NORTH CAROLINA WILD PLACES: A CLOSER LOOK
NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
The N.C. Wildlife Resources Commission is the state agency that is responsible for regulating the hunting, fishing and trapping activities that go on in North Carolina. But our duties and responsibilities encompass much more than that.

We are biologists who conduct research on wildlife, both game and nongame, common and endangered. We are officers who enforce the state’s wildlife laws. We are writers, editors, photographers and graphic designers who produce publications about wildlife, notably WARD, the North Carolina Wildlife magazine. We are educators who teach environmental education to teachers and students. We are an agency that cares about the wildlife that is our charge and the natural resources on which wildlife depend.
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It has been over 24 years since North Carolina Wild Places: A Closer Look was first printed and even longer since it was first conceived.

The project arose in the Wildlife Education Division, which facilitates educator trainings, such as Project WILD and Growing Up WILD, which are just a few of the formal and non-formal education workshops offered by NCWRC. The Wildlife Education Division also manages the Hunter Education program, the Becoming an Outdoors Woman program, three education centers, the shooting sports program, Wildlife in North Carolina magazine and much more.

The original writing, graphic design and artwork for the book took the efforts of a talented group of naturalists, educators, biologists, graphic designers and artists. We want to acknowledge the hard work these folks put into this book, without which you wouldn’t have this version today. Those people are: John Alderman, A. Sidney Baynes, Carl Betull, Alvin Beavell, Jim Brown, John Conners, Phil Doer, Mike Dunn, Lawrence S. Earley, Steve Hall, Merrill Lynch, Laura Mansburg, David Penrose, Sarah Friday Peters, Doreen Robbins, Anna Marshall Baynes, Michael Schalke, Kimberly KC Schott, Ernest Seneca, Terry Sharp, Leslie Sponaugle, Donna Stewart, Perry Sunner, Mark Taylor, Vic Ventre, Alan Winkley, Tom Westworth and Randy Wilson.

The Outreach Education Specialists who worked on the updates of this book include: Mike Campbell, CC King, Becky Skaia, Casey Williams, Kevin Hining and Tanya Pool. They received assistance from Jeff Hall, Shannon Jenkins, Danny Bay, Justin McVey, Ann May, Naomi Avissar, Lori Williams, Kay Mullinich, Dr. Jennifer Frick Ruppert and Ryan Jacobs.

The Publications Department staff who contributed to the update of this book include graphic designer Amy Friend, art director Marsha Tillett and editor Josh Leverett.
What is a habitat and why is it important to wildlife? What are some of North Carolina’s most important wildlife habitats? How are animals adapted to their habitats? What is the importance of particular habitats in our state and how are they threatened today?

These are basic questions that people ask about wildlife habitats in North Carolina, yet before the publication of this book you might not have been able to find answers to them on the shelves of your bookstore or library.

That’s the reason why the N.C. Wildlife Resources Commission published North Carolina WILD Places: A Closer Look. Between the covers of this book are found short, accurate descriptions of 13 of North Carolina’s major habitats, including their plants and animals. Some of these habitats are widespread through North Carolina, while others are limited to relatively small areas of the state. Carolina bays exist nowhere but in the southeastern portion of the state, and trout streams are found in the upper elevations of our mountains.

The state contains dozens of habitats, some quite large and others tiny, but in this book we’ve focused on 13 of the most important.

HOW TO USE THIS BOOK
After the introductory chapters on habitat, four chapters discuss specific habitats found in each of the physiographic sections of the state. Each habitat discussion begins with a sensory introduction. You are there, walking through the habitat at a particular time of year, aware of colors, sounds and smells characteristic of the habitat. Anne Marshall Runyon’s illustrations show you what the habitat looks like and where key plants and animals are located. An illustration key identifies each of the plants and animals depicted.

WHO WILL USE THIS BOOK?
North Carolina WILD Places: A Closer Look has been written with many audiences in mind. One of our primary audiences will be educators, formal and non-formal. We hope the book will give educators and their students a handy guide to the diversity of the state’s natural communities.

THE PURPOSE OF NORTH CAROLINA WILD PLACES: A CLOSER LOOK
This book is intended to help the reader understand some of North Carolina’s most important natural communities and the ways that humans affect them. The concentration of our population in the Piedmont section of the state has meant that few natural communities there have survived intact. But in the Coastal Plain and the Mountains, the remnant natural communities are daily affected by various human activities, most of them intended to accommodate a growing population. What are we losing as we grow? Do the gains outweigh the losses? We should not be surprised to learn that a naturally functioning ecosystem is as important to the health of humans as to that of wildlife. Informed citizens make good decisions about what is important. This is the educational purpose behind North Carolina WILD Places: A Closer Look.

INTRODUCTION

A child’s world is fresh and new and beautiful, full of wonder and excitement. It is our misfortune that for most of us that clear-eyed vision, that true instinct for what is beautiful and new-stopping, is dimmed and even lost before we reach adulthood. It has relevance with the good fairy who is supposed to preside over the christening of all children. I should add that her gift to each child in the world be a sense of wonder no matter what it is. It would last throughout life…

—Rachel Carson, The Sense of Wonder
WHAT IS HABITAT?

On a warm spring day, the surface of the tiny woodland pond is ruffled by a vagrant breeze. Look around. What do you see? What do you hear? A dragonfly dressed out in iridescent green and resting on a cattail? Lily pads offering their creamy flowers to the attentions of buzzing insects? A bullfrog jug-a-rumming somewhere?

If you’re lucky, you may see a bluegill finning gently beneath the wide lily pads while looking for tasty aquatic insects. Or a great blue heron stalking fish along the pond margins. Or a red-tailed hawk floating overhead, its wings outstretched. Another world, below the pond surface, is also full of creatures: mosquito larvae hang from the surface of the water; a giant water beetle sucks the life out of a frog; tiny water fleas and microscopic creatures swim, invisible to the naked eye.

No matter where you go on this green planet, you’ll find creatures in every size, color and shape. Some animals have backbones, while others don’t. Some have fins, others wings; still others have legs. Some curious organisms, called slime molds, seem to be plants at one time, animals at another! Whales are so big they could take up an entire room in a museum, but to see a mite you’d need a microscope.

Animals differ in their social habits, too. Some are rarely found away from their own kind, while others prefer to be more solitary, keeping company only during the mating season. Among the social animals are ocean fish called menhaden that swim in vast schools stretching for miles. Woodland bobcats are more solitary, choosing to hunt by themselves for most of the year.

Scientists have documented at least a million and a half different animal species existing on Earth today, each with its own habits and needs. But that number may only be a beginning. There may be as many as 30 million species, most of them insects found in tropical rainforests.

1  WHAT IS HABITAT?

If you were to look down on the Earth from space, all would appear silent and still. But if you plunge down, an extraordinary array of living things mammals and move on the face of the Earth… They exist together in some form of accommodation. Living and letting live, always suited to the ways of life they must follow, often present in startlingly diverse ways.

— Paul Colman, *Why Big Fierce Animals Are Rare*

NORTH CAROLINA’S CORNUCOPIA:

A total of 885 birds, mammals, reptiles, amphibians, freshwater fishes and crayfish are found in North Carolina. Of the 360 species of birds, 36 species are protected by state or federal endangered species laws. Of the 121 species of mammals, 21 are protected. Of the 92 amphibian species, 17 are protected. Of the 82 reptile species, 20 are protected. Of the 230 freshwater fish species, 56 are protected.
WHAT IS HABITAT?

Habitat is the place where an animal lives, where it finds its food and water, where it goes to escape from its enemies, and where it finds enough space to carry on its life. Habitat is home.

Habitats are different because each has a unique combination of soil, temperature and rainfall. Among the superlative physical adaptations of a great blue heron, for example, you might say that these fish all work in the same building, but on different floors doing different jobs. You might enable them to avoid tripping over each other by their environments, developing "tools" that help them exploit the habitat to its fullest. These tools are called adaptations.

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example, for a generalist because it can adapt to many different habitats across the state. It depends on a single kind of food, nor is it choosy about where it finds cover. Beneficiaries are generalists, too, and so are spouses, bulrushes, riparian, large-mouth bass and so on. Thus it can be considered the ultimate generalist. ‘We’re able to live in a variety of environmental conditions using tools and technology to adapt to some environments. In contrast, red-cockaded woodpeckers are nothing if not choosy. This wildlife specialist not only uses open longleaf pine forests for its habitat, but mature longleaf pine trees—trees that are at least 75 to 100 years old. Most woodpeckers build their cavities in dead trees, but not the red-cockaded woodpecker. Because longleaf pine trunks are frequently, standing trees but at times are killed. The red-cockaded woodpecker has adapted to these conditions by digging its cavities in living trees, whether older trees uninfected with a disease called ‘red heart’ that softens the tree’s interior, making it easier to dig out the wood. This woodpecker has been more successful than other woodpeckers in exploiting this once vast forest (see “Sandhills Longleaf Pine Forest”). This success has also been its undoing. As the long-leaf pine forests were cut down or grew up in oak thickets, this woodpecker lost its primary habitat. Today the red-cockaded woodpecker is an endangered species. Because environments tend to be constant, species can have an edge. A species that is able to exploit the hard-to-get food in its native habitat will have fewer competitors than the generalist. But specialists are more vulnerable to changing conditions, and is the reason for instance, the rabbit population may increase once again. In some cases, ‘limiting factors’ determine the carrying capacity of a habitat. Limiting factors are those deficiencies in a habitat that prevent populations from increasing. Woodpeckers for instance, may be limited by a small number of dead trees available for nesting cavities. Or perhaps a high number of predators such as owls and hawks. The WEB OF LIFE As we discuss how animals adapt to their habitats, it may be growing clearer that plants and animals are not independent of each other, and are connected within each habitat by complex relationships. For example, grasses provide food for rabbits, and rabbits provide food for predators such as foxes or bobcats. Many food chains connect with rabbit, but the plant actually has the most important role. Ecologists think of plants as primary producers, because they make food out of the sun’s radiant light through the process of photosynthesis. All life on Earth depends on plants. Animals are consumers, primary consumers are herbivores, plants primary consumers or carnivores, eat plant-eaters. Many food chains even have a top carnivore. But eventually all carnivores die, decomposers—both plants and animals—break down the bodies of the dead. Microorganisms—help turn their bodies into substances that can be used by grasses again. And the cycle begins anew. Energy from the sun is transferred to primary producers in their respective ecosystems. Rabbits and snails don’t have much in common, either, but they both require the same grass, which is broken down by decomposers in both cases. How will animals that depend on a habitat survive if it is changed? These questions are the subjects of the next chapter. In all directions, food chains grow into food webs. In a salt marsh, for example, a grasshopper is one of the few species that eats the living spartina grass. Worth eating grasshoppers and marsh hawks eat worms. Spiders and snail eat grasshoppers, too, and the hawk will also eat red-winged blackbirds, bitters and mice. Each food chain or food web can be formed into a web that encompasses an amazing number of plants and animals. How happens when an area is removed from this web of life? How will animals that depend on a habitat survive if it is changed? These questions are the subjects of the next chapter.
Today, North Carolinians enjoy a temperate climate in which the winters are generally mild, the summers are hot and rainfall is moderate. As a result, our habitats consist of plants and animals that are adapted to these conditions.

Yet 18,000 years ago, North Carolina had a very different climate that hosted quite different animals and plants. At that time, the climate was much colder than it is today. In the most recent ice age, glaciers flowed down from Canada as far south as Pennsylvania on the East Coast. The area today called New York was encased in a mile-high block of ice. North Carolina was spanned the glaciers, but temperatures more like Canada today were normal here, by standards and snow was more common than it is now. Only plant species adapted to cold climates could live here. The dominant trees were conifers—sequoia, fir, jack pine and hemlock. Mountain tops were bare.

