-flower melic grass	x		
Microstegium vimineum	Japanese stilt grass			x
Muscadinia rotundifolia	muscadine	x		
Packera anonyma	Small's ragwort	x		
Paspalum floridanum	Florida paspalum		x	
Passiflora incarnata	purple passionflower		x	
Penstemon sp.	beardtongue	x		
Piptochaetium avenaceum	blackseed needlegrass	x		
Pluchea camphorata	camphorweed	x		
Pycnanthemum tenuifoliumn	narrow-leaf mountain mint		x	
Ruellia caroliniensis	Carolina ruellia	x		
Saccharum sp.	plumegrass	x		
Schizachyrium scoparium	little bluestem		x	
Scutellaria integrifolia	Helmet skullcap		x	
Senna marilandica	Maryland senna		x	
Smilax sp.	catbriar			x
Solanum carolinense	horse-nettle		x	
Thyrsanthella difformis	climbing dogbane	x		
Tridens flavus	purpletop		x	
Uvularia sessilifolia	sessile-leaf bellwort	x		
Vaccinium sp.	blueberry	x		

**exotic species*

SCOTT KING ROAD

LATIN NAME	COMMON NAME	MIXED HARDWOOD	POWER LINE
CANOPY			
Liquidambar styraciflua	sweetgum	x	
Pinus taeda	Loblolly Pine	x	
Quercus alba	white oak	x	
Quercus falcata	Spanish red oak	x	
Quercus velutina	black oak	x	
UNDERSTORY			
Acer rubrum	red maple	x	
Cornus florida	flowering dogwood	x	
Gleditsia triacanthos	honey locust	x	
Ilex decidua	possumhaw	x	
Sambucus canadensis	black elderberry	x	
HERB LAYER			
Ambrosia artemisifolia	common ragweed		x
Andropogon glomeratus	bushy broomsedge		x
Andropogon virginicus	broomsedge		x
Apocynum cannabinum	Indian-hemp		x
Boehmeria cylindrica	false nettle		x
Campsis radicans	trumpet vine		x
Clitoria marinana	pigeonwings		x
Coleataenia anceps	Beaked panicum		x
Eragrostis spectablis	purple lovegrass		x
Erechtites hieraciifolia	American burnweed		x
Eupatorium hyssopifolium	hyssopleaf thoroughwort		x
Eupatorium pubescens	roundleaf thoroughwort		x
Hypericum gentianoides	pineweed		x
Iva annua	sumpweed		x
*Lespedeza bicolor**	shrubby lespedeza		x
Paspalum floridanum	Florida paspalum		x
Passiflora incarnata	purple passionflower		x
Polypremum procumbens	rustweed		x
Pseudognaphalium obtusifolium	sweet everlasting		x
Rubus spp.	blackberry		x
Saccharum sp.	plumegrass		x
Schizachyrium scoparium	little bluestem		x
*Setaria sp.**	millet		x
Solidago pinetorum	Small's goldenrod		x
Stylosanthes biflora	pencilflower		x
Tridens flavus	purpletop		x
Verbena hastata	swamp vervain		x
Verbesina occidentalis	yellow crownbeard		x

WANDERLUST LANE

LATIN NAME	COMMON NAME	DRY OAK HICKORY	MESIC FOREST
CANOPY			
Juglans nigra	black walnut		x
Pinus echinata	shortleaf pine	x	
Pinus taeda	Loblolly Pine		x
Quercus alba	white oak	x	
Quercus pagoda	cherrybark oak		x
Quercus velutina	black oak	x	
UNDERSTORY			
Acer floridanum	southern sugar maple	x	x
Carya carolinae-septrionalis	southern shagback hickory	x	
Carya tomentosa	mockernut hickory	x	
Juniperus virginiana	eastern red-cedar		x
Ostrya virginiana	American hop-hornbeam	x	
SHRUB LAYER			
Ilex decidua	possumhaw		x
Viburnum prunifolium	nannyberry		x
HERB LAYER			
Ageratina aromatica	white snakeroot	x	
Amphicarpaea bracteata	American hog-peanut	x	
Andersonglossum virginanum	wild comfrey	x	
Carex sp.	sedge		x
Chrysogonum virginianum	green and gold	x	
Coreopsis major	greater tickseed	x	
Desmondium rotundifolium	Round-leaved trailing tick-trefoil	x	
Elymus hystrix	bottlebrush grass		x
Eupatorium altissimum	tall boneset	x	
Eupatorium godfreyanum	Godfrey's thoroughwort	x	
Helianthus divaricatus	woodland sunflower	x	
Penstemon sp.	beardtongue	x	
Scutellaria sp.	skullcap	x	

