

The outstanding scientific discovery of the twentieth century is not television, or radio, but rather the complexity of the land organism. Only those who know the most about it can appreciate how little we know about it. The last word in ignorance is the man who says of an animal or plant: "What good is it?" If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

Aldo Leopold
Conservation, 1953

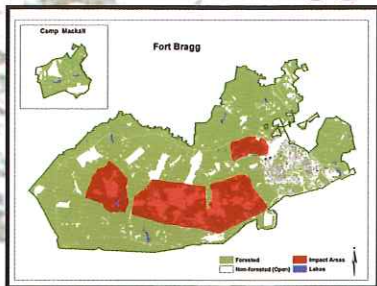
The Longleaf Pine-Wiregrass Ecosystem

Fort Bragg North Carolina

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Fort Bragg & Camp Mackall



Fort Bragg and Camp Mackall Installations occupy over 161,000 acres with approximately 120,000 forested acres of longleaf pine-wiregrass ecosystem, and cover portions of 6 counties in what is known as the Sandhills Region of North Carolina. The reservations along with

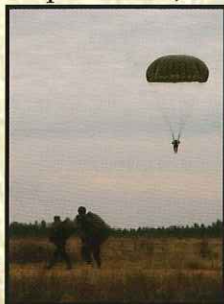
adjacent forests comprise the largest remaining contiguous block of the ecosystem remaining in the state. It is a remnant of the vast longleaf landscape that once dominated the southeastern coastal plain, but now is highly threatened.

Until the late 1800's old-growth longleaf pine forests were plentiful, and for many years the Sandhills region was a major supplier of timber and naval store products including tar, pitch and turpentine. Old growth stands no longer occur in the Sandhills except for two small remnant stands, and individual old growth trees scattered across the Installations.

Twenty-three plant communities have been identified within the longleaf pine-wiregrass ecosystem, providing a range of habitats for diversified military training. Islands of quality natural habitat have led the Department of Defense (DoD) properties to harbor a disproportionate number of rare species compared to some lands managed by other agencies.

The reservations include 7 major drop zones, 4 artillery impact areas, 84 ranges, 16 live fire maneuver areas, and 2 airfields, all used for a variety of training, including small arms, heavy artillery, air-to-ground firing, tank maneuvers, and parachute drops.

DoD has developed a policy for ecosystem management placing emphasis on the balance between commodities, amenities, and ecological integrity. To maintain this integrity for imperiled plant and animal species, managing for the ecosystem as a whole is a more practical approach than managing for individual species.



E. Evans

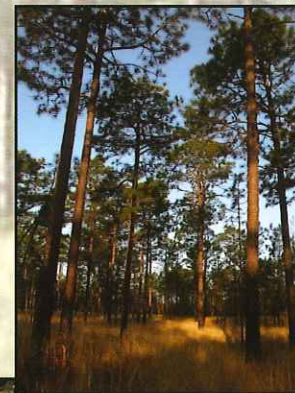
Longleaf Pine-Wiregrass Ecosystem

The longleaf pine-wiregrass ecosystem is considered globally endangered with less than 3% of 93 million acres remaining.

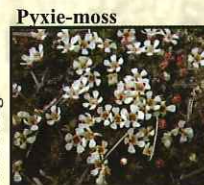
The following characteristics define the longleaf pine-wiregrass ecosystem:

- A series of flat-topped ridges alternating with broad flat valleys, wet seeps, and stream systems
- Well-drained to excessively well-drained soils composed of deep sands and clay
- A canopy dominated by longleaf pine
- A conspicuous lack of midstory trees and shrubs presents a scenic, park-like vista through the forest
- A well developed ground layer, dominated by wiregrass and other bunch grasses that carry fire
- Frequent fires that skim across the ground's surface reducing encroaching woody vegetation and replenishing nutrient-poor soils
- A high diversity of plants and wildlife species adapted to fire

Fort Bragg and Camp Mackall support approximately 1,200 plant species, as well as approximately 350 faunal species (including birds). Many species are uniquely adapted to this ecosystem and are rare, threatened, or endangered. The Sandhills Pyxie-moss, Sandhills lily, Northern pine snake, Saint Francis' butterfly and Red-cockaded woodpecker are a few examples.



