

## KEY CONCEPT

# 14

# Biomes contain many ecosystems.

### BEFORE, you learned

- Feeding relationships describe how energy flows through ecosystems
- The amount of available energy decreases as it flows through ecosystems

### NOW, you will learn

- How biomes vary by region and by the plant life they support
- How different ecosystems make up a biome
- About the different land and water biomes on Earth

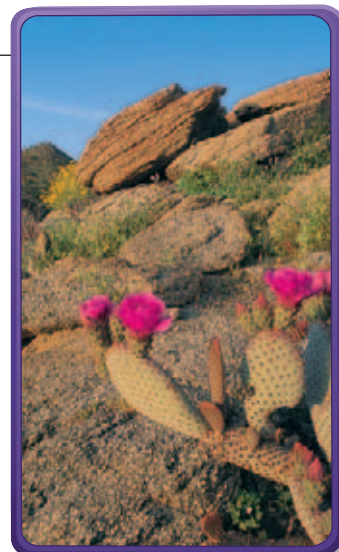
## VOCABULARY

biome p. 30  
coniferous p. 32  
deciduous p. 33  
estuary p. 36

### THINK ABOUT

#### *What do this plant's characteristics suggest about its environment?*

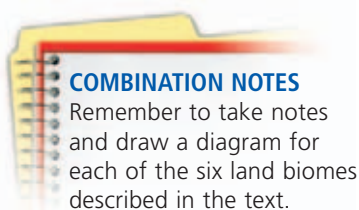
A plant's overall shape and form help it to survive in its environment. Look closely at this plant in the photograph. Describe its shape. Does it have leaves? a stem? flowers? Look at the surrounding area. What do your observations suggest about the environment in general?



## Regions of Earth are classified into biomes.

If you could travel along the 30° latitude line, either north or south of the equator, you'd notice an interesting pattern. You would see deserts give way to grasslands and grasslands give way to forests. Across Earth, there are large geographic areas that are similar in climate and that have similar types of plants and animals. Each of these regions is classified as a **biome** (BY-OHM). There are six major land biomes on Earth, as shown on the map on page 31.

Climate is an important factor in land biomes. Climate describes the long-term weather patterns of a region, such as average yearly rainfall and temperature ranges. Climate also affects soil type. Available water, temperature, and soil are abiotic factors important in ecosystems. The fact that the abiotic factors of a particular biome are similar helps to explain why the ecosystems found in these biomes are similar. Biomes represent very large areas, which means that there will be many ecosystems within a biome.

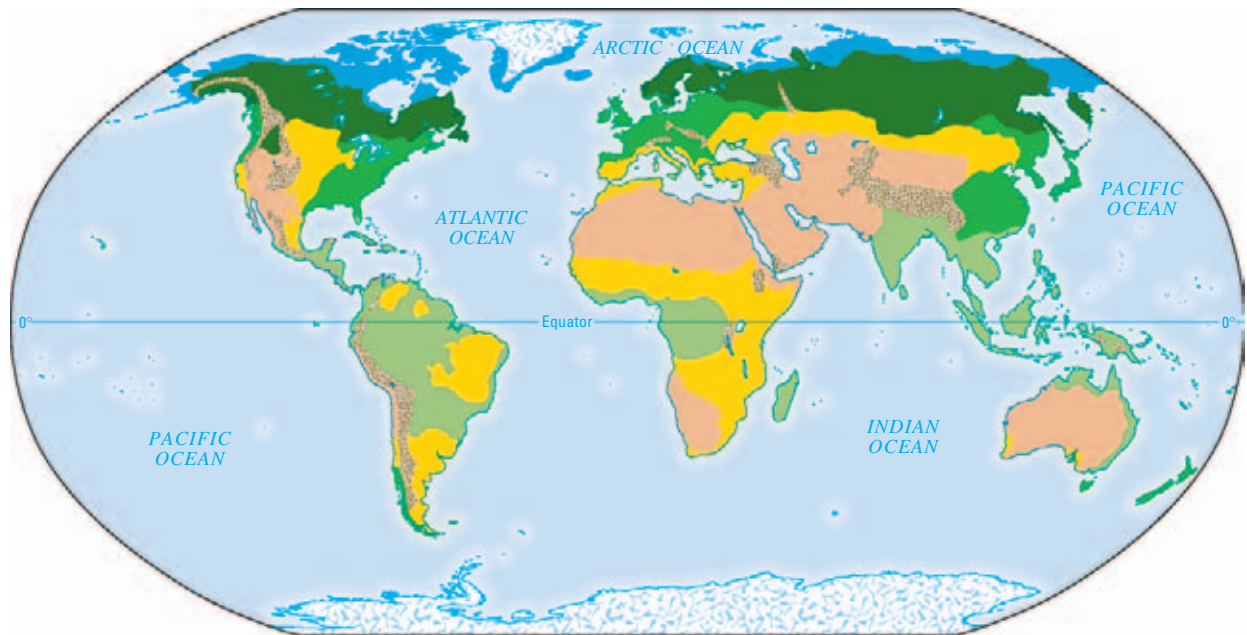


### COMBINATION NOTES

Remember to take notes and draw a diagram for each of the six land biomes described in the text.