**exotic species*

FAYETTEVILLE ROAD

LATIN NAME	COMMON NAME
CANOPY	
Liquidambar styraciflua	sweetgum
Pinus taeda	Loblolly Pine
Quercus alba	white oak
UNDERSTORY	
Acer rubrum	red maple
Liriodendron tulipifera	tulip-poplar
Oxydendrum arboreum	sourwood
Quercus coccinea	scarlet oak
Quercus falcata	Spanish red oak
Quercus nigra	water oak
Quercus rubra	northern red oak
HERB LAYER	
Amauropelta noveboracensis	New York fern
Athyrium asplenioides	southern lady fern
Coleataenia anceps	Beaked panicum
Cynodon sp	Bermuda grass
Dichantelium laxiflorum	open-flower witchgrass
Elephantophus tomentosus	elephant's foot
Hypericum hypericoides	St. Andrew's cross
*Lespedeza cuneata**	sericea lespedeza
Lespedeza procumbems	trailing lespedeza
Muscadinia rotundifolia	muscadine
Onoclea sensibilis	sensitive fern
Osmundastrum cinnamonea	cinnamon fern
*Paspalum notatum**	Bahia grass
Potentilla sp.	cinquefoil
Salvia lyrata	lyre-leaf sage
Tipularia discolor	cranefly orchid
Vaccinium sp.	blueberry

SOUTH LOWELL ROAD

LATIN NAME	COMMON NAME	UPLAND FOREST	FIELD
CANOPY			
Carya carolinae-septrionalis	southern shagback hickory	x	
Fagus grandifolia	American beech	x	
Pinus echinata	shortleaf pine	x	
Quercus alba	white oak	x	
Quercus falcata	Spanish red oak	x	
Quercus rubra	northern red oak	x	
UNDERSTORY			
Cercis canadensis	redbud	x	
Oxydendrum arboreum	sourwood	x	
HERB LAYER			
Asclepias syriaca	common milkweed		x
Elymus hystrix	bottlebrush grass		x
Eupatorium capillifolium	dog-fennel		x
Passiflora incarnata	purple passionflower		x
Pycnanthemum incanum	hoary mountainmint		x
Pyrrhopappus carolinianus	Carolina desert-chicory		x
Rubus spp.	blackberry		x
*Setaria sp.**	millet		x
Solanum carolinense	horse-nettle		x
Solidago altissimum	Canada goldenrod		x
*Sorghum haplense**	Johnson grass		x
Symphyotrichum pilosum	frost aster		x
Tridens flavus	purpletop		x
Verbesina occidentalis	yellow crownbeard		x
Vernonia gigantea	tall ironweed		x

**exotic species*

STADIUM DRIVE

LATIN NAME	COMMON NAME
Ambrosia artemisifolia	common ragweed
Andropogon ternarius	splitbeard bluestem
Bidens sp.	beggarticks
Chamaecrista nicitans	sensitive pea
Coleataenia anceps	beaked panicum
Dichantelium laxiflorum	open-flower witchgrass
Eupatorium hyssopifolium	hyssopleaf thoroughwort
Eupatorium serotinum	late boneset
Hypericum hypericoides	St. Andrew's cross
*Lespedeza bicolor**	shrubby lespedeza
*Lespedeza cuneata**	sericea lespedeza
*Lonicera japonica**	Japanese honeysuckle
Muscadinia rotundifolia	muscadine
Pinus taeda	Loblolly Pine
Pseudognaphalium obtusifolium	sweet everlasting
*Rubus bifrons**	Himalayan blackberry
Rubus spp.	blackberry
Saccharum sp.	plumegrass
Salvia lyrata	lyre-leaf sage
Scutellaria integrifolia	Helmet skullcap
Smilax rotundifolia	common greenbrier
Solidago altissimum	Canada goldenrod

**exotic species*

NORTH CAROLINA
Natural Heritage Program

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