

Chapter 6: Biomes  
Section 1: What is a Biome?

**DAY ONE**



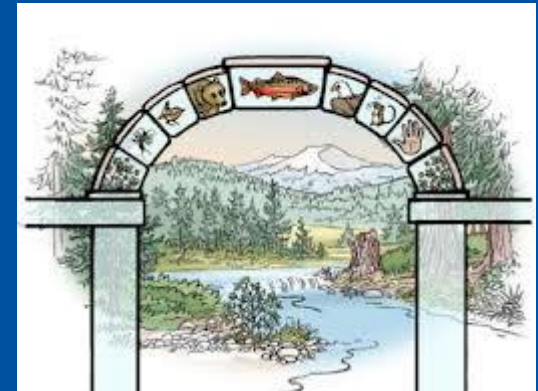
## What is a Biome?

- Biomes are large regions characterized by a **specific type of climate and certain types of plant and animal communities**.
- The **climate and geography** of a region determines what type of biome can exist in that region.
- Each biome is made up of many individual **ecosystems**.
  - Communities within the biome have adapted to the small differences in climate and the environment inside the biome.
- Major biomes include deserts, forests, grasslands, tundra, and several types of aquatic environments.



## More on Biomes

- All living things are **closely related** to their environment.
- Any change in one part of an environment, like an **increase or decrease** of a species of animal or plant, causes a **ripple effect** of change in other parts of the environment.
- Remember, each organism depends in some way on other living and nonliving things in its surroundings.



## Biome Information

What is Biome?

## To understand a world biome, you need to know the following:

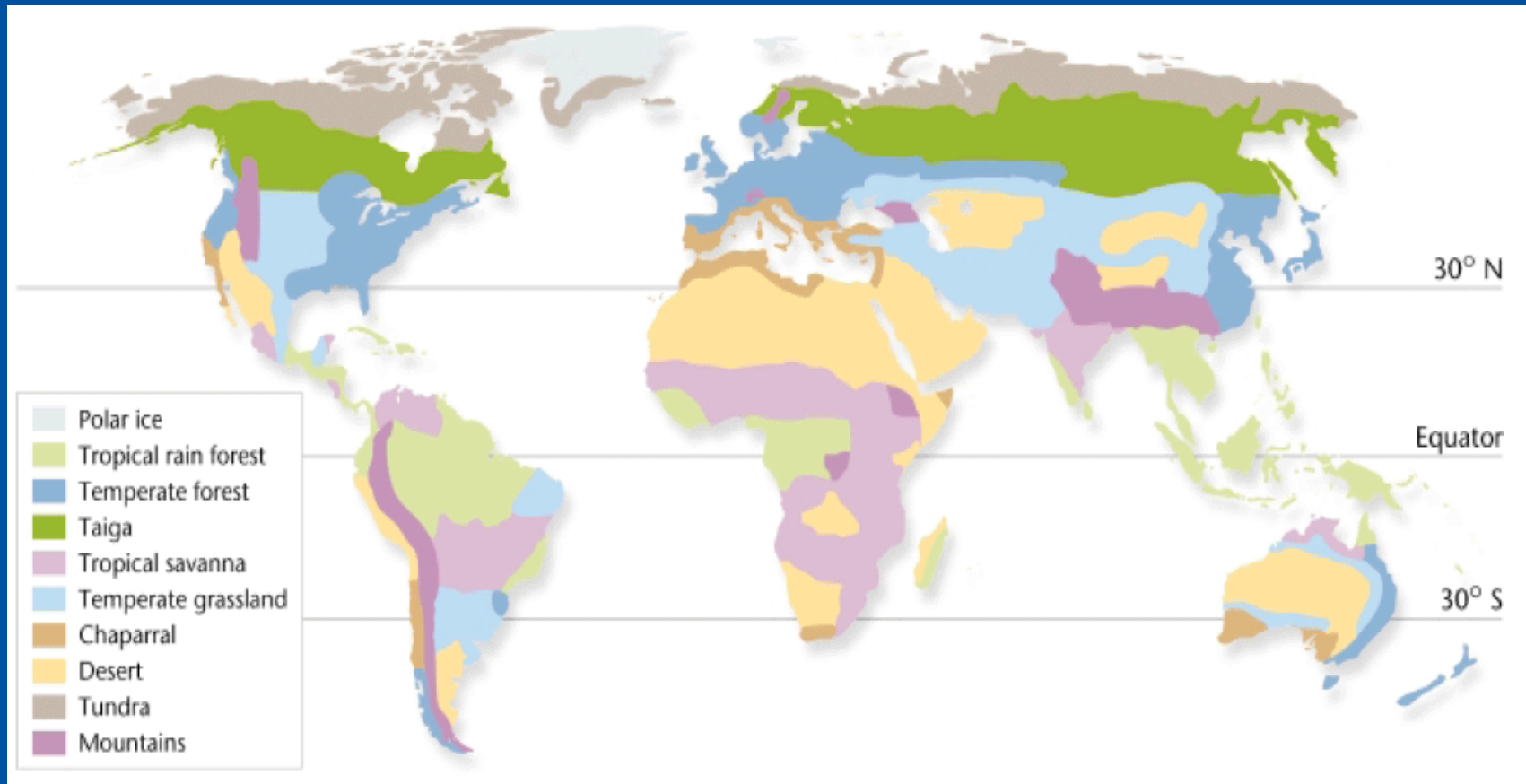
- What the **climate** of the region is like
- Where each biome is **found** and what its **geography** is like.
- The special **adaptations** of the vegetation.
- The types of animals found in the biome and their **physical and behavioral** adaptations to their environment.



