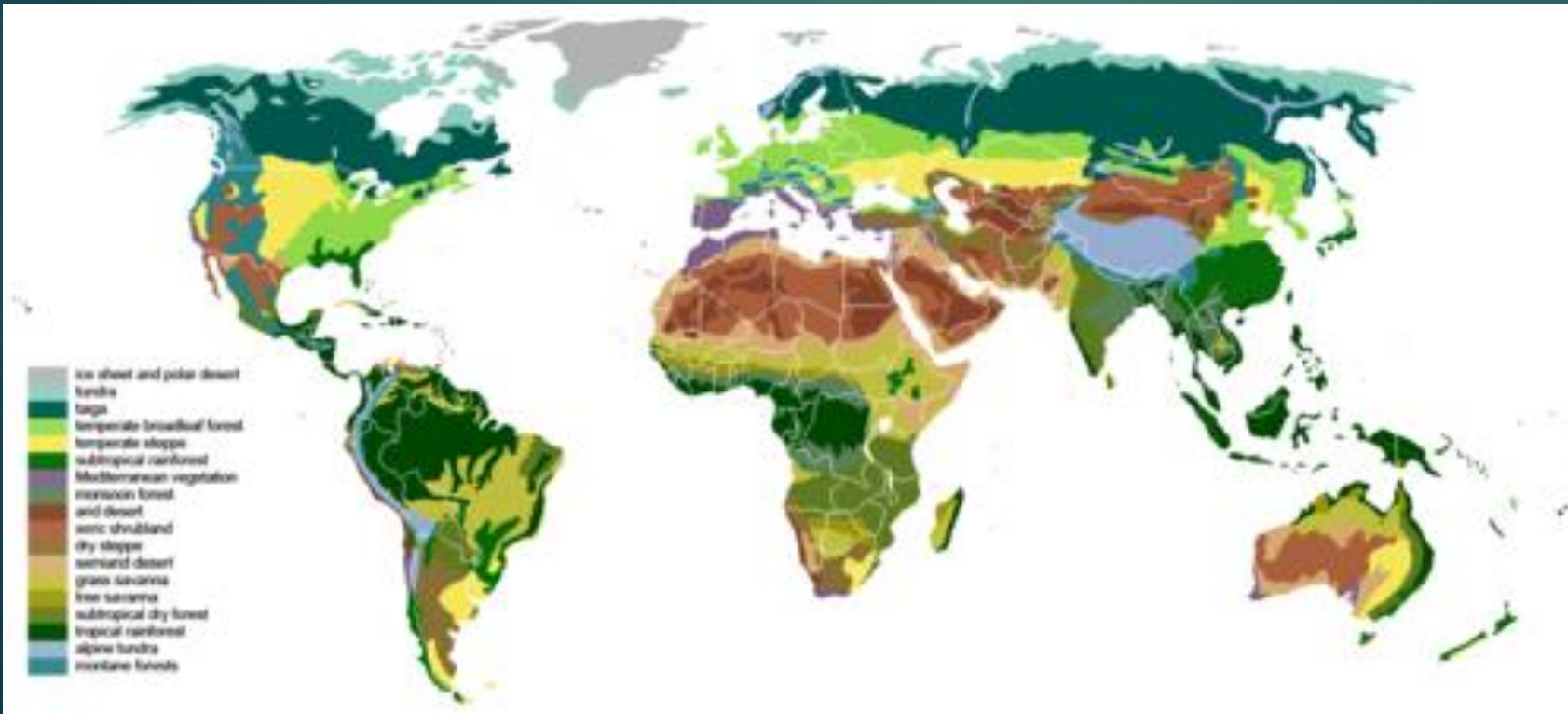


# Biomes and Ecosystems

## Lesson Objectives

- Define biome and climate, and explain how biomes are related to climate.
- Outline how climate determines growing conditions for plants and affects the number and biodiversity of plants in a biome.
- Explain how climate is related to biodiversity of biomes and adaptations of organisms.



## Next Lesson

Ecosystem interactions  
Habitat niches  
Species adaptation  
Introduction to evolution

# Biomes and Ecosystems

## Quick definitions



**Climate** - Weather conditions in an area in general or over a long period.

**Net primary productivity (NPP)** - How much  $\text{CO}_2$  vegetation takes in during photosynthesis minus how much  $\text{CO}_2$  the plants release during respiration.

**Biomass** - Total mass of organisms in an area.

**Deciduous** - Trees or shrubs that shed its leaves annually.

**Extra-cellular freezing** - (plants) liquids are secreted to be frozen on the outer leaf. This protects the interior cells from the cold.

