

**FOCUS
ON
SCIENCE**

Exploring Ecosystems

Advanced Level

Life Science
Animals and Plants in Their Environment

FOCUScurriculum

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Scientific Inquiry

The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

Life Science

Individual organisms and species change over time.

In all environments, organisms with similar needs may compete with one another for resources.

Organisms maintain a dynamic equilibrium that sustains life.

All organisms require energy to survive. The amount of energy needed and the method for obtaining this energy vary among cells. Some cells use oxygen to release the energy stored in food.

The methods for obtaining nutrients vary among organisms. Producers, such as green plants, use light energy to make their food. Consumers, such as animals, take in energy-rich foods.

Herbivores obtain energy from plants. Carnivores obtain energy from animals. Omnivores obtain energy from both plants and animals. Decomposers, such as bacteria and fungi, obtain energy by consuming wastes and/or dead organisms.

Food provides molecules that serve as fuel and building material for all organisms. All living things, including plants, must release energy from their food, using it to carry on their life processes.

Plants and animals depend on each other and their physical environment.

Energy flows through ecosystems in one direction, usually from the Sun, through producers to consumers and then to decomposers. This process may be visualized with food chains or energy pyramids.

Food webs identify feeding relationships among producers, consumers, and decomposers in an ecosystem.

Photosynthesis is carried on by green plants and other organisms containing chlorophyll. In this process, the Sun's energy is converted into and stored as chemical energy in the form of a sugar. The quantity of sugar molecules increases in green plants during photosynthesis in the presence of sunlight.



Life Science *(con't)*

Human decisions and activities have had a profound impact on the physical and living environment.

A population consists of all individuals of a species that are found together at a given place and time. Populations living in one place form a community. The community and the physical factors with which it interacts compose an ecosystem.

The environment may be altered through the activities of organisms. Alterations are sometimes abrupt. Some species may replace others over time, resulting in long-term gradual changes (ecological succession).

Overpopulation by any species impacts the environment due to the increased use of resources. Human activities can bring about environmental degradation through resource acquisition, urban growth, land-use decisions, waste disposal, etc.

Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Pollution has cumulative ecological effects such as acid rain, global warming, or ozone depletion. The survival of living things on our planet depends on the conservation and protection of Earth's resources.

English Language Arts

The following is a selective listing of the competencies and indicators addressed in this book.

Literacy Competencies

Word Recognition

- Recognize at sight a large body of high-frequency words and irregularly spelled content vocabulary

Background Knowledge and Vocabulary

- Determine the meaning of unfamiliar words by using context clues, dictionaries, glossaries, and other resources

Comprehension/Strategies

- Use prior knowledge in concert with text information to support comprehension, from forming predictions to making inferences and drawing conclusions



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How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

- Underline main ideas in paragraphs.
- Circle details that support the main ideas.
- Write down questions as they read.
- Circle key words as well as unfamiliar words.

Printing Instructions

Student Book: print pages 5–26

Assessments: print pages 27–30

Answer Key: print pages 31–34

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SCIENCE**

Exploring Ecosystems

How are plants and animals in an ecosystem connected?

Plants and animals living together in an ecosystem are connected in many ways. They share the resources of the ecosystem including the available water, sunlight, shelter, and nutrients. Different ecosystems provide different amounts and types of these resources and therefore are able to support different types of plants and animals.

You'll learn more about ecosystems, how they work, and how the organisms they support are interrelated as you read this book.



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Build Background

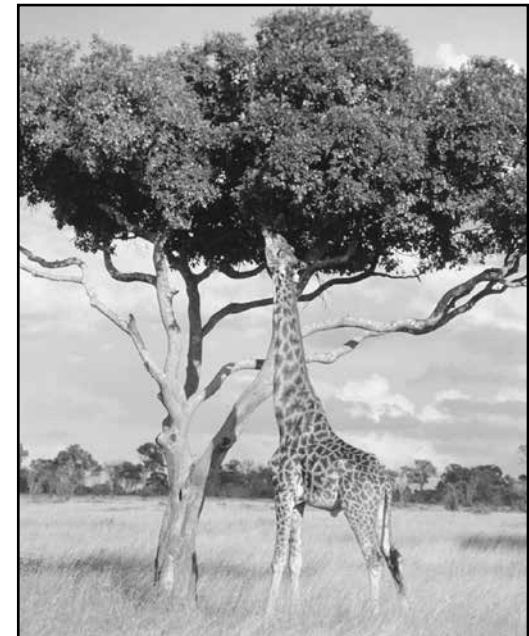
Food Chains

Below is food chain that shows how energy flows through a habitat in an African grassland. Green plants get energy from the food they make during photosynthesis, which is fueled by sunlight. Gazelles get their energy by eating grass and other green plants in the habitat. Lions, in turn, get their energy from hunting, capturing, and eating other animals, such as gazelles. Hyenas and vultures eat the dead remains of animals after the lions have eaten their fill. Finally, the decaying remains of dead plants and animals are consumed by worms and microorganisms, such as bacteria, in the soil.

green plants → gazelle lion → hyenas, vultures → worms, bacteria

List an example or two from the food chain for each type of organism.

- 1. producer _____
- 2. consumer _____
- 3. predator _____
- 4. prey _____
- 5. herbivore _____
- 6. carnivore _____
- 7. omnivore _____
- 8. scavenger _____
- 9. decomposer _____



Are giraffes herbivores, carnivores, or omnivores?



Key Vocabulary

Rate Your Knowledge

Each word in the list below is important, but some may be new to you. Rate your knowledge of each by putting a check or a few words in the appropriate column. After completing this book, come back to this page and write the definitions of words you did not know.

	I don't know it.	I've seen it, and I think it means . . .	I know it well. It means . . .
microorganism			
producer			
consumer			
abundant			
terrain			
transpiration			
nocturnal			
bog			
fen			
lichen			
carrion			

Synonyms and Antonyms

Answer the questions below using words from the list above.