## 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.

# The World's Major Terrestrial Biomes



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## Biomes and Climate

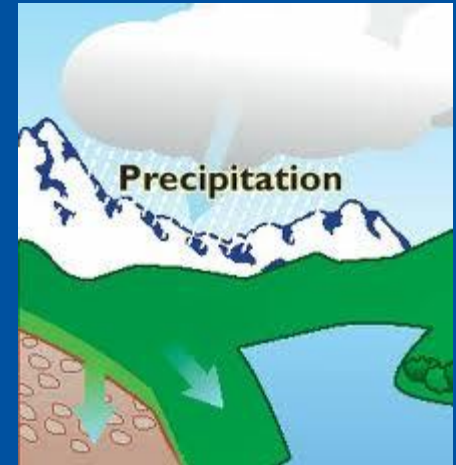
- **Climate** is the average weather conditions in an area over a long period of time.
- Climate is the **main** factor is determining which plants can grow in a certain area, which in turn defines the biome.
- **Temperature and precipitation** are the two most important factors that determine a region's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



# Weather versus Climate

[NASA Explains](#)

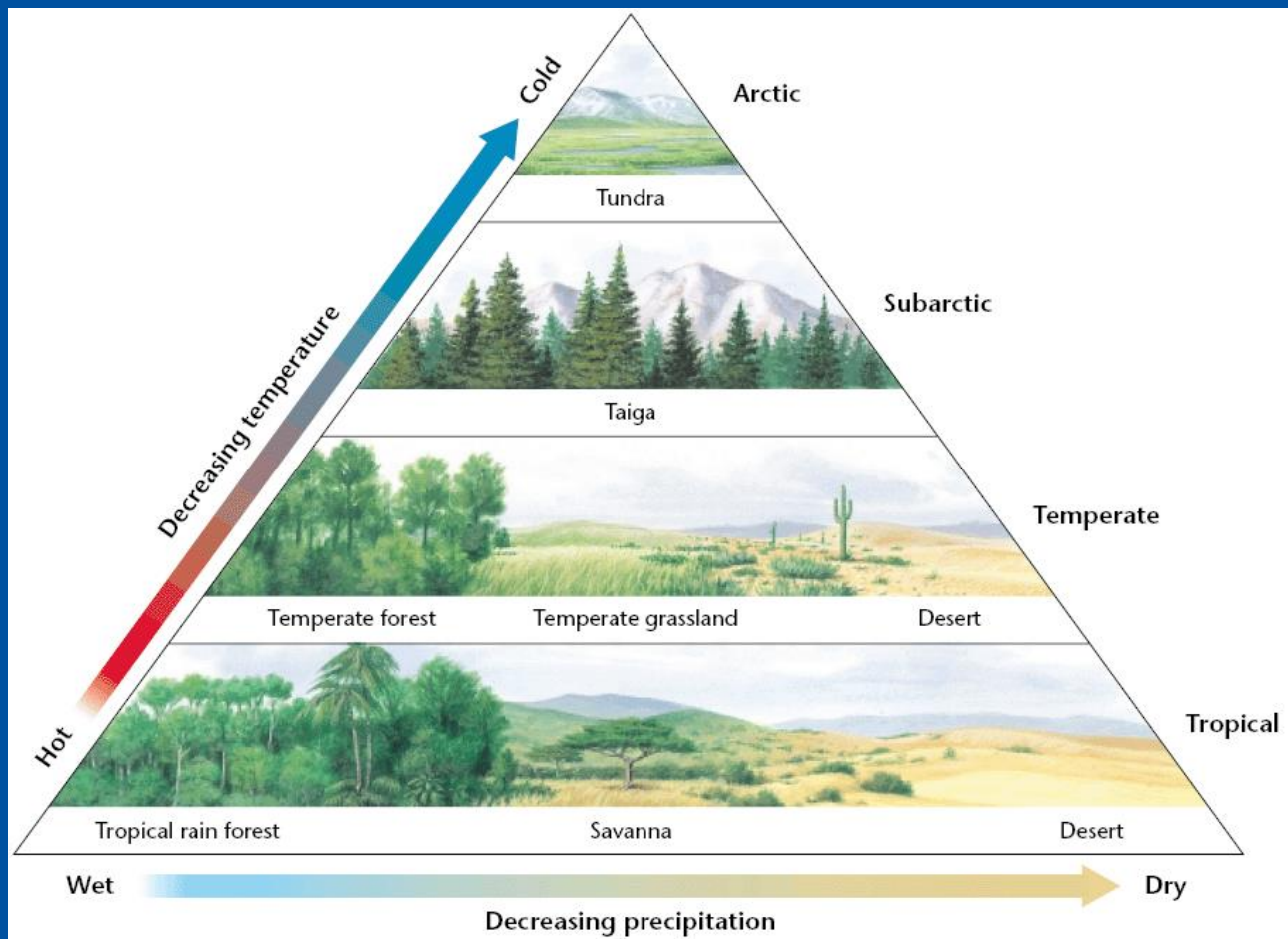


## Latitude and Altitude

- **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.