# Biomes

*A biome is a large region on Earth with a specific climate, physical features, plants, and other organisms.*

Biomes contain ecosystems, populations, and communities, as well as specific biotic and abiotic factors.

All biomes are part of the biosphere they are described as either **terrestrial** or **aquatic**.



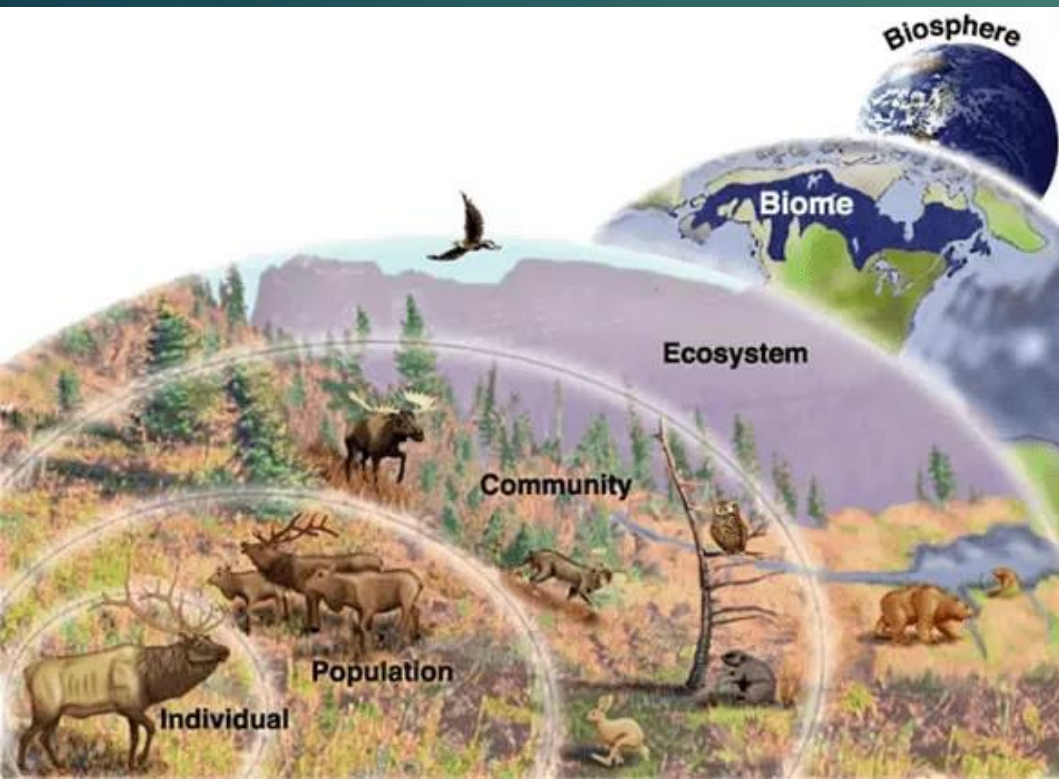
# Biomes and Ecosystems

What's the difference?



A biome is a specific geographic area notable for the species adapting to live there.

An ecosystem is the interaction of living and nonliving things within a biome.



A biome can be made up of many ecosystems.

