

Temperate Forest



Temperate Forest: Climate & Land

This biome has four changing seasons including winter, spring, summer, and fall. These seasons happen because of the tilt of the Earth's axis. Throughout the year, rays from the sun hit different parts of the world more directly than others, causing varying temperatures, or seasons. If the Earth were not tilted on an axis, temperatures around the globe would always be the same. Temperate deciduous forests also have quite a wet environment. Following rainforests, temperate deciduous forests are the second-rainiest biome. The average yearly precipitation is 30 - 60 inches. This precipitation falls throughout the year, but in the winter it falls as snow. The average temperature in temperate deciduous forests is 50°F. Summers are mild, and average about 70°F, while winter temperatures are often well below freezing.

Geography: **Temperate Forest**

- Northern Hemisphere
- Southern Hemisphere

Climate and Temperature:

- Cool, rainy areas
- Avg. temperature is 75
- 2-5 feet of precipitation
- Humid

Biotic Factors:

- **Trees lose leaves in Fall**
- Large variety of trees, shrubs, and flowers
- Large variety of animals: Bears, deer, rabbits, eagles, wolves, frogs, snakes, lizards, and mice



Temperate Forest: Plants

Trees and plants in deciduous forests have special adaptations to survive in this biome. Deciduous trees are trees with leaves rather than pine needles, and they dominate temperate forests. As the seasons change each year, so do the leaves. Each year deciduous trees lose their leaves, and grow them back. In the summer their broad green leaves capture sunlight and help the trees make food through photosynthesis. As temperatures cool in the fall, the chlorophyll (green pigment in leaves) breaks down, causing the beautiful red, yellow and orange leaf colors of fall. In the cold winter, deciduous trees and plants go into dormancy, kind of like sleep. It is too cold for them to protect their leaves from the damage of freezing in the winter, so they simply lose them and seal up the places where the leaves attach to the branch. The warmer spring days signal to the trees that they can grow new leaves again, and restart the cycle.

Temperate Forest: Animals

Animals in temperate deciduous forests have to adapt to changing seasons. They must be able to cope with cold winters and hot summers. Some animals hibernate or migrate during the winter to escape the cold. Animals who do not hibernate or migrate must have special adaptations to deal with higher exposure to predators in the winter. When leaves fall, there is less cover for animals in this biome to hide from predators.

The black bear is an animal that is well adapted for the temperate deciduous forest biome. It has a heavy coat made of many layers of fur to deal with the winter cold. Black bears have long claws that help them to climb trees. This is an essential adaptation because black bears often live in hollowed trees. Black bears are omnivores, so they eat plants and animals. Most of their diet is composed of plant material, so their long claws are useful to get their food from trees and shrubs. They also hibernate to avoid having to find food in the snowy, frozen winter.

Desert



Desert: Climate & Land

The seasons in hot and dry deserts are usually very hot during the summer and warm during the rest of the year. During winter these deserts get little rainfall. Rain is often light, or in short concentrated bursts. Most of the time evaporation rates are faster than rainfall rates. Sometimes the rain evaporates before even hitting the ground. This is the reason for the dry characteristic of this type of desert.

Desert: Plants

Deserts plants have many adaptations to survive in such a dry environment. They are good at storing and finding water. Some plants have seeds that can stay dormant in the sand for a long time, until there is enough rain for them to grow. In hot deserts, you'll often find Cacti. Cacti are great at storing water. With their waxy coating, water can't escape and their spines protect them from being desert dinner. Their roots are shallow, and widely spread so that any rain can be absorbed immediately! Some other plants you might find in the hot desert are creosote bush, sagebrush, and ocotillo.

Desert: Animals

Some animals that live in the hot desert are cold-blooded, like snakes, insects, and lizards. Mammals that live in the desert are usually small, such as the kangaroo rat and kit fox. Sometimes it's hard to survive in the desert. Some mice build their home out of fallen cactus spines to protect themselves from predators like coyotes and hawks.

