

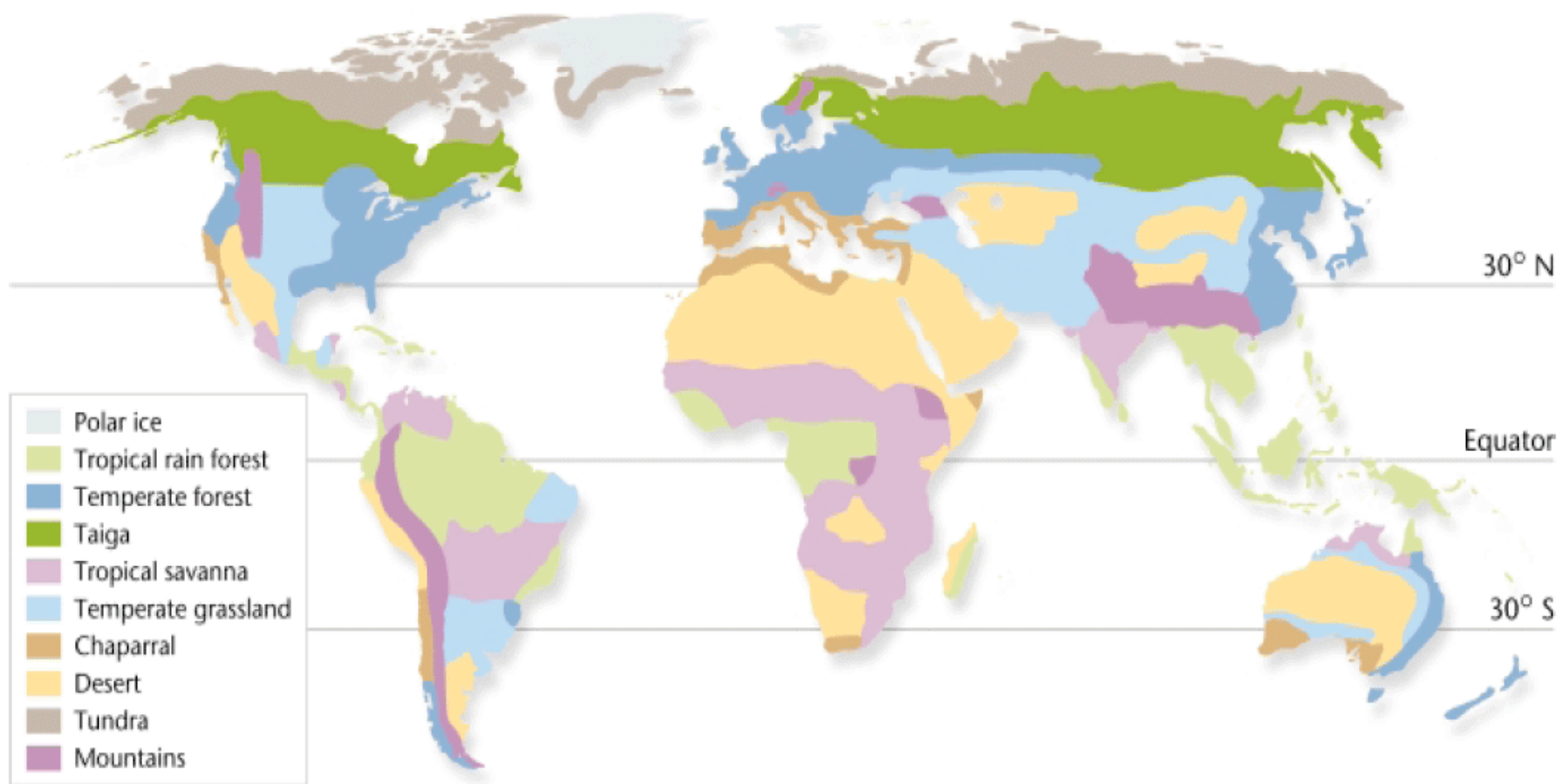
CHAPTER 6: BIOMES

What is a Biome?

- ◎ Biomes are large regions characterized by a specific type of climate and certain types of plant and animal communities.
- ◎ Each biome is made up of many individual ecosystems.

Biomes and Vegetation

- ◎ Biomes are described by their vegetation because plants that grow in an area determine the other organisms that can live there.
- ◎ **Plants in a particular biome have characteristics, specialized structures, or adaptations that allow the plants to survive in that biome.**
- ◎ These adaptations include size, shape, and color. For example, plants in the tundra tend to be short because they cannot obtain enough water to grow larger.



Biomes and Climate

- ◎ **Climate** is the average weather conditions in an area over a long period of time.
- ◎ Climate is the main factor is determining which plants can grow in a certain area, which in turn defines the biome.
- ◎ **Temperature and precipitation are the two most important factors that determine a region's climate.**

Temperature and Precipitation

- ◎ Most organisms are adapted to live within a particular range of temperatures and will not survive at temperatures too far above or below their range.
- ◎ Precipitation also limits the organisms that can be found in a biome because all organisms need water, and the bigger the animal, the more water it needs.

