

**Chapter 4 Ecosystems and Communities****Summary****4-1 The Role of Climate**

Weather is the condition of Earth's atmosphere at a particular time and place. Climate is the average yearly condition of temperature and precipitation in a region. Climate is caused by latitude, winds, ocean currents, and the shape and height of landmasses. Climate affects ecosystems, because all organisms have certain needs for temperature and other aspects of climate.

Temperature on Earth stays within a range suitable for life due to the greenhouse effect. The greenhouse effect is the trapping of heat by gases in the atmosphere.

Differences in latitude determine the angle of sunlight striking Earth. This angle determines how much of the surface is heated. Differences in heating result in three main climate zones: polar, temperate, and tropical. Unequal heating of Earth's surface also causes winds and ocean currents. Winds and currents move heat through the biosphere.

**4-2 What Shapes an Ecosystem?**

Organisms in ecosystems are influenced by both biological, or biotic, and physical, or abiotic, factors. Biotic factors include all the living things with which organisms interact. Abiotic factors include temperature, soil type, and other nonliving factors. The area where an organism lives is called its habitat. A habitat includes both biotic and abiotic factors.

A niche consists of all the physical and biological conditions in which an organism lives and the way in which the organism uses those conditions. For example, a niche includes what an organism eats and how it gets its food.

Organisms in communities may interact in one of three ways: competition, predation, or symbiosis. Competition occurs when organisms try to use the same resources, or necessities of life. Competition often results in one organism dying out.

This is the basis of the competitive exclusion principle. This principle states that no two species can occupy the same niche in the same habitat at the same time. Predation occurs when one organism (the predator) captures and eats another (the prey). Symbiosis occurs when two species live closely together in one of three ways: mutualism, commensalism, or parasitism. In mutualism, both species benefit from the relationship. In commensalism, one species benefits and the other is neither helped nor harmed. In parasitism, one species benefits by living in or on the other and the other is harmed.

As an ecosystem ages, older inhabitants gradually die out and new organisms move in. The series of predictable changes that occurs in a community over time is called ecological succession. Primary succession occurs on bare rock surfaces where no soil exists. The first species to live in an area of primary succession are called pioneer species. Secondary succession occurs when a disturbance changes a community without removing the soil.

**4-3 Biomes**

A biome is a group of communities on land that covers a large area and is characterized by certain soil and climate. Within a biome, there may be microclimates. A microclimate is the climate of a small area that differs from the climate around it. Species may be found over a large or small area, depending on their tolerance. Tolerance is the ability to survive and reproduce under difficult conditions.

There are ten major biomes: tropical rain forest, tropical dry forest, tropical savanna, desert, temperate grassland, temperate woodland and shrubland, temperate forest, northwestern coniferous forest, boreal forest (or taiga), and tundra. Each biome has a unique set of abiotic factors and a characteristic collection of organisms.

In tropical rain forests, the tops of tall trees form a covering, called the canopy. Shorter trees and vines form another layer, called the understory. In other forests, trees may be deciduous, meaning they shed their leaves during a particular season each year. Coniferous forests have trees called conifers that produce seed cones. Temperate forests have soils rich in humus, which forms from decaying leaves and makes soil fertile. Tundra is characterized by permafrost, a layer of permanently frozen subsoil. Some areas, such as mountains and polar ice caps, do not fall neatly into the major biomes.

#### **4-4 Aquatic Ecosystems**

Aquatic ecosystems are determined mainly by the depth, flow, temperature, and chemistry of the water. In many aquatic ecosystems, tiny organisms called plankton are common. Plankton consist of phytoplankton and zooplankton. Phytoplankton are unicellular algae that use nutrients in water to produce food. They form the base of many aquatic food webs. Zooplankton are animals that feed on phytoplankton.

Freshwater ecosystems include flowing-water ecosystems (rivers and streams), standing-water ecosystems (lakes and ponds), and freshwater wetlands (bogs and swamps). In wetlands, water either covers the soil or is present at or near the surface for at least part of the year.

Estuaries are wetlands formed where rivers meet the sea. They contain a mixture of fresh and salt water. Most of the food produced in estuaries enters food webs as tiny pieces of organic matter, or detritus. Salt marshes are temperate estuaries. Mangrove swamps are tropical estuaries.

Marine ecosystems are found in the ocean. The ocean can be divided into zones based on how much light penetrates the water. The photic zone is the well-lit upper layer of water where photosynthesis can occur. The aphotic zone is the permanently dark lower layer of water where only chemosynthesis can occur.

