

Biomes

Say Thanks to the Authors

Click <http://www.ck12.org/saythanks>

(No sign in required)



To access a customizable version of this book, as well as other interactive content, visit www.ck12.org

CK-12 Foundation is a non-profit organization with a mission to reduce the cost of textbook materials for the K-12 market both in the U.S. and worldwide. Using an open-content, web-based collaborative model termed the **FlexBook®**, CK-12 intends to pioneer the generation and distribution of high-quality educational content that will serve both as core text as well as provide an adaptive environment for learning, powered through the **FlexBook Platform®**.

Copyright © 2015 CK-12 Foundation, www.ck12.org

The names “CK-12” and “CK12” and associated logos and the terms “**FlexBook®**” and “**FlexBook Platform®**” (collectively “CK-12 Marks”) are trademarks and service marks of CK-12 Foundation and are protected by federal, state, and international laws.

Any form of reproduction of this book in any format or medium, in whole or in sections must include the referral attribution link <http://www.ck12.org/saythanks> (placed in a visible location) in addition to the following terms.

Except as otherwise noted, all CK-12 Content (including CK-12 Curriculum Material) is made available to Users in accordance with the Creative Commons Attribution-Non-Commercial 3.0 Unported (CC BY-NC 3.0) License (<http://creativecommons.org/licenses/by-nc/3.0/>), as amended and updated by Creative Commons from time to time (the “CC License”), which is incorporated herein by this reference.

Complete terms can be found at <http://www.ck12.org/terms>.

Printed: January 20, 2015

flexbook
next generation textbooks



CHAPTER 1

Biomes

Lesson Objectives

- Define biome.
- Explain how climate affects terrestrial biomes, and give examples of terrestrial biomes.
- Identify freshwater and marine biomes and relate them to sunlight and nutrients.

Lesson Vocabulary

- aphotic zone
- aquatic biome
- biome
- climate
- freshwater biome
- marine biome
- photic zone
- terrestrial biome

Introduction

Look at the two photos in **Figure 1.1**. The left photo shows a forest in South Carolina. The right photo shows Death Valley, a desert in California. Both places are found at about the same latitude, or distance from the equator. However, in many other ways, the two places could hardly be more different. What explains the differences? The South Carolina forest is near an ocean, giving it a wet climate. Death Valley is the rain shadow of mountains, giving it a very dry climate.



FIGURE 1.1

Two locations in the US at about 35 degrees North latitude: South Carolina forest (left) and California desert (right).

The two photos in **Figure 1.1** represent two different biomes. A biome is a group of similar ecosystems with the same general abiotic factors and primary producers. Producers are organisms that produce food for themselves and other organisms. Biomes may be terrestrial or aquatic.

Terrestrial Biomes

Terrestrial biomes are land-based biomes. They range from arctic tundra to tropical rainforests. **Figure 1.2** shows the locations of the world's major terrestrial biomes.

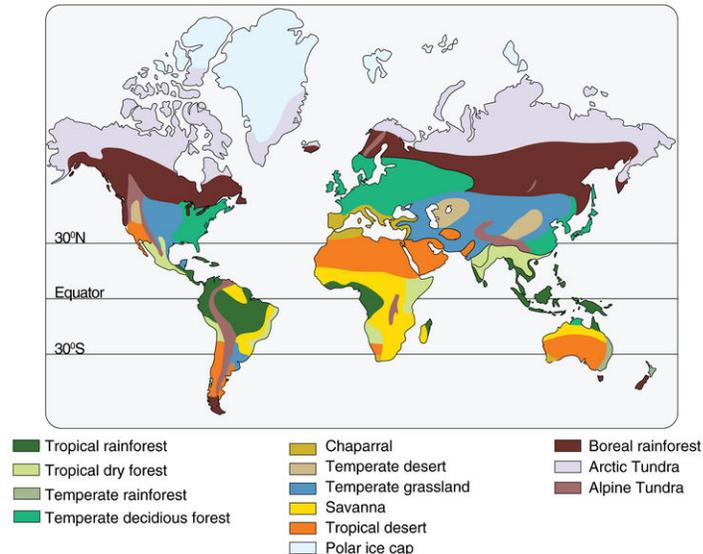


FIGURE 1.2

Major terrestrial biomes

Terrestrial Biomes and Climate

Plants are the primary producers in terrestrial biomes. They make food for themselves and other organisms by photosynthesis. The major plants in a given biome, in turn, help determine the types of animals and other organisms that can live there.