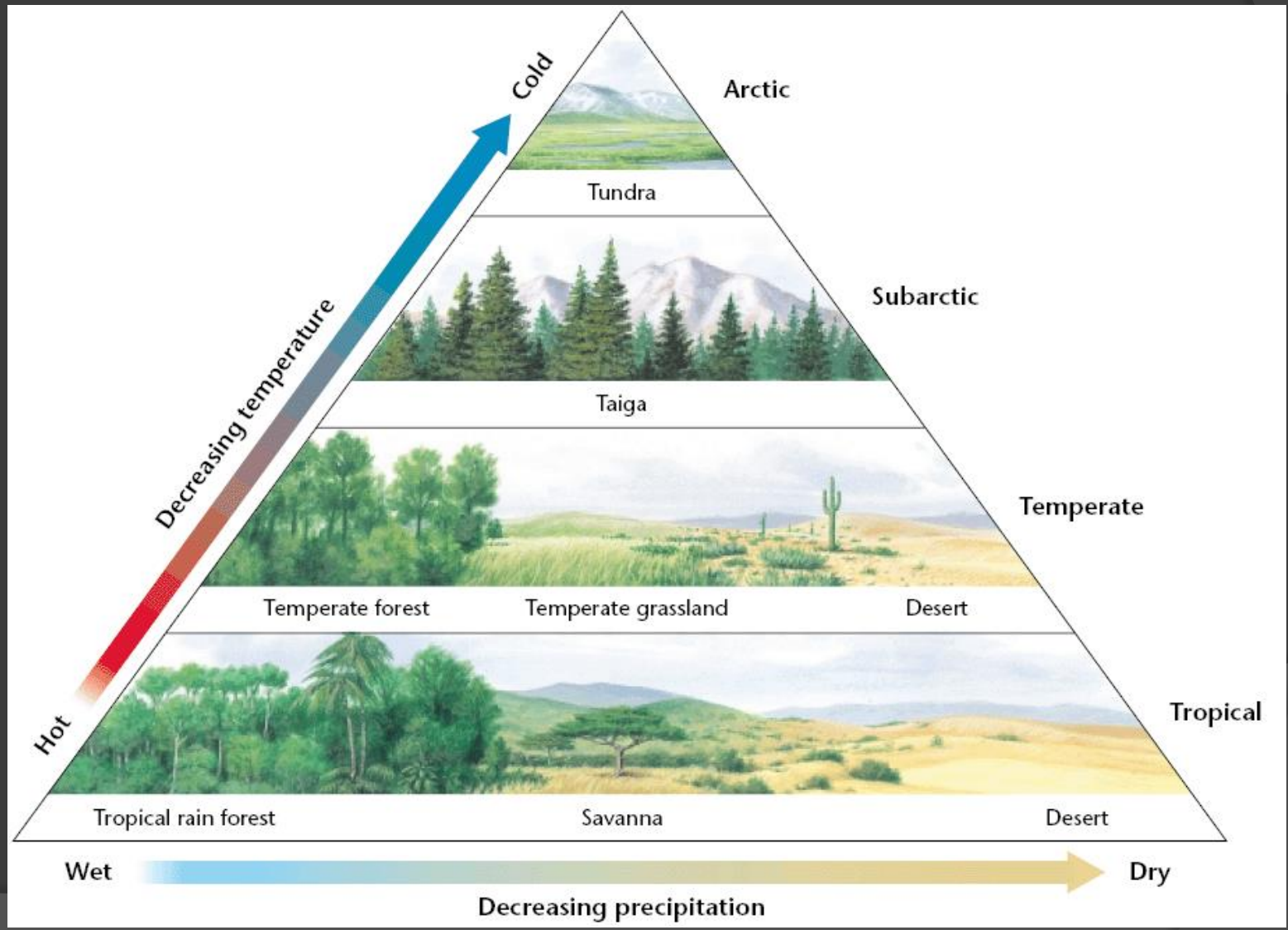
Temperature and Precipitation

- ◎ Biomes that do not receive enough rainfall to support large trees support communities dominated by small trees, shrubs, and grasses.
- ◎ In biomes where rainfall is not frequent, the vegetation is mostly cactuses and desert shrubs. In extreme cases, lack of rainfall results in no plants, no matter what the temperature is.
- ◎ The higher the temperature and precipitation are, the taller and denser the vegetation is.

Latitude and Altitude

- ◎ **Latitude** is the distance north or south from the equator, and is expressed in degrees.
- ◎ **Altitude** is the height of an object above a reference point, such as sea level or the Earth's surface.
- ◎ Climate varies with latitude and altitude.
- ◎ For example, **climate gets colder as latitude and altitude increase**. This is why it gets colder as you move further up a mountain.

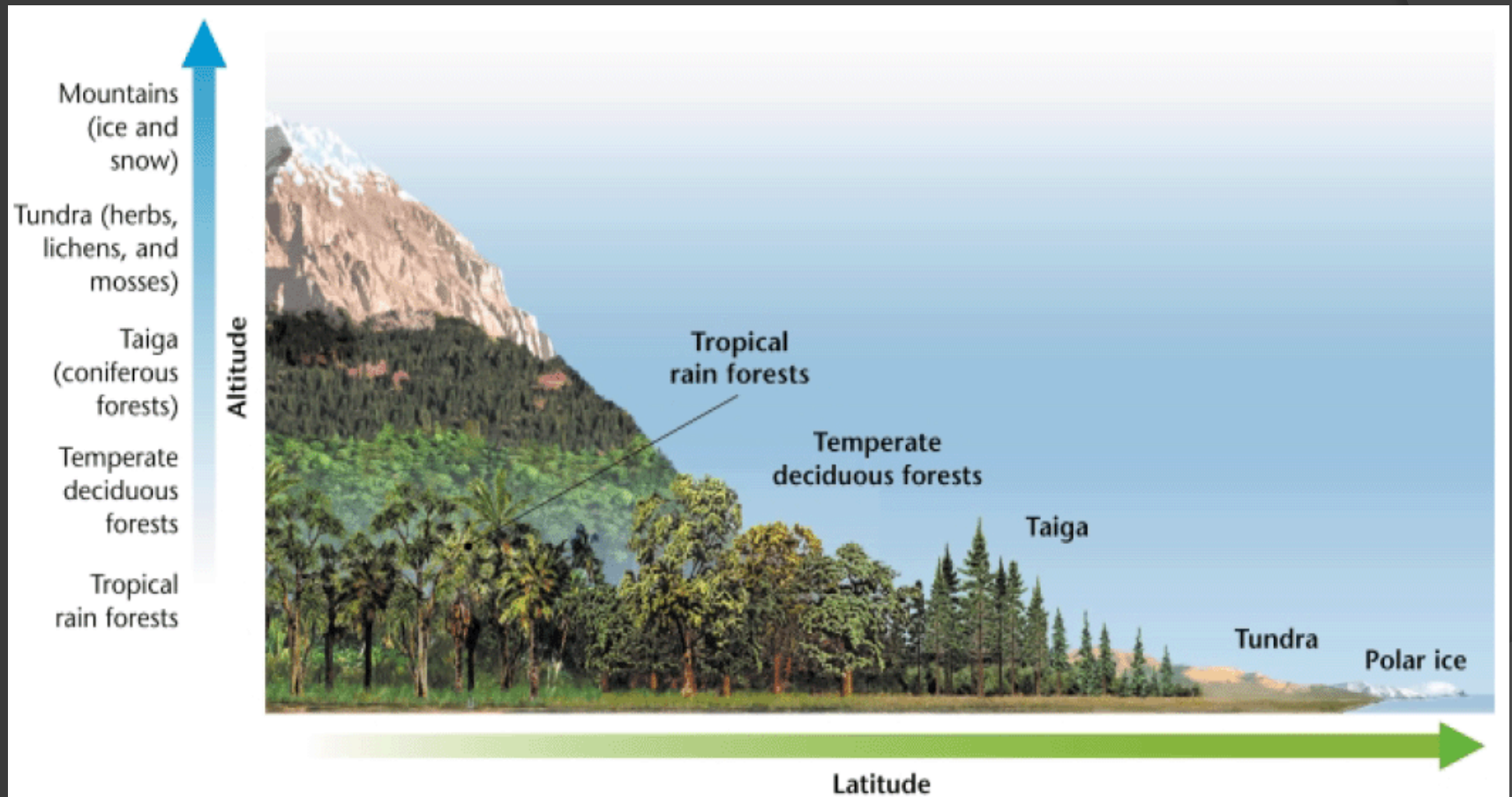
Temperature and Precipitation



Latitude and Altitude

- ◎ As latitude and altitude increase, biomes and vegetation change.
- ◎ Trees of tropical rainforests usually grow closer to the equator, while mosses and lichen of the tundra grow closer to the poles.
- ◎ The temperate region includes biomes such as temperate forests and grasslands, which usually have moderate temperatures and fertile soil that is ideal for agriculture.

Latitude and Altitude



Forest Biomes

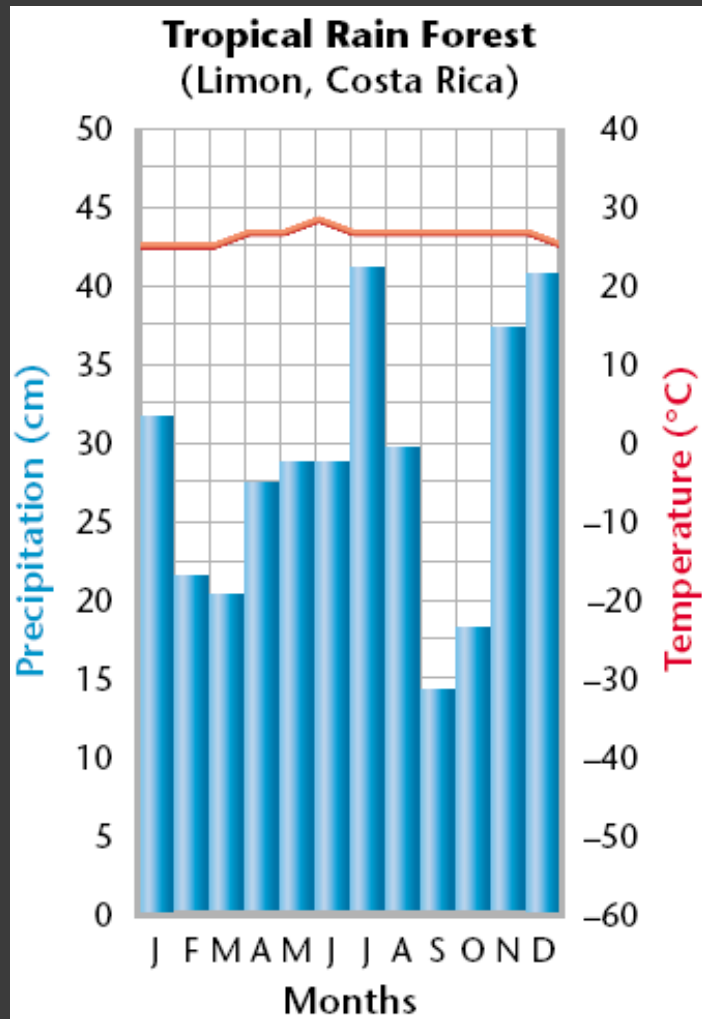
- ◎ Of all the biomes in the world, forest biomes are the most widespread and the most diverse.
- ◎ The large trees of forests need a lot of water, so forests can be found where temperatures are mild to hot and where rainfall is plenty.
- ◎ There are three main forest biomes of the world: tropical, temperate, and coniferous.

