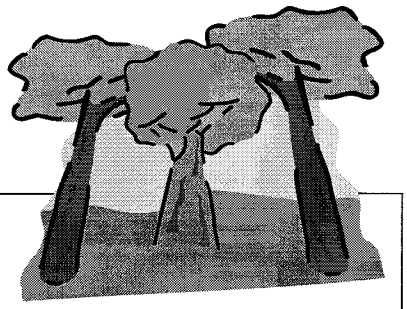
Biomes

Section 20.1
Tundra and Desert Biomes



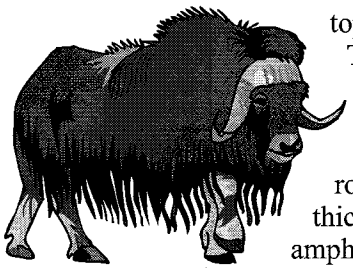
Pre-View 20.1

- **Biome** – a physical environment that has certain characteristic plants and animals mainly due to climate
- **Land** (or **terrestrial**) **biome** – a biome that occurs on land and not in the water
- **Tundra** – a land biome characterized by cold temperatures, high winds, and small plants
- **Desert** – a land biome characterized by little rainfall and extreme changes in temperature
- **Climatogram** – a graph that shows both annual precipitation and temperature in an area

Just what is a biome? A **biome** is a certain physical environment that has a set of plants and animals that is characteristic of that environment. There are land biomes and aquatic biomes. Let's look at land biomes first.

Every **land** (or **terrestrial**) **biome** has a set of characteristics that makes it different from the other biomes. The climate and other abiotic (nonliving) factors, especially temperature and the amount of precipitation received annually, give each biome its unique characteristics.

Tundra Biome

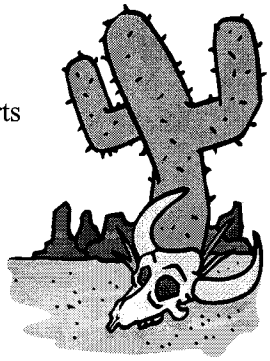


One land biome is the **tundra**, which has a layer of subsoil that always remains frozen. The topsoil may thaw a few centimeters in the summer, during which time small plants grow. The ground becomes soggy and freezes again in the winter, and the roots of the plants are crushed. When you consider the cold temperatures, high winds, and a short growing season, it's easy to see why the tundra plants are so small. Plants that do grow must grow quickly. The environmental factors limit the animals that can live there: small rodents, musk ox, caribou, and some birds. Animals that live in the tundra likely have thick fur and large stores of fat for keeping warm. You won't find cold-blooded reptiles or amphibians in the tundra since the temperature never gets warm enough for them to survive. A typical food chain might be *grass* → *rodents* → *owls*. The tundra ecosystem is one of the most fragile. Small, external disturbances can have a large impact. For example, manmade footprints can easily kill the fragile plant life and cause large-scale erosion. A tundra biome is found in northern Alaska and northern Canada.

Common tundra plant adaptations: low-growing, shallow roots, small leaves, quick growth cycle

Common tundra animal adaptations: warm-blooded, thick fur, able to store fat, likely to migrate or hibernate

