
Native Plant Studies Certificate Project:
Educational Posters on Threatened Plant
Communities of North Carolina



Nonriverine Wet Hardwood Forest from the Coastal Plain, NC. [Photo by David Blevins, Ph.D.]

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Native Plant Studies Certificate Project: Educational Posters on Threatened Plant Communities of North Carolina

Background: Around the world, native plant communities are disappearing at an alarming rate (Noss and Peters 1995). This trend is particularly evident in the Southeastern United States, where 10 of the 21 most threatened plant communities in the country occur (Noss and Peters 1995). North Carolina has been named as one of the top ten states at risk of extreme ecosystem loss (Noss and Peters 1995). Moreover, over 40% of North Carolina's plant associations are currently listed as extinct, imperiled or vulnerable (NatureServe 2011). To protect these communities, it is critical to inform the public about their loss and ecological value. To do this, I led 36 freshmen students at Duke University in the development of a display of posters for the North Carolina Botanical Garden about threatened plant communities in North Carolina and the Southeastern United States.

Project Description: To inform and inspire conservation efforts, we have developed a poster display highlighting twelve of North Carolina's most threatened plant communities. In *From Woods to Words*, a freshmen class offered at Duke University, 36 students created posters highlighting the characteristics of these plant communities, including:

- the original and current distribution of the plant community
- the natural and anthropogenic threats to that community
- unusual geology
- the dominant and/or unique plant species of that community
- the dominant and/or unique animal species of that community

Prior to the creation of these posters, I educated the 36 students about plant community endangerment and restoration, as well as about select native plant communities in North Carolina and the Southeastern United States, through a series of lectures and readings. Next, students worked in groups of three to create accurate and professional posters using peer-reviewed and scientific literature. The posters were reviewed and revised at three times in both large- and small-group workshops, with my input and guidance being given during the entire process of poster creation. The 12 posters on threatened plant communities in North Carolina were displayed at the North Carolina Botanical Garden from March 24 to 27, 2012.

Timeline:

Mid-January: I began to teach students about the threatened plant communities of North Carolina, the cause of plant community imperilment, and community restoration.

Mid-February: Students began working in triads on the poster for their plant community

Mid-March: I reviewed the students' posters, and provide them with comments for mandatory revisions. Johnny Randall, Director of Conservation at the NCBG also reviewed the posters.

Mar. 24, 2012: Twelve posters were displayed at the North Carolina Botanical Garden.

Most Threatened Plant Communities in North Carolina:

Forest and Woodland

- Eastern Serpentine Woodland*
- Central and Southern Appalachian Spruce-Fir Forest*
- Appalachian Shale Barrens*
- Atlantic Coastal Plain Fall-line Sandhills Longleaf Pine Woodland
- Atlantic Coastal Plain Upland Longleaf Pine Woodland*
- Central Atlantic Coastal Plain Maritime Forest
- Southeastern Interior Longleaf Pine Woodland
- Southern Appalachian Northern Hardwood Forest*

Savanna and Shrub-Steppe

- Southern Piedmont Glade and Barrens*

Upland Grassland and Herbaceous

- Southern Appalachian Grass and Shrub Bald*
- Southern Atlantic Coastal Plain Dune and Maritime Grassland*

Woody Wetlands and Riparian

- Atlantic Coastal Plain Clay-Based Carolina Bay Wetland*
- Southern and Central Appalachian Bog and Fen*
- Southern Atlantic Coastal Plain Nonriverine Swamp and Wet Hardwood Forest*
- Atlantic Coastal Plain Peatland Pocosin and Canebrake
- Southeastern Coastal Plain Natural Lakeshore

Mixed Upland and Wetland

- Northern Atlantic Coastal Plain Dune and Swale*

Sparsely Vegetated

- Southern Piedmont Granite Flatrock and Outcrop*

- Southern Appalachian Rocky Summit

* Indicate those communities for which posters were completed during this project.

Poster Display at the North Carolina Botanical Garden

(March 24, 2012)

Threatened Plant Communities of North Carolina: A Student Presentation from Duke University at the North Carolina Botanical Garden, UNC-Chapel Hill



Posters

Introduction

Threatened Plant Communities of North Carolina: A Student Presentation from Duke University

Threatened Plant Communities

Around the world, native plant communities are disappearing at an alarming rate. This trend is particularly evident in the Southeastern United States, where 10 of the 21 most threatened plant communities in the country occur. North Carolina has been named one of the top ten states at risk of extreme ecosystem loss. Moreover, over 40% of North Carolina's plant associations are currently listed as extinct, imperiled or vulnerable.

About this Project

To inform and inspire conservation efforts, we have developed a poster display highlighting twelve of North Carolina's most threatened plant communities. In *From Woods to Words*, a freshmen class offered at Duke University, 36 students created posters highlighting the characteristics of these plant communities, including:

- their original and current distributions
- natural and human-generated threats
- unusual geology
- dominant or unique plant species
- unique or interesting animal species



Nonriverine Wet Hardwood Forest from the Coastal Plain, NC.
Photo by David Blevins, Ph.D.

Most Threatened Plant Communities in North Carolina

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- Southern Piedmont Granite Flatrock and Outcrop
- Southern Appalachian Rocky Summit

Acknowledgements

We would like to extend gratitude to all of the people that have supported this project.

Thank you to **Johnny Randall**, NCBG Assistant Director for Conservation, who has advised this project and donated his time to talk with the students and comment on their posters. Thank you to **Laura Gadd** and **Mike Schafale** of the North Carolina Natural Heritage Program for generously providing maps of these rare plant communities and cross-referencing references. Thank you to **David Blevins** for allowing us to use his mesmerizing photographs of North Carolina natural areas.

Thanks also goes to our colleagues at Duke University, including **Kristin Wright** and the Office of Service-Learning for generously funding this project. **Jill Charles Foster** of the Biology Department for her letting us use these wonderful assets; and **Denise Comer** and **Mardia Rego** of the Thompson Writing Program for supporting the efforts of *From Woods to Words*.

Finally, I would like to thank my 36 wonderful *From Woods to Words* students for their dedication to this project and their extraordinary creativity. These students have worked long hours researching both plant communities and poster design to create an informative and inspiration display. Thank you all.

"In the end, we will only conserve what we love. We will only love what we understand. We will only understand what we are taught."

— Baba Dioum, Senegalese Conservationist

Further Information

If you would like to know more about this project or have any questions or comments about the posters presented here, please contact Dr. Nicolette L. Cagle, Thompson Writing Program, Duke University at nlc4@duke.edu.