Tropical Rainforest



Tropical Rainforest: Climate & Land

Tropical rainforests are lush and warm all year long. Temperatures don't even change much between night and day. The average temperature in tropical rainforests ranges from 70 to 85°F (21 to 30°C). The environment is pretty wet in tropical rainforests, maintaining a high humidity of 77% to 88% year-round. The yearly rainfall ranges from 80 to 400 inches (200 to 1000 cm), and it can rain hard. It can downpour as much as 2 inches (5 cm) in an hour. (source: nceas.ucsb.edu/)

Tropical Rainforest: Plants

One type of plant often found in a rainforest is an epiphyte. Epiphytes are plants that live on the surface of other plants, especially the trunks and branches. They often grow on trees to take advantage of sunlight in the canopy. There are many kinds of epiphytes, including orchids and bromeliads. There are more than 20,000 varieties of orchids found in the rainforest.

Tropical rainforests have a bigger variety of trees, hundreds of species in fact! These trees are mostly broadleaf trees and have a shorter lifespan. They usually live for 50 - 100 years.

Most trees in tropical rainforests have thin, smooth bark. They don't need thick bark to keep them from drying out because the rainforest is so wet. Also, smooth bark makes it difficult for other plants, such as epiphytes, to grow on the tree surface. Trees often have buttresses, large branching ridges near the base, for support because their roots are often shallow and they grow tall to reach the sunlight. Prop roots also help support trees in shallow soils. Many plants in the rainforests have adapted leaf shapes that help water drip off the plant to avoid too much moisture, which might make bacteria and fungus grow.

Tropical rainforests are so big that they are divided into four zones. The top layer of the rainforest is called the emergent layer. Giant trees grow here that are much taller than the trees below. The next layer is the canopy. It contains trees standing 60 to 150 feet (18 to 45 meters) tall. Their branches form a canopy, like a big beach umbrella that shades the forest floor. Thick, woody vines are found in the canopy. Over 2,500 species of vines grow in the rainforest. Some vines, called lianas, are sometimes as big around as a person! They climb the trees in the canopy to reach for sunlight. The next layer, the understory, is a dark, cool area below the canopy, but above the ground. The understory is shaded from much of the sunlight by the canopy. The forest floor is the bottom layer of the rainforest. This is the area where fallen, decomposing plants and trees lay on the ground. Many insects live here. Temperate rainforests have all of these zones except the emergent layer. The tallest trees in the temperate rainforest canopy grow to be about 300 feet

Tropical Rainforest: Animals

Tropical rainforests are home to half the plant and animal species on Earth. Scientists believe that there is such a great diversity of animals in tropical rainforests because they are one of the oldest ecosystems on earth. Some forests in Southeast Asia have been around

for at least 100 million years, ever since dinosaurs roamed the earth. Animals in the tropical rainforest are specially adapted to live in this unique environment. A common characteristic found among mammals, birds, reptiles and amphibians, is an adaptation to living in trees. One example is New World monkeys that have prehensile tails that curl around branches allowing the monkey to hold onto the tree with its tail! Other animals are brightly colored, sharply patterned, have loud vocalizations, and like to eat lots of fruit. Most of the animals in the tropical rainforest live in the canopy. There is so much food available up there that some animals never go down to explore the forest floor! Birds are important to rainforests because they like to eat seeds and fruit. Their droppings grow into new plants and help rainforests to survive. In turn, tropical rainforests are important to birds because they provide winter grounds as migratory destination. Parrots are not the only type of birds you will see in the rainforest. In fact, about 27% of the bird species in the world live in tropical rainforests. Insects make up the largest single group of animals that live in tropical forests. They include bright beautiful butterflies, mosquitoes, camouflaged stick insects, and colossal colonies of ants.

Taiga



Taiga: Climate & Land

Long, cold winters, and short, mild, wet summers are typical of this region. In the winter, chilly winds from the arctic cause bitterly cold weather in the taiga. The length of day also varies with the seasons. Winter days are short, while summer days are long because of the tilt of the earth on its axis. Fire is not uncommon in the taiga during the summer. Fires may seem destructive, but they actually help this biome by removing old sick trees, making room for new growth. Precipitation is relatively high in the taiga and falls as snow during the winter and rain during the summer. The total yearly precipitation in the taiga biome is 10 - 30 inches.

