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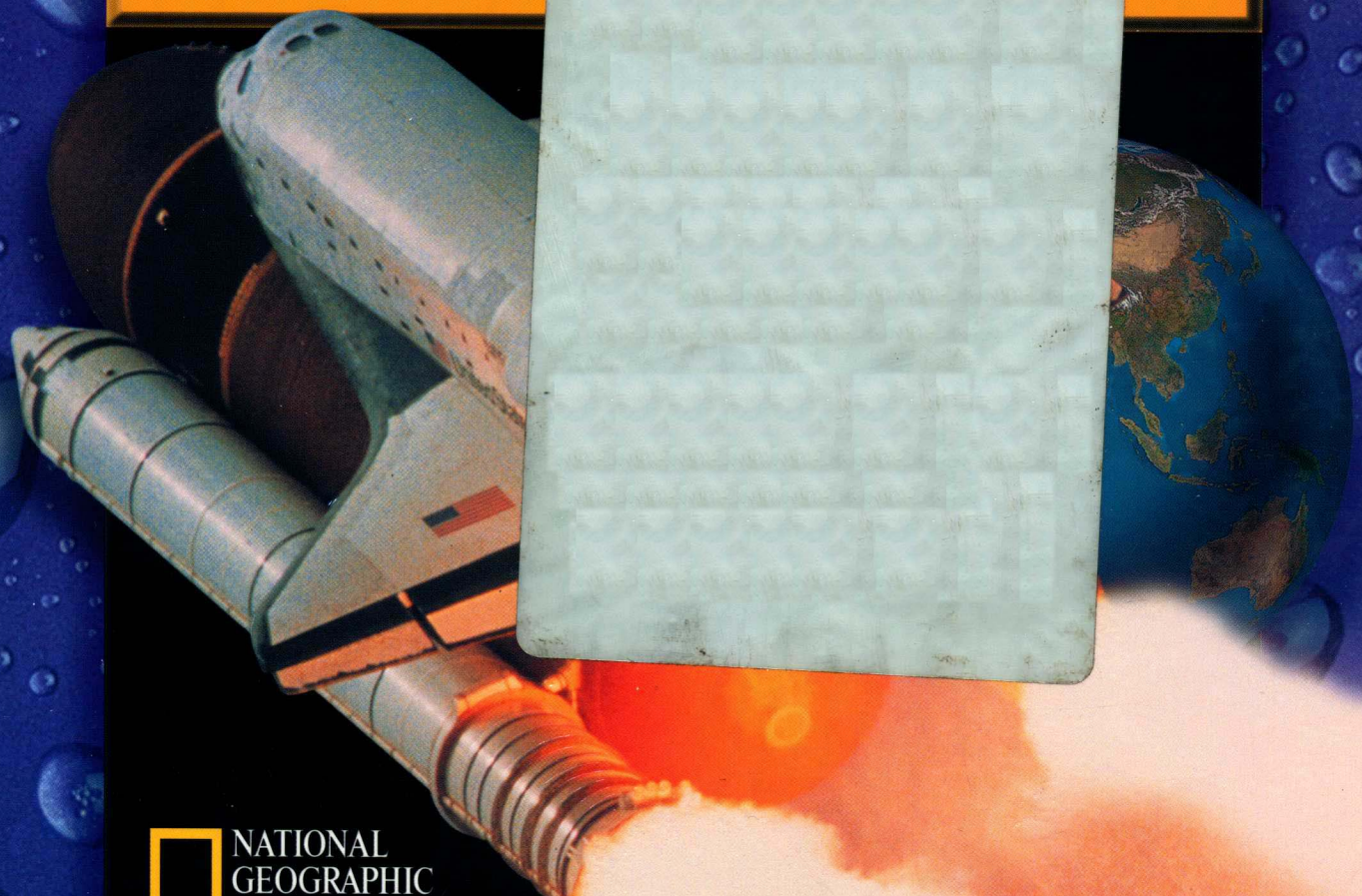
North Carolina Edition

