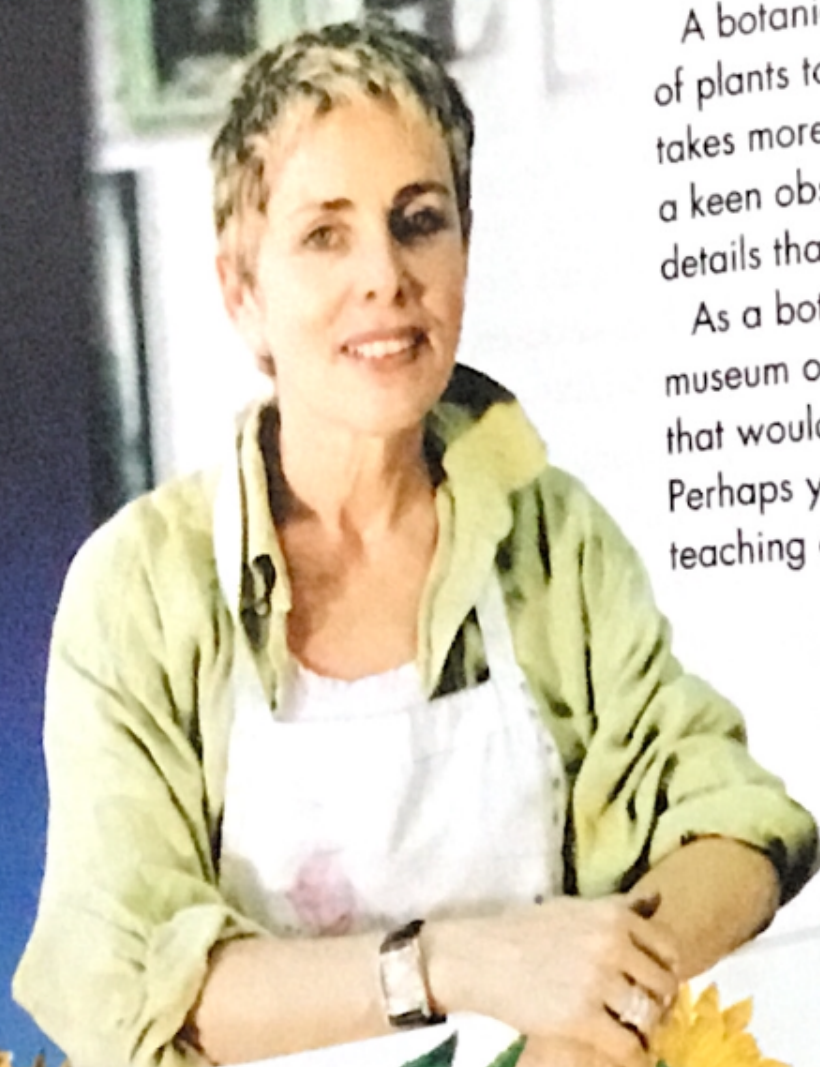


Science Ch. 6

Biomes

Botanical Illustrator



Do you like to draw? Do you enjoy planting flowers, tending a vegetable garden, or even just hiking through the woods? If so, a career as a botanical illustrator might be perfect for you.

A botanical illustrator creates drawings or paintings of plants to show people what they look like. That takes more than artistic talent. The illustrator has to be a keen observer of nature so that the art can show the details that make one plant different from another.

As a botanical illustrator, you could work for a museum or botanical garden. You might create art that would be part of displays, books, or brochures. Perhaps you would pass along your love of nature by teaching children how to identify and draw plants.

To be a botanical illustrator, you would need a degree from a college or art school. Most of your classes would be in art, but you would take some biology classes, too.



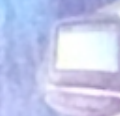
Lab zone

Take-Home Activity

Find a flower, tree, or other plant. It could be outside or a houseplant. Make a drawing or painting of it. Focus on details, such as the edges of the leaves and the shades of color. Find out the name of your plant and label it. Display your work.

Chapter 6

Biomes



Web Games

Take It to the Net
pearsonsuccessnet.com



online Student Edition

pearsonsuccessnet.com

You Will Discover

- how the biosphere is organized.
- what Earth's biomes are.
- how Earth's biomes differ.

