

GREEN GROWTH TOOLBOX SANDHILLS REGION APPENDIX



To all that live in the North Carolina Sandhills, it is probably no surprise that the region is rich in diversity. From peaches to pine straw, fox hounds to forestry, horses to hunting, the Sandhills has it all! In addition to supporting nationally important species, habitats, and ecosystems found nowhere else in the world, the natural areas in the Sandhills provide a wide variety of services that contribute to the economic development and quality of life in the region. They also support one of the most critical military installations for the country's national defense, Fort Bragg. In the Sandhills, conservation of natural resources is essential for sustaining the area's forestry, agriculture, and recreational traditions, as well as for the success and preparedness of the military.

The information in this appendix supplements the content provided in the Green Growth Toolbox handbook by offering additional region-specific knowledge and data about the priority natural resources in the region. Incorporating the principles and recommendations of the Sandhills Region Appendix and the Green Growth Toolbox into land use activities can help protect the region's diverse natural heritage and unique quality of life for future generations.

The Sandhills Region Appendix is organized into six sections:*

- INTRODUCTION TO SANDHILLS NATURAL HISTORY
- IMPORTANT HABITATS IN THE SANDHILLS
- SANDHILLS REGION GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA
 - Overview
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- OTHER SANDHILLS PROJECTS & GIS RESOURCES
- REGIONAL CONTACTS FOR GREEN GROWTH IN THE SANDHILLS
- GLOSSARY (for terms in bold)

* Appendices for the Greater Uwharries, and Coastal Plain regions provide similar information and are available at <http://www.ncwildlife.org/Conserving/Programs/GreenGrowthToolbox/DownloadHandbook.aspx>.

INTRODUCTION TO SANDHILLS NATURAL HISTORY

The Sandhills is a distinct biogeographical region characterized by porous sandy soils, gently rolling hills, and the critically imperiled longleaf pine ecosystem. It extends north from Georgia through South Carolina and into southern North Carolina where it encompasses large portions of Moore, Harnett, Cumberland, Hoke, Scotland, and Richmond counties and smaller areas in Montgomery, Lee, and Anson counties (Figure 1). In North Carolina, the Sandhills occupies a transition zone between the Piedmont region in the central part of the state and the Coastal Plain region in the east.

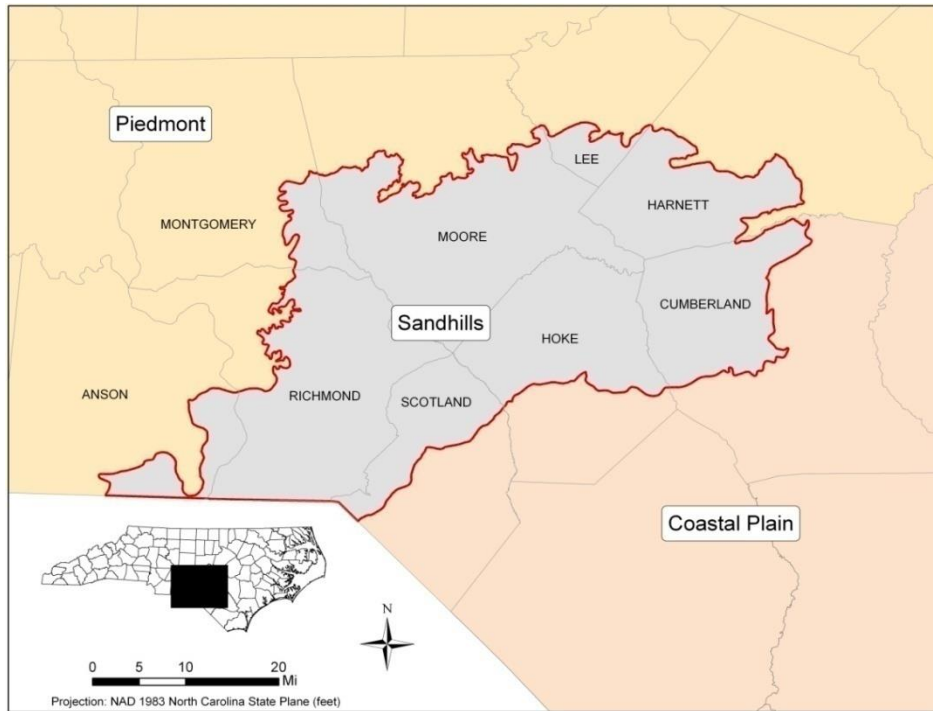


Figure 1. The map shows counties that occur within the Sandhills region of North Carolina in addition to the approximate boundaries of the Piedmont and Coastal Plain regions.

The North Carolina Sandhills boasts an impressive diversity of plants and animals, supporting up to 40% of the state's **biodiversity**. It is home to 5 federally endangered species and 41 species of federal concern. Some species such as the Sandhills Chub, a fish, and the St. Francis Satyr, a butterfly, occur nowhere else in the world. Many of these animals live in **habitats** that occur within the longleaf pine ecosystem, a nationally and internationally recognized rare and valuable natural system. Outside of the Sandhills region but within the county borders, there are an additional 5 federally endangered species. For example, the endangered Cape Fear Shiner, which only occurs in the Upper Cape Fear River Basin, resides in some of the brownwater stream systems in northern Moore, Lee, and Harnett counties.

