



UNIT 2

59

Earth's Biomes and Ecosystems

Big Idea

Matter and energy together support life within an environment.

Mangroves

What do you think?

Mangroves and Roseate Spoonbills are both found in Florida. How do organisms like these get and use matter and energy?



Roseate Spoonbill



Unit 2 Earth's Biomes and Ecosystems

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CITIZEN SCIENCE

It's Alive!

This garden is home to many vegetables and other plants.

1 Think About It

What role do plants play in your life?



2 Ask A Question

How do plants use matter and energy?
As a class, design a plan for a garden plot or window box garden in which the class can grow a variety of plants. Remember that plants have different growing periods and requirements.

Sketch It!

Draw your plan to show where each plant will be placed.

3 Apply Your Knowledge

A What do your plants need in order to grow?

B Which of the things you listed above are examples of matter? Which are examples of energy?

C Create and care for your classroom garden and observe the plant growth.



Take It Home

Describe an area in your community that is used for growing food. If there is no such area, initiate a plan to plant in an area that you think could be used.

Lesson 1

Land Biomes

ESSENTIAL QUESTION

What are land biomes?

By the end of this lesson, you should be able to describe the characteristics of different biomes that exist on land.

The North American prairie is an example of a grassland biome. It is home to grazing animals such as the bison.



Herd of thousands of bison used to roam the prairies. Bison became rare as people hunted them and developed the prairie into farmland.

Lesson Labs

Quick Labs

- Climate Determines Plant Life
- Identify Your Land Biome

Field Lab

- Survey of a Biome's Biotic and Abiotic Factors

Engage Your Brain

1 Compare How are the two biomes in the pictures at right different from each other?

2 Infer Which of these biomes gets more rain? Explain your answer.



Active Reading

3 Word Parts Parts of words that you know can help you find the meanings of words you don't know. The suffix *-ous* means "possessing" or "full of." Use the meanings of the root word and suffix to write the meaning of the term *coniferous tree*.

Root Word	Meaning
<i>conifer</i>	tree or shrub that produces cones

coniferous tree:

Vocabulary Terms

- biome
- desert
- grassland
- deciduous tree
- taiga
- coniferous tree

4 Apply As you learn the definition of each vocabulary term in this lesson, create your own definition or sketch to help you remember the meaning of the term.



Home Sweet Biome

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What is a biome?

If you could travel Earth from pole to pole, you would pass through many different biomes. A **biome** is a region of Earth where the climate determines the types of plants that live there. The types of plants in a biome determine the types of animals that live there. Deserts, grasslands, tundra, taiga, temperate forests, and tropical forests are all types of biomes.

What makes one biome different from another?

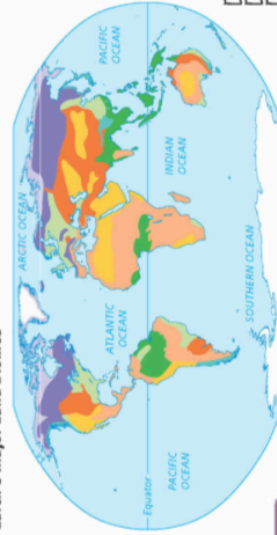
Each biome has a unique community of plants and animals. The types of organisms that can live in a biome depend on the biome's climate and other abiotic, or nonliving, factors.

Climate

Climate is the main abiotic factor that characterizes a biome. Climate describes the long-term patterns of temperature and precipitation in a region. The position of a biome on Earth affects its climate. Biomes that are closer to the poles receive less annual solar energy and have colder climates. Biomes that are near the equator receive more annual solar energy and have warmer climates. Biomes that are close to oceans often have wet climates.

The taiga is a northern latitude biome that has low average temperatures, nutrient-poor soil, and coniferous trees.

Earth's Major Land Biomes



Visualize It!

5 Predict Find the locations of the major land biomes on the map. Underline the names of two biomes that would have some of the coldest temperatures. Place a check mark next to the names of two biomes that would have some of the warmest temperatures.