Threatened Plant Communities

APPALACHIAN SHALE BARRENS

Upon first glance, you might think the Appalachian shale barrens is a community that lacks attraction and inspiration. With arid conditions, crumbling shale rock, and sparse vegetation, you might ask, why are the shale barrens so special? The beauty of this community lies in its collection of unusual geology, endemic plants, and rare animals.



The Shale Barren Community

Shale barrens are found in the Appalachian Mountains, in the Valley and Ridge Province of the Appalachian Highlands, which extends from Southern Pennsylvania to Maryland, West Virginia, and eastern Virginia.

Characteristics of this area:

- Sparsely spread scrubland, woodland, & herbaceous rock outcrop
- Usually found in areas with low hills or mountains & flat valley bottoms.
- Made of sloping bedrocks of shale rock, usually with a stream at the base.
- Xeric landscapes with temperatures that can exceed 100°F
- Little to no leaf litter on the surface layer of soil



Shale barrens (left) occur in a long narrow belt of folded strata, giving the region the name: Folded Appalachians.

An Occurrence of Unique Geological Circumstances

Shale barrens occur along a band of Devonian shale. Because shale is a highly friable rock, the landscape of the barrens is unstable and fragile. With sparse vegetation, low moisture conditions, and high temperatures, it seems like the soil should be nutrient deficient. However, studies have shown that the soil of shale barrens are similar to normal vegetated slopes. The only difference is that shale soil lacks an "organic O horizon." Instead of a layer of leaf litter and decaying organic material, the soil surface of shale barrens is covered with a thin layer of shale rock pieces. Shale is a type of fine grained sedimentary rock. It is made up of several thin layers and can be easily split along these layers. Black shale can be broken down to form natural gas, making it a possible alternative energy source.



Example of Shale Rock

Endemic Plants

Stunted trees of Chestnut Oak and Northern Red Oak are common in the shale barrens, but what makes the Appalachian shale barrens special is its population of endemic plants.

As a result of the unique geological and climate conditions of the shale barrens, the community is home to more over 18 endemic taxa of plants. These species of plants are specially adapted to the environment of the barrens, and several are considered endangered.



White-Haired Leatherflower (*Clematis vitalba*)
Millboro Leatherflower (*Clematis vitalba*)
Kate's Mountain Clover (*Trifolium virginicum*)
Shale Barren Ragwort (*Packera antenariifolia*)

Rare Animals

The shale barrens is home to a variety of animals, including:

- Reptiles: eastern fence lizards, wood turtles, copperheads and timber rattlesnakes
- Birds: Carolina wrens, common ravens, broad-wing hawks, and even turkeys

The shale barrens are known to host many locally rare species, including two species of butterflies: the Olympia Marble and Appalachian grizzled



The Appalachian grizzled skipper (*Pyrgus centaureae wyandoti*)
The Olympia Marble (*Euchloe olympia*)

The Appalachian grizzled skipper (left) is known to dart quickly and closely to the ground. The Olympia Marble butterfly (right), with marble patterned white wings, lays bullet shaped eggs on flower buds.

Shale Barren Rock Cress (*Arabis serotina*)

Only occurring in the Appalachian shale barrens, and with an estimated population of less than 20 individual plants, the shale barren rock cress was listed as endangered in 1989. This plant is biennial – the non-reproductive individuals have leaves while the reproductive ones have flowering plants. Threats to the species include drought, destruction of habitat from road construction, and deer over-browsing



Did You Know?

The North Carolina Botanical Garden, through its affiliation with the Center for Plant Conservation, stores seeds of *Arabis serotina* in their rare plant seed bank as insurance against extinction in the wild.

Threats and Conservation

Sadly, this unique habitat is currently being threatened. The shale barrens are being jeopardized by natural factors, like rainfall that erodes the friable slopes of the barrens and deer that are over-browsing endemic vegetation. But they are also endangered by human activity, ranging from walking on the fragile landscape to constructing roads. Home to endemic plants, rare animals, and unique geological characteristics, the Appalachian Shale Barrens is a community that needs protection.

Don't Know What it Means? Look Here!

- Xeric:** conditions of limited water supply, as seen in deserts and extremely cold habitats
- Strata:** a layer of sedimentary rock or soil with consistent characteristics
- Friable:** easily breakable
- Organic O Horizon:** the surface layer of soil that consists of large amounts of decaying organic material
- Endemic:** describes a species that can only be found in a particular region
- Biennial:** a plant which blooms in its second year then dies

"Our task must be to free ourselves... by widening our circles of compassion to embrace all living creatures and the whole of nature and its beauty." —Albert Einstein

Appalachian Spruce-Fir Forests

"If future generations are to remember us with gratitude rather than contempt, we must leave them something more than the miracles of technology. We must leave them a glimpse of the world as it was in the beginning, not just after we got through with it."
—President Lyndon B. Johnson, on the signing of the Wilderness Act of 1964

Forest Overview

The spruce-fir forests claim the highest mountain peaks in the central and southern Appalachians. The forests are dominated by high elevation canopies of Red Spruce or Fraser Firs under natural conditions. The ecosystem contains two distinct species: the Red Spruce (*Picea rubens*) and the Fraser Fir (*Abies fraseri*). The species are further split into subtypes based on location and surrounding strata (Fourth Approximation 2002). The high mountain peaks of North Carolina provide colder temperatures, higher rainfall, and fog deposition for these boreal-like forests to thrive in. This unique environment is home to a majestic ecosystem, but tragically, environmental and human invasions significantly threaten the native wildlife.

Threats

The spruce-fir forest has faced numerous threats to its mountain ecosystem over the past century. The most prominent are human-caused perils such as logging, acid rain, and the invasive woolly adelgid (Blevins 2011). These problems have resulted in abnormal interactions between the native species, severely damaging the forests (Nicholas 1992). The natural reproductive process depends on surrounding trees to provide a canopy, allowing a seedling to grow in place of the dead tree. However, these perils threaten the forest's ability to provide seedling cover, limiting the natural replenishment of their population. Experts predict that if this trend were to continue, we may lose a large portion of spruce-fir forests in Southern Appalachia (Third Approximation 1990). The growing threats to the spruce-fir ecosystem increase the challenge of preserving this important plant community.

Red Spruce

The Red Spruce is more tolerant to lower elevations than the Fraser Fir, and is often found at an altitude as low as 5,500 feet. At the highest elevations, the spruce-fir forests transition to mainly Fraser Firs (Fourth Approximation 2002). The Red Spruce is named for its unique red tint on the inside of the bark in the early logging days. Red Spruce was targeted more heavily because of its more valuable wood, but has since regained its prominence because of its greater longevity. Based on a study, Red Spruce had a lifespan of approximately 300-400 years (Fourth Approximation 2002). As a comparison, an old Red Spruce falling now was a seedling before the land below it was called the United States of America.