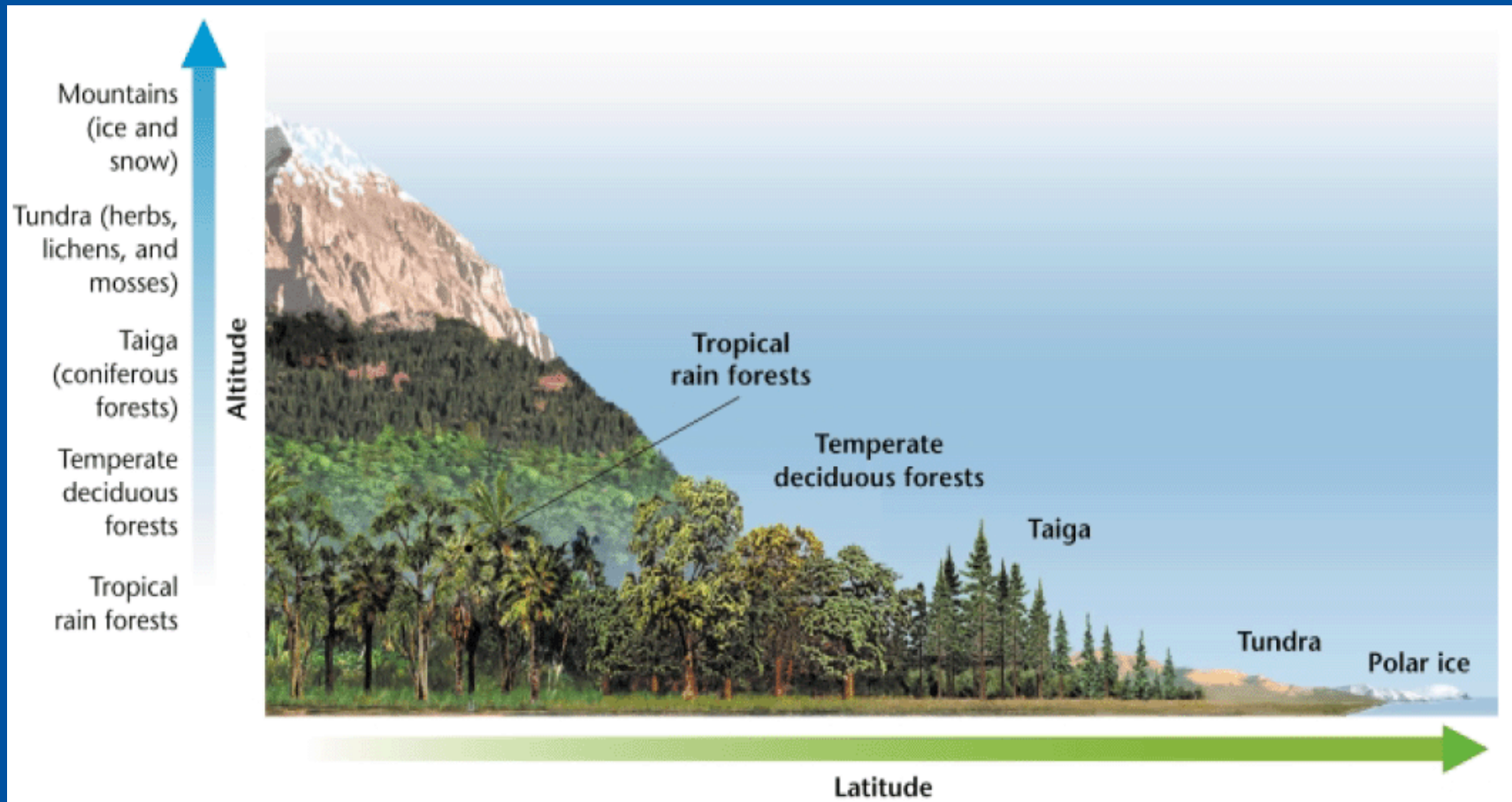
# Temperature and Precipitation



## 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



Chapter 6: Biomes  
Section 2: Forest Biomes

**DAY ONE**





## 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**.

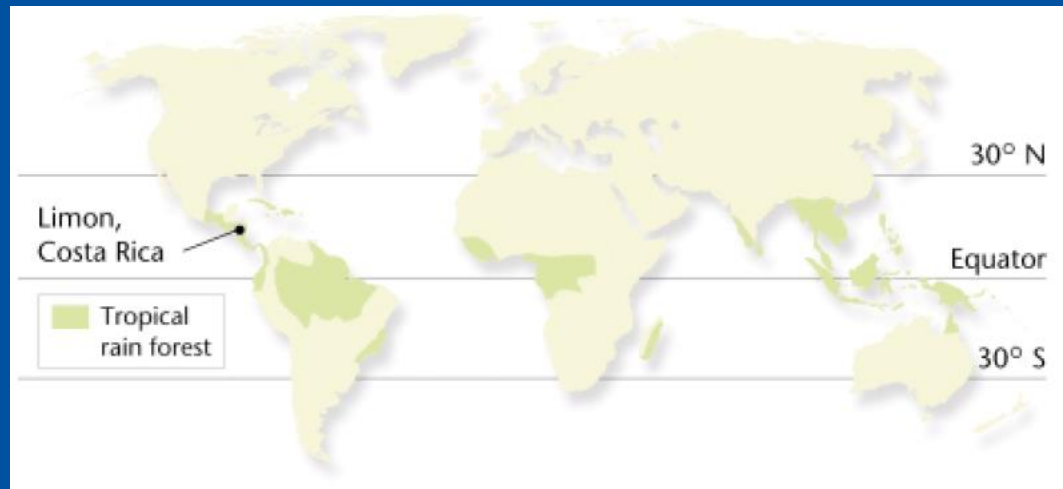
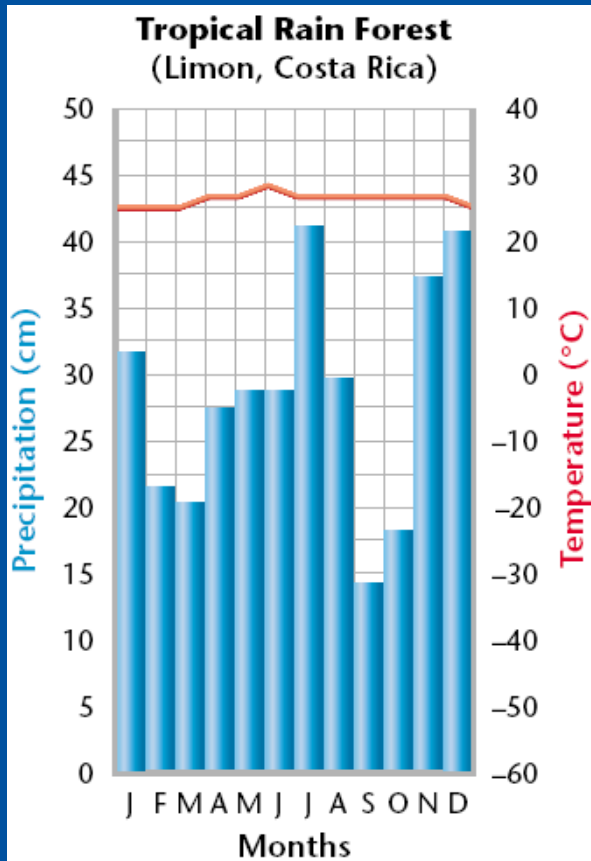