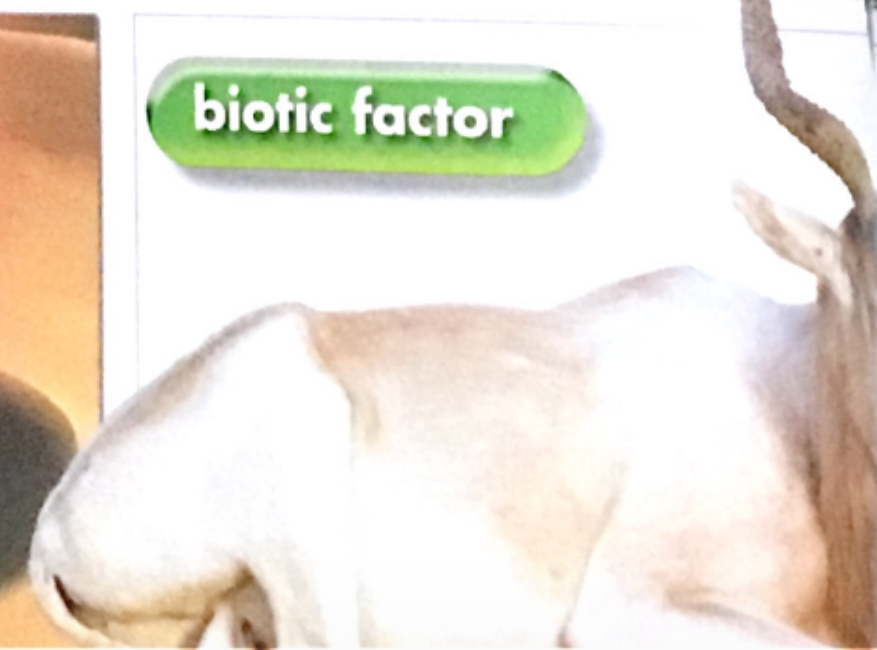
How do organisms live together in ecosystems?