Taiga: Plants

Compared to other biomes, the taiga has less diversity in plant life. The most common type of tree found in the taiga is the conifer, or cone-bearing tree. Conifers, also known as evergreens, include pines, spruces and firs. There may also occasionally be deciduous species present, such as oak, birch, willow, or alder, in a particularly wet or disturbed area. The soil in the taiga is thin, acidic and not very nutrient rich. It also is rocky.

The name, evergreen, describes an important adaptation of conifers-- they are always green. Because they don't drop their leaves in the winter, they don't have to regrow them in the spring. This is good for trees in a tough environment because growing new leaves takes a lot of energy. Another adaptation of conifers to live in the taiga has to do with their needles. Although the taiga has moderately high precipitation, the frozen winter ground makes it difficult for trees to get water. Having thin needles with a waxy coating limits water loss of the conifer through transpiration. The dark color of the pine needles is also important. What happens when you wear a dark T-shirt on a sunny day? You get hot, right? This is because your dark shirt is absorbing energy from the sun. Well, the dark needles do the same thing for the evergreen. They help the tree absorb the maximum amount of energy from the sun for photosynthesis. Conifers also have that pointy shape for a good reason. The winter snow slides right off of their branches. Without this shape the heavy snow might break or damage the conifer branches.

Taiga: Animals

The cold climate of the taiga makes it a difficult place for many animals to live. Many have thick coats of fur to insulate against the cold, and some hibernate. Others migrate to warmer areas in the chilly winters. Animal populations are mainly seed-eating squirrels and jays; small mammals like ermine and moles; and larger browsing animals such as deer, moose, elk, and snowshoe hare. The bogs and ponds in the taiga provide a great summertime breeding place for many different insects. Migratory birds often come to the taiga to nest and feed on all these insects. The typical predators for this area are grizzly bears, wolves, lynxes and wolverines. These are pretty ferocious, so their prey must adapt to flourish. Some animals hide from predators by changing color to blend into the different summer and winter habitats. For example, the ermine is dark brown in the summer, but in the winter it turns white. What excellent camouflage!

Tundra



Tundra: Climate

The tundra is the coldest and the driest of all the biomes on Earth. There is very little rainfall in the tundra; it rains less than ten inches a year. Winters here are long, and summers short, sometimes they last for only 6 - 10 weeks. In the winter the temperature can reach -50°F.

Because the tundra is so close to the north pole, summer days are 24 hours long. Summer temperatures rarely get above 50°F, just enough to thaw the surface of the ground. In the summer the soil becomes very soggy from melted snow and rain. The moisture sinks into the ground, which is called permafrost. The permafrost lies six inches below the ground, and is frozen for most of the year. The top layer of the permafrost thaws, but the bottom layer of gravel and finer material stays frozen all year which keeps moisture from rain on the surface of the ground.

Tundra: Plants

You would think that plants would never live or survive in this biome, but the answer is quite a surprise. There is low diversity in organisms that live here, but many still flourish. Many lichens, mosses, and small shrubs flourish in the arctic tundra. The plants that live in the harsh permafrost soil usually adapt to the weather by being short and grouped together to resist winds and to be protected. The growing season in the tundra is short and lasts up to 60 days. Tundra plants get their energy from the sun through photosynthesis like all other plants, but have adapted to low temperatures and low light intensities. Compared to plants in other biomes they use a minimal amount of energy.

Tundra: Plants

You might find lemmings, caribou, and arctic hares in the tundra. The polar bear is the largest and most dangerous animal in the tundra. Polar bears love to eat fresh, fatty meat. Fatty foods might not be good for humans, but polar bears need the energy from fat to survive the cold tundra. Seals, at times walrus, and sometimes even belugas trapped in open water pockets surrounded by ice are some of the polar bear's favorite meals. They will also eat berries and eggs in the summer. Polar bears hunt by the power of scent and can smell their food at 20 miles away. The stomach of an adult polar bear is so big that it can hold more than 150 pounds of food. Other predators of the tundra are arctic foxes and wolves. Some migratory birds also live in the tundra during part of the year.