- Which two words in the list are antonyms? _____
- Which word is an antonym for *scarce*? _____
- Which word is a synonym for *land*? _____
- Which two words in the list both name wetlands? _____
- Which word in the list has something to do with nighttime? _____

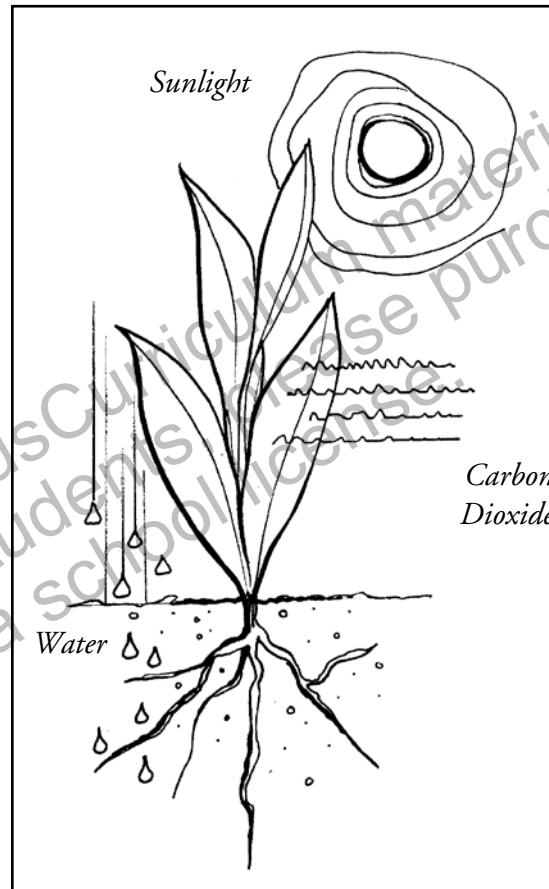
Photosynthesis

Plants make their own food using a process called photosynthesis. Photo means “light.” *Synthesis* means “put together.” During photosynthesis, plants use the energy of sunlight to combine carbon dioxide and water.

During photosynthesis, green matter in leaves, called chlorophyll, traps the energy in sunlight. Chlorophyll is contained in special cells in the leaves called chloroplasts. A chemical reaction using light energy combines carbon dioxide from the air and water from the soil to produce a type of sugar called glucose, which is a food rich in chemical energy. Plants use some of this energy to grow and reproduce; but some of the energy remains and is passed to the animal that eats the plant.

When an animal eats the plant, its body changes the chemical energy from the plant into other forms of energy. One is heat energy. The animal uses heat energy to stay warm, grow, and reproduce. In the same way, the plants and animals that we eat give us the energy to stay warm, grow, and reproduce.

The process of photosynthesis produces more than just glucose. It also produces oxygen, which escapes and becomes part of the air we breathe. Plant photosynthesis, which has been occurring since the first plants appeared on the planet, is the source of much of the oxygen in our atmosphere.



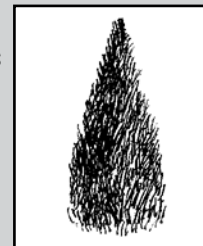
Photosynthesizing plants evolved about 3 billion years ago.

ACTIVE READER

1 List What are the two products of the process of photosynthesis?

Good to Know

Pine trees have evolved to be shaped like an upside down cone because of photosynthesis. The tree has developed branches that taper as they go up the trunk so that more of the tree's leaves (needles) are exposed to the sun. In this way, the tree can produce enough energy to grow taller.



Chapter 1 Earth's Biomes

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This section explains the differences among a biome, and ecosystem, and a habitat. Look for information about which term refers to a specific species.

Biomes, Ecosystems, and Habitats

The words *biome*, *ecosystem*, and *habitat* can be confusing because they all refer to an environment in which living things interact with each other and with nonliving things such as air, water, and soil. What are the differences among the three?

What is a biome? A biome is a large area of the Earth's surface that serves as home to similar plants, animals, and **microorganisms**. Most of us are familiar with rainforests near the equator, tundra in the arctic regions, and the evergreen trees in the boreal, or cold climate, forest. When we think of biomes, we think primarily about the nonliving elements and vegetation in a large area: the cold climate, rough terrain, and coniferous trees of a northern boreal forest, for example.

What is an ecosystem? An ecosystem can be as large as the Great Plains in North America, or as small as a puddle in your backyard. When we think of an ecosystem, we often think about how a community of plants, animals, and microorganisms interact and thrive within their common environment. Each of these communities contains species that are adapted to its varying conditions of water, heat, and soil. For example, penguins thrive in the **Antarctic** while cactus plants have needle-like leaves that help preserve water in the hot desert.

Ecosystems will fail if they do not remain in balance. No ecosystem can support more organisms than its food, water, and shelter will allow. Each organism has its own role to play—plants as **producers** and animals as **consumers**, for example.



The cactus is perfectly adapted to its desert habitat.

ACTIVE READER

1 Connect *Did your understanding of biome and ecosystem change as a result of reading this page? If so, tell how it changed.*

2 Analyze *Which phrase below best tells how the information on this page is presented?*

- statement and example*
- cause and effect*
- events in sequence*
- question and answer*

What is a habitat? A habitat is all the conditions under which a specific population of creatures lives. When we speak of habitats, we are concerned with a single species. So, the habitat of the Mountain Gorilla is the cloudy, misty, and cold forests of central and eastern Africa where certain plants, which provide food for the Gorilla, are **abundant**. Habitats can overlap within an ecosystem, and ecosystems can overlap within a biome.

More About Biomes

Biomes and ecosystems are Earth's natural communities where living and nonliving things come together. Plants, animals, and other organisms share living space that is characterized by similar climate and **terrain**. The living things that inhabit a biome are interrelated in many ways. Each species fits into one or more food webs that explain feeding relationships and show how energy flows through the biome. Species can be characterized by where they live and the spaces they inhabit: below the ground, on the ground, above the ground. The growth or decline in population of a specific species within a biome can be explained by environmental factors such as pollution, natural disasters, and changing climate. Population growth and decline can also be explained by looking at how adaptable a species is to changing conditions in their habitat.

