

Lesson Overview

4.4 Biomes

The Major Biomes



What abiotic and biotic factors characterize biomes?



Biomes are described in terms of abiotic factors like climate and soil type, and biotic factors like plant and animal life.

The Major Biomes

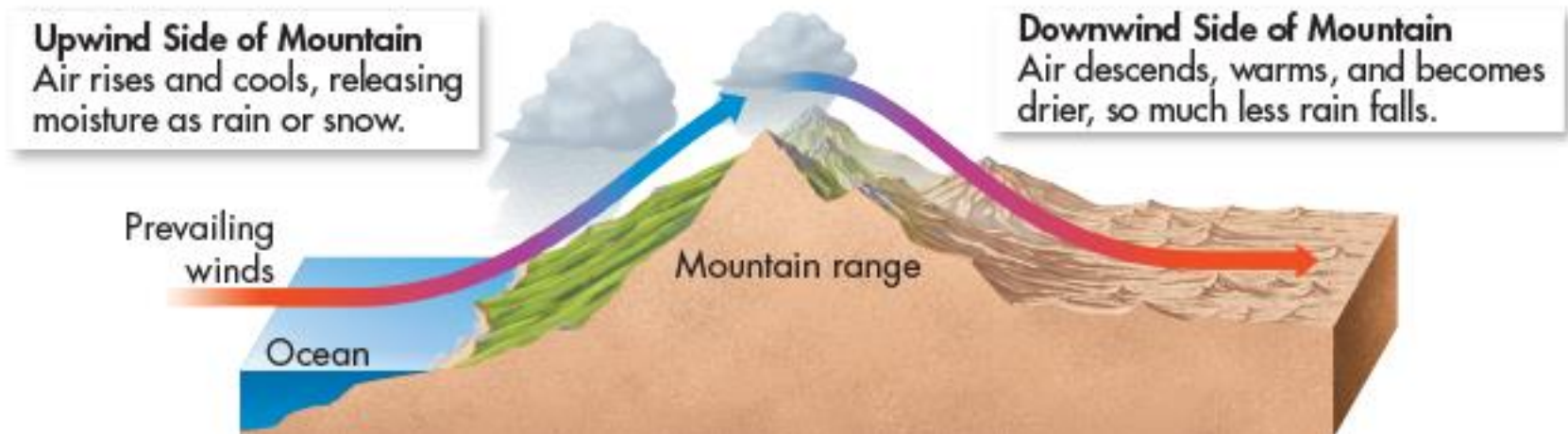
Latitude and the heat transported by winds are two factors that affect global climate.

Other factors, among them an area's proximity to an ocean or mountain range, also influence climate.

Regional Climates

Oregon borders the Pacific Ocean, and moist air carried by winds traveling west to east is pushed upward when it hits the Rocky Mountains.

This air expands and cools, causing the moisture in the air to condense and form clouds.

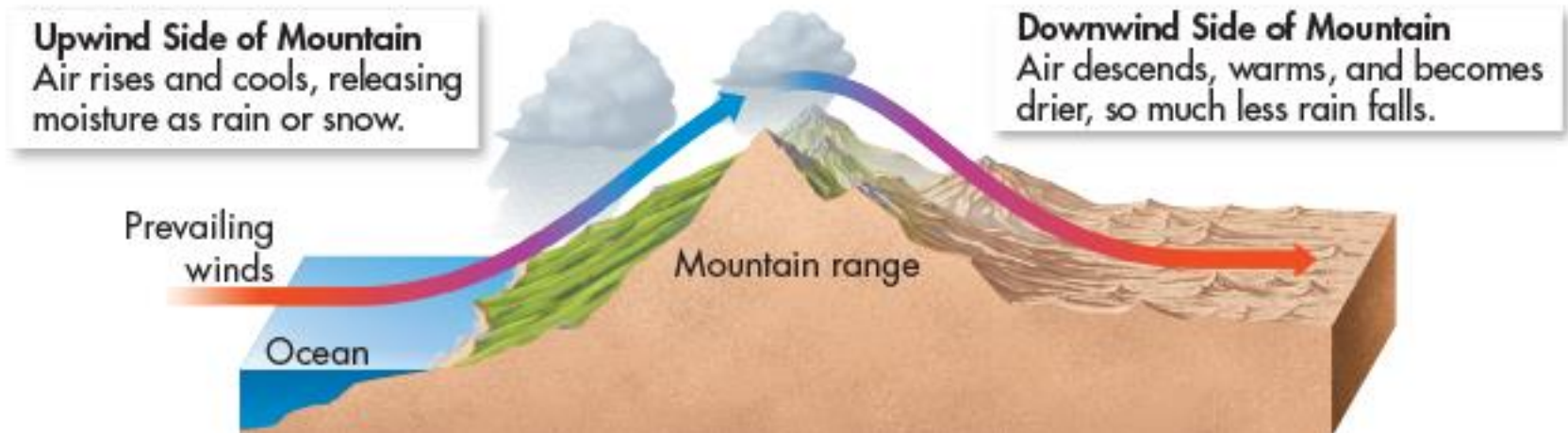


Regional Climates

The clouds drop rain or snow, mainly on the upwind side of the mountains.

As the air sinks on the downwind side of the mountain, it expands, warms, and absorbs moisture.

As a result, west and east Oregon have very different regional climates, and different climates mean different plant and animal communities.



Defining Biomes

Ecologists classify Earth's terrestrial ecosystems into at least ten different groups of regional climate communities called biomes.