E. Evans



A. Young

Major threats to the longleaf pine ecosystem today include fire suppression, conversion to other species, pine plantations, logging, agriculture and urban development.

Endangered Species

Fort Bragg and Camp Mackall installations are currently home to 5 endangered species: 3 plants, 1 insect, and 1 bird.

Rough-leaved Loosestrife

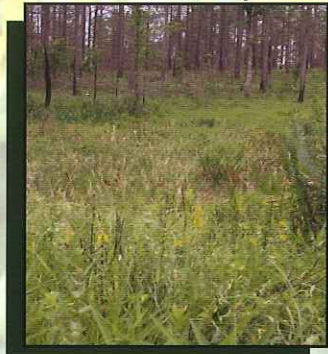
Lysimachia asperulifolia

General Description

Rough-leaved loosestrife, a member of the primrose family, is a perennial herb with loosely grouped yellow flowers at the top of the stem. The flowers are known to smell like bubble gum, and bloom from late May to early June. The plant grows 1 to 2 feet in height, and has bluish-green leaves that grow in bundles of 3 or 4, circling the stem. Rough-leaved loosestrife was listed as federally endangered in 1987.



E. Guinn



E. Evans

Habitat, Distribution, and Abundance

Rough-leaved loosestrife occurs in moist areas between dry longleaf pine forests and wet shrubby areas along the coastal plain of North and South Carolina. The majority of the populations range-wide are found on Fort Bragg.



American Chaffseed

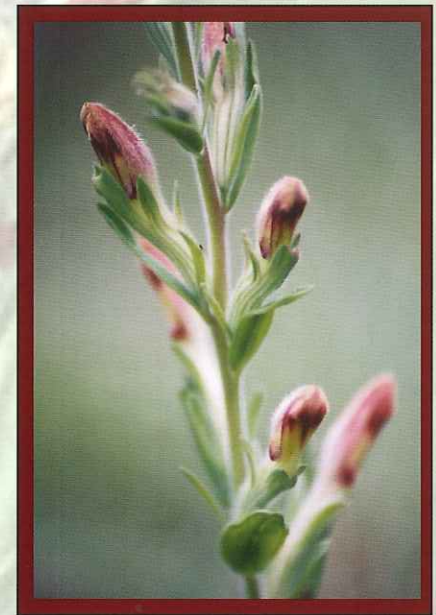
Schwalbea americana

General Description

American chaffseed, a member of the snapdragon family, is a perennial herb with bright yellow-purple tubular flowers that bloom from April to June. The plant grows 1 to 2 feet in height, and is densely covered with tiny hairs. American chaffseed is known as a "hemi-parasite", or in other words, a plant that obtains some of its food and water from the roots of other plants. American chaffseed was listed as federally endangered in 1992.



E. Evans



E. Guinn

Habitat, Distribution, and Abundance

American chaffseed is found only in pine forests with moist sandy soils along the coastal plain of New Jersey, North and South Carolina, Georgia, and Florida. The majority of the populations in NC, occur on Fort Bragg.



Endangered Species

Michaux's Sumac

Rhus michauxii

General Description

A member of the cashew family, Michaux's sumac is a non-poisonous short, woody shrub reaching 1 to 3 feet in height. Stems are red, with 9-13 serrated (toothed) leaflets per stem. The entire plant is densely covered with tiny hairs. In June, clusters of small greenish-yellow to white flowers appear, which continue to develop from August to September into small, red, hairy fruits. The primary means of reproduction is by underground rhizomes. Cloning occurs when one common root produces several individual plant all of the same genetic material. Michaux's sumac was listed as federally endangered in 1989.