And the animals? You might have seen strange-looking herbivores such as elephant-sized woolly mammoths and three-ton ground sloths. The predators would have included such scary creatures as the saber-toothed tiger and the dire wolf. All of these animals are extinct today.

Other animals that roamed North Carolina would have been more familiar—bison, caribou, musk oxen and beaver may have wandered across the frozen landscape. Though not extinct, they are long gone from North Carolina. As the climate warmed and the plant communities changed, the animals followed their accustomed habitats north. Gradually, forests of Southern pines and hardwood trees adapted to warmer climates became dominant here, along with animals adapted to them.

But habitats change in other ways. Consider what happens to the site of a Piedmont farm after it's been abandoned. Without human aid, the field will gradually grow back into a forest that once grew there, but not all at once. During the first couple of years, it will flourish with grasses, and then shrubs will grow up along with young loblolly pines. In 25 to 50 years, the pines will gradually fill the field and all the grasses and shrubs will die back, starved for light. During the next 50 to 150 years, oak or hickory trees will slowly grow and finally overtake the pines.

Today, about half of North Carolina’s wetland habitats have been destroyed since European settlement here, according to one estimate. Over the years, thousands of acres of salt marshes have been drained for coastal development. Vast acres of bottomland hardwood forests have been cleared for agricultural crops or pine plantations. Hundreds of Carolina bays have been ditched and drained, and hundreds of thousands of acres of pocosins have been converted into mega-farms.

Sometimes succession is stalled and the full progression of stages doesn’t take place. For example, the longleaf pine forest is one of several community types in North Carolina that hosted quite different animals and plants. At that time, the forests would have con-
WHAT'S HAPPENING TO OUR SONGBIRDS?

Wetlands and other natural habitats are vanishing in the face of a growing shift in the human population toward the coast. Ninety-five percent of our wetlands are located in the Coastal Plain, but as coastal areas grow, these natural areas are being replaced by homes, shopping malls and highways.

Habitat Fragmentation: Draining a swamp and fragmenting a habitat is almost as bad as destroying it.

Habitat destruction is the most obvious and immediate consequence of urban sprawl. It not only depletes the genetic diversity of wildlife species, it also reduces the amount of habitat available for many species.

Farms are not the only source of nutrient pollution. Urban runoff, wastewater treatment plants and industries contribute their share. Nutrient pollution can cause thousands of fish to die and has been

WHAT'S HAPPENING TO OUR SONGBIRDS?

Over time, some landscapes change naturally from bare field to oak forest...
Acid Precipitation: Carried off in the smoke from factories and oil refineries, sulfur and nitrogen present in fuels that power our cars, trucks, trains, factories, and homes form acids in the air. These acids fall back to Earth as acid rain, which is known to harm plants and wildlife. Acidic precipitation can be blown off from higher peaks to create acid rain that acidifies freshwater bodies, forests, and streambeds. When it rains or snows or when heavy fogs coat the trees, these deadly pollutants enter mountain soils and streams, causing an increase in acidity. This acidity has been blamed at least in part for the massive die-off of trout streams growing on Mount Mitchell and other high-elevation forests in the southern Appalachians.

Mount Mitchell: Wildlife habitats are also degraded when humans introduce harmful exotic and invasive species to an area either accidentally or deliberately. Many such species were brought here to control pests, and because they cannot survive in the wild, they eat the things we want. The worst invader to hit the region is the mountain pine beetle. This beetle has killed the native chestnut trees in the Appalachians, eliminating a major component of the forest and depriving wildlife of a rich food source. A fungus, introduced from Asia earlier this century, has killed more than 50 percent of the state. Public education is key to minimizing spread of this pest.

Acid Precipitation: When it falls on the ground, it kills plants, shrubs, and trees. It flushes nutrients from the soil, speeding runoff from fields and forests. It increases acidity of stream water, killing fish and other aquatic life. It can also make soil more acid, altering its chemistry and making nutrients unavailable to plants.

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Extinction is Forever: Many species are so important that their existence is essential to our own survival. Wildlife habitats are also degraded when humans introduce harmful exotic and invasive species to an area either accidentally or deliberately. Many such species were brought here to control pests, and because they cannot survive in the wild, they eat the things we want. The worst invader to hit the region is the mountain pine beetle. This beetle has killed the native chestnut trees in the Appalachians, eliminating a major component of the forest and depriving wildlife of a rich food source. A fungus, introduced from Asia earlier this century, has killed more than 50 percent of the state. Public education is key to minimizing spread of this pest.

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The mountain region extends west from the Blue Ridge Mountains to the Tennessee border. It’s a region of lofty mountains—43 peaks rise above 6,000 feet and 82 are between 5,000 and 6,000 feet. This area boasts the highest mountains east of the Mississippi River and the greatest mass of high-elevation peaks in all the Southern Appalachians.

This is where Mount Mitchell rises 6,684 feet high, the tallest mountain in eastern North America. You can find thousands of acres of public game lands, including lands owned and managed by the N.C. Wildlife Resources Commission, as well as those on two vast national forests, Pisgah and Nantahala. The region also contains several state parks and two popular national parks—the Blue Ridge Parkway and Great Smoky Mountains National Park.

It’s a region of spectacular gorges and waterfalls, where about 80 inches of rain and snow fall each year. It’s a place where mist clings to the valleys, and innumerable cold streams trickle down from the mountain heights, sheltering trout and other aquatic life.

These mountains contain a rich diversity of habitats, from rare bogs to rich cove forests, to spruce-fir forests on often icy mountain tops. There are more than 1,600 species of flowering plants in the region, including more than 100 native tree species—that’s more tree species than the entire nation of Great Britain!

“Twenty-five thousand years ago, as a great ice-cap formed over Labrador and pushed slowly out across North America, animal and plant life fled before its crushing destruction. Seeds were distributed by wind and animals and insects in front of the creeping glacier, until at last all of the northern United States was buried under ice, and trees and plants once native to Canada made their last stand on the heights of the Southern Appalachians.”

—Marina Dykeman, The French Broad

MAP KEY

Mountain cove forest
Spruce-fir forest
Trout stream

3 MOUNTAIN HABITATS
"Cove" is the name given to the upper portions of mountain valleys and to mountain slopes that have been carved by small creeks and streams. Scattered throughout our mountains, some of these remote and rugged sites have never been logged. The result is some of the oldest mature deciduous forest known in the Southern Appalachians—indeed, in eastern North America. These cove areas contain enormous specimens of tulip poplar, yellow buckeye, hemlock and sugar maple trees.

You’ll climb steep slopes when you explore a cove forest, and you’ll find boulders, fallen logs and stumps in your path. Then there are creeks, branches, seeps, and springs flowing from the mountainside and tumbling downslope. In a mountain cove, it’s hard to see the sun. The steep slopes and a dense canopoy of tall, deciduous trees make sunshine rare.

Most challenging of all are the “laurel hells”. These dense thickets of rhododendrons grow mostly in the deeper and steeper-sloped ravines, and can be quite a challenge to navigate over, under, and around.

Don’t be scared off. A visit to a mountain cove is well worth the effort. Nowhere else will you find so many different kinds of trees, and so tall and wide. Nowhere else will you find such a lush carpet of flowering plants and ferns.

For coastal residents, the word “cove” conjures up images of skiffs gently bobbing in a sleepy little inlet on the edge of a bay. But for a mountain native, a cove is another thing altogether.

LIFE IN A MOUNTAIN COVE FOREST

Visiting a mountain cove for the first time in winter, you might think it a drab and boring place. Bird song and the musical trickle of water are silenced by icy temperatures. The thick carpet of herbaceous plants is missing, but with the arrival of spring, all of this changes.

1. Christmas fern
2. Hemithe tree
3. Black bear cub
4. Tulip poplar tree
5. Black bear sow
6. Chipmunk
7. Junco and nest
8. Walking fern
9. Yonahlossee salamander
10. Camouflaged spider
11. Fiddleheads
12. Ground beetle
13. Red eft (red-spotted newt)
14. May apple
15. Yellow trillium
16. Ants with larvae
17. Red-backed salamander with eggs
18. Yellow violets
19. Ovenbird
20. Foam flower
21. Black-throated blue warbler (male)
22. Fraser’s nebulous
Mountains range from 2,000 to 5,000 feet in elevation and support a great diversity of flora and fauna. Not far from the Appalachian Ridge, there is still hope for restoring this native giant tree. In the late 19th century, the hemlock woolly adelgid, a small insect from Asia, arrived in the eastern United States and started feeding on hemlocks. This insect attacks the tree by injecting a hormone that makes the tree’s leaves drop. The tree dies within a few years. The adelgid has long been considered one of the most harmful pests of eastern hemlock. Nearly 70 percent of the forests in New England are infested with adelgids, and 40 percent of the eastern hemlock stands in the state. Other hemlocks are found in the Smoky Mountains and the Appalachian Mountains. Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today. According to the 2015 North Carolina Wildlife Action Plan, the most pressing problem affecting mountain cove forests today.
Spruce-Fir Forest

Let’s take a mountain hike. Starting at the sunny banks of a roaring stream, you enter the shady deciduous forest of a mountain cove. During the long upward climb you pass through a grove of birch and beech trees on a slight ridge, stumble over boulders, crawl through rhododendron thickets and leap over soggy seeps.

The air is cool and full of the smell of fall—rotting leaves and mushrooms. Red, yellow and orange leaves settle on the ground at your feet. The roar and tumble of the stream will have faded away by the time you reach the uppermost slopes of the mountains. Now the flute-like notes of the veery, or the loud, wandering song of the tiny winter wren keep you company.

With hardly a warning, you find yourself in a mist-shrouded grove of tall evergreen trees. The tree trunks are shaggy with mosses and lichens. The air is cool and strongly flavored with the pungent smells of spruce and fir needles and rotting wood.

LIFE IN A SPRUCE-FIR FOREST

The climate of a spruce-fir forest can be harsh. Wind and ice storms are facts of life here, trees with their tops missing are common sights. And, as with any high-elevation ecosystem, in a spruce-fir forest. Now the voices you hear are of the wind.

The spruce-fir forest is a forest type composed of needle-leaved evergreen trees, mostly spruce and fir trees, that grow where temperatures are cool, moisture is abundant and mosses cover just about every surface. Plants and animals living here are the same as (or are close relatives of) those found in the spruce-fir forests of New England.

In the Southern Appalachians, you might call these forests “islands in the sky,” since spruce-fir forests only occur above 5,500 feet, limiting them to the highest peaks of the Blue Ridge Mountains of southern Virginia and North Carolina, and the Great Smoky Mountains of Tennessee and North Carolina.

Spruce-Fir Forest

1. Red spruce tree
2. Fraser fir tree
3. Raven
4. Migrating hawks
5. Red-breasted nuthatches
6. Dead fir trees
7. Sand myrtle
8. Saw-whet owl
9. Red spruce cones
10. Catawba rhododendron
11. Coal skink
12. Red squirrels
13. Mushrooms
14. Mountain wood fern
The Fraser fir shares the canopy with red spruce, which provides winter den sites for many small mammals. Though it is heavily shaded, the ground layer of the spruce-fir forest can be densely populated with plants. The delicate, clorotic leaves of wood sorrel are most prominent here, and add a pretty pastel hue to the forest floor. The leaves of red spruce, on the other hand, are needle-like, pointy and slightly curved. Generally, the cows of the fir stand upright, while those of the spruce dangle from the branches.

