

Exploring the Ecosystems of Eastern North Carolina

Alignment to NC Essential Standards

Science 4.L.1, 5.L.2

Social Studies 4.G.1, 5.G.1, 5.G.1.2

Language Arts RI.5.1, RI.5.4, RI.5.7, W.5.7, W.5.10

Learning Objectives

- Students will describe and compare the characteristics of several common ecosystems found in eastern North Carolina.
- Students will compare and contrast local ecosystems found on their school grounds

Time Required:

Activity 1: 60 minutes

Activity 2: 20 minutes per ecosystem

Materials

For each student or group:

- 1 copy of *Natural Environments of the Tar-Pamlico Basin*
- 1 copy of *Ecosystems of Eastern North Carolina*
- 1 copy of *Ecosystem Datasheet*
- Thermometer
- Field guides appropriate to the ecosystems being studied

Vocabulary

ecoregion, ecology, ecosystem, estuary, salt marsh, Carolina bay, floodplain, hardwood forest, maritime forest, wetland, farm pond, barrier island, tidal freshwater marsh, food chain, biotic, abiotic, organism, biome, lake

Overview

Learning about ecosystems is more engaging when students can use local examples. This lesson provides information on a number of ecosystems specific to eastern North Carolina and the Tar-Pamlico river basin so that teachers may incorporate local ecosystems into their lessons. It also includes an activity that allows students to make observations and comparisons about the ecosystems they encounter.

Background

There can be some confusion among the various terms used to define natural communities and their surrounding environment. **Biomes** are ecological zones which are defined by the dominant vegetation that occur in particular temperature and rainfall (climate) conditions around the world. An **ecoregion** is a defined area that contains similar soils and landforms and where similar types of **ecosystems** can be found. The boundaries of ecoregions delineate the original extent of natural communities prior to major land use change by humans. Ecoregions are generally smaller and more defined units than biomes.

An **ecosystem** is the interaction between a **community** of living (**biotic**) things and the nonliving (**abiotic**) environment. Ecosystems can be small or very large. The biotic and abiotic components are linked together through energy flow and nutrient cycling. Landforms, soils, vegetation, climate, organisms, water, and nutrients all work together to create healthy, functioning ecosystems. Whether we realize it or not, many of our economies depend on healthy ecosystems.

There are still many things that we do not know about these natural systems and how human activities may be affecting them and, in turn ourselves. **Ecologists** study ecosystems in order to better understand how living and nonliving things are interconnected and how, if necessary, we can restore ecosystems that have been impacted by our human activities.

Preparation

Prior to activity 2, identify at least 3 different local ecosystems on or near school grounds that students can access and collect data.

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Procedure

Activity 1

Introducing the Ecosystems of Eastern North Carolina

Time: 60 minutes

1. Students can work alone or in groups.
2. Review the concept of ecosystem with your students.
3. The handout, *Ecosystems of Eastern North Carolina*, describes a few specific types of ecosystems under the more general headings of forest, wetland, lakes and ponds, and coastal aquatic. These brief descriptions can be supplemented with the online resources, including:
 - NC Wildlife Coastal Plain Habitats <http://www.ncwildlife.org/Learning/Habitats/Coastal.aspx>
 - NC Natural Heritage Program Ecosystem Groups <http://www.ncnhp.org/web/nhp/ecosystem-assessment>.A few species of concern are listed in the handout, but the NC Wildlife Coastal Plain Habitats web page has links to documents that list all of the species of concern that are found in each ecosystem.
4. Ask students to read the descriptions of the three different types of forests in the Ecosystems of Eastern North Carolina handout.
 - What are common characteristics of each?
 - What makes them all forests?
 - What makes each type different?
5. Have students read about the various wetland ecosystems.
 - What are common characteristics of each?
 - What makes them all wetlands?
 - What makes each type different?
6. Have students read about freshwater aquatic ecosystems.
 - What is the difference between a wetland and a lake?
 - A reservoir can serve as habitat for fish, mammals and bird species, but if the reservoir is created by damming a river or a large stream, how does the dam affect the river ecosystem?
7. Have students read about the coastal aquatic ecosystems.
 - What are the differences between an estuary and the ocean?
8. Ask students what connections they can make between two or more ecosystems.
 - Are ecosystems distinct or are they interconnected with other ecosystems?
 - What evidence do they have for their conclusions?