This brief overview of Sandhills natural history is just a snapshot of the breadth and uniqueness of the flora and fauna found here. Within the Sandhills and surrounding area, the North Carolina Natural Heritage Program tracks over 100 plants, animals, and natural communities, many of which also receive priority conservation status in the State's Wildlife Action Plan. Several of the contacts listed at the end of this appendix, including the North Carolina Sandhills Conservation Partnership, the North Carolina Wildlife

Resources Commission, The Nature Conservancy, and the US Fish and Wildlife Service, can provide additional information and references on this topic.

IMPORTANT HABITATS IN THE SANDHILLS

The following habitats are some of the highest priorities for conservation in the Sandhills; several of these habitats are also relevant for counties that extend into the Piedmont or Coastal Plain regions.¹ Local governments may consider these habitats as environmental assets, and thus will benefit their communities by targeting these priority areas with conservation strategies. Since it is difficult to map some of these habitats, the Green Growth Toolbox encourages site-specific surveys to accurately determine what environmental assets exist at a particular location. It is also important to note that although the habitat types listed below are individually described, they often occur on the landscape as a mosaic of habitats dictated by moisture and topography. These priority habitats are detailed in the NC Wildlife Action Plan².

- Longleaf Pine -

- The longleaf pine ecosystem once extended over 90 million acres across the Southeast, but it now occupies less than 3% of its original range. In North Carolina, 115,000 acres of intact longleaf pine are estimated to remain within the Sandhills region.³
- The longleaf pine habitat is characterized by a tree **canopy** dominated by longleaf pine, an open **midstory**, and an **understory** dominated by wiregrass, other herbaceous plants, and/or scrub oaks.
- The longleaf pine habitat depends on frequent fire (approximately every 2 – 4 years) to maintain its ecological structure and recycle its nutrients. In the absence of fire, nutrients are not replenished, and hardwood trees begin to shade out the groundcover, eventually decreasing the habitat value for many plants and animals.
- Many of the species that rely on longleaf pine habitat require large areas; tracts that are over 2,000 acres provide the most benefit to wildlife.
- Some of the **priority species** that call this habitat home are: Bachman's Sparrow, Eastern Fox Squirrel, Red-cockaded Woodpecker, and Southern Hog-nosed Snake.



- Wet Pine Savanna -

- The wet pine savanna habitats include Pine Savanna, Wet Pine Flatwoods, and Sandhills Seeps. All are characterized as a type of mineral wetland, which generally refers to wet sands underlain by clays.
- Under normal conditions, these habitats typically consist of a longleaf pine or pond pine canopy with an open midstory, and a mixed understory of wiregrass, cane, herbs, or shrubs depending on the soil moisture and fire frequency.
- In the absence of fire, understory diversity declines and shrubs begin to dominate, eventually disrupting the natural ecological structure of these habitats and decreasing their suitability for wildlife.

- Priority species such as Brown-headed Nuthatch, American Kestrel, and Pine Barrens Treefrog may live in these habitat types.

Prescribed Fire

- Prescribed burning, otherwise known as ‘prescribed fire’ or ‘controlled burning,’ is defined as the “planned use of fire set under predetermined weather and fuel parameters to obtain specific management objectives” (http://www.ncprescribedfirecouncil.org/pdfs/guide_for_prescribed_fire.pdf).
- Most prescribed burns are conducted by certified professionals that have been trained by either state or federal agencies. Burn plans, fire breaks, and smoke management protocols are standard precautionary features on most prescribed fires.
- Prescribed burning helps to reduce the safety and property risks posed by uncontrolled wildfires.
- Many of North Carolina's natural ecosystems require periodic fire to flourish. Thus, prescribed fire is essential for the maintenance and restoration of many of the plant and animal habitats found across the state.
- The longleaf pine ecosystem is particularly dependent on fire. Seeds of the longleaf pine tree require bare mineral soil to germinate, and the dominant understory grass, wiregrass, produces seeds only after a fire has occurred.
- For more information on prescribed fire in NC, see www.ncprescribedfirecouncil.org

- Pocosins -

- Pocosin habitats include Streamhead Pocosins and Streamhead Atlantic White Cedar Forests. Both occur along small headwater streams and are characterized by peat soils that are usually saturated with water.
- These habitat types are influenced by fire on adjacent uplands and generally have a sparse canopy of pine, potentially mixed with hardwoods such as sourwood or yellow poplar (typically known as tulip poplar). A dense shrub layer is usually present, which provides important food for wintering birds.
- Associated priority species include Swainson’s Warbler, Red-headed Woodpecker, and Oak Toad.