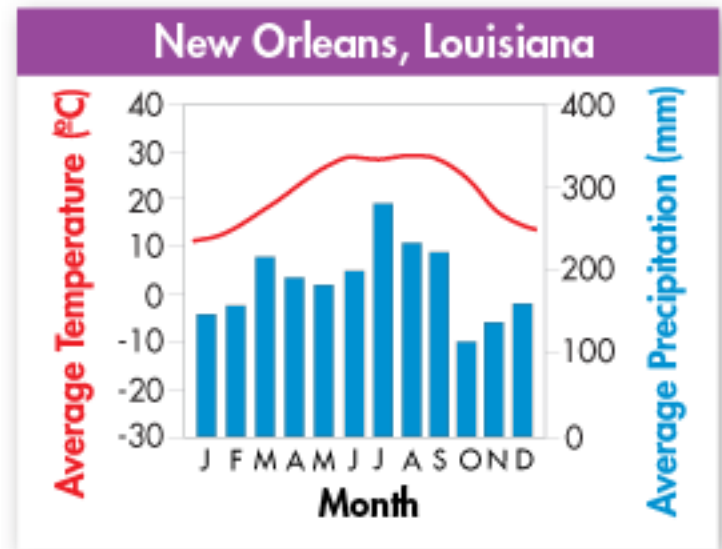
Biomes are described in terms of abiotic factors like climate and soil type, and biotic factors like plant and animal life.

Major biomes include tropical rain forest, tropical dry forest, tropical grassland/savanna/shrubland, desert, temperate grassland, temperate woodland and shrubland, temperate forest, northwestern coniferous forest, boreal forest, and tundra.

Defining Biomes

Each biome is associated with seasonal patterns of temperature and precipitation that can be summarized in a graph called a climate diagram.

A climate diagram shows the average temperature and precipitation at a given location during each month of the year. On this climate diagram, temperature is plotted as a red line, and precipitation is shown as vertical blue bars.



Defining Biomes

Organisms within each biome can be characterized by adaptations that enable them to live and reproduce successfully in the environment.

However, even within a defined biome, there is often considerable variation among plant and animal communities.

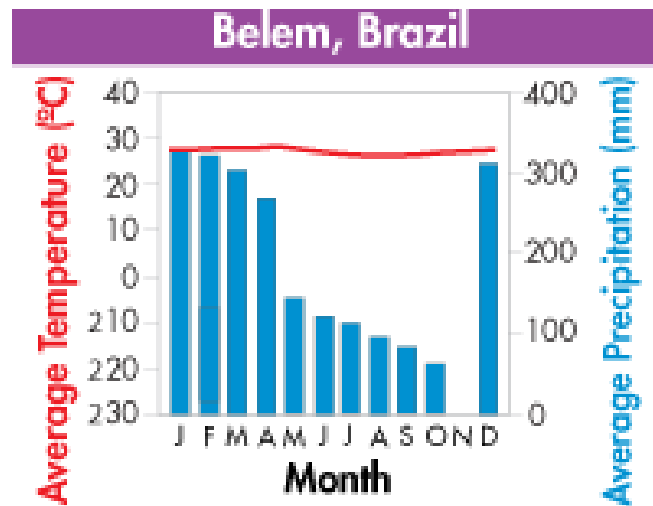
These variations can be caused by differences in exposure, elevation, or local soil conditions.

Local conditions also can change over time because of human activity or because of community interactions.

TROPICAL RAIN FOREST

Tropical rain forests are home to more species than all the other biomes combined.

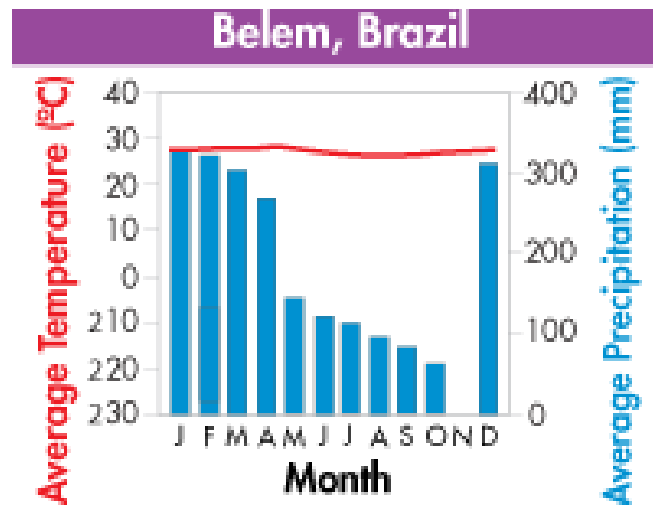
Rain forests get at least 2 meters of rain a year!



TROPICAL RAIN FOREST

Tall trees form a dense, leafy covering called a **canopy** from 50 to 80 meters above the forest floor. In the shade below the canopy, shorter trees and vines form a layer called the **understory**.

Organic matter on the forest floor is recycled and reused so quickly that the soil in most tropical rain forests is not very rich in minerals.

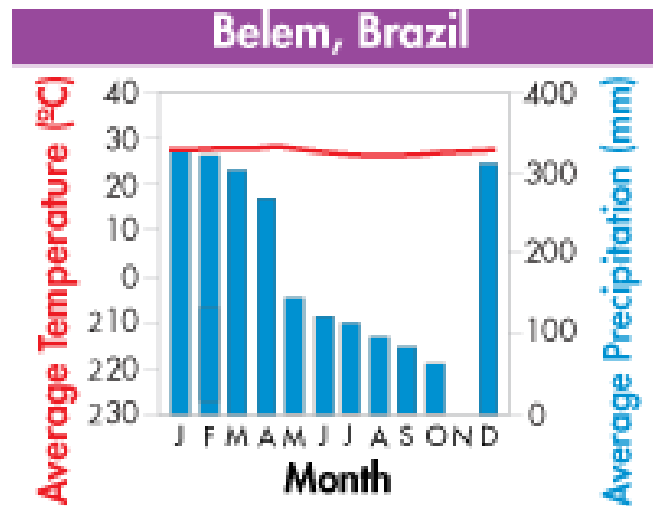


TROPICAL RAIN FOREST

Abiotic Factors:

Rain forests are hot and wet year-round.

