

A stylized, light green illustration of a plant with several large, rounded leaves and a cluster of small, round buds or flowers on a thin stem, positioned on the left side of the slide.

1.2 TERRESTRIAL BIOMES

Enduring Understanding: Ecosystems are the result of biotic and abiotic interactions.

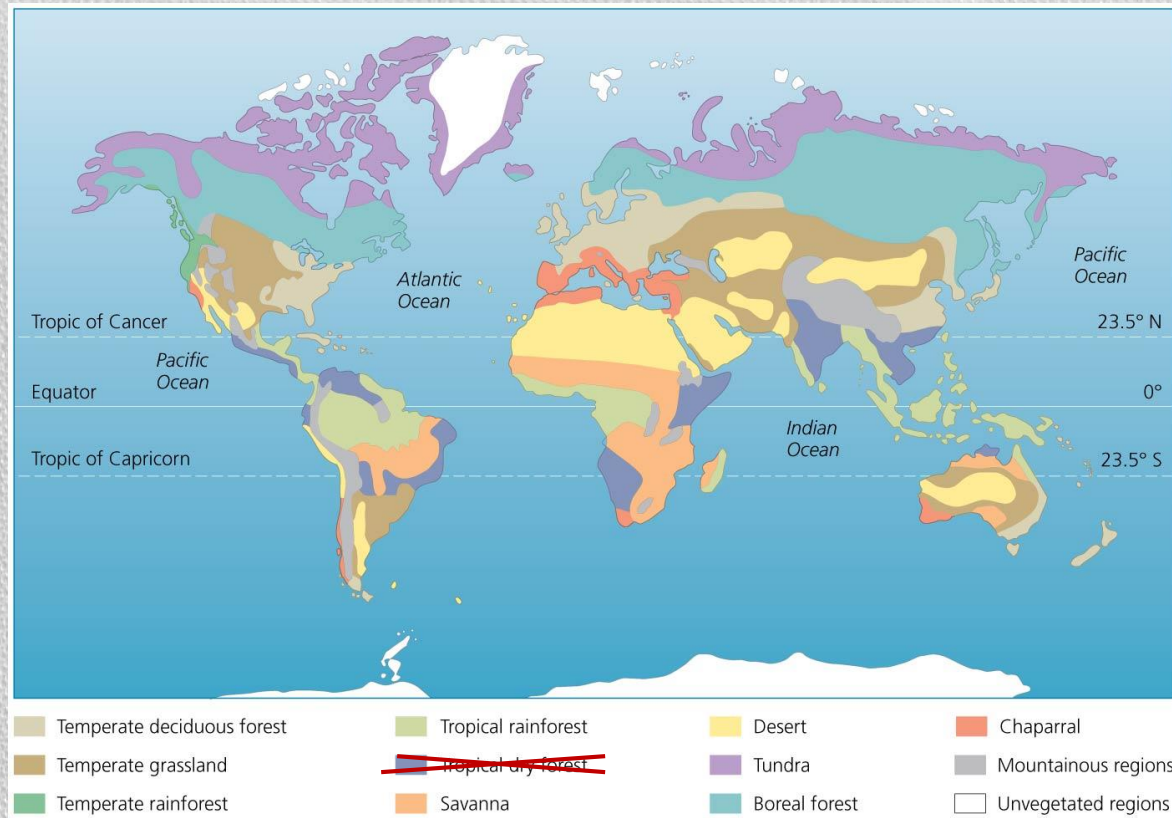
Learning Objective: Describe the distribution and principal environmental aspects of terrestrial biomes.

Related Readings: pg. 93-100, “Environment; The Science Behind the Stories” 4th edition, Withgott, Jay and Laposata, Matthew.

Earth's Biomes

- **Biome**

- major regional complexes of similar biological communities recognized by plant type and vegetation structure resulting from adaptation to similar climates
- Includes the interactions of species, populations, communities and ecosystems within the biome.



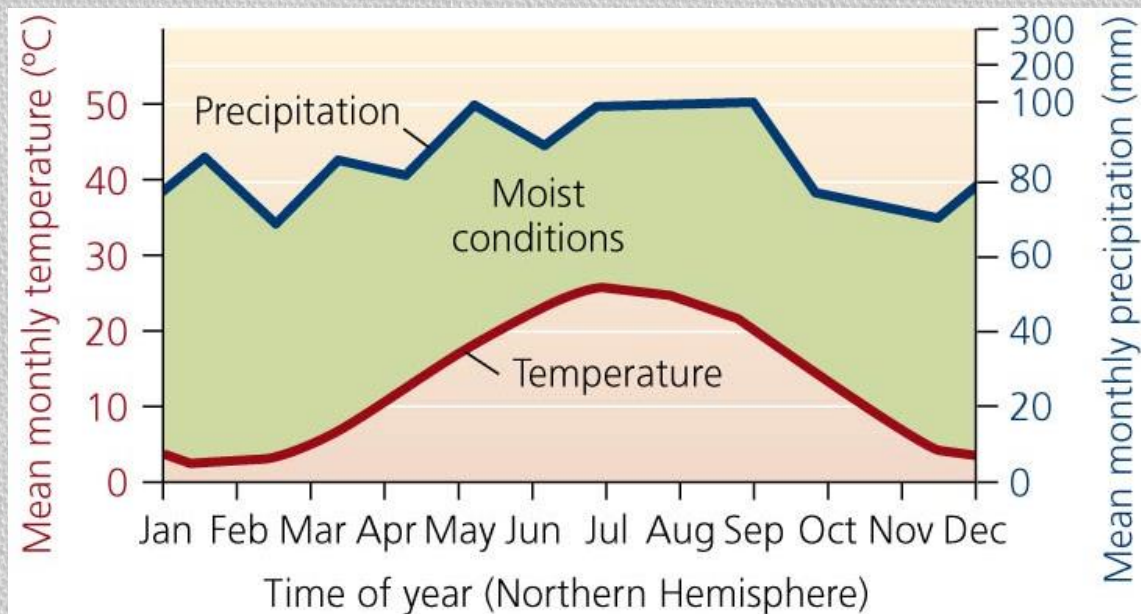
- **Widely separated regions may have similar biomes due to similar climates**
- **Biomes do not have distinct boundaries**
 - One biome will often gradually transition into an adjacent biome with no sharp border between them.
 - There are a number of similar classification systems for biomes that result in different names for the same biome based on regional names (boreal forest and taiga are the same). (College Board recognizes 9 terrestrial biomes.)
 - Permanently ice covered areas are not considered biomes as they do not have vegetation, let alone distinct characteristic vegetation types.