- Small Wetlands –

- Small wetland habitats include vernal pools, floodplain pools, and small depression ponds. Some of these habitat types are referred to as ‘ephemeral wetlands’ because they do not hold water year-round, while others remain permanently flooded.
- Ephemeral wetlands provide valuable habitat for breeding and larval development of priority amphibian species, e.g. frogs and salamanders, because they contain few aquatic predators such as fish. During the non-breeding season, adjacent upland areas provide important habitat for many of the adult animals that breed in ephemeral wetlands. It is important to protect a minimum of undisturbed 150’ buffer around pool’s edge; 600’ beyond this buffer, development should be limited.

See the main Green Growth Toolbox handbook for small wetlands habitat conservation information.

- Permanently flooded small wetlands are year-round habitats for some priority reptile species, e.g. turtles, as well as breeding habitat for some amphibians.

Water quality and connectivity to upland areas are crucial features of small wetland communities. These habitats are often small and easily impacted by development and drainage, which alters hydrology and habitat quality. It is important to avoid constructing roads between small wetlands, as roads impede connectivity for wildlife. A few of the priority species that depend on small wetland habitats for important components of their life cycle are: Eastern Tiger Salamander, Eastern Chicken Turtle, and Carolina Gopher Frog. -

Floodplain Forests -

- Floodplain forest habitats are associated with the Pee Dee River, the Lumber River, and the Cape Fear River.
- Bottomland Hardwoods are a type of floodplain forest that may consist of different groups of tree species depending on whether it is associated with rivers or streams originating in the Coastal Plain or Piedmont. For the benefit of neotropical migratory birds, it is best to protect these forests where they are the widest.
- Intact, connected floodplain areas provide important movement corridors for wildlife and are habitat for priority species such as the Rafinesque's Big-eared Bat, Southeastern Bat, and Sandhills Salamander.

- Rivers, Streams, and Riparian Areas -

- Rivers and streams of all sizes are important habitats for many fish, mussels, and salamanders. The areas directly adjacent to these habitats, referred to as 'riparian areas,' also provide essential habitat for wildlife.
- Riparian areas have a direct impact on the quality of water and habitat within waterways because they influence and regulate the deposition of nutrients, debris, pollutants, and other inputs into rivers and streams.
- Riparian areas with native forest vegetation provide the best habitat for wildlife, the best protection for instream water quality, and the most beneficial inputs for stream habitat. The Sandhills and surrounding region are comprised of three distinct river basins, all of which contain instream and riparian habitats that have been negatively impacted by urban development, impoundments, drainage, and invasive species.

1. The Yadkin-PeeDee River Basin – Headwaters originate in the Blue Ridge but most of the basin is located in the Piedmont. The PeeDee River and associated tributaries flow through the western portion of the region. The Sandhills Chub, a fish, and the Pod Lance, a freshwater

Headwaters are the beginning of streams where water is collected and drained from the land during rains. They act as a vessel for water entering perennial streams. Headwater streams drain up to 90 percent of the land area of eastern North America. Streams or rivers with headwaters in the Sandhills are considered **blackwater** systems.

They are characterized by variable flow regimes, low nutrient content, and high amounts of dissolved organic matter, which is responsible for their distinctive clear, but dark waters. The mainstem of the Lumber River is the only blackwater river in North Carolina that is a designated National Wild and Scenic River

(<http://www.rivers.gov/rivers/rivers/lumber.php>).

mussel, are examples of priority species associated with some habitats in the Yadkin-PeeDee Basin.

2. The Lumber River Basin – Headwaters of the Lumber River originate in the Sandhills and associated tributaries flow through the central and southern part of the region. Habitats within the Lumber Basin support the Pinewoods Darter and freshwater mussels such as the Yellow Lampmussel.
3. The Cape Fear River Basin – Headwaters originate in the Piedmont and in the Sandhills. The Cape Fear River flows through the eastern portion of the region. A unique animal found in habitats within the Cape Fear River Basin is the Sandhills Spiny Crayfish.

- Early Successional Habitats –

- **Early successional habitats** include meadows, pastures, and grasslands that are dominated by native grasses and wildflowers. The understory of very open longleaf pine stands can mimic this type of habitat. Together, these locations provide year-round habitat for several priority birds, reptiles, amphibians, and mammals.
- Golf courses, lawns, and high production agricultural fields are not good examples of this type of habitat. Fire suppression, increased development, and detrimental agricultural practices impair the quality of early successional habitat for wildlife that depend on it.
- In agricultural areas, small patches of early successional habitat (i.e., 20 acres) provide benefit to many early successional wildlife species. In urbanizing areas, larger patches of habitat (i.e., 50 acres) are needed to provide benefits to wildlife. (see p. 40 of the handbook for more information).
- Northern Bobwhite, Chuck-will's Widow, and Eastern Coachwhip are a few examples of priority species that might occur in early successional habitat.

- Sparsely-Settled Habitat-

- Sparsely-settled habitats include a variety of non-developed habitats such as working farms and working forests.
- These areas provide important habitat and movement corridors for wide-ranging species such as bobcat and black bear. These animals can use a variety of habitats, but to persist, they need large blocks of habitat which are not divided by high-traffic roads or highways.
- Sparsely-settled areas support populations of many game species, such as deer and turkey, thereby providing hunting opportunities.
- This habitat type also helps to buffer intact, high-quality tracts of other important habitats from disturbance.
- Extensive development and major highways negatively affect the ability of sparsely-settled habitats to support healthy populations of wildlife and to buffer other important habitat types.