- ☐ Desert
- ☐ Tropical grassland
- ☐ Temperate grassland
- ☐ Tropical rain forest
- ☐ Temperate deciduous forest
- ☐ Temperate rain forest
- ☐ Taiga
- ☐ Tundra

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Active Reading

6 Identify As you read, underline the abiotic factors besides climate that characterize a biome.

Other Abiotic Factors

Other abiotic factors that characterize a biome include soil type, amount of sunlight, and amount of water that is available. Abiotic factors affect which organisms can live in a biome.

Plant and Animal Communities

Adaptations are features that allow organisms to survive and reproduce. Plants and animals that live in a biome have adaptations to its unique conditions. For example, animals that live in biomes that are cold all year often grow thick fur coats. Plants that live in biomes with seasonal temperature changes lose their leaves and become inactive in winter. Plants that live in warm, rainy biomes stay green and grow all year long.

Visualize It!

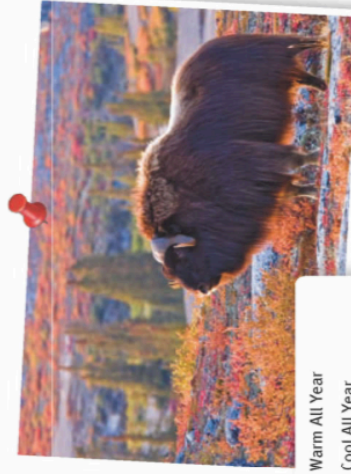
7 Infer Place a check mark in each box to predict the average temperature range for each of the biomes shown.



- ☐ Warm All Year
- ☐ Cool All Year
- ☐ Seasonal Temperatures



- ☐ Warm All Year
- ☐ Cool All Year
- ☐ Seasonal Temperatures



- ☐ Warm All Year
- ☐ Cool All Year
- ☐ Seasonal Temperatures

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Life in a Biome

How are ecosystems related to biomes?

Most biomes stretch across huge areas of land. Within each biome are smaller areas called ecosystems. Each *ecosystem* includes a specific community of organisms and their physical environment. A temperate forest biome can contain pond or river ecosystems. Each of these ecosystems has floating plants, fish, and other organisms that are adapted to living in or near water. A grassland biome can contain areas of small shrubs and trees. These ecosystems have woody plants, insects, and nesting birds.



Visualize It!

Three different ecosystems are shown in this temperate rain forest biome. Different organisms live in each of these ecosystems.

- 8 Identify** List three organisms that you see in the picture that are part of each ecosystem within the biome.



What are the major land biomes?

There are six major land biomes. These include tundra, taiga, desert, grassland, temperate forest, and tropical forest.



- Active Reading 9 Identify** Underline the abiotic features that characterize tundra and taiga biomes.

Tundra

Tundra has low average temperatures and very little precipitation. The ground contains permafrost, a thick layer of permanently frozen soil beneath the surface. Tundra is found in the Arctic and in high mountain regions. Tundra plants include mosses and woody shrubs. These plants have shallow roots, since they cannot grow into the permafrost. Tundra winters are dark, cold, and windy. Animals such as musk oxen have thick fur and fat deposits that protect them from the cold. Some animals, such as caribou, migrate to warmer areas before winter. Ground squirrels hibernate, or become dormant, underground.



Visualize It!

- 10 Describe** Below each picture, describe how organisms that you see are adapted to the biome in which they live.



Tundra



Taiga



Desert



11 Identify As you read, underline the characteristics of deserts.

Desert biomes are very dry. Some deserts receive less than 8 centimeters (3 inches) of precipitation each year. Desert soil is rocky or sandy. Many deserts are hot during the day and cold at night, although some have milder temperatures. Plants and animals in this biome have adaptations that let them conserve water and survive extreme temperatures. Members of the cactus family have needlelike leaves that conserve water. They also contain structures that store water. Many desert animals are active only at night. Some animals burrow underground or move into shade to stay cool during the day.



Visualize It!