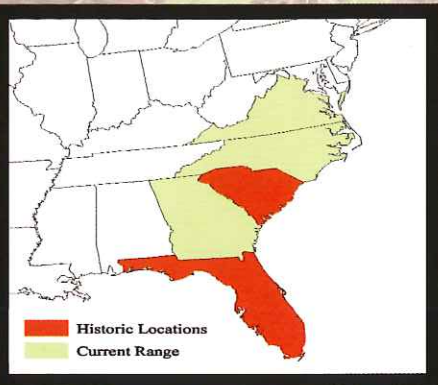
E. Evans

Habitat, Distribution, and Abundance

Intolerant of shade, Michaux's sumac occurs in open fields and open forested areas with loose sandy or rocky soils. It is found along the Coastal Plain and lower piedmont of North Carolina, Virginia, and Georgia. The majority of the populations ranges wide are found on Fort Bragg and Camp Mackall.

All Endangered plants sites

Natural Resource personnel monitor, protect and conduct landscape level habitat management for all endangered plant populations occurring on the installations. Prescribed burns and some hardwood midstory is removed for habitat restoration. Protection from ground disturbing activities includes preventing human activity within the plant sites by marking these areas with yellow signs.



Saint Francis' Satyr

Neonympha mitchellii francisci

General Description

Once collected to near extinction, the Saint Francis' satyr is considered one of the rarest butterflies in Eastern North America. A member of the satyr and wood nymph butterfly family, this satyr is a small, dark brown butterfly with dark-reddish brown eyespots encircled with yellow on the underside of the wings. Its wings have four orange colored bands across them, and spread 1 to 2 inches in width. The Saint Francis' Satyr was listed as federally endangered in 1995.



B. Hudgens

Habitat, Distribution, and Abundance

Fort Bragg supports the only known population. There is little known about the life history and habitat requirements for this species, and the Army supports critical research. Biologists do know that preferred habitat consists of open, wet meadows, many of which are abandoned beaver ponds filled with grasses, sedges, and rushes. Beavers as well as fire play an important role in habitat development.



N. Haddad

Two broods are produced each year and during the larval form, the satyr caterpillar appears green and white striped and feeds extensively on sedges. The development continues through 6 larval instar stages and after the final stage, the caterpillar forms a pupa and later emerges as an adult butterfly.

Endangered Species

Red-cockaded Woodpecker

Picoides borealis

General Description

One of 8 local woodpecker species, the red-cockaded woodpecker (RCW) was listed as endangered in 1968. The RCW is slightly larger than a bluebird, has a black head with conspicuous white cheek patches, and horizontal rows of white spots on its back giving a ladder-like appearance. The sexes look alike except for a small tuft of red feathers (cockade) above the cheek patch on adult males. A highly specialized species, the RCW is considered an "indicator species" reflecting the overall health of the longleaf pine ecosystem.

Habitat, Distribution, and Abundance

Fort Bragg and surrounding lands are home to the 2nd largest existing population which is critical for species recovery. Historic distribution ranges were closely associated with the longleaf pine forests. Currently, populations are found in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Eastern Texas, Virginia, Arkansas, and Oklahoma.

Red-cockaded woodpeckers live in family groups and occupy an aggregate of cavity trees called a cluster. They require forests of mature pine with little hardwood midstory for foraging and nesting - habitat historically created and maintained by frequent fires. Prescribed burning is an important management tool used for improving the birds' habitat.



A. Young



E. Evans

The RCWs prefer habitat made up of open longleaf pine forests with trees at least 80 years old. The RCW is the only species to excavate cavities for roosting and nesting in living pine trees. At least 20 other species use these cavities, including screech owls, wood ducks, bluebirds, snakes, flying squirrels, fox squirrels, insects and bats. As the longleaf age, they develop more heartwood than sapwood making it easier for the birds to create cavities, but it can still take several years to complete one. Since these older trees are rare on the landscape today, providing artificial cavities is another major management tool.