ACTIVE READER

1 Infer *Why aren't Mountain Gorillas native to North America?*

FOCUS QUESTIONS

1. What term is used to refer to the environment in which a particular population of monkeys lives?

2. When leaving one biome and traveling to a new location in another, what would you expect to be different?

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In this section you will learn about the six types of biomes. Read to find out what makes them different from one another.

Major Types of Biomes

There are six major types of biomes: Tundra, desert, grassland, freshwater, marine, and forest.

Tundra is found in the northernmost areas of the world and in high mountainous areas. It is the coldest biome and features short summers, long cold winters and sparse, low vegetation such as mosses and lichens. Permanently frozen subsoil, called permafrost, prevents plants with deep roots from growing here. The recent warming trend in worldwide climate threatens the tundra because of the melting of this permafrost. Common animals here include insects, voles, arctic hares and squirrels, caribou, bears, falcons, gulls, salmon, and trout.

Hot and dry deserts are areas that receive less than 50 centimeters (about 20 inches) per year of rainfall. Plants and animals found in desert areas have special adaptations that allow them to thrive in such a harsh climate. For example, the needles on a cactus plant are actually the leaves of the plant. They are small and spiny to reduce **transpiration**, the escape of moisture from the plant. Many desert animals are **nocturnal**, active at night, to avoid the scorching sun. Animals commonly found in hot and dry deserts include insects, spiders, reptiles, and birds.

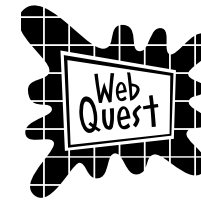
Grasslands are open areas characterized by tall grasses. Some also have low shrubs and a few widely scattered trees. Changeable seasons are a feature of grasslands and there is often a dry and a rainy season. Fauna, animal life, might include worms, beetles, termites, mice, snakes, owls, and large mammals. Depending on the location of the grassland, you might find such mammals as lions, leopards, hyenas, buffalo, zebra, wild horses, and elephants. Prairies in North America, steppes in Asia, savannas in Africa, and pampas in South America are all examples of grasslands.

Freshwater habitats include ponds and lakes, wetlands, and streams and rivers. These habitats are scattered throughout the globe and are usually surrounded by other biomes — grasslands or forests, for example. The food chain begins with producers such as algae and aquatic plants found near the surface of the water with access to sunlight for photosynthesis. Egg and larval stages of insects and other small organisms provide food for fish, turtles, snakes, and birds.

Wetlands include **marshes**, **swamps**, **bogs**, and **fens**. Plants in wetlands include cattails. Cattails are adapted to a wet environment. Wetlands support many species of amphibians, reptiles, birds, and small mammals.

ACTIVE READER

1 Define Find out the meaning of the word *terrestrial*. Which of the biomes described here are terrestrial?



Use the Internet to find images of each of the biomes described here. Also find pictures of plants and animals that are typical of each biome. Use the images to create an informational poster display.

Marine biomes are the largest of the six biome types and have the most diverse array of plants and animals. Oceans, coral reefs, **estuaries**, and wetlands such as salt marshes are included in this category.

Oceans are organized into levels that have different characteristics and are home to different plants and animals. The **intertidal zone** is where the land and ocean meet. These areas are sometimes submerged and sometimes not. The **pelagic zone** is open water away from the coastal areas. Here, **phytoplankton** are the producers that form the base of the food chain. Pelagic consumers include crustaceans, birds, fish such as tuna and sharks, and mammals such as sea otters, dolphins and whales.

Most of the creatures living at the sea floor, the **benthic zone**, are scavengers. These bottom dwellers eat dead and decaying material that has fallen to the sea floor from above. The **abyssal zone**, the deepest part of the pelagic zone, is thousands of feet below the surface where no light can penetrate.

ACTIVE READER

1 Recall Which biome is Earth's largest and has the most diversity of plant and animal life?

FOCUS QUESTIONS

1. What are the differences between a marine and a freshwater biome?

2. Complete the food chain below for a desert ecosystem. Tell which organisms in the chain are producers and which are consumers.

cacti → _____ → lizards → hawks

Stop and Think

This page will help summarize what you have read so far.

1. Which term refers to the environment in which a particular group of Canada Geese lives?

- (1) biome
- (2) ecosystem
- (3) habitat
- (4) population

2. In which biome are you most likely to find nocturnal animals?

- (1) tundra
- (2) marine
- (3) freshwater
- (4) desert

Base your answers to questions 3 and 4 on the food chain below and on your knowledge of science.



3. Which biome is best suited to supporting the organisms in this food chain?

4. What is an example of an adaptation that has helped an animal in this biome succeed?

Dear Ms. Understanding,

I'm really interested in studying the coral reef marine habitat, but I live in New York City. Where's the nearest coral reef? My family is thinking about taking a trip to the Jersey Shore this summer. Will I find what I'm looking for there?



Mired in Midtown

Dear Mired,

Don't get me wrong, the Jersey Shore is great. But it's no place to search for a coral reef. You'll have to travel to a tropical area near the equator to find a coral reef. So, go south. I hear there's a great one off the coast of Belize!



Ms. Understanding

Chapter 1 The Forest Ecosystem

FOCUS

This section introduces the forest ecosystem and defines the three main types of forest. Look for similarities and differences as you read.

Types of Forests

Approximately 30 percent of the Earth's surface is covered in forests. Forests play an important role in the health of our planet. They control the water cycle, stabilize soils, store carbon dioxide, produce oxygen, and provide habitats for wildlife. Across the world there are several different types of forest ecosystems each with its own set of unique habitats.

Tropical Rain Forest

Tropical rain forests cover the Amazon region in South America and regions near the equator in Africa, Asia, and the east coast of Central America. Tropical rain forests support many species of **broadleaf** evergreen trees, vines, ferns, and palms. Rain forest habitats are organized into layers: the emergents, the canopy, the understory, and the forest floor.