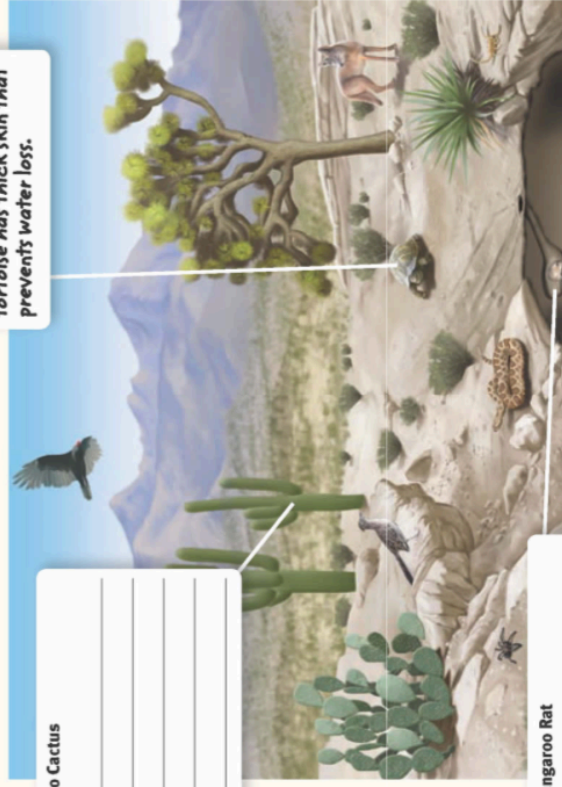
12 Describe List the ways that each plant or animal in the picture is adapted to the desert biome.

Saguaro Cactus

Kangaroo Rat

Desert Tortoise

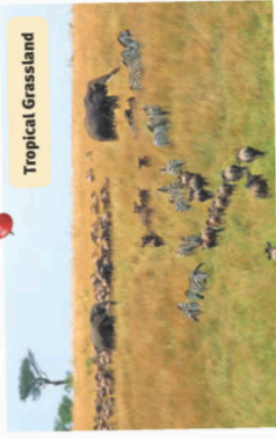
A tortoise can crawl into shade or retreat into its shell to avoid the heat. A tortoise has thick skin that prevents water loss.



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Tropical Grassland



Temperate Grassland



Tropical Grassland

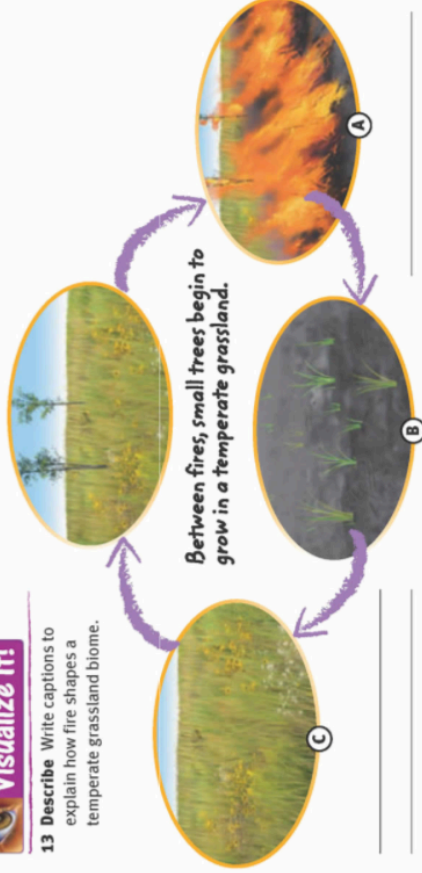
A **grassland** is a biome that has grasses and few trees. Tropical grasslands, such as the African savanna, have high average temperatures throughout the year. They also have wet and dry seasons. Thin soils support grasses and some trees in this biome. Grazing animals, such as antelope and zebras, feed on grasses. Predators such as lions hunt grazing animals. Animals in tropical grasslands migrate to find water during dry seasons. Plants in tropical grasslands are adapted to survive periodic fires.

Temperate Grassland

Temperate grasslands, such as the North American prairie, have moderate precipitation, hot summers, and cold winters. These grasslands have deep soils that are rich in nutrients. Grasses are the dominant plants in this biome. Bison, antelope, prairie dogs, and coyotes are common animals. Periodic fires sweep through temperate grasslands. These fires burn dead plant material and kill trees and shrubs. Grasses and other nonwoody plants are adapted to fire. Some of these plants regrow from their roots after a fire. Others grow from seeds that survived the fire.

Visualize It!