Fraser Fir

Although the most likely place a person would see a Fraser Fir is in their living room on Christmas, Fraser Firs are an important keystone in the natural ecosystem of the high elevation Appalachian slopes. Fraser Fir forests are typically located above 5000 feet, but extend to lower elevations in some sites and coxies (Fourth Approximation 2002). The range of Fraser Fir forests goes from the southern limit of Richard Balsam to Mt. Rogers in Virginia. In forests containing both Red Spruce and Fraser Firs, the fir is more likely than the spruce to dominate in gaps. The dominance of the fir in the highest elevations could be caused by the more frequent disturbances from weather. (Fourth Approximation)




Invasive Species: Woolly Adelgid

One of the primary threats to the spruce-fir ecosystems of North Carolina is a non-native insect called the balsam wooly adelgid (Busing 2004). The adelgid was brought over to North America in the early 20th century from Europe and has spread to nearly all collections of Fraser Firs. The insect minimally affects European firs due to a genetic resistance, but the Southeast Appalachian firs are especially susceptible to its toxin. The adelgid feeds on the nutrients in the bark of the trees. As it is feeding, toxic salivary secretions enter into the surrounding bark which causes the tree to grow redwood. This wood is unable to pass water or nutrients to the rest of the tree causing a similar effect as a drought. This process virtually starves the forests causing a virtual wipeout of thousands of trees across the Appalachians (Crain 1987).




Man Made Threats

Other threats to the Appalachian spruce-fir forest ecosystem include man-made issues such as logging and air pollution. Pioneers began logging the Appalachian spruce-fir forests in the late 19th century causing disturbances in the typical growth patterns of the forest (Logging 2006). When the loggers cleared large areas of trees, the soil canopy was removed, allowing temperatures to rise and the soil to dry out (Logging 2006). Since both red spruce and fraser-fir are cool temperature and moist soil, these changes made it difficult for the trees to recolonize the logged areas (Fourth Approximation 2002). Certain regions have yet to repair their original populations nearly a century after being logged (Logging 2006). See Figure 7 for a visual representation of the effect logging had on the distribution of trees in the Great Smoky Mountain National Park.

Air pollution has also put stress on this ecosystem (Third Approximation 1990). There are currently many ways for air pollution to cause harm to trees, including increased ozone in the air, increased acidification and aluminum toxicity of the soil, a decrease in magnesium in the foliage, and excess nitrogen in the soil (Coker 1997). Because of the extensive effects of air pollution, we should strive to decrease society's production of air pollution to help preserve this susceptible ecosystem. (Blevins 2011)




Isa Ferrall, Ryan Westphal, Daniel Reiff
isa.ferrall@duke.edu, ryan.westphal@duke.edu, daniehref@duke.edu

THE ATLANTIC COASTAL PLAIN CLAY-BASED CAROLINA BAY WETLAND

We define our landscapes as much as they define us ~ Phil Harding

Introduction

These wetlands are home to thousands of plants and animals, including endangered species. Many Carolina Bays are also important breeding sites for amphibians. Currently, this habitat faces dangers from a variety of sources, many of which stem from humans. If nothing is done soon, the wetlands, along with its unique species, will perish. However, it is not too late to make a difference! With a little effort, we can restore this community to its once pure, natural state.

Geology

These wetlands are characterized by their oval-shaped, shallow depressions, and virtually flat bottoms in portions of the Atlantic Coastal Plain. Mineral soils and clay hardpans in the depressions help retain water from rainfall.



AERIAL VIEW of this unique ecosystem
Can you spot the oval depressions?

Distribution

These kinds of habitats are most abundant in South Carolina, but they can also be found in Georgia and the Inner Coastal Plain of North Carolina. While these bays are usually small and isolated (¼ kilometers or ¼ miles long) some may overlap and cover a huge area!



Unique Flora

Pondberry (*Lindera melissifolia*)

Status/Distribution: **Endangered Species** – can be found in Sampson and Cumberland counties in North Carolina, but barely anywhere else in the world, making it a very rare plant!

Description: Deciduous shrub that grows as high as 2 meters (6.5 ft.) with yellow flowers that appear in the spring while the bright red fruits mature in the fall.

Threats: Drainage ditching and urbanization are the two main factors for this species' endangered status.



DID YOU KNOW?
The bright red fruits you see actually have no reproductive value!

Hirsts' Panic Grass (*Dichanthelium hirstii*)

Status/Distribution: **Endangered species** – only found in New Jersey, Delaware, and North Carolina, "critically impaired" on a global scale

Description: Perennial grass with flowering stems that can grow up to 1 meter tall (3.3 ft.)

Threats: Vegetation that infringes on the species' habitat, oscillation in environmental conditions, and human activity.



DID YOU KNOW?
This grass was named after 2 brothers who first discovered this species in New Jersey!

Interesting Fauna

Eastern Tiger Salamander (*Ambystoma tigrinum*)

Status/Distribution: See picture



Description: With stout limbs, a long tail, and a brownish-black body with yellow spots this salamander ranges from 7-8 inches.

Habitat: Lives in sandy areas with temporary or permanent pools for breeding.

Threats: Urbanization, habitat disturbances due to recreational activities, pesticides, and other contaminants

Threats to the Community:

Timber Harvesting:

The abrupt removal of trees every 30-50 years disrupts the surrounding ecosystem. It causes a rise in the water table due to a decrease in transpiration and disturbs the soil. The heavy equipment used also negatively impacts the negatively.



THINK GREEN! Instead of using trucks that damage the ground, timber harvesters are now starting to use horses to drag logs!

Threats to the Community:

Urbanization:

The low land value makes the area cost effective to build roads and bridges on. As the USEPA reports, "urbanization has resulted in direct loss of wetland acreage as well as degradation of wetlands." This increased rate of degradation comes from the increasing amount of pollutants and introduction of invasive species that disturb these ecosystems.

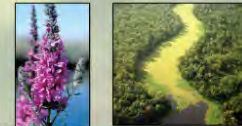
DID YOU KNOW?

Humans are the major cause of environmental problems in the world! What can you do to fix this?



Non-native Plants & Animals:

In recent years, the wetlands of the Carolinas have seen the introduction of invasive, non-native vegetation such as purple loosestrife (*Lythrum salicaria*) (image to the left), water hyacinth (*Eichornia crassipes*), and salvinia (*Salvinia molesta*) (image to the right). These aggressive plants disrupt the food web and out compete the native plants for resources. This is a serious issue because the native plants start to disappear, causing a reduction of diversity.