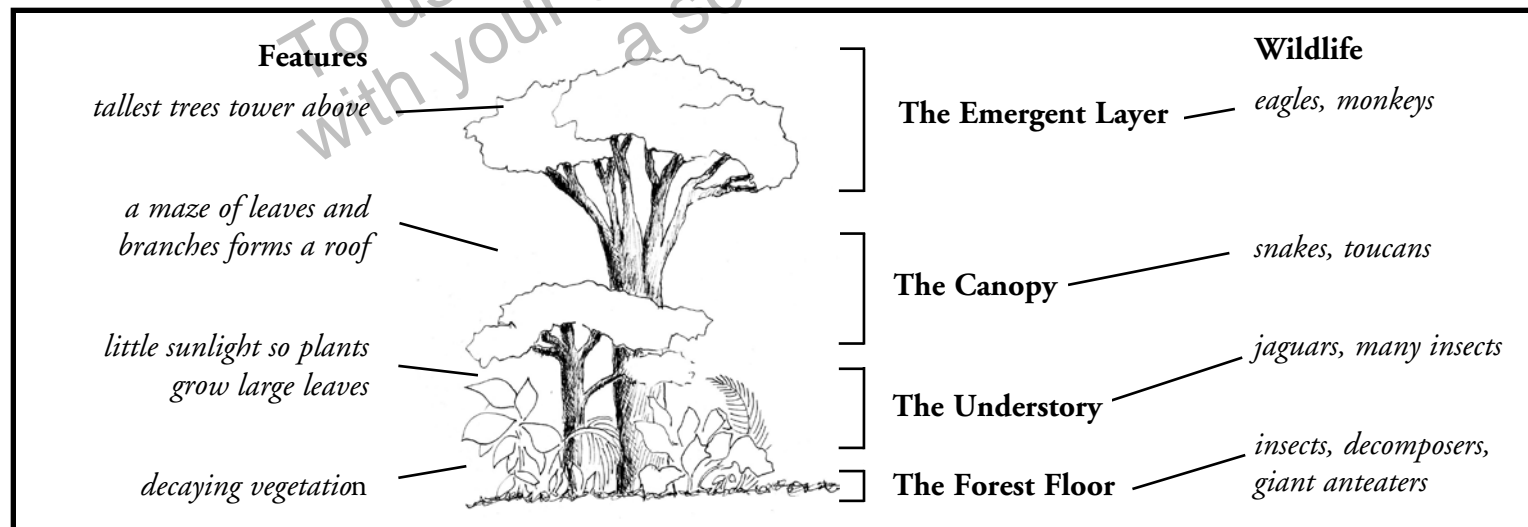
ACTIVE READER

1 Infer According to the chart, which animals are most likely the top consumer in each of the following layers?

Emergent: _____

Understory: _____

Forest Floor: _____



Temperate Deciduous Forests

Temperate Deciduous Forests are found in North America, Europe, Asia and a few places in Australia and New Zealand. The climate here is changeable, with four distinct seasons. It is cold in the winter and hot in the summer. Deciduous trees, which lose their broad leaves in winter, predominate. Maple, oak, beech, hickory, and chestnut are examples of deciduous trees that have adapted to cold winters by dropping their leaves and going into a kind of hibernation. Evergreens are also common. Mountain laurel, azaleas, and mosses are adapted to the low sunlight of the forest floor.

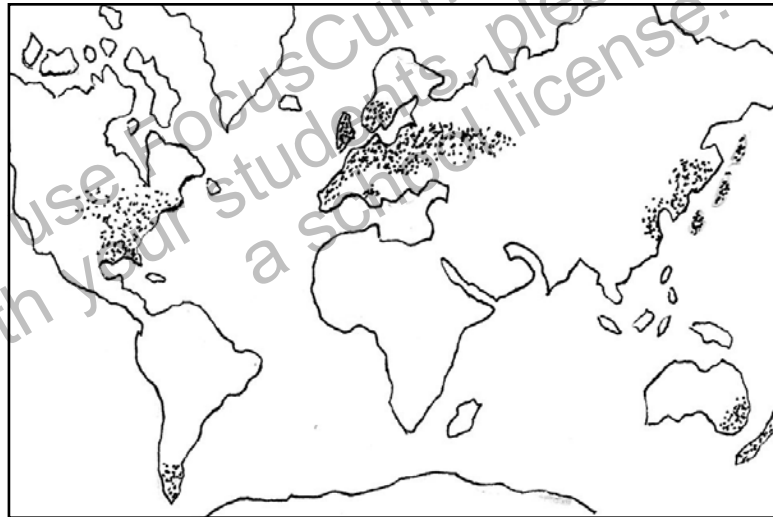
These forests also feature habitats at different layers from the sunny canopy to the darker ground. A wide variety of herbivorous, omnivorous and carnivorous animals live in the deciduous forest.

The dormouse, chipmunk, and ground squirrel are omnivores that eat fruit, seeds, nuts, insects, and bird's eggs. Their predators are snakes, hawks, and owls.

The white-tailed deer prefers farmlands at the edge of forested areas. They are herbivores, although have been known to eat bird's eggs when other food is scarce.

Bald eagles are forest dwellers but like to build their large nests near wetlands and lakes. The eagle is an amazing predator. Its diet includes a wide variety of fish, reptiles, and small mammals. Eagles also become scavengers, eating the flesh of dead animals, when their prey is sparse.

The weasel lives in the Asian deciduous forest. It is the smallest carnivore and eats mice, rats, moles, small birds, and rabbits.



Temperate Deciduous Forests are found in North America, Europe, Asia and a few places in Australia and New Zealand.

ACTIVE READER

1 Recall *What are some examples of these types of trees?*

Deciduous _____

Evergreen _____

Good to Know

The largest deciduous tree in the United States is the American Planetree, also called the Sycamore and Buttonwood. It can grow to 140 - 170 feet tall with a canopy that is 100 feet across. It's trunk can reach ten to eleven feet in diameter. Sycamores often line the banks of streams.