They have thin, nutrient-poor soils that are subject to erosion.



TROPICAL RAIN FOREST

Biotic Factors – Plant Life

Understory plants compete for sunlight, so most have large leaves that maximize capture of limited light.

Tall trees growing in poor shallow soil often have buttress roots for support.

Epiphytic plants grow on the branches of tall plants as opposed to soil. This allows the epiphyte to take advantage of available sunlight while obtaining nutrients through its host.

TROPICAL RAIN FOREST

Biotic Factors – Animal Life

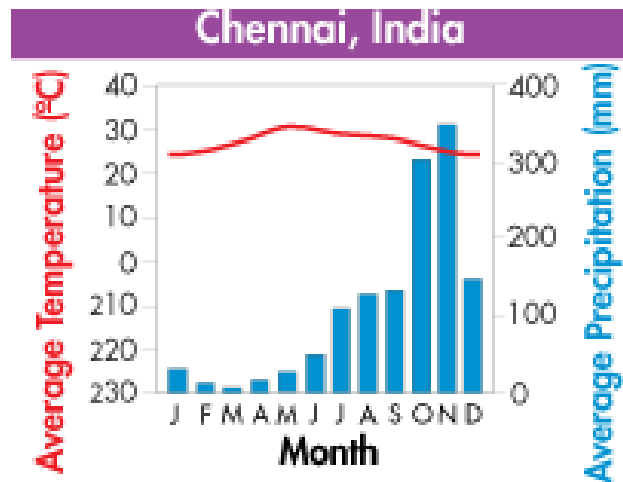
Animals are active all year. Many animals use camouflage to hide from predators, and some can change color to match their surroundings.

Animals that live in the canopy have adaptations for climbing, jumping, and/or flight.

TROPICAL DRY FOREST

Tropical dry forests grow in areas where rainy seasons alternate with dry seasons.

In most places, a short period of rain is followed by a prolonged period of drought.

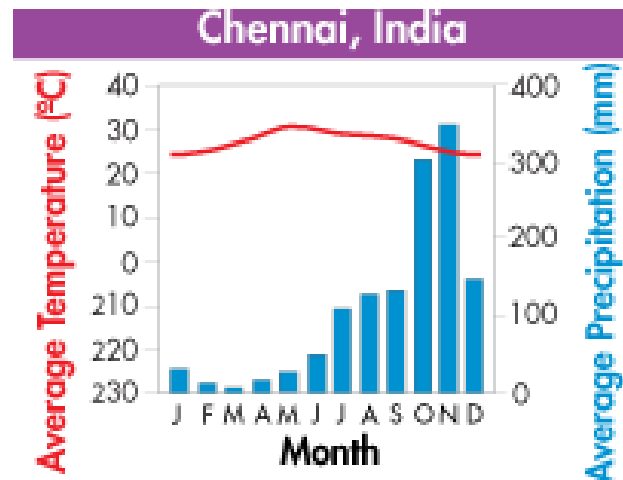


TROPICAL DRY FOREST

Abiotic Factors

Tropical dry forests are warm year-round, with alternating wet and dry seasons.

Their rich soils are subject to erosion.



TROPICAL DRY FOREST

Biotic Factors – Plant Life

Adaptations to survive the dry season include seasonal loss of leaves.

A plant that sheds its leaves during a particular season is called **deciduous**.

Some plants also have an extra thick waxy layer on their leaves to reduce water loss, or they store water in their tissues.

TROPICAL DRY FOREST

Biotic Factors – Animal Life

Many animals reduce their need for water by entering long periods of inactivity called *estivation*.

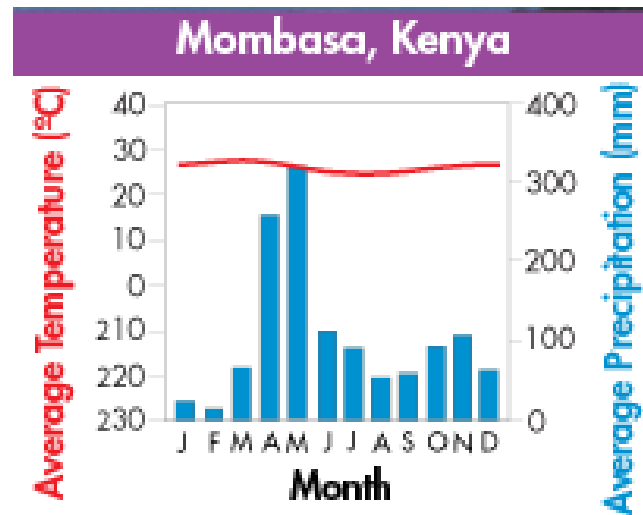
Estivation is similar to hibernation, but typically takes place during a dry season.

Other animals, including many birds and primates, move to areas where water is available during the dry season.

TROPICAL GRASSLAND/SAVANNA/SHRUBLAND

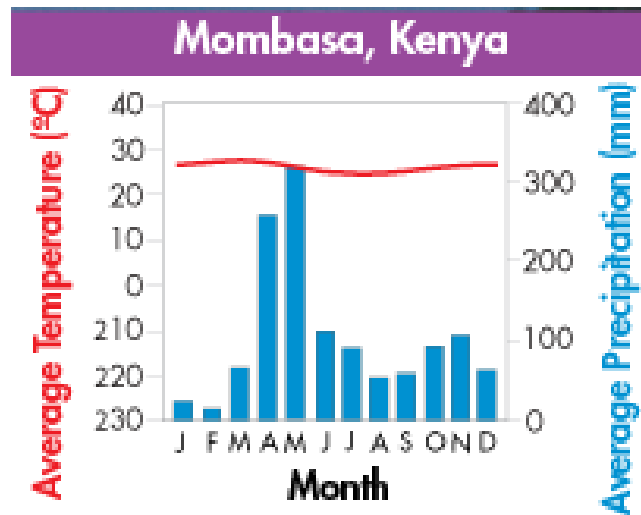
This biome receives more seasonal rainfall than deserts but less than tropical dry forests.