E. Guinn



E. Guinn



E. Evans



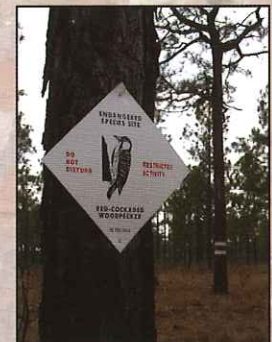
A. Young

Biologists visit clusters annually to determine if they are occupied by the RCWs. To assist in monitoring the population, a select group of birds are color banded. The combined data are used to evaluate population demographics and trends.



K. Crawford

Cavity trees are protected and identified by 2 white bands and buffered with signs. Human activities within these areas are limited.



E. Evans

Native Species



J. Gray – Sandhills Petunia



E. Evans- Snapping Turtle



E. Evans- Ruby-crowned Kinglet



E. Evans- Evening Bat



E. Evans- Milkweed/moth



B. Ball –Northern Pine Snake



A. Young- Mabee's Salamander



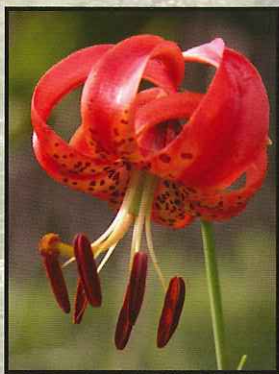
A. Young- Spring Peeper

The longleaf-pine wiregrass ecosystem is considered globally endangered. Embedded within the longleaf-wiregrass ecosystem are 23 different vegetative communities that support a diversity of flora and fauna with many of these species becoming rare.

For many species that are endemic to the Sandhills, the majority of the populations are found on the installations. These species have become rare due to loss of habitat and lack of a frequent fire regime, and often there is little life history information available. Fort Bragg supports inventories and species specific research for some rare species in order to manage more effectively and prevent future species listings. New county records have been documented for the state and species new to science have been discovered. The Army takes a proactive approach by taking endangered and rare populations into consideration when assessing projects and military training requests.

Flora

Over 1,200 species have been documented on Fort Bragg and Camp Mackall. Of these, approximately 975 species are highly specific to the longleaf ecosystem. Contributing to this floral diversity is frequent fire. Prescribed fire maintains the diversity, composition, and the structure of the plant communities. We have a low percentage of alien (introduced) species and a high presence of rare species. Contributing to this uniqueness is where the installations sit geographically. The majority of our plants are typical of the southeast coastal plain but we have remnant plant species from the Appalachian mountains, pocosin peatlands and the Gulf Coastal Plains occupying micro-habitats within the longleaf pine-wiregrass ecosystem.



E. Evans- Sandhills Lily



E. Evans- Yellow Meadow Beauty

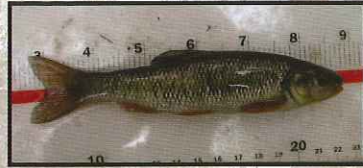


E. Evans- Grass-Pink

Aquatics

Fort Bragg and Camp Mackall host an assortment of aquatic habitats. There are 24 man-made impoundments, 45 rivers/streams, and over 150 natural ponds. Of the 24 impoundments, four are intensively managed for game fish, and four are managed for channel catfish. The remaining water bodies are left in a natural state. The ecological health of many of the installations watersheds rate from good to very good on the NC Index of Biotic Integrity scale. The aquatic habitats hold a diversity of species including the newly described Sandhills Spiny crayfish. Fifty species of fish have been documented. Special among these, are endemic species like the Sandhills chub (*Semotilus lumbee*) and the Pinewoods darter (*Etheostoma mariae*). Both are currently state listed as species of Special Concern, and are very sensitive to disturbance and changes in the environment.