SCIENCE VOYAGES

Exploring the Life nces



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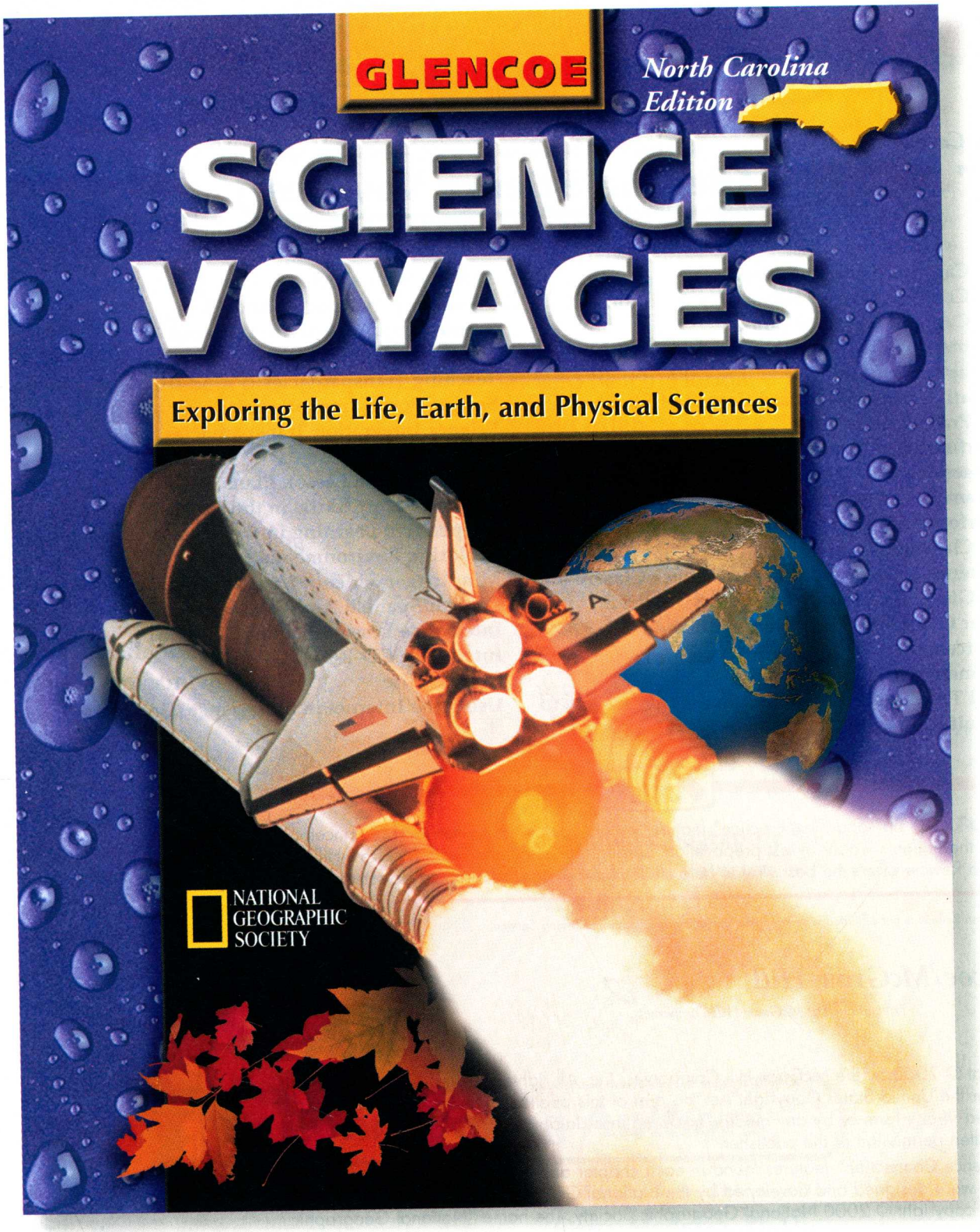

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North Carolina Edition

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SAFETY SYMBOLS

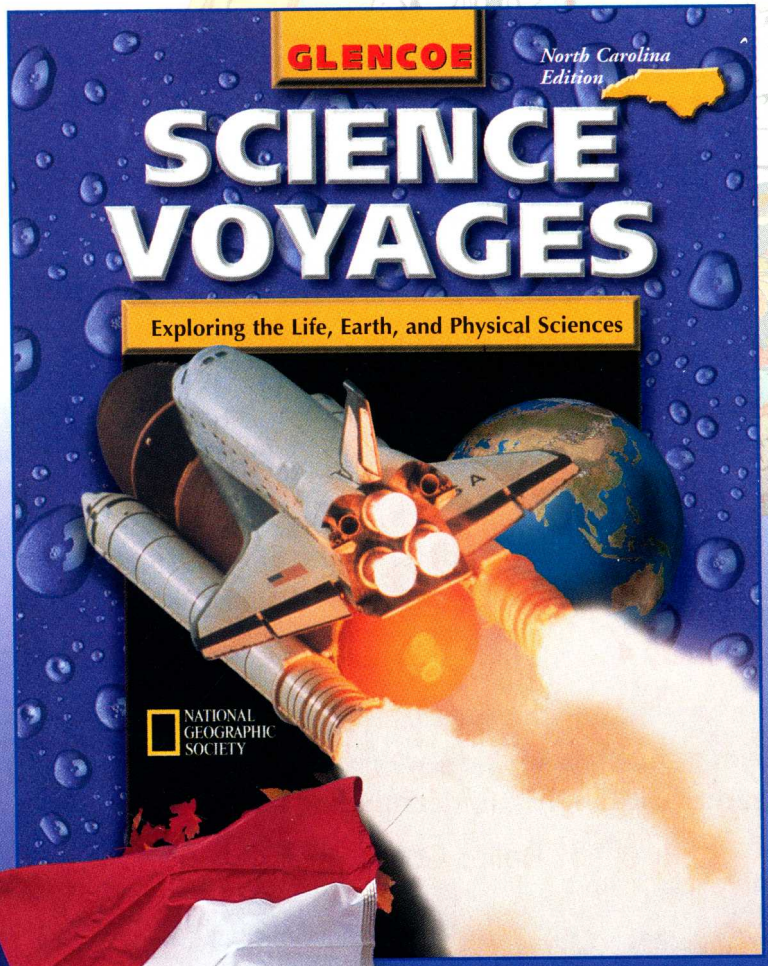
	HAZARD	PRECAUTION	REMEDY
Disposal 	Special disposal required	Dispose of wastes as directed by your teacher.	Ask your teacher how to dispose of laboratory materials.
Biological 	Organisms that can harm humans	Avoid breathing in or skin contact with organisms. Wear dust mask or gloves. Wash hands thoroughly.	Notify your teacher if you suspect contact.
Extreme Temperature 	Objects that can burn skin by being too cold or too hot	Use proper protection when handling.	Go to your teacher for first aid.
Sharp Object 	Use of tools or glassware that can easily puncture or slice skin	Practice common sense behavior and follow guidelines for use of the tool.	Go to your teacher for first aid.
Fumes 	Potential danger from smelling fumes	Must have good ventilation and never smell fumes directly.	Leave foul area and notify your teacher immediately.
Electrical 	Possible danger from electrical shock or burn	Double-check setup with instructor. Check condition of wires and apparatus.	Do not attempt to fix electrical problems. Notify your teacher immediately.
Irritant 	Substances that can irritate your skin or mucous membranes	Wear dust mask or gloves. Practice extra care when handling these materials.	Go to your teacher for first aid.
Chemical 	Substances (acids and bases) that can react with and destroy tissue and other materials	Wear goggles and an apron.	Immediately flush with water and notify your teacher.
Toxic 	Poisonous substance	Follow your teacher's instructions. Always wash hands thoroughly after use.	Go to your teacher for first aid.
Fire 	Flammable and combustible materials may burn if exposed to an open flame or spark	Avoid flames and heat sources. Be aware of locations of fire safety equipment.	Notify your teacher immediately. Use fire safety equipment if necessary.