environment

ecosystem



abiotic factor



biotic factor

Chapter 6 Vocabulary

environment

page 144

population page 144

community page 144

ecosystem page 145

abiotic factor

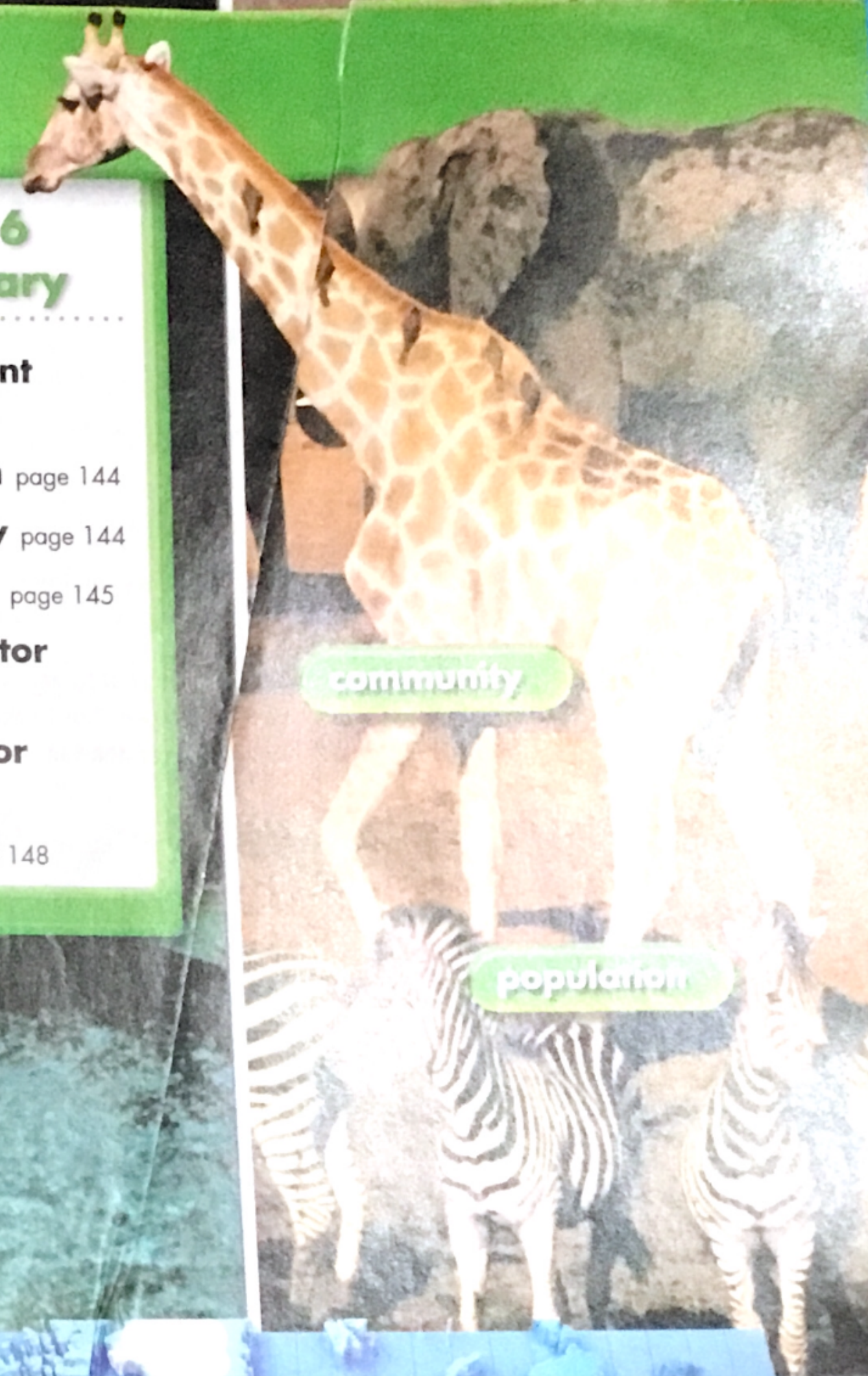
page 146

biotic factor

page 146

biome page 148

biome



community

population

◆ You Are There!

The sizzling sun beats down on you. Sweat covers your body. You're hot and thirsty, but there is no shade in the desert. Wait! What's that sound? A rattlesnake lies coiled up on the path in front of you. You jump back. Ouch! You just brushed against the spiny thorns of a cactus. What other surprises will you find here?



Lesson 1

How are organisms on Earth connected?

All living things on Earth share resources, such as air, water, and light. Living things, including humans, are connected through the resources they share. The actions of humans can affect other parts of the biosphere.

Connections in the Biosphere

No matter where you go—the highest mountain, the deepest ocean, the hottest desert, or the coldest Arctic area—you will find living things. From microscopic bacteria to the largest whales, a variety of living things covers Earth. The biosphere is the part of Earth in which living things are found. It extends from about 10 kilometers above Earth's surface to about 10 kilometers below the surface of the ocean.

Although organisms may live in different parts of the biosphere, they all share Earth's resources, such as water, air, and light. Living things depend on and are connected to each other through the resources they share. If something happens to one organism, other organisms can be affected too. Humans—including you—are part of the relationships formed between living things in the biosphere. Human actions can affect the biosphere.

The study of how living things interact with each other and their environment is called ecology. The word *ecology* comes from the Greek words *oikos*, meaning "place where one lives," and *logos*, meaning "the study of." An ecologist is a scientist that studies the interactions of living things.



Coral reefs such as this one are home to thousands of species. When reefs are damaged or destroyed, the organisms that depend on them often die.

1. **✓ Checkpoint** Explain how organisms in the biosphere are connected.
2. **Technology in Science** Organisms live deep in the ocean around vents that spew hot gases and other materials into the water. Find out what technology scientists use to study these deep areas and what they have discovered.



Studying an individual species, such as zebras, helps scientists learn more about how organisms interact with their environment.



How would members of this population compete among themselves and with other populations?

Interactions

How many people did you interact with today? What did you do? Do you have a pet? What do you and your pet do together? When you think about it, getting through the day without interacting with other living things is difficult. And what about the nonliving things around you? You breathe oxygen in and carbon dioxide out, drink water, and are warmed by sunshine. You couldn't live without any of those things.