Desert Biome



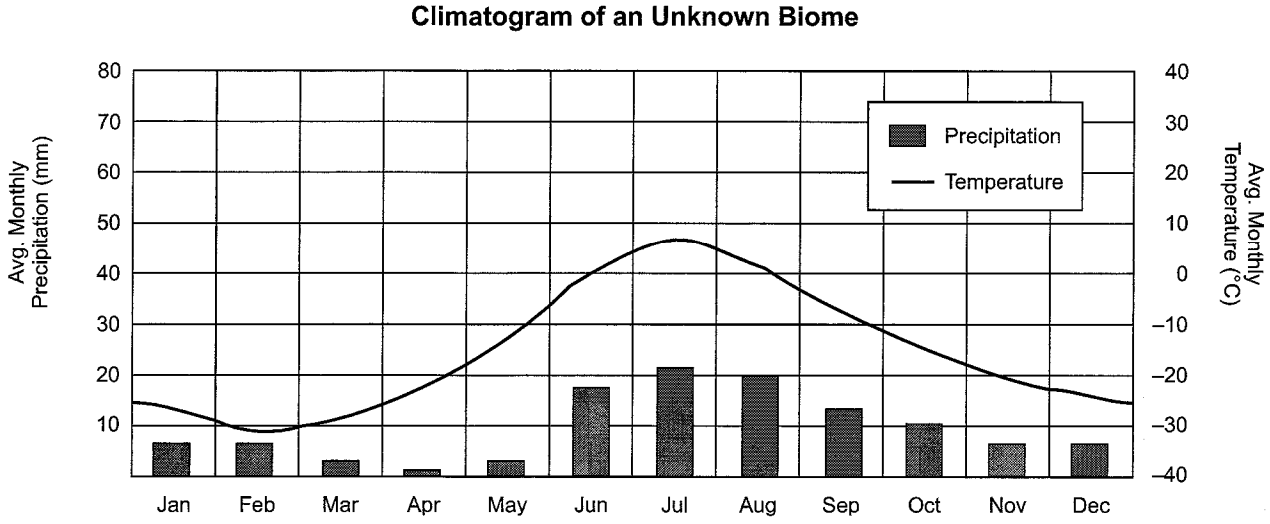
Although the two areas may seem very different, the tundra and the **desert** have one thing in common. They both receive about the same amount of rainfall per year, sometimes as little as 25 centimeters or less. All deserts are fairly dry, but they are not always hot. In fact, many deserts can get very cold at night, especially those in higher elevations. Any organism that lives in the desert has to be able to adapt to the dry conditions and to the extreme changes in temperature. Most of the plant life tend to be cacti or succulents that can store water. Since plants are scarce, the soil does not contain much organic matter. Many predators live in the deserts, including bobcats, coyotes, owls, and hawks. They prey on herbivores such as antelope, sheep, and rats that also live in the desert. Insects make their homes there as well as reptiles, such as lizards and rattlesnakes. A desert food chain might be *seeds* → *rat* → *hawk*.

Common desert plant adaptations: deep roots, spines or small leaves, waxy leaves

Common desert animal adaptations: small, likely to burrow underground, active at night, large ears to disperse heat, able to get water from food

Climatograms

A **climatogram** is normally a combination of a bar graph and a line graph that shows temperature and precipitation in an area. Study the climatogram below.



On a climatogram, the bars represent precipitation. The line represents temperature. To read precipitation, use the scale on the left. To read temperature, read the scale on the right. Consider the following questions:

Which month receives the most precipitation? Which month receives the least?
Since the bars represent precipitation, look only at the bars to answer this question. The month with the highest bar has the greatest precipitation. That month is July. The month with the lowest bar has the least precipitation, which is April.

What is the lowest temperature indicated on this climatogram? What is the highest temperature?
Temperature is indicated by the line, and the scale is on the right. The line drops to its lowest point in the month of February. Notice that the line drops below the line that represents –30°C, so the lowest temperature is about –32°C. The highest temperature occurs in July, which is seen at the top peak of the line. The highest temperature is around 7°C.

Which biome is most likely represented by this climatogram?
Understanding metric measurements is important in answering this question. Precipitation is given in millimeters (mm). Remember that millimeters are very small increments. This biome receives between 2 mm and 22 mm of precipitation each month. If you add the total precipitation for the year, you get around 114 mm, or 11.4 cm, which is a very small amount. Now look at the average monthly temperatures. The temperatures range from –32°C to 7°C. Remember that room temperature is around 23°C, so this biome has very cold average temperatures. With low precipitation and cold temperatures, this climatogram represents a tundra biome.

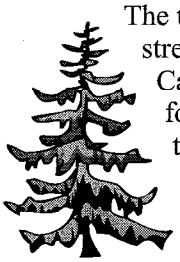
Biomes

Section 20.2
Forest Biomes

Pre-View 20.2

- **Taiga** (or **coniferous forest** or **boreal forest**) – a land biome characterized by cool summers, cold winters, and mostly coniferous ("evergreen") trees
- **Temperate forest** (or **deciduous forest**) – a land biome characterized by having more deciduous trees (trees that lose their leaves in the winter) than conifers; includes the eastern United States
- **Humus** – decaying organic matter that makes up part of soil
- **Tropical rainforest** – the most biodiverse land biome; found near the equator where year-round temperatures and rainfall are high