The Endangered Coastal Upland Plains of Longleaf Pine Woodlands

"God has cared for these trees, saved them from drought, disease, avalanches, and a thousand tempests and floods. But He cannot save them from fools."

John Muir

Ecosystem Description

The Atlantic Coastal Plain Upland Longleaf Pine Woodland is a very important and endangered natural community. As the name of the community suggests, the most prominent plant of the woodland is the longleaf pine. In addition, the woodland community has a plethora of scrub oaks that crowd the forest floor. The soil is composed primarily of sand and is typically dry to the touch. This community is a habitat of hundreds of species of animals including the gopher tortoise, and red-cockaded woodpeckers.

Distribution

This community used to stretch from northern Virginia to Central Florida, but because of human-induced deforestation, the community has diminished. The light green represents the area the community used to cover. The dark green represents its current area.

Light Green = Prior area
Dark Green = Current area



The Longleaf Pine can be identified by its long dark green pine needles. These needles average around 30cm (12in).

The most prominent plant of the community is the longleaf pine. The longleaf pine (*Pinus palustris*) can grow up to 120 feet tall. It takes around 150 years for the plant to reach this height. The tree can live up to 500 years old.



Beneficial Fires

The ecosystem has adapted to the main natural force, fire, in fascinating ways over millions of years. Fed by extremely flammable grasses, lightning-induced ground fires used to ravage huge swaths of woodland across the United States. While seemingly destructive, this process is essential because it reduces excessive vegetation and allows sunlight to reach the ground, releases nutrients stored in dead plants back into the soil, controls insects and germs, and strangely enough, prevents even bigger wildfires.

Nowadays, low-intensity controlled fires are used to help the ecosystem thrive while keeping local people safe.



The Red-cockaded Woodpecker

The Red-cockaded Woodpecker (*Picoides borealis*) is a threatened bird that inhabits the southeastern range of the United States. The name is derived from a small red line on the male birds' heads. The Red-cockaded Woodpecker prefers to make its home in holes bored into longleaf pine trees. It can take a Red-cockaded Woodpecker up to two years to carve out one hole. They play an essential role in the ecosystem because many other small animals that live in the same habitat like flying squirrels, insects, and other birds can also use these holes. These precious birds, however, are classified as vulnerable due to human expansion and southern pine beetles (*Dendroctonus frontalis*), which destroy their holes in trees.



Threats to the Ecosystem

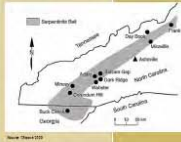
The longleaf pine woodlands have been diminished for the past two hundred years mostly due to human interactions. These anthropogenic interactions include turpentine extraction, livestock farming, and logging. Turpentine extractors suppress natural fires to encourage pines, the source, to grow, which is ironically detrimental because it allows for invasive species to out compete pine growth. Logging and livestock farming involve cutting down and burning trees respectively, both of which have reduced the woodland area. However, the primary impact of humans on this particular ecosystem has been fragmentation, or division of the woodland area, through infrastructure and urbanization. Concrete roads act as artificial fire breaks, preventing natural fires from spreading and renewing the region.

The Eastern Serpentine Woodland

Presented by Maggie Stiggleman, Danielle Morrissey, and Jenny Yao, Duke University – Writing 20: Woods to Words

The Eastern Serpentine Woodland, also known as the Ultramafic Outcrop Barren, consists of dunite, peridotite, and primarily serpentine rocks, resulting from the shifting of tectonic plates roughly 450 million years ago (New York Natural Heritage Program 2011).

DISTRIBUTION



Within the United States, the Eastern Serpentine Woodland is located in Maryland, North Carolina, Pennsylvania, and Virginia. In 1771, the largest serpentine area in the eastern United States was 700-800 hectares (Anderson 1999). However, over time these areas have drastically diminished due to prominent threats and lack of conservation.

In North Carolina, there is still an ultramafic belt, which extends from Frank in Avery County to Buck Creek in Clay County, as pictured to the left.



Serpentine woodlands are rare in North Carolina "due to limited availability of suitable habitat" (Maurer 2007).

Significant threats include, but are not limited to, human development and exploitation, such as logging, man-made trails, and a lack of periodic fires. These fires help to maintain the Woodland's natural species composition. The lack of periodic fires poses a major threat to these rare areas (New York Natural Heritage Program 2011).

THREATS



In 1996, the Buck Creek Serpentine Barren, under the direction of the US Forest Service, used prescribed fire to restore the area. The fire site, when necessary, burning in the area (US Forest Service 2010).

GEOLOGY



The Serpentine Woodland is heavily associated with ultramafic rocks. The root word "mafic" is derived from Magnesium ("ma") and Iron ("fi") (Narz 2007). This is because high concentrations of magnesium and iron are found in the soils in which Serpentine Woodland subsists.

Unlike most soils in which plants and vegetation thrive, serpentine soils have a high concentration of heavy metals, such as magnesium (Mg) and nickel (Ni), and drastically low concentrations of essential nutrients, like calcium (Ca), potassium (K), and phosphorus (P); this creates a highly toxic environment for common flora.

Because this toxic soil creates an infertile environment, the types that flora that do grow are rare and specialized. Different serpentine barrens yield different, rare species, all of which include large canopies, woods plants, and rare flora.

One species found in the Serpentine Woodland is the *Gentianopsis crinita*, or the Fringed Gentian. It is a beautiful, yet endangered plant species that is known for its striking deep blue or purple petals that uniquely bloom horizontally. Currently, it is only found in Ashe, Clay and Watauga counties of North Carolina (North Carolina Native Plant Society 2008).

FLORA



"Come forth into the light of things, let nature be your teacher." – William Wordsworth

Granite Flatrock Outcrops in North Carolina



What did the flatrock say to the flowers?



Don't take me for Granite!



At a Glance

Small or expansive, level or sloped, densely populated or bare, North Carolina's Granite Flatrock outcrops stand as an interesting plant community for examination. The smooth rock allows for the growth of a mosaic of vegetation and fauna (1). In a single outcrop one will find varying soil depths, plant ages, and levels of development. The community is characterized strongly by herbaceous plants (5), including a number of endemic and rare species (4). Unfortunately, between quarrying, pollution, fire and more, the environmental condition of the vegetation continues to be compromised (10). Thus, the alluring biodiversity of this community makes it not only worth investigating, but preserving. This delicate collection of life is much more than a pile of rocks. Read on to learn more!