## Land Biomes

Each land biome is characterized by a particular climate, the quality of the soil, and the plant life found there.



### Biomes

- |        |           |                  |
|--------|-----------|------------------|
| Tundra | Desert    | Temperate Forest |
| Taiga  | Grassland | Tropical Forest  |

### Other zones

- |                |
|----------------|
| Mountain Zones |
| Polar Ice      |

## Taiga and Tundra

If you go to the northernmost regions of Earth, you will find two biomes—tundra and taiga—that are characterized by long cold winters and short cool summers. In the Arctic tundra, temperatures can go as low as  $-50^{\circ}\text{C}$ , with a high of about  $18^{\circ}\text{C}$ . Temperature ranges in the taiga (TY-guh) are similar,  $-40^{\circ}\text{C}$  to  $20^{\circ}\text{C}$ .

The tundra doesn't get much precipitation, less than 25 centimeters each year. Yet the area is wet because cold temperatures keep the water from evaporating. One of the important characteristics of tundra is permafrost, a deep layer of permanently frozen soil that lies just below the surface soil. Permafrost prevents trees from taking root in the tundra. Plants of the tundra are small and include mosses, grasses, and woody shrubs. Organisms called lichens also do well in the tundra.

The producers of tundra ecosystems support rodents, caribou, and musk oxen. Grizzly bears, white fox, and snowy owls are predators found there. Migrating birds come to nest in the tundra, feeding on insects that mature in summer.



snowy owl



**Tundra** Only small plants and lichens grow in the tundra because the soil below the surface is frozen.



**Taiga** Evergreen trees grow in the taiga, where the ground is cold but not frozen.

Even though the temperatures of the taiga are similar to those of the tundra, the taiga has more precipitation, 30 to 60 centimeters a year. The effect of this is that there is more snow on the ground, which insulates the soil below, keeping it from freezing.

Taiga ecosystems are characterized by evergreen trees called **coniferous** (koh-NIHF-uhr-uhs) trees. These trees have needlelike leaves that produce food all year long. This is an advantage in taiga ecosystems because decomposers work slowly in the cold, so the soil is low in nutrients. The wood and leaves of these trees feed insects and their seeds feed birds and squirrels. Taiga ecosystems support deer, elk, snowshoe hares, and beavers. Predators include lynx, owls, bears, and wolves.

## Desert and Grassland

collared lizard



Deserts and grasslands are biomes found toward the middle latitudes. You can see from the map on page 31 that a desert biome often leads into a grassland biome. What deserts and grasslands have in common is that they do not get enough precipitation to support trees.

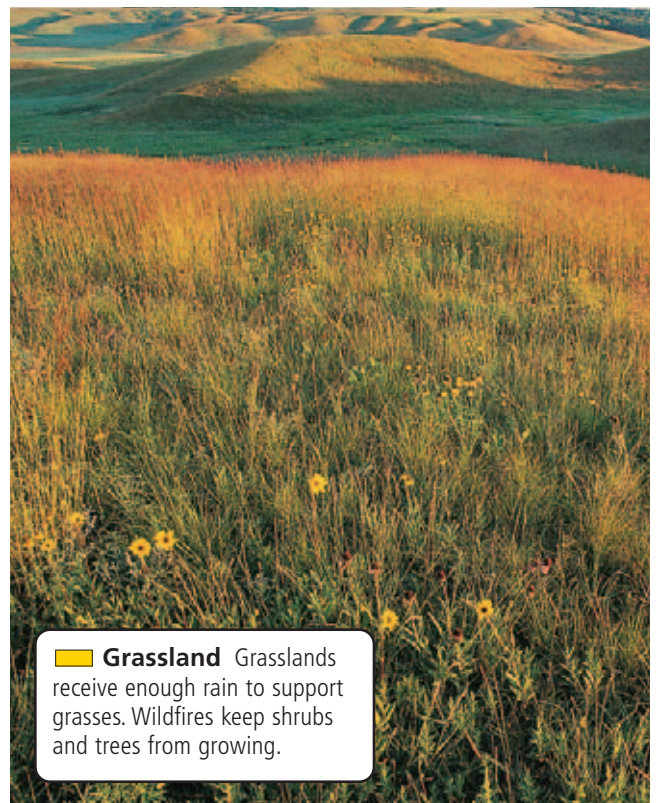
Some deserts are cold and some deserts are hot, but all deserts are characterized by their dry soil. Less than 25 centimeters of rain falls each year in a desert. Desert plants, like the cactus, and desert animals, like the collared lizard, can get by on very little water. Small burrowing animals like the kangaroo rat and ground squirrel are part of desert ecosystems. Desert predators include snakes, owls, and foxes.