Boreal Forests (Taiga)

Boreal Forests are coniferous (evergreen) forests of the north. They exist in a broad band across Canada and the Eurasian land mass just south of the tundra. The climate is cold with long, snowy winters and short, cool summers. In addition to fir and pine trees, mosses and lichens are common. These may provide food for various species of animals that live here, including the snowshoe hare and the porcupine. Reindeer moss, shown in the photo at the right, is actually a **lichen**, a combination of an algae and a fungus, and a source of food for reindeer and caribou. These and other large herbivores, such as elk and moose, live here as do predators such as bobcats, foxes, and grizzly bears.



Reindeer Moss

ACTIVE READER

1 Extend Which term best describes the mutually beneficial relationship between the green algae and the colorless fungus that together make up the reindeer moss lichen?

- predator/prey
- symbiosis
- phytoplankton
- competition

Human Impact on Forests

Since prehistoric times, humans have converted forests into farmland and living space. We have domesticated forest plants and animals and have introduced invasive species. More recently, pollution from human sources has degraded habitats within forests. Climate change and human population growth have altered or eliminated forests around the world.

FOCUS

QUESTIONS

1. What is the difference between a deciduous tree and an evergreen tree?

2. Reindeer and caribou are primary consumers because they eat mostly plants. What term is used for animals that are plant-eaters?

FOCUS

Read this section and imagine yourself walking through a forest that separates wetlands from a farmer's field.

A Walk Through a Forest

More than sixty percent of the land in New York State is forested. Most of the forests here are temperate deciduous forests, but there is some boreal forest on the hills of the Adirondack Mountains in the northern part of the state. Forest ecosystems near more populated areas in New York State are likely to have been fragmented because of farming, the growth of cities and towns, and logging. Freshwater ecosystems, including streams, rivers, and wetlands—bogs, marshes, and swamps—are intermingled with forest and grassland.

Forest and Streambed

The forest that runs along a stream forms a buffer zone between the stream and a nearby farmer's land. There are large trees here as well as many low shrubs. The floor of this forest is covered with fallen leaves and branches. The material in the top layer is mostly newly-fallen leaves. Underneath, we find decomposed organic matter that is being turned into rich soil by tiny **microbes**.

The roots of the trees and shrubs closest to the stream grow down the bank and stick out into the water. These trees offer shade and help keep that water cool, even on the hottest days.

The trees and their roots also help keep the soil around the stream loose and porous. So, during the spring when the winter snows melt and the stream floods its banks, the soil can absorb the water. This keeps it from flowing onto the farmer's field and washing away all of the valuable topsoil.

Most of the trees in these woods can stand wet conditions. There are river birch trees, red maple, sycamore, and many types of willow. We are likely to see songbirds, herons, wood ducks, and even eagles in these trees. And, if we are quiet and careful, we might see foxes, too.



ACTIVE READER

1 Recall Which large tree might you find growing along the banks of a stream?

Web Quest

Use the Internet to find the locations of forested areas in New York State. Draw a map to identify forested areas, freshwater lakes, and urban areas. Write a report describing the ways New Yorkers can use their forests and lakes for recreational purposes.

Now, let's put on our high wading boots so we can walk down to the stream and wade into the current. Don't forget the insect repellent, too. Then walk along this small brook that winds its way through the woods and empties into the stream ahead.

There's a willow tree growing right at the point where the brook empties into the stream. Its leafy branches and dense roots hang over the water and shade the pool below. The pool is at the shallow edge of the stream, away from the rushing stream.

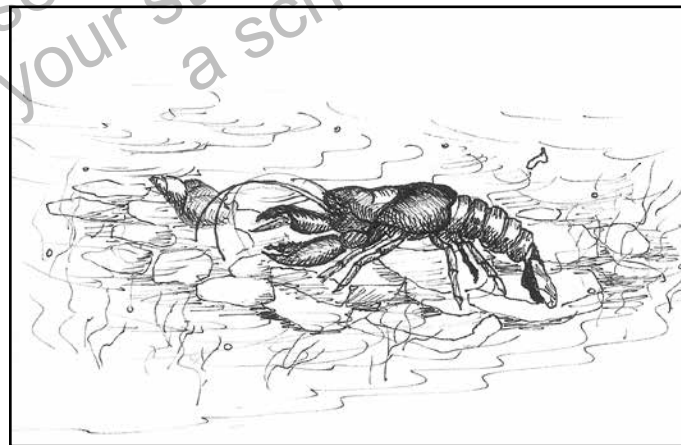
No doubt that's a spot where smallmouth bass like to hang out. They like to hide and rest in quiet areas near rocks to save energy—swimming against a current all day is hard work. Other fish you will find in this stream range in size from small shiners to larger bluegill to large trout. Any of them would make a good lunch.

We can hear the buzz of dragonflies and other insects all around. Look closely at the surface of the water. In areas where the flow is quieted, you will see skaters, sometimes called water boatmen and water striders.

Waterlogged pieces of wood and debris at the edge of the stream are crawling with the larvae of various insects. You can also see crayfish scuttling along the streambed and snails and salamanders crawling on nearby algae-covered rocks. Downstream where the streambed narrows, a beaver is working on building a dam.

The streambed itself changes continuously and the plants and animals that live there are adapted to this flow of water. The amount of water in the streambed varies with the seasons and the amount of rainfall and snowmelt.