In a spruce-fir forest you will also notice the abundance of dead and dying trees. While historical logging and associated slash fires, as well as land development from Mount Rogers in southwestern Virginia to our mountain peaks from Mount Rogers in southwestern Virginia to our high-elevation cove forest and the spruce-fir forest, both contributed to the overall decline of the red squirrel. Although it is heavily shaded, the ground layer of the spruce-fir forest is not visited by many birds that favor the more open forest. Instead, it supports a community of birds that make their homes in the understory. Many of these birds nest in the forest canopy and will return again and again throughout the year, building their nests and raising their young. The most well-known of these birds is the red-breasted nuthatch and the brown creeper, gleaners of insects in the trees. You will also find a large variety of warblers, including black-throated blue, black and white, rufous-sided, and black-capped. All these birds are found in the spruce-fir forest. In fact, it is one of the few places in the United States where you can see a wide variety of birds in their natural environment. Whether you are a birdwatcher or just enjoy watching nature, the spruce-fir forest is a great place to visit.

The red squirrel is another species that thrives in the spruce-fir forest. These small mammals are known to be excellent climbers and can often be seen moving in the branches of trees. They are also known for their ability to store food in the ground, often burying it in the soil or under rocks. This behavior is important for the forest as it helps to disperse seeds and promote new growth.

The spruce-fir forest is also home to a variety of insects. The balsam woolly adelgid (a kind of adelgid) is a pest that can cause significant damage to spruce and fir trees. The adelgid feeds on the inner bark of the tree, which can lead to the death of the tree. Other insects include the Colorado potato beetle and the spruce beetle, which can also cause significant damage to the forest.

The spruce-fir forest is also home to a variety of reptiles and amphibians. The red-sided garter snake, for example, can be seen on the forest floor or in the underbrush. The snake is a common species found in many environments, including forests, fields, and even urban areas. The red-sided garter snake is an important part of the ecosystem, as it controls the population of insects and other small animals. Other reptiles and amphibians found in the spruce-fir forest include the wood frog, the American toad, and the spotted salamander.

The spruce-fir forest is also an important habitat for many mammals. The red squirrel is one of the most common mammals found in the spruce-fir forest. The red squirrel is a small, brown animal with a white belly and a bushy tail. It is an excellent climber and can often be seen moving through the branches of trees. The red squirrel is also known for its ability to store food in the ground, often burying it in the soil or under rocks. This behavior is important for the forest as it helps to disperse seeds and promote new growth.

The spruce-fir forest is also home to a variety of birds. The red-breasted nuthatch and the brown creeper, for example, are two species that are commonly found in the spruce-fir forest. These birds are small and have a bushy tail. They are often found moving in the branches of trees, searching for insects to eat. Other birds that are commonly found in the spruce-fir forest include the red-breasted and white-breasted nuthatches, the white-throated sparrow, and the song sparrow.

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It’s clear because there’s no pollution in the watershed. The ecology of a trout stream completely depends on its temperature and clarity. If the water temperature warms because shading trees are cut down, or if dirt from construction activities enters a stream, the inhabitants of a trout stream could be in danger.

An early evening in summer is a magical time! You see aquatic insects hatching from immature larvae into winged adults. Trout are feeding on the insects that are hatching. Through the tree, shafts of sunlight appear and downstream you may see a doe with her new fawn drinking water. A fisherman once wrote that the environments in which trout are found are always beautiful and an endless source of delight.

In North Carolina, trout streams are mostly mountain habitats, although some are also found in the foothills. Wherever trout streams are found, they are cool places to visit, especially in late spring or early summer. Shaded by trees and dense bushes, the cold water makes past builders and smaller rocks, making a merry sound that is part of its appeal.

Unlike most streams in the Piedmont or Coastal Plain regions of North Carolina, mountain trout streams flow quite rapidly. Because most flow down steep mountain slopes, they may fall several hundred feet within a mile. This high gradient creates a series of waterfalls, splash pools and boulder-filled riffles that host different kinds of aquatic life forms. The splash pools, found directly below the waterfalls, are often the best places to see trout swimming. The riffles are the swift, shallow-stream sections between the pools and waterfalls. Most aquatic insects are found in riffle areas.

Mountain Trout Stream
You take a few steps out into a mountain stream. Even in the summer the water feels cold against your legs and it’s also crystal-clear. The water feels cool because it comes from cold springs and is always shaded along its course.

1. Hemlock tree
2. Mayfly adult
3. Rhododendron
4. Phoebe
5. Epeorus mayfly nymph
6. Epeorus mayfly dun
7. Epeorus mayfly adult
8. Brook trout
9. Rosyside dace
10. Acroneuria stonefly larva
11. Heteroplectron caddisfly larva
12. Pycnocesta caddisfly larva
13. Tallaperla stonefly larvae
14. Neophylax caddisfly larva
15. Goera caddisfly larva
16. Apatania caddisfly larva
17. Hydropsyche caddisfly larva
18. Isonychia mayfly nymph
19. Glossosoma caddisfly larva
20. Seal salamander
21. Sculpin
22. Acroacrisius stonefly larva
23. Telicynopa caddisfly larva
24. Telicynopa caddisfly larva
25. Neosphyra caddisfly larva
26. Coene caddisfly larva
27. Pycnocesta caddisfly larva
28. Heteroplectron caddisfly larva
29. Isonychia mayfly nymph
30. Chilosoma caddisfly larva
31. Soil salamander
LIFE IN A MOUNTAIN TROUT STREAM

When you are on the go, you can open a search engine and search for information about the rules and regulations of trout fishing. This search will provide you with information about which regulatory classifications apply. You can open a search engine and search for information about trout fishing. This search will provide you with information about which regulatory classifications apply. You can also visit a government website: www.ncwildlife.org. There you will find the rules and regulations of trout fishing. This search will provide you with information about which regulatory classifications apply.

There are several good ways to find a mountain trout stream. One of the best ways is to visit a government website: www.ncwildlife.org. There you will find the rules and regulations of trout fishing. This search will provide you with information about which regulatory classifications apply. You can also visit a government website: www.ncwildlife.org. There you will find the rules and regulations of trout fishing. This search will provide you with information about which regulatory classifications apply.

North Carolina has approximately 4,000 miles of streams capable of supporting trout and providing angling opportunity. Most of these trout streams are designated as part of the recharge area of surface water systems (RATAS) and are managed as a part of the Public Mountain Trout Waters (PMTW) program. Nearly 1,000 miles of these trout streams are designated as part of the recharge area of surface water systems (RATAS) and are managed as a part of the Public Mountain Trout Waters (PMTW) program. Nearly 1,000 miles of these trout streams are designated as part of the recharge area of surface water systems (RATAS) and are managed as a part of the Public Mountain Trout Waters (PMTW) program.

The most common type of trout found in mountain streams is the brook trout (Salvelinus fontinalis). This species is native to North America and is found in a variety of aquatic habitats, including streams, rivers, and lakes. Brook trout are known for their adaptability and ability to thrive in a wide range of environments. They are also prized by anglers for their fighting ability and their ability to survive in cold water.

In clean, unstressed mountain streams, the most abundant aquatic fish species are trout. Brown trout, or grayling (Salmo trutta), are the only non-native trout species found in North Carolina. In most large trout streams, these beautiful fish have been replaced by non-native rainbow trout (Oncorhynchus mykiss). Both of these species are ecoregions—two of them are actually introduced to our streams in attempts to increase the trout population. Brown trout and rainbow trout are almost identical in appearance, but the brown trout lives in a cool, clear stream, while the rainbow trout lives in a warmer, more turbid stream. Brown trout and rainbow trout are almost identical in appearance, but the brown trout lives in a cool, clear stream, while the rainbow trout lives in a warmer, more turbid stream.

You can often spot the brown trout in clean, cold streams. The brown trout is a sleek, streamlined fish with a long, narrow body and a dark, mottled coloration. It is a excellent predator, feeding on a wide variety of prey, including other fish, crustaceans, and aquatic insects. The brown trout is an important component of the trout ecology, and its presence is a sign of a healthy, well-managed aquatic ecosystem.

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North Carolina Wild Places

Visit a mountain trout stream. Mountain trout streams are the best kept secret of the state. North Carolina Mountain Trout Streams

MOUNTAIN HABITATS | Mountain Trout Streams

The range of the brook trout, the only trout species native to the Eastern United States, is reduced, often good places to look for aquatic insects. Animals have not yet been discovered about being swept away as do animals that live in the current. At one time, the brown trout was considered an undesirable species. This is because it is often found in streams that support many native species, including salmonids, black bear, flying squirrels, and mountain lions. However, the brown trout is now considered an asset to the ecology of mountain streams. It was originally introduced to the East Coast of the United States to support angling opportunities. It has since become a valuable asset to mountain streams, providing food and habitat for many other species.

Brook trout streams are the best kept secret of the state. They are often found in remote, high-elevation areas, and are home to a diverse array of aquatic insects and other invertebrates. Brook trout streams are also important for their role in supporting salmonid populations, as they provide important spawning and rearing habitat for salmonids. Brook trout streams are also important for their role in supporting salmonid populations, as they provide important spawning and rearing habitat for salmonids.

A common stonefly larva is the Hexagenia nigripennis, which is a common sight in mountain trout streams. It is a large, flattened insect with a distinctive black and orange coloration. The Hexagenia nigripennis is a common sight in mountain trout streams. It is a large, flattened insect with a distinctive black and orange coloration. The Hexagenia nigripennis has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream. The Hexagenia nigripennis has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream.

Another common stonefly larva is the Lumbricine, which is a common sight in mountain trout streams. It is a small, flattened insect with a distinctive black and orange coloration. The Lumbricine is a common sight in mountain trout streams. It is a small, flattened insect with a distinctive black and orange coloration. The Lumbricine has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream. The Lumbricine has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream.

One of the most common stonefly larvae in mountain trout streams is the Ephemera danica. This species is a small, flattened insect with a distinctive black and orange coloration. The Ephemera danica is a common sight in mountain trout streams. It is a small, flattened insect with a distinctive black and orange coloration. The Ephemera danica has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream. The Ephemera danica has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream.

In several watersheds in the Great Smoky Mountains National Park, mountain trout streams are used as habitats for other animals, including the black bear and the red-cockaded woodpecker. The black bear is a common sight in many of the watersheds in the Great Smoky Mountains National Park. It is a large, powerful animal with a distinctive black and white coloration. The black bear has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream. The black bear has a life cycle that is similar to that of the salmonfly, and it is a excellent indicator of the health of the trout stream.

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The most common group of aquatic insects found in trout streams are the caddisfly larvae that make up a portion of trout's diet at different times of the year. Over 3,000 species of these two caddisfly larvae are found in North Carolina. This group of insect larvae in trout streams is not that one. Many other invertebrates and aquatic insects may fish for a living. Many of these are brown trout. The brown trout is the most active predator, trout, although sometimes it will eat them all. Also along stream edges, and at the water line, there are many other sources of food by scraping algae off rocks and logs. Some species of caddisfly larvae build portable shelters that protect them from predators and for ballast. Some species of caddisfly larvae build portable shelters that protect them from predators and for ballast.

Another group of aquatic insects are the stonefly larvae. It can sometimes be a spectacular sight when you look under the rocks for attached algal food material. One advantage that occurs naturally in North Carolina streams, is that the fish will eat them all. Also along stream edges, and at the water line, there are many other sources of food by scraping algae off rocks and logs. Some species of caddisfly larvae build portable shelters that protect them from predators and for ballast. Some species of caddisfly larvae build portable shelters that protect them from predators and for ballast.

North Carolina's water runoff over heated impervious surfaces, and impoundments. Finally, the introduction of invasive species into trout streams may have negative effects on the trout population. The introduction of invasive species into trout streams may have negative effects on the trout population.
Because its softly rolling hills reminded them of their foothills in Europe, early settlers use the term “Piedmont” (literally, “foot of the mountain”) to refer to the region between the Blue Ridge Mountains in the west and the fall line in the east. The fall line is where the harder rock of the Piedmont comes into contact with the younger and softer rock sediments of the Coastal Plain. Rivers and streams entering the Coastal Plain erode the soft sedimentary layers more easily, creating a series of rapids and small waterfalls.