Grassland ecosystems develop in areas of moderate rainfall, generally from 50 to 90 centimeters each year. There is enough rain to support grasses, but too little rain to support forests. Periodic wildfires and droughts keep smaller shrubs and tree seedlings from growing. Summers in grassland ecosystems are warm, up to 30°C, but winters are cold.

Grasses do well in large open areas. The more rain a grassland ecosystem gets, the higher the grasses grow. These ecosystems support seed-eating rodents that make their burrows in the grassland soil. There are also large grazing animals, like bison, wild horses, gazelle, and zebra. Predators include wolves, tigers, and lions.



**Desert** Plants of the desert are adapted to survive in dry soil. Many must also survive high daytime temperatures.



**Grassland** Grasslands receive enough rain to support grasses. Wildfires keep shrubs and trees from growing.

## Temperate Forest and Tropical Forest

Trees need more water than smaller plants, shrubs, and grasses. So forest biomes are usually located in regions where more water is available. The taiga is a forest biome. There the coniferous trees survive on smaller amounts of precipitation because the cold weather limits evaporation. Across the middle latitudes, temperate forests grow where winters are short and 75 to 150 centimeters of precipitation fall each year. Near the equator, there are no winters. There, tropical forests grow where 200 to 450 centimeters of rain fall each year.

Most temperate forests are made up of deciduous trees, sometimes referred to as broadleaf trees. **Deciduous** (dih-SIHJ-oo-uhs) trees drop their leaves as winter approaches and grow new leaves in spring. The



**Temperate Forest**

Temperate forests contain many trees with leaves that change color and fall as winter approaches.



**Tropical Forest**

Tropical forests are warm enough that trees stay green during the entire year.

most common broadleaf trees in North American deciduous forests are oak, birch, beech, and maple. Temperate forests support a wide variety of animals. Animals like mice, chipmunks, squirrels, raccoons, and deer live off seeds, fruit, and insects. Predators include wolves, bobcats, foxes, and mountain lions.

Most temperate forests in North America are deciduous. However, the wet winters and dry summers in the Pacific Northwest support forests made up mostly of coniferous trees—redwoods, spruce, and fir. These forests are referred to as temperate rain forests. The largest trees in the United States are found in these temperate rain forests.

Tropical forests are located near the equator, where the weather is warm all year, around 25°C. The tropical rain forest is the wettest land biome, with a rainfall of 250 to 400 centimeters each year. The trees tend to have leaves year round. This provides an advantage because the soil is poor in nutrients. High temperatures cause materials to break down quickly, but there are so many plants the nutrients get used up just as quickly.

More types of animals, plants, and other organisms live in the tropical rain forest than anywhere else on Earth. The trees grow close together and support many tree-dwelling animals like monkeys, birds, insects, and snakes. There are even plants, like orchids and vines, that grow on top of the trees.



How does the variety of plants in a biome affect the variety of animals in a biome?

## INVESTIGATE Climate

### How can you graph climate data for your area?

#### PROCEDURE

- 1 Gather local data on the average monthly precipitation and the average monthly temperature for a 12-month period.
- 2 On graph paper, mark off 12 months along the x-axis. Make a y-axis for each side of the graph, marking one "Temperature (°C)" and the other "Precipitation (mm)."
- 3 Plot the average precipitation for each month as a bar graph.
- 4 Plot the average temperature for each month as a line graph.

#### WHAT DO YOU THINK?

- How much precipitation did the area receive overall?
- What is the temperature range for the area?

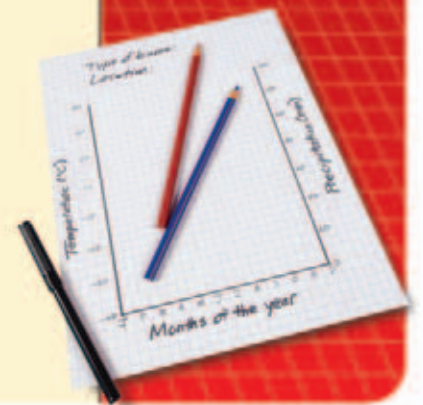
**CHALLENGE** Collect data for the same location, going back 10, 20, and 30 years ago. Graph the data for each of these and compare these graphs to your original graph. Has the climate in your area changed? How might severe changes in climate affect the plant and animal life in your area?