Taiga Biome

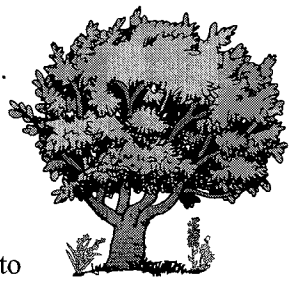


The **taiga biome** (sometimes called a **coniferous forest** or a **boreal forest**) is the largest land biome. It stretches across northern North America, northern Europe, and northern Asia. It includes large portions of Canada and Russia. Its giant redwoods, firs, spruces, and hemlocks provide a hospitable environment for plants and animals. Summers are usually cool, and winters are cold and often harsh. The temperature range is approximately –50°C to 20°C with six months or more of freezing temperatures, and the growing season is short. Taiga biomes get about 40 to 90 centimeters of rain per year. Winters usually receive snowfall, so trees are shaped to shed snow without breaking their branches. Plenty of rain allows a variety of plants, such as conifers, dogwoods, mosses, and flowering shrubs to grow, but most of the trees are coniferous. There can be a variety of wildlife, which includes bears, moose, elk, squirrels, snowshoe rabbits, beavers, lynx, and owls. These animals, similar to those that inhabit the tundra, are well-insulated with heavy fur or extra layers of fat, or they adapt to the colder temperatures by modifying their behavior (such as hibernating during the coldest weather). A typical food chain might be *tree bark → beaver → lynx.*

Common taiga plant adaptations: evergreen leaves, needle-like leaves, waxy coating on leaves, cone-shaped trees with branches slanting downward

Common taiga animal adaptations: thick fur, layers of fat, insulating feathers (for birds), likely to migrate or hibernate, able to change fur color from brown to white during seasonal changes (in mammals)

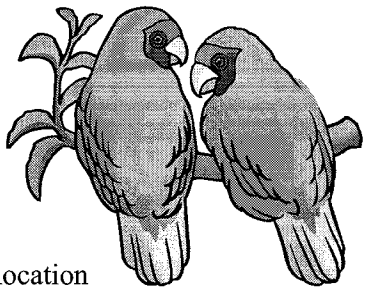
Temperate Forest Biome



The state of Mississippi is in a temperate forest biome, as is most of the eastern United States. **Temperate forests** (also referred to as **deciduous forests**) have some conifers, but they have mostly deciduous trees that shed their leaves in the winter when the colder temperatures cause plant growth to slow down. Many wildflowers bloom in the spring, and the forest floor is rich in **humus**, which is decaying organic matter that makes the soil fertile. This biome has four distinct seasons with warm summers and cool winters. The temperature may range from around –30°C in the winter to 30°C in the summer. Annual precipitation is approximately 75 to 150 centimeters. There is enough precipitation all year to support an abundance of plant life, which attracts many songbirds as well as deer, bears, raccoons, turkeys, mice, squirrels, and even skunks! An example of a food chain in the deciduous forest might be *ant → beetle larva → skunk.*

Common temperate forest plant adaptations: likely to migrate or hibernate during winter months, likely to store nuts and seeds

Common temperate forest animal adaptations: broad leaves that shed in the autumn



Tropical Rainforest Biome

More species of living organisms inhabit the **tropical rainforests** than all of the other terrestrial biomes put together. This characteristic makes the tropical rainforest the most biodiverse. Tropical rainforests are located in regions near the equator, and their location accounts for their year-round high temperatures. They also receive a lot of precipitation so that many types of plants can live in the rainforests. Rainfall may be anywhere from 150 to 600 centimeters per year or more. The plants in a rainforest form layers. Broadleaf evergreen trees form the canopy, which may be 70 meters tall. Beneath the canopy is a second layer of shade-loving plants, such as ferns, plus climbing plants, such as orchids and bromeliads. Very few plants near the ground of the rainforest because so little sunlight reaches there.

The rainforest contains an abundance of animal life. Insects include butterflies, ants, beetles, and bees. Various reptiles, such as boa constrictors and anacondas, and many types of amphibians, including the poison arrow frogs, can also be found. Parakeets, parrots, and many other brightly feathered birds live in the tropical rainforests. The slow-moving sloth is an herbivore that lives in the rainforests along with many other animals, such as monkeys, anteaters, and jaguars. Many rainforest animals prefer to live in trees and will often have prehensile tails, tails that can be used to grab objects and to hang from tree limbs. A tropical rainforest food chain might be *fruit* → *monkey* → *jaguar*.