Just like you, all organisms that live together in an area interact with each other and their environments. An organism's **environment** is anything that can affect the organism. An environment includes both living and nonliving parts.

Organization of the Biosphere

A **population** is a group of individuals that belong to the same species and live in the same area. All of the zebras in the pictures are a population living together. Each kind of grass growing there is also a population. But all the animals living there do not make up a population. That's because they are members of different species.

Each particular population lives in a certain area. For example, scientists may refer to a population living in a large area, such as the United States. Or they may only be interested in a particular population living in a very small area, such as the population of ticks on a dog.

Members within a population compete for resources in the environment. Each needs food, water, air, space, shelter, and other resources. If resources become limited, individuals can die, and the population gets smaller.

Individual populations do not live alone. Several populations live together and interact in an environment. A **community** is a group of populations that interact with each other in a particular area. The elephants, zebras, and giraffe are all part of the same community. If your family has pet dogs and cats, several populations live in your house—the human population, the dog population, and the cat population. Other populations live there too—bacteria, molds, and fleas on your pets.



Communities depend on the nonliving environment to meet many of their needs—water, shelter, and minerals are just a few. An **ecosystem** is a community of organisms living together along with the nonliving parts of the environment. An ecosystem can be as small as a crack in a sidewalk or as large as a forest. Earth's biosphere is made up of many ecosystems. Every ecosystem interacts with other ecosystems. Study the pictures to see how individuals, populations, and communities make up this ecosystem.

A community includes all organisms living together, not just the animals. What other organisms would be part of this community?

1. **✓ Checkpoint** How are individuals, populations, communities, and ecosystems related?
2. **Social Studies in Science** Compare and contrast the community in the picture with the community in which you live. If possible, use a camera to take pictures of your community to show similarities and differences.

Meeting the Needs of Organisms

Although the organisms living in a community may differ in many ways, they all depend on their environment to meet their needs. **Abiotic factors** are the nonliving parts of an ecosystem. Water, sunlight, temperature, soil, and air are important abiotic factors that organisms depend on.

All living things need some water to survive. That's because many important chemical processes that take place in organisms need water. The amount of water in an ecosystem can limit the number of organisms it can support. If there isn't enough water for all the organisms in an ecosystem, some will die.

Because plants need sunlight for photosynthesis, sunlight is important to all living things. Most organisms that cannot make their own food by photosynthesis depend directly or indirectly on plants. The amount of sunlight an area receives determines the kinds of plants that grow there. That, in turn, determines the other organisms that live there.

Most organisms need air as a source of oxygen. Your own body cannot survive without oxygen for more than a few minutes. Organisms that live in water, such as fish, use oxygen that is dissolved in the water. Plants need another gas found in air, carbon dioxide, to carry on the process of photosynthesis.

The temperature of an area also helps determine which organisms live there. Each organism can live only in a particular temperature range. Your own body would not survive long without some protection in freezing temperatures. But the polar bear is at home in those temperatures.

Biotic factors are the living organisms in an ecosystem. Many biotic factors are too tiny to be seen. These include the billions of bacteria that can be found in the soil, microscopic mites that live on your skin, algae that fill the ocean, and protists that live in the digestive system of cattle.

This addax affects and is affected by other things in its environment.



How do the biotic and abiotic factors of these desert and arctic ecosystems differ?

Temperature is an important abiotic factor. Each organism can live only in a particular temperature range. This polar bear would not survive in the heat of a desert.



Adaptations

Biotic and abiotic factors shape the communities that live in an ecosystem. For example, the arctic environment is cold and windy. Most of the fresh water is frozen all year. The soil is frozen too. During the winter months, there is little or no daylight. How do these factors affect organisms that live there?

All organisms in a particular ecosystem have adaptations that help them survive there. An adaptation is a characteristic that helps an organism live and reproduce in a particular environment. Polar bears have thick fur to help keep their body warmth from escaping into the environment. They have black skin, which absorbs sunlight to warm the animal. Polar bears also have strong claws that help them walk on ice and capture animals for food. Their fur, which looks white, helps camouflage them in the snow.