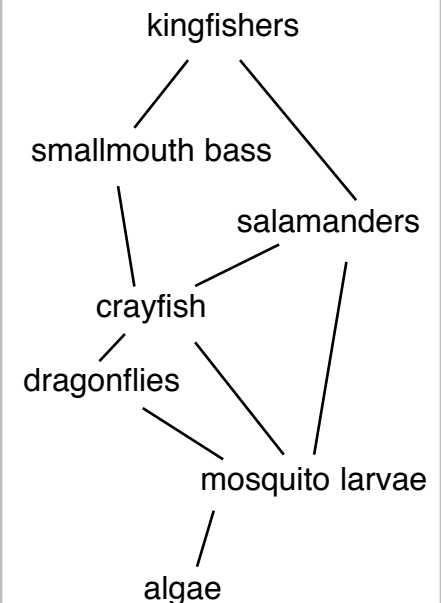
The energy of this ecosystem begins with algae and plant photosynthesis. But energy also comes from the leaves and twigs from the buffer zone that fall into the stream and are broken down by microorganisms. These become the base of a food chain that leads to the fish, birds, and mammals that live in the ecosystem.



crayfish

ACTIVE READER

1 Identify *The Kingfisher is a predatory bird that catches fish and other aquatic animals by swooping down from a perch above the water. Which other organisms in the food web below are predators?*



A Cattail Marsh

If we follow the stream to its source, we find a marsh in a large clearing with forest beyond. It is summer and the first thing we see as we approach is the great blue heron standing knee-deep in the water at the very edge of the marsh.

Cattails are behind the great blue heron. Red-winged blackbirds live in them. They use material from the cattails to make their nests. They don't like the great blue heron and dive-bomb him as they fly around his head. They are fierce defenders of their territory, and they don't want the great blue heron anywhere near their nests. He ignores them and peers into the dark water looking for the movement of a small fish to catch for lunch.

The great blue heron also stays away from the family of geese that are paddling in the small area of open water in the middle of the marsh. The sun is out and the snapping turtles are sunning themselves on a nearby floating log. They are cold-blooded, and need the sun to increase their body temperatures.

The turtles blend in well. They are all covered with algae and warty skin so they look more like a log than an animal. This helps them surprise their prey. They also feed on fish that swim by, but they specialize in the less mobile, sick, wounded, and diseased ones. Be careful of these guys, they can snap a finger off if you get too close.

The muskrat swimming near the bank is fun to watch. We watch her dive beneath the water and then emerge nearby on a cleared spot of land at the edge of the marsh. The muskrat has built an underwater tunnel up to her nest. Cattails and other marsh vegetation make up most of her diet, but she also eats small turtles, fish, and frogs.

There are organisms we can't see living in the marsh, too. For example, if we fill an eyedropper with water from the surface of the marsh, and looked at the water under a microscope, we would probably find tiny single-celled creatures called amoebas.

Like the stream, the energy of the wetland ecosystem begins with the photosynthesis of algae and aquatic plants. In this process, algae and plants make their own food using energy from sunlight to combine carbon dioxide from the air with hydrogen from water. This produces a type of sugar called glucose, which the plants use to grow. During this process oxygen is given off as well. These algae and plants form the base of a food web that leads to microscopic organisms, fish, and to reptiles, birds, and mammals that inhabit the marsh and nearby forest.

ACTIVE READER

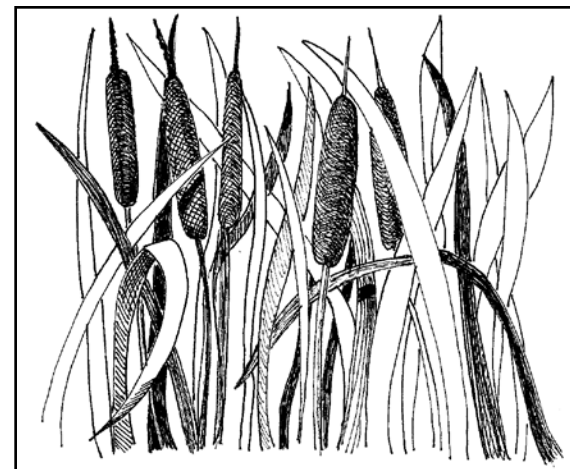
1 Infer According to the text, what are two techniques the snapping turtle uses for protection?

2 Recall Which term best describes the muskrat?

_____ carnivore

_____ herbivore

_____ omnivore



cattails

A Farmer's Cornfield

As we walk up from the stream, back through the forest, and into the farmer's cornfield, I think about how many different plants and animals we saw in the marsh and stream ecosystems. Here in the cornfield we see a different story. There seems to be a few insects, no animals, and the only plant I see is corn.

But, if we look closer, we realize that there is more to this cornfield than meets the eye. The corn ears are well along in their development. The ears have tassels and are beginning to look full.

We can see that some of the leaves above the ears have a reddish-brown dusty-looking growth. This is common corn rust. It's a type of fungus. Another type of fungus that uses the corn plant as a host is called smut. Smut can infect the stalk, ears, or leaves of the corn plant.

If we pick an ear and strip off the outside leaves, we can sometimes find insect pests such as the larvae of armyworms, earworms, and corn borers. We also find grasshoppers all around, and see some eating around the edges of leaves on some of the corn plants.

Standing at the edge of the cornfield, we hear a rustling noise ahead. All of a sudden we see a flash of white—it's a white-tailed deer bounding out of the cornfield and dashing into the woods beyond. Deer eat the corn around the edges of the field and find places in the field to lie down and hide or rest.

Birds are all around, too, especially crows. Farmers usually don't like crows because they can eat huge numbers of young corn plants. That's why they build scarecrows. But crows are very smart. If you put a scarecrow in a cornfield and leave it alone for a few days, the crows will figure out that it's not a real person and they will use it as a perch. Scarecrows have to be moved around every couple of days in order for them to work.

After the corn is established and growing, crows are less of a problem. In fact, crows eat many weeds and insects, such as grasshoppers, that threaten the corn plant.

ACTIVE READER

1 Analyze Which phrase below best tells how the information on this page is presented?

- _____ statement and example
- _____ cause and effect
- _____ events in sequence
- _____ question and answer

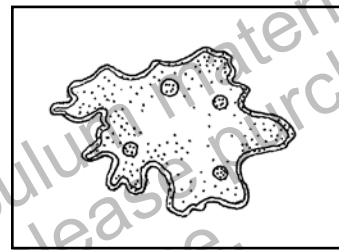


At the end of one section of rows we come upon a low, wet place in the field. It's a muddy puddle that is filled with rotting leaves and pieces of cornstalk left over from previous growing seasons. A recently dead raccoon lies nearby and vultures are circling overhead. They have found the carrion before the foxes have had a chance to eat it.