Climate influences the location of biomes

- **The type of biome depends on abiotic factors**
 - Temperature and precipitation exert the greatest influence
 - Similar latitudes have similar climates. Climate is strongly related to latitude on a global scale.
 - Therefore similar latitudes should have similar biomes (*usually, but not always true*)
 - Altitude, proximity to oceans, proximity to mountains, and prevailing winds also affect a regions climate, and therefore biome, on a more localized scale.
 - Soil types and disturbance regimes can also influence the type of biome present in an area.

- **Climatograph**

- A climate diagram summarizes an area's mean monthly temperature and precipitation.
- Regions with similar ***climatographs*** often have similar biomes.



(b) Washington, D.C., USA

9 Terrestrial Biomes

• Forests

1. Taiga or Boreal Forests (polar and temperate)
2. Temperate Rainforests (temperate)
3. Temperate Deciduous Forests (temperate)
4. Tropical Forests (tropical)

• Scrublands

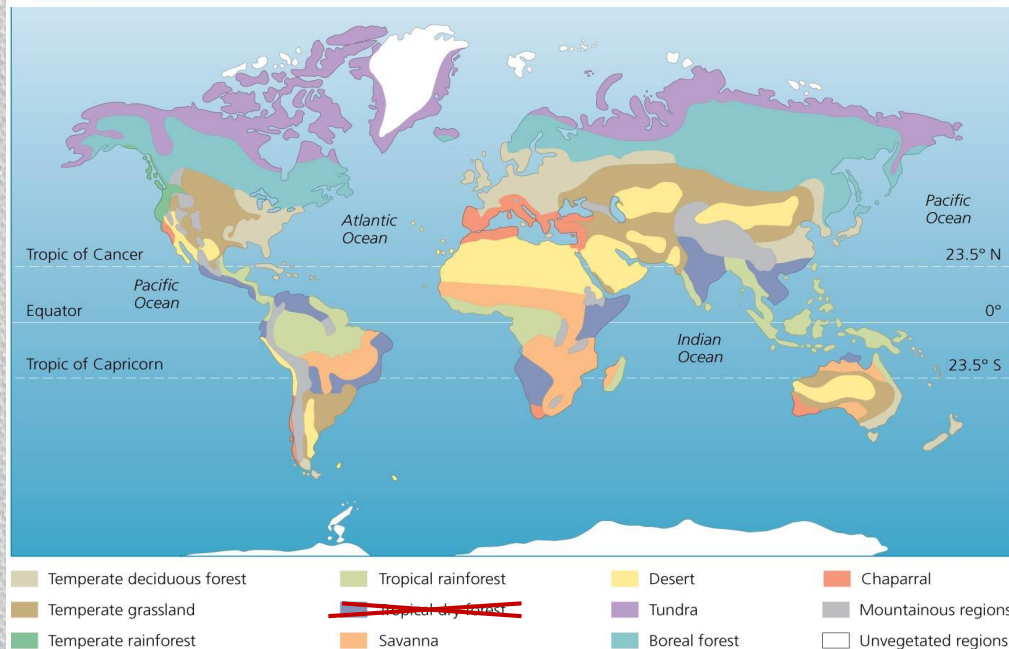
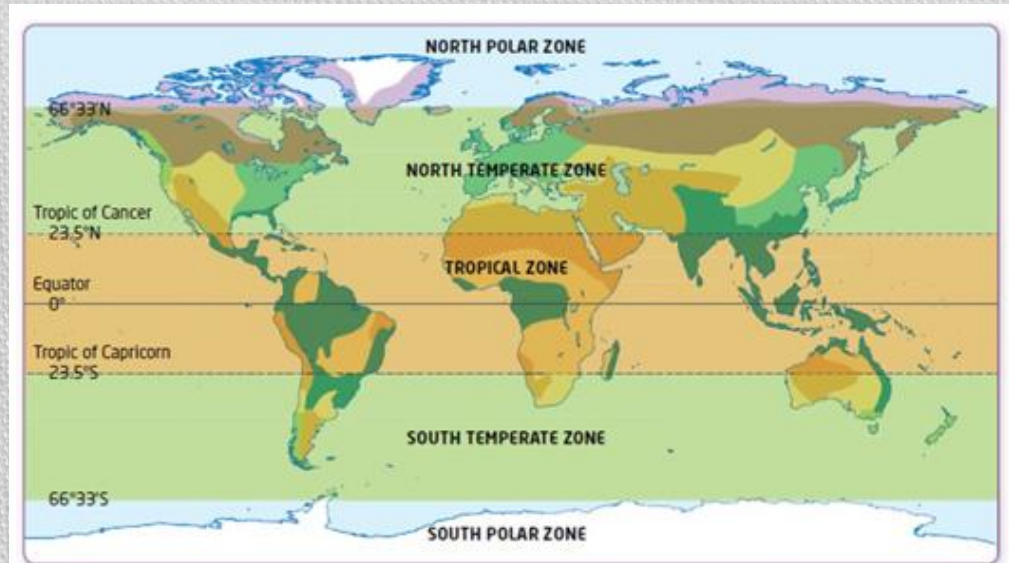
5. Chaparral (temperate)