Animals who live in the tundra have special adaptations to survive. Some animals in the tundra are adapted to the climate by breeding and raising their young in the summer. Many animals hibernate, or sleep during the worst part of winter to minimize energy loss. Because animals of the tundra are generally migratory, this biome's population is constantly changing. Resident animals have to change what they are hunting and eating as the seasons change. The food chain in the Arctic Tundra consists of predators such as owls, foxes, wolves, and polar bears at the top of the chain. Predators hunt herbivores, plant eating animals, such as caribou, lemmings, and hares. Mosquitoes, flies, moths, grasshoppers, arctic bumblebees, and other insects are at the bottom of the arctic food chain. Many birds feed on these insects.

Savanna



Savanna: Climate

An important factor in the savanna is climate. The climate is usually warm and temperatures range from 68° to 86°F (20 to 30°C). Savannas exist in areas where there is a 6 - 8 month wet summer season, and a 4 - 6 month dry winter season. The annual rainfall is from 10 - 30 inches (25 - 75 cm) per year. During the dry season, lightning often strikes the ground, igniting the dry grasses that cover the savanna.

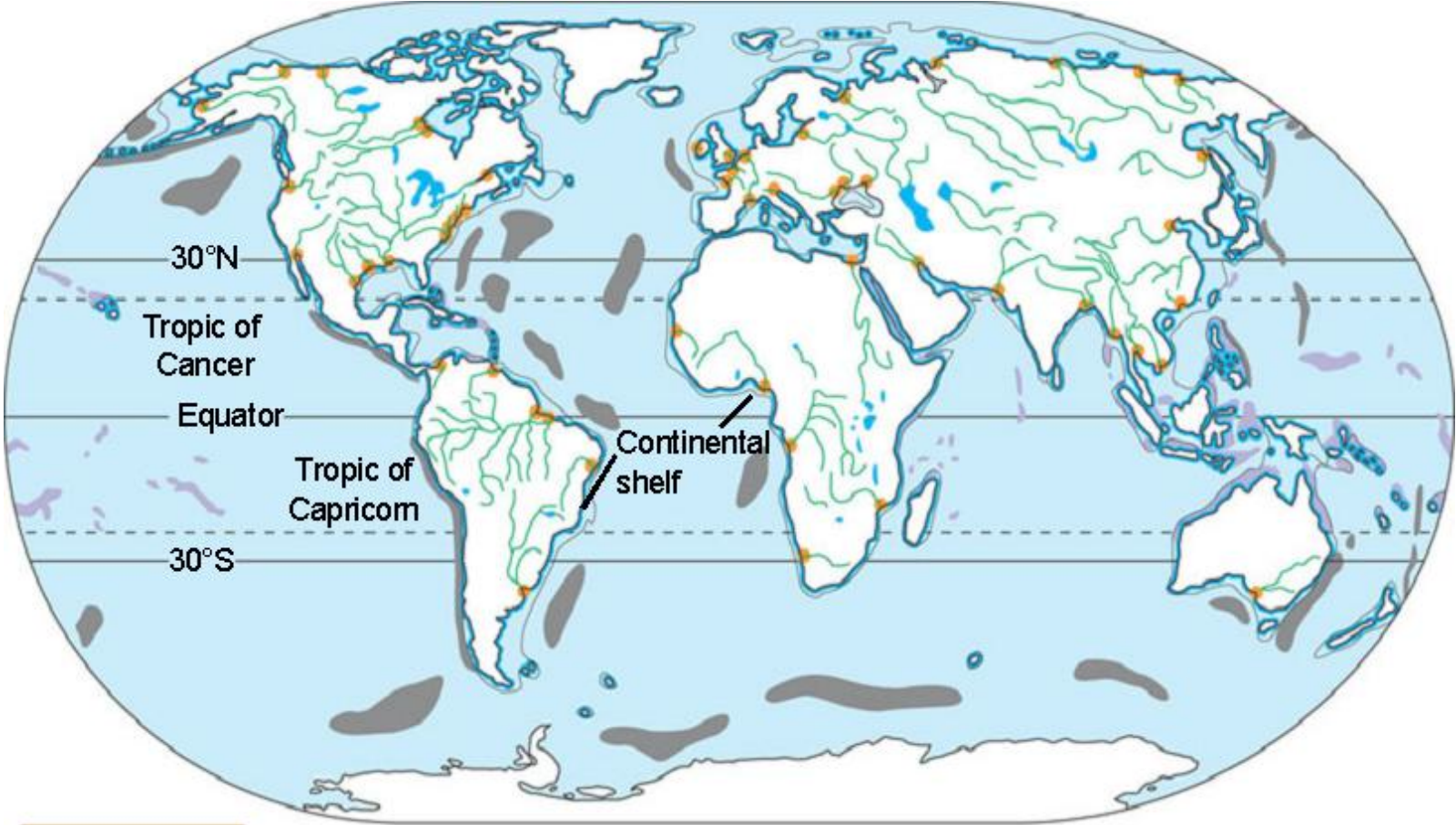
Savanna: Plants

The savanna is dominated by grasses such as Rhodes grass, red oats grass, star grass, lemon grass, and some shrubs. Most savanna grass is coarse and grows in patches with interspersed areas of bare ground. You won't see many trees in the savanna because of little rainfall. Occasionally, you'll find individual trees or small groves of trees. These mostly live near streams and ponds. The Acacia tree is an interesting plant in the savanna. It has an umbrella shape, with branches and leaves high off the ground that giraffes like to eat. Baobab trees also live in the savanna. They deal with dry conditions by storing water between the bark and meat of the tree.

Savanna: Animals

