

## 4-3 Biomes

A **biome** is a complex of terrestrial communities that covers a large area and is characterized by certain soil and climate conditions and particular assemblages of plants and animals.

Variations in plants and animals help different species survive under different conditions in different biomes. Plants and animals exhibit variations in **tolerance**, or the ability to survive and reproduce under conditions that differ from their optimal conditions.

### Biomes and Climate

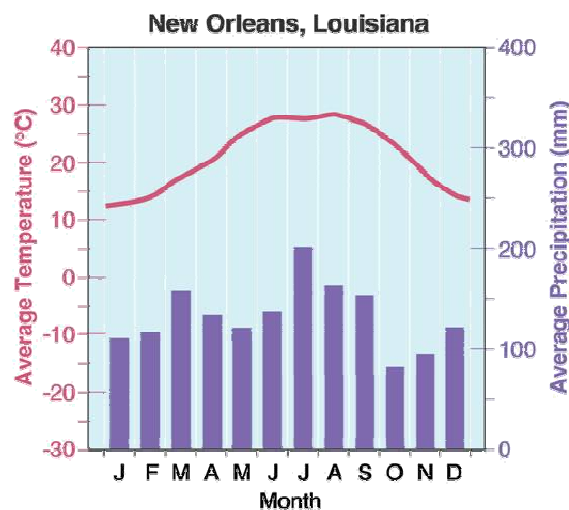
The climate of a region is an important factor in determining which organisms can survive there.

Within a biome, temperature and precipitation can vary over small distances.

The climate in a small area that differs from the climate around it is called a **microclimate**.

Two components of climate, temperature and precipitation, can be summarized in a graph called a climate diagram.

Climate diagrams show the average temperature and precipitation at a given location during each month of the year. In this graph, and the others to follow, temperature is plotted as a red line. Precipitation is shown as vertical purple bars.



### The Major Biomes

The world's major biomes include:

- tropical rain forest
- tropical dry forest
- tropical savanna
- desert
- temperate grassland
- temperate woodland and shrubland
- temperate forest
- northwestern coniferous forest
- boreal forest
- tundra

**Biomes are defined by a unique set of abiotic factors—particularly climate—and a characteristic assemblage of plants and animals.**

### Tropical Rain Forest

Tropical rain forests are home to more species than all other biomes combined. The tops of tall trees, extending from 50 to 80 meters above the forest floor, form a dense covering called a **canopy**. In the shade below the canopy, a second layer of shorter trees and vines forms an **understory**. Organic matter that falls to the forest floor quickly decomposes, and the nutrients are recycled.

**Abiotic factors:** hot and wet year-round; thin, nutrient-poor soils

**Dominant plants:** broad-leaved evergreen trees; ferns; large woody vines and climbing plants

**Dominant wildlife:** sloths, capybaras, jaguars, anteaters, monkeys, toucans, parrots, butterflies, beetles, piranhas, caymans, boa constrictors, and anacondas.

**Geographic distribution:** parts of South and Central America, Southeast Asia, parts of Africa, southern India, and northeastern Australia

### **Tropical Dry Forest**

Tropical dry forests grow in places where rainfall is highly seasonal rather than year-round. During the dry season, nearly all the trees drop their leaves to conserve water. A tree that sheds its leaves during a particular season each year is called **deciduous**.

**Abiotic factors:** generally warm year-round; alternating wet and dry seasons; rich soils subject to erosion

**Dominant plants:** tall, deciduous trees; drought-tolerant plants; aloes and other succulents

**Dominant wildlife:** tigers, monkeys, elephants, Indian rhinoceroses, hog deer, great pied hornbills, pied harriers, spot-billed pelicans, termites, snakes and monitor lizards

**Geographic distribution:** parts of Africa, South and Central America, Mexico, India, Australia, and tropical islands

### **Tropical Savanna**

Tropical savannas, or grasslands, receive more rainfall than deserts but less than tropical dry forests. They are covered with grasses. Compact soils, fairly frequent fires, and the action of large animals prevent them from becoming dry forest.

**Abiotic factors:** warm temperatures; seasonal rainfall; compact soil; frequent fires set by lightning

**Dominant plants:** tall, perennial grasses; drought-tolerant and fire-resistant trees or shrubs

**Dominant wildlife:** lions, leopards, cheetahs, hyenas, jackals, aardvarks, elephants, giraffes, antelopes, zebras, baboons, eagles, ostriches, weaver birds, and storks

**Geographic distribution:** large parts of eastern Africa, southern Brazil, and northern Australia

### **Desert**

All deserts are dry, defined as having annual precipitation of less than 25 centimeters. Deserts vary greatly, some undergoing extreme temperature changes during the course of a day. The organisms in this biome can tolerate extreme conditions.

**Abiotic factors:** low precipitation; variable temperatures; soils rich in minerals but poor in organic material

**Dominant plants:** cacti and other succulents; plants with short growth cycles

**Dominant wildlife:** mountain lions, gray foxes, bobcats, mule deer, pronghorn antelopes, desert bighorn sheep, kangaroo rats, bats, owls, hawks, roadrunners, ants, beetles, butterflies, flies, wasps, tortoises, rattlesnakes, and lizards

**Geographic distribution:** Africa, Asia, the Middle East, United States, Mexico, South America, and Australia

### **Temperate Grassland**

Temperate grasslands are characterized by a rich mix of grasses and underlaid by fertile soils. Periodic fires and heavy grazing by large herbivores maintain the characteristic plant community.