The climate of the Arctic makes it difficult for trees and large plants to grow there. The plants that do grow in the Arctic are small. They are adapted to grow low to the ground to avoid damage from the strong winds. They need little sunlight for photosynthesis.

✓ Lesson Checkpoint

1. List five things you need to stay alive. Tell how your environment helps you meet each need.
2. Identify each factor as biotic or abiotic: sunlight, grass, sand, bird, rock.
3. **Main Idea and Details** How do abiotic factors shape the communities that live in an ecosystem?

Lesson 2

What are Earth's biomes?

Earth can be divided into biomes with similar climates and organisms. Temperature and amount of rainfall can be used to describe these biomes.

Climate and Biomes

If you traveled around the world and looked at the organisms living in different parts, you would notice that similar communities occur in places that have similar climates and landforms. A **biome** is a large group of ecosystems with similar climates and organisms. Grouping ecosystems into biomes helps ecologists describe the world.

Water, sunlight, and temperature are important abiotic factors that different organisms need in different amounts. For that reason, climate—the average yearly temperature and precipitation in an area—helps determine the characteristics of a biome. For example, the growing season of plants is mostly determined by temperature. Only plants that are adapted to the yearly temperatures of a particular biome can survive there. Because animals depend on plants for food, as plant populations get larger, so do the animal populations. More plants, more food.

Environments Within Biomes

Think about a tropical rain forest. Its wet, humid conditions and long periods of sunlight make it an ideal place for large trees and other plants to grow. Trees block some sunlight and help make different environments within the rain forest. The top layer gets plenty of sunlight, but lower toward the forest floor, conditions become darker. An amazing variety of species can survive in the many different environments of a rain forest. And, scientists estimate that at least two million species live in Earth's rain forests.

In cold climates, the growing season is short and the ground is frozen most of the year. Trees do not grow there, but you will find mosses and small shrubs. The number of species living in cold climates is much smaller than that of the rain forest.

Taiga

Taiga covers the largest area of any type of biome on Earth. Its temperatures range from -40°C to 20°C . The amount of precipitation each year is about 60 cm.

Tundra

Tundra is found at the far northern parts of Earth. This biome is cold and dry. Temperatures are as low as -40°C during winter months. Only about 20 cm of precipitation falls each year.

Tropical Rain Forest

Tropical rain forests are found near the equator. They are warm and rainy all year with temperatures between 20°C and 25°C . The annual rainfall is about 200 cm.



Deciduous Forest

Deciduous forests are located in the areas halfway between the Arctic and the equator. They have an average precipitation of about 120 cm a year. These forests have four seasons.

Grassland

Grasslands get about 60 cm of precipitation a year. The summers are hot and winters are cold.

Desert

Deserts are dry. They get less than 25 cm of precipitation a year. But not all deserts are hot. Some areas of the world, such as the Antarctic continent, receive so little precipitation per year that they are considered deserts. In hot deserts, daytime temperatures can be as high as 38°C .

1. **✓ Checkpoint** What are two ways that biomes differ?
2. **Math in Science** Find out how to change centimeters to inches. Then make a chart that shows the average precipitation in inches of each biome.

Characteristics of Biomes

Climate is an important factor in determining which organisms can live in an area. Another important factor influences biome communities too. Soil varies from place to place, and it plays an important role in what kinds of plants can survive in an ecosystem. A plant with roots that are adapted for absorbing water near the soil surface would not survive in areas where the only water is deep in the ground.

As you read about the different biomes on the next three pages, think about what you learn about each biome's soil. Then try to figure out how the organisms living in each biome are adapted to conditions there. Each biome is not a particular place, but different areas of the world that share similar characteristics. For example, the Mojave Desert of the southern United States has many characteristics similar to the Namib Desert in Africa. Keep in mind that although similar biomes in different parts of Earth will share similar climate and organisms, there are differences.

This porcupine doesn't have any hair on the bottom of its feet. The smooth skin there helps the animal climb deciduous forest trees, where it spends much of its time.



Tropical Rain Forest

The tropical rain forest contains more species than any other biome. These forests once covered 14 percent of Earth's land surface. More than half of those rain forests have been destroyed.