The ocean also can be divided into three zones based on depth and distance from shore: the intertidal zone, coastal ocean, and open ocean. The intertidal zone is exposed to the rise and fall of tides each day. This may lead to zonation, or horizontal distribution of different types of organisms. Coastal ocean is the relatively shallow border of water that surrounds the continents. Kelp forests and coral reefs are found in coastal ocean. Open ocean consists of the rest of the ocean. Nutrients are scarce in open ocean, and fish are the dominant animals. The ocean floor is the benthic zone. Organisms that live on the ocean floor are called benthos.

**Chapter 4 Ecosystems and Communities**

**Section 4-1 The Role of Climate (pages 87-89)**

**Key Concepts**

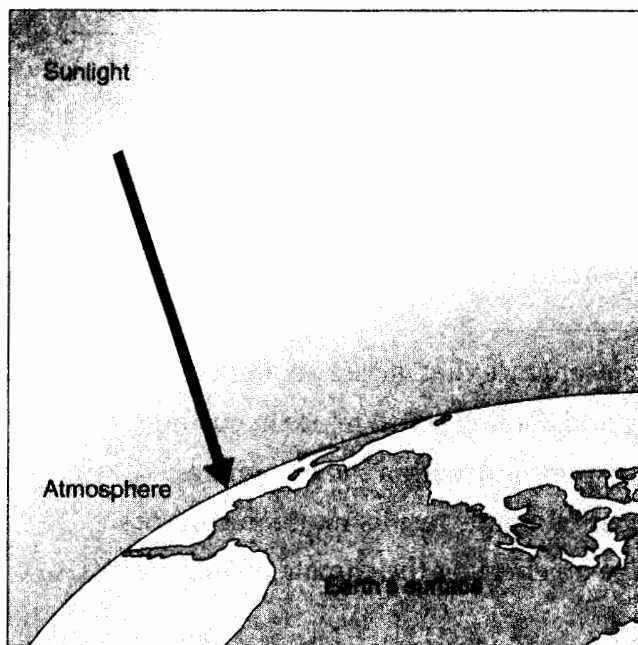
- How does the greenhouse effect maintain the biosphere's temperature range?
- What are Earth's three main climate zones?

**What Is Climate? (page 87)**

1. How is weather different from climate? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. What factors cause climate? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**The Greenhouse Effect (pages 87-88)**

3. Circle the letter of the world's insulating blanket.  
a. oxygen    b. the atmosphere    c. the oceans    d. solar energy
4. Complete the illustration of the greenhouse effect by showing in arrows and words what happens to the sunlight that hits Earth's surface.



5. What effect do carbon dioxide, methane, and a few other atmospheric gases have on Earth's temperature? \_\_\_\_\_
6. What is the greenhouse effect? \_\_\_\_\_

**The Effect of Latitude on Climate (page 88)**

7. Why does solar radiation strike different parts of Earth's surface at an angle that varies throughout the year? \_\_\_\_\_
8. Circle the letter of where the sun is almost directly overhead at noon all year.  
 a. the North Pole    b. China    c. the equator    d. the South Pole
9. Why does Earth have different climate zones? \_\_\_\_\_

10. Complete the table about Earth's three main climate zones.

**MAIN CLIMATE ZONES**

Climate Zone	Location	Climate Characteristics
	Areas around North and South poles	
	Between the polar zones and the tropics	
	Near the equator	

**Heat Transport in the Biosphere (page 89)**

11. What force drives winds and ocean currents? \_\_\_\_\_
12. The process in which water rises toward the surface in warmer regions is called \_\_\_\_\_.
13. Circle the letter of each sentence that is true about ocean currents.
  - a. Patterns of heating and cooling result in ocean currents.
  - b. Ocean currents transport heat within the biosphere.
  - c. Surface water moved by winds results in ocean currents.
  - d. Ocean currents have no effect on the climate of landmasses.

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## Section 4-2 What Shapes an Ecosystem? (pages 90-97)

### Key Concepts

- How do biotic and abiotic factors influence an ecosystem?
- What interactions occur within communities?
- What is ecological succession?

### Biotic and Abiotic Factors (page 90)

1. Complete the table about factors that influence ecosystems.

**FACTORS THAT INFLUENCE ECOSYSTEMS**

Type of Factor	Definition	Examples
Biotic factors		
Abiotic factors		

2. What do the biotic and abiotic factors together determine? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### The Niche (pages 91-92)

3. What is a niche? \_\_\_\_\_  
 \_\_\_\_\_
4. In what ways is food part of an organism's niche? \_\_\_\_\_  
 \_\_\_\_\_
5. Circle the letter of each sentence that is true about niches.
  - a. Different species can share the same niche in the same habitat.
  - b. No two species can share the same niche in the same habitat.
  - c. Two species in the same habitat have to share a niche to survive.
  - d. Different species can occupy niches that are very similar.