• Grasslands

6. Temperate grasslands (temperate)
7. Savanna (tropical)

• Deserts

8. Deserts (temperate)
9. Tundra (polar)



- Avoid thinking of biomes as a laundry lists of facts to memorize
- Look for patterns and trends to help you remember and compare key features of the biomes.
- Latitude, climate, adaptations, biodiversity all show patterns

HHMI Biome Viewer

<https://www.biointeractive.org/classroom-resources/biomeviewer>

Boreal Forests (aka Taiga)

- **Location**

- $\approx 50^\circ - 60^\circ$ N lat, not found in southern hemisphere (Canada, Alaska, Russia, Northern U.S.)

- **Climate**

- Summers are short. Winters are long, cold, and dry. Precipitation is low – only 40 to 100 centimeters per year, which arrive mainly as snow but sometimes also as fog. Temperatures are low.

- **Species**

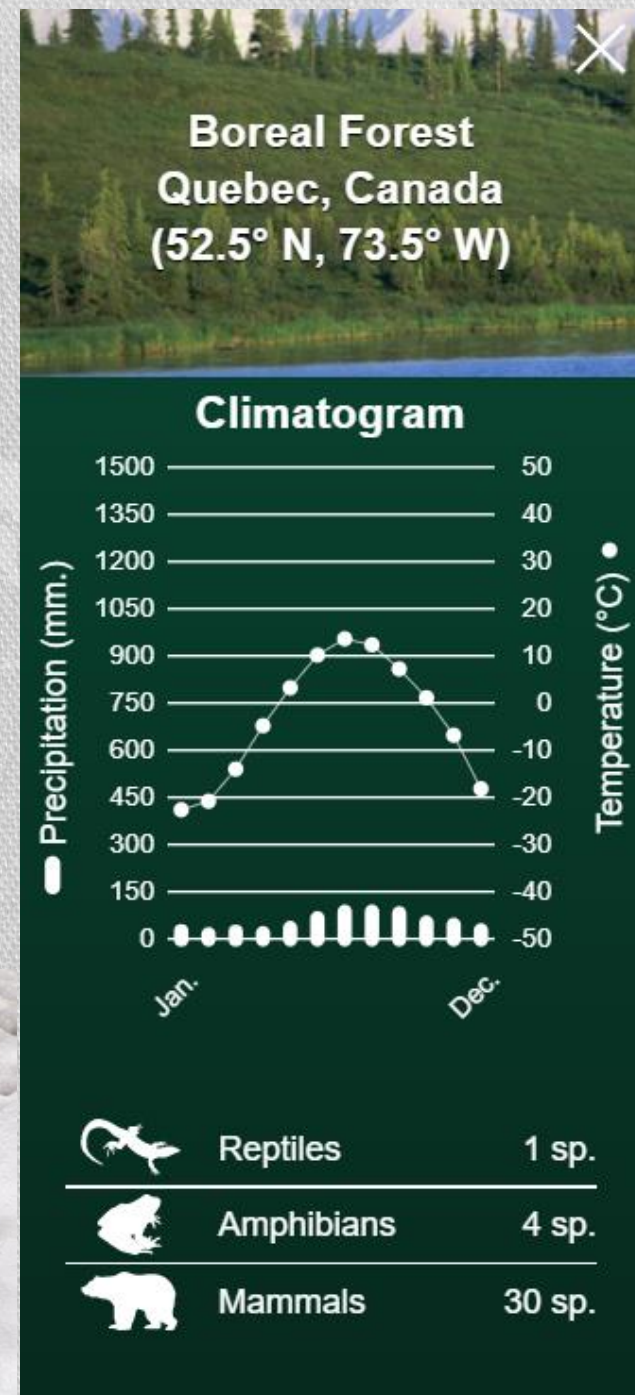
- Low species richness (number of species)
- Dominated by a few species of coniferous trees
- Mostly small to medium mammal species

- **Soils**

- Shallow, nutrient poor, acidic soils.

- **Threats**

- Logging
- Oil and Gas exploration



Temperate Coniferous Forests

• Location

- In the northern hemisphere, the temperate climate zone lies between the tropical and the polar zones, from 23.5 to 66.5 degrees north latitude. This biome covers western Canada and extends south through the Pacific Northwest, and parts of California.

• Climate

- Moderate temperate range, with warm summers and cool to cold winters
- Precipitation varies, Some snow, and in many locations large amounts of rain, leading some regions to be classified as rainforest.

• Species

- Low to medium species richness (number of species)
- Deer, elk, grizzly bear, Northern spotted owl

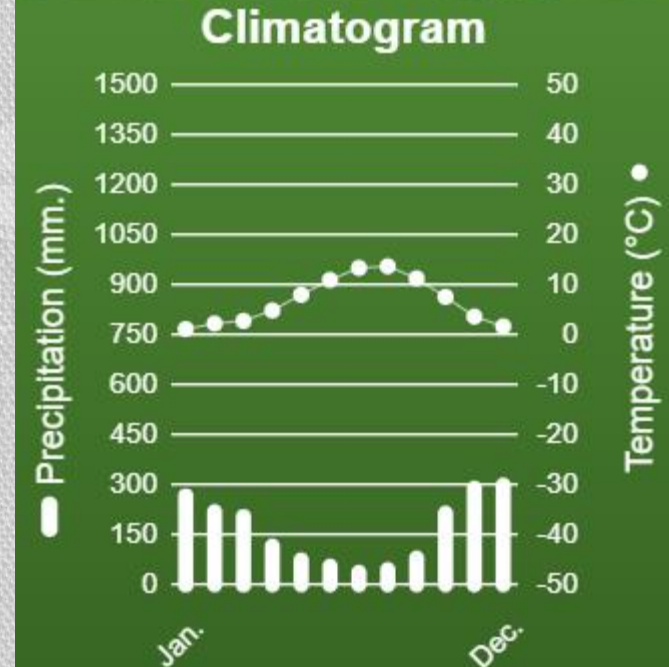
• Soils

- Shallow, nutrient poor, acidic soils.