The importance of large, connected tracts of habitat and wildlife corridors

Wildlife use habitat to satisfy four basic life requirements: food, water, shelter, and reproduction. Large, connected tracts or **patches** of habitat are best for wildlife for two major reasons:

First, they allow wildlife to meet their life cycle needs while moving safely and easily through the landscape. When habitats are disconnected or **fragmented**, wildlife risk exposure to predators and other dangers such as cars.

Second, large connected patches of habitat help wildlife populations remain resilient to **natural disturbances** such as fires and hurricanes. If habitat patches are small and isolated, the ability of a species to rebound after a disturbance is greatly diminished.

Wildlife corridors are areas that animals can use to travel safely between suitable habitat patches. A variety of habitat types, which may or may not provide breeding or foraging habitat, can serve as wildlife corridors. Barriers such as roads with heavy traffic and large areas without habitat can prevent animals from accessing the habitat they need to satisfy their basic life needs. Over time, populations of wildlife tend to decline in health and number if their habitats are not large and well connected; wildlife corridors help to mitigate these impacts.

See page 74 of the Green Growth Toolbox handbook for more information.

SANDHILLS REGION GIS DATA - Overview

Section 2 of the Green Growth Toolbox handbook describes how to use wildlife habitat and natural resource GIS data that is available statewide in three levels of planning: Visioning and Plan Making, Ordinance and Rule Setting, and Development Review and Site Design. This appendix describes in detail additional GIS data that are available only for counties in the Sandhills region.

The Sandhills Region Appendix GIS data are presented below in two tiers. The two-tier system provides a general characterization of the available wildlife habitat and natural resources data; it also helps to summarize recommendations for green growth presented throughout the toolbox. Additional recommendations may be included with the description of each map layer; these are shown in *italics*. Individual counties or municipalities may choose to group map layers in any format that works best.

Sandhills Region Appendix GIS data were created by the Sandhills Conservation Partnership (www.ncscp.org), which is a collaboration of state and federal natural resource and wildlife agencies and organizations including: the U.S. Fish and Wildlife Service, the NCWRC, the Nature Conservancy, the N.C. Forest Service, the N.C. Natural Heritage Program, the U.S Army and the Sandhills Area Land Trust among others.

Tier 1/Tier 2 Resources – Composite Map Layers:

Map layers of the Tier 1 and 2 Resources described below are combined into composite maps for each tier. The Tier 1 Resource composite map contains all Tier 1 map layers combined into one map and the same for the Tier 2 Resource composite map. The composite maps include statewide conservation data map layers available in the Green Growth Toolbox Statewide Data in addition to datasets that only exist in the Sandhills Ecological Region.

Tier 1 Resources – This layer shows all the Tier 1 Resources Map Layers combined into a single dataset. These layers include: Natural Heritage Natural Areas (formerly called Significant Natural Heritage Areas) and Candidate Sites, Other Element Occurrence Sites, Other Natural Managed Areas, Active Red-Cockaded Woodpecker Foraging Habitats and Landscape Habitat Indicator Guild Core Areas (for habitat specialists).

We recommend avoiding development to the maximum extent possible or managing natural areas with assistance from the N.C. Wildlife Commission in Tier 1 Resource areas.

Tier 2 Resources – This layer shows all the Tier 2 Resource Map Layers combined into a single dataset. These layers include: Potential Upland Habitats, Wildlife Habitat Connectors, Smoke Awareness Areas, Inactive and Not Visited Red-Cockaded Woodpecker Foraging Areas, Restoration Areas, Stream Buffers, Floodplains, and Landscape Habitat Indicator Guild Core Areas (for habitat generalists).

We recommend low overall development density but clustered development in Tier 2 Resource areas that avoids natural open space as much as possible to maintain wildlife travel corridors.

As it is with the individual map layers, the composite layers may be used in all levels of land use or transportation planning.

Tier 1 Resources: Sandhills Sensitive Wildlife and Natural Resource Areas

These wildlife habitats are the most sensitive to development. NCWRC Green Growth Toolbox recommendations are to set aside these areas from development as much as possible. If development must occur within sensitive wildlife and natural resource areas, it is recommended that conservation design principles be used to minimize impacts such as fragmentation, sedimentation, loss of natural vegetation, and introduction of non-native, invasive species. See the Green Growth Toolbox handbook for more information on wildlife habitat conservation in planning.

Active Red-Cockaded Woodpecker (RCW) Foraging Habitats are areas in which RCWs, a federally endangered species, search for and acquire food. They are delineated by ½ mile boundaries drawn around the geographic center of a cluster of RCW cavity trees; each cluster of trees is used by a single RCW group for nesting and roosting. The area within this boundary represents the likely foraging habitat for a given group of RCWs. This determination is consistent with criteria established for RCW management by the U.S. Fish & Wildlife Service. *The Green Growth Toolbox recommends consultation with the U.S. Fish and Wildlife Service for specific recommendations about development in these areas. More information is available at www.fws.gov/ncsandhills/private_lands.html.*

Landscape Habitat Indicator Guild Core Areas (for habitat specialist species) are identified by a landscape-level analysis of habitat types and field collected records of the groups of animals that use them. A core area contains habitat with sufficient connectivity to support a group of indicator species, or guilds. Guild species are habitat specialists that depend on a particular habitat type and that are sensitive to habitat fragmentation.