There are many different types of animals that live in the savanna. The species found in savannas vary by the geographic location of the biome. Animals native to African savannas include African elephants, zebras, horses, and giraffes. Many animals in the savanna are herbivores, which means they eat plants, and there is plenty of grass in the savanna. During the rainy months animals thrive in the savanna, but the rainy season is only half the year. During the dry season, surface water from the rain is quickly absorbed into the ground by thirsty soils. The competition for water during the dry season is so intense that most birds and many of the large mammals migrate elsewhere in search of water. Depending on the severity of the drought, the migration may be to a place nearby, or far away. The dry season is often associated with fires. Many insects with short life spans die in these fires, but the birds and larger animals are usually able to fly or run to safety. Although small burrowing animals probably can't outrun the flames, they often survive the fire by digging deep into the ground and remaining there until the flames are gone. Some birds, such as the Fork-tailed Drongos, don't flee the fires; they actually fly to the fires. For these birds fire means dinner. They eat the fleeing or flame-roasted insects.

Estuary



Key

- Lakes
- Rivers
- Estuaries
- Abyssal zone (below oceanic pelagic zone)
- Coral reefs
- Oceanic pelagic zone
- Intertidal zone

Estuary: Location

An estuary is an area where seawater mixes with freshwater. Estuaries can be found along the coast. Each day as the tide rises, saltwater is brought into the estuary. Freshwater comes down the rivers and creeks and mixes with this saltwater. During the dry season there may not be much freshwater flowing down the rivers. This can make the estuary very salty. Also, during the dry season water evaporates out of the estuary making it even more salty. If you have ever tasted the water in the ocean, you know it is very salty. Estuaries can become even saltier! (But don't try tasting the water, not only will it taste bad, but it can be bad for your health.)

Estuary: Plants

Plants found in estuaries need to be adapted to salty conditions. Having too much salt can kill many types of plants. Some plants, like pickle weed, can absorb the salt water and store the salt in special compartments, called vacuoles, in the leaves. This makes the plant taste very salty which may be one of the reasons it is called pickle weed. Other plants, like salt grass and alkali heath, are able to push the salt out onto the surface of the leaves. The salt crystals can be seen if you look very closely.