• Threats

- Logging of old growth
- Currently, many large roadless areas

Temperate Coniferous Forest British Columbia, Canada (49.3° N, 125.2° W)



Reptiles

7 sp.



Amphibians

13 sp.



Mammals

57 sp.

Temperate Deciduous Forests

• Location

- Located in the temperate latitudes of Europe, the Eastern United States and temperate regions of Asia

• Climate

- Highly variable climate with strong seasonal changes throughout the year. Consistent precipitation throughout the year, falling as snow in the winter, and rain at other times

• Species

- Medium to high species richness (number of species)
- Dominated by deciduous tree species

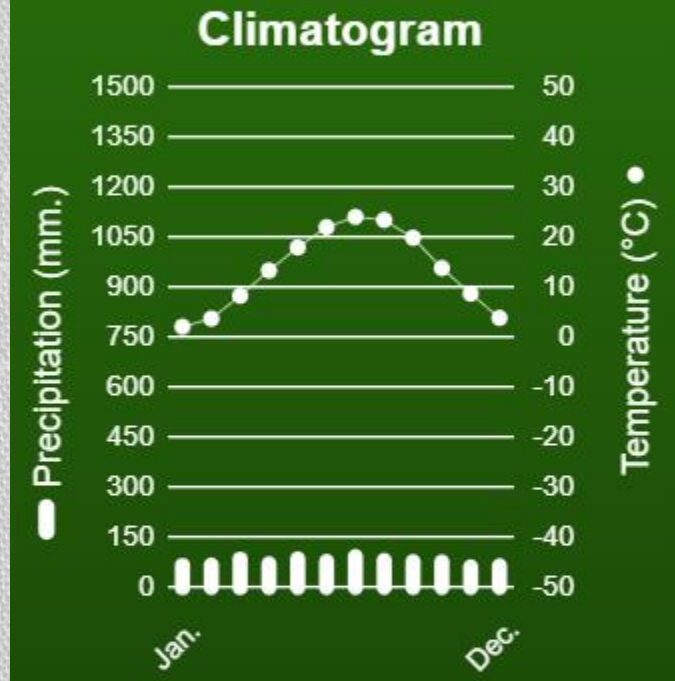
• Soils

- Deep, nutrient rich soil

• Threats

- Clearing for agriculture, logging and expansion of urban/suburban areas

Temperate Deciduous Forest Buffalo, North Carolina (36.5° N, 80.6° W)



Reptiles

28 sp.



Amphibians

39 sp.



Mammals

60 sp.

Tropical Rainforests

• Location

- In patches throughout Earth's tropical zone, Brazil's Amazon Basin (the largest), parts of tropical Africa, and Mal

• Climate

- High, stable temperatures and high precipitation throughout the year.

• Species

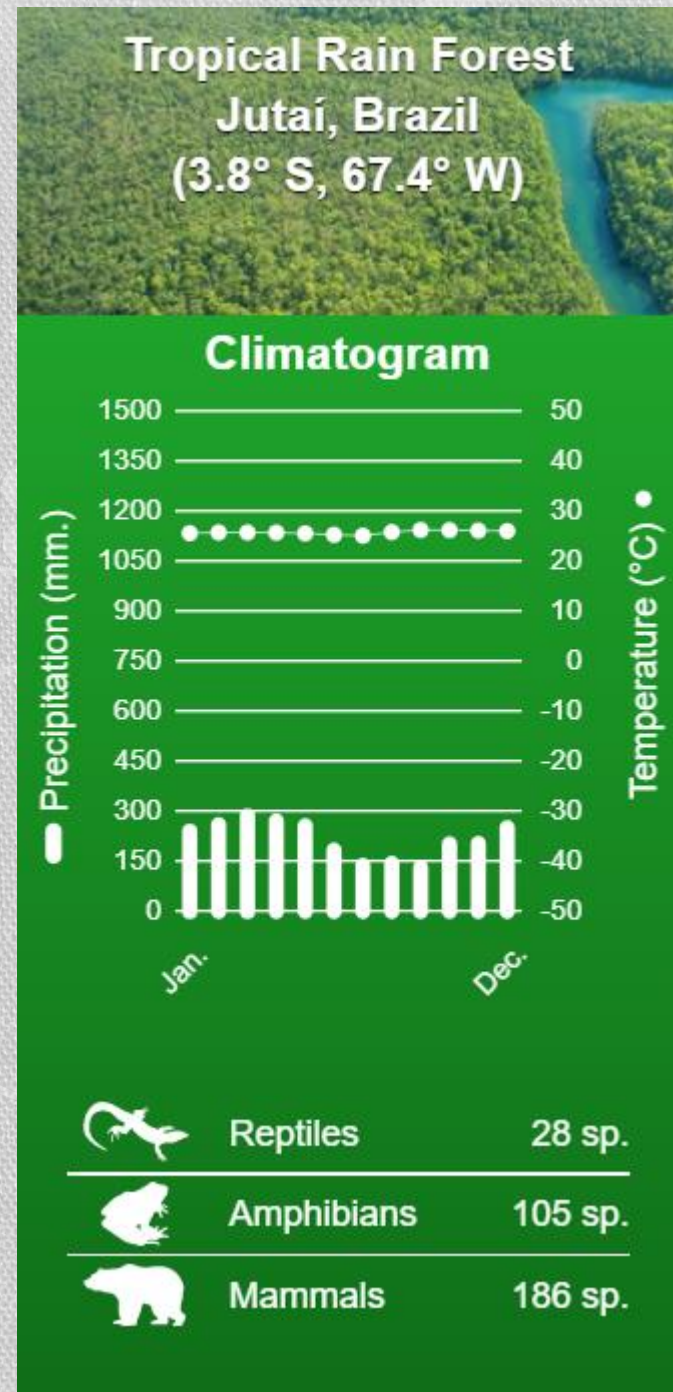
- Extremely high species richness (number of species)
- Up to 1000 species per 1 km²
- Broadleaf evergreen trees, many with adaptations to compete for light in dense canopy