Common tropical rainforest plant adaptations: large leaves, shallow roots or aerial roots, thin and smooth bark, specialized traits to obtain nutrients and sunlight including the ability to climb (vines), the ability to "eat" insects (carnivorous plants), and the ability to grow in the air

Common tropical rainforest animal adaptations: bright colors to warn of poison, camouflage against predators, specialized traits to eat a specific food, various beak sizes and shapes for specific purposes (in birds), specialized traits for living in trees (such as prehensile tails)

Biomes

Section 20.3
Grassland Biome

Pre-View 20.3

- **Grassland biome** – land biome characterized by moderate rainfall, fields of grasses, and few trees
- **Prairie** – a type of grassland that makes up the Midwestern United States; characterized by tall grasses and grazing herbivores
- **Savanna** – a type of grassland found primarily in Africa; has small clusters of trees, large herbivorous animals, such as giraffes, elephants, rhinoceros, and hippopotamuses, and large cats, such as lions and cheetahs

The **grassland biome** can be found around the world. This biome generally receives a moderate amount of rainfall, 15 to 75 centimeters per year, but not enough to support many trees. Grasslands usually have fertile soil that grows mostly grasses, which may include cereal grasses, such as wheat, oats, and rye. The animals found there include grazing mammals, birds that nest on the ground, various insects, and a few reptiles. The winters are normally cold, averaging around 0°C, and the summers are hot, averaging around 25°C. The grasses are generally resistant to drought and cold as well as to the fires that occasionally sweep through the plains.

Common grassland plant adaptations: colorful wildflowers to attract pollinators, drought-resistant and fire-resistant grasses with deep roots and narrow leaves, flexible stems to withstand high winds

Common grassland animal adaptations: flat teeth and specialized digestive systems that enable herbivores to eat grasses, camouflaged fur colors for both predators and prey, specialized traits to burrow underground (small animals), nocturnal habits to protect against predators, tendency of medium to large herbivores to form herds for protection against predators, tendency of predators to be fast runners and to form packs for hunting

There are several categories of grasslands. Take a look at two common types.

Prairie

The Midwestern United States is largely made up of **prairie**, a type of grassland that contains tall grasses and few trees. Large herbivores, such as buffalo, antelope, and wild horses, live in the prairie. Smaller mammals, such as mice, voles, rabbits, and prairie dogs, can also be found there. Carnivores might include coyotes, foxes, snakes, and hawks. A typical food chain might be *grass* → *prairie dog* → *coyote.*

Savanna

A **savanna** is a type of grassland that has grasses, small clusters of trees and shrubs, and a few trees that are away from other plants. Savannas often get more rainfall than prairies, up to 100 cm per year. Temperatures are usually warm, and the seasonal rainfall may include thunderstorms with lightning that causes wildfires. Large animals, such as elephants and rhinos, help to keep the soil compacted. A number of herbivores, including antelope, zebras, and giraffes, feed on the tall grasses and occasional trees. Insects, especially termites, are found in the savannas along with ostriches, storks, eagles, and other birds. Carnivores include lions, leopards, cheetahs, jackals, and hyenas. A common example of a savanna is a large part of the African continent, but savannas can also be found in South America, parts of the Middle East, and Australia. A typical food chain might be *grass* → *zebra* → *lion.*

Biomes

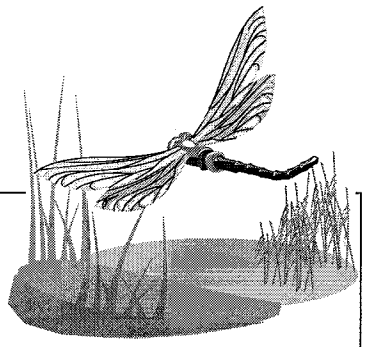
Section 20.4
Terrestrial Biome Review

Review each type of terrestrial biome by filling in the chart below. For each biome, give the general climate and distinct characteristics including the amount of annual precipitation and temperatures if known. Also give examples of plant life and plant adaptations found in each biome, examples of animal life and animal adaptations found in each biome, and an area of the United States, North America, or the world where you might find that biome.

Biome	Climate and Characteristics	Plants/Adaptations	Animals/Adaptations	Geographic Example
Tundra				
Desert				
Taiga				
Temperate Forest				
Tropical Rainforest				
Grassland				