Figure 1: Map of Granite Flatrock distribution



Landscape

Granite Flatrock ecosystems are found on outcrops of granite and other similar rocks throughout the Southeastern United States. These rock outcroppings are characterized by their horizontal orientation and their smooth, generally crack-less nature (2). The physical rock surface is usually bare with thin mats of soil and small depressions scattered throughout. These depressions often fill with rainwater and form unique micro-climates, and are one of the granite flatrock ecosystem's most distinctive features. (1) Although all of the rock outcrops share these characteristics, some may rise up to 200m above the surrounding landscape while others lie level with the surrounding environment. (2) See above map for distribution information.

Take a Look!

Let's zoom in on a distinctive herbaceous species.

Dianthus smullii Popular on the Granite Flatrock Outcrops of North Carolina, this winter annual endemic species exists in soil depths of 1 to 3 inches (5). It has evolved to tolerate weather extremes, such as alternating flood and drought conditions (9), even though it stands on average only 4 cm tall (7). The plants have small flowers, the pollen of which is spread by ants, and exist in densities of about 41.2 +/- 0.56 plants per dm² (7). While *D. smullii* is a rare species, such is not because of its ability to reproduce. This species is limited by its specific habitat and density-dependent reproductive processes (8). Take a closer look, and check it out nearby!

Visit North Carolina, Rutherford County, 7.2 km WNW of Cliffside (7).

Figure 3: *Dianthus smullii*



Flora

The Granite Flatrock ecosystem is a vibrant and ever-changing community of a diverse group of plant and animal species many of which are not found anywhere else in the world. Only about 10% of the ecosystem is vegetated and consists of various plant communities living on different depths of thin soil mats and small wetland communities surrounded by areas of lichen covered rock (1). These mats are continually changing in thickness and vary in depth throughout, nurturing different plant communities at the same time while changing their entire makeup throughout time (1,5). The natural succession of a typical granite flatrock ecosystem is pictured below with selected species from each of five different depths of soil pictured.

Figure 2: Succession in a Granite Flatrock Ecosystem



Threats

Habitat change is still the biggest threat to this community. Mining, development, and habitat fragmentation in general severely damage the plants and reduce their chances of survival. (10) Habitat change splits the flat rock communities into smaller populations, driving them towards extinction.

Invasive species

Granite flatrock ecosystems have significant problems with invasive species. These introduced invasive species pose a big threat to biodiversity simply because they are alien and hold competitive advantages over the native species, resulting in possible extinction of native species. Examples of invasive species include non-native weeds. (11)

Climate change

Many exotic plants are becoming endangered as they cannot tolerate more extreme temperatures or climates. Climate change has also increased the chances of fire, which also severely damages the community (10). This increase in likelihood of natural fire is caused by higher temperatures and drought (predicted less rainfall in future), as the depressions in rocks that hold water becomes significantly drier.

"In all things of nature there is something of the marvelous"

—Aristotle

Southern Appalachian Northern Hardwood Forest

Introduction

The Northern Hardwood is the most common and oldest forests in North America. Our fathers and forefathers were shaped by it, and they shaped it. This forest gave our forefathers the tools to be successful, a hunting ground for sustenance, wood to build homes and fire to keep warm.

Description

Northern hardwood forests are found in western North Carolina in high elevation regions with significant rainfall in a cool climate. The Northern Hardwood Forests consists of sugar maples, yellow birch, American beech, hobblebush, and striped maple. Eastern hemlock and eastern white pine have also been found in it. Wintergreen, wild sarsaparilla and wood sorrel are different species and herbs that grow within it. Common wild life in these forests consists of black-capped chickadee, white-throated sparrow, flying squirrel, cedar waxwing, porcupine, snowshoe hare, white-tailed deer and American Red Squirrel.

Restoration

Many efforts have been made to combat the threats mentioned in the other section. Corporations are moving away from these precious lands and legislature is being passed to establish limits to protect these ecosystems. Many environmentalists also make the effort on a daily basis to nurture these forests as if they were their own. Frequent visits and assessments are made and necessary accommodations are made. The effort to correct the grave mistakes made over the last few centuries since the Industrial Revolution is definitely and thankfully growing.

Hobblebush

Also known as Viburnum Lacinoides, it grows up to 12 feet and can form white or pink flowers. Also, it's branches can be broken to make a pestle, making it the forest. It also has large leaves. Many mammals eat this forest type food as it leaves and fruit. It grows primarily with spring and trees. It flowers provide nectar in the spring to many species of honey.





Figure 4: Hobblebush

Spotlight on the Flying Squirrel

The flying squirrel is an endangered species that inhabits Northern Hardwood Forests all across North America. Its primary diet consists of fruits and plants. Because the plants at the bottom of the food chain are most susceptible to environmental damage and deforestation, the squirrel is at increased risk of extinction. Many corporations aim to protect species such as this one by being greener through acts such as recycling and water conservation. After all, once a species is gone, it will never come back and people are just now starting to realize the magnitude of their actions.



The flying squirrel logs through the canopies of Northern Hardwood Forests, and glides.

Threats to the Forest

The Northern Hardwood Forest is fairly abundant across the eastern United States. Because it spreads such a large range, many threats jeopardize the wellbeing of the organisms and fauna that comprise this grand system.

Common Threats include:

- * Gists
- * Global Warming
- * Forest Fires
- * Severe Droughts

When omnivores and herbivores starve, they send a ripple up the food chain as predators higher up end up not having a source of food. Although such a system can sustain regular droughts, severe droughts occasionally afflict it. Global warming and the lumber industry also send a similar tremor through the forests. An unobvious source of problems for the Northern Hardwoods is nitrogen imbalance. When certain plants die, their nitrogen emission ceases and other organisms that are dependent on it suffer. After all of these points, it becomes clear that so many species in these forests are interdependent. A slight nuance causes a disproportionately large effect in the forest as a whole.




Figure 2: Effects of nitrogen, carbon dioxide, and forest fires on the Northern Hardwood Forest


Conclusions

This forest has been apart of our history since the beginning of our Western Hemisphere pilgrimage. The way we treat the forest now, and its inhabitants despite our history we've created with it is unacceptable, and should not go on further. Push for environmentalists, attorneys to protect the Hardwood forest, and it's inhabitants.

Table 1: The increase in forestry for commercial growth, has led to the restoration of the Northern Hardwood.

Driver of Deforestation	Rate of Deforestation/ Degradation % of total	Area (Millions ha/a)
Small scale agriculture & Shifting cultivation	42	5.5
Commercial scale agriculture crops	20	2.6
Cattle ranching	12	1.6
Fuelwood & NTFP Gathering	6	0.7
Commercial scale logging (both legal and illegal)	14	1.8
Traded fuelwood and charcoal	6	0.7
Total	100	12.9

Figure 1: The increase in forestry for commercial growth, has led to the restoration of the Northern Hardwood.