13 Describe Write captions to explain how fire shapes a temperate grassland biome.





Temperate Deciduous Forest

Temperate deciduous forests have moderate precipitation, hot summers, and cold winters. These forests are located in the northeastern United States, East Asia, and much of Europe. This biome has **deciduous trees**, which are broadleaf trees that drop their leaves as winter approaches. Fallen leaves decay and add organic matter to the soil, making it nutrient-rich. Songbirds nest in these forests during summer, but many migrate to warmer areas before winter. Animals such as chipmunks and black bears hibernate during winter. Deer and bobcats are active year-round.



14 Summarize Fill in the missing information on the cards to describe each of these temperate forest biomes.



Temperate Deciduous Forest

- A. Climate: _____
- B. Soil: _____
- C. Plants: _____
- D. Animals: _____



Temperate Rain Forest

Temperate rain forests have a long, cool wet season and a relatively dry summer. Temperate rain forests exist in the Pacific Northwest and on the western coast of South America. This biome is home to many coniferous trees, including Douglas fir and cedar. The forest floor is covered with mosses and ferns and contains nutrient-rich soil. Plants grow throughout the year in the temperate rain forest. Animals in this biome include spotted owls, shrews, elk, and cougars.



Temperate Rain Forest

- A. Climate: _____
- B. Soil: _____
- C. Plants: _____
- D. Animals: _____

Think Outside the Book Inquiry

15 Apply With a classmate, compare the adaptations of animals that migrate, hibernate, or stay active year-round in a temperate deciduous forest.

Tropical Rain Forest

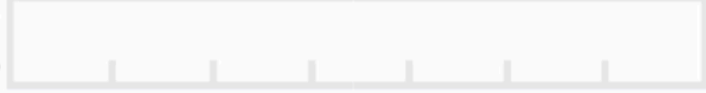
Tropical rain forests are located near Earth's equator. This biome is warm throughout the year. It also receives more rain than any other biome on Earth. The soil in tropical rain forests is acidic and low in nutrients. Even with poor soil, tropical rain forests have some of the highest biological diversity on Earth. Dense layers of plants develop in a tropical rain forest. These layers block sunlight from reaching the forest floor. Some plants such as orchids grow on tree branches instead of on the dark forest floor. Birds, monkeys, and sloths live in the upper layers of the rain forest. Leaf-cutter ants, jaguars, snakes, and anteaters live in the lower layers.



16 Display Color in the band labeled *Light Level* next to the picture of the tropical rain forest. Make the band darkest at the level where the forest would receive the least light. Make the band lightest at the level where the forest would receive the most light.



Light Level



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Lesson 1

Vocabulary

Define Draw a line to connect the following terms to their definitions.

1 a region that has a specific climate and a specific community of plants and animals



19 The plant below is adapted to what conditions?

17 What are the major land biomes?

Each biome can contain many ecosystems.



18 How are ecosystems different from biomes?

20 Predict Describe what might happen to the organisms in a desert if the climate changed and rainfall increased.

Sample answers: 17 tundra, taiga, desert, grassland, temperate forest, tropical forest; 18 Ecosystems are smaller areas within biomes that include communities of organisms and their nonliving environment.; 19 dry conditions

Lesson Review

Vocabulary

Define Draw a line to connect the following terms to their definitions.

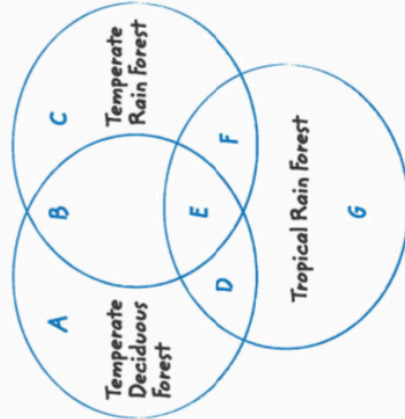
1 a region that has a specific climate and a specific community of plants and animals

2 a region with low average temperatures and little precipitation

3 long-term temperature and precipitation patterns in a region

Key Concepts

4 Identify What are the abiotic factors that help to characterize a biome?



8 Infer In which space on the Venn diagram would you write *coniferous trees*?

9 Analyze What is common among all three types of forests in the diagram?

6 Explain How does climate determine the organisms that live in a biome?

7 Summarize Why can many ecosystems exist in one biome?

10 Relate What biome do you think you live in? Explain your answer.

Aquatic Ecosystems

ESSENTIAL QUESTION

What are aquatic ecosystems?