Eye Safety
This symbol appears when a danger to eyes exists.

Clothing Protection
This symbol appears when substances could stain or burn clothing.

Animal Safety
This symbol appears whenever live animals are studied and the safety of the animals and students must be ensured.

North Carolina Case Studies



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Grade 8

North Carolina

Case Studies for Grade 8

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What are the North Carolina Case Studies?

Welcome to Science Voyages for North Carolina. Do you like to find out what makes things work? Perhaps you just like to spend time watching birds. Maybe you just like to stand and watch the ocean as it moves in and out. Whatever your interest, you will come to know that science is an exciting subject that has something for everyone. The Case Studies on the following pages will help you learn about science in North Carolina. They also will help you to achieve the understanding of the standards for science that are listed in the North Carolina Standard Course of Study for Grade 8.

Science—what it is, how science is done, and the effects that scientific developments have on your life—are covered in the articles and illustrations on the following pages. The Case Studies, and activities that go with them, have been selected to reinforce the objectives and Competency Goals for science in North Carolina.

How to Use the North Carolina Case Studies

As you read each story, notice that it is about a topic in North Carolina. Notice too, at the beginning of each article, that it is correlated to the North Carolina Standard Course of Study Science Competency Goals and objectives. Each Case Study has one or more Inquiry Activities as well. These activities will help you to understand each science goal better and help you remember its importance.

At the end of each Case Study, there are references to chapters in your textbook where you will study more about each of the topics.

The North Carolina Advisory Board

North Carolina CASE STUDY

North Carolina's Underground Resource

COMPETENCY GOAL 1
The learner will build an understanding of the hydrosphere.

Large reservoirs of water are stored beneath Earth's surface. This water becomes available for use by digging wells deep into the ground. Approximately 20 percent of the total water used in the United States comes from underground sources. In North Carolina, roughly 55 percent of the population depends on underground water for their water supply.

The Water Cycle—Constant and Changing

The water on Earth makes up the hydrosphere. The hydrosphere includes oceans, rivers, streams, lakes, and other bodies of water. It includes water frozen in the polar ice caps and water vapor in the atmosphere. All water in the hydrosphere is locked into a constant recycling process called the water cycle. This endless circulation of water among the ocean, atmosphere, and land is shown in **Figure NC1-1.** Solar energy evaporates water from the surface of the ocean and other bodies of water, the soil, and the