Of all the provinces in the state, the Piedmont has been settled the most densely. While the clay soils disappointed early settlers, the fast-flowing rivers provided power for grist mills and textile mills. Industry developed first in the Piedmont. Most of our major cities are located here, as are most of our people. Economically, it’s the most important region in the state.

Because the original mixed pine and hardwood forests were cut and the land was farmed not only by Europeans but by Native Americans before them, much less is left of the Piedmont natural communities than those of any other region in the state. In many places, decades of poor farming practices have denuded the land of its topsoil. As farms wore out and were abandoned, they were often replaced by forestland.

“Portaging the fall-line rapids in the late 1600s, European man looked up through a vaulted canopy of deciduous giants, a different vegetation from that of the Coastal Plain, particularly different from the pine stands of the fall zone hills. We can only imagine this experience, for we have no analog in the province now to give us a taste of the sensation. The primal Piedmont is gone utterly.”

— Michael A. Godfrey, A Sierra Club Naturalist’s Guide to the Piedmont

MAP KEY

Old field Piedmont stream forest Beaver pond

PIEDMONT HABITATS

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PIEDMONT HABITATS
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As the days grow shorter with the onset of winter, the fields are covered with the brown and rust of broomsedge and the dried seed heads of various wildflowers.

When early settlers arrived in North Carolina's Piedmont, they saw a different landscape than we see today. Originally, hardwood forests of chestnuts, oaks, hickories and tulip poplars towered over much of this area. But the settlers cut the forests to build houses and they farmed the land. A typical Piedmont farm was moderate in size and consisted of a patchwork of many different land uses. Tilled fields of row crops and a cluster of tobacco barns adjoined pastures for grazing livestock. A small orchard, woodlots and the farmers' small pond provided a diversity of habitat types for wildlife.

1. Oak/hickory forest
2. Red-tailed hawk
3. Cotton rat
4. Pine seedlings
5. Apple tree
6. White-tailed deer
7. Field sparrow
8. Yellow sweet clover
9. Meadow vole
10. Queen Anne's lace
11. Praying mantis
12. Eastern black swallowtail caterpillar
13. Broomsedge
14. Eastern black swallowtail butterfly
15. Red fox
16. Viceroy butterfly
17. Insect galls
18. Monarch butterfly
19. Goldenrod
20. Buckeye butterfly
21. Red cedar tree
22. Common flicker

Piedmont Old Field

Old Fields are a habitat type that develops after a farmer abandons the corn or tobacco field permanently or doesn't plant anything for a few years. When a farmer abandons a piece of cropland, a succession of different plant communities invades the bare soil, following each other in a predictable order. At first, herbs such as crabgrass and broomsedge appear. In two to three years, asters and broomsedge begin to dominate. Gradually, shrubs, vines and pine seedlings and cedar trees begin to appear and if left undisturbed for 10 or 15 years, the pines will quickly grow into a young pine forest. The grasses and other early plants will die down in the shade of the pines. After another 30 to 110 years, a forest of deciduous oak and hickory trees will replace the pine forest and again dominate the landscape. Scientists call this process plant succession. An old field represents the early years of this ecological process.

Where did all these plants come from? In some cases, seeds were already present in the soil, waiting for the proper light...
Threats to Piedmont Old Fields

Unlike most habitats in this book, old fields are not natural. They come about because of human-caused changes in the landscape. One reason these habitats are important is that they provide a variety of ecological services, such as nutrient cycling, erosion control, and habitat for wildlife. Many studies have shown that old fields are important for a variety of species, including birds, butterflies, and other invertebrates. The remaining old fields in the Piedmont region are sites of cultural and ecological significance, and their preservation is important for the conservation of biodiversity in the region.

A few examples of the threats to Piedmont old fields include:

- **Urbanization and Development**: As more people move into the Piedmont region, more and more land is being developed for residential and commercial use. This can lead to the loss of old fields and other wildlife habitats.
- **Invasive Species**: Invasive plant species, such as knapweed and garlic mustard, can outcompete native plants and disrupt the natural balance of the ecosystem.
- **Agricultural Practices**: Some agricultural practices, such as overgrazing and intensive management, can disrupt the natural processes that occur in old fields.
- **Climate Change**: Changes in temperature and precipitation patterns can affect the timing of plant and animal life cycles, leading to changes in the composition of the ecosystem.

Overall, the remaining old fields in the Piedmont region are important for the conservation of biodiversity and the preservation of cultural heritage. Efforts to protect and restore these habitats will be crucial for their continued existence and the health of the ecosystems they support.
North Carolina’s Piedmont Stream Forest

Most of us pass them every day on our way to and from work, school or home. You may even have one in your backyard—a small stream surrounded by woods.

By day, the summer stream forest is an exciting place to explore. Taking one of the many paths through this woodland, you’ll see numerous insects, frogs, toads and maybe a snake or two. You may even flush a rabbit from a brier tangle. Under streamside rocks are crayfish, salamanders and other amphibians. In the stream, minnows and larger fish flash by. In the trees above are common year-round residents like cardinals, mockingbirds and blue jays, while bright flashes of color announce summer residents like Kentucky warblers, black-and-white warblers and yellow-throats. The shade from the overhead trees helps hold in the moisture from the stream, and vegetation will be lush, the air humid and ripe with the smells of plants, mud and water.

But after the sun sets, another world emerges. You may not see much wildlife now, but you can hear it. The summer streamside forest hums with life—crickets chirping, insects buzzing, frogs puddling, opossums and possums scurrying through the leaves. Moist leaves and vines slap at your legs as you walk through.

Unlike people, many animals are adapted to feeding, hunting, flying and walking even in the dark of night. Night offers special opportunities for animals that can exploit them. Species that are most active at night are known as nocturnal animals. Species active by day are diurnal animals. Species active at dawn or dusk are crepuscular animals.

In many cases, the lines aren’t always clearly drawn between the three types. Some species, such as shrews, are active during all three periods, while others, such as white-tailed deer, might be diurnal in remote areas but are crepuscular or nocturnal in locations heavily populated by humans. For these adaptable species, darkness offers safety from people.

1. Persimmon tree
2. Southern flying squirrel
3. Luna moth
4. Great horned owl
5. Southern short-tailed shrew
6. Cecropia moth
7. Ironweed
8. Big brown bat
9. Opossum
10. Raccoon
11. Cardinal flower
12. Southern leopard frog
13. Freshwater mussel
14. Crayfish
15. Queen snake

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that are adapted to life in land and in water. The freshwater environment attracts so many different species, it becomes a kind of laboratory where one type of animal (or invertebrate) can be compared with another. The stream as a habitat is not only physically efficient for bringing food down its length to fish and mussels in the water but also biologically beneficial for growth, attracting insects and animals that feed on vegetation. In turn, predatory animals are attracted by these animals.

If the water quality is good, the stream will support a healthy population of freshwater mussels. Mussels filter feeding by taking tiny particles of organic matter from the water. In creeks and urban areas, mussels can be the most abundant life form found in the water. In creeks in urban areas, only species that can tolerate pollution, if any, will exist. Popular game fish like the black bass and striped bass are examples of these. Local mussels can find food and live off small mussels of the same species. Feeds on another. The stream acts like a conveyor belt for the water as well. The moisture also encourages lush plant growth along the edges of the water. The plants in the riparian zone can be important for filter feeding organisms such as freshwater mussels. Urban wildlife is often found in low-lying moist areas. Their wings are covered with fluffy feathers that help the mussels and other aquatic life found in streams.Popular game fish like the black bass and striped bass are examples of these. Local mussels can find food and live off small mussels of the same species. Feeds on another. The stream acts like a conveyor belt for the water as well. The moisture also encourages lush plant growth along the edges of the water. The plants in the riparian zone can be important for filter feeding organisms such as freshwater mussels. Urban wildlife is often found in low-lying moist areas. Their wings are covered with fluffy feathers that help the mussels and other aquatic life found in streams.

Bats are mammals with an ability to fly. The Southern leaf-nosed bat is almost entirely nocturnal, usually being active about 15 minutes after sunset. During the day, they roost in culverts, rock crevices, and under the leaf litter and travel through the water. They are able to produce a series of highly pitched sounds, calling at a rate of perhaps two hundred times per second. The sound business off objects, including insect prey—and it is picked up by the bat’s highly sensitive ears and turned into a visual image of its prey. Bats are highly effective in the air. To combat this, they have evolved a set of uniquely effective flight control systems. Many of the rarest mussels are found in Piedmont stream forest habitats. Many of the rarest mussels are found in Piedmont stream forest habitats. Many of the rarest mussels are found in Piedmont stream forest habitats. Many of the rarest mussels are found in Piedmont stream forest habitats.

Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body. Opossums are among the most common and unusual mammals in the state. They are nocturnal and are mostly active in the hours just after dark and just before dawn. It is the North American marsupial species. Marsupials are animals that carry their young in a pouch on their body.
PIEDMONT HABITATS

The lake edge is soggy and your shoes quickly get wet. A dank smell of decaying vegetation hangs heavy in the mist over the water. Many of the trees have died and stand starkly gray. Others have fallen and now lie criss-cross like giant pick-up sticks. Thickets of alder, cat brier and marsh grasses form a green tangle where once there were trees. You realize that walking through a beaver swamp may not be easy.

Beaver ponds have their own life cycle. The initial flooded woodland swamp stage may last five years. In the next five to 10 years, it flourishes as an open marsh with a woody border. In the final stage, when beavers have exhausted their preferred-tree supply and have abandoned the pond, the beaver dams disintegrate and a stream channel develops. Gradually the marsh reverts to a wet meadow and then to a bottomland forest. At this point beavers may re-enter the woodland and begin the process anew.

Populations of plant and animal species change throughout this pond cycle. During the flooded stages, many species of fish, reptiles and amphibians prosper. Muskrats, mink, river otters, gray foxes and other mammals are quick to inhabit beaver ponds. So are Canada geese, mallards and wood ducks, and swamp nesting birds like the red-shouldered hawk and the prothonotary warbler. Habitat for woodland species like the gray squirrel is poor during these stages.

It feels strange and disquieting, this drowned and girdled woodland. Last autumn, the pond was alive with color and creatures. When winter came, the silence was broken only by a creaking tree or digging woodpecker. At any time of year, you see felled trees, peeled twigs and girdled stumps—the unmistakable signs of the pond’s chief engineer, the beaver.

It’s a cool mid-May morning on the path skirting the shores of this urban lake. You’ve decided to spend the entire day in the wooded upper reaches of this old millpond park where a colony of beavers has created a beaver pond.

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LIFE IN A BEAVER POND

The beavers have built themselves a home in the pond. The water is clear and cold, and the scent of the forest lingers on the air. The beavers have created a dam to control the flow of water and create a sheltered area. They have built lodges to live in, and the pond is filled with trees and plants that provide food and shelter for other creatures.

In the pond, you can see numerous species of fish, including bass, catfish, and sunfish. The American marten, the bobcat, and the snowshoe hare are just a few of the animals that visit the pond. These predators are attracted to the pond for the abundance of food it provides.

The pond is also home to many insects, such as dragonflies and damselflies. These insects play an important role in the ecosystem by serving as food for other animals, including birds and fish.

Throughout the pond, you can observe the natural beauty of the surrounding landscape. The pond is surrounded by trees and shrubs, and the sound of birds singing fills the air. The pond is a peaceful and serene place, providing a haven for many species of wildlife.

The pond is a vital part of the local ecosystem and serves as a source of food and shelter for many animals. It is a place of wonder and beauty, and a reminder of the interconnectedness of all living things.
This low, flat region extends from the fall line to the Atlantic Ocean, as much as 150 miles in width. So flat is this area of the state that at its highest at the fall line it’s only 500 feet in elevation. With so little slope and with little hard rock to flow through, the rivers entering the Coastal Plain from the rocky Piedmont meander in broad, graceful loops through the soft layers of sand.