### Community Interactions (pages 92-93)

6. When does competition occur? \_\_\_\_\_  
 \_\_\_\_\_
7. What is a resource? \_\_\_\_\_
8. What is often the result of direct competition in nature? \_\_\_\_\_  
 \_\_\_\_\_

9. What is the competitive exclusion principle? \_\_\_\_\_  
 \_\_\_\_\_
10. What is predation? \_\_\_\_\_  
 \_\_\_\_\_
11. When predation occurs, what is the organism called that does the killing and eating, and what is the food organism called? \_\_\_\_\_  
 \_\_\_\_\_
12. What is symbiosis? \_\_\_\_\_  
 \_\_\_\_\_
13. Complete the table about main classes of symbiotic relationships.

**MAIN CLASSES OF SYMBIOTIC RELATIONSHIPS**

Class	Description of Relationship
Mutualism	
Commensalism	
Parasitism	

14. The organism from which a parasite obtains nutritional needs is called a(an) \_\_\_\_\_.
15. Circle the letter of each sentence that is true of parasites.
- a. They generally weaken but do not kill their host.
  - b. They obtain all or part of their nutritional needs from the host.
  - c. They neither help nor harm the host.
  - d. They are usually smaller than the host.

**Ecological Succession (pages 94–97)**

16. What is ecological succession? \_\_\_\_\_  
 \_\_\_\_\_
17. What is primary succession? \_\_\_\_\_  
 \_\_\_\_\_
18. The first species to populate an area when primary succession begins are called \_\_\_\_\_.
19. When a disturbance changes a community without removing the soil, what follows?  
 \_\_\_\_\_  
 \_\_\_\_\_
20. An area that was once referred to as a climax community may appear to be permanent, but what might cause it to undergo change? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Section 4-3 Biomes (pages 98-105)



### Key Concept

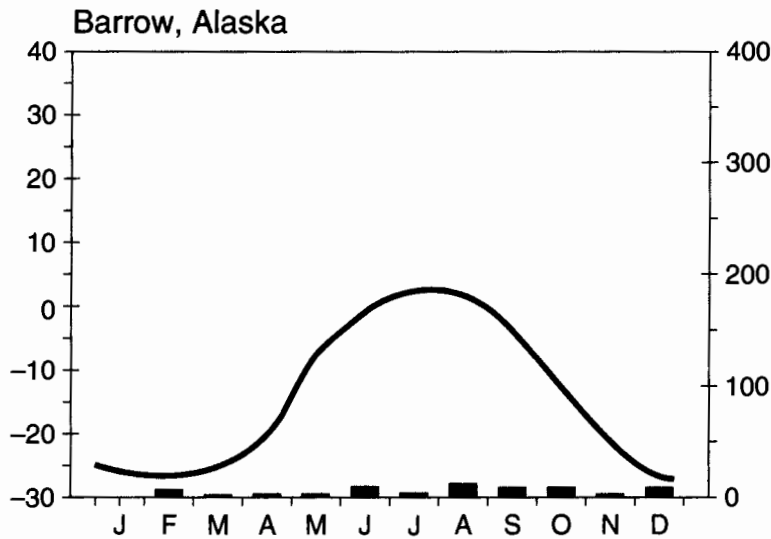
- What are the unique characteristics of the world's major biomes?

### Introduction (page 98)

1. What is a biome? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### Biomes and Climate (page 98)

2. What does a climate diagram summarize? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
3. Complete the climate diagram by adding labels to the bottom and both sides of the graph to show what the responding variables are.



4. On a climate diagram, what does the line plot, and what do the vertical bars show?  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
5. What is a microclimate? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**The Major Biomes (pages 99–104)**

6. Circle the letter of each sentence that is true about how each of the world’s major biomes is defined.
- a. Each is defined by a unique set of abiotic factors.
  - b. Each has a characteristic ecological community.
  - c. Each is defined by the country it is in.
  - d. Each is particularly defined by climate.

Use the map in Figure 4–11 on page 99 of your textbook to match the biome with its geographic distribution.