Which plants grow in a given biome depends mainly on climate. Climate is the average weather in a place over a long period of time. The major climatic factors affecting plant growth are temperature and moisture.

Examples of Terrestrial Biomes

You can read about three different terrestrial biomes in **Figure 1.3**: tropical rainforest, temperate grassland, and tundra. You can learn more about these and other terrestrial biomes by watching this video: <http://www.youtube.com/watch?v=dTaWsFct32g> .



MEDIA

Click image to the left or use the URL below.

URL: <http://www.ck12.org/flx/render/embeddedobject/140776>

**FIGURE 1.3**

Terrestrial biomes include tropical rainforest, temperate grassland, and tundra.

Aquatic Biomes

Aquatic biomes are water-based biomes. They include both freshwater biomes, such as rivers and lakes, and marine biomes, which are salt-water biomes in the ocean. The primary producers in most aquatic biomes are phytoplankton. Phytoplankton consist of microscopic bacteria and tiny algae that make food by photosynthesis. Unlike terrestrial biomes, which are determined mainly by temperature and moisture, aquatic biomes are determined mainly by sunlight and dissolved substances in the water. These factors, in turn, depend mainly on depth of water and distance from shore.

Aquatic Biomes and Sunlight

Only the top 200 meters or so of water receive enough sunlight for photosynthesis. This part of the water is called the photic zone. Below 200 meters, there is too little sunlight for photosynthesis to take place. This part of the water is called the aphotic zone. In this zone, food must come from other sources. It may be made by chemosynthesis, in which microorganisms use energy in chemicals instead of sunlight to make food. Or, food may drift down from the water above.

Aquatic Biomes and Dissolved Substances

In addition to sunlight, aquatic producers also need dissolved oxygen and nutrients. Water near the surface generally contains more dissolved oxygen than deeper water. Many nutrients enter the water from the land. Therefore, water nearer shore usually contains more dissolved nutrients than water farther from shore.

Freshwater Zones

A lake is an example of a freshwater biome. Water in a lake generally forms three different zones based on water depth and distance from shore.

- The shallow water near the shore is called the littoral zone. It has diverse community of organisms. There is adequate light for photosynthesis and plenty of dissolved oxygen and nutrients. Producers include algae and aquatic plants (see **Figure 1.4**). Animals in this zone may include insects, crustaceans, fish, and turtles.
- The top layer of water farther from shore is called the limnetic zone. There is enough light for photosynthesis and plenty of dissolved oxygen. However, dissolved nutrients tend not to be as plentiful as they are in the littoral zone. Producers here are mainly phytoplankton. A variety of zooplankton and fish also occupy this zone.
- The deeper water of a lake makes up the profundal zone. There isn't enough light for photosynthesis in this zone, so most organisms here eat dead organisms that drift down from the water above. Organisms in the profundal zone may include clams, snails, and some species of fish.



FIGURE 1.4

Plants and algae are producers in the littoral zone along the shore of this lake in Iceland.

Ocean Zones

Zones in the oceans include the intertidal, pelagic, and benthic zones. The types of organisms found in these ocean zones are also determined by such factors as depth of water and distance from shore, among other factors.

One of the most familiar ocean zones is the intertidal zone. This is the narrow strip along a coastline that is covered by water at high tide and exposed to air at low tide. You can see an example of an intertidal zone in **Figure 1.5**. There are plenty of nutrients and sunlight in the intertidal zone. Producers here include phytoplankton and algae. Other organisms include barnacles, snails, crabs, and mussels. They must have adaptations for the constantly changing conditions in this zone.