Teacher Notes:

A forest is an ecosystem dominated by trees.

A wetland is land where the soil is saturated with water and the plants growing there can tolerate very wet soil.

A lake or pond has standing water all year, except perhaps during drought, and the water area is clear of vegetation. There can and should be vegetation around the edges.

A reservoir is a lake that is not naturally made. It is made by people, usually by damming up a stream or river.

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Activity 2

Compare and Contrast Local Ecosystems

Time: 20 minutes per ecosystem

- Prior to this activity, identify at least three local ecosystems that the students can access.
- Review the *Ecosystem Datasheet* with the students and procedures for collecting the data.
- Divide the class into groups of 3 or 4. Assign one student to record data and the others to collect data. At each ecosystem, students can rotate roles.
- Have students write the name of each ecosystem in the first row of the Ecosystem Datasheet. Explain that they will collect the data described in the first column and record the results in the column under the name of the ecosystem.
- If visiting multiple ecosystems in one session, give each group one ecosystem to start and allow 20-30 minutes for data collection. Then have the groups rotate to the next ecosystem. Otherwise, if doing this activity over the course of several field experiences, allow about 20-30 minutes for data collection at each ecosystem that students visit.
- After data has been collected for all ecosystems, bring the group back together for discussion.
- Ask the students:
 - What data was easiest to collect, what data was hardest to collect?
 - Have them compare the plant life they found in each ecosystem. Why do they think there are differences (think about the interaction between biotic and abiotic components)?
 - Ask them to compare percent shade cover to temperature. Do they find any correlation between these?
 - What data results did they find interesting?
 - Did they observe something they perhaps would not have observed if they were just walking by?

Wrap-up: Learning about ecosystems is not just about science, it is about understanding where we live and how we impact our environment. We are still learning about interactions within ecosystems and also how human activity impacts ecosystems in different ways. Careful observations and data collection are important skills needed by ecologists in order to gain new understanding about ecosystems and our role in the environment.

You may wish to share the video *How Wolves Changed Rivers* with your students to illustrate this point and spark discussion about how data can be used to understand ecosystem changes. <https://vimeo.com/86466357>

Extensions

The Albemarle-Pamlico Estuarine System: Birds and Habitats

Conduct this activity, developed by the NC Coastal Research Program, to learn more about our estuarine habitats and the birds that use them. http://portal.ncdenr.org/c/document_library/get_file?uuid=ffe28dbe-429c-4887-bd1f-60fbd7edbc2&groupId=61572

Guest Speaker or Field Trip

Coordinate with a contact from the North Carolina Natural Heritage Program, State Parks, NC Wildlife Resources Commission, U.S. Fish and Wildlife, or a local environmental education center, to either arrange a visit to a preserved natural ecosystem or have a guest speaker come to the classroom to present on a nearby preserved natural ecosystem. Contact information is located in the resources section below.

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Assessment

Ask students to imagine they are ecologists and must pick their favorite ecosystem in the Tar-Pamlico Basin (or other basins in eastern North Carolina) to study. Ask them to write an essay addressing the following content:

- Describe your ecosystem including living and nonliving things.
- Can you describe at least one food chain in this ecosystem?
- How would changing part of that ecosystem affect the organisms that live there?
- Why is it important to protect or restore this ecosystem?

Resources

NC Natural Heritage Program Staff Directory <http://www.ncnhp.org/web/nhp/contact>

NC Wildlife Resources Commission Education Centers <http://www.ncwildlife.org/Learning/EducationCenters.aspx>

Medoc Mountain State Park <http://www.ncparks.gov/Visit/parks/memo/main.php>

Goose Creek State Park <http://www.ncparks.gov/Visit/parks/gocr/main.php>

A Time for Science <http://www.atimeforscience.org/contact/>

Lake Mattamuskeet Wildlife Refuge http://www.fws.gov/refuge/mattamuskeet/about/contact_us.html