Biome	Geographic Distribution
_____ 7. Tropical rain forest	a. Forest biome that occurs almost exclusively in the Northern Hemisphere
_____ 8. Tundra	b. Biome that occurs on or near the equator
_____ 9. Boreal forest	c. Biome that occurs near or above 60°N latitude

10. Complete the table about layers of a tropical rain forest.

**LAYERS OF A TROPICAL RAIN FOREST**

Layer	Definition
	Dense covering formed by the leafy tops of tall trees
	Layer of shorter trees and vines

11. In what kind of place do tropical dry forests grow? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
12. What is a deciduous tree? \_\_\_\_\_  
 \_\_\_\_\_
13. What is another name for tropical savannas? \_\_\_\_\_
14. Is the following sentence true or false? Savannas are found in large parts of eastern Africa. \_\_\_\_\_
15. Circle the letter of each sentence that is true about deserts.
- a. They are hot, day and night.
  - b. The soils are rich in minerals but poor in organic material.
  - c. Cactuses and other succulents are dominant plants.
  - d. Reptiles are the only wildlife.
16. What amount of annual precipitation defines a desert biome? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

17. What factors maintain the characteristic plant community of temperate grasslands?

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18. Why is fire a constant threat in temperate woodland and shrubland? \_\_\_\_\_

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19. Communities that are dominated by shrubs are also known as \_\_\_\_\_.

20. What kinds of trees do temperate forests contain? \_\_\_\_\_

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21. What is a coniferous tree? \_\_\_\_\_

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22. What is humus? \_\_\_\_\_

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23. What is the geographic distribution of the northwestern coniferous forest?

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24. Boreal forests are also called \_\_\_\_\_.

25. What are the seasons like in a boreal forest? \_\_\_\_\_

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26. Circle the letter of each sentence that is true about boreal forests.

- a. Dominant plants include spruce and fir.
- b. They have very high precipitation.
- c. They have soils that are rich in humus.
- d. Dominant wildlife includes moose and other large herbivores.

27. What is permafrost? \_\_\_\_\_

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28. What happens to the ground in tundra during the summer? \_\_\_\_\_

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29. Why are tundra plants small and stunted? \_\_\_\_\_

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**Other Land Areas (page 105)**

30. When are the polar regions cold? \_\_\_\_\_  
\_\_\_\_\_
31. What plants and algae can be found in the polar ice regions? \_\_\_\_\_  
\_\_\_\_\_
32. In the north polar region, what are the dominant animals? \_\_\_\_\_  
\_\_\_\_\_
33. The abiotic and biotic conditions of mountain ranges vary with \_\_\_\_\_.
34. Number the sequence of conditions you would find as you moved from the base to the summit of a mountain. Number the conditions at the base 1.
- \_\_\_\_\_ a. Stunted vegetation like that in tundra
  - \_\_\_\_\_ b. Grassland
  - \_\_\_\_\_ c. Forest of spruce and other conifers
  - \_\_\_\_\_ d. Open woodland of pines

**Reading Skill Practice**

You can often increase your understanding of what you've read by making comparisons. A compare-and-contrast table helps you to do this. On a separate sheet of paper, make a table to compare the major land biomes you read about in Section 4-3. The characteristics that you might use to form the basis of your comparison could include a general description, abiotic factors, dominant plants, dominant wildlife, and geographic distribution. For more information about compare-and-contrast tables, see Organizing Information in Appendix A of your textbook.

## Section 4-4 Aquatic Ecosystems (pages 106-112)



### Key Concepts

- What are the main factors that govern aquatic ecosystems?
- What are the two types of freshwater ecosystems?
- What are the characteristics of the different marine zones?

### Introduction (page 106)

1. Aquatic ecosystems are primarily determined by what characteristics of the overlying water?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  - d. \_\_\_\_\_
2. What does the depth of the water determine? \_\_\_\_\_  
\_\_\_\_\_
3. What does water chemistry primarily refer to? \_\_\_\_\_  
\_\_\_\_\_

### Freshwater Ecosystems (pages 106-107)

4. What are the two main types of freshwater ecosystems?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
5. Where do flowing-water ecosystems originate? \_\_\_\_\_  
\_\_\_\_\_
6. How does the circulating water in a standing-water ecosystem affect the ecosystem? \_\_\_\_\_  
\_\_\_\_\_
7. What is plankton? \_\_\_\_\_  
\_\_\_\_\_
8. Complete the table about kinds of plankton.