## Tropical Rainforests

- **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.
- 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 Rainforests



## Nutrients in Tropical Rainforests

- Most nutrients are within the **plants**, not the soil.
- Decomposers on the rainforest 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 rainforest floor.
- In this relationship, the fungi **transfer** the nutrients from the dead matter directly to the tree.



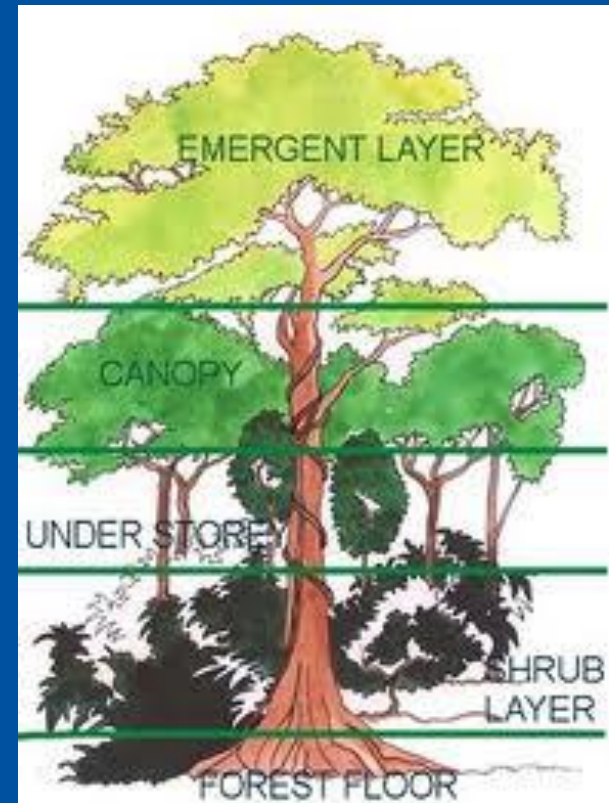
## Nutrients in Tropical Rainforests

- 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.