Tropical Rain Forests

- ◎ **Tropical rain forests** are forests or jungles near the equator. They are characterized by large amounts of rain and little variation in temperature and **contain the greatest known diversity of organisms on Earth (biodiversity)**.
- ◎ They help regulate world climate and play vital roles in the nitrogen, oxygen, and carbon cycles.
- ◎ They are humid, warm, and get strong sunlight which allows them to maintain a fairly constant temperature that is ideal for a wide variety of plants and animals.



Tropical Rain Forests



Nutrients in Tropical Rain Forests

- ◎ **Most nutrients are within the plants, not the soil.**
- ◎ **Decomposers** on the rain-forest floor break down dead organisms and return the nutrients to the soil, but plants quickly absorb the nutrients.
- ◎ Some trees in the tropical rain forest support fungi that feed on dead organic matter on the rain-forest floor. In this relationship, the fungi transfer the nutrients from the dead matter directly to the tree.

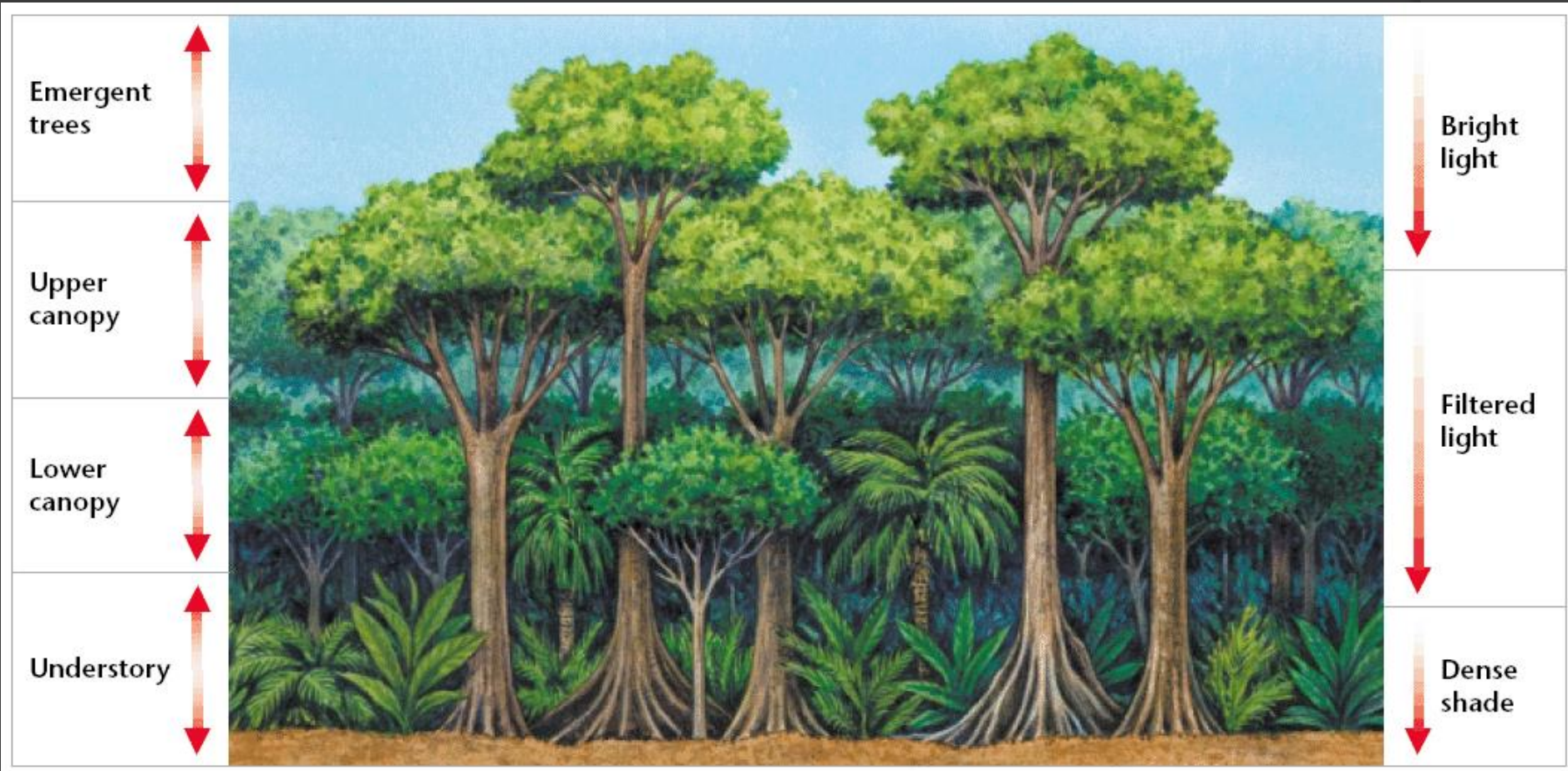
Nutrients in Tropical Rain Forests

- ⦿ Nutrients from dead organic matter are removed so efficiently that runoff from rain forests is often as pure as distilled water.
- ⦿ Most tropical soils that are cleared of plants for agriculture lack nutrients and cannot support crops for more than a few years.
- ⦿ Many of the trees form above ground roots called *buttresses* or *braces* that grow sideways from the tree to provide it with extra support in the thin soil.

Layers of the Rain Forest

- ◎ In tropical rain forests, different types of plants grow in different layers.
- ◎ There are four main layers of the rain forest:
 - The Emergent Layer
 - The Upper Canopy
 - The Lower Layer
 - The Understory

Layers of the Rain Forest



Layers of the Rain Forest

- ◎ The **emergent layer** is the **top** foliage layer in a forest where the trees extend above surrounding trees.
- ◎ Trees in this layer grow and emerge into direct sunlight reaching heights of 60 to 70 m and can measure up to 5 m around.
- ◎ Animals such as eagles, bats, monkeys, and snakes live in the emergent layer.

Layers of the Rain Forest

- ◎ The **canopy** is the layers of treetops that shade the forest floor, and is considered to be the **primary layer of the rain forest**.
- ◎ The tall trees, more than 30 m tall, form a dense layer that absorbs up to 95 percent of the sunlight.
- ◎ The canopy can be split into an upper and lower canopy with the lower canopy receiving less of the sunlight.



Layers of the Rainforest

- ◎ **Epiphytes** are plants that use another plant for support but not for nourishment, and are located on high trees in the canopy.
- ◎ Growing on tall trees in allows them to reach the sunlight needed for photosynthesis, and to absorb the water and nutrients that run down the tree after it rains.
- ◎ Most animals that live in the rain forest live in the canopy because they depend on the abundant flowers and fruits that grow there.



Layers of the Rainforest

- ◎ The **understory** is the foliage layer that is beneath and shaded by the main canopy of a forest.
- ◎ Little light reaches this layer allowing only trees and shrubs adapted to shade to grow there.
- ◎ Most plants in the understory do not grow more than 3.5 m tall.
- ◎ Herbs with large flat leaves that grow on the forest floor capture the small amount of light that penetrates the understory.