Sandhills Chub



A. Young



A. Young-Largemouth Bass



A. Young- Creek Chubsucker



A. Young-Bluespotted Sunfish



A. Young-Sandhills Spiny Crayfish

Reptiles & Amphibians

The installations support a wide diversity of reptiles and amphibians. A total of 51 reptile and 44 amphibian species have been documented. The large diversity of species can be attributed to the variety of habitats found on Fort Bragg and Camp Mackall, including upland sandhills, pine savannas, mixed hardwood bottomland, open drop zones and cypress swamps. Currently no reptiles or amphibians are listed as endangered; however, the Northern pine snake (*Pituophis melanoleucus melanoleucus*), Southern hognose snake (*Heterodon simus*) and Carolina gopher frog (*Rana capito capito*) are listed as Federal Species of Concern and the Eastern tiger salamander (*Ambystoma tigrinum tigrinum*) is listed as Threatened in North Carolina.



A. Young-Pine Barrens Treefrog



B. Ball-Southern Hognose Snake



A. Young-E. Tiger Salamander



E. Evans-Gopher Frog

Native Species

Birds



E. Evans-Tufted Titmouse



E. Evans-Hermit Thrush



E. Evans-American Kestrel



E. Evans- Bird Banding

Fort Bragg and Camp Mackall forests are inhabited by 197 resident and migrant bird species and were designated as a Globally Important Bird Area by the Audubon Society in 2001. Large and species diverse winter flocks are found within the fire-maintained longleaf pine ecosystem throughout the winter, and a variety of neotropical migrants breed throughout its vegetative strata during the summer. Large population declines of neotropical migrants have been documented across North America, as a result of habitat destruction in both the United States and on the wintering grounds in Mexico, Central & South American. The Institute of Bird Populations has monitored the health and populations of neotropical migrants and resident species on Fort Bragg since 1995 through a program called MAPS (Monitoring Avian Productivity & Survivorship). Documenting these population trends are important to prevent future listings of candidate threatened and endangered species on Fort Bragg and Camp Mackall. One example of a resident species is the rare Bachman's Sparrow. It depends on open fire-maintained pine forest to survive and flourish.

Mammals



A. Young-Southern Flying Squirrel



A. Young-Field Mouse



M. Gumbert -Southeastern Bat



C. Bryan-Fox Squirrel

Biologists have confirmed the presence of 41 mammal species on Fort Bragg and Camp Mackall installations. Commonly seen species include: white-tailed deer, eastern gray squirrels, fox squirrels, raccoons, opossums and beavers. Some of the uncommon species include: black bears, river otters, mink, and short tail shrew. One of the more elusive mammals, the Star-nosed mole (*Codylura cristata perva*), is also a North Carolina Special Concern Species. Surveys are conducted annually on the installations to estimate population numbers and for management decisions as well as documenting presence of rare species. A rare bat survey, initiated in 2004, has confirmed the rare Southeastern bat (*Myotis austroriparius*) and the Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*) on the Camp Mackall installation. Both are listed as Federal Species of Concern. The Southeastern bat is also listed as a North Carolina Special Concern Species and it's presence is a new record for Moore, Richmond and Scotland counties. The Rafinesque's Big-eared bat is listed by the state as Threatened and a new record for Moore county.

Ecosystem Management

The following management tools are used to keep the forest healthy while maintaining suitable training areas for the soldiers.

Fire is the primary management tool in maintaining and perpetuating the longleaf pine-wiregrass ecosystem. Historically this ecosystem burned on a 1-3 year frequency and with regular low intensity surface fires, maintaining an open pine woodland relatively free of woody undergrowth. The presence of grasses, especially wiregrass, provides a ready source of fuel to carry fire across the landscape. Without fire, longleaf stands develop a dense scrub oak midstory. This competition suppresses ground cover and pine regeneration due to the decreased sunlight and increased litter depth, leading to a loss of species diversity. The life cycle of most of the plants and animals associated with this ecosystem are adapted to low intensity fires at frequent intervals.

Pre-settlement fires were ignited primarily by lightning, shaping the evolution of this fire-maintained ecosystem. Native Americans played a substantial role too, setting fires during the fall and winter months to drive game for hunting. Today emphasis is placed on prescribed burns corresponding with the historical fire regime. Prescribed burning during spring and early summer keeps the forest healthy by suppressing thick underbrush, allowing sunlight to reach the forest floor to increase ground cover and diversity, recycle nutrients back into the soil and provide bare mineral soil for pine regeneration.