Biomes

Section 20.5
Aquatic Biomes

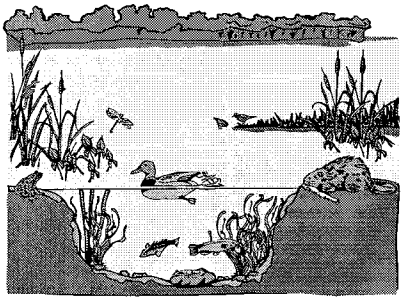


Pre-View 20.5

- **Aquatic biome** – a biome that occurs in water
- **Flowing water biome** – a freshwater biome characterized by moving water, such as in a river or a stream
- **Standing water biome** – a freshwater biome characterized by relatively still water, such as in ponds and lakes
- **Plankton** – a term used to describe microorganisms found in water
- **Zooplankton** – a term used to describe small (but not microscopic) organisms found in water that tend to eat plankton
- **Aphotic zone** – the area deep in the ocean where no light reaches
- **Coastal ocean** – the area of the ocean where sunlight does reach
- **Intertidal zone** – the area of the ocean where the tide goes in and out
- **Coral reef** – an area in the ocean where coral forms a calcium carbonate structure that is home to many different types of organisms
- **Estuaries** – areas where freshwater rivers merge with the ocean

Now let's take a look at the aquatic biomes, which are found in water. **Aquatic biomes** are most often determined by the depth and temperature of the water and the chemicals that are dissolved in the water, especially salts and oxygen. Aquatic biomes can be divided into two main groups: freshwater and saltwater (marine). The salt concentration of fresh water is very low, less than one percent. The salt concentration of salt water is usually around three percent.

Freshwater Biomes



Some freshwater biomes are **flowing water biomes**, such as rivers and streams. Many of the animals that live in flowing water have adaptations, such as hooks or suckers, that keep them anchored in place. Others, such as trout, have streamlined bodies that allow them to move with or against the water currents. Where the water is fast-moving, there may be little plant life. Slower moving water usually has more plant life.

Standing water biomes include lakes and ponds. The water is relatively still although it does circulate to distribute heat, oxygen, and nutrients. Many standing water biomes have small organisms called **plankton** that live in the still water. Phytoplankton are algae that form the base of many food webs. The tiny animals that feed on them are **zooplankton**.

Saltwater Biomes

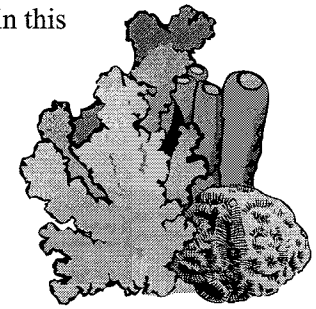
Saltwater biomes include an area called the aphotic zone, the coastal ocean, the intertidal zone, coral reefs, and estuaries.

"Aphotic" means without light, and the **aphotic zone** of the ocean is always dark. It is so deep that no sunlight ever reaches there. The only producers in the aphotic zone are chemosynthetic autotrophs that do not need light.

An area that you are probably more familiar with is the **coastal ocean**, which is the area between the outer continental shelf and the low-tide mark. Since sunlight can penetrate this water, there are many producers in the coastal ocean. Kelp grows in certain areas, and there are fishes, snails, seals, sea urchins, and whales as well.

The **intertidal zone** is the area between low tide and high tide. Organisms that live in an intertidal zone must be able to adapt to the extreme changes that occur regularly due to the tides. Most of the time, they live in sunlight and are exposed to air and temperature changes. Then during high tides, they are submerged by seawater. They also may be affected by waves and strong currents. Because of the currents, many of the organisms in intertidal zones are permanently attached to rocks, or like starfish and sea urchins, they are able to cling to the rocks by using suckers or tube feet.

Coral reefs are one of the most beautiful and diverse biomes to study. They are formed by the tiny cnidarians called corals that secrete calcium carbonate. The calcium carbonate builds up to form a reef that is home to many organisms. Colorful fishes, sea anemones, starfish, and the corals themselves live in this environment, which is found only in warm water and is usually no deeper than 40 meters.



Estuaries are formed where freshwater rivers and streams merge with the ocean. Estuaries have varying salt concentrations somewhere between the small salt concentration in fresh water and the larger salt concentration of salt water. Algae, seaweed, and marsh grass can usually be found growing in estuaries, and a wide variety of animals, such as oysters, shrimp, worms, crabs, and waterfowl, can be found there. Many saltwater fish lay their eggs in estuaries, so the immature forms of these fish can also be found there.

Practice 2

Fill in the chart below. For each aquatic biome, give general characteristics, such as depth, temperature, mineral concentration, and motion if known. Then give examples of plant life and animal life found in each biome.

Biome	General Characteristics	Types of Plants and Animals
Rivers and Streams		
Lakes and Ponds		
Aphotic zone		
Coastal ocean		
Intertidal zone		
Coral Reefs		
Estuaries		