Dead organisms decay quickly in the hot, moist rain forest environment. Nutrients from the decaying plants are recycled quickly. Most of the nutrients are contained in the biome's plants, not in its soil. In fact, the soil is nutrient poor.

Rain forest trees can grow 75 meters tall. Their leafy tops form a dense covering called the canopy. Below are smaller trees, ferns, and vines. Few plants grow on the forest floor where little sunlight reaches. Many animals live in the canopy, where they eat fruits and insects. Bright colors, bold patterns, and loud sounds are common features of rain forest animals.



Tree frogs such as these are common in tropical rain forests.

Deciduous Forest

The most common plants of the deciduous forests are deciduous trees—those that shed their leaves each year and then grow new ones. Examples include oak, maple, beech, and hickory. Gymnosperms also grow here. Shrubs and small plants grow on the forest floor. Songbirds, deer, bears, and raccoons are some common forest animals.

The winters in the deciduous forest are cold, so some animal species hibernate during the winter months. Many bird species migrate to warmer climates for the winter.

As the forest trees lose their leaves each year, they fall to the ground and decay. As a result, the soil of the deciduous forest is nutrient rich. The rich soil enables many species to live there. The trees themselves provide habitats for climbing plants, mosses, lichens, fungi, and algae.

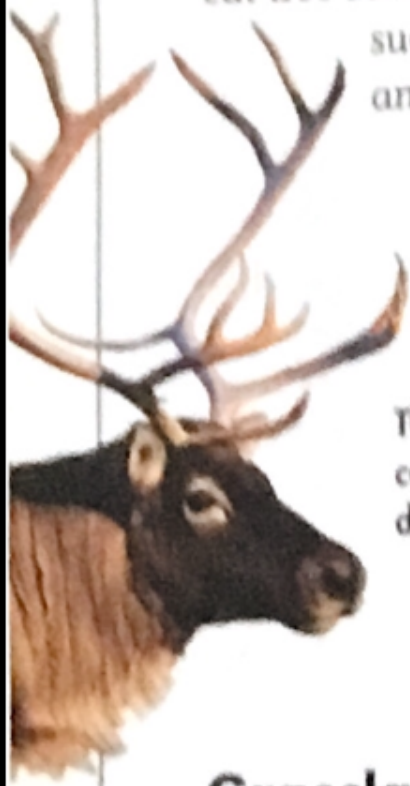
1. **✓ Checkpoint** What are three factors that help determine the communities in an ecosystem?
2. **Art in Science** Design an organism that is adapted to live in a tropical rain forest or a deciduous forest. Use common art supplies to make your organism.



Taiga

Conifers, such as fir, spruce, and hemlock, are some of the plants that have adapted to the poor soil and long, cold winters of the taiga, also called the boreal forest or coniferous forest. A few deciduous trees and small shrubs also grow here.

Many animals, such as squirrels, birds, and insects, eat berries and seeds of the conifers. Large animals, such as elk, moose, and deer, eat tree bark and new plant shoots. Predators such as wolves, lynx, grizzly bears, and hawks eat other animals.



The long, thick hair of this caribou helps keep it warm during long taiga winters.

Grassland

Grasslands do not receive enough rain to support many large trees. But they have some of the most fertile soil on Earth, which makes them excellent for farming. Every year millions of tons of wheat, corn, and soybeans are produced on the grasslands of the United States. Lush tall grasses and other small plants cover the land.

Some of the largest animals on Earth live on grasslands—including bison, zebras, rhinoceros, and giraffes. Coyotes, prairie dogs and other rodents and insects such as grasshoppers, are common grassland animals too.

The many grasses of the grassland biome provide plentiful food for grasshoppers.



The dark feathers of this ptarmigan turn white in winter, which helps it hide from predators in the snow.