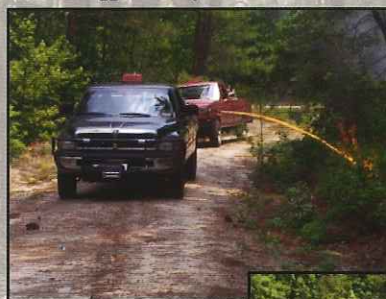
Hardwood midstory control is primarily accomplished through the use of fire. Scrub oaks are highly fire adapted and prescribed burns conducted during early and late spring are most effective in keeping them in the understory. Scrub oaks readily sprout back and will quickly out compete the establishment of longleaf pine seedlings and ground cover, if not frequently burned. Chemical and mechanical treatments are used initially to restore areas when the height of scrub oaks are beyond the flame length.



E. Evans

Pine thinning is conducted to reduce incidence and size of wildfires, manage for endangered species, and remove damaged timber. Thinning reduces competition between trees allowing them to grow larger, and opens up the canopy to allow sunlight for pine regeneration and increase groundcover diversity. Pine thinning may be used to reduce the incidence of potential insect infestation or reduce the amount of dead timber, helping to reduce potential wildfires.

Fort Bragg Forestry Branch



E. Evans



Fort Bragg Forestry Branch

Reforestation reestablishes longleaf pine forests in previously cleared areas and is used in the conversion of loblolly or other non-native stands back to longleaf pine. Longleaf pine is well adapted to the dry, infertile, deep sandy soils of the Sandhills region. The ultimate goal is to restore a viable and functioning ecosystem with natural regeneration. Where natural regeneration is not possible, training areas are planted with approximately 1,000 longleaf pine seedlings per acre. One or two-year old longleaf pine seedlings are used for planting, with preference given to those of North Carolina origin. Planting of native longleaf pine is also encouraged in military project areas.

Threats to Ecosystem

Loss of habitat contributed greatly to the demise of the longleaf pine-wiregrass ecosystem. Original longleaf communities in the Atlantic and Gulf Coastal Plains were heavily impacted by exploitation for naval stores and then virtually eliminated by widespread logging and subsequent reproductive failure of longleaf pine. Naval stores industries harvested pine resin for the production of tar, pitch, and turpentine, commodities in high demand during colonial times. Today, mature pine woodlands are still disappearing due to logging, erosion, conversion to agricultural fields, and from sprawling urban development.

10 March 1954



US Army Photograph-Fort Bragg



E. Evans

Fire suppression increased with the rise of pine plantations, a land use which began in the 1930's and 40's and continues to increase today. Fire suppression has severe and numerous impacts on southern pine ecosystems, including changes in tree species composition and forest structure. During suppression, longleaf pines cannot reproduce without access to bare mineral soil to germinate, and are replaced by other species of pines and hardwoods. The open canopy and diverse groundcover structure are lost and replaced with a multi-layered midstory and canopy with little or no groundcover diversity.



J. Merk

Invasive species are a leading cause of species endangerment and extinction both in the United States and worldwide. These non-native species are tolerant to disturbance, have no predators to keep them in check, grow quickly and are easily spread by humans, airborne seeds, and animals. We have identified 39 invasive plants and 1 insect, the red imported fire ant, on the installations.

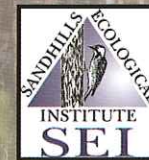
Help prevent the spread of invasive species by washing down vehicles/equipment, planting native species to our area and not releasing exotic pets back "into the wild."



E. Evans

Partnership

Created in 2000, the N.C. Sandhills Conservation Partnership (NCSCP) is a group of 8 organizations that share responsibility and management of the Sandhills ecosystem. Partners share information, provide assistance and implement management guided by a comprehensive plan. Primary stakeholders include:



Additional stakeholders include other NC state agencies, city governments, conservation groups and representatives from landowners, foresters, pine needle harvesters and the real estate industry