By the end of this lesson, you should be able to describe the characteristics of marine, freshwater, and other aquatic ecosystems.

Coral reefs are coastal ocean ecosystems that are located in many tropical areas. Coral reefs have some of the highest biological diversity on Earth.

Lesson Labs

Quick Labs

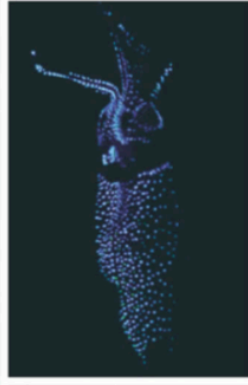
- Life in Moving Water
- Light Penetration and Water Clarity

Engage Your Brain

1 Predict Check T or F to show whether you think each statement is true or false.

- | | |
|--------------------------|--|
| T | F |
| <input type="checkbox"/> | <input type="checkbox"/> Wetlands can protect areas close to shorelines from flooding. |
| <input type="checkbox"/> | <input type="checkbox"/> Most ponds contain both salt water and fresh water. |
| <input type="checkbox"/> | <input type="checkbox"/> Plants and animals cannot live in fast-moving waters. |
| <input type="checkbox"/> | <input type="checkbox"/> The deep ocean is colder and darker than other marine ecosystems. |

2 Predict How do you think organisms like this squid are adapted to life in the deep ocean?



Active Reading

3 Synthesize You can often define an unknown word if you know the meaning of its word parts. Use the word parts and sentence below to make an educated guess about the meaning of the word *wetland*.

Word part	Meaning
wet-	having water or liquid on the surface
-land	solid part of Earth's surface

Example sentence:

Many species of birds and mammals rely on wetlands for food, water, and shelter.

wetland:

Vocabulary Terms

- wetland
- estuary

4 Identify As you read, place a question mark next to any words that you don't understand. When you finish reading the lesson, go back and review the text you marked. Work with a classmate to define the words that are still unclear.



Splash Splash

What are the major types of aquatic ecosystems?

Have you ever gone swimming in the ocean, or fishing on a lake? Oceans and lakes support many of the aquatic ecosystems on Earth. An *aquatic ecosystem* includes any water environment and the community of organisms that live there.

The three main types of aquatic ecosystems are freshwater ecosystems, estuaries, and marine ecosystems. Freshwater ecosystems can be found in rivers, lakes, and wetlands. Marine ecosystems are found in oceans. Rivers and oceans form estuaries where they meet at a coastline.



Visualize It!

5 Identify Fill in the major types of aquatic ecosystems in the picture.

Freshwater and marine ecosystems meet at a coastline. These ecosystems form estuaries, which have a mixture of fresh water and salt water.



B

6 Compare What is the main difference in the water that is in freshwater ecosystems, estuaries, and marine ecosystems?

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What abiotic factors affect aquatic ecosystems?

Abiotic factors are the nonliving things in an environment. The major abiotic factors that affect aquatic ecosystems include water temperature, water depth, amount of light, oxygen level, water pH, salinity (salt level), and the rate of water flow. An aquatic ecosystem may be influenced by some of these factors but not others. For example, a river would be influenced by rate of water flow but not typically by salinity.



Visualize It!

5 Identify Fill in the major types of aquatic ecosystems in the picture.

Freshwater and marine ecosystems meet at a coastline. These ecosystems form estuaries, which have a mixture of fresh water and salt water.



B

6 Compare What is the main difference in the water that is in freshwater ecosystems, estuaries, and marine ecosystems?

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Where are examples of freshwater ecosystems found?

Freshwater ecosystems contain water that has very little salt in it. Freshwater ecosystems are found in lakes, ponds, wetlands, rivers, and streams. Although freshwater ecosystems seem common, they actually contain less than one percent of all the water on Earth.

In Lakes and Ponds

Lakes and ponds are bodies of water surrounded by land. Lakes are larger than ponds. Some plants grow at the edges of these water bodies. Others live underwater or grow leaves that float on the surface. Protists such as algae and amoebas float in the water. Frogs and some insects lay eggs in the water, and their young develop there. Clams, bacteria, and worms live on the bottom of lakes and ponds and break down dead materials for food. Frogs, turtles, fish, and ducks have adaptations that let them swim in water.