Grassy areas are spotted with isolated trees and small groves of trees and shrubs.



TROPICAL GRASSLAND/SAVANNA/SHRUBLAND

Compacted soils, fairly frequent fires, and the action of large animals prevent some areas from turning into dry forest.

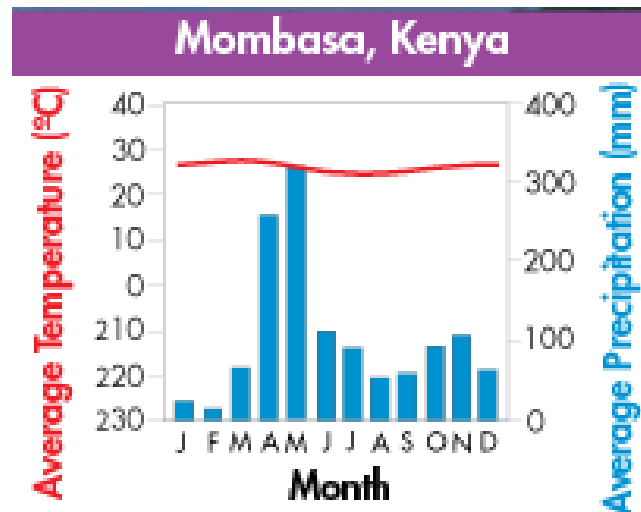


TROPICAL GRASSLAND/SAVANNA/SHRUBLAND

Abiotic Factors

This biome is warm, with seasonal rainfall.

The soil is compact, and there are frequent fires set by lightning.



TROPICAL GRASSLAND/SAVANNA/SHRUBLAND

Biotic Factors – Plant Life

Plant adaptations include waxy leaf coverings and seasonal leaf loss.

Some grasses have a high silica content that makes them less appetizing to grazing herbivores. Unlike most plants, grasses grow from their bases, not their tips, so they can continue to grow after being grazed.

TROPICAL GRASSLAND/SAVANNA/SHRUBLAND

Biotic Factors – Animal Life

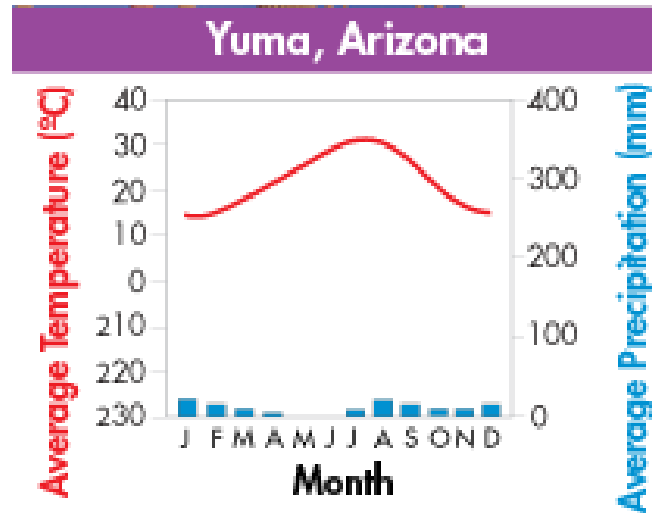
Many animals migrate during the dry season in search of water.

Some smaller animals burrow and remain dormant during the dry season.

DESERT

Deserts have less than 25 centimeters of precipitation annually, but otherwise vary greatly, depending on elevation and latitude.

Many deserts undergo extreme daily temperature changes, alternating between hot and cold.

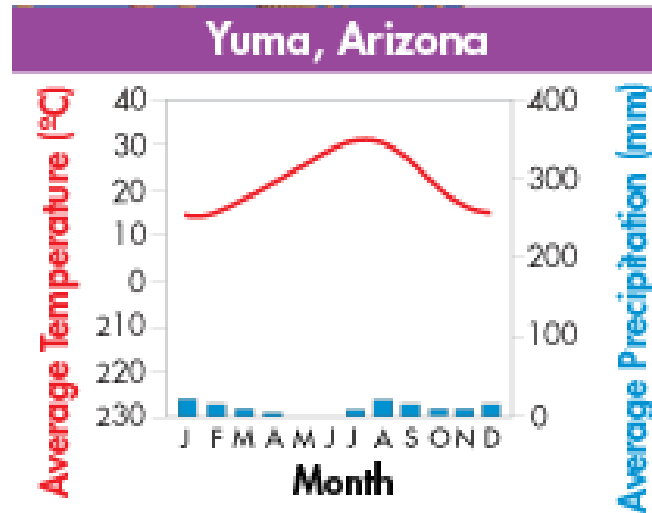


DESERT

Abiotic Factors

Deserts have low precipitation and variable temperatures.

Their soils are rich in minerals, but poor in organic material.



DESERT

Biotic Factors – Plant Life

Many plants, including cacti, store water in their tissues, and minimize leaf surface area to cut down on water loss. Cactus spines are actually modified leaves.

Modified photosynthesis in some plants requires leaf pores to open only at night, enabling plants to conserve moisture on hot, dry days.

DESERT

Biotic Factors – Animal Life

Many desert animals get the water they need from the food they eat. To avoid the hottest parts of the day, many animals are nocturnal—active only at night.

Large or elongated ears and other extremities often have many blood vessels close to the surface to help the animal lose body heat and regulate body temperature.

TEMPERATE GRASSLAND

Plains and prairies once covered vast areas of the midwestern and central United States.