Find an Environmental Education Center near you using the NC EE website

<http://web.eenorthcarolina.org/net/content/search.aspx?s=0.0.108.37430&btid=3&tid=38022&basic=1&load=0>

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BACKGROUND INFORMATION

Ecosystems of Eastern North Carolina

Forest

Longleaf Pine

Longleaf pine ecosystems are spread across most of the Coastal Plain and into parts of the Piedmont in the southern part of the state. Longleaf pine ecosystems used to cover most of the Coastal Plain before Europeans settled in North Carolina. Longleaf pines need fire in order to survive. The plants on the ground below the longleaf pine are mostly wiregrass with a few other small plant types. When people stopped forest fires, other trees were able to outgrow the longleaf pines. Now there are not a lot of longleaf pine forests left. Two animals that love to live in the longleaf pine forest are the red-cockaded woodpecker and the eastern fox squirrel.

Oak-Hickory-Pine

Guess what types of trees are found in the oak-hickory-pine forest ecosystem? Different types of oak, hickory and pine trees. This ecosystem may also have other trees such as the tulip poplar, red maple, and sweet gum. Before people settled in North Carolina, there were not many oak-hickory-pine forests in the Coastal Plain, because that was mostly longleaf pine forest. Most of the original oak-hickory-pine forests were in the Piedmont. Many oak-hickory-pine forests took over longleaf pine forest in the Coastal Plain when forest fires were stopped by people. Now, most of the land has been cleared for farming or planting loblolly pines for wood. Animals that live in an oak-hickory-pine forest include the eastern mole, long-tailed weasel and the eastern fox squirrel.

Maritime Forest

Maritime forests are located on the barrier islands. The main trees in maritime forests are live oak, sand laurel oak, and loblolly pine. A big difference between a maritime forest and a forest on the mainland is that the maritime forest has to live near a lot of salt spray from the ocean. Only a few trees and shrubs can tolerate salt spray. Maritime forests grow behind the shelter of sand dunes and shrubs and trees that can handle salt spray, such as wax myrtle and live oak. Maritime forests also experience high winds, sand erosion and salt water flooding during big storms. One special animal that lives on the maritime forest is the white footed mouse.

Wetland

Freshwater Tidal Wetlands

Freshwater tidal wetlands can be found up the coastal rivers. In the Pamlico River, for example, freshwater tidal marshes can be found from the Pamlico Sound all the way up to Washington. Lunar (moon) or wind tides make the water rise and fall, just as they do in the coastal salt marshes, except that the water is freshwater. Large amounts of freshwater coming down from the river keeps the saltwater from coming up river that far. Freshwater tidal wetlands can also be found in the sound, far away from the ocean inlet. Cypress-Gum swamps are common in these areas and contain trees such as swamp black gum, swamp tupelo and bald cypress. Marshes can also be found in these freshwater tidal areas and contain different wetland grasses including cattail, saw grass, giant cordgrass (*Spartina cynocerooides*), black needle rush and marsh fern. Important birds in this ecosystem include several types of rail and bitterns. Anhinga, Little Blue Heron, Snowy Egret and American Bald Eagle are other well-known birds that thrive in this ecosystem. Mammals that live here include the Star-nosed Mole, Least Shrew and Marsh Rabbit.

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Salt Marsh

Salt marsh ecosystems are found where tides regularly flood the area with seawater. The seawater rises and falls with the tide, which makes the saltmarsh alternately flooded and bare. There are only a few types of plants that can handle that kind of environment. Saltmarsh cordgrass (*Spartina alterniflora*) is the most common plant. In the salt flats, where water evaporates and leaves high levels of salt, salt grass and glasswort grow. On the higher edges of the salt marsh, black needle rush and salt meadow cordgrass (*Spartina patens*) grows. The salt marsh also contains many mollusks and crustaceans. Few mammals, reptiles or amphibians are permanent residents of the saltmarsh because of the high salt content and wet soils. Salt marshes are very important habitats for wading and water birds.