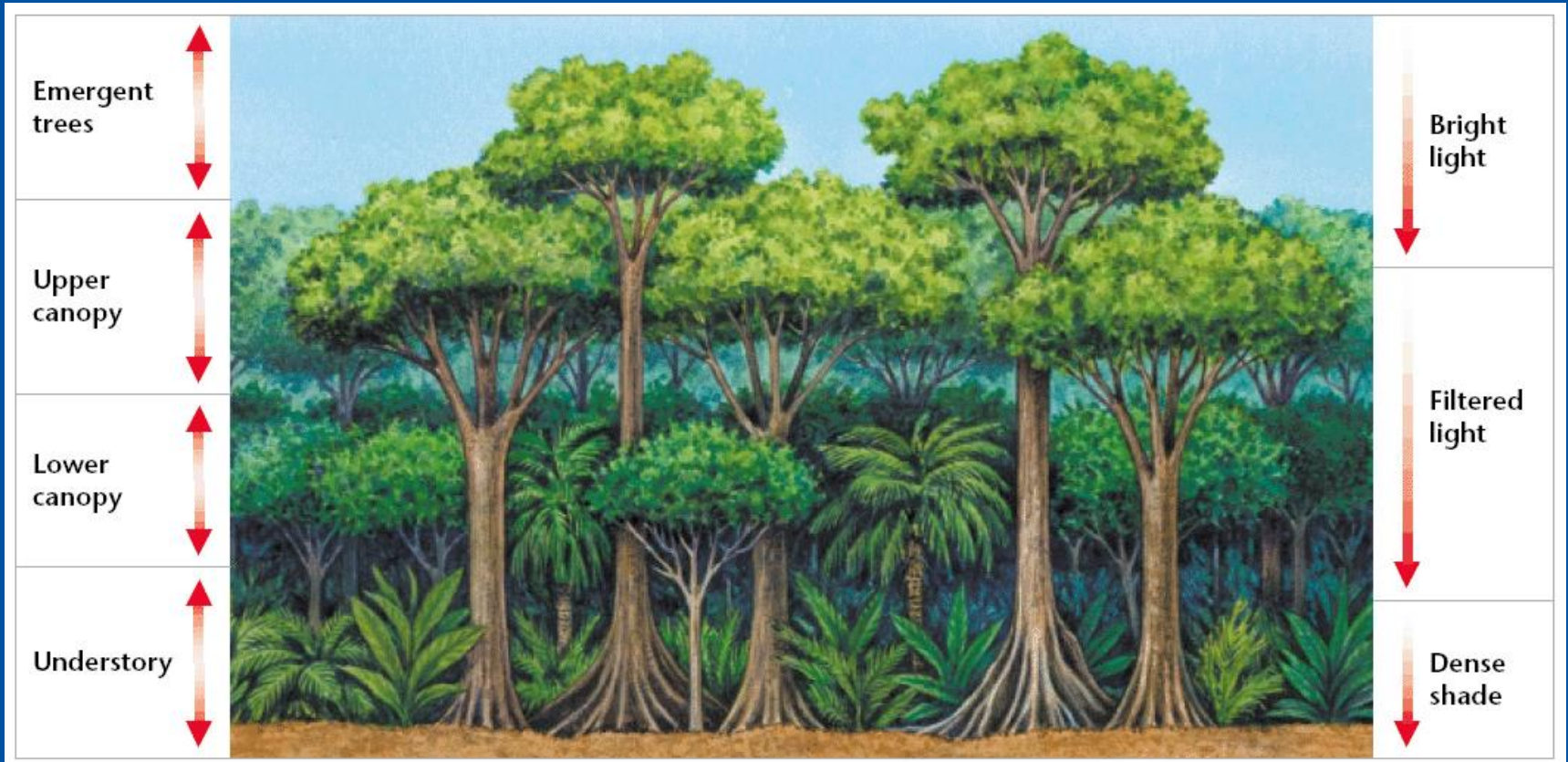


## Layers of the Rainforest

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



# Layers of the Rainforest



## Layers of the Rainforest

- 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 Rainforest

- 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 and **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 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 rainforest 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 Rainforests

- 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 Rainforests

- 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.

## 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**
  - **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**.



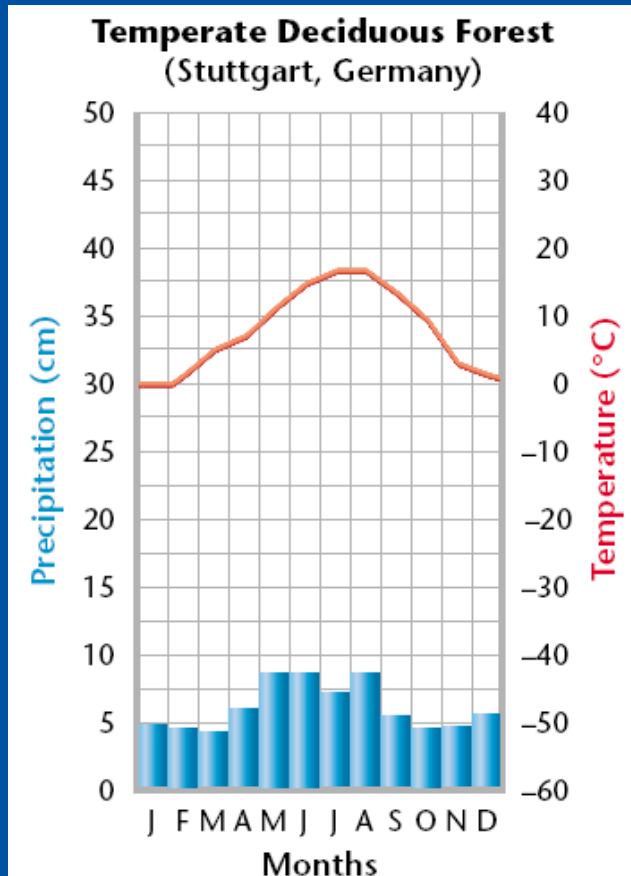
## Temperate Deciduous Forests

- **Temperate deciduous forests** are forests characterized by trees that **shed their leaves** in the fall, and located between  $30^{\circ}$  and  $50^{\circ}$  north latitude.
- The range of temperatures can be extreme, with summer temperatures soaring to  $35^{\circ}\text{C}$  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.

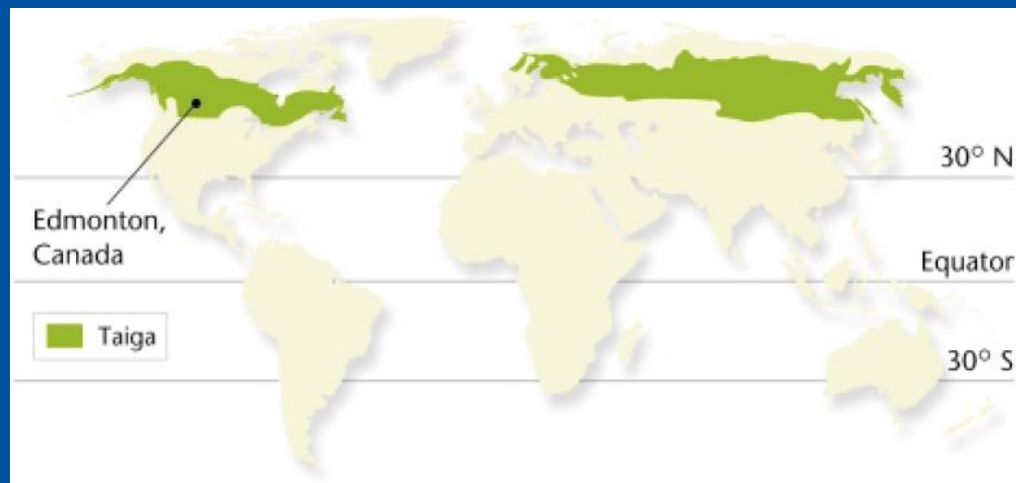
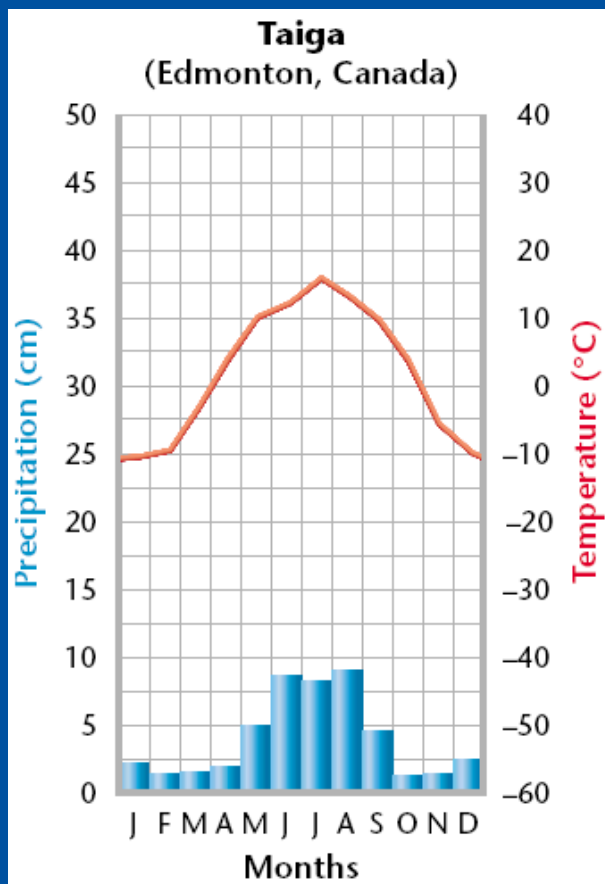