Species Diversity

- ◎ The diversity of rain-forest vegetation has led to the evolution of a diverse community of animals.
- ◎ Most rainforest animals are specialists that use specific resources in particular ways to avoid competition and have adapted amazing ways to capture prey and avoid predators.
- ◎ Insects use camouflage to avoid predators and may be shaped like leaves or twigs.

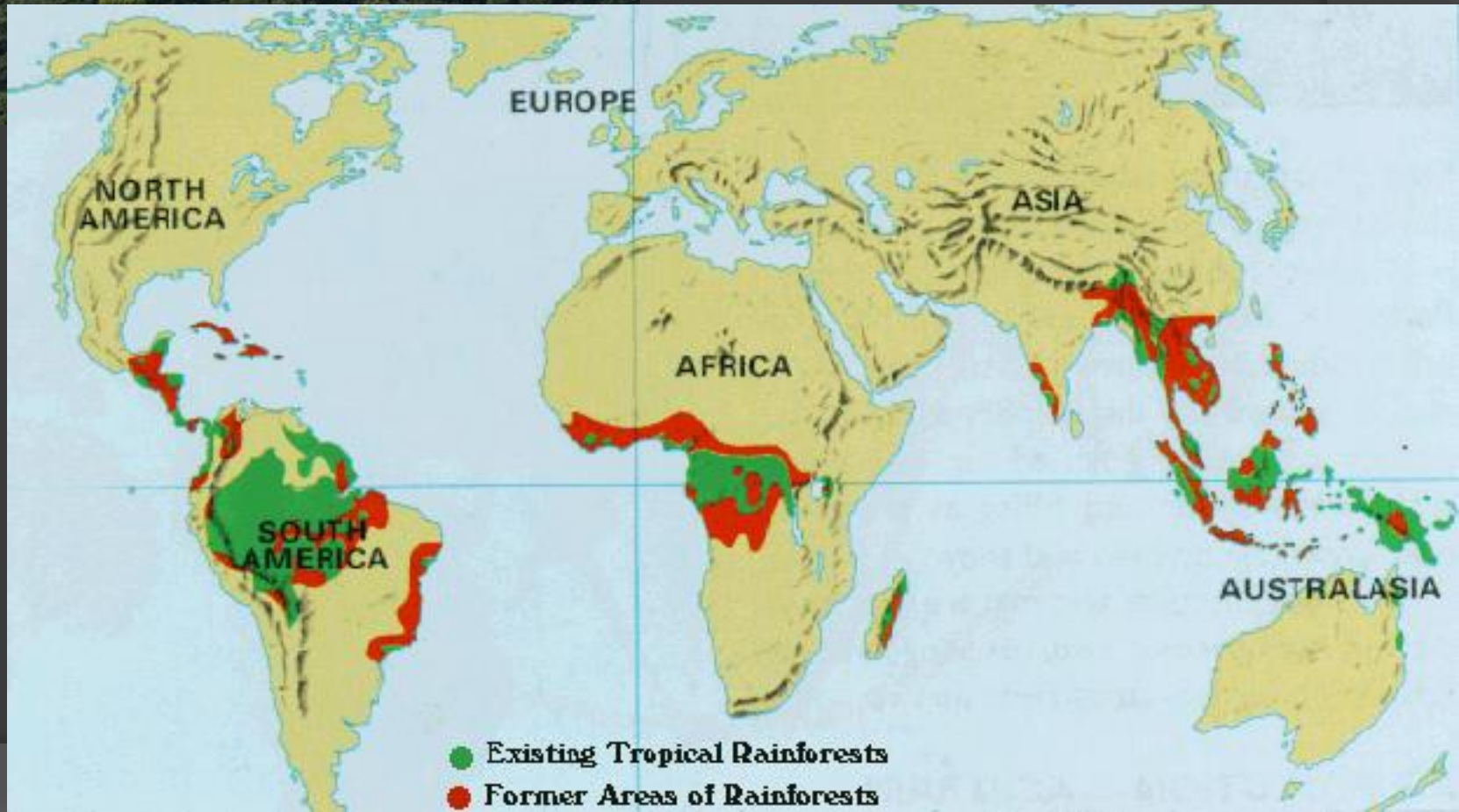


Threats to Rain Forests

- ◎ Every minute of every day, 100 acres of tropical rainforest are cleared for logging operations, agriculture, and oil exploration. Exotic-pet trading robs the rain forests of rare and valuable plant and animal species only found there.
- ◎ Habitat destruction occurs when land inhabited by an organism is destroyed or altered.
- ◎ If the habitat that an organism depends on is destroyed, the organism is at risk of disappearing.

Threats to Rain Forests

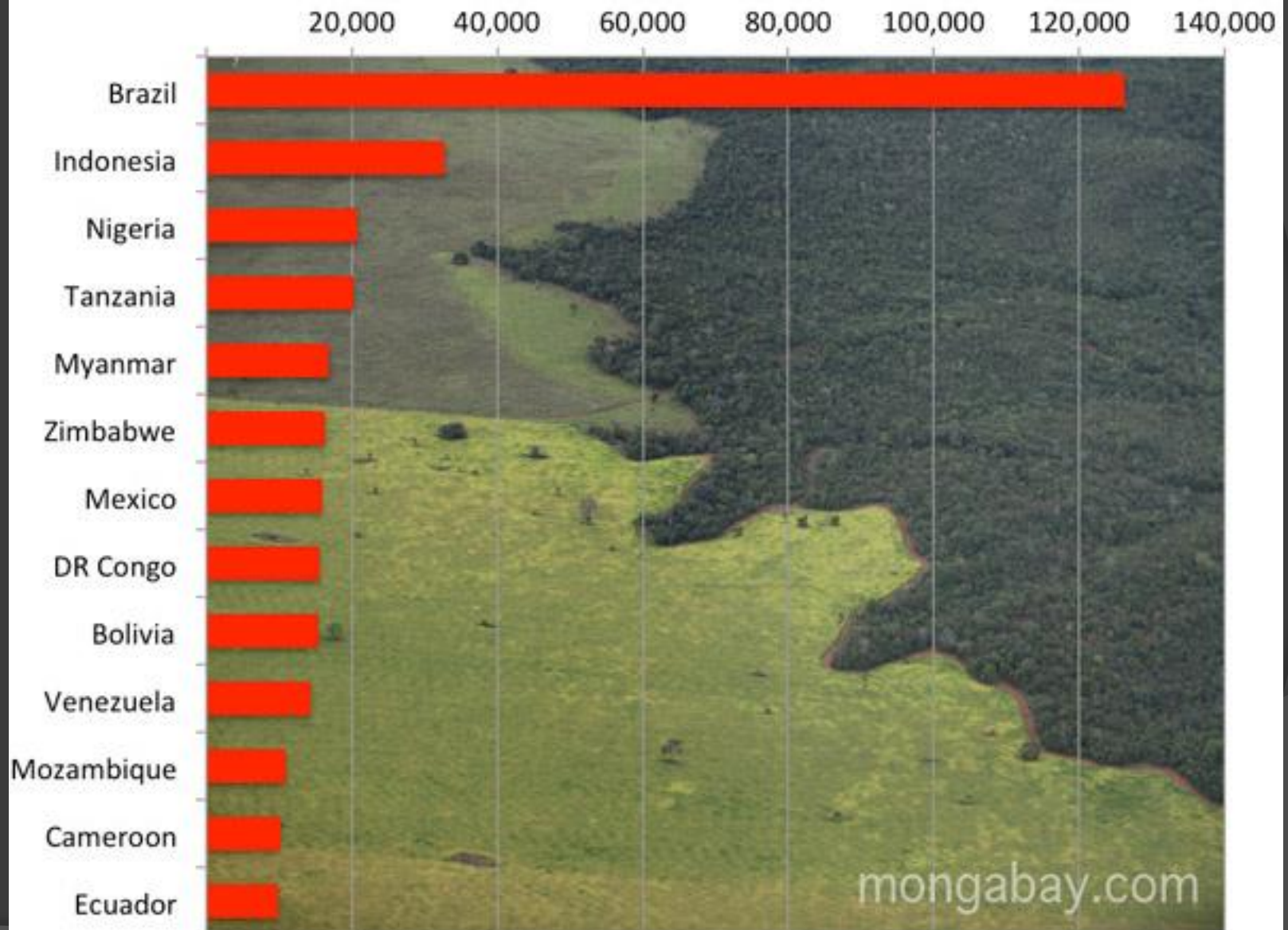
- ◎ An estimated 50 million native peoples live in tropical rain forests and are also threatened by habitat destruction.
- ◎ Because they obtain nearly everything they need from the forest, the loss of their habitat could force them to leave their homes and move into cities.
- ◎ This drastic change of lifestyle may then cause the native peoples to lose their culture and traditions.