Its sandy soils makes clear that the Coastal Plain was once wholly under water. Over the last 2 million years, it has been inundated by the sea many times, leaving a series of terraces across the landscape to mark its advances. As recently as 18,000 years ago, the shoreline would have been many miles miles east of where it is today.

The Coastal Plain is a land of great natural diversity, where most of our state’s wetlands occur—bald cypress swamps, deep peat bogs, freshwater marshes and mysterious Carolina bays. Historically, its uplands were covered in longleaf pines and scrubby oaks. It’s a region where fire has occurred naturally and frequently over the centuries, carving out a rich variety of plant and animal communities adapted to fire.

“On the eastern flat lands, Nature attains in our state her fullest and most varied expression of loveliness in the form of wildflowers. Only the spring display in the mountain meadows of the far west can rival the unusual wildflower show of our lower coastal plain grass-sedge bogs. And fortunately our bog beauties are not confined to the spring season at all, but during the summer and even in the late fall they continue to make glorious the sunny savannahs.”

—B. W. Wells, The Natural Gardens of North Carolina
COASTAL PLAIN HABITATS

You can hear the songs of birds and see colorful flashes of their feathers around you. The tall, mature hardwoods form a closed canopy, casting a deep shadow on the relatively open, park-like understory.

The fall is usually that driest time of year. The only water lies in the deepest sloughs. Vines are everywhere. Only a couple of inches difference in elevation marks a dramatic change in the type of vegetation you walk through. Passing through a forest of oak, hickory, beech and sweet gum trees, you will walk down a small slope to the edge of a swamp where cypress and gum trees grow. Last spring’s flood waters have left a distinct dark waterline on their trunks. If you had been here in March, you would have been wading in a foot or more of water!

Bottomland hardwood forests are composed of a variety of broad-leaved hardwood trees that grow in the flood plains of our rivers and streams. Why are they called bottomland forests? One reason is that they grow in low areas that are flooded for a portion of the year when rainfall causes the rivers and streams to overflow their banks. Not only have the plants and animals of the bottomland hardwood forest adapted to this annual flooding cycle, they depend on it.

In a typical bottomland, for example, the lowest areas, often referred to as sloughs or swales, contain trees such as tupelo gum and bald cypress. These trees are adapted to long periods of flooding and, once established, can even thrive in areas that are flooded year-round. Oaks, hickories, ash, pignut hickory, elm and other trees grow on higher and dryer portions of the floodplain. These higher areas, also known as ridges, terraces or levees, flood only occasionally and usually for brief periods. Geologists refer to this

As you walk through a bottomland hardwood forest in the early fall you may not see many animals because they are hidden by the dense green foliage. But you can see tracks and other animal signs present in the muddy margins of the stream banks and sloughs.

1. Prothonotary warbler
2. Cherrybark oak tree
3. Dead shumard oak tree
4. Barred owl
5. Pileated woodpecker
6. Bald cypress trees
7. Tupelo gum trees
8. Mallard ducks and black ducks
9. Overcup oak tree
10. Great blue heron
11. Bobcat
12. Pawpaw
13. Zebra swallowtail butterfly
14. Cottonmouth
15. Sedge
16. Wild turkey
17. White-browed nachtsong
18. Beauty berry
19. Male wood duck
20. Giant cane

Bottomland Hardwood Forest
as it flits
the golden flash of a
prothonotary warbler
is named because its acorns are almost completely
overcup oak
of the floodplain, the
grows. This oak
producing acorns. Cherrybark oak is a type of red oak
cherrybark oak
In early fall, the bottomland hardwood forests are
alternating pattern of high ground and low ground as
bottomland hardwood forest in the Brown Creek floodplain
millpond-state-park
trails and camping available. www.ncparks.gov/merchants-
containing cypress-gum swamp forest. Canoeing, hiking
Merchants Millpond State Park
Roanoke River National Wildlife Refuge
(Bertie County).
Upper-Roanoke-River.pdfpdf
Hunting/Game-Land-Maps/Coastal/RR-Wetlands-RRNWR.
Roanoke River Wetlands
Halifax and Martin counties). The
in the United States but spend the winter months in
neo-tropical migrants. Neo-tropical songbirds nest
around the abundant acorns produced by the various
common residents are the
bobcat
and the colorful
one of the wariest inhabitants of the forest. The turkey

A shed that is frequently encountered in dry
stands and wetlands is the black bear
beauty berry. Also known as French mulberry, this
shrub produces clusters of bright purple berries that
taste sweet and juicy. Black bear

importance of Bottomland Hardwood Forests
In the spring, summer and early fall you may spot
this. Barred owls are often heard but only occasionally
pileated woodpecker
white-breasted nut-
Wood ducks and prothonotary warblers raise their
micro-habitats is the abundant cavities that are found
excavates its own cavity in dead trees or limbs. These
Bottomland hardwood forests contain many small
on ancient trees are the strange-looking, known as cypress 'knees,' that actually
Giant cane
sedges
zebra swallowtail butterfly
4 inches long, that is eaten by many wildlife species
Pawpaw produces a greenish, banana like fruit, 2 to
pawpaw
woody stem that can grow to heights of 10 feet or
Giant cane

features of these
ancient trees are the strange-looking, known as cypress 'knees,' that actually

Importance of Bottomland Hardwood Forests
By slowing and cushioning the enormous force of
flooding and destruction of many bottomland hard-
be causing long-term changes to the bottomland hard-
hardwood forests. Below the dams, the water releases may
IMPORTANCE OF BOTTOMLAND
HARDWOOD FORESTS
Bear that require thousands of acres for their survival.
Bottomland hardwoods are a type of wetland that occurs throughout the
Southeastern United States. In North Carolina, they
are most extensive along the floodplains of our major Coastal Plain rivers such as the Roanoke, Cape Fear, Tar, Black and Lumber rivers.

Part of the food chain, feeding on fish, amphibians, and reptiles, is the freshwater turtle.
If it weren’t for the pleasant rolling hills, the forest would look a lot like a savannah, another habitat where longleaf pine grows. Here and there beneath the grasses you can see the sandy soil covered with a brown carpet of fallen pine needles. As you walk to a ridge where the sand is especially deep, the grass gives way to broad mats of lichens, one of the few plants that can grow in the Sandhills water-starved soil. The first travelers described the region as a “dreary” wasteland consisting of monotonous vistas of pines. Indeed, the deep sands make the Sandhills look almost like a desert or a beach, which it once was. Rainfall wets the soil only briefly before drying up or percolating down, and only special plants and animals can adapt to these dry conditions.

- Red-cockaded woodpecker
- Sharp-shinned hawk
- Mature longleaf pine tree
- Bluebird
- Bluejack oak
- Turkey oak
- Fox squirrel
- Post oak
- Gray fox
- Cottontail rabbit
- Michaux’s sumac
- Wiregrass
- Scarlet kingsnake
- Lupines
- Ratsnake
- Pole-stage longleaf pine
- Pine elfin butterfly
- Sandworts
- Carolina anole

Once, the sand in the region was thought to be laid down by ancient seas. Today, however, scientists believe that the sand came most probably from river sediments deposited near the coast. Winds blew the sediments into dunes that were cut by streams, forming the rolling, sandy hills that we see today. The North Carolina Sandhills region lies in the Coastal Plain in an area east of the fall line, consisting of portions of Moore, Montgomery, Richmond, Scotland, Hoke, Cumberland, Harnett, and Lee counties. On early maps it was referred to as the “pine barrens,” yet as early as the 18th century, Scots Highlanders began to settle in the area, making a living from the forest and its naval stores products (tar, pitch, turpentine and rosin). Later, Southern Pines began to achieve renown for its healthy climate and Pinehurst and other resorts began to open. Today the region is known for its many golf courses.

COASTAL PLAIN HABITATS

Even in May, the heat is punishing but the mostly evergreen forest looks open and park-like. At mid-day, the tall pine trees drop dark shadows on the grassy forest floor. The wide spaces between the trees are occupied by high grasses.


LONGLEAF PINE FOREST

Longleaf pine ecosystems once covered vast areas not only in North Carolina, but in large parts of the Southeastern United States. As much as 92 million acres of these once widespread forests were lost from southeastern Virginia to the eastern Texas. The Sandhills longleaf pine forests differ from other kinds of longleaf pine forests because they grow on one thing in common: their dependence on fire. The warm and humid climate of the Southeast offers perfect conditions for summer thunderstorms. Over thousands of years, the climate has driven many adaptations to resist, avoid or even take advantage of it. Fire, following a summer fire, the wiregrass quickly regenerates and produces a fertile seed head.

The erect clumps of wiregrass provide cover after burning for ground-sitting wildlife species such as quail and cottonseed rabbits. The longleaf pine has also adapted to fire by altering its fire-fighting mechanism. In its early years the pine does not appear to be fire-resistant; it looks very much like a clump of grass, which is the reason why the early years of a longleaf pine is called the grass stage. During this stage, the vulnerable growing tip is protected from fires by a dense growth of pine needles while the pine grows a deep tap root. A fire can consume the needles, but generally the growing tip is unharmed. The tree’s roots are well equipped to resist fires throughout the longleaf pine region. So common was this trait that plant scientists developed many adaptations to resist, avoid or even take advantage of it.

Fire helps longleaf pine in many ways. One of the seeds of this pine need have ground to germinate and plenty of sunlight to grow. So-prepares the ground for the pine’s root system by preventing forest fires. The wiregrass, the tall grass that grows abundantly throughout the forest, helps the sandhills longleaf pine and they bloom with small white flowers.

In the EARS, MANY BUTTERFLIES seeking nectar hover around bright wildflowers. The pine eddle butterfly is small but it can be seen near loblolly pine trees. The female butterfly also lays her eggs on the longleaf pine needles where the female wiregrass rabbit eats. Almost one of every two species of butterflies that live in the Sandhills has adapted to the pine forests. Wildfires have burned every few years, this wood-destroying infection. The name came from the leafless state of the pine in the hot summer. The anole is a lizard with a surprising ability to change the color of its skin depending on weather conditions and even mood. Covering pine needles to get its fish, bobbins, jack-rabbets, and woodpeckers need open forests in which to forage.

Another animal adapted to the open longleaf pine forest of the Sandhills is the quail. The red fox is a large animal that roams large areas. The quail has adapted to forage for food. The quail is not an endangered species, but its numbers were once very low. In longleaf pine forests, quail forage for ground-welling wildlife species such as quail and timber resources.

What’s left of these Sandhills longleaf pine forests is a critical habitat for such rare and endangered species as the red-cockaded woodpecker. The quail has adapted to the lack of dead trees and logs, hunting lizards, mice and other wildlife. The quail is also a soil specialist; it buries its eggs on the longleaf pine needles where the female wiregrass rabbit eats. Almost one of every two species of butterflies that live in the Sandhills has adapted to the pine forests. Wildfires have burned every few years, this wood-destroying infection. The name came from the leafless state of the pine in the hot summer. The anole is a lizard with a surprising ability to change the color of its skin depending on weather conditions and even mood. Covering pine needles to get its fish, bobbins, jack-rabbets, and woodpeckers need open forests in which to forage.

An appropriate management scheme for this habitat will help both quail and the red-cockaded woodpecker. The red-cockaded woodpecker depends on open longleaf pine forests. An appropriate management scheme for this habitat will help both quail and the red-cockaded woodpecker. The red-cockaded woodpecker depends on open longleaf pine forests. An appropriate management scheme for this habitat will help both quail and the red-cockaded woodpecker.
COASTAL PLAIN HABITATS

One of these travelers, the Philadelphia botanist William Bartram, described a savanna in 1791 as “always green, sparkling with ponds of water.” Another early traveler said that they appeared “at a distance like so many Pleasure Gardens.”