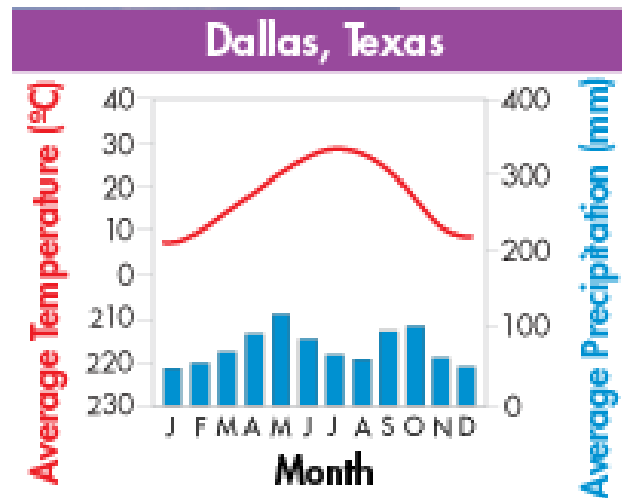
Periodic fires and heavy grazing by herbivores maintained grassland plants.

Today, most have been converted for agriculture because their soil is so rich in nutrients and is ideal for growing crops.

TEMPERATE GRASSLAND

Temperate grasslands experience warm to hot summers and cold winters, with moderate seasonal precipitation.

The soil is fertile and there are occasional fires.



TEMPERATE GRASSLAND

Biotic Factors – Plant Life

Grassland plants—especially grasses, which grow from their base—are resistant to grazing and fire.

Wind dispersal of seeds is common in this open environment. The root structure and growth habit of grassland plants help establish and retain deep, rich, fertile topsoil.

TEMPERATE GRASSLAND

Biotic Factors – Animal Life

Because temperate grasslands are such open, exposed environments, predation is a constant threat for smaller animals.

Camouflage and burrowing are two common protective adaptations.

TEMPERATE WOODLAND AND SHRUBLAND

In open woodlands, large areas of grasses and wildflowers are interspersed with oak and other trees.

Communities that are more shrubland than forest are known as chaparral.

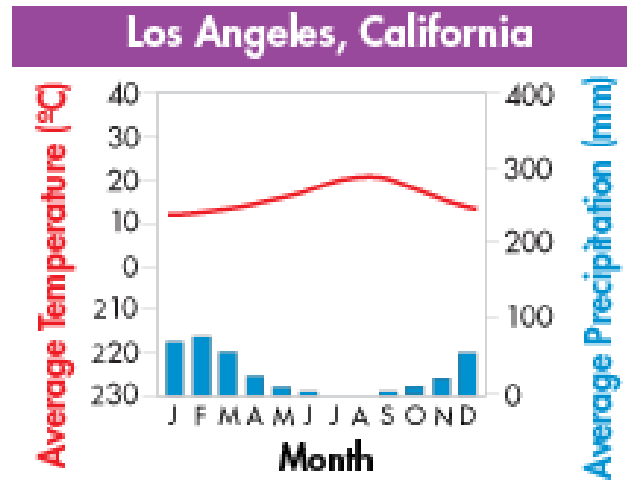
Dense low plants that contain flammable oils make fire a constant threat.

TEMPERATE WOODLAND AND SHRUBLAND

Abiotic Factors

The woodlands experience hot dry summers and cool moist winters.

They have thin, nutrient-poor soils and experience periodic fires.



TEMPERATE WOODLAND AND SHRUBLAND

Biotic Factors – Plant Life

Woodland plants have adapted to drought.

Woody chaparral plants have tough waxy leaves that resist water loss.

Fire resistance is important, although the seeds of some plants need fire to germinate.

TEMPERATE WOODLAND AND SHRUBLAND

Biotic Factors – Animal Life

Woodland animals tend to eat varied diets of grasses, leaves, shrubs, and other vegetation.

In exposed shrubland, camouflage is common.

TEMPERATE FOREST

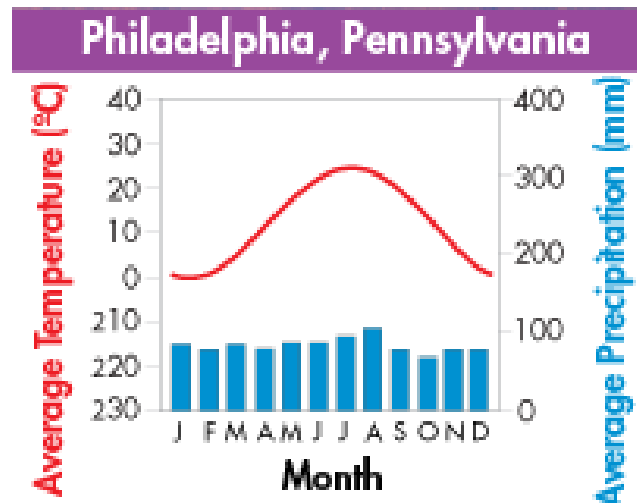
Temperate forests are mostly made up of deciduous and evergreen coniferous trees.

Coniferous trees, or conifers, produce seed-bearing cones, and most have needle-shaped leaves coated in a waxy substance that helps reduce water loss.

TEMPERATE FOREST

Temperate forests have cold winters. In autumn, deciduous trees shed their leaves. In the spring, small plants burst from the ground and flower.

The fertile soils are rich in **humus**, a material formed from decaying leaves and other organic matter.