The rate of commercial scale logging is increasing.

Figure 1: A geographical indicator of where the Northern Hardwood Forest is located in the North America.




Figure 2: Effects of nitrogen, carbon dioxide, and forest fires on the Northern Hardwood Forest

Go back for detailed content for this article, as well as our professor Dr. Cagle's for this opportunity.

For further opportunity:

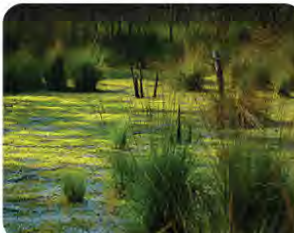
Have content email@biology.edu. More information on this and related projects can be obtained at www.projects.edu. (give the URL, the industry web site). A link to content, PDF version of the project is also, too.

Jimmy Zhang, Can Tuncer & Avery American Morton

SOUTHERN APPALACHIAN BOGS

BOGS AND THEIR SIGNIFICANCE

BOGS are acidic wetlands. Southern Appalachian bogs are formed in depressions and flat valleys. Bogs are generally fed water through either seepage or springs in order to maintain a soaked organic mineral soil layer (Wildlife Research, 2004).




Studies suggest that bogs once covered 5,000 acres of land in North Carolina and that as recently as 2002, only 500 of these acres remain (The US Fish and Wildlife Service, 2002). Human impact is a major factor in this decrease. Bogs have been drained, filled, or impounded for human benefit. Industrial, commercial, and residential development as well as agriculture and overgrazing have had a detrimental effect on the Southern Appalachian bogs (Wildlife Research, 2004).

Test samples of the bogs have proven them to be some of the most diverse and thriving ecosystems in the Appalachian highlands. Some plant species have survived the interglacial warming cycle, and their presence today stems from distributions that date back 18,000 years.

NATIVE SPECIES


Mountain Sweet Pitcher Plant

Wanted for its leaves which grow in a trumpet shape, the pitcher plant can be anywhere from 8 to 29 inches tall. These plants serve as habitats for a variety of insects that live in the pitchers including mosquitoes, flies, and gnats. The Pitcher plants are in bloom from April to June but individual plants have proven to live between 20 and 35 years.




Beavers

Beavers contribute significantly to the formation of mountain bogs. The dams built by beavers slow the flow of water, causing it to collect and saturate the surrounding soil. Beaver dams, however, are becoming scarcer for two main reasons. The first is that humans over hunt the beaver population for their pelts. The second is that humans are known to destroy beaver dams that may be causing flooding on their property.




Sphagnum

This type of moss is the most prevalent plant species in most bogs and is pivotal to the survival of the bog. The moss holds moisture and releases it slowly to maintain the water table of the bog during dry periods. Many endangered species are also reliant on the bog. Bog turtles and four-toed salamanders lay eggs in the moss. The seeds of many plants, including the pitcher plant, get caught in the moss and take root there.



Bog Turtle

The Bog Turtle is 3 to 3 1/2 inches in length and has bright orange or yellow spots on either side of its head. Usually found in North Carolina, this species is seriously endangered because they are often collected as pets and their bog habitat is being destroyed. Many Bog Turtles are crushed by vehicles as they try to cross major streets to get from one habitat to another.



BOG RESTORATION

In North Carolina, a strong emphasis has been placed on preserving bogs. This has translated to a widespread conservation effort by the state that has led to 75% of all these specific systems in North Carolina to be under some sort of bog management (Baugh 2011). The arduous process of preserving the habitat of the southern Appalachian bogs contains three steps (Baugh 2011).

PHASE I- Removal of Reed Canary Grass (Phalaris Arundinacea)

Reed Canary Grass is an invasive species in the bog that grows up to 2.5 meters and ruins the soil of the bogs as its dense root-system excludes other vegetation from growing within its proximity (Baugh 2011). The continuous use of herbicides to exterminate the grass takes about 1-1.5 years till the species is fully eliminated.

PHASE II- Hydrology

Southern Appalachian bogs must maintain a certain level of moisture in the soil for the survival of the plant species present in the wetlands. In order to prevent too much seepage from taking place, a network of ditches and troughs that redistribute the water evenly throughout the bog is constructed (Baugh 2011).

PHASE III- Elimination of Other Invasive Species

Finally, any other species that does not belong in the habitat is immediately removed and replaced with plant life that is meant to reside in the ecological community.

*-Murdock, 1994

BOGS ARE "ONE OF THE MOST IMPORTANT HABITATS FOR RARE SPECIES IN THE SOUTHEAST,"

Southern Appalachian Grass and Shrub Balds

Bao, Steven | Chen, Bojia | Su, Elysia

INTRODUCTION

The Southern Appalachian Grass and Shrub Bald is an ecosystem located in the lower Appalachians, at their highest elevation. In addition to the extreme elevation of the ecosystem, a variety of other harsh conditions, such as a lack of wetlands and rock outcrops, make it an adverse environment for many organisms [8]. Nonetheless, the assortment of life that does exist in the Southern Appalachian Grass and Shrub bald is distinct, with a significant amount of endemic species, although many are already or are becoming endangered [8].

FLORA

Open areas characterize the Southern Appalachian Grass and Shrub bald. However, although these regions are relatively open, and lack trees, they do not consist solely of empty land. Rather, diverse and dense vegetation can be found. The flora of the region is lush, ranging from grasses and sedges to vibrant wildflowers that dot the meadows. Overall, they sometimes "appear as seas of green leaves" but may "blossom" with the pink rhododendron flowers [1]. This assortment of colors and plants shows the true range of the Southern Appalachian Grass and Shrub Bald, something that is important to maintain as part of North Carolina's ecological diversity.



Gray's Lily

General Information:

Coverage:
 • Mountains of GA, KY, NC, TN, VA, WV
 • Formation at elevations above 2000ft (609.6m)

Endangered Plants:

- Cant's Reedgrass
- Wretched Sedge
- Appalachian Gentian
- Spreading Arises
- Mountain Bluet
- Blue Ridge St. John's-wort
- False Dandelion
- Gray's Lily
- Appalachian Polytrichum Moss
- Roan Mountain Rattlesnake-root

DISTRIBUTION

- Balsam Mountains [NC]
- Great Smoky Mountains [NC]
- Blue Ridge Mountains [NC, VA]
- Cumberland Mountains (Limited) [WV]
- Distribution in Georgia is questionable

APPALACHIAN COTTONTAIL

The Appalachian Cottontail is an organism that is mainly restricted to the highest elevations of the lower Appalachian Mountains, including the entire western border of North Carolina [4]. More specifically, this species of rabbit lives in evergreen forests bordering the characteristic brush and shrub of the Southern Appalachian Grass and Shrub Bald [5]. It prefers thick shrub cover, which is a major problem considering the fact that shrub undergrowth is receding due to encroachment by trees [6]. The maintenance and protection of the Southern Appalachian Grass and Shrub Bald ecosystem is of utmost importance to ensure the survival, and continued dominance, of the Appalachian Cottontail [6].