**SKILL FOCUS**  
Graphing data

#### MATERIALS

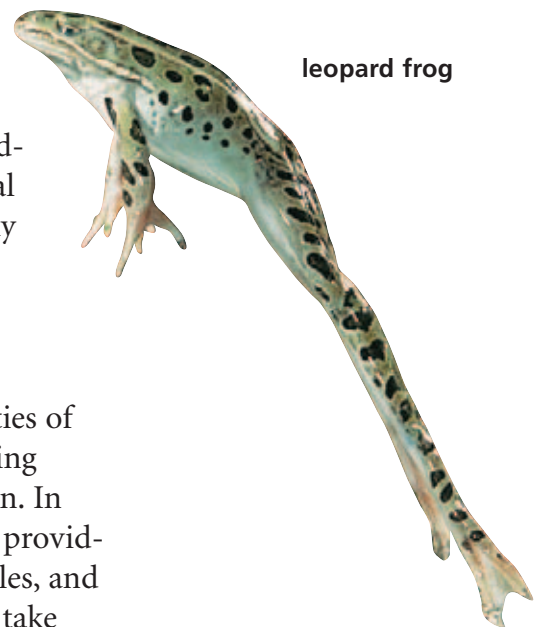
- graph data
- 2 colored pencils

**TIME**  
20 minutes



## Water covers most of Earth's surface.

Close to three-quarters of Earth's surface is covered by water. Water, or aquatic, biomes can be divided into two broad categories: freshwater biomes and saltwater biomes. Plants have a role as producers in the water biomes that are closely surrounded by land—in ponds and streams and wetlands, and in coastal areas. The food chains of deepwater ecosystems depend on tiny photosynthetic microorganisms called phytoplankton.



leopard frog

### Freshwater Biomes

The ecosystems of freshwater biomes are affected by the qualities of the landscape in which they are found. For example, the running water of streams and rivers results from differences in elevation. In shallow rivers, green algae and plants grow in from the banks, providing food for insects and snails that feed fish, salamanders, turtles, and frogs. Plants in a freshwater biome, like a stream or river, may take root in the soil under the water if the water is not too deep or moving too fast. Phytoplankton are not part of river ecosystems because of the moving water.

## Aquatic Biomes

**Freshwater biomes** include the still water of lakes, the running water of rivers, and estuaries where fresh and salt waters mix.

### Lakes and Ponds



### Estuaries



### Rivers and Streams



Ponds and lakes have still water. Ponds are shallow and support many plants as producers. The deeper lakes depend much more on phytoplankton. Ponds and lakes support many different insects, shellfish, snakes, fish, and the land animals that feed off them.

#### CHECK YOUR READING

Name two types of freshwater biomes.

Estuaries are water ecosystems that mark a transition between freshwater and saltwater biomes. An **estuary** is the lower end of a river that feeds into the ocean, where fresh water and salt water mix. Marshes and wetlands are two types of estuaries. Estuaries are sometimes referred to as the nurseries of the sea because so many marine animals travel into the calm waters of an estuary to reproduce. Seaweed, marsh grasses, shellfish, and birds all thrive in estuaries.

## Marine Biomes

Marine biomes are saltwater biomes. The three general marine biomes are coastal ocean, open ocean, and deep ocean. Beaches are part of the coastal ocean biome. Tidal pools also form along the coast as the tide comes in and goes out and the conditions constantly change. Organisms like crabs and clams are able to survive the ever-changing conditions to thrive in coastal areas.

Organisms in the open ocean receive less sunlight than in the coastal ocean, and the temperatures are colder. Many types of fish and



Find out more about land and aquatic biomes.

## Coastal



**Marine biomes** include rocky and sandy shores as well as the open ocean and the deep waters below, where little or no light can reach.

## Open Ocean



## Deep Ocean



other marine animals and floating seaweed live in the upper ocean. There are no plants in the open ocean. The producers at the bottom of the food chain are different types of phytoplankton.

The deep-ocean regions are much colder and darker than the upper ocean. In the deep ocean there is no sunlight available for photosynthesis. The animals in the deep ocean either feed on each other or on material that falls down from upper levels of the ocean. Many organisms in deep ocean biomes can only be seen with a microscope.

# 1.4 Review

## KEY CONCEPTS

1. In biomes located on land, abiotic factors are used to classify the different biome types. What are these abiotic factors?
2. Name a characteristic type of plant for each of the six land biomes.
3. Name six different aquatic biomes.

## CRITICAL THINKING

4. **Predict** If an ecosystem in the grassland biome started to receive less and less rainfall every year, what new biome would be established?
5. **Infer** Name some abiotic factors that affect aquatic biomes and ecosystems.

## CHALLENGE

6. **Apply** Use the map on page 31 to list the following four biomes in the order you would find them moving from the equator to the poles.
  - desert
  - taiga
  - tropical Forest
  - tundra