● Existing Tropical Rainforests

● Former Areas of Rainforests

Highest tropical forest loss between 2005 and 2010 (square kilometers)



Temperate Forests

- ◎ **Temperate rain forests** are forests communities that are characterized by cool, humid weather and abundant rainfall, where tree branches are draped with mosses, tree trunks are covered with lichens, and the forest floor is covered with ferns.
- ◎ They occur in North America, Australia, and New Zealand, and are dominated by evergreen trees such as the Douglas fir and Sitka spruce.

Temperate Forests

- ⦿ Although located north of most other rain forests, the temperate rain forest of the Pacific Northwest still maintains a moderate temperature year round.
- ⦿ It rarely freezes because the nearby Pacific Ocean waters keep temperatures mild by blowing cool ocean water over the forest.
- ⦿ As the ocean winds meet the costal Olympic Mountains, a large amount of rainfall is produced which keeps the temperature cool and moist.

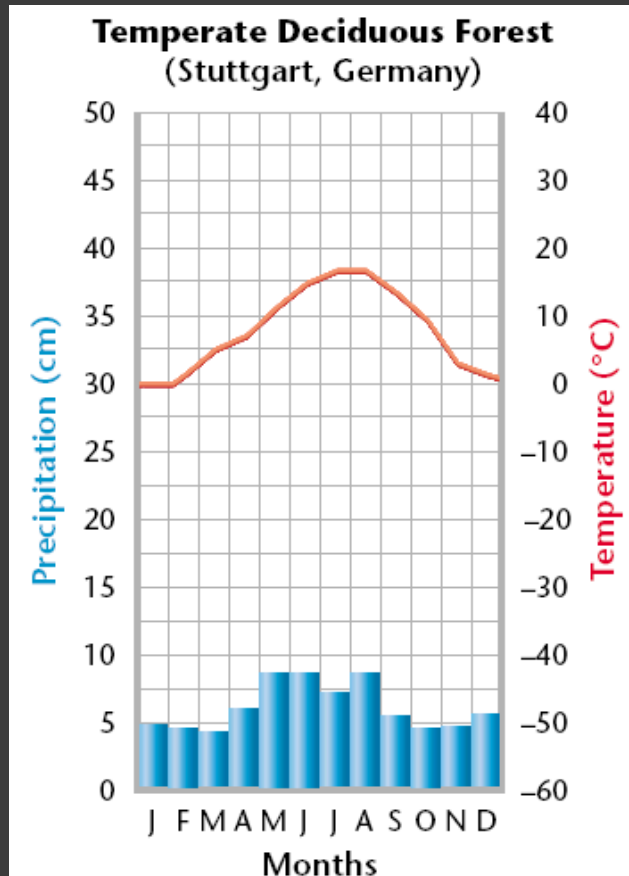


Temperate Deciduous Forests

- ◎ **Temperate deciduous forests** are forests characterized by trees that shed their leaves in the fall, and located between 30° and 50° north latitude.
- ◎ The range of temperatures can be extreme, with summer temperatures soaring to 35°C and winter temperatures often falling below freezing.
- ◎ They receive 75 to 125 cm of precipitation annually which helps to decompose dead organic matter contributing to the rich soils of the forest.



Temperate Deciduous Forests



Plants of Deciduous Forests

- ◎ Plants in the deciduous forests grow in layers with tall trees, such as birch, dominating the canopy while shrubs cover the understory. Also, more light reaches deciduous forest floors than rain forests floors allowing more plants to grow.
- ◎ Temperate-forest plants are adapted to survive seasonal changes. In the fall and winter, trees shed their leaves and seeds go dormant under the insulation of the soil. With the returning warmth in the spring, the trees grow new leaves and seeds germinate.

Animals of Deciduous Forests

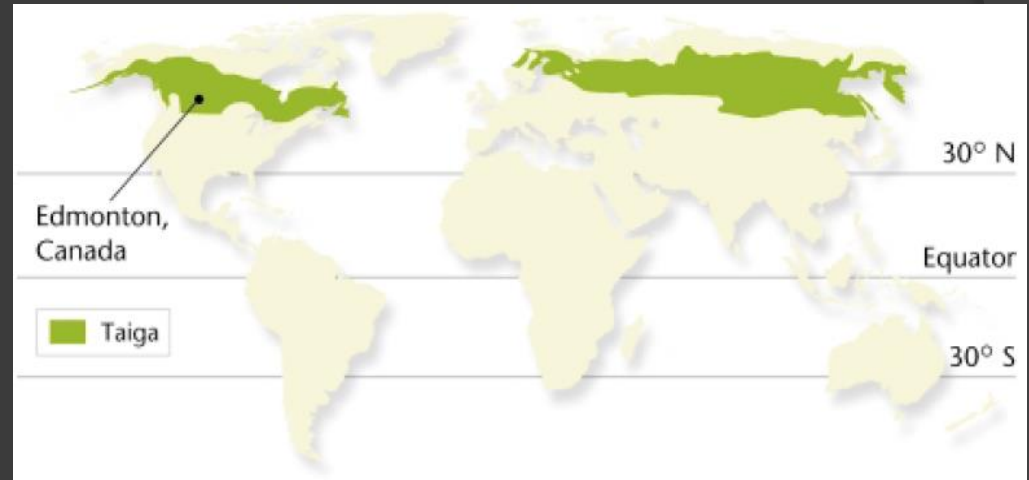
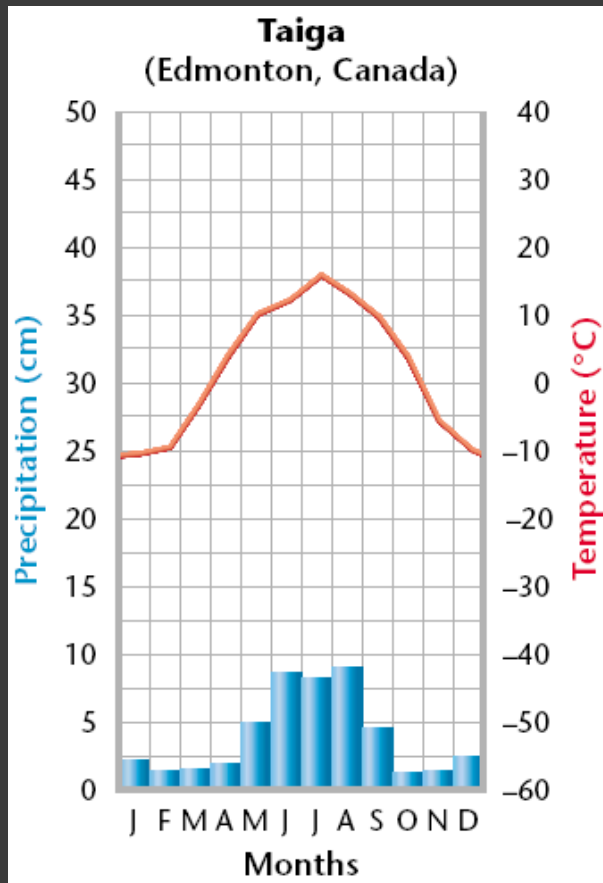
- ◎ The animals of temperate deciduous forests are adapted to use the forest plants for both food and shelter.
- ◎ Birds cannot survive the harsh winter of the deciduous forests so each fall they fly south for warmer weather and better availability of food.
- ◎ Other animals, such as mammals and insects, reduce their activity so that they do not need as much food for energy, enabling them to survive the winter.