Gerald and Buff Corsi
© California Academy of Sciences

Estuary: Animals

Many types of animals are found in estuaries. In fact, the complex food web found in an estuary helps to support an amazing diversity of animals. The decaying plants are eaten by microorganisms (animals so tiny you need a microscope to see them.) The microorganisms are eaten by small invertebrates (animals without backbones.) Fish, like carp and stickleback, then eat the invertebrates. Many of the fish we eat depend upon estuaries. They are sheltered places where fish can have their young and the young fish can grow before moving out into the open ocean. Without estuaries, the number of fish in our oceans would decrease greatly. Occasionally, water in certain areas of the estuary can dry up and all that is left is a mud flat. It may seem like there is no life in this mud flat at all, but there are all kinds of mussels, shrimp, worms and other invertebrates living in the mud. Often you can see birds probing the mud with their beaks looking for a tasty meal.

There are a large number of birds found in estuaries. The migrating birds such as geese use them to rest and feed. There are also birds who are permanent residents of the estuaries. Many of these birds, such as the Great Blue Heron, and the Great Egret, have long legs that they use for wading in the water. Egrets are excellent at hunting fish. Some wiggle their toes in the sand to attract fish, which they can snap up for a meal. If you look at the different types of birds, you will notice that they all have different lengths of bills. This means that each type of bird is adapted to eating different things. This reduces the amount of direct competition between the birds and allows more types of birds to live in the same area.

Coral Reef



Coral Reef: Location

Coral reefs are generally found in clear, tropical oceans. Coral reefs form in waters from the surface to about 150 feet (45 meters) deep because they need sunlight to survive. The three types of reefs include fringing reefs, barrier reefs, and atolls. Fringing reefs occur along shorelines of continents and islands and are commonly found in Hawaii and the Caribbean. Barrier reefs are found farther offshore than fringing reefs, occurring most often in the Indo-Pacific and Caribbean. Atolls are a series of low coral islands surrounding a central lagoon, frequently found in the Indo-Pacific. The largest reef in the world, the Great Barrier Reef in Australia is longer than 1200 miles.

Coral reefs need water that is between 68 - 82°F (20 - 28°C), which is often located along the eastern shores of land. Reefs usually develop in areas that have a lot of wave action because the waves bring in food, nutrients and oxygen to the reef. Waves also prevent sediment from falling on the reef. Reefs need calcium from the water to grow, which is more often available in shallow warm waters.

Coral Reef: Plants

The sun is the source of energy for the coral reef ecosystem. Plant plankton, called phytoplankton, algae and other plants convert light energy into chemical energy through photosynthesis. As animals eat the plants and other animals, energy is passed through the food chain. Reef building corals work together with microscopic algae, called zooxanthellae, that live in their tissue. The zooxanthellae provide oxygen and food to the coral through photosynthesis. The coral polyp gives the algae a home, and the carbon dioxide it needs through respiration. Besides zooxanthellae, algae and seagrasses are the main types of plants in the coral reef ecosystem. These plants give food and oxygen to the animals that live on the reef. Seagrasses are especially important because they provide shelter for juvenile reef animals like conch and lobster.

Coral Reef: Animals

Did you know that there can be as many different types of fish in two acres of coral reef in Southeast Asia as there are species of birds on the entire continent of North America? Coral reefs only make up about 1% of the ocean floor, but they house nearly 25% of life in the ocean. Animals use coral reefs either as a stopping point, like an oasis, as they travel the deep blue sea, or they live as residents at the reef. The corals themselves are the most abundant animal on the reef. They are tiny organisms called polyps, that attach themselves to the hard reef and live there forever. The reef is like a giant apartment building in New York City and the coral polyps live together in each apartment. Corals are closely related to sea anemones and sea jellies, and use their tentacles for defense and to capture their prey. Corals can be a variety of colors, white, red, pink, green, blue, orange and purple, due to natural pigments and the zooxanthellae in their tissues.

Other animals that live on the coral reef include sea urchins, sponges, sea stars, worms, fish, sharks, rays, lobster, shrimp, octopus, snails and many more. Many of these animals work together as a team like the coral polyps and zooxanthellae. This teamwork is called symbiosis. One example of symbiosis on the reef is the anemonefish and sea anemone. The sea anemone's tentacles provide protection and safety for the fish and their eggs, while the fish protects the anemone from predators, such as butterflyfish. Sometimes anemonefish even remove parasites from their home anemone.