**Abiotic factors:** warm to hot summers; cold winters; moderate, seasonal precipitation; fertile soils; occasional fires

**Dominant plants:** lush, perennial grasses and herbs; most are resistant to drought, fire, and cold

**Dominant wildlife:** coyotes, badgers, pronghorn antelopes, rabbits, prairie dogs, introduced cattle, hawks, owls, bobwhites, prairie chickens, mountain plovers, snakes, ants and grasshoppers

**Geographic distribution:** central Asia, North America, Australia, central Europe, and upland plateaus of South America

## Temperate Woodland and Shrubland

This biome is characterized by a semiarid climate and mix of shrub communities and open woodlands. Large areas of grasses and wildflowers are interspersed with oak trees. Communities that are dominated by shrubs are also known as **chaparral**.

The growth of dense, low plants that contain flammable oils makes fires a constant threat.

**Abiotic factors:** hot, dry summers; cool, moist winters; thin, nutrient-poor soils; periodic fires

**Dominant plants:** woody evergreen shrubs; herbs that grow during winter and die in summer

**Dominant wildlife:** coyotes, foxes, bobcats, mountain lions, black-tailed deer, rabbits, squirrels, hawks, California quails, warblers, lizards, snakes, and butterflies

**Geographic distribution:** western coasts of North and South America, areas around the Mediterranean Sea, South Africa, and Australia

## Temperate Forest

Temperate forests contain a mixture of **deciduous** and coniferous trees. **Coniferous** trees, or conifers, produce seed-bearing cones and most have leaves shaped like needles. These forests have cold winters that halt plant growth for several months. In autumn, the **deciduous** trees shed their leaves. Soils of temperate forests are often rich in **humus**, a material formed from decaying leaves and other organic matter that makes soil fertile.

**Abiotic factors:** cold to moderate winters; warm summers; year-round precipitation; fertile soils

**Dominant plants:** broadleaf deciduous trees; some conifers; flowering shrubs; herbs; a ground layer of mosses and ferns

**Dominant wildlife:** Deer, black bears, bobcats, squirrels, raccoons, skunks, numerous songbirds, turkeys

**Geographic distribution:** eastern United States; southeastern Canada; most of Europe; and parts of Japan, China, and Australia

## Northwestern Coniferous Forest

Mild, moist air from the Pacific Ocean provides abundant rainfall to this biome. The forest is made up of a variety of trees, including giant redwoods, spruce, fir, hemlock, and dogwood. Because of its lush vegetation, the northwestern coniferous forest is sometimes called a “temperate rain forest.”

**Abiotic factors:** mild temperatures; abundant precipitation during fall, winter, and spring; relatively cool, dry summer; rocky, acidic soils

**Dominant plants:** Douglas fir, Sitka spruce, western hemlock, redwood

**Dominant wildlife:** bears, elk, deer, beavers, owls, bobcats, and members of the weasel family

**Geographic distribution:** Pacific coast of northwestern United States and Canada, from northern California to Alaska

## Boreal Forest

Dense evergreen forests of coniferous trees are found along the northern edge of the temperate zone. These forests are called boreal forests, or **taiga**. Winters are bitterly cold. Summers are mild and long enough to allow the ground to thaw. Boreal forests occur mostly in the Northern Hemisphere.

**Abiotic factors:** long, cold winters; short, mild summers; moderate precipitation; high humidity; acidic, nutrient-poor soils

**Dominant plants:** needleleaf coniferous trees; some broadleaf deciduous trees; small, berry-bearing shrubs

**Dominant wildlife:** lynxes, timber wolves, members of the weasel family, small herbivorous mammals, moose, beavers, songbirds, and migratory birds

**Geographic distribution:** North America, Asia, and northern Europe

## 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 and wet. In winter, the topsoil freezes again. Cold temperatures, high winds, the short growing season, and humus-poor soils also limit plant height.

**Abiotic factors:** strong winds; low precipitation; short and soggy summers; long, cold, and dark winters; poorly developed soils; permafrost

**Dominant plants:** ground-hugging plants such as mosses, lichens, sedges, and short grasses

**Dominant wildlife:** birds, mammals that can withstand the harsh conditions, migratory waterfowl, shore birds, musk ox, Arctic foxes, caribou, lemmings and other small rodents

**Geographic distribution:** northern North America, Asia, and Europe

**Mountain ranges** and **polar icecaps** do not fit neatly into any of Earth's major biomes.

### **Mountain Ranges**

Abiotic and biotic conditions vary with elevation. Temperatures become colder as you move from base to summit. The amount of precipitation increases as you move from base to summit. Plants and animals also change, adapting to the changing environment.

### **Polar Ice Caps**

The polar regions are cold all year round. In the north polar region, the Arctic Ocean is covered with sea ice and a thick ice cap. Dominant organisms include mosses, lichens, polar bears, seals, insects, and mites. In the south polar region, Antarctica is covered by a layer of ice nearly 5 kilometers thick in some places. The dominant wildlife includes penguins and marine mammals.