**KINDS OF PLANKTON**

Kind	Organisms	How Nutrition Obtained
	Single-celled algae	
	Planktonic animals	

9. What is a wetland? \_\_\_\_\_  
\_\_\_\_\_

10. What is brackish water? \_\_\_\_\_
11. What are three main types of freshwater wetlands?  
a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_
12. What distinguishes a marsh from a swamp? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Estuaries (page 108)**

13. What are estuaries? \_\_\_\_\_  
\_\_\_\_\_
14. Tiny pieces of decaying plants and animals make up the \_\_\_\_\_ that provides food for organisms at the base of an estuary's food web.
15. Circle the letter of each sentence that is true about estuaries.  
a. Most primary production is consumed by herbivores.  
b. They contain a mixture of fresh water and salt water.  
c. Sunlight can't reach the bottom to power photosynthesis.  
d. They are affected by the rise and fall of ocean tides.
16. What are salt marshes? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
17. What are mangrove swamps, and where are they found? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Marine Ecosystems (pages 109–112)**

18. What is the photic zone of the ocean? \_\_\_\_\_  
\_\_\_\_\_
19. The permanently dark zone below the photic zone is called the \_\_\_\_\_.
20. What are the three main vertical divisions of the ocean based on the depth and distance from the shore?  
a. \_\_\_\_\_  
b. \_\_\_\_\_  
c. \_\_\_\_\_

21. Circle the letter of each sentence that is true about the intertidal zone.
- a. Organisms there are exposed to extreme changes in their surroundings.
  - b. The rocky intertidal zones exist in temperate regions.
  - c. Organisms are battered by currents but not by waves.
  - d. Competition among organisms often leads to zonation.
22. What is zonation? \_\_\_\_\_  
\_\_\_\_\_
23. What are the boundaries of the coastal ocean? \_\_\_\_\_  
\_\_\_\_\_
24. Why is the coastal ocean often rich in plankton and many other organisms?  
\_\_\_\_\_  
\_\_\_\_\_
25. A huge forest of giant brown algae in the coastal ocean is a(an)  
\_\_\_\_\_.
26. Circle the letter of each sentence that is true about coral reefs.
- a. The coasts of Florida and Hawaii have coral reefs.
  - b. The primary structure of coral reefs is made of the skeletons of coral animals.
  - c. Almost all growth in a coral reef occurs within 40 meters of the surface.
  - d. Only a few organisms are able to live near coral reefs.
27. What are the boundaries of the open ocean? \_\_\_\_\_  
\_\_\_\_\_
28. The benthic zone covers the ocean \_\_\_\_\_.
29. What are the boundaries of the benthic zone? \_\_\_\_\_  
\_\_\_\_\_
30. Organisms that live attached to or near the bottom of the ocean are called  
\_\_\_\_\_.

**Chapter 4 Ecosystems and Communities**

**Vocabulary Review**

**Multiple Choice** *In the space provided, write the letter of the answer that best completes each sentence.*

- \_\_\_\_\_ 1. The situation in which atmospheric gases trap the sun's heat and keep Earth's surface warm is called
  - a. weather.
  - b. greenhouse effect.
  - c. climate.
  - d. primary succession.
  
- \_\_\_\_\_ 2. Earth's three main climate zones are the result of
  - a. latitude and angle of heating.
  - b. precipitation and temperature.
  - c. winds and ocean currents.
  - d. air masses and mountains.
  
- \_\_\_\_\_ 3. An example of a biotic factor is
  - a. air temperature.
  - b. availability of water.
  - c. soil type.
  - d. soil organisms.
  
- \_\_\_\_\_ 4. The type of community interaction that involves one species living in or on another organism and harming the other organism is called
  - a. commensalism.
  - b. parasitism.
  - c. competition.
  - d. mutualism.
  
- \_\_\_\_\_ 5. A group of communities on land that covers a large area and is characterized by certain soil and climate is referred to as a(an)
  - a. niche.
  - b. wetland.
  - c. biome.
  - d. habitat.

**Completion** *Fill in the blanks with terms from Chapter 4.*

- 6. The average yearly condition of temperature and precipitation in a region is called \_\_\_\_\_.
  
- 7. A physical factor that influences an ecosystem is called a(an) \_\_\_\_\_.
  
- 8. When one organism captures and eats another it is referred to as \_\_\_\_\_.
  
- 9. The first species to live in an area of primary succession are called \_\_\_\_\_.
  
- 10. The area where an organism lives is its \_\_\_\_\_.
  
- 11. The ability of organisms to survive and reproduce under less than optimal conditions is called \_\_\_\_\_.
  
- 12. The well-lit upper layer of ocean water is known as the \_\_\_\_\_.
  
- 13. Kelp forests are found in the ocean zone called \_\_\_\_\_.
  
- 14. Organisms that live on the ocean floor are referred to as \_\_\_\_\_.
  
- 15. Zonation occurs in the ocean zone called the \_\_\_\_\_.