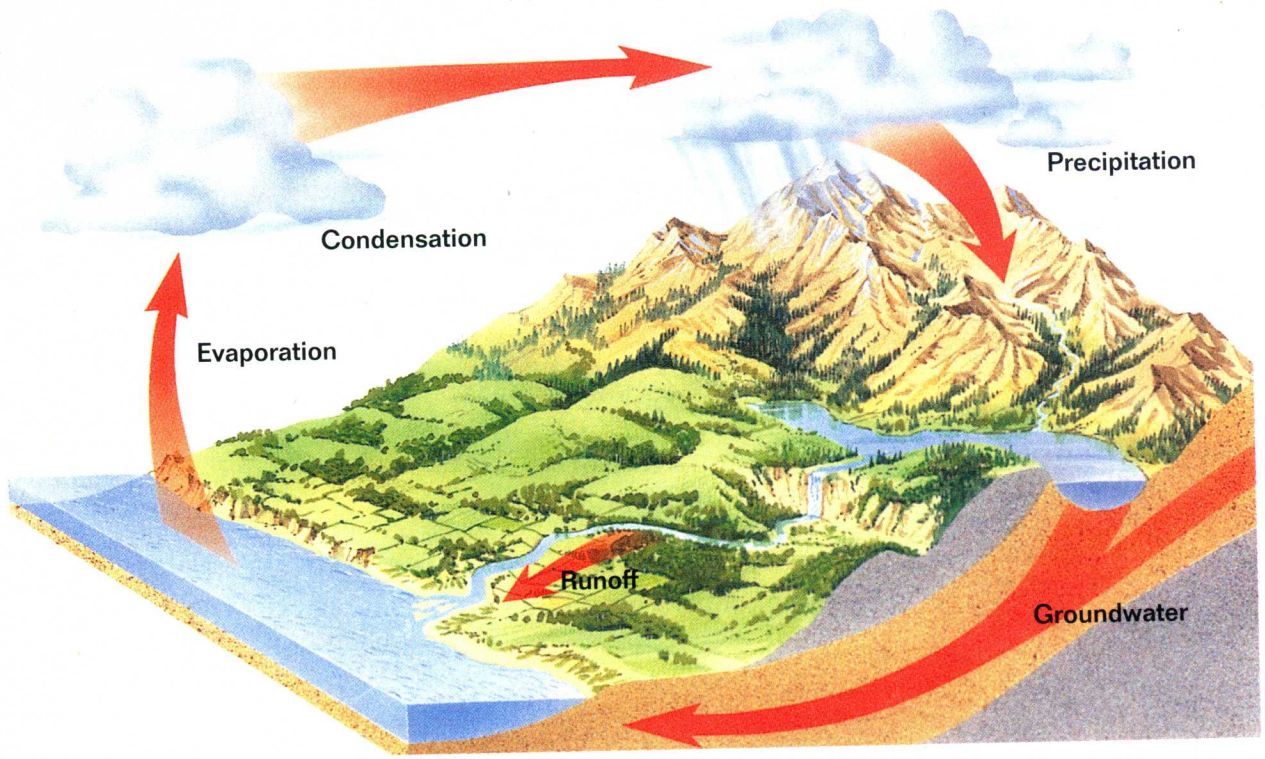

Figure NC1-1 Water in the hydrosphere is constantly moving between the atmosphere and Earth in what is known as the water cycle.

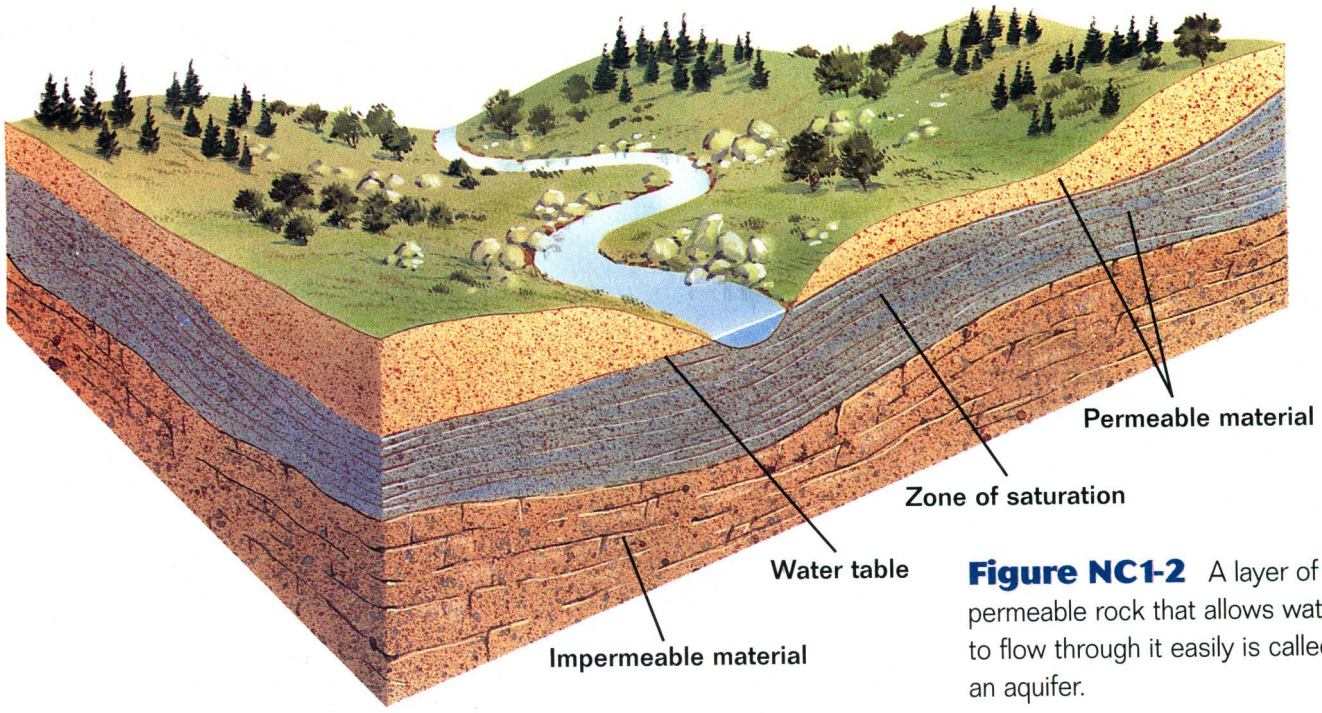

Figure NC1-2 A layer of permeable rock that allows water to flow through it easily is called an aquifer.

surfaces of plants. The air containing water vapor moves across Earth's surface and the warm, moist air cools. Water droplets condense and fall to land as rain, most of which sinks into the ground or flows downhill until it eventually returns to the ocean. The water that sinks into the ground may be stored for long periods in underground reservoirs. This water is called groundwater. The water that flows back to the ocean is runoff. Groundwater is an integral part of the water cycle.

Aquifers

Groundwater moves through the pores and small openings of the loosely arranged rock that forms part of Earth's crust. Water soaks through the surface from rainfall, snowmelt, or surface streams—then gradually saturates the permeable rock, shown in **Figure NC1-2.** Hard, underlying bedrock, called the impermeable layer, prevents water from moving lower.

Water accumulates in the porous layer called an aquifer, a term taken from the Latin *aqua* (water) and *ferre* (to bear). Aquifers must have two important properties: they must be able to store water and they must allow water to pass through. Underground water flow is extremely slow and is usually expressed in feet per day. Water may remain in an aquifer for only a short period of time, but in the deeper portions of the formation, it may stay for tens, hundreds, and even thousands of years. In order for an aquifer to function, it must have an area of recharge. This area feeds the aquifer with any moisture that is available from rain and snow or from streambeds.