As you walk through a savanna in late summer, you get a feeling for what they were talking about. The tall grass whips your legs and you are aware of swaying pine trees and multicolored wildflowers all around. The breezes moving the trees make a sound like the surf crashing on a far-away shore. The dominant color is green, yet hundreds of orchids and other wildflowers add jewel-like dots of color to the scene. In another few months, the grass will turn a tawny gold but other wildflowers will continue to bloom, even in winter.

1. White-tailed deer
2. Pond pine
3. Black bear
4. Longleaf pine tree
5. Bobwhite quail
6. Meadow beauty
7. Wiregrass
8. Toothache grass
9. Canebrake rattlesnake
10. Vanilla plant
11. Yellow-eyed grass
12. Dragonfly
13. Eastern glass lizard
14. Grasshopper
15. Yellow pitcher plant
16. Blackfly
17. Pine barrens tree frog
18. Sweet gallberry
19. Sweetbay
20. Eastern king snake

Longleaf Pine Savanna and Pocosin

As you cross a savanna, you find yourself blocked by a border of almost solid evergreen vegetation. This is a pocosin (pronounced “puh-ko-sin”). The ground is wetter and more sponge-like here. Though the longleaf pines still grow in the area, you begin to see pond pines now, shorter and more stunted than longleaf.

What a contrast between savanna and pocosin! The savanna is grassy and open, the pocosin is choked with shrubs. The savanna soil is sandy, often white or gray or a salt-and-pepper color; pocosin soil is peaty and mushy, and it holds salt and spongy when you walk on it. Yet both habitats are wetlands. Dense with evergreen bushes and trees, pocosins are among the most forbidding habitats in the state to human intrusion. Yet pocosins are so thick and bristly that many animals find excellent shelter there, and in the fall they eat berries and other foods. Most often, animals need more than one habitat in which to find food, shelter and water, and so it is with savannas and pocosins.

Once, much of our Coastal Plain was covered by broad, grassy pine savannas bordered by thick, brushy wetlands called pocosins. Riding their horses through the Southeast, many early naturalists were enchanted by the open savannas and compared them to meadows or parks.
LIFE IN A SAVANNA AND POCOSIN

In the coastal plain, particularly as the wire- grass grows its summer hue. The longleaf pine grows 60 to 70 feet tall and produces a twice the circumference of its trunk, and its needles last 4 to 7 years. In the fall, when the pines are shed, the seeds are released, and the wind spreads them to new areas. The pines are adapted to fire, and the fires that are kept under control by forest managers in the longleaf pine forests create a unique and diverse landscape.

Croatan National Forest Coastlines.surf/nc/ourinitiatives/ with carnivorous plants. Managed by the NC chapter of the Nature Conservancy. The longleaf pine, as well as other habitats. In every season, the pines produce dense thickets of gallberries, trees, and sweet bay offer shelter for the bear that is lacking in the open savannas. Another spectacular insect-eating plant that grows here is the Venus flytrap, which is important for North Carolina’s commercial development. Frequently, mice, and sometimes even snakes live in these holes. Southern flying squirrels. This squirrel, as a painkiller for toothaches.

To learn more about red-cockaded woodpeckers, as well as red-headed woodpeckers, compete with the snake for food and shelter. In winter, meadow beauties are burned frequently. In early spring, the savannas put on a colorful orchid display during the growing season, and wildflowers bloom there almost all year long. Many of these plants won’t flower at all unless they can survive fire because of their underground stems. Other plants in the ecotone are the tall, purple-flowered vanilla plant. In the past, its leaves were used as a jelly to thicken porridge. As important as they are to the state’s natural heritage, our pocosins have been destroyed. Most of North Carolina’s once extensive savannas and pocosins have made savannas one of the world’s great natural habitats. Both pocosins and savannas offer complementary habitats for the bear and other large mammals to roam.

The savanna is another habitat type where fire is a natural feature. In the centuries on this flat plain where it has been used to produce naval stores; tar, pitch, turpentine and rosin. The product, however, was a natural gum that flows from the tree when it is wounded. This gum was used to produce the proper mixture of salt and fresh water that’s critical to young fish that grow up in these secluded waters, preferring the open forest habitat. This savanna in North Carolina has 70 percent of the remaining pocosins.

As fire breaks out in the pocosin, the woods begin to smoke. The stink of it goes well up into the air, advertising the presence of a fire somewhere nearby. Their deep, peaty soils absorb rainwater and release it slowly. This function is especially valuable where pocosins adjoin estuaries, because they act as a sponge and release water slowly into the estuary. This is important for young fish that are shared by several states in the southeastern United States.

In the early fall, the savanna is still green as the longleaf pine trees have been scorched by fire. The trees are burned frequently. In winter, meadow beauties are burned frequently. In early spring, the savanna put on a colorful orchid display during the growing season, and wildflowers bloom there almost all year long. Many of these plants won’t flower at all unless they can survive fire because of their underground stems. Other plants in the ecotone are the tall, purple-flowered vanilla plant. In the past, its leaves were used as a jelly to thicken porridge. As important as they are to the state’s natural heritage, our pocosins have been destroyed. Most of North Carolina’s once extensive savannas and pocosins have made savannas one of the world’s great natural habitats. Both pocosins and savannas offer complementary habitats for the bear and other large mammals to roam.

The savanna is another habitat type where fire is a natural feature. In the centuries on this flat plain where it has been used to produce naval stores; tar, pitch, turpentine and rosin. The product, however, was a natural gum that flows from the tree when it is wounded. This gum was used to produce the proper mixture of salt and fresh water that’s critical to young fish that grow up in these secluded waters, preferring the open forest habitat. This savanna in North Carolina has 70 percent of the remaining pocosins.
By day, the bay is a serene landscape of scattered pond cypress trees looming over dark, still waters. By night, however, the sound of rain gently splashing on the water is drowned out by a chorus of frogs that have gathered at the bay to mate and lay eggs.

Later on, during the summer, the bay will look very different. Hot, sunny weather will dry out the bay except for maybe a few deep holes. Indeed, the plants and animals of the Carolina bay are adapted for an environment that is sometimes wet, sometimes dry.

Carolina bays are unique and mysterious wetlands found mostly in the southeastern portion of the state. No one even knew they existed until some of the first aerial photographs were taken of the Coastal Plain. What had been subtle or even hidden features to a person on the ground became obvious from the air—thousands upon thousands of soft oval shapes that covered the landscape. Strangely, all of them were oriented along a northwest-southeast axis, and many of them had a pronounced sand rim on their southeastern ends. There were more than 400,000 of these bays, ranging in size from a fraction of an acre wide to over 5,000 acres wide, and they covered the Coastal Plains from New Jersey to Georgia. The greatest concentration of these formations, however, were and still are in southeastern North Carolina and adjacent South Carolina.

What caused these wetlands to form? An early theory held that the oval-shaped depressions were the result of a prehistoric meteor shower. But geologists have largely discounted this theory because they have never uncovered meteoric rocks or other alien material beneath the bays.

A more recent theory suggests that the bays formed when strong winds blew across a cold, sandy, sparsely vegetated landscape during the last ice age. Over time, these strong winds blew against the sand, creating a series of windrows that eventually formed the bays.

It is February at a Carolina bay. A gentle, cold rain has been falling for several hours. This rain, along with others during the winter, has filled the bay with a foot of water.
The Carolina bays is the bay located in Hoke County in the upper Coastal Plain. Tamland, interspersed with forests of longleaf pine, occurs in the thin sandy soil. For those who are curious about why they are categorized as wetlands. This seasonal flooding has probably been most important in shaping what grows in the bays.

Some bays are filled with water all the time, forming natural lakes such as Lake Waccamaw and Waccamaw National Wildlife Refuge. Others are only seasonally wet, including bays with a clay layer beneath a thin layer of sand. These are called seasonally water-filled bays, many small ponds and wetlands. Some bays are filled with water only at certain times of the year, often referred to as ephemeral ponds. These ponds may fill up with water during heavy rains and then dry up again soon after. The reason for this variability in water availability is due to the size and shape of the bay. Larger bays, such as those in the Coastal Plain, are more likely to have a persistent water source, while smaller bays, such as those in the Piedmont, are more likely to dry up completely.

The Carolina bays are a natural curiosity that has captured the attention of scientists and nature enthusiasts alike. The bays are unique because they are formed by a natural process known as the Carolina bays. The Carolina bays are a series of small, elliptical ponds that are found in the Coastal Plain of the southeastern United States. The bays are typically filled with water and are surrounded by a ring of vegetation. The bays are believed to have formed as a result of the movement of the tectonic plates that formed the Earth. Over time, the movement of the tectonic plates caused the land to rise and fall, creating the bays.

The Carolina bays are not only a unique geological feature, but they also support a diverse array of flora and fauna. The bays provide a habitat for a variety of plants and animals, including waterfowl, small mammals, and amphibians. The bays are also important for water quality, as they help to filter and clean the water that flows into them. The Carolina bays are a valuable natural resource that should be protected and conserved for future generations.

The Carolina bays are an interesting and unique example of how natural processes can shape the landscape. The bays are a reminder of the power of nature and the importance of preserving our natural resources. The Carolina bays are a testament to the beauty and diversity of the natural world, and they are a reminder of the importance of protecting and conserving our natural resources. The Carolina bays are a valuable natural resource that should be protected and conserved for future generations.
Along the easternmost edge of North Carolina are the barrier islands, a thin chain of sandy beaches and marshes. Situated between the pounding waves on one side and the shallow sounds or estuaries on the other, they are popular vacation destinations for millions of people who enjoy the sea air and the gentle waves.

Forming a series of graceful arcs, these connecting islands protect the mainland from the destructive effects of powerful storms and their mighty waves. They were probably once the dunes of ancient beaches formed when the sea level was much lower. During the past 15,000 years, however, rising seas breached the dune line, creating the shallow sounds behind them and leaving the dune islands high and dry.

Sandy as a desert and scoured by frequent and fierce storms, barrier islands and the nearby waters of the continental shelf host several important wildlife habitats. Out on the shallow continental shelf not far from the islands, are underwater habitats known as hardbottoms. Behind the dunes lie the cool maritime forests while on the western sides of the islands, fringing the sounds, salt marshes nurture countless numbers of fish, shellfish and wildlife.

“All of us are drawn to the sea’s edge as to a fire. Its vast waves roll and heave in the light. There is an incalculable weight of waters withheld just beyond us, a roaming kept in check. What an exalting thing it is to see those waters dancing with silver castings from the moon!”

—John Hay, The Great Beach
There’s no mistaking a salt marsh—it’s unlike any other habitat in North Carolina. Perhaps the only other habitat it looks like is the salt grass prairies of the Midwest. Salt marshes are found in the protected environment behind our barrier islands. They border the large, shallow sounds and estuaries where our inland rivers empty.

Let’s visit a salt marsh in summer: The air smells salty but you can also detect an unpleasant odor, too. (This “rotten egg” smell is evidence of plant and animal decomposition, a natural process that’s important for the marsh.) Because there are no trees to block your view, you can see quite far in a salt marsh. The grasses are tossed by coastal breezes and from deep in the marsh you can hear the sounds of insects and birds, especially the “laughing” of the hidden clapper rail.

Meandering through salt marshes are tidal creeks that rise and fall regularly twice a day, flooding the marsh and then retreating. (North of Beaufort, the tides are caused by the wind and are not regular.) If you were to walk from the land side of the marsh to the creek, you’d pass several important zones. Near the trees and shrubs, in the upper marsh, you’d find marsh elder, silverling, wax myrtle and sea oxeye. As you walked into the lower marsh, you’d pass salt-meadow hay, black needlerush and glasswort, a plant that turns blood-red in midsummer. Flooded the longest is an area near the creek where salt marsh cordgrass grows, one of the most important plants in the marsh. In summer this grass is green, but when it dies in late fall it turns a deep golden color.