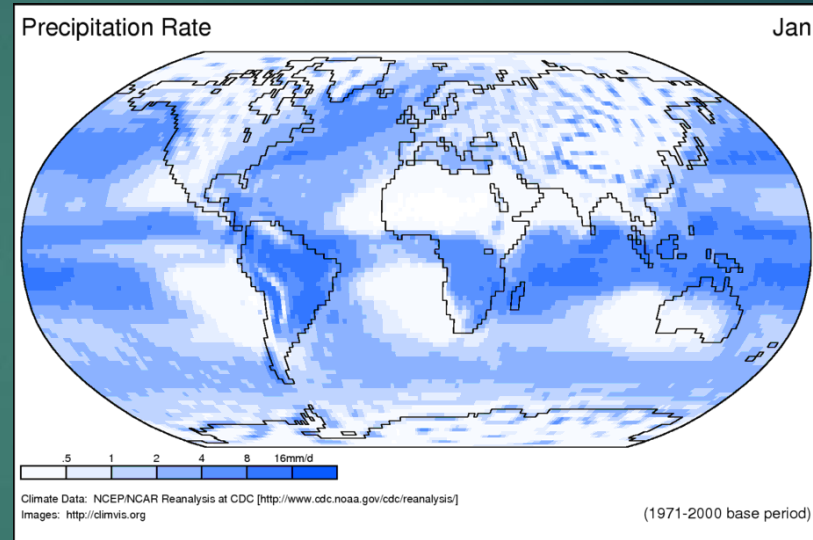
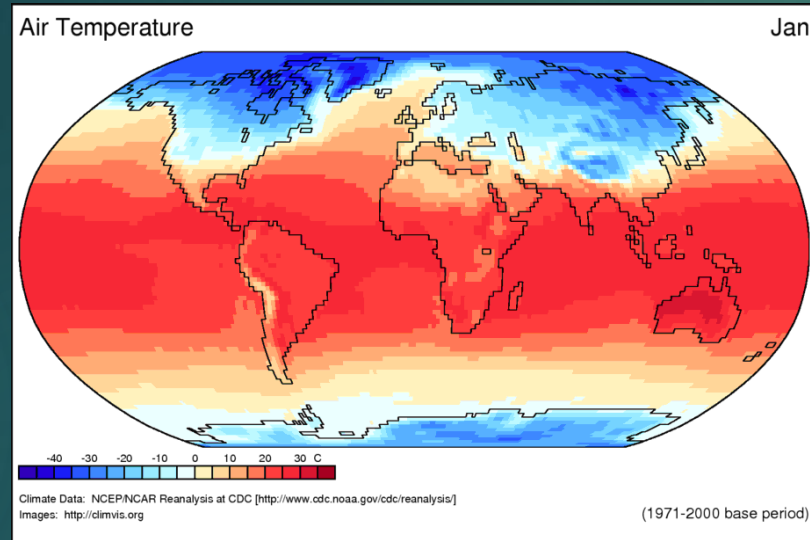
For example, an aquatic biome can contain ecosystems such as coral reefs and kelp forests.

Kelp forest



# Biomes and Ecosystems

Biomes are influenced by many factors, such as closeness to the equator or the poles and proximity to the sea, as well as things like ocean currents, atmospheric pressure belts and prevailing winds.



**Climate\*** is the major factor affecting the number and diversity of plants that can grow in a terrestrial biome.

It is possible to divide the world into a number of climatic zones or biomes, each with their own characteristic climate, vegetation and wildlife.



# Tropical Forests

Tropical forests have high net primary productivity (NPP)\* because temperatures and precipitation in these areas are ideal for plant growth.

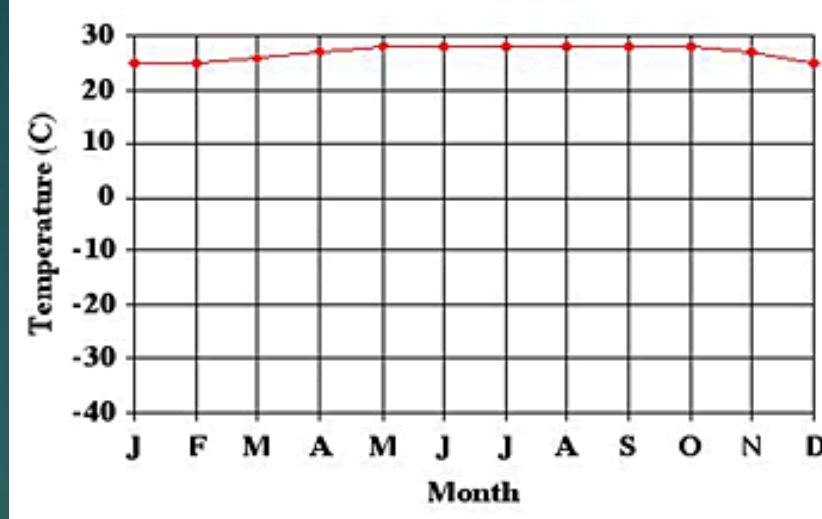
So, the biomass\* present in the tropical wet forest leads to plant communities with very high species diversities.

## Temperature

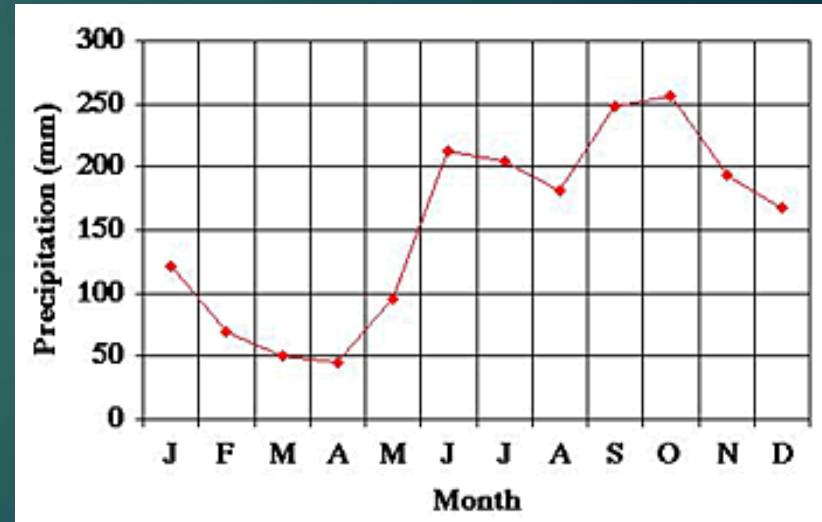
20°C to 25°C, must remain warm and frost-free