Taiga

- ◎ The **taiga** is the region of evergreen, coniferous forest below the arctic and subarctic tundra regions.
- ◎ The taiga has long winters and little vegetation.
- ◎ The growing season can be as short as 50 days with most plant growth occurring during the summer months because of nearly constant daylight and larger amounts of precipitation.

Taiga







Plants of the Taiga

- ◎ A **conifer** is a tree that has seeds that develop in cones. Their leaves' arrow shape and waxy coating helps them to retain water in the winter. The conifer's shape also helps the tree shed snow to the ground and not get weighed down.
- ◎ Conifer needles contains substances that make the soil acidic when they fall to the ground preventing plants from growing on the floor.
- ◎ Also, soil forms slowly in the taiga because the climate and acidity slow decomposition.

Animals of the Taiga

- ◎ The taiga has many lakes and swamps that in the summer attract birds that feed on insects.
- ◎ To avoid the harsh winters, birds migrate, while some year round residents, such as shrews, burrow underground for better insulation.
- ◎ Other animals, such as snowshoe hares, have adapted to avoid predation by shedding their brown summer fur and growing white fur that camouflages them in the winter snow.



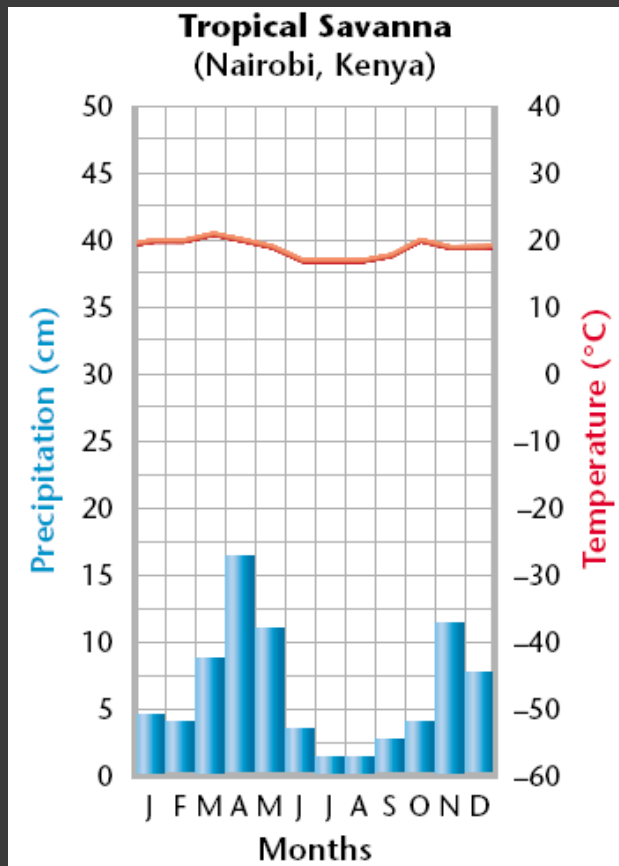
Grassland, Desert, and Tundra Biomes

- ◎ In climates that have less rainfall, forest biomes are replaced by savanna, grassland, and chaparral biomes.
- ◎ As even less rain falls in these biomes, they change into desert and tundra biomes.
- ◎ **As precipitation decreases in an area, the diversity of the species in the area also decreases.** But, the number of individuals of each species present may still be very large.

Savannas

- ◎ **Savannas** are plains full of grasses and scattered trees and shrubs that are found in tropical and subtropical habitats. Found mainly in regions with a dry climate, such as East Africa and western India.
- ◎ Although savannas receive little precipitation throughout the year, they do have a wet season and a dry season.
- ◎ Many animals are only active during the wet season. Grass fires help to restore nutrients to the soil during the dry season.

Savannas





Plants of the Savanna

- ◎ Because most of the rain falls during the wet season, plants must be able to survive **prolonged periods without water**.
- ◎ Some plants have large **horizontal root systems** to help them survive the dry season. These roots also enable the plant to grow quickly after a fire.
- ◎ The grasses also have coarse vertical leaves that expose less surface area to help conserve water, while some trees shed their leaves. Almost all have thorns for protection from herbivores.

Animals of the Savanna

- ◎ Grazing herbivores, like the elephant, have adopted migratory ways of life, following the rains to areas of new grass and fresh watering holes. Predators often stalk these animals for food.
- ◎ Many savanna animals give birth only during the rainy season, when food is abundant and the young are more likely to survive.
- ◎ Some species of herbivores reduce competition for food by eating vegetation at different heights than other species do.



Temperate Grasslands

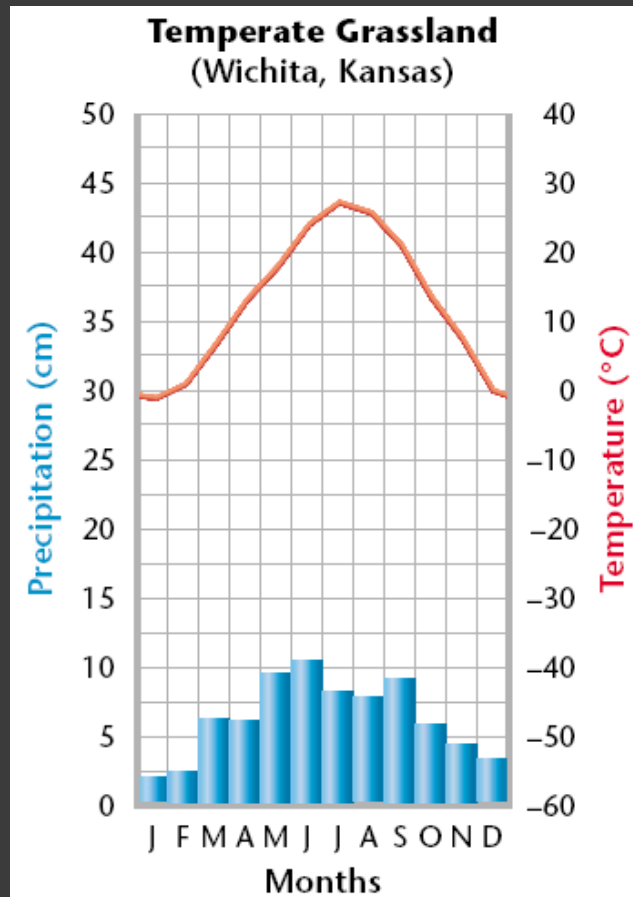
- ◎ **Temperate grasslands** are communities (or biomes) that are dominated by grasses, have few trees, and are characterized by hot summers and cold winters, with rainfall that is intermediate between that of a forest and a desert.
- ◎ **Temperate grasslands have the most fertile soil of any biome.** Few natural temperate grasslands remain because many have been replaced by grazing areas and farms growing crops such as corn, soybeans, and wheat.



Temperate Grasslands

- ◎ Temperate grasslands are located on the interiors of continents where too little rain falls for trees to grow and include the prairies of North America.
- ◎ Mountains often play a crucial role in maintaining grasslands as rain clouds from the west are blocked. However, rainfall does increase as you move eastward, allowing taller grasses to grow.
- ◎ Heavy precipitation is rare in the grasslands, allowing the hot temperatures in the summer to make the grasslands susceptible to fires.