• Soils

- Shallow and nutrient poor

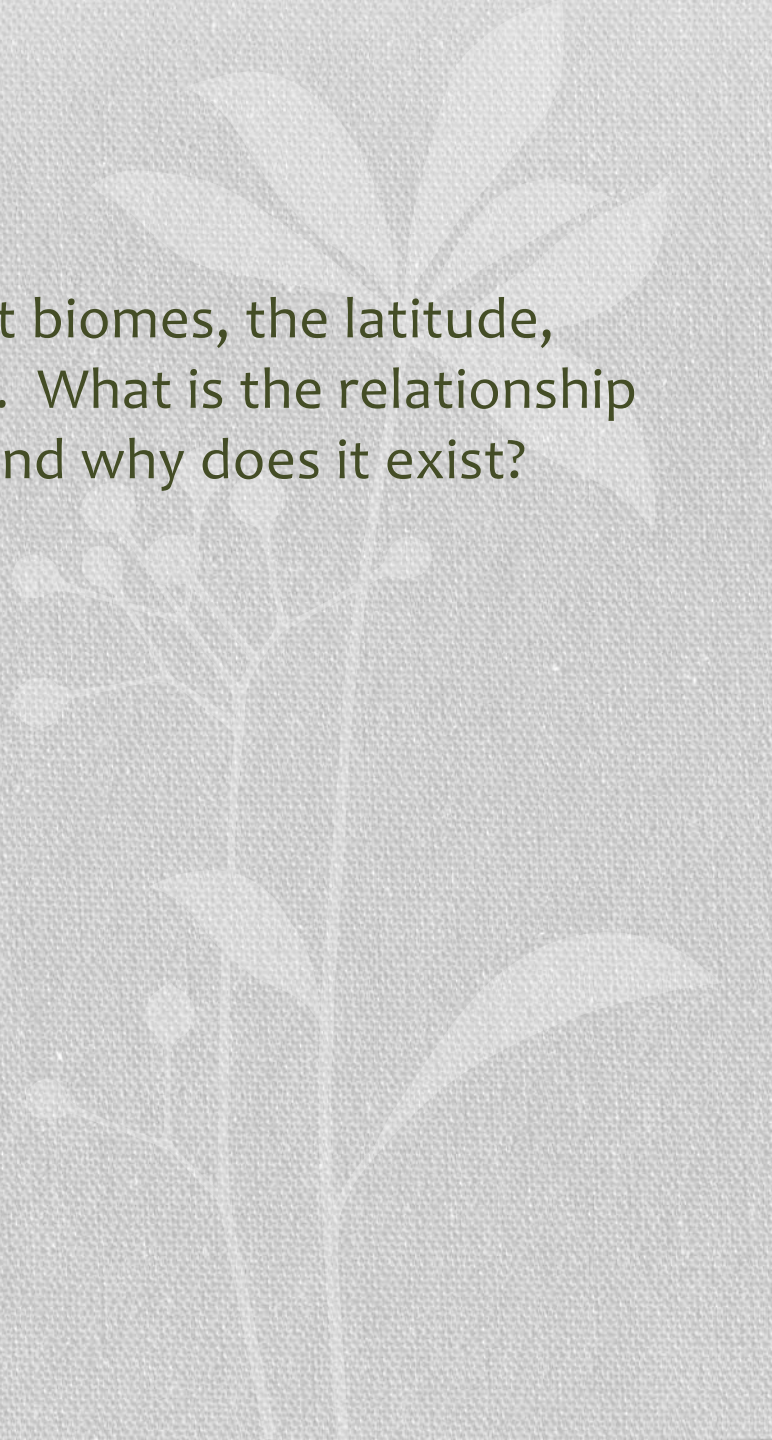
• Threats

- Clearing for agriculture, logging and expansion of urban/suburban areas



Understanding Check

- As we toured through the last four forest biomes, the latitude, climate and species diversity all changed. What is the relationship between latitude and species diversity, and why does it exist?



Scrublands - Chaparral

• Location

- Located at similar latitudes to deserts, but with the moderating influence of nearby oceans. Only 5 locations in the world, including San Diego.

• Climate

- Hot, dry summers and cool (not cold) rainy winters.

• Species

- Moderate species richness (number of species), but a high degree of endemism, especially among plants
- Eucalyptus forests and shrubland containing densely packed evergreen shrubs and small trees. Most plants have adapted to and depend on periodic wildfire disturbances to survive.