The older, decaying plant material is covered with a network of yellow, slimy, moldy stuff. This is slime mold and it's made of amoeba-like cells that feed on microorganisms in the soil and on decaying wood. Slime mold, bacteria, and worms are important in an ecosystem because they eat dead or decaying matter. These organisms are called the decomposers.

Even though the cornfield seems to be a much simpler ecosystem than a marsh or stream, a wide variety of life forms live together in the cornfield and depend on each other for growth, development, and reproduction.

Each of the habitats we have visited—the forest and stream, the marsh, and the cornfield—have nonliving and living elements. The nonliving elements include water, air, sunlight, and soil. The living inhabitants include animals, plants, and fungi. These living inhabitants interact with each other and with the nonliving parts of the ecosystem as they grow, develop, and reproduce.



an amoeba

ACTIVE READER

1 Analyze Which phrase below best tells how the information in paragraph 4 is presented?

- _____ statement and example
- _____ cause and effect
- _____ events in sequence
- _____ question and answer

FOCUS QUESTIONS

1. A scavenger is an animal that feeds on carrion, the carcasses of recently-dead animals. What two scavengers are mentioned on this page?

2. In which habitat would you be most likely to find a muskrat?

_____ forest floor _____ cornfield _____ forest canopy _____ marsh _____ puddle



Explore a Forest Even though you may live in a city, a suburb, or far away from a forest, you can still explore a forest ecosystem using books, videos, and various online resources. Start by looking for a website devoted to a forest in your state. Use the questions below to guide your exploration. Work with a group to create a presentation about your findings.

Location

- What are the latitude and longitude coordinates of the forest?
- What county is the forest in?
- How far do you live from the forest?
- What major roads would you take if you could drive to the forest?

Area

- How many square miles does the forest cover?
- What counties border the forest?
- What geological formations (lakes, rivers, mountains) are a part of the forest?
- What is the weather like during each season?

Wildlife

- What plants and animals are native to this forest?
- What threatened, endangered, or sensitive species are found here?
- What invasive species are found here?
- What mammals, raptors, or fish are carnivores (top consumers) in this forest?
- What animals are herbivores (primary consumers) in this forest?
- What animals are scavengers in this forest?

Human Impact

- What roads are open to the public in the forest?
- What recreational activities are available to the public?
- What rules are in place to control human impact?
- What special passes or permits are required?
- How does farming in the area affect the forest?
- Are there any special problems caused by pollution, such as acid rain?

Natural Resources

- What natural resources are available in the forest?
- Is lumbering allowed?
- How are the available water resources used by visitors?

Natural History

- What is the geologic history of the forest?
- How and when were the local landforms created?
- What is the history of the Indian population in this part of the state?
- How has this land been used by people over its history?

Conservation and Preservation

- What plans are in place to keep this forest habitat healthy and in balance?

Stop and Think

This page will help summarize what you have read so far.

Base your answers to questions 1–3 on the food web at the right and on your knowledge of science.

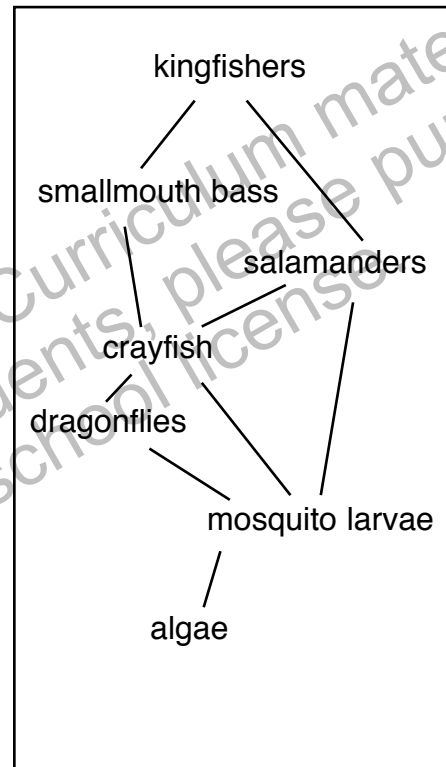
1. According to the food web, smallmouth bass and salamanders

- (1) are both producers
- (2) may mate with each other
- (3) live in habitats that don't overlap
- (4) compete for food

2. Dragonflies are

- (1) herbivorous
- (2) carnivorous
- (3) microorganisms
- (4) carrion

3. Mosquito larvae also eat bacteria that they filter out of the water they live in. Add bacteria to the food web to show this feeding relationship.



Dear Ms. Understanding,

I've heard that the soil in a rainforest is very poor and lacks nutrients. If that's so, how come the rainforest is so lush and packed with so many different kinds of plants?



Jungle-less in Jamestown

Dear Jungle,

The soils in a rainforest are poor because all of the nutrients are contained in the trees and other vegetation.



Because the soils are poor, only plants well-adapted to the rainforest ecosystem can thrive here.

Ms. Understanding

Glossary

abundant – plentiful; existing in large quantities

abyssal zone – the deepest part of the ocean found at depths of 2,000 to 6,000 meters