When the tide is high, the water may reach to the outer edges of the marsh, but low tide empties the marsh of almost all its water. You might think you could walk through the grass all the way to the sea, but high tides can move like great floods and be very dangerous.

**Salt Marsh**

Between the land and the sea lies a special habitat called the salt marsh. When you go to the beach, you may see what looks like a broad, flat, treeless meadow covered with waving grasses.
One of the most amazing things about salt marshes is that many of the events that mean the most to marsh creatures. Every-thing that lives in or depends on a marsh is adapted in some way to the tidal and waterlogged conditions in a marsh. The low tide is a time when the mud and the flat muds are exposed, the high tide is when they are covered by water. Spartina grass (also called salt marsh grass) is one of the most successful of these plants. Its roots spaces in its leaves enable oxygen to be absorbed and the plant to take in. Other animals depend on the spartina plant. The marsh is a small world that lives on the spartina surface. During high tides it crawls up the stalk to stay above the water; during low tides it crawls down again. In particularly high tides, it may be totally submerged, yet its lung enables it to survive. It also provides a footing for oysters and other small creatures. These wading birds have long, sharp bills and they feed in the marsh, too. With their long bill, the yellow-billed egret is a marvel of the marsh food web. Bacteria and fungi immediately break down the living spartina plant to take in. detritus is the base of the marsh food web, and so are we. The salt marsh food web also supports the numer-ous waterfowl that winter in salt marshes. And for you and me, the marsh food web, which contains immense quantities of nutrients. Some of these resources are brought into the estuary by the rivers that flow from the interior. Other nutrients are released in a way that enhances them in the estuarine or salt marsh environment. Marshes are also vulnerable to pollution that washes into them from rivers draining towns and cities. And shellfish like flounder, mullet and shrimp would not be able to grow. Threats to marshes. The marsh is one of the most valuable habitats in the world. Like many other wetlands, people once considered them as wastelands. They dumped garbage in them and filled them in so that houses, condominiums, shopping centers and marinas could be built on them. Now, laws protect these valuable habitats from indiscrimate destruction. Marshes are also vital to people who live in their vicinity. Without the marshes, many of the most valuable fish and shellfish such as flounder, mullet, shrimp, blue crabs and oysters. These small shrimp are one of the most fertile in the world. The two daily tides in the salt marsh perform useful services. They flush out waste products from the marsh and spread rich sediments and nutrients back into the estuarine environment. South Carolina is a wonder land rich in seafood. The marsh is one of the most valuable habitats in the world. Like many other wetlands, people once considered them as wastelands. They dumped garbage in them and filled them in so that houses, condominiums, shopping centers and marinas could be built on them. North Carolina’s sounds are so rich in seafood. The marsh is one of the most valuable habitats in the world. Other nutrients are brought into the estuary by the rivers that flow from the interior. Without the marshes, many of the most valuable fish and shellfish would not be able to grow. Threats to marshes. The marsh is one of the most valuable habitats in the world. Like many other wetlands, people once considered them as wastelands. They dumped garbage in them and filled them in so that houses, condominiums, shopping centers and marinas could be built on them. Now, laws protect these valuable habitats from indiscrimate destruction. Marshes are also vital to people who live in their vicinity. Without the marshes, many of the most valuable fish and shellfish such as flounder, mullet, shrimp, blue crabs and oysters. These small shrimp are one of the most fertile in the world. The two daily tides in the salt marsh perform useful services. They flush out waste products from the marsh and spread rich sediments and nutrients back into the estuarine environment. South Carolina is a wonder land rich in seafood. The marsh is one of the most valuable habitats in the world. Like many other wetlands, people once considered them as wastelands. They dumped garbage in them and filled them in so that houses, condominiums, shopping centers and marinas could be built on them. North Carolina’s sounds are so rich in seafood. The marsh is one of the most valuable habitats in the world.
It’s cool in the forest—usually 15 degrees cooler than it is on the beach nearby. You smell pine and the leaves from red bay trees, and you hear songbirds, woodpeckers and the buzz of mosquitoes. And be on the lookout for a host of mammals scampering through the forest. reptiles, amphibians and insects, too, pick up activity as the days grow longer and warmer.

What you see and sense all about you inside the maritime forests is what European explorers of the 16th century saw. As they sailed toward what is now the North Carolina coast, a beautiful sight greeted them on the barrier islands. Maritime forests of sprawling live oaks, loblolly pines and laurel oaks blanketed the thin chain of islands that fringe the coastal mainland.

For years, Native Americans had used these bountiful forests that had been shaped by wind and salt spray. They hunted game there and foraged for nuts, berries and other foods. Centuries later, loggers cleared live oak and red cedars from maritime forests for ship timbers. Leaves from yaupon holly supplied tea for American colonists rebelling against the British tea tax. Locals harvested dogwoods to sell the wood for spindles for cotton mills and red cedar was cut for pencils. Horses, cows, hogs and other livestock grazed the brushy thickets and forest floor until a ban was passed in 1937.

As you walk into a maritime forest on a spring day, a canopy of tall trees shades you. Live oaks, pines and hickories knit together above you and the understory of trees shimmers with new, pale green leaves.

For the most part, the remaining maritime forests look like the dense thickets and trees that the explorers saw 400 years ago. Maritime forests rise up from dunes several hundred years old. Most of the forest topography looks like a washboard, with ridges and hollows where water pools after rain.

1. Fish crows
2. Carolina anole
3. Red cedar tree
4. Live oak tree
5. Gum trees
6. Osprey
7. Dead pine tree with osprey nest
8. White-tailed deer
9. Great blue heron
10. Leopard frog
11. Male prairie warbler
12. Wax myrtle bush
13. Smilax vine
14. Garden spider
15. Baby raccoons
and valley, called coves, that will hold water and make critical habitats for many wildlife species. Behind the forest, the small, gray-green and evergreen leaves protects them from the salt spray. Throughout North Carolina’s maritime forests, the live oak is the dominant tree. This hardy canopy tree has a twisted trunk and branches that make strong boat frames. It grows to over 100 feet tall, although wind and salt spray can prune live oaks to the size of firebreaks. A wave crashing on the small, gray-green and evergreen leaves protects them from the salt spray. Salt spray can prune live oaks to the size of firebreaks.

North Carolina Wild Places

North Carolina’s maritime forest is a prominent feature of many of the state’s maritime forests. Rainwater collects in the swales between the dunes and the barrier islands. Summer months see rainwater in the overlying sea water. The freshwater pond is a source of active animals such as snakes, salamanders, frogs, fish, and furbearers. In the early spring, for example, spotted salamanders emerge from the ponds to bear egg clusters floating on the surface. Water moccasins, garter snakes, hog-nosed snakes and corn snakes slither around the water. Wading birds such as the great blue heron and egrets feed plenty of food around. In the early spring, a Great Blue Heron hunts a troll frog along the pond’s edge. The North Carolina’s maritime forest is a dominant tree. This hardy canopy tree has a twisted trunk and branches that make strong boat frames. It grows to over 100 feet tall, although wind and salt spray can prune live oaks to the size of firebreaks. A wave crashing on the small, gray-green and evergreen leaves protects them from the salt spray. Salt spray can prune live oaks to the size of firebreaks.

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Eighty feet below, the desert-like expanse of sand is broken by a ledge of rubble and rock. You have arrived at one of the special wild places in North Carolina—the colorful, exciting marine communities known as “hardbottoms.”

The rocky surface of the outcrop is covered with seaweeds brightly colored red, brown, yellow and green. In the winter months scientists see a lot more seaweeds than in summer. Schools of small baitfish swim just over the surface. This ledge is one type of hardbottom. It is like an oasis in the desert—a center for marine life.

How these undersea oases came about is a geological story. Much of the continental shelf south of Cape Lookout is crisscrossed with remnants of old river channels. They were cut into hard rock of the continental shelf exposed during glacial periods when sea level was much lower than today. The cliff-like edges of these ancient channels still exist in places. They are called hardbottoms because they are made from rock—limestone, sandstone or consolidated clays. Their margins form breaks in the sea floor’s typically smooth topography. The cliff range in height from a few inches to over 25 feet. Most occur in Onslow Bay, the area of North Carolina’s continental shelf between Cape Lookout and Cape Fear.

While some of the cliffs are located within sight of shore in 40 to 50 feet of water, other hardbottom habitats are found across the shelf in hundreds of feet of water. People are just beginning to understand how hardbottoms change as they get deeper and farther from shore.

Instead of smooth featureless rock, the cliff faces are eroded into a maze of cavities. Chunks of broken rocks form rubble piles across with remnants of old river channels. They were cut into hard rock of the continental shelf exposed during glacial periods when sea level was much lower than today. The cliff-like edges of these ancient channels still exist in places. They are called hardbottoms because they are made from rock—limestone, sandstone or consolidated clays. Their margins form breaks in the sea floor’s typically smooth topography. The cliff range in height from a few inches to over 25 feet. Most occur in Onslow Bay, the area of North Carolina’s continental shelf between Cape Lookout and Cape Fear.

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Ocean Hardbottom

Splash! You slide off the boat into the cool waters of the Atlantic just beyond Cape Fear. As you sink quietly into the ocean, you hear only the sound of bubbles from scuba gear. The visibility of the water is very good; you can see 50 or 60 feet underwater.

1. Little tunny
2. Round cod and striped anchovies
3. Sea whipp
4. Striped anchovies
5. Sargassum seaweed
6. Sea fan
7. Butterfly fish
8. Striped anchovies
9. Codium seaweed
10. Barracuda
11. Flamingo tongue
12. Featherduster worms
13. Hydroid
14. Spadefish
15. Sea urchin
16. Palmate sponge
17. Spiny lobster
18. Boring clams
19. Soft coral
20. Finger sponge
21. Carminefish eggs
22. Male damselfish
23. Black sea bass

5. Ocean Hardbottom
20 19 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
at the base. Biological and physical forces have formed this very irregular maze. Boring clams and sponges, crabs and other animals have tunneled into the rock. Large, lavender white, red and yellow polyps of the fan. A snail that feeds directly on the individual coral polyps of the fan.

MASSIVE, BRANCHING REEF CORALS cannot endure the rocky crust of the cliff. The sides of the river valleys that form the cliffs vary in height. The cliffs are deeply bored and excavated by biological and physical processes. The rims of the ledges lead to sand ramps and on to vast desert-like topography

Unwary fish, worms, wandering crabs or other careless animals—"sea strawberries." Much more slowly, schools of black-and-white striped round scad for baitfish that congregate over the hardbottoms. Even more slowly, schools of blue running scad entering the clear water. These meadows consist of seaweeds that hold fast to the rock. Large, lavender white, red and yellow polyps of the fan.

Feather baskets of green sargassum and cordy fingers of green sargassum to the rocky crust of the cliff. Arrow crabs grasping a piece of coral. The tall algae fronds of the sargassum hold them and their geologic origin. Biologists are determining the make-up of the complex food web. There are many questions to answer, and that makes this research exciting.
On a warm spring afternoon, a dozen people gather on the viewing deck at Jordan Lake, a reservoir near Raleigh built by the U.S. Corps of Engineers in 1982. Many of them scan the water with binoculars. “There’s one!” someone cries and everyone strains to catch a glimpse of a large bird with broad wings and a white-feathered head—unmistakably a bald eagle. The eagles at Jordan Lake demonstrate that a man-made habitat like a reservoir is just as capable of attracting wildlife as a natural habitat.