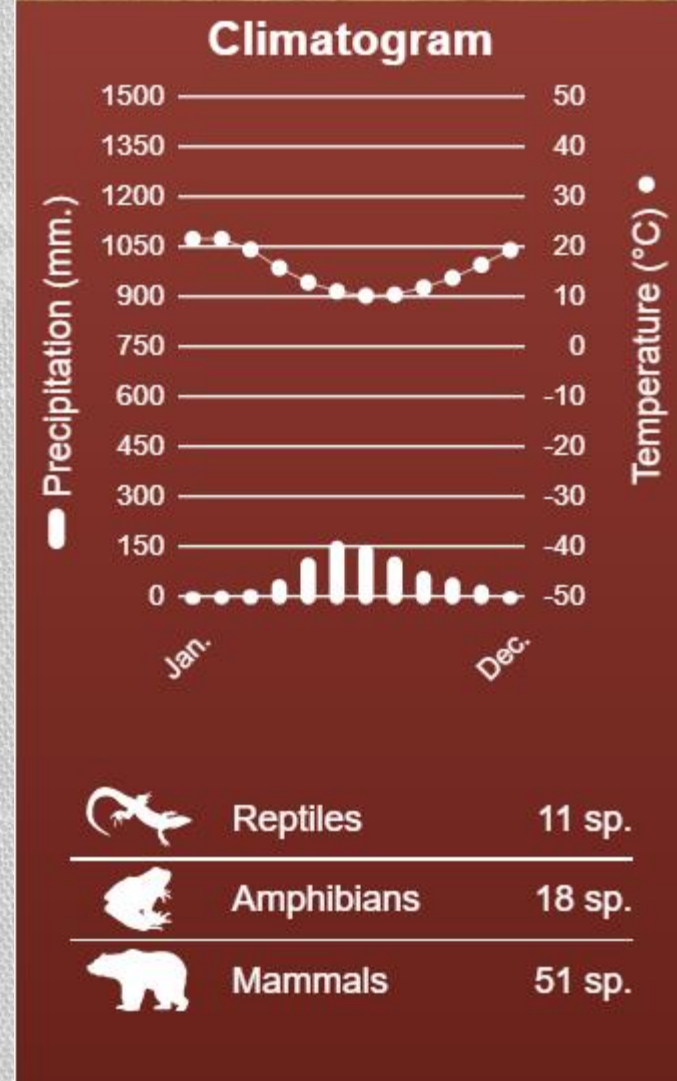
- Deer, rabbits, lizards

• Soils

- Thin, low fertility, heavy clay soils.

• Threats

- Grazing and further expansion of urban/suburban areas as populations grow.



Temperate Grasslands

• Location

- Earth's temperate zones, which lie between the tropical and polar zones, or between 23.5 and 66.5 degrees north and south latitudes. This biome covers much of central North America and Central Asia.

• Climate

- Extreme seasonal temperature variation (100+ summers and sub-0 winters). Low to moderate precipitation, mostly occurring in the summer.

• Species

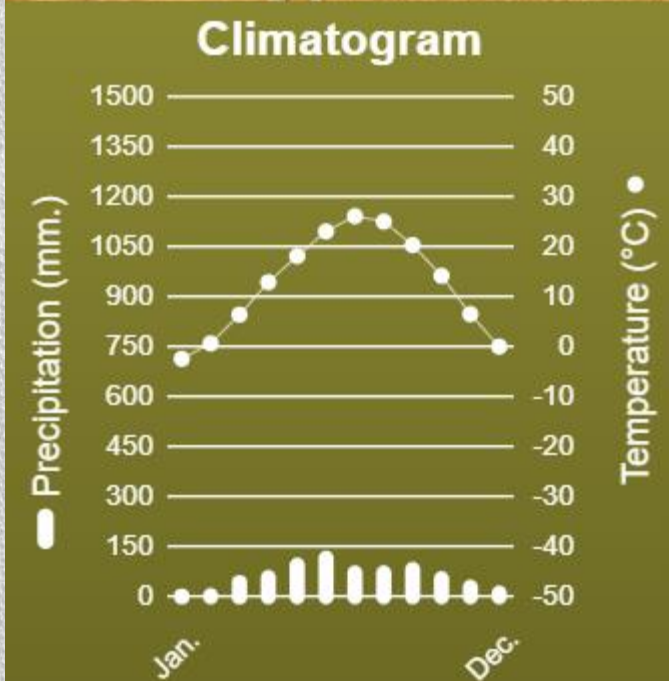
- Moderate species richness (number of species), due to rich soils and a relatively long growing season, despite hard winters.
- Dominated by annual grasses, many of which are fire adapted.
- Buffalo, antelope

• Soils

- Extremely deep, nutrient rich soils

• Threats

- Conversion to agriculture and grazing lands.



Reptiles

33 sp.



Amphibians

15 sp.



Mammals

57 sp.

Savanna

• Location

- Dry climate regions within tropical and subtropical latitudes, lower than 40 degrees. This vast biome is the largest in Africa, extending from just below the Sahara Desert to South Africa.