Appalachian Cottontail

FAUNA

The lack of trees and other major plant life in the Southern Appalachian Grass and Shrub Bald may lead some to think that there would be a lack of faunal diversity. However, in reality there is a vast assortment of wildlife that inhabits the region, ranging from insects such as grasshoppers and locusts, to mammals such as red wolves, Eastern cougar, and Appalachian cottontails. Many of the organisms found in the Southern Appalachian Grass and Shrub Bald are considered endangered, or threatened, so it is important to ensure the survival of this ecosystem.



Red Wolf

FORMATION THEORIES

Natural Causes:
 It is hypothesized that during the Hypsithermal, a period of increased warmth, spruce-fir forests migrated to higher elevations to maintain a cool environment. When the climate cooled down, the trees were forced to lower elevations as the mountain summits were too cold. Thus, scientists think that the balds replaced these mountain summits as the trees receded [1]. Furthermore, fires caused by lightning are thought to have wiped out the trees on mountain summits and that the balds subsequently replaced the fire-sensitive trees with more fire-tolerant ones [2].

Human Causes:
 Scientists theorize that early settlers cleared some summits of trees and used the land for grazing [7]. Some hypothesize that Americans burned mountaintops to "create openings for campsites and forest-edge habitat for game animals" [1].

MOUNTAIN BLUET

The Mountain Bluet is a flowering herb endemic to eastern Tennessee and western North Carolina, especially at higher elevations. A characteristic trait of the plant is its bright purple flower, each of which is funnel-shaped. It generally grows between rocks, near spruce or fir forests. Due to habitat destruction in the Southern Appalachian Grass and Shrub Bald ecological system, however, the Mountain Bluet is considered endangered in North Carolina. It is important that existing populations of the Mountain Bluet are maintained and protected to prevent extinction of the species [3].



Mountain Bluet

THREATS

Southern Appalachian Shrub Balds face a big threat: tree encroachment. In the process of natural succession, larger flora gradually take over smaller flora. Evidence of this is present as shrub and tree species such as serviceberry, hawthorn and northern red oak are encroaching on the balds. Some researchers hypothesize that reforestation could occur in 50 to 100 years [7].

Unlike many other cases, humans do not pose a significant threat to these balds. In fact, grazing has been shown to suppress the invasion of larger shrubs and trees [7]. The loss of these habitats would be devastating as they provide habitat for a plethora of rare plants and animals. Balds are also prized for their "contributions to local and regional biodiversity, local historical significance, and scenic vistas" [2].

"Knowing trees, I understand the meaning of patience. Knowing grass, I can appreciate persistence." -Hal Borland

The Southern Atlantic Coastal Plain Dunes and Maritime Grasslands

"Look deep into nature, and then you will understand everything better" Albert Einstein

THE ENVIRONMENT

The Southern Atlantic Coastal Plain Dune and Maritime Grassland ecosystem is comprised of four states: North Carolina, South Carolina, Georgia, and Florida. This ecosystem is mainly made up of grasslands and shrub lands, although wetlands and uplands are also existent in this ecosystem.

The overall environment is considered to be quite dynamic. Local environments are often times significantly altered by the reshaping of sand by storms or high winds. Additionally, the environment is responsible for the disappearance of certain plant communities in the ecosystem. For example, intense salt spray and overwash from the ocean have considerably hindered the growth of woody plants (State of the State 2012).

FLORA

The coastal plain dunes and maritime grasslands of North Carolina, South Carolina, Georgia, and Florida lay host to a wide diversity of plant species adapted to this environment's unique conditions. With constant exposure to salt air, the amount of plant species that can inhabit the area is limited to primarily shrubs and grasses (Comer et al 2003).



South Atlantic Coastal Plain

Coastal Goldenrod: Due to the increasing development of North Carolina's coastal plains and dunes, there are a number of plant species that are being threatened. The Coastal Goldenrod, *Solidago villosa*, is one such threatened species. Noted for its long stem and bright golden flowers the Coastal Goldenrod is classified as significantly rare and can be found in only four wild populations. Limited to Onslow and Pender Counties, the Coastal Goldenrod faces many challenges as land development and invasive species crowd out its natural habitat. The species is little understood or studied making conservation efforts difficult (Leblond and Franklin 2004).



FAUNA

Upland grasslands are considered one of the most ideal places for birds to nest because this environment provides the necessary resources and protection for grassland birds to settle (Grassland Birds 1999). There are several grassland bird species found in this area including Vesper Sparrows and Eastern Meadow Larks (NatureServe 2011).



Eastern kingsnakes are another species found in Southern Atlantic Coastal Plain Dunes. This large reptile is characterized by its activity almost exclusively during the day and its prey of other snakes, lizards, rodents and birds. These snakes inhabit swampy areas near water (Andrews and Wilson 2012).



Known for its unique spotted patterns and large powerful jaws, the Diamondback Terrapin can be found hunting for periwinkle and other mollusks among the areas brackish waters. Some of the main threats facing the species include land development and unattended crab traps that young terrapins wander into (Conant 2012).



THREATS TO THE AREA

In recent years, infringing urban development has disturbed grassland environments. From 1950 to 1980, the population grew by 63% in North Carolina causing about half of North Carolina's wetlands to be lost due to residential development and conversion to cropland. The specification of one crop grown in certain areas of the grasslands has eliminated nutrients from the land thus causing pests and disease to spread easily. This has led to the necessity of using potentially toxic pesticides to rid these areas of pests and diseases, further disturbing the land. Moreover, erosion of coastal plain dunes has cut down on their acreage (North Carolina Wildlife Resources Commission 2011).



RESTORATION EFFORTS

Through educational efforts mostly offered by nature centers and conservation centers in the area, professionals have been teaching people how to protect the soil and prevent soil erosion. Of the non-developed, or non-urbanized, maritime grasslands, dry season burning has taken place in order to gain fresh growth and restore calcium to the soil. This better enhances the soil that makes up the dry grasslands for the upcoming farming season. Tall trees have also been planted in these areas to break the harsh winds and better prevent erosion (North Carolina Wildlife Resources Commission 2011).

Southern Atlantic Coastal Plains: Wetlands and Swamps

Introduction

If you've taken a ride through northeastern North Carolina, odds are you've seen the wet forests of the coastal plains.