There are approximately 48,000 lakes, ponds and reservoirs in North Carolina and almost all of them are manmade; natural lakes and ponds are rare in the state and occur only in the Coastal Plain. Reservoirs perform important services—supplying water for towns and cities, protecting buildings from floods, providing recreation, or generating electricity. And although bald eagles seem to have singled out Jordan Lake as a primary habitat in North Carolina, lake habitats aren’t biological deserts. Species such as ospreys and wading birds respond to these open aquatic habitats, along with complete food chains of many fish and animals that are stocked in or attracted to these waters and their surroundings.

Farms and residential backyards are also man-made habitats. Yet, natural habitats are of greater value to native plants and wildlife than man-made habitats. For one reason, natural habitats support a greater diversity of species. Indeed, our natural habitats are the main reason why North Carolina has such an extraordinary number of plants and wildlife, from the world-famous varieties of mushrooms and salamanders in the mountains to the unique insect-eating plants of the Coastal Plain. Man-made habitats, on the other hand, are created at the expense of these diverse ecosystems. Reservoirs flood and destroy wetland habitats such as bottomland hardwood forests and river forests that are increasingly rare in the state and that serve as wildlife corridors. As a result, the wildlife changes accordingly. Wild turkeys disappear and wading birds, ospreys and even bald eagles exploit the new habitat. Yet, the total diversity of wildlife in and around lakes declines.

Natural habitats are important also because they have been shaped through the long evolutionary processes of time rather than by human manipulations. And in many cases, they represent remnants of habitats that once were more extensive. For these and other reasons, truly wild places are the rarest and most valuable habitats in the state.

“I have faith in man’s future, faith in the possibilities latent in the human experiment: but it is faith in man as a part of nature, working with the forces that govern the forests and the seas, faith in man sharing life, not destroying it.”

Marston Bates, The Forest and the Sea

7 | PROTECTING WILD PLACES
Park Service manages all of them. Within the Great
Establishing the Yellowstone Park Forest Reserve. In
the first step toward a national forest system by
Breeding and reintroducing species into habitats
Quarter National Wildlife Refuge. Salt marshes can be found in Swan
Savannas are located in the Alligator River National
Wildlife Refuge are some of the Southeast’s best pre-
National Wildlife Refuge and the Pee Dee National
Fish and Wildlife Service, national wildlife refuges
managed in parks, national wildlife refuges
manage these lands not only for featured game
Species, private conservation groups have also protected
Area. One of the most successful has been
The Nature Conservancy’s North Carolina chapter, which has identified and protected over 2,000,000 acres
of land, most of which it transfers to public agencies like the Wildlife Commission or the Fish and Wildlife Service,
which have managed several properties that include such wildlife places as rare
pines. Carolina should be balanced between economy and the environment, balancing forest, freshwater habitats, and mountain balds.
While the North Carolina chapter of The Nature Conservancy manages
areas within the forest. The area has deep sandy soils
that yearly threatens so many of our wild places and
destroyed. That was not the attitude that President Theodore
that was ethically as well as economically. “All ethics so far evolved
and others among the first conservationists to set
petrol.” Roosevelt wrote: “I do not recognize our
right to waste [our natural resources], or to rob by
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In this book, we will discuss the incredible history as we explore how
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The U.S. Fish and Wildlife Service is also an agency that
State Forests.
State Parks.
State Parks.
The N.C. Division of Forest Resources
manages and owns a state forest and five state
educational forests, comprising almost 40,000 acres
of land. Among the reasons for establishing Bladen
Lake State Forest was to protect important natural
area within the forest. The area has deep sandy soils
with sandhills types of longleaf pine forests. Carolina
islands and swamps. The Wildlife Commission
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State Forests.
Acid precipitation: The process by which chemical compounds from factories are emitted into the atmosphere and deposited into mountain ecosystems in North Carolina when it rains or snows, or when heavy fog coats the mountains. These chemicals increase the acidity of mountain streams and soils, and can threaten wildlife and plants.

Adaptation: An evolutionary process by which living things adjust to their environment over time. Biologists distinguish between physical adaptations and behavioral adaptations: an example of a physical adaptation is the shape of a bird’s wing; a behavioral adaptation would be the way canids hunt in packs.

 Carnivore: An animal that eats meat.

Carrying capacity: The ability of a habitat to support a specific number of animals of a given species. A habitat offers enough food, water and shelter for only a limited population of any species. If carrying capacity is exceeded, many animals may starve or die of other causes.

Community: The plants and animals in a habitat, each located in a separate niche, and interacting in food chains and in other ways.

Coniferous: Having to do with trees that bear their seeds in cones, also known as “conifers.” Coniferous trees are pines, firs or spruces.

Consumer: An organism in an ecosystem that makes its living from eating producers. Consumers are generally animals and can be primary or secondary. Rabbits, which eat grass, are primary consumers; rabbit-eating hawks and other predators are secondary consumers.

Deciduous: Having to do with trees that shed their leaves on a yearly basis, such as oaks and maples.

Decomposers: Plants or animals that feed on dead organisms and help break them down. Their chemical components are then recycled by other organisms.

Disrupt: An isolated population of plants or animals that is located far from the main area occupied by the species.

Diverse: An animal that is active during the day.

Ecologist: A scientist who studies the ways that living things interact in an ecosystem.

Ecology: The study of the ways that living things relate in an ecosystem.

Ecosystem: A natural system—salt marsh, Carolina bay, Mountain Cove Forest, etc.—in which living things (biotic) and non-living things (abiotic: soil, air, etc.) are linked.

Ecosystem, edge effect: The transitional zone between two habitats that is particularly rich in wildlife because of the diversity of food and cover types offered by both habitats.

Endangered species: A species in danger of extinction throughout all or a portion of its range.

Endemic: An organism that is restricted to an area; found nowhere else.

Environment: The total surroundings of a plant or animal including other plants and animals, climate and location.

Ephemeral pond: A temporary pond, one that dries up during a portion of the year.

Erosion: The process by which soil is stripped from the land by rain or wind.

Estuarine: Semi-enclosed coastal areas with brackish water formed by the mixture of fresh water from inland rivers and salt water from the sea. Brackish water estuaries serve as nurseries for young fish and support large numbers of shellfish as well.

Exoskeleton: The skeleton of an insect or crustacean that forms the external surface of the body.

Extinct: A plant or animal introduced into an area from somewhere else and not originally native to the area.

Extinction: No longer living on the earth, the fate that laws protecting endangered species are intended to prevent.

Food chain: The way that energy is transferred from a plant to a plant-eater and then to a predator of the plant-eater.

Food web: A more embracing concept of the food chain, based on chains that combine to form a web of relationships.

Generalist: An animal that is adapted to many different habitats, the opposite of a specialist.

Conservation is a state of harmony between man and land. —Aldo Leopold, "The Land Ethic"
A substance contaminating land, water or air.

and minerals into vegetable matter.

Photosynthesis: The chemical process by which the sun’s energy converts water

...cowbirds are nest parasites that lay their eggs in other birds’ nests. Brown-headed

killing it immediately. Mistletoe is a parasite that grows on trees. Brown-headed

decaying on the forest floor.

Old-growth forest:

and cause fish to die.

can encourage the growth of algae which can deplete the oxygen in the water

Chemicals necessary for the growth of plants and animals. When

Nutrients:

animal makes its living in the habitat.

Niche:

— that limits the numbers of a species or a population.

Limiting factor:

Habitat fragmentation:
The reduction of a large habitat into smaller pieces

Habitat:

An area where an animal can find enough food, water, shelter and space
to carry on its life needs.

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An area where an animal can find enough food, water, shelter and space
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Habitats, wildlife populations can become isolated and lose their genetic variability

GLOSSARY

habitats, wildlife populations can become isolated and lose their genetic variability

Growing Up WILD is primarily oriented toward formal and non-formal educators

Vegetable oil: A substance containing land, water or air, which is important in preserving the vitality of the species.

CATCH (Caring for Aquatics Through Conservation) workshops teach educators

www .eenorthcarolina.org.

www .ncwildlife.org/Learning/Education-Centers

www .ncwildlife.org

www .ncwildlife.org

It’s important for you to talk about your needs and wants with your children to help them understand what they need.

www .ncwildlife.org/Learning/Education-Centers

and wildlife careers. The innovative, multidisciplinary lessons offered through

www .ncwildlife.org

www .ncwildlife.org/Learning/Education-Centers

Programs:

The N.C. Wildlife Resources Commission’s Wildlife Education Division offers a variety of professional development workshops for formal and non-formal educators, as well as the general public. Workshops range from 2 to 10 hours and sometimes continue education credit (CEUs) and training hours for NC licensed teachers. The workshops also count toward the Environmental Education Certification Programs offered by the Office of Environmental Education and Public Affairs (www .ncwildlife.org). Commission staff identify and set up workshops throughout the year that will be available to your site as a staff development opportunity. Find out more about a workshop near you by contacting the local project coordinator or the Office of Environmental Education in your area at www .ncwildlife.org.

At the core of these workshops are five curriculum-based wildlife conservation and education programs. This includes a variety of activities to help them reach their curriculum objectives. All activities include objectives, methodology, materials, background information, procedures, suggestions for evaluation, and are keyed to grade level, subject area, and key vocabulary. These workshops are six hours in length and include a free activity guide.

Commission and partner organizations conduct workshops throughout the state with a North Carolina focus. For 30 years, Project WILD has engaged teachers and there is no minimum age requirement, however, classes are taught at a grade level appropriate for the group and, in general, 3rd grade and up. Workshops range from 2 to 10 hours and are suitable for teachers, parents and other interested individuals. Workshops range from 2 to 10 hours and provide service-learning opportunities for students. Activities can stand alone as part of a classroom curriculum.

Participants also learn about current wildlife management and research topics involving these species in North Carolina. Outdoor Skills Experiences are designed to improve enjoyment of our state’s wildlife resources, and include tutorials on game cameras, bird watching, fishing, hunting, archery and shooting sports. In addition, daily and weekend workshops for women provide skill-building and fellowship through the Becoming an Outdoors Woman program. The Commission also offers hunter education classes throughout the state. More than a firearm safety course, instruction includes ethics and responsibility, conservation, and the culture and history associated with hunting and fishing, survival for the individual, and, truth and trust are standing. There are no minimum age requirements, however, classes are taught at a grade level appropriate for the group and, in general, 3rd grade and up. Workshops range from 2 to 10 hours and are suitable for teachers, parents and other interested individuals. Workshops range from 2 to 10 hours and provide service-learning opportunities for students. Activities can stand alone as part of a classroom curriculum.

North Carolina Wild Places

www .ncwildlife.org

www .ncwildlife.org/Learning/Education-Centers

Pisgah Forest, Fayetteville and Corolla. Each center offers programs unique to

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Programs:

The Commission owns and staffs three wildlife education centers. These facilities are located in Pogonomyrmex badius. In the early 1890s, one of its regions of the state, many of which are aligned with N.C. Common Core and Essential Standards. To find out more about the programs offered online, visit our wildlife education center at www .ncwildlife.org/Learning/Education-Centers

Growing Up WILD workshops teach in-depth a variety of animal and plant species and the roles that an animal plays in an ecosystem—whether it is diurnal or nocturnal; how the animal makes a living in the habitat. North Carolina wildlife and development activities of one sort or another.

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Flying WILD provides activities to teach middle school students about birds, their migration, and how to help their birds and their habitats. Designed to help teach middle school students about new ways and then they teach others about it. The activities are provided service-learning opportunities for students. Activities can stand alone as part of a classroom curriculum.
“We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect.” — Aldo Leopold, A Sand County Almanac
“As wildlife conservationists and as responsible citizens, we should be intensely concerned about the preservation of species. Yet as this book suggests, our concern should also encompass the wild places where our native plants and animals are found. As we have seen, habitat is precious and fragile; the entire web of life linking plants and animals rests on the health of habitats. Indeed, the only sure way to protect our native species is to protect the habitats they call home.”

—from N.C. WILD Places: A Closer Look