Natural Heritage Program Natural Area Candidate Sites exhibit wire grass ground cover and mature longleaf pine in much of the uplands and/or have rare communities present and a lack of widespread soil disturbance. These sites should currently support or have a high likelihood of supporting rare species associated with longleaf pine forest, wetland, seep, or streamhead habitats. These sites are candidates for evaluation as Natural Heritage Natural Areas by the N.C. Natural Heritage Program.

Other Element Occurrence Sites will be part of the N.C. Natural Heritage Program Element Occurrence statewide dataset, but which have not yet been added to that dataset. These sites are the locations of habitat for documented field-collected records of rare Sandhills wildlife and plant species.

The following map layers are also Tier 1 Resources and are available statewide.

- Natural Heritage Natural Areas (formerly call Significant Natural Heritage Areas, source: N.C. Natural Heritage Program - NCNHP)
- Natural Heritage Element Occurrences (source: NCNHP)

Please refer to Section 2 of the Green Growth Toolbox handbook for descriptions of the other Tier 1 layers, which are statewide conservation data layers.

Tier 2 Resources: Sandhills Wildlife Habitat Landscapes

Based on current knowledge, these areas contain wildlife habitats, wildlife corridors, and buffers for lands on which wildlife management or recreational activities take place. These areas are generally larger and occur within a greater variety of land uses than the Tier 1 habitats. Wildlife in these locations are sensitive to

extensive residential and road development but less sensitive to rural land uses. Green Growth Toolbox recommendations are to sustain working lands or large areas of natural open space within Tier 2 areas. For any development expected within wildlife habitat landscapes, it is recommended that conservation design principles. Locate development on the edges of natural open space without completely surrounding any given habitat patch, i.e., minimizing habitat fragmentation and maintaining connections between habitat patches; and maintaining forested parcels and lots, i.e., minimizing removal of trees and other natural vegetation.

See the Green Growth Toolbox handbook for more information.

Potential Upland Habitats are sites identified by biologists from aerial photography as upland longleaf pine habitats, which in some locations include streamheads, seeps, and upland depression wetlands. These areas are termed ‘potential habitats’ because they are likely to contain priority habitats, but the presence and quality of the habitat has not been confirmed on the ground. *For more detailed information about the environmental assets occurring within these locations, the Green Growth Toolbox recommends field surveys.*

Landscape Habitat Indicator Guild Core Areas (for habitat generalist species) are identified by a landscape-level analysis of habitat types and field collected records of the groups of animals that use them. A core area contains habitat with sufficient connectivity to support a group of indicator species, or guilds. Guild species are habitat generalists that use a variety of different and more common habitat types; however these generalist species are sensitive to habitat fragmentation.

Wildlife Habitat Connectors are identified areas that are important for the movement of wildlife between rare habitats in the Sandhills. The movement of animals and plants between habitat patches is important to keep species from becoming extinct. Animals, in particular, need to move around the landscape to meet their needs. Major roads, large scale developments, and other land uses that limit the ability of wildlife to move through the landscape will have disproportionately large impacts in the areas identified by this data layer. These connectors also include Red-Cockaded Woodpecker movement corridors, which represent important habitat for the persistence of this federally endangered species.

Inactive or Not-Visited Red-Cockaded Woodpecker (RCW) Foraging Habitats are areas in which RCWs, a federally endangered species, were known in the past to search for and acquire food. They are delineated by ½ mile boundaries drawn around the geographic center of a cluster of RCW cavity trees that are no longer known to be occupied; each cluster of trees was used in the past by a single RCW group for nesting and roosting. The area within this boundary represents the potential foraging habitat for a given group of RCWs should they return to the area. This determination is consistent with criteria established for RCW management by the U.S. Fish & Wildlife Service. *The Green Growth Toolbox recommends consultation with the U.S. Fish and Wildlife Service for specific recommendations about development in these areas. More information is available at www.fws.gov/ncsandhills/private_lands.html.*

Restoration Areas are known to contain ground cover vegetation comprised of most of the species diversity that is characteristic of longleaf pine communities. Sites with remnant ground cover are better candidates for restoration than those where it has been completely lost. Typical examples include areas that have been clear-cut and had substantial soil disturbance but which still have some wiregrass and other natural ground cover plants. Areas where fire suppression and canopy cutting has allowed the understory to become thick and eliminate most but not all of the ground cover are also typical examples.

Stream Buffers are mapped along streams. The buffer widths follow official NCWRC recommendations for the amount of native forest that is needed adjacent to streams in order to conserve aquatic species. These buffers range from 100 to 200 feet on each side of perennial streams. The wider buffer is recommended to conserve federally listed aquatic species known to exist in waterways within “Subwatersheds with federally listed aquatic species” (source: U.S. Fish & Wildlife Service and available through the NCWRC Green Growth Toolbox website Conservation Data page Important Watersheds folder).