## Taiga

- 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.



Chapter 6: Biomes

Section 3: Grassland, Tundra, and Desert

**DAY ONE**





## Grassland, Desert, and Tundra Biomes

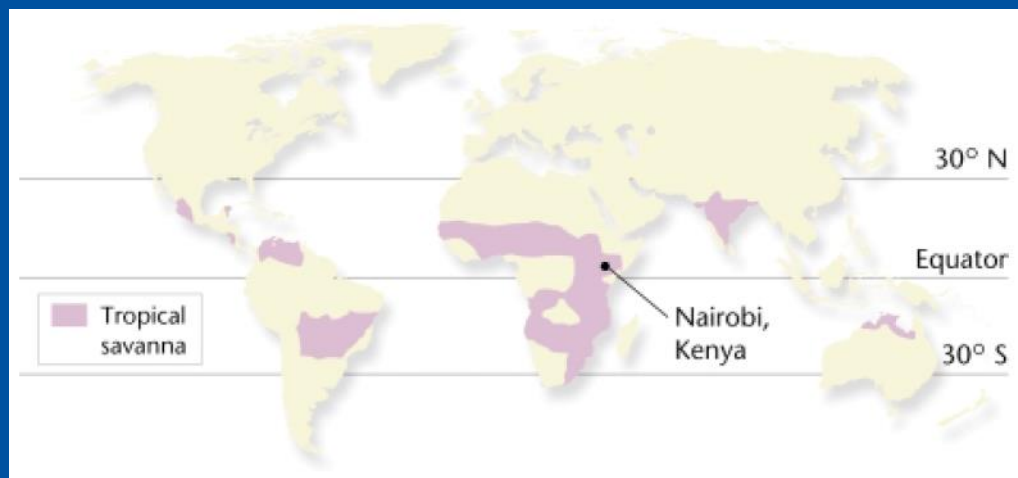
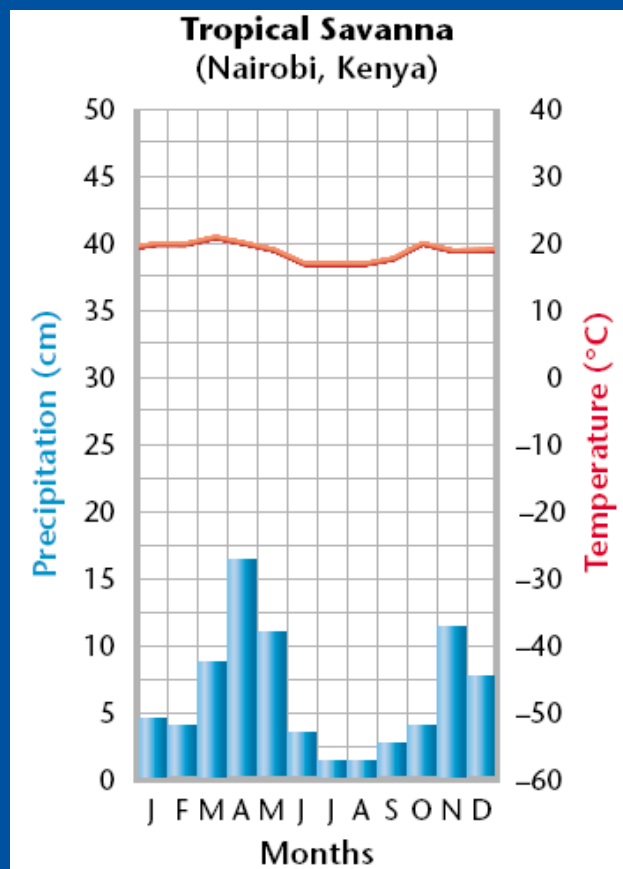
- In climates that have less rainfall, forest biomes are replaced by **savanna, grassland, and chaparral biomes**.
- As even less rain falls in these biomes, they change into desert and tundra biomes.
- As precipitation **decreases** in an area, the diversity of the species in the area also **decreases**.
- 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.