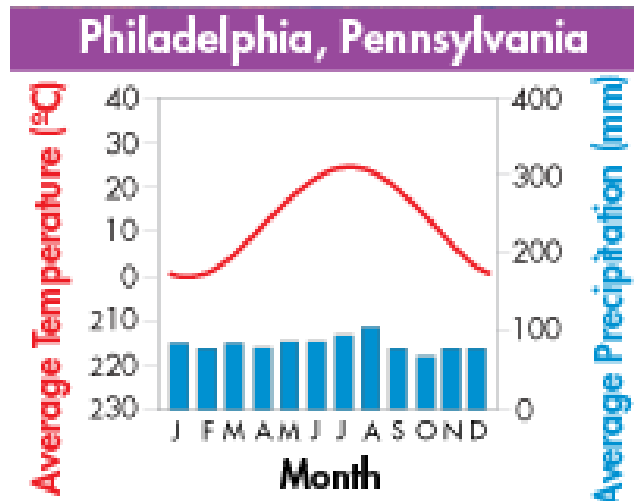


TEMPERATE FOREST

Abiotic Factors

Temperate forests experience cold to moderate winters and warm summers.

They have year-round precipitation and fertile soils.



TEMPERATE FOREST

Biotic Factors – Plant Life

Deciduous trees drop their leaves and go into a state of dormancy in winter.

Conifers have needlelike leaves that minimize water loss in dry winter air.

TEMPERATE FOREST

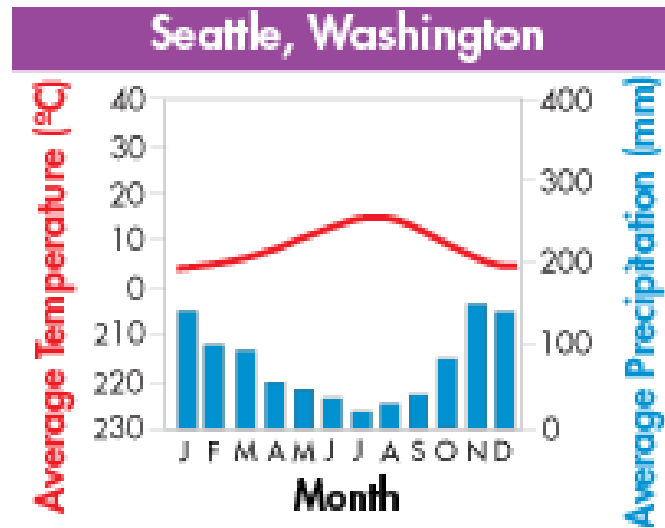
Biotic Factors – Animal Life

To cope with the changing weather, some animals hibernate, while others migrate to warmer climates.

Animals that do not hibernate or migrate may be camouflaged to escape predation in the winter, when bare trees leave them more exposed.

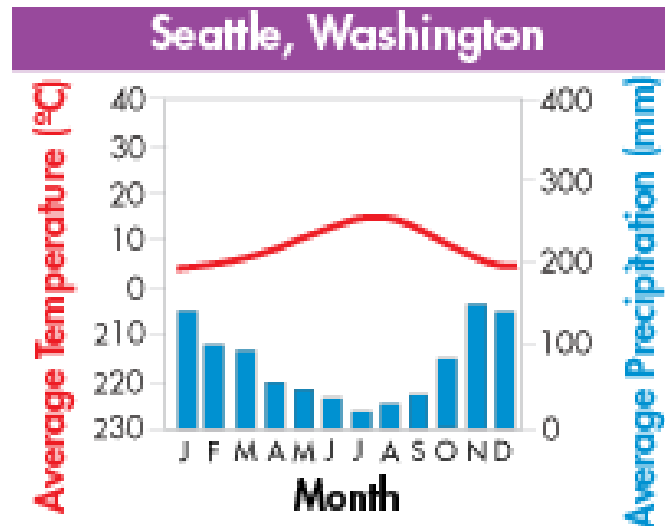
NORTHWESTERN CONIFEROUS FOREST

Mild moist air from the Pacific Ocean influenced by the Rocky Mountains provides abundant rainfall to this biome.



NORTHWESTERN CONIFEROUS FOREST

The forest includes a variety of conifers, along with flowering trees and shrubs such as dogwood and rhododendron. Moss often covers tree trunks and the forest floor. Because of its lush vegetation, the northwestern coniferous forest is sometimes called a “temperate rain forest.”

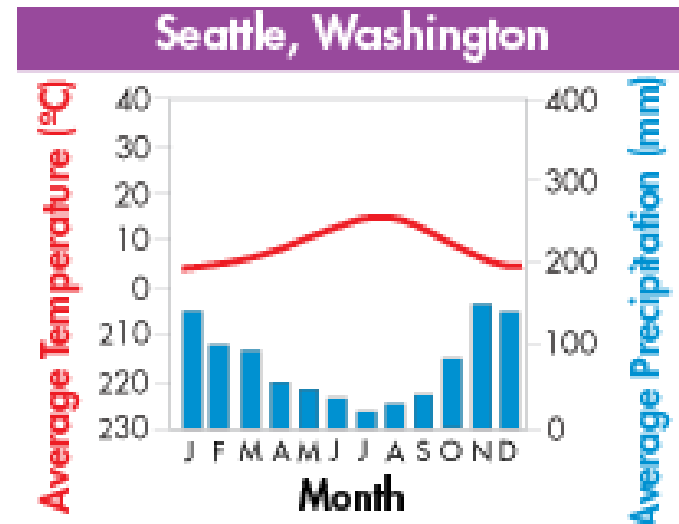


NORTHWESTERN CONIFEROUS FOREST

Abiotic Factors

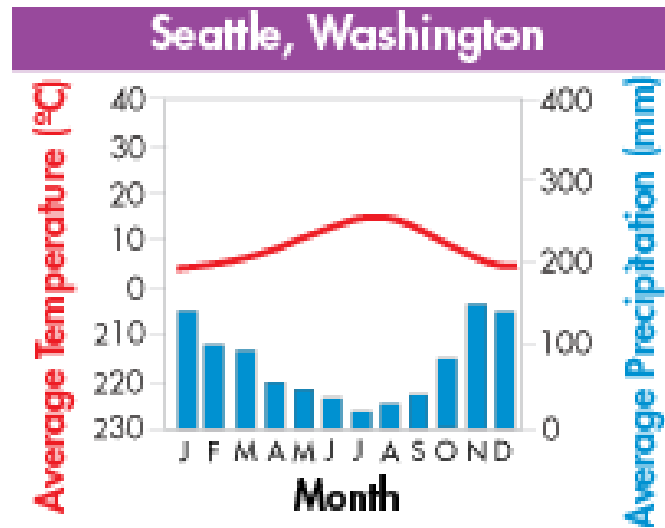
Northwestern coniferous forests experience mild temperatures and abundant precipitation in fall, winter, and spring. The summers are cool and dry.