The following map layers are also Tier 2 Resources and are available statewide.

- Smoke Awareness Areas (source: NCWRC)
- Floodplains (source: N.C. Floodplain Mapping Program)

Please refer to Section 2 of the Green Growth Toolbox handbook for descriptions of the other Tier 2 layers, which are statewide conservation data layers.

SANDHILLS REGION GIS DATA – Note to Users

The data described within this appendix and in Section 2 of the Green Growth Toolbox handbook provide important information that may be used for local land use planning and decision making processes including: visioning and plan-making, ordinance and rule-setting, and development review and site design. While the best available data is provided, it is important to note a few key points.

- These data are not comprehensive; available GIS data does not completely capture all of the important habitats or environmental assets that exist within the region. The principles and recommendations provided in Sections 3 through 6 of the Green Growth Toolbox handbook are applicable to all areas, including those for which conservation data are absent or incomplete.
- These data are not final; most of the datasets are regularly updates Users should keep the most up-to-date data within their Green Growth Toolbox GIS database.
- These data are not guaranteed; data developers try to ensure the most accurate and precise product possible, but the exact location and condition of resources on the ground may vary.

When appropriate, local governments and communities are encouraged to conduct site-specific surveys and field inventories to augment existing data. Emphasis on and timing of these efforts may depend on the government or community’s objectives, the level of planning the data is being used for, and/or the funding available for such activities. Further guidance on this topic is available by request.

OTHER SANDHILLS PROJECTS & GIS RESOURCES

Sustainable Sandhills – *Land Use Suitability Maps*

Sustainable Sandhills and a group of planners, developers, and natural resources organizations developed a set of land use suitability maps to inform land use decisions in the communities surrounding Fort Bragg. The project began in 2005 with funding from the EPA and the U.S. Army. It has continued to evolve and mature with sustaining funding from the NC Department of Transportation. The overarching goal of the project is to provide a resource for evaluating the potential suitability for six types of land uses: Commercial, Residential, and Industrial Development; Working Farm Lands, Working Forest Lands, and Natural Areas. Suitability is assigned on a scale of 1 to 9, respectively indicating Low to High Suitability, based on criteria and factors that are specific for each land use.

The Natural Areas Suitability Surface is one of six maps produced through this project. This map indicates areas which contribute biological value necessary to sustain priority species, natural communities, and ecosystems. These locations support rare species or high quality communities; occur in or near important wildlife habitats, lands managed for conservation, and/or areas that buffer aquatic systems; and provide connectivity between or buffer natural areas. The Natural Areas surface is made up of several datasets that are combined based on defined criteria and weights. It is conceptually similar to the Biodiversity and Wildlife Habitat Assessment (BWA: Section 2 of the Green Growth Toolbox handbook) provided with the statewide datasets, but the applied inputs, criteria, and value scale are different. In particular, the map layers discussed above that are only available in the Sandhills were used in the Natural Areas surface but not the BWA.

For users who wish to use the suitability surfaces in conjunction with the Green Growth Toolbox, further guidance can be provided, but in general the recommendations are as follows:

- The Green Growth Toolbox recommends using the entire set of land use suitability maps, including the Natural Areas Suitability Surface, for visioning and plan-making when it is desirable to *compare the potential of a region for different types of land uses*. The suitability maps, when used as a set, help to identify areas with potential for conflicting land uses and also to identify areas where one type of land use is less likely to compete with other priorities.
- The Green Growth Toolbox recommends using a composite Tier 1/Tier 2 Resources layer for visioning and plan-making when a *broad perspective on the location and distribution of natural resource priorities* is sought. The composite Tier 1/Tier 2 Resources layer may also be appropriate for development review and site design and for crafting rules or recommendations when specific details about the natural resources are not necessary.
- The Green Growth Toolbox recommends using the individual Tier 1 and Tier 2 Resources data layers when it is desirable to *have more detailed information on why a given area is a natural resources priority*. Such instances might arise for development review and site design as well as for crafting rules or recommendations that address specific natural resource needs. In addition, both the individual Green Growth Toolbox data layers and the composite Tier 1/Tier 2 Resources layer are more applicable at smaller spatial scales than the Suitability Surfaces.

The results of the Land Use Suitability project, including the GIS map layers, can be acquired from Sustainable Sandhills at www.ncwildlife.org/Portals/0/Conserving/GreenGrowthData/Sandhills%20Suitability%20Model.zip.