Active Reading

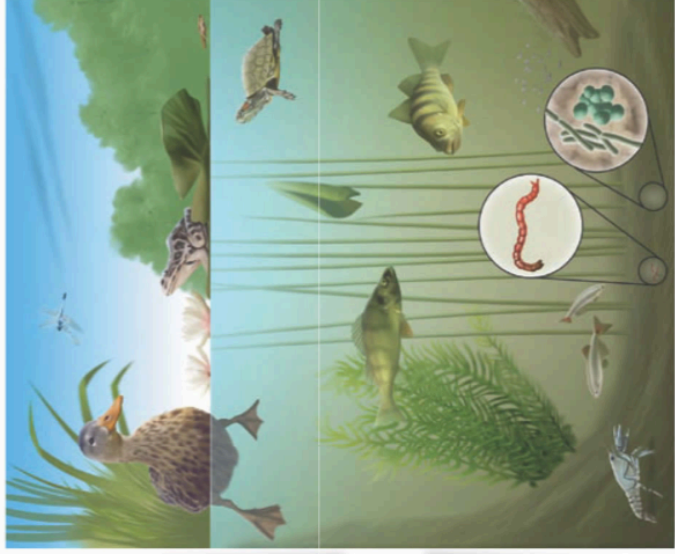
7 Identify As you read, underline the names of organisms that live in or near lakes and ponds.

Visualize It!

8 Describe Pick a plant and animal in the picture. Describe how each is adapted to a pond.

Plant

Animal



Lesson 2 Aquatic Ecosystems 77



In Wetlands

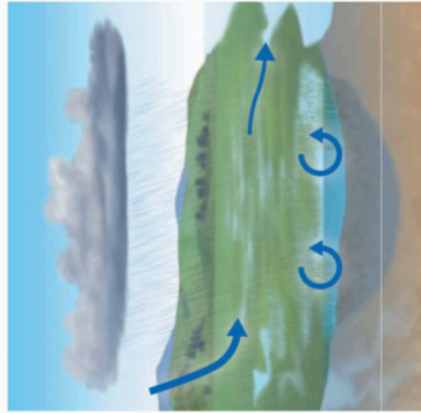
A **wetland** is an area of land that is saturated, or soaked, with water for at least part of the year. Bogs, marshes, and swamps are types of wetlands. Bogs contain living and decomposing mosses. Many grasslike plants grow in marshes. Swamps have trees and vines. Plants that live in wetlands are adapted to living in wet soil.

Wetlands have high species diversity. Common wetland plants include cattails, duckweed, sphagnum moss, sedges, orchids, willows, tamarack, and black ash trees. Animals found in wetlands include ducks, frogs, shrews, herons, and alligators. Water collects and slowly filters through a wetland. In this way, some pollutants are removed from the water. Since wetlands can hold water, they also protect nearby land and shore from floods and erosion.

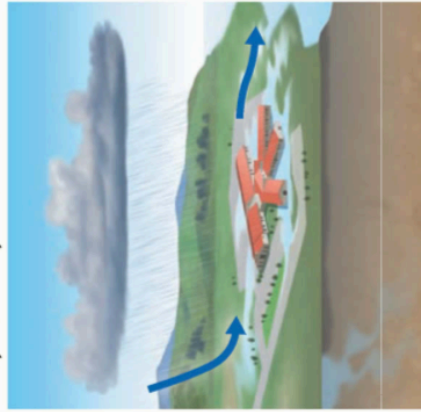
Visualize It!



Wetland



Development That Replaced Wetland



10 Describe What can happen when a wetland is replaced by a development in an area?

Think Outside the Book Inquiry

9 Apply Use library and Internet resources to put together an identification guide to common wetland plants.



In Rivers and Streams

Water moves in one direction in a stream. As water moves, it interacts with air and oxygen is added to the water. A large stream is called a river. Rivers and streams are home to many organisms, including fish, aquatic insects, and mosses. Freshwater ecosystems in streams can have areas of fast-moving and slow-moving water. Some organisms that live in fast-moving water have adaptations that let them resist being washed away. Immature black flies can attach themselves to rocks in a fast-moving stream. Rootlike rhizoids let mosses stick to rocks. In slow-moving waters of a stream, water striders are adapted to live on the water's surface.