FIGURE 1.5

Intertidal zone along the North Sea in the Netherlands

Other ocean zones are farther from shore in the open ocean. All the water in the open ocean is called the pelagic zone. It is further divided by depth:

- The top 200 meters of water is the photic zone. Producers here include seaweeds and phytoplankton. Other organisms are plentiful. They include zooplankton and animals such as fish, whales, and dolphins.
- Below 200 meters is the aphotic zone. There are no primary producers here because there isn't enough sunlight for photosynthesis. However, the water may be rich in nutrients because of dead organisms drifting down from above. Organisms that live here may include bacteria, sponges, sea anemones, worms, sea stars, and fish.
- The bottom of the ocean is called the benthic zone. It includes the sediments on the bottom of the ocean and the water just above it. Organisms living in this zone include clams and crabs. They may be few in number due to relatively scarce nutrients in this zone.
- There are many more organisms around deep-sea vents. Microorganisms use chemicals that pour out of the vents to make food by chemosynthesis. These producers support large numbers of other organisms, including

crustaceans and red tubeworms like those pictured in **Figure 1.6**.



FIGURE 1.6

Ocean vent biome

Lesson Summary

- A biome is a group of similar ecosystems with the same general abiotic factors and primary producers.
- Terrestrial biomes are determined mainly by temperature and moisture. Plants are the primary producers. Examples of terrestrial biomes include tropical rainforests, temperate grasslands, and tundra.
- Aquatic biomes are determined mainly by depth of water and distance from shore. They include freshwater and marine biomes.

Lesson Review Questions

Recall

1. What is a biome?
2. Identify three terrestrial biomes.
3. Describe the intertidal zone.

Apply Concepts

4. Randomly choose a location on the map in **Figure 1.2**. Identify its biome and then research that biome to find out what plants and animals you might find there.

Think Critically

5. Explain the relationship between climate and terrestrial biomes.
6. Compare and contrast the photic and aphotic zones of a body of water.

Points to Consider

In all biomes, ecosystems need a constant input of energy. Matter, on the other hand, is constantly recycled in ecosystems.

1. Where do most ecosystems get energy?
2. What are some examples of cycles of matter?

References

1. John Foxe (left); Roger469 (right). <http://commons.wikimedia.org/wiki/File:WaterFallsTableRockStatePark.jpg> (left); http://commons.wikimedia.org/wiki/File:Death_Valley,19820817,Stovepipe_Wells,Desert_dunes.jpg (right) . public domain
2. CK-12 Foundation. [CK-12 Foundation](#) . CC BY-NC 3.0
3. Flickr: lana.japan (L); Brian Kell (C); Alpine tundra: User:Fawcett5/Wikimedia Commons; Arctic tundra: Courtesy of U.S. Fish and Wildlife Service (R). <http://www.flickr.com/photos/13007595@N05/2697183159/> (L); http://commons.wikimedia.org/wiki/File:Oglala_National_Grassland.jpg (C); Alpine tundra: http://commons.wikimedia.org/wiki/File:Alpine_flora.png; Arctic tundra: http://commons.wikimedia.org/wiki/File:Tundra_coastal_vegetation_Alaska.jpg (R) . CC BY 2.0 (L); Public Domain (C R)
4. Axel Kristinsson. [http://commons.wikimedia.org/wiki/File:Elli%C3%B0avatn_\(5765818419\)_\(2\).jpg](http://commons.wikimedia.org/wiki/File:Elli%C3%B0avatn_(5765818419)_(2).jpg) . CC BY 2.0
5. Sonty567. http://commons.wikimedia.org/wiki/File:Bank_met_ondermeer_kokkels_mosselen_en_Japanse_oesters_in_de_Waddenzee_bij_Schiermonnikoog.jpg . public domain
6. NeMO 2007 Cruise Report, NOAA. http://commons.wikimedia.org/wiki/File:Palm_worms.jpg?fastccci_from=431092 . public domain