Castle Hayne Aquifer

The groundwater reservoir of North Carolina's coastal plain consists of ten aquifers stacked one on top of the other and partially overlapping adjoining ones. The aquifers are separated by nine layers of impermeable material, made up of clay.

The Castle Hayne aquifer, shown in **Figure NC1-3,** is a major source of freshwater for much of North Carolina's coast. In some areas, it is the only source because other local aquifers contain saltwater. The Castle Hayne is also the most productive aquifer in North Carolina. More water is pumped from this formation than any other.

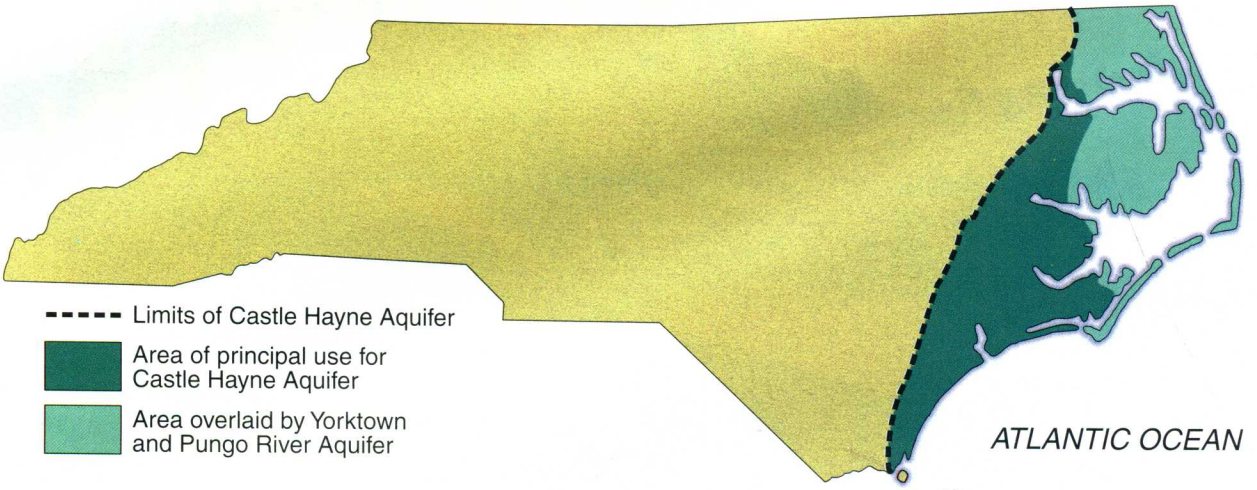

Figure NC1-3 Groundwater accumulates in ten aquifers beneath coastal area of North Carolina. The Castle Hayne aquifer is the most productive aquifer in the region.

Nearly 400 million L per day are pumped from this aquifer for municipal, industrial, and irrigation use. Wells that tap the Castle Hayne commonly yield between 800 and 1000 L per minute, making it a dependable freshwater source.

The Castle Hayne aquifer is a huge wedge of limestone overlaying sandstone and is located over a 32 375 km^2 area. Water taken from the Castle Hayne limestone does not have to be filtered, but it does have a lot of calcium carbonate in solution. This occurs because limestone dissolves in groundwater, creating hard water. Another characteristic of Castle Hayne limestone is that it allows water to pass through it at a higher rate than an aquifer of sand and silt would. For this reason, the Castle Hayne has such high yield capabilities, with production as high as 8000 L per minute from a single well.

Water Uses

The economic significance of groundwater on North Carolina's coastal plain is substantial. Water use can be divided into four categories: domestic use, agricultural use, in-stream use, and industrial use. Domestic use includes water for drinking, air conditioning, bathing, washing clothes, washing dishes, flushing toilets, and watering lawns and gardens. On the average, each person uses 300 to 400 L of water per day. The major use of water in most parts of the world is for agriculture, mainly irrigation. The amount of water used for irrigation and livestock continues to increase. Therefore, it is becoming important to modify irrigation practices to use less water. In-stream uses of water are for hydroelectric power, recreation, and navigation. Sailing, waterskiing, swimming, fishing, and camping all require water of reasonably good quality. Water for industrial use accounts for more than half of the total water taken from groundwater.

Inquiry Activity

Objective 1.04

Research water-quality standards in your state. Why must water be of good quality, even for recreational use?

Response to Environmental Concerns

Groundwater contamination can occur naturally from large concentrations of inorganic substances such as chloride, iron, manganese, or sodium. Humans can also be responsible for groundwater contamination. This is caused by leakage from landfills, underground storage tanks, and septic tanks; accidental chemical spills; the application of fertilizers and pesticides; and improper storage and disposal of household and lawn chemicals.

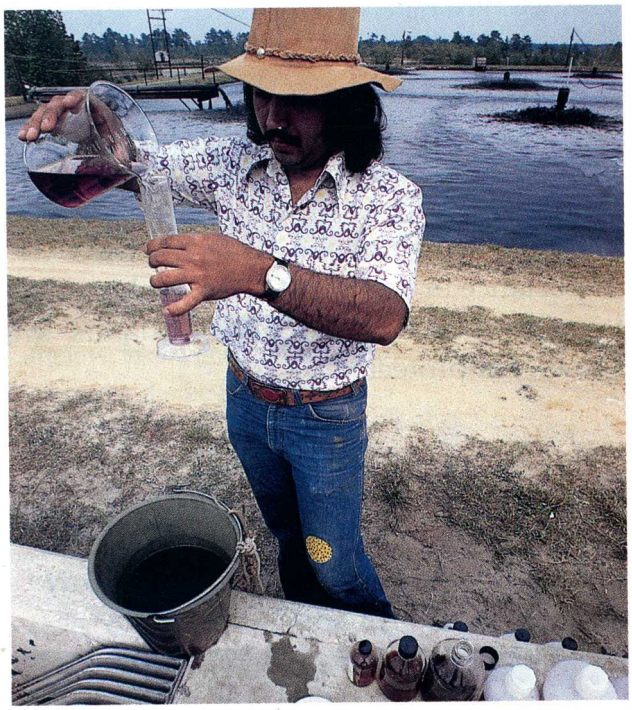

Figure NC1-4 Frequent monitoring helps assure good water quality.