Soils are rocky and acidic.



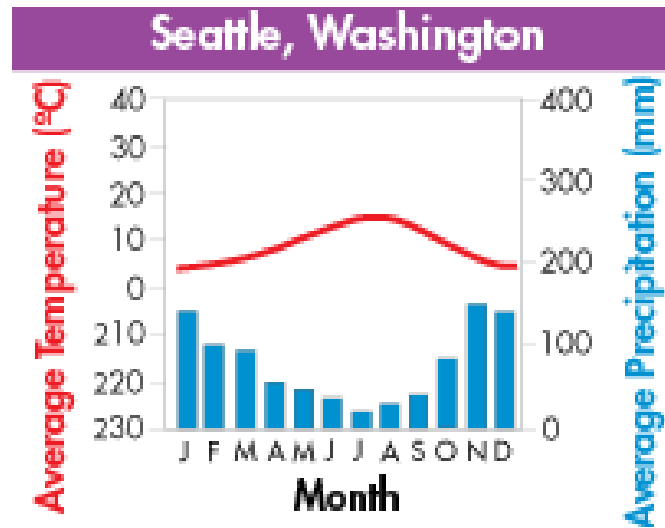
NORTHWESTERN CONIFEROUS FOREST

Seasonal temperature variation results in less diversity in this biome than in tropical rain forests. However, ample water and nutrients support lush, dense plant growth.



NORTHWESTERN CONIFEROUS FOREST

Adaptations that enable plants to obtain sunlight are common. Trees here are among the world's tallest.



northwestern coniferous forest

Biotic Factors – Animal Life

Camouflage helps insects and ground-dwelling mammals avoid predation. .

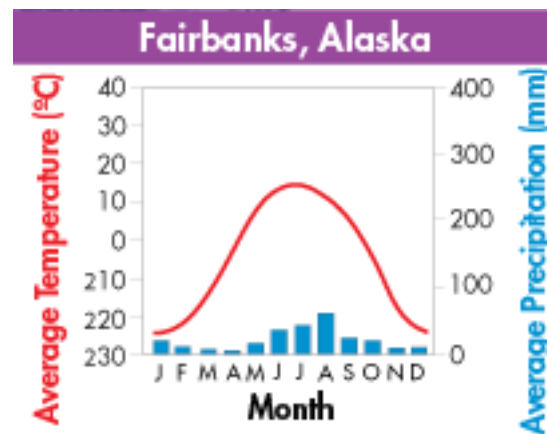
Many animals are browsers—they eat a varied diet—an advantage in an environment where vegetation changes seasonally.

BOREAL FOREST

Dense forests of coniferous evergreens along the northern edge of the temperate zone are called boreal forests, or **taiga**.

Winters are bitterly cold, but summers are mild and long enough to allow the ground to thaw.

Boreal forests occur mostly in the northern part of the Northern Hemisphere. The word *boreal* comes from the Greek word for “north.”



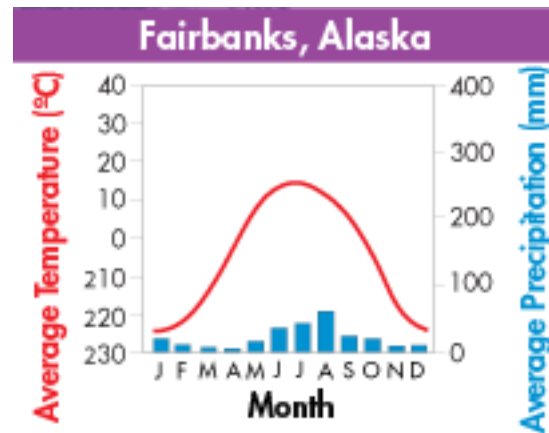
BOREAL FOREST

Abiotic Factors

Boreal forests have long cold winters and short mild summers.

There is moderate precipitation and high humidity.

The soil is acidic and nutrient-poor.



BOREAL FOREST

Biotic Factors – Plant Life

The conical shape of conifers sheds snow, and their wax-covered needlelike leaves prevent excess water loss, making conifers well suited to the boreal forest environment.

In addition, the dark green color of most conifers absorbs heat energy.

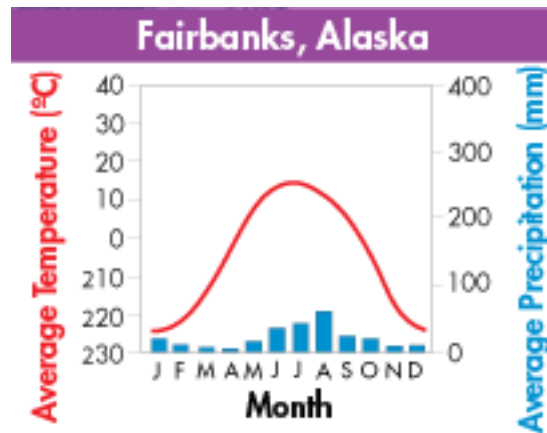
BOREAL FOREST

Biotic Factors – Animal Life

Staying warm is the major challenge for boreal forest animals.