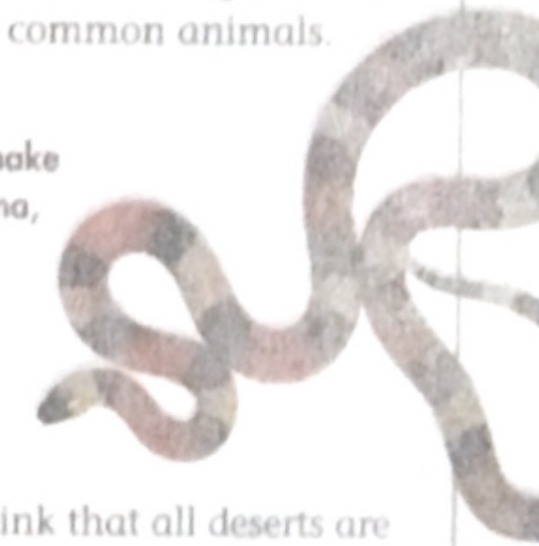


Tundra

An important feature of the tundra is its permafrost—a layer of permanently frozen soil just beneath the surface. In summer, the top layer of soil thaws. The resulting water cannot seep through the frozen layer of soil, so the top soil layer becomes soggy. The cold temperatures, high winds, and short growing season of the tundra limit plant growth to short shrubs, grasses, mosses, and a few very short trees.

Flies and mosquitoes are food for many birds, which migrate in winter. Foxes, lemmings, hares, and caribou are among the common animals.

This sonoran kingsnake lives in Utah, Arizona, New Mexico, and Nevada.



Desert

Although many people think that all deserts are hot, many deserts can be quite cool, especially at night. The common characteristic of all deserts is that they are dry. Some of the driest deserts of the world don't receive any rainfall at all! In areas where rain falls, most of the water evaporates.

Desert plants include cacti and other plants that have short growth cycles. Many animals are active at night when temperatures are cooler.

Lesson Checkpoint

1. Explain how climate is important in determining what organisms live in an ecosystem.
2. Why do so many species live in tropical rain forests?
3. **Main Idea and Details** Write a main idea statement about one of the biomes in this lesson. Give three details to support your main idea.

Statistics About CLIMATES

Distance from the equator, which is 0° latitude, is often a good predictor of temperature; the farther from the equator, the colder the climate. The same is not true for distance from the prime meridian, which is 0° longitude.

The chart below gives information for three cities that are close to 28° E longitude, making them roughly equal distances from the prime meridian. Notice that their average annual temperatures vary as their distances from the equator vary.

City	Approximate Latitude	Average annual temperature	Average Monthly Precipitation (in mm) for selected months					
			January	March	May	July	September	November
Helsinki, Finland	60° North	5°C	46	36	36	60	70	67
Cairo, Egypt	30° North	21°C	5	3	0	0	0	3
Johannesburg, South Africa	26° South	16°C	125	89	19	5	28	114



Use the chart on page 156 to answer each question.

- Find the mean monthly precipitation in Helsinki for the six months given. Look at the average annual precipitation. Would you expect the months not shown for Helsinki to have more or less precipitation than the months shown?
- What is the mode for monthly precipitation in Cairo? What does this suggest about the climate in Cairo?
- If Johannesburg has a wet season and a dry season, does the data indicate that the wet season occurs in winter or in summer? Remember, Johannesburg is in the Southern Hemisphere.
- If an Egyptian travel company wanted to convince people that the climate in Cairo is not totally dry, should it report the mean, median, or mode of average monthly precipitation? Explain.
- Based on what you have learned in this chapter, in which biome do you think each of the three cities lies? Compare the amounts of precipitation in the three locations on the chart. Can you infer any relationship between latitude and precipitation?

Lab zone Take-Home Activity

Make outdoor temperature recordings at three regular times during the day (possibly before school, after school, and at bedtime) for two weeks. Analyze your data. Can you draw any conclusions about temperature and time of day?

Use Vocabulary

abiotic factor (p. 146)	ecosystem (p. 145)
biome (p. 148)	environment (p. 144)
biotic factor (p. 146)	population (p. 144)
community (p. 144)	

Choose the vocabulary term from the box that best matches each definition.