To help address the groundwater problems, the North Carolina Department of Natural Resources and Community Development (NRCD) has established a statewide groundwater-quality network to monitor water quality and investigate reports of groundwater contamination. Meanwhile, the Department of Human Resources (DHR) monitors all solid-waste landfills and hazardous-waste disposal sites for groundwater contamination.

Inquiry Activity

Objective 1.02

Contact the North Carolina Department of Environment and Natural Resources to determine how they monitor the health of a water system. What tests do they perform? How frequently? Find out what the acceptable levels are for temperature, dissolved oxygen, pH, alkalinity, and nitrates. What does the NRCD do when these levels change to undesirable levels?

Going Further

To learn more about the hydrosphere, see

1.01 Chapter 2, Section 2, Groundwater
Chapter 5, Section 3, Water Environments
Chapter 6, Section 3, Water
Chapter 12, Section 1, What causes volcanoes?
Chapter 13, Section 2, Seafloor Spreading
Chapter 13, Section 3, Plate Tectonics

1.02 Chapter 4, Section 2, Life in the Ocean
Chapter 6, Section 3, Water

1.03 Chapter 2, Section 1, Surface Water
Chapter 3, Section 1, Ocean Water
Chapter 3, Section 2, Ocean Currents
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Chapter 4, Section 2, Life in the Ocean
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1.04 Chapter 2, Section 3, Ocean Shoreline
Chapter 3, Section 1, Ocean Water
Chapter 4, Section 2, Life in the Ocean
Chapter 6, Section 1, Energy Resources
Chapter 6, Section 3, Water
Chapter 6, Section 4, Land

1.05 Chapter 6, Section 3, Water

North Carolina CASE STUDY

North Carolina's Wetlands

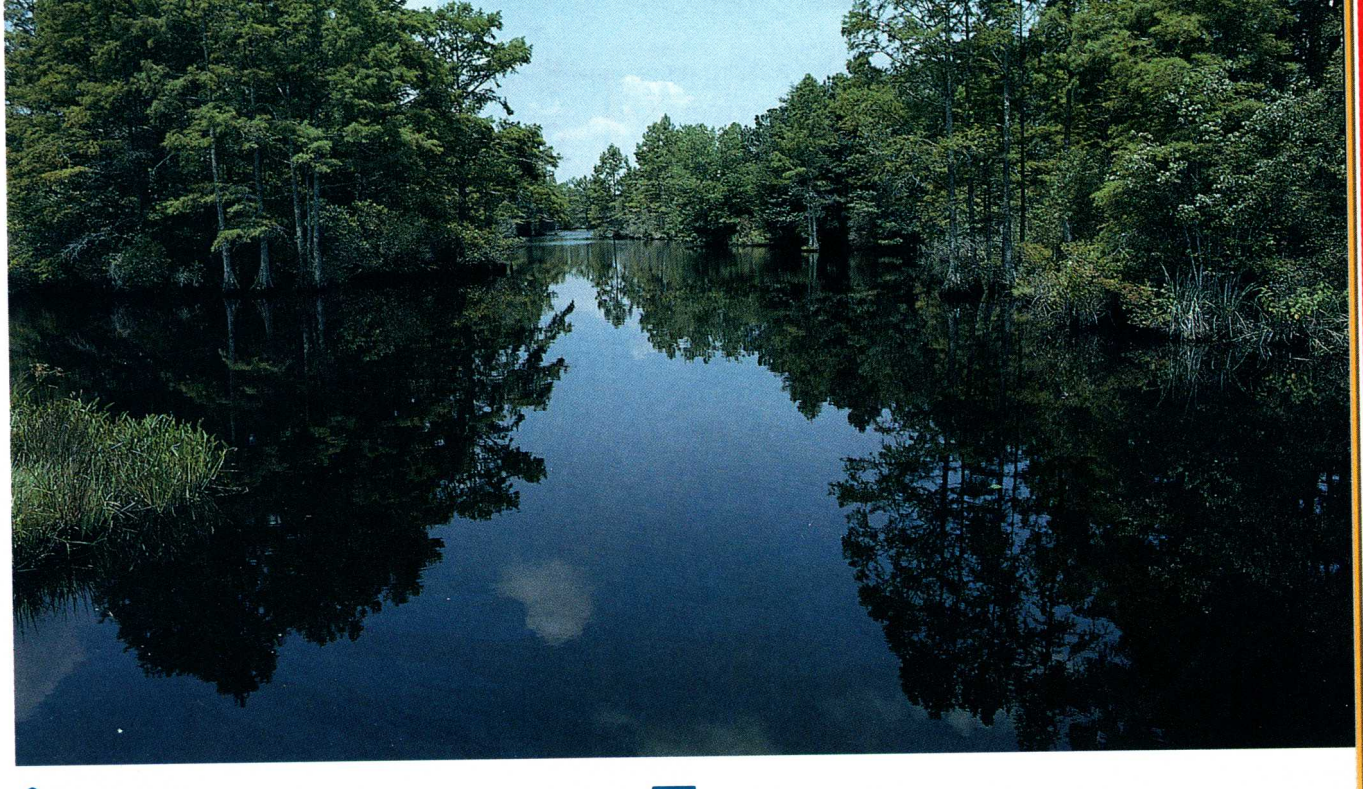
COMPETENCY GOAL 1
The learner will build an understanding of the hydrosphere.