Cypress Gum Swamp

Cypress-Gum Swamps occur in the wettest, forested parts of the coastal floodplains. They have few tree species that can tolerate such long-term flooding including bald cypress, pond cypress and swamp black gum. The prevalence of this ecosystem has decreased significantly since Europeans arrived and altered the ecosystem through drainage, logging and farming. Cypress-Gum Swamps are habitat to many birds, mammals, reptiles and amphibians. Hollow cypress and black gum trees are important for bats, chimney swifts and other animals that live in trees. In addition, many water birds rely on swamp forest for nesting habitat.

Freshwater Aquatic

Natural Lakes

Natural lakes only occur in the Coastal Plain of North Carolina. These natural lakes form in low areas, or depressions, in the land. These lakes do not get their water from rivers or streams. Natural lakes in North Carolina, such as Lake Mattamuskeet, get all of its water from rain. Most of these lakes are very acidic (like lemons) and the main plant life is algae and plants that grow on the bottom of the lake. These lakes are important habitat to winter water fowl such as the tundra swan, Canada geese, snow geese and more than 18 types of duck.

Reservoirs

Reservoirs are lakes that have been created by people by blocking the natural flow of river or stream water with a dam. Reservoirs are created for water supply, flood control and sometimes even wildlife habitat. Though not naturally created, once a reservoir is there for a long time, it can become an important habitat for fish, amphibians, reptiles, mammals and birds. The large reservoirs in the Tar-Pamlico basin include Lake Royale and Tar River Reservoir. There are thousands of small mill and farm ponds.

Riverine

Rivers and streams are waters that flow in one direction. Rivers and streams have many important habitats for many land and water animals. Good water quality is important for these aquatic ecosystems. Many water quality problems begin higher in the watershed, in the streams and rivers, and are carried down to the estuary and ocean. Several rare mussels have been found in the upper Tar River; the endangered dwarf mussel is one example. The Tar River is important for drinking water and fish habitat. There are 100 freshwater fish species found in the Tar-Pamlico River. Two rare species are the Carolina madtom and the Neuse River waterdog. Both of these can only be found in the Neuse and Tar-Pamlico river basins.

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Coastal Aquatic

Estuary

An estuary is an area where freshwater and saltwater mix. It is often protected from the open ocean and partially enclosed by land. The Pamlico Sound is an estuary which receives freshwater from the Tar-Pamlico River and the Neuse River. It is separated from the ocean by the Outer Banks. The main source of salt water comes from Ocracoke and Hatteras inlets, which are quite small. More than 70 species of fish and shellfish spend at least part of their lives in the Pamlico Sound. Striped bass, shad and herring are three examples of fish that lay their eggs in the freshwater, higher up in the Pamlico River. After the fish hatch, they work their way back toward the ocean. Blue crab and oysters are two important shellfish species found in the estuary.

Atlantic Ocean

The ocean floor, off the coast of North Carolina, has some soft bottom (sand beaches, flats and shoals) and some hard bottom (rock, coral, ship wrecks). The soft bottom floor is home to worms, clams and other burrowing animals that serve as fish food for spot, croaker, mullet and sturgeon. Shallow soft bottom areas are also breeding grounds for flounder and shrimp. Hard bottom ocean floors are more commonly known as reefs. As many as 47 fish species live in reefs off the coast of North Carolina. King Mackerel, grouper, snapper, black sea bass and damselfish are some of the fish that use these ecosystems.

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ECOSYSTEM DATA SHEET

Team Members:

Ecosystem Type					
Wind Direction/Speed					
Percent Shaded					
Topography (flat, hills, mountains)					
Soil	Moisture (wet, moist, dry)				
	Texture (sandy, clay, decaying leaves)				
	Smell (describe how the soil smells)				
Temperature	3 feet above ground				
	at ground level				
	1 inch into soil				

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ECOSYSTEM DATA SHEET

Ecosystem Type					
Water (if water is in this ecosystem)	Temperature				
	Color and Clarity				
	Flow (not flowing, slow or fast)				
Aquatic Plants (algae, submerged plants, plants growing out of the water)					
Terrestrial Plants (Groundcover, shrubs, trees and how much)					
Animal life Animals seen or signs of life (scat, tracks, burrows, chewed twigs, etc.)					
Other Observations					