The habitat creates *ecotones*, a zone bridging two separate ecosystems, between wetlands & fields, or alongside roads and towns. This area is brimming with wildlife, housing the vibrant Cerulean Warbler & Sherman's fox squirrel. And, high above the region's sodden ground, more than three hundred bird species thrive.

All the flora & fauna have formed unique & carefully-balanced relationships over eons. But, tragically, they face rapidly changing weather conditions, invasion of harmful alien species, logging, & conversion of land for agriculture & urbanization.

The Redbay Tree: NATIVE

Persea borbonia, more commonly known as redbay, swampbay and scrubbay is a native evergreen tree that is known for its aromatic leaves. Under ideal conditions, it can grow up to sixty-five feet tall and three feet wide in diameter. Prior to 2002, these trees could be found as far west as Texas and as far south as Florida. Recently, however, redbays are slowly dying out in the Southern United States from logging and a fungal disease carried by redbay ambrosia beetles.

Redbay Ambrosia Beetle: INVASIVE

The redbay ambrosia beetle is about two millimeters long. It infects the Redbay tree with (*Raffaelea lauricola*), a fungus, that causes laurel wilt disease to the tree. Typically, these beetles burrow holes in dead trees, but recently they have been attacking living Redbays for no known reason. These beetles are an invasive species, spreading thirty-four miles per year and just one beetle can spawn an invasion. The invasion of this beetle could be controlled if more than just a handful of people were studying it.

The Red Wolf: NATIVE

The red wolf (*Canis lupus rufus*), standing at two to three feet tall, is an endangered species of North Carolina that was once extinct in the wild. Its an omnivore whose diet includes rabbits, rodents, insects and beetles. Through conservation efforts, captive breeding, and successful reintroduction to the wild in the 1980s, there are currently about one hundred freely living red wolves. The Red wolf is currently threatened by human development and logging.

Blains Wet Forest of Coastal Plains Flats

The Cerulean Warbler

What's being done to save this region?

- ✓ Restoration of water quality fouled by pollution & urban run-off
- ✓ Improved management of agricultural & industrial practices in urban landscapes
- ✓ Higher quality ventures for wetlands protection, conservation, & restoration
- ✓ Augmentation & implementation of native vegetation
- ✓ Resource devotion to projects that reconnect fragmented habitats
- ✓ Forest restoration by replanting in old pasture & farm lands

"Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop off like autumn leaves."

- John Muir

We are starting to realize the value of conserving the cherished Southern Atlantic Coastal Plains. Even when people simply observe nature, they develop a primitive connection with their surroundings that can evoke their feelings. Furthermore, we are discovering that devotion to environmental protection is a positive commitment to the generations yet to discover nature's wonders.

SOUTHERN PIEDMONT GLADE AND BARRENS

"When I hear of the destruction of a species, I feel just as if all the works of some great writer have perished."
-Franklin D. Roosevelt

What is the Southern Piedmont Glade and Barrens?

The Southern Piedmont Glade and Barrens system is characterized by a clearing in the surrounding trees and is generally composed of a slightly damp, sloping rock-area covered in a small layer of nutrient-rich soil. To passerby's, it may seem to be a simple rock formation; however, it is home to many plant and animal species, mostly shrubs, grassland and forest species. Although some trees do live in the community, the thin layer of soil tends to impede any significant tree growth, distinguishing this area from its surrounding woodlands. The Southern Piedmont Glade and Barrens is also home to many different types of igneous and metamorphic rocks, namely diabase, mudstone, and shale, that are often exposed for extended distances.

The glade and barrens system, shown above, is a sunlight-rich break in the surrounding tree canopy, where rocks, low-growing plants, and a variety of unique species thrive.

Primary Conservation Techniques

Conservation techniques are key to restoring the natural boundary between these communities and the adjacent forest. Some techniques include:

- Prescribed burning: Fire decreases canopy cover and lowers shrub coverage restoring the natural forest structure around this community; however, this treatment is potentially dangerous in conditions of intense drought, so it is important to assess the unique characteristics of each population of this community prior to using prescribed burning as a conservation technique.
- Decreased Human Development: Development is noted as the largest threat to the conservation of this community. Human awareness is important to preserve the endangered species that live there. Protecting and expanding the remaining samples of this community is of utmost importance.

The decline of rare communities like Southern Piedmont Glade and Barrens and the importance of their conservation reflect a more global problem of biodiversity loss and its negative ecological consequences.

Threats to the Community

- Human intervention: Development, including logging and exploitation of the land, is the primary threat to the Southern Piedmont Glade and Barrens community. The characteristic basic chemical composition of these rare rocky outcrops is home to unusual rocks such as dunite and peridotite that serve as a breeding ground for some of the rare and endangered plant species, which live in this community. Exploitation of these natural resources will deplete the habitats that these species depend on.
- Fire Suppression and Drought: Most species within this community are tolerant to drought and heat. Drought conditions confer advantages to these low elevation outcrops and cliffs, allowing them to thrive in an environment where other plants struggle to survive. Such dry conditions cause trees and plants surrounding the community to recede, a natural effect of wildfire, decreasing the surrounding canopy and its harmful shading. Fire suppression is a threat to the community because it prevents the necessary natural depletion of surrounding canopy on which this community is reliant.

Prescribed burning is an effective conservation technique that is often used in communities like the Southern Piedmont Glade and Barrens.

Rare and Endangered Species

Schweinitz's Sunflower

Schweinitz's Sunflower (*Helianthus schweinitzii*) is a perennial herb that grows 1-2 meters tall on mafic rocks. This species previous thrived in prairie-like habitats maintained by natural fires but can now be found along roadsides, in old pastures, or in woodland openings. In 1991, Schweinitz's Sunflower was listed as an endangered species. Fire suppression, highway construction, and residential development all threaten Schweinitz's Sunflower.

Bear Oak

Bear Oak (*Quercus ilicifolia*), a plant species in the low elevation rocky summit community, is representative of changes occurring in other low elevation outcrops and cliffs in the Piedmont. This species is abundant in mid-Atlantic states but reaches its southern limit in NC. In the past, Bear Oak's habitat has been maintained by lightning induced fires; however, fire suppression over the past 50 years has led to forest succession and habitat loss.

Eastern Cougar

The Eastern Cougar (*Felis concolor couguar*) is actually considered extinct in the eastern United States. It was, however, native to this community. This heartbreaking loss is attributed greatly to the depletion of the cougar's habitat. Help prevent further loss of biodiversity by protecting the sensitive ecosystems like the glade and barrens that so many extraordinary plants and animals call home.

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