Wetlands are areas that link aquatic and terrestrial ecosystems. They are areas of waterlogged soils or are soil covered with shallow water during at least part of the year. Wetlands, are breeding grounds for many species of fish and birds, and a suprising number of larger animals. The presence of water determines the plants, animals, and type of soil of the area.

At one time wetlands were thought of as wastelands or areas that needed to be drained so that farms, housing developments, or industries could be built on them. Wetlands also are a breeding place for mosquitoes. Mosquito-borne diseases, such as malaria and yellow fever, may have once caused wetlands to be viewed as a menace to public health. Today, however, the importance of wetlands to the hydrosphere is widely recognized and wetlands are somewhat protected by law.

Figure NC1-5 About 95 percent of North Carolina's wetlands are located in the coastal plain.

A The Bodie Island lighthouse has been in operation since 1872. Visitors can take a self-guided tour of the nearby marshes.



B Wetlands can occur along rivers, streams, lakes, and ponds. Others occur with the seasons.

C The estuarine wetland behind Topsail Beach is an area where salt water mixes with freshwater.

The Importance of Wetlands

Wetlands are among the most productive areas on Earth. Wetland plants provide enough food to support a wide variety of organisms. Wetlands are wildlife habitats for migratory waterfowl and many other bird species, beavers, muskrats, and gamefish. Wetlands cover less than five percent of the land in the lower 48 states, yet nearly one half of threatened and endangered species use wetlands at some time in their life. According to the North Carolina Natural Heritage Program, 70 percent of the plants and animals from North Carolina that are on rare, special concern, threatened, or endangered species lists are linked to wetland habitats. North Carolina's wetlands are unique in being the home of rare species of plants and amphibians. Carnivorous plants, the smallest North American frog, and many unusual salamanders live in the coastal wetland areas of North Carolina.

Wetlands help control floods by acting as sponges holding excess water when rivers and streams flood their banks. The stored floodwater drains slowly back into the rivers, providing a steady flow of water throughout the year.

One of the most important roles of wetlands is to clean and purify water runoff from pollution sources. Wetlands do this by acting as a reservoir, trapping and holding the pollutants in the flooded soil. Water also slowly filters through the woody plants and their roots. Certain wetland plants are also successful in removing heavy metals from runoff.

In coastal areas, marsh plants break the impact of the waves and help prevent beach erosion. Wetlands also provide a protective buffer against seasonal storms that threaten coastal communities every year. Coastal wetlands also have a direct effect on jobs. Most of the fish harvested by the fishing industry live part of their life cycle in coastal waters.

Inquiry Activity

Objective 1.01

Explain the importance of wetlands in the water cycle.

Types of Wetlands

Wetlands are found near oceans, rivers, streams, lakes, and ponds, but they don't have to be close to these bodies of water. Certain wetlands are depressions surrounded by dry land. In some, the water level changes by the hour; in others, it varies by the season. The amount of water present and the time of year it is present determine the function of a wetland in the environment. Plant and animal species have adapted to these changes.

Swamps are wetland areas dominated by woody plants—trees and shrubs. Swamps may form in the floodplains along rivers and streams. Cypress swamps, shown in

Figure NC1-6 Cypress trees have adapted to their watery environment and stretch their roots beneath the water of the swamp.