Temperate Grasslands

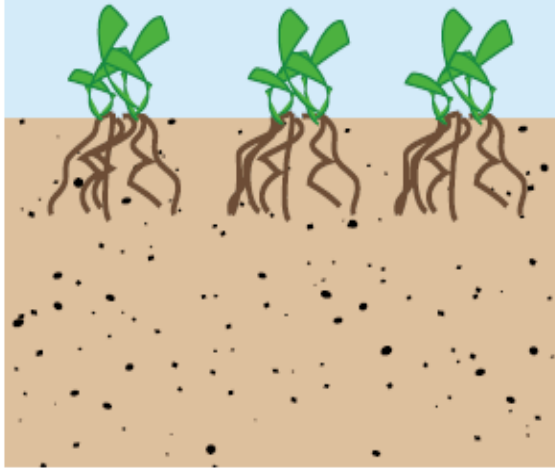


Plants of Temperate Grasslands

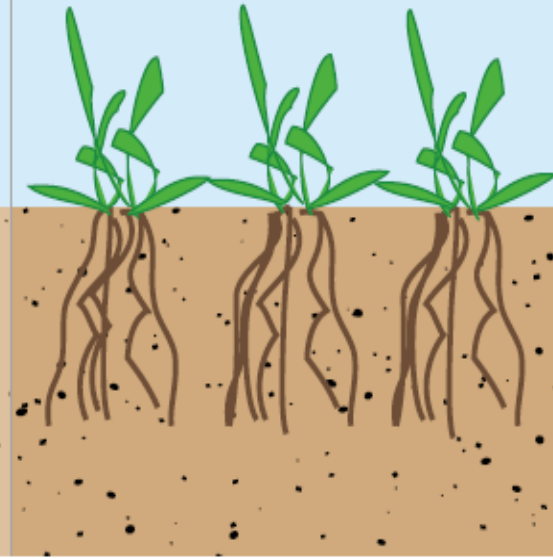
- ◎ The roots system of prairie grasses form dense layers that survive drought and fire allowing the plants to come back from year to year.
- ◎ **Few trees** survive on the grasslands because of the lack of rainfall, fire, and the constant winds.
- ◎ The amount of rainfall in the area determines the types of plants that will grow in that area with varying root depth and grass height.

Grassland Plants

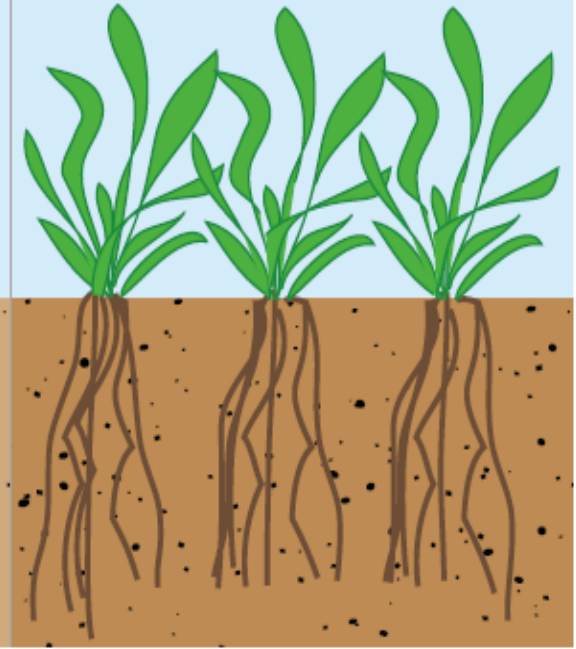
Shortgrass prairie
(about 25 cm
rain per year)



**Mixed or
middlegrass prairie**
(about 50 cm
rain per year)



Tallgrass prairie
(up to 88 cm
rain per year)



Animals of Temperate Grasslands

- ◎ Some grazing animals, such as the bison and pronghorn antelope, have large, flat teeth for chewing the coarse prairie grasses.
- ◎ Other grasslands animals, such as prairie dogs, owls, and badgers, live protected in underground burrows that protect them from predators on the open grasslands.



Threats to Temperate Grasslands

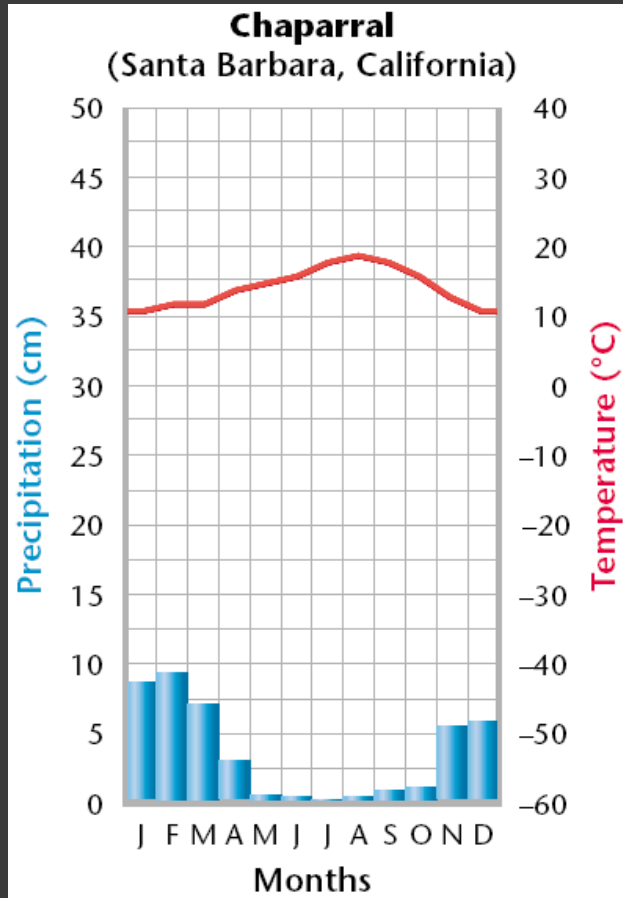
- ⦿ Farming and overgrazing have changed the grasslands.
- ⦿ Grains crops cannot hold the soil in place as well as native grasses can because the roots of crops are shallow, so soil erosion eventually occurs.
- ⦿ **Erosion** is also caused as the grasses are constantly eaten and trampled.
- ⦿ Constant use can change the fruitful grasslands into desert-like biomes.

Chaparral

- ◎ **Chaparral** is a type of temperate woodland biome with vegetation that includes broad leaved evergreen shrubs and is located in areas with hot, dry summers and mild, wet winters.
- ◎ Chaparrals are located in the middle latitudes, about 30° north and south of the equator.
- ◎ Chaparrals are located primarily in coastal areas that have Mediterranean climates.



Chaparral



Plants of the Chaparral

- ◎ Most chaparral plants are low-lying, evergreen shrubs and small trees that tend to grow in dense patches and include chamise, manzanita, scrub oak, and herbs like sage and bay.
- ◎ These plants have small, **leathery** leaves that contain oils that promote burning, allowing natural fires to destroy competing trees.
- ◎ Chaparral plants are well **adapted to fire** and can resprout from small bits of surviving plant tissue.

Animals of the Chaparral

- ◎ A common adaptation of chaparral animals is camouflage, shape or coloring that allows an animal to blend into its environment.
- ◎ Animals such as quail, lizards, chipmunks, and mule deer have a brownish gray coloring that lets them move through the brush without being noticed.