Base Realignment and Closure Regional Task Force (BRAC RTF) – Comprehensive Regional Growth Plan, Working Lands Program

The BRAC RTF developed the Comprehensive Regional Growth Plan to foster cooperative regional planning in areas surrounding Ft. Bragg that would be affected by the base realignment and closure decisions. This process attempted to consider factors needed to protect and enhance military training and readiness, natural resources conservation, economic growth, and quality of life. As a result of this effort, a ‘center-corridor-wedge’ approach to land use planning, which was in part based on the results of the Land Use Suitability project mentioned above, was adopted. In addition, a working land protection program was

initiated. The following description, written by the planner in charge of this effort, Donald Belk, describes these projects in more detail:⁴

Comprehensive Regional Growth Plan

As the BRAC region prepares for an influx of new residents over the next three to five years, the counties have to be prepared to make changes to accommodate growth. Ensuring that we have well-planned communities, recreational facilities, shopping areas and natural space throughout the 11 counties and more importantly land to accommodate mission growth around the installation is a priority for our local communities. The final Comprehensive Regional Growth Plan is a study of the 11-county area that identifies the impacts associated with changes and other transformational growth opportunities in the region and steps that need to be taken to prepare the area for this growth. Many community leaders, business professionals and others from the 11 counties joined one or more of the nine working groups to gather information and work together to understand the changes and impact of BRAC.

The Comprehensive Regional Growth Plan also identifies functional areas that require additional or more detailed assessments, as well as recommendations that can and should be implemented through the BRAC RTF staff. The staff will solicit qualified consultants to assist with implementing these recommendations, which comprise the implementation and action plan tasks described in the Comprehensive Regional Growth Plan.

Working Lands Program

The BRAC RTF agricultural initiatives will strengthen the economy by opening new markets for local growers/producers, including Fort Bragg; preserve the heritage of family farms and rural entrepreneurship; link agriculture to new technologies which will expand opportunities and the potential for the next generation of farmers.

Additional information on these and other ongoing BRAC RTF projects can be found at:
www.bractrf.com/index.php

Fort Bragg/Pope Air Force Base Regional Land Use Advisory Commission - *Joint Land Use Study (2008), Telecommunications Tower Study (2008), Light Pollution Study (2007)*

The mission of the Regional Land Use Advisory Commission is to promote a regional perspective on land use and environmental issues that affect both the military installations and the adjacent communities. It seeks to provide a forum for discussing problems associated with noise and accident potential in order to develop mitigation actions. The Commission also works to develop recommendations for the placement of compatible land uses within civilian and military areas.

Within the last several years, the Commission has produced several studies that provide crucial information for planning and development in communities near Ft. Bragg/Pope Air Force Base. It also offers non-regulatory and non-binding reviews of proposed site plans for counties surrounding Ft. Bragg/Pope Air Force Base including Moore, Richmond, Harnett, Hoke, Scotland, Robeson, Cumberland, Bladen, and Sampson. For more information, contact the Executive Director, James Dougherty at jdougher7@embarqmail.com. Links to the above mentioned studies can be found at:
<http://www.rluac.com/index.php/projects>

Fort Bragg Sustainable Growth Management Strategy

<https://www.ncwildlife.org/Conserving/Programs/Green-Growth-Toolbox/Conservation-Data/Regional-Data>

“The Sustainable Growth Management Strategy (SGMS) provides the platform for local governments, military interests, agencies, businesses and others to realize unprecedented coordination on infrastructure decisions, economic development strategies, critical resource protection, land compatibility and other interconnected issues. This fosters more prosperous communities through sustained mission operability, new quality jobs and smart infrastructure investments.”

REGIONAL CONTACTS FOR GREEN GROWTH AND LAND CONSERVATION IN THE SANDHILLS

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(910) 638-4887

Organization <i>(listed alphabetically)</i>	Primary Expertise or Areas of Interest	Website or Contact Information
Mid-Carolina Council of Government	<ul style="list-style-type: none"> ▪ Technical assistance services to Cumberland, Harnett, and Sampson governments including land use planning, zoning administration, subdivision and zoning ordinances, water and sewer studies, annexation reviews, and community development workshops on timely issues 	<p>www.mccog.org (910) 323-4191</p>
Natural Resources Conservation Service (NRCS) & Resource Conservation and Development Councils (RC&D)	<ul style="list-style-type: none"> ▪ Natural resources conservation and community development ▪ Grants for land conservation, water management, community development, and environmental needs in designated RC&D areas 	<p>http://www.nc.nrcs.usda.gov/ or Find your local RC&D office at: www.nc.nrcs.usda.gov/contact/directory/rcd.html</p>
NC Cooperative Extension	<ul style="list-style-type: none"> ▪ Extension programs support the work of other government and nonprofit agencies which join together to improve the quality of life for county residents ▪ Educational programs for farmers, rural and urban residents, community leaders, homemakers, parents, and youth 	<p>Find your local extension office at: www.ces.ncsu.edu/index.php?page=countycenters</p>
NC Forest Service	<ul style="list-style-type: none"> ▪ Landowner programs include reforestation services, forest fire prevention and suppression, and insect and disease control ▪ Involved in the operation of tree seedling nurseries, long range forestry planning and technical development, water quality controls, urban forestry assistance, training, and support to volunteer fire departments and forestry education 	<p>www.ncforestservation.gov</p> <p>Region 2 Forester: (919) 542-1515</p>
NC Sandhills Conservation Partnership	<ul style="list-style-type: none"> ▪ Development and implementation of collaborative conservation strategies for wildlife and habitat in the Sandhills 	<p>www.ncscp.org</p>
NC Wildlife Resources Commission	<ul style="list-style-type: none"> ▪ Technical guidance on wildlife management and conservation to private landowners, government, and the public ▪ Cost-share program enrollment to qualified private landowners to assist with costs of enhancement and management of wildlife habitats on private lands 	<p>www.ncwildlife.org</p> <p>Habitat Conservation Division: (919) 707-0366</p>
Regional Land Use Advisory Committee	<ul style="list-style-type: none"> ▪ Land use planning consultation within 9 counties surrounding Ft. Bragg ▪ All American Trail 	<p>www.rluac.com (910) 583-1233</p>