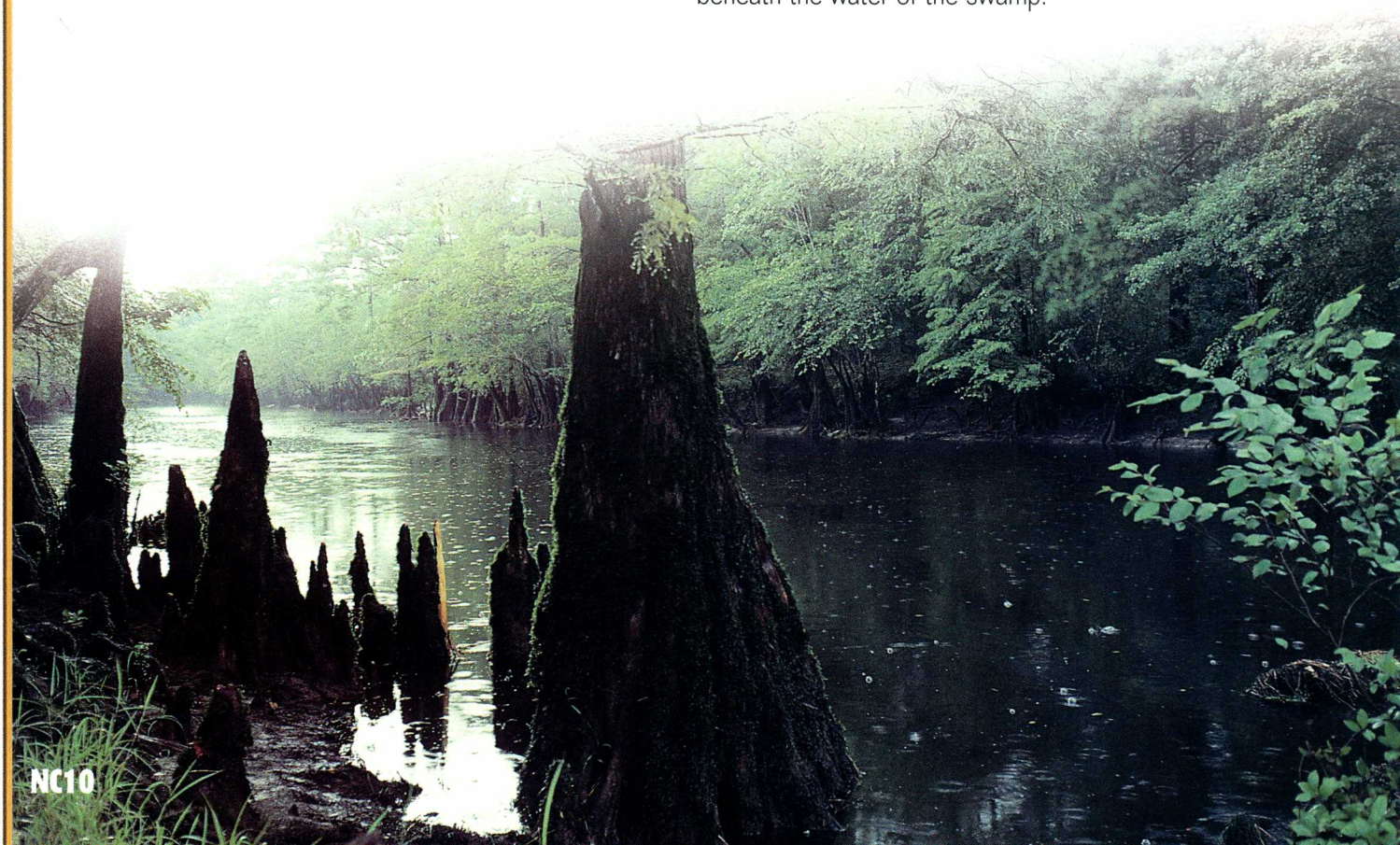


Figure NC1-7 Plants and animals have adapted to a difficult environment of salt water and tides in this saltwater marsh at Sunset Beach.

Figure NC1-6, are found in North Carolina and other southern states. They act as natural purifiers to remove pollutants from the water. Roots of cypress trees trap and use excess nitrates released from fertilizer runoff.

Soft-stemmed grasses are the primary plants found in marshes. The water levels of saltwater marshes vary with the tides. Saltwater marshes, such as the one shown in **Figure NC1-7,** provide nesting areas and protection for two thirds of the commercial fish harvested in North Carolina. In North Carolina, saltwater marshes can be found along the Atlantic coastline, near the Inland Waterway, and between barrier island beaches. The variations among freshwater marshes are great. Some marshes are filled with less than an inch of water. Others may have a depth of six feet or more. Freshwater marshes form along lakes, streams, rivers, and in other low-lying places. Cattails and muskrats, shown in **Figure NC1-8A and B,** are common to many freshwater marshes.

North Carolina's Threatened Wetlands

At one time, more than 220 million acres of wetlands covered the United States. Today, less than 100 million acres remain. In the past 200 years, wetlands have been drained, paved, filled, or destroyed. This loss has been slowed by federal and state protective regulations and by efforts of environmental and conservation groups.

The loss of wetlands is legislatively controlled by a section of the 1972 Clean Water Act, but this act does a poor job of protecting inland wetlands. The Emergency Wetlands Resource Act of 1986 authorizes the U.S. Fish and Wildlife Service to designate and acquire critically important wetlands.

Presently, the United States is attempting to prevent any new net loss of wetlands. This policy is complicated by confusion about the definition of wetlands and by ownership of wetlands. The federal government owns less than five percent of wetlands in the United States and the other 95 percent is privately owned. This means that private citizens control whether wetlands are protected and preserved or developed and destroyed.

In North Carolina, swamps and marshes are threatened. North Carolina has 486 km of oceanfront land, and about 6400 km of river, stream, and lake shoreline. Swamps and marshes surround much of this land. Demand for property along these fragile shorelines is great. Even though the state has strict laws regulating

Figure NC1-8 Cattails (A) provide food and shelter for ducks, muskrats (B), and other wildlife. Their leaves make great nesting material.

Figure NC1-9 Many animals use wetlands for food, shelter, breeding grounds, and resting sites during migration. These ibis are on a tidal flat on Bald Head Island.

coastal development, businesses and landowners continually push to expand. Wetlands not destroyed by new development may still be threatened as more and more people move into these areas.

Inquiry Activity

Objective 1.05

Define the terms *point* and *nonpoint* sources of pollution. Contact the Department of Environment and Natural Resources in North Carolina to learn how pollution affects North Carolina's wetlands.

Going Further

To learn more about the hydrosphere, see

1.01 Chapter 2, Section 2, Groundwater
Chapter 3, Section 1, Ocean Water
Chapter 3, Section 2, Ocean Currents
Chapter 3, Section 3, Ocean Tides and Waves
Chapter 5, Section 3, Water Environments

1.02 **To Come**

1.03 Chapter 4, Section 2, Life in the Ocean
Chapter 5, Section 2, Land Environments

1.04 Chapter 2, Section 3, Ocean Shoreline
Chapter 6, Section 3, Water
Chapter 6, Section 4, Land

1.05 Chapter 6, Section 3, Water