Visualize It!



11 Match Match the correct captions to the pictures showing areas of fast-moving and slow-moving water.



- A** Water striders move across the surface of a pool of water in a river.
- B** Rocks form small waterfalls in areas of some streams.
- C** Aquatic plants can live below the surface of a river.
- D** Mosses can grow on the surface of rocks even in fast-moving water.

Inquiry

12 Infer Why might stream water have more oxygen in it than pond water does?

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Where River Meets Sea

What is an estuary?

An **estuary** is a partially enclosed body of water formed where a river flows into an ocean. Because estuaries have a mixture of fresh water and salt water, they support ecosystems that have a unique and diverse community of organisms. Seagrasses, mangrove trees, fish, oysters, mussels, and water birds all live in estuaries. Fish and shrimp lay eggs in the calm waters of an estuary. Their young mature here before moving out into the ocean. Many birds feed on the young shrimp and fish in an estuary.

Organisms in estuaries must be able to survive in constantly changing salt levels due to the rise and fall of tides. Some estuary grasses, such as smooth cordgrass, have special structures in their roots and leaves that let them get rid of excess salt.

Visualize It!

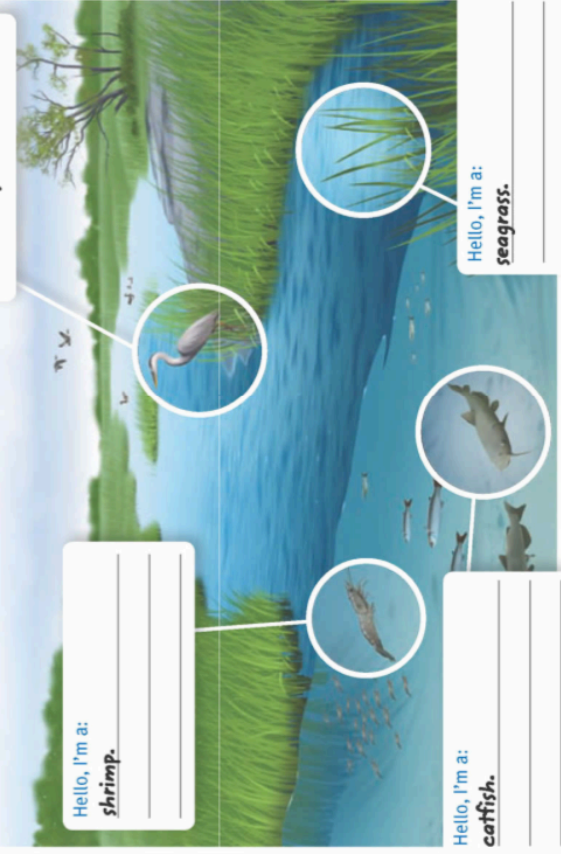
- 13 Describe** Fill in the rest of the name tags for each estuary organism. List at least one way the organism uses an estuary to survive.

Hello, I'm a:
shrimp.

Hello, I'm a:
catfish.

Hello, I'm a:

great blue heron. I hunt for the young fish that live in this estuary.



Hello, I'm a:
seagrass.



Why It Matters

Protecting Estuaries

Why are estuaries important? The mixture of salt water and nutrient-rich fresh water in an estuary supports breeding grounds for birds, commercial fish, and shellfish such as crabs and shrimp. The grasses in estuaries also protect coastal areas from erosion and flooding.



Oil Spill!

In 2010, a major oil spill occurred in the Gulf of Mexico. Oil flowed into the ocean for almost three months.



Coastal Damage
Estuaries along the northern Gulf Coast were affected. Oil killed birds and other animals. It soaked seagrasses and damaged fish and shellfish nurseries.

Cleaning Up

A large cleanup effort began after the spill. Continuing work will be important to restore ecosystems and protect fishing and tourism jobs in the area.

Extend

- 14 Explain** What are the economic benefits from estuaries?

- 15 Research** Find out about another damaged estuary ecosystem. How has the estuary been restored?

Inquiry

- 16 Hypothesize** Form a hypothesis about how the loss of estuaries can increase erosion along shorelines.