Sandhills Area Land Trust	<ul style="list-style-type: none"> ▪ Land conservation and farmland preservation in Moore, Richmond, Scotland, Hoke, Cumberland, and Harnett counties 	www.sandhillslandtrust.org (910) 695-4323
Soil and Water Conservation Districts	<ul style="list-style-type: none"> ▪ Financial, technical and educational assistance to districts, landowners, agricultural producers, and the general public for conservation and protection of soil and water 	Find your county SWCD office at: www.enr.state.nc.us/dswc/pages/district_offices.html
Sustainable Sandhills	<ul style="list-style-type: none"> ▪ Awareness & Education, Air Quality, Recycling, Green Business, Regional Planning, Local Food and Culture ▪ Programs serve the 8 county region around the Sandhills 	www.sustainablesandhills.org (910) 484-9098
The Nature Conservancy	<ul style="list-style-type: none"> ▪ Land conservation in the Sandhills 	www.nature.org (910) 915-8813
US Fish & Wildlife Service	<ul style="list-style-type: none"> ▪ Coordination of Red-cockaded woodpecker recovery and Safe Harbor implementation ▪ Cost-share enrollment in Partners for Fish and Wildlife programs 	www.fws.gov/ncsandhills (910) 695-3323

GLOSSARY

Biodiversity – The entire suite of life present in a particular habitat, natural community, or ecosystem, i.e., all organisms from microbes to insects to plants to animals present within a given area.

Blackwater streams – These streams originate in the Sandhills and Coastal Plain regions and are distinguished by their clear, but dark waters.

Canopy – This is the uppermost layer of vegetation within a forest structure. In optimal longleaf pine habitat, this would consist of the tallest and oldest longleaf pine trees.

Early Successional Habitat – This type of habitat represents the first stage of an ecosystem process called ‘succession’ in which the composition of an ecological community changes over time. Succession occurs after a disturbance (e.g. hurricane, flood), or when working lands are allowed to return to a naturally vegetated state.

Fragmented Habitat – These are habitats which are disjointed, or disconnected, often as a result of manmade structures.

Habitat – This is the natural environment that populations of plants or animals use for food, water, shelter and reproduction.

Headwaters – These are the beginnings of streams where water is collected and drained from the land.

Midstory – This is the middle layer of vegetation within a forest structure. In fire-suppressed longleaf pine habitats, this layer might consist of turkey oak and other hardwoods.

Natural Disturbance – A natural disturbance is an event such as a hurricane, tornado, or windstorm, which may temporarily disrupt wildlife habitat conditions.

Patches – These are areas of habitat of varying sizes and shapes, which are often referred to when considering habitats within fragmented landscapes.

Priority Species – These are animals that have been identified by biologists in the state to be declining in population number or for which information about the species is too sparse to understand its status.

Riparian Areas or Riparian Zones – These are the lands directly adjacent to all streams and rivers. Riparian areas maintained in their native forested state provide water quality and wildlife habitat benefits.

Riparian Buffers or Stream Buffers – These are lands within the riparian area that are set aside and maintained in a native forested state to help protect water quality and instream habitat.

Understory – This is the lower layer of vegetation within a forest structure. In optimal longleaf pine habitat, this layer would consist of wiregrass and other native, herbaceous plants.

Wildlife Corridors – These are areas of mixed habitat types (e.g., sparsely-settled habitats) that animals can use to travel safely between larger, more suitable habitat locations.

Working Lands – These are lands managed for revenue, typically through agriculture or timber production.

Version 1.0 – Created April 2010
Version 1.1 – Updated July 2011
Version 1.2 – Updated January 2013

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Longleaf Pine Forest – Sara DiBacco

Military Paratroopers – Fort Bragg Endangered Species Branch

Peaches – Suat Eman at FreeDigitalPhotos.net

¹ North Carolina Wildlife Resources Commission. 2015. *North Carolina Wildlife Action Plan*. Raleigh, NC

² Ibid

³ Sorrie, Bruce. *Unpublished data*. December 2009

⁴ Description accessed from http://www.bracrtf.com/regional_planning.php on 2/4/2010

About the Author: Sara DiBacco Childs wrote this appendix as a representative of the NC Sandhills Conservation Partnership and in contribution to the cooperative effort of the Partnership, Sustainable Sandhills, and the NC Wildlife Resources Commission to implement the Green Growth Toolbox in the Sandhills Region of North Carolina.