• Climate

- High Temperatures, brief period of heavy monsoonal rain in summer. Warm and extremely dry thru the rest of the year

• Species

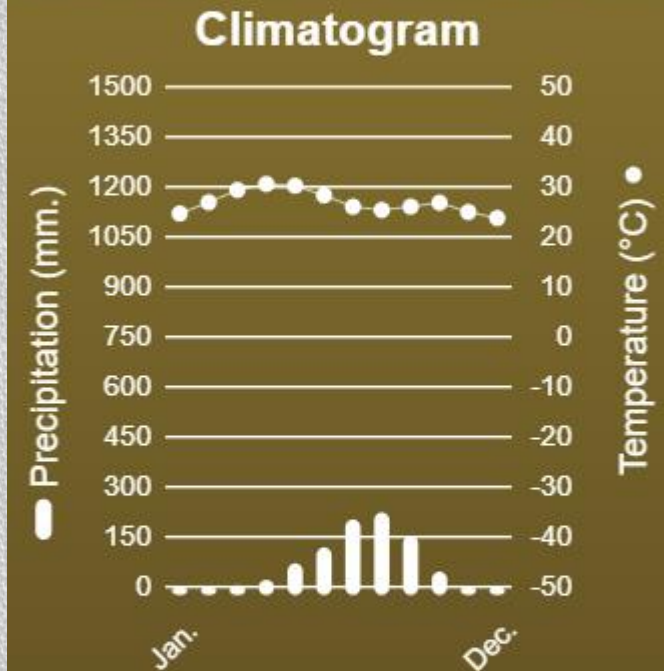
- Moderate to high species richness (number of species), Extremely high mammalian diversity
- Coexistence of grass and trees. Grasses typically dominate the vast landscapes, but other regions within this biome may support woodlands or shrubs may dominate entirely.
- Large herds of large grazing mammals and smaller packs of predators

• Soils

- Deep, nutrient rich soils

• Threats

- Conversion to agriculture and grazing lands. Over grazing. Population growth.



Reptiles

7 sp.



Amphibians

16 sp.



Mammals

83 sp.

Deserts

• Location

- At locations near 25° N or S latitude. The Sahara desert of Northern Africa is the world's largest and covers approximately 10% of the continent.

• Climate

- Generally high temperatures, but lots of variability in temp in deserts around the world. Defined by their aridity. Deserts usually receive less than 25 cm/yr of rain.

• Species

- Low species diversity. Low productivity.
- Characterized by low densities of woody shrubs, cacti, and related species. Many adapted to the arid environment.
- Many animal species are nocturnal.

• Soils

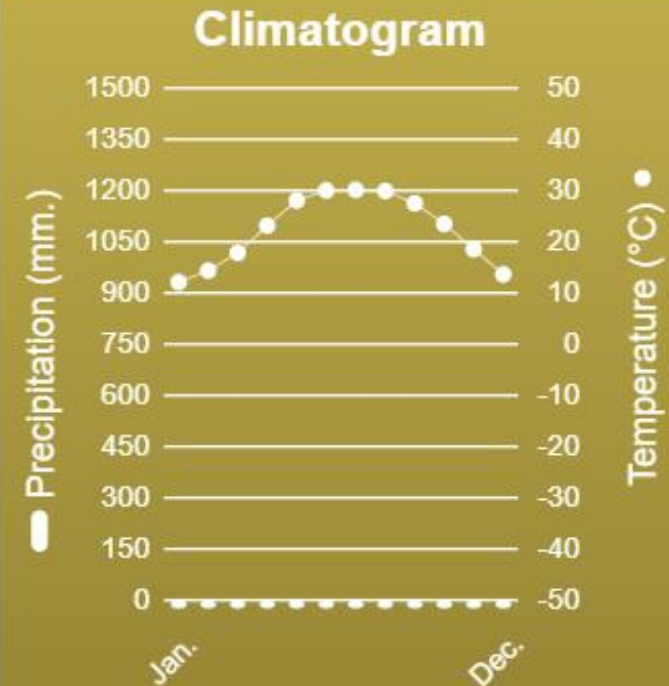
- Sandy, low nutrient soils, with high mineral content.

• Threats

- Deserts are the only biome in the world that are expanding. (due to poor agricultural and grazing practices)



Desert
Kufra, Libya
(25.8° N, 24.6° E)



Reptiles

4 sp.



Amphibians

0 sp.



Mammals

10 sp.

Tundra

• Location

- High northern latitudes (70°-80° N). This biome covers the northern parts of Alaska, Canada, Siberia and the coastline of Greenland

• Climate

- Long, extremely cold winter, the ground is snow-covered and frozen solid. Many areas of experience no sun for days to weeks during the winter, and periods where the sun doesn't set during summer nights. Summertime brings long days, a brief thaw of the top few inches of soil, and a short growing season for plants and animals. There's not much precipitation, but melting snow creates lakes, marshes, and streams.

• Species

- Low species richness. Vegetation is sparse and clumped together to withstand harsh winds. There are no trees, but many species of grass, sedge, dwarf shrub, moss, and lichen.
- Many animal species migrate or hibernate.

• Soils

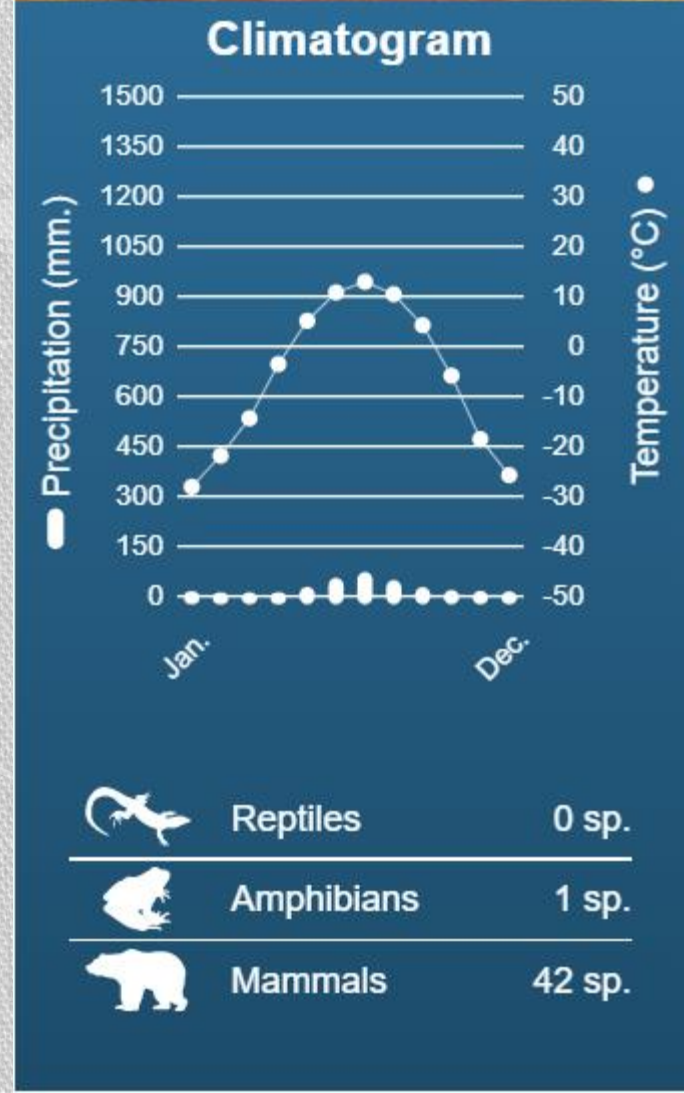
- Permafrost soils that are perpetually frozen at some depth.