## Precipitation

2,000 to 10,000 mm of rain per year



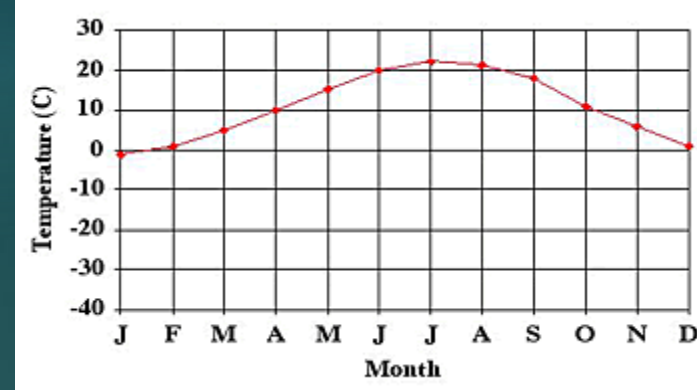
Average annual temperature and precipitation Campa Pita, Belize



In tropical forests, deciduous\* trees shed all their leaves in the beginning of the dry season to avoid excessive loss of water through transpiration\*.

# Temperate Forest

Temperate forests growing season is during the spring, summer, and early fall.

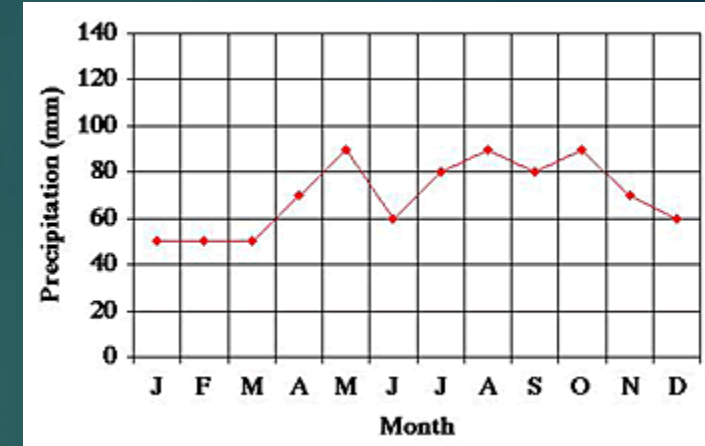


Staunton, Virginia, United States

Temperate deciduous forests are located in the mid-latitude areas which means that they are found between the polar regions and the tropics.

Deciduous trees are the dominant plant in this biome.

Since they lose their leaves in the winter, the **net primary productivity\*** of temperate forests is less than that of tropical wet forests.



Soils of the deciduous forests are rich in inorganic and organic nutrients from decaying leaf litter.

The annual average temperature is about 10°C. Deciduous forests get about 750 to 1,500 mm of precipitation throughout the year.



# Taiga Boreal Forest

This biome has cold, dry winters and short, cool, wet summers.

The long and cold winters in the boreal forest have led to the dominance of cold-tolerant **evergreen conifers\***.

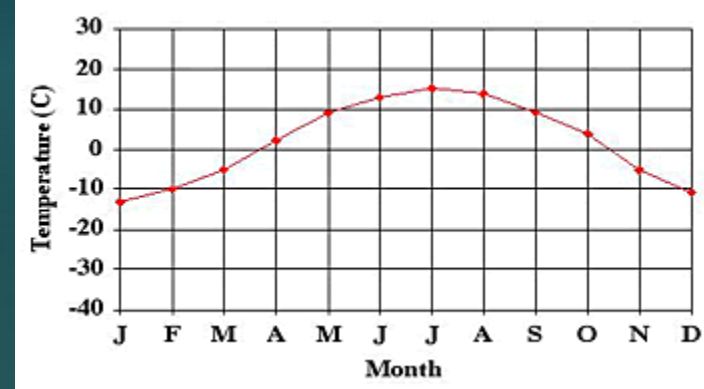
Conifers have adapted to the cold climate via **extracellular freezing\***  
Essentially dehydration to prevent damage.

The **net primary productivity of boreal forests is lower** than that of temperate forests and tropical wet forests.

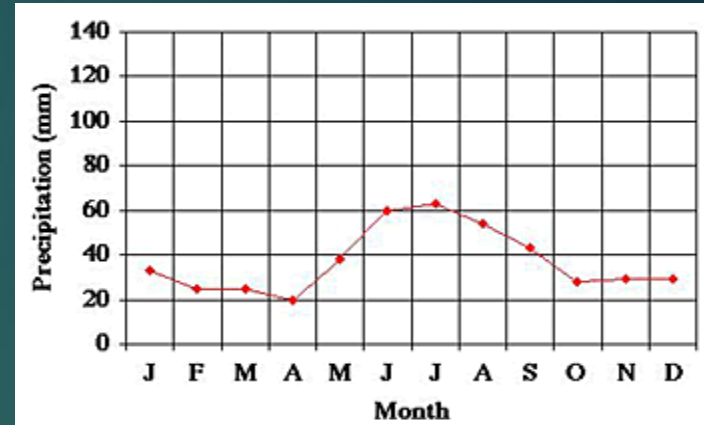
As such, **they have less biodiversity.**

Temperature  
-40°C to 20°C, average summer temperature is 10°C

Precipitation  
300 to 900 millimeters of rain per year



Beaverlodge, Alberta, Canada





# Savannas

Savannas are grasslands with scattered trees.

Savannas are hot, tropical areas. Due to dry climate and low rainfall; bush fires are common.



Savannas have an extensive dry season, so forest trees do not grow as well.

Plants and trees have evolved well-developed root systems that allow them to quickly re-sprout after a fire.

*Temperature*  
averaging from 24 °C to 29 °C

*Precipitation*  
annual rainfall of 10–40 cm.  
*Vegetation*  
Grasses, mixed woodland



# Deserts

Low and unpredictable precipitation limits the vegetation and animal diversity of this biome.

Very dry deserts lack perennial\* vegetation.

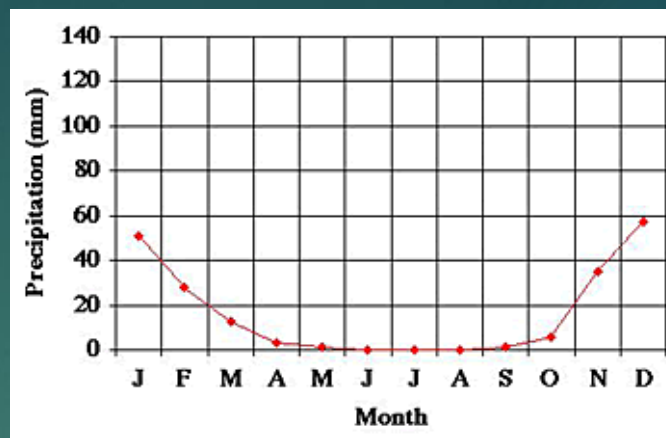
Many plants grow quickly and reproduce when rainfall occurs. Then due to energy constraints they die.

Other plants adapt to conserve water, with deep roots, reduced foliage, water-storing stems, or seeds that can be dormant between rains.



Deserts display extreme high and low temperatures and have a lack of vegetative shelter - most desert animals may be nocturnal or burrow.

\*Perennial - lives from one year to the next.



El-Oasr el-Akhdar, Egypt

Temperature  
Average of 38°C (day),  
average of -3.9°C (night)

Precipitation  
About 250 mm of rain per year

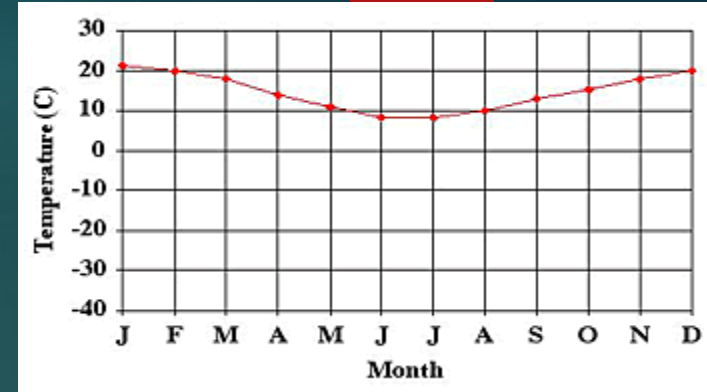
Vegetation  
Cacti, small bushes, short grasses





# Chaparral

The chaparral, or scrub forest, has annual rainfall that ranges from 65 cm to 75 cm, and the majority of the rain falls in the winter.