Antarctic – the region around Earth’s South Pole including the continent of Antarctica

benthic zone – the region of a lake or ocean along the floor including sediments and subsurface layers where organisms live

bog – a wetland in which deposits of dead plant material accumulate and become peat and whose water chemistry is acidic

broadleaf – the leaves of deciduous trees and other garden plants and weeds that have flat leaves rather than spiky needles

buffer zone – a natural area that separates two other areas, such as a stream and an open field or meadow

carrion – the carcass of a dead animal

consumers – animals that get their energy by eating plants and other animals

estuary – a body of water along a coast that is fed by rivers and streams and open to the sea at one end

fauna – animal life

fen – a wetland that is rich in dissolved minerals and whose water chemistry is alkaline or neutral

intertidal zone – the area of a marine ecosystem that is exposed at low tide

lichen – an organism that is a composite of an algae and a fungus

marsh – a shallow-water wetland that supports grasses, reeds, mosses, and other similar plants

microbes – a living organism that is microscopic, too small to be seen without magnification, such as bacteria or fungi

microorganisms – microbes

nocturnal – active at night

pelagic zone – the open water away from coastal areas in a marine ecosystem

phytoplankton – photosynthesizing microorganisms that form the base of the marine food web

producers – organisms that produce their own food, chiefly through photosynthesis

swamp – a shallow-water wetland that, unlike a marsh, supports trees and other woody plants

terrain – land, especially the topography of the surface of land

transpiration – the loss of water vapor from plants through evaporation

**FOCUS
ON
SCIENCE**

Exploring Ecosystems

Assessments

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Check Understanding



In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

1. Microorganisms on the forest floor
 - (1) decompose dead plant material
 - (2) produce their own food
 - (3) are primary consumers
 - (4) are responsible for photosynthesis

2. A ground squirrel eats nuts, seeds, spiders and insects. Based on its feeding behavior, which term describes the ground squirrel?
 - (1) producer
 - (2) herbivore
 - (3) carnivore
 - (4) omnivore

3. Where does the flow of energy begin in a forest ecosystem?
 - (1) microorganisms and microbes
 - (2) leaves and twigs from a buffer zone
 - (3) plant photosynthesis
 - (4) rainfall and snowmelt

Answer Document

- | | | | | | | | | | |
|----|---|---|---|---|----|---|---|---|---|
| 1. | ① | ② | ③ | ④ | 3. | ① | ② | ③ | ④ |
| 2. | ① | ② | ③ | ④ | | | | | |

Check Understanding



The organisms listed below were found in a forest and a nearby lake. Base your answers to questions 4 and 5 on the list and on your knowledge of science.

- algae
- ants
- bear
- deer
- dragonflies
- eagles
- ferns
- fish
- frogs
- mice
- mosquitoes

4. Sketch a likely food chain using at least four of the organisms.

A large, empty rectangular box provided for the student to draw a food chain using the organisms listed above.

5. Bears and eagles are both predators who hunt for fish. What kind of relationship develops between bears and eagles when their habitats overlap?

A series of horizontal lines provided for the student to write their answer to question 5.

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Exploring Ecosystems

Answer Key

Answer Key

Page 8: Starting Points

Build Background

Food Chains: Sample answers: 1. green plants; 2. hyena; 3. lion; 4. gazelle; 5. gazelle; 6. lion; 7. hyena; 8. vulture; 9. worms

Page 9: Starting Points

Key Vocabulary

Rate Your Knowledge: Answers will vary according to the student's prior knowledge.

Synonyms and Antonyms:

1. producer, consumer; 2. abundant; 3. terrain; 4. bog, fen; 5. nocturnal

Page 10: Starting Points

Key Concepts

Active Reader: 1. glucose and oxygen

Page 11: Chapter 1

Active Reader: 1. Answers will vary.; 2. question and answer

Page 12: Chapter 1

Active Reader: 1. Answers should suggest that a habitat that would support Mountain Gorillas doesn't exist in North America. Focus Questions: 1. habitat; 2. Answers should suggest that a different terrain and climate would be encountered when traveling from one biome to another.

Page 13: Chapter 1

Active Reader: 1. Terrestrial means land. Terrestrial biomes are tundra, forest, desert, and grassland.

Page 14: Chapter 1

Active Reader: 1. marine

Focus Questions: 1. marine biomes are salt-water environments; 2. insects or spiders; cacti are producers and the other animals are consumers.

Page 15: Chapter 1

Stop and Think

1. (3); 2. (4); 3. desert; 4. Many animals are active at night. Plants have spiky leaves to reduce transpiration.

Page 16: Chapter 2

Active Reader: 1. eagles; jaguars; giant anteaters

Page 17: Chapter 2

Active Reader: 1. Deciduous: oak, beech, maple; Evergreen: pine, fir

Page 18: Chapter 2

Active Reader: 1. symbiosis

Focus Questions: 1. Deciduous trees lose their leaves in the fall and go into a kind of dormancy during the cold months. Evergreens stay green all year long; 2. herbivores

Page 19: Chapter 2

Active Reader: 1. sycamore

Page 20: Chapter 2

Active Reader: 1. smallmouth bass, salamanders, crayfish, dragonflies

Page 21: Chapter 2

Active Reader: 1. camouflage that makes them blend into their surroundings and strong snapping jaws; 2. omnivore

Page 22: Chapter 2

Active Reader: 1. events in sequence

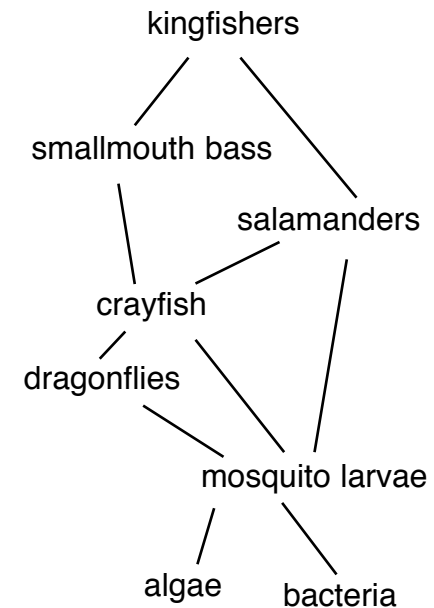
Page 23: Chapter 2

Active Reader: 1. statement and example Focus Questions: 1. raccoons and vultures; 2. marsh

Page 25: Chapter 1

Stop and Think

1. (4); 2. (2); 3.



Answer Key

Page 29

Check Understanding

1. (1); 2. (4); 3. (3)

Page 30

Check Understanding

4. Sample answer:

algae > mosquito larvae > dragonflies > frogs > eagles; 5. Bears and eagles are in competition for food, such as fish and frogs.

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