• Threats

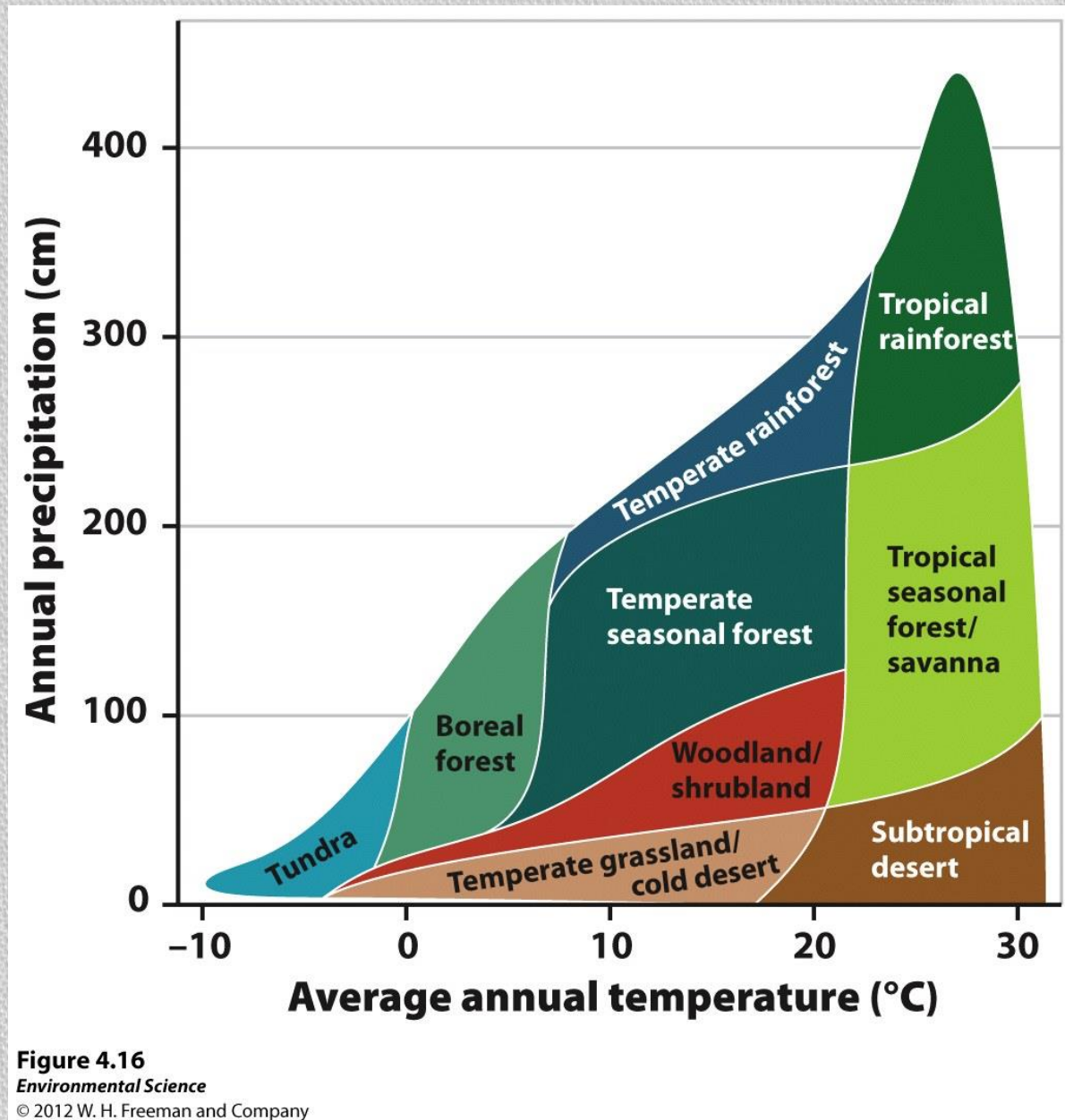
- Climate change, oil/gas exploration and drilling.



Tundra
Yukon, Canada
(62.7° N, 140.1° W)



Biome Distribution is Largely Determined by Climate



Changing Biomes

The worldwide distribution of biomes is not fixed.

- Biome distribution has continually shifted as climates have changed throughout geologic time.
- Global climate change is already causing the current biomes to shift
 - Areas of alpine tundra are shrinking.
 - Tundra is melting and giving way to taiga
 - Deserts are growing
 - Humans also change biome distribution through urbanization, deforestation, and poor agricultural practices