Most have small extremities and extra insulation in the form of fat or downy feathers.

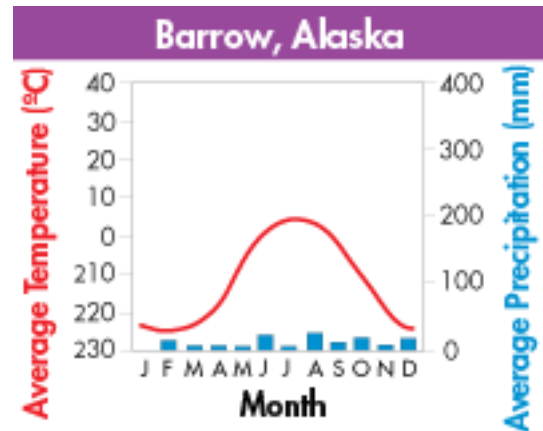
Some migrate to warmer areas in winter.



TUNDRA

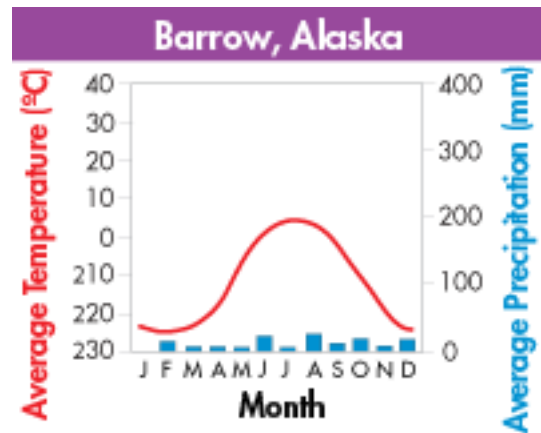
The tundra is characterized by **permafrost**, a layer of permanently frozen subsoil.

During the short cool summer, the ground thaws to a depth of a few centimeters and becomes soggy. In winter, the top layer of soil freezes again. The cycle of thawing and freezing, which rips and crushes plant roots, is one reason that tundra plants are small and stunted.



TUNDRA

Cold temperatures, high winds, a short growing season, and humus-poor soils also limit plant height.

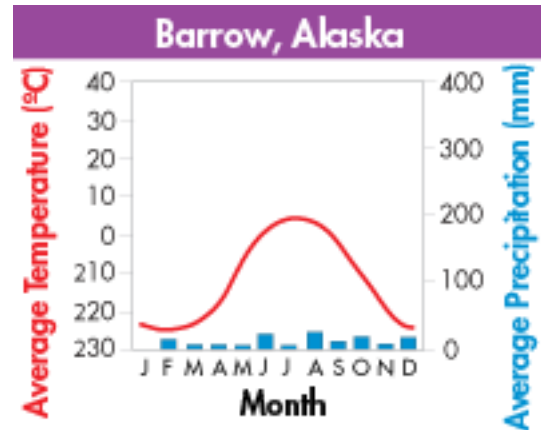


TUNDRA

Abiotic Factors

The tundra experiences strong winds and low precipitation.

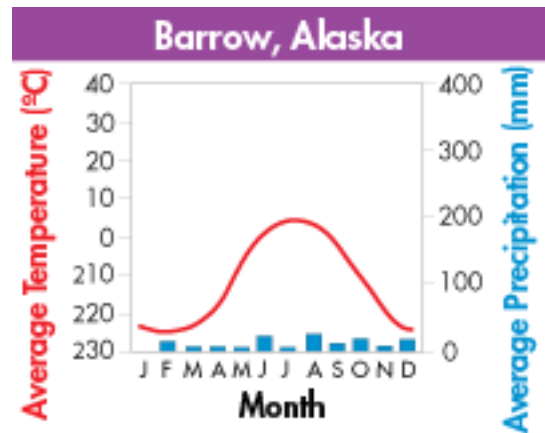
The summers are short and soggy, and the winters are long, cold, and dark.



TUNDRA

Abiotic Factors

The soil is poorly developed, with a permanently frozen subsoil layer called permafrost.



TUNDRA

Biotic Factors – Plant Life

By hugging the ground, mosses and other low-growing plants avoid damage from frequent strong winds.

Seed dispersal by wind is common.

Many plants have adapted to growth in poor soil, like legumes, which have symbiotic bacteria on their roots that fix nitrogen.

TUNDRA


Biotic Factors – Animal Life

Many animals migrate to avoid the long harsh winters.

Animals that live in the tundra year-round display adaptations such as natural antifreeze, small extremities that limit heat loss, and a varied diet.

Other Land Areas

 What areas are not easily classified into a major biome?

 Because they are not easily defined in terms of a typical community of plants and animals, mountain ranges and polar ice caps are not usually classified into biomes.

Mountain Ranges

Mountain ranges exist on all continents and in many biomes.

On mountains, temperature, precipitation, exposure to wind, and soil types all change with elevation, and so do organisms.

Mountain Ranges

If you climb the Rocky Mountains in Colorado, for example, you begin in a grassland.

You then pass through pine woodland and then a forest of spruce and other conifers.

Thickets of aspen and willow trees grow along streambeds in protected valleys.

Higher up, soils are thin. Strong winds buffet open fields of wildflowers and stunted vegetation resembling tundra.

Glaciers are found at the peaks of many ranges.

Polar Ice Caps

Polar regions border the tundra and are cold year-round.

Plants are few, though some algae grow on snow and ice.

Where rocks and ground are exposed seasonally, mosses and lichens may grow.

Marine mammals, insects, and mites are the typical animals.

Polar Ice Caps

In the north, where polar bears live, the Arctic Ocean is covered with sea ice, although more and more ice is melting each summer.

In the south, the continent of Antarctica is covered by ice nearly 5 kilometers thick in places.