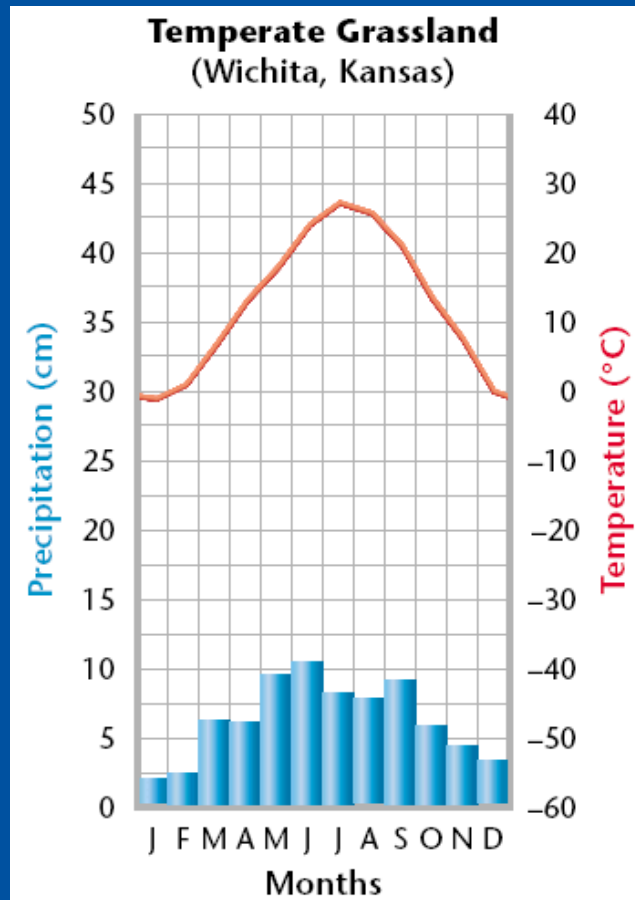


## Temperate Grasslands

- 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



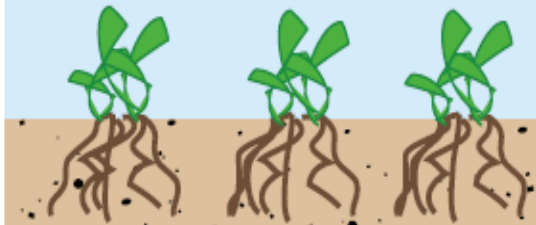


## Plants of Temperate Grasslands

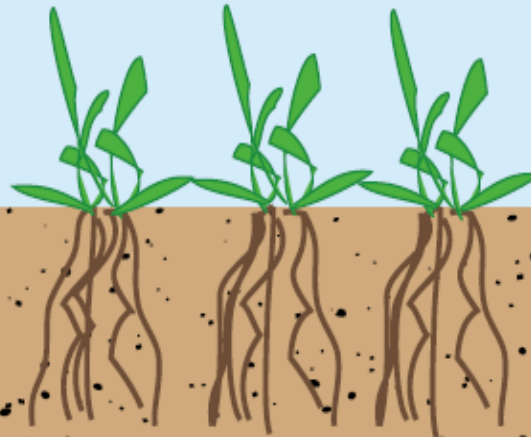
- The roots system of prairie grasses form **dense layers** that survive **drought and fire** allowing the plants to come back from year to year.
- Few trees survive on the grasslands because of the lack of rainfall, fire, and the constant winds.
- The **amount of rainfall** in the area determines the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

## Grassland Plants

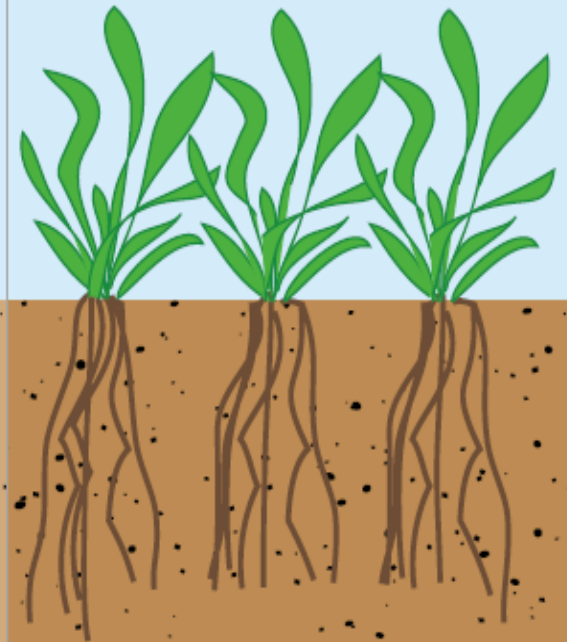
**Shortgrass prairie**  
(about 25 cm  
rain per year)



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



**Tallgrass prairie**  
(up to 88 cm  
rain per year)



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## 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.

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## Threats to Temperate Grasslands

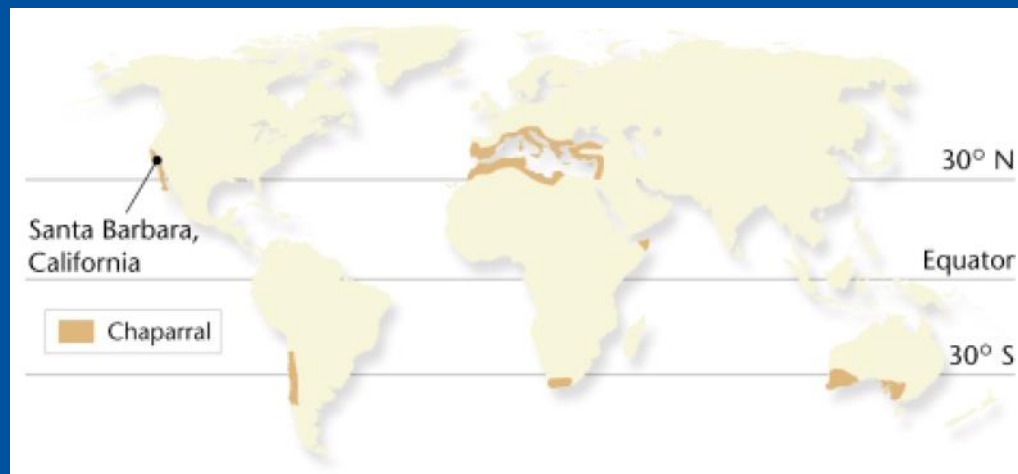
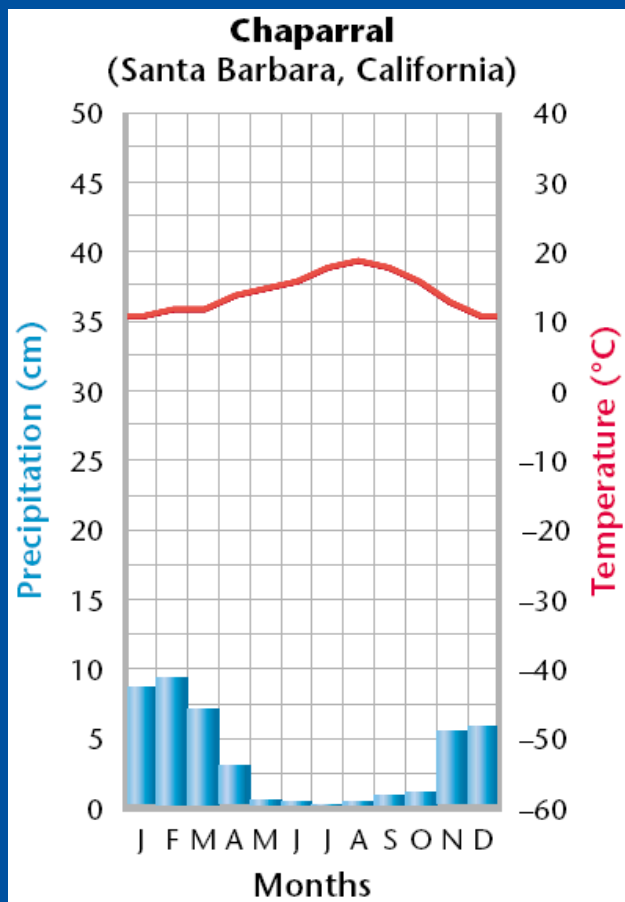
- **Farming and overgrazing** have changed the grasslands.
- **Grain crops** cannot hold the soil in place as well as native grasses can because the roots of crops are shallow, so **soil erosion** eventually occurs.
- **Erosion** is also caused as the grasses are constantly eaten and trampled.
- Constant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

## Chaparral

- **Chaparral** is a type of **temperate woodland** biome with vegetation that includes broad leafed 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 re-sprout** 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.





## 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.

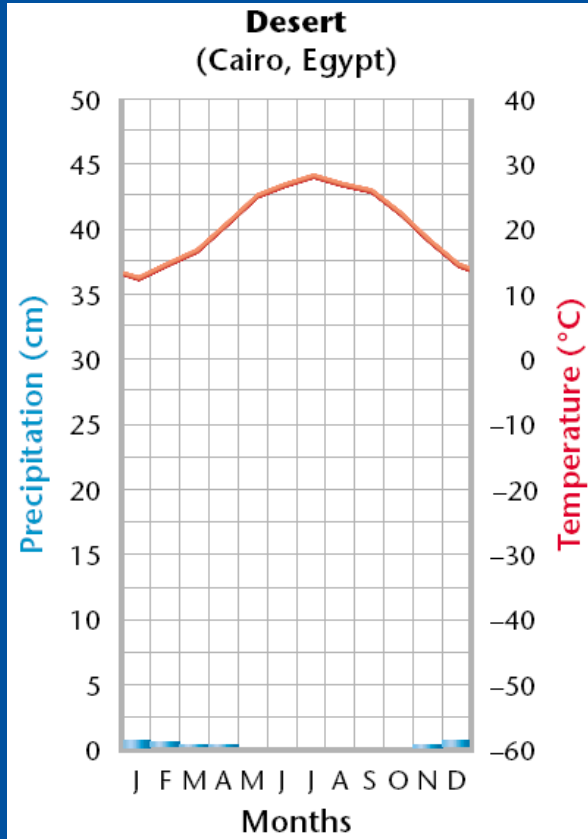


## Deserts

- **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



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## 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.



## 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.

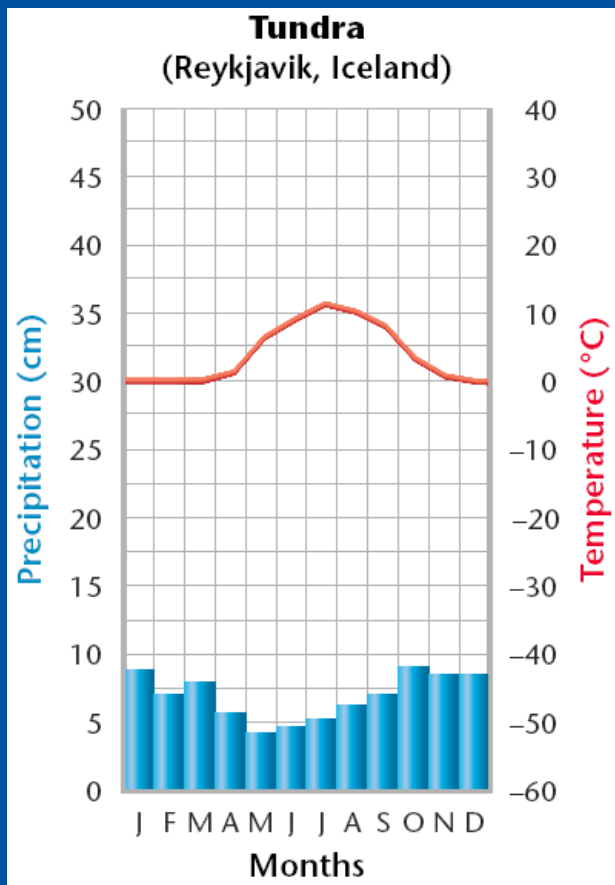


## Tundra

- 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.