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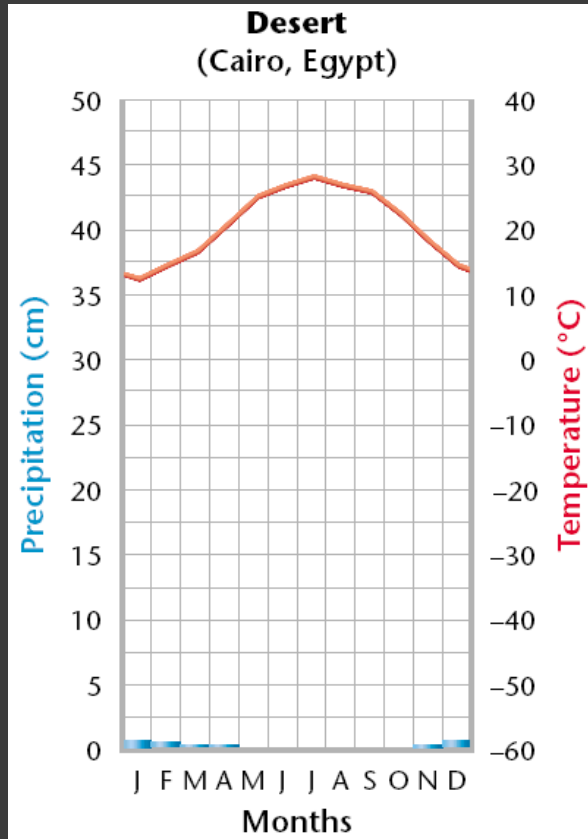
Threats to the Chaparral

- ◎ Worldwide, the greatest threat to chaparral is **human development**.
- ◎ Humans tend to develop lands of the chaparral for commercial and residential use because these biomes get a lot of sun, are near the oceans, and have a mild climate year round.

Deserts

- ◎ **Deserts** are regions that have little or no vegetation, long periods without rain, and extreme temperatures.
- ◎ Although there are hot and cold deserts, one characteristic they both share is the fact that they are the **driest places on Earth**.
- ◎ Deserts are often located near large mountain ranges because mountains can block the passage of moisture-filled clouds, limiting precipitation.

Deserts



Plants of the Desert

- ◎ All desert plants have adaptations for obtaining and conserving water, which allows the plants to live in dry, desert conditions.
- ◎ Plants called *succulents*, such as cactuses, have thick, fleshy stems and leaves that conserve water. Their leaves also have a waxy coating to prevent water loss, while sharp spines on the plant keep animals away.
- ◎ Many plant roots spread out just under the surface to absorb as much rain as possible.



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Plants of the Desert

- ◎ Some plants are adapted to survive for long periods of time without water.
- ◎ When conditions are too dry, these plants die and drop their seeds that stay dormant until the next rainfall. Then, new plants quickly germinate, grow, and bloom before the soil becomes dry again.
- ◎ These plants can survive their water content dropping to as low as 30 percent of their mass.

Animals of the Desert

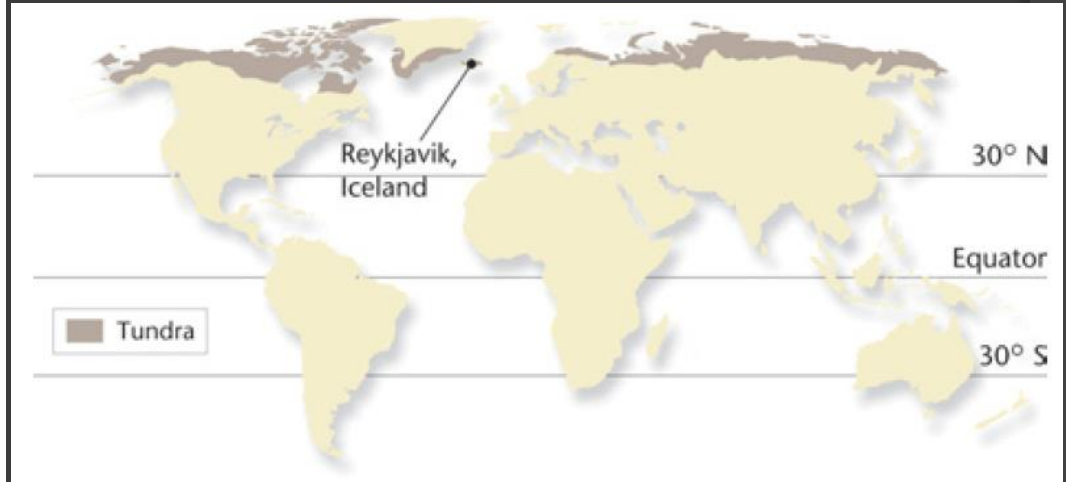
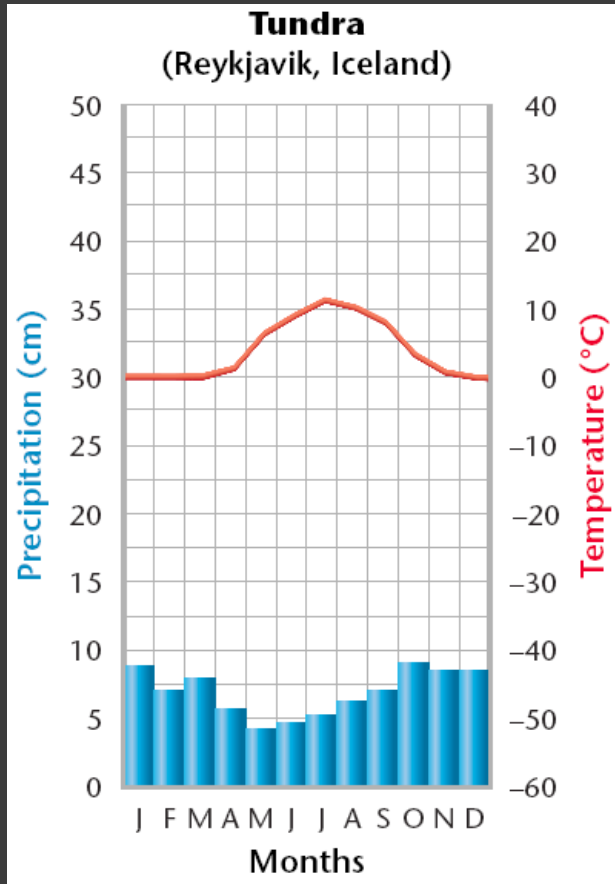
- ◎ Animals of the desert have adapted many different ways to prevent water loss.
- ◎ Reptiles have thick, scaly skin that prevents water loss. Amphibians survive by estivating, or burying themselves in the ground and sleeping through the dry season. Insects are covered with body armor that helps them retain water.
- ◎ In addition, most desert animals are nocturnal, meaning they are active mainly at night or dusk when it is cooler.



Tundra

- ◎ The **tundra** is a treeless plain that is located in the Arctic or Antarctic and that is characterized by very low winter temperatures, short, cool summers, and vegetation that consists of grasses, lichens, and perennial herbs.
- ◎ Summers are short in the tundra, so only the top few centimeters of soil thaw.
- ◎ **Permafrost** is the permanently frozen layer of soil or subsoil and can be found in the tundra regions.

Tundra



Vegetation of the Tundra

- ◎ Mosses and lichens, which can grow without soil, cover vast areas of rocks in the tundra.
- ◎ The soil is thin, so plants have wide shallow roots to help anchor them against the icy winds.
- ◎ Most flowering plants are short, which keeps them out of the wind and helps them absorb heat from the sunlit soil. Woody plants and perennials have evolved dwarf forms that grow flat along the ground.

Animals of the Tundra

- ◎ Millions of migratory birds fly to the tundra to breed in the summer when food is abundant.
- ◎ Caribou migrate throughout the tundra in search of food and water. Hunters such as wolves prey on migratory caribou, deer, and moose.
- ◎ Rodents stay active, but burrow underground to avoid the cold. Other year-round residents, such as arctic foxes, lose their brown summer coat for white fur that camouflages them with the snow.



Threats to the Tundra

- ◎ The tundra is one of the most fragile biomes on the planet. The food chains are relatively simple so they are easily disrupted.
- ◎ Until recently these areas have been undisturbed by humans. But oil was located in parts of the tundra, and oil exploration, extraction, and transport has disrupted many tundra habitats.
- ◎ Pollution caused by spills or leaks of oil and other toxic materials may also poison the food and water sources of organisms of the tundra.