- The nonliving parts of an ecosystem
- A group of individuals that belong to the same species and live in the same area
- Large group of ecosystems with similar climates and organisms
- Group of populations living together in a particular area
- Anything that can affect an organism
- The living components in an ecosystem
- Community of organisms living together along with the nonliving parts of the environment

Explain Concepts

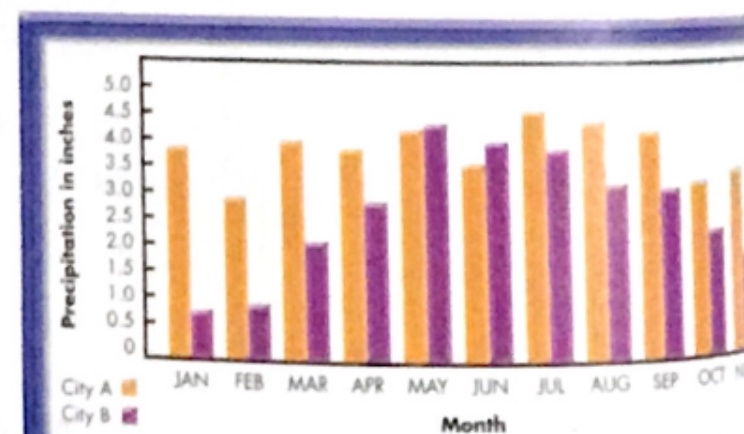
- Describe three adaptations of a polar bear and tell how each helps the animal survive in its environment.
- Compare and contrast deciduous forests and tropical rain forests.
- Write a description of the desert shown in the photograph. Use the terms *population*, *community*, and *ecosystem*.



- The tundra biome gets about 20 cm of precipitation each year. The tropical rain forest gets about 200 cm of precipitation. What percentage of precipitation does the tundra get compared to the amount the tropical rain forest receives?

Process Skills

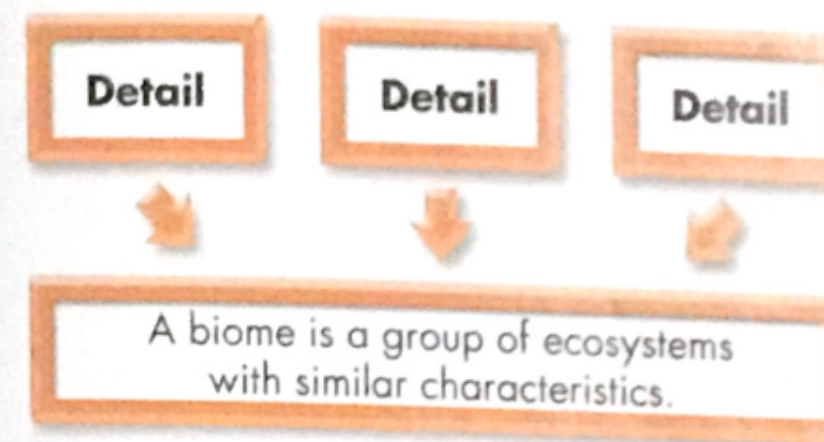
- Interpret Data** The graph shows climate information for two cities. City A is in the northeast part of the United States, where forests are common. City B is in the midwestern part of the United States, where forests seldom grow. Use the climate data to explain why forests do not grow near City B.



- Infer** Suppose a scientist discovers the remains of an unknown species. By examining the remains, scientists learn that the animal was adapted to conserve water. What can you infer about the environment the animal lived in?

Main Idea and Details

- Make a graphic organizer like the one shown below. Write details to support the main idea.



Test Prep

Choose the letter that best completes the statement or answers the question.

- What two factors can be used to summarize the climate of a biome?
 - wind and temperature
 - wind and soil
 - precipitation and temperature
 - precipitation and soil

- A group of tigers living together is an example of
 - a community
 - a population
 - an ecosystem
 - an environment

- Which biome has soil that is frozen most of the year?
 - deciduous forest
 - tundra
 - grassland
 - tropical rain forest

- Which is an example of a biotic factor of an ecosystem?
 - amount of water
 - number of living things
 - amount of light
 - daily temperatures

- Explain why the answer you chose for Question 15 is best. For each of the answers you did not choose, give a reason why it is not the best choice.

- Writing in Science Persuasive** Write an advertisement to convince travelers to visit one of the biomes you learned about in this chapter. Include a description of the following: the biome's climate, three plants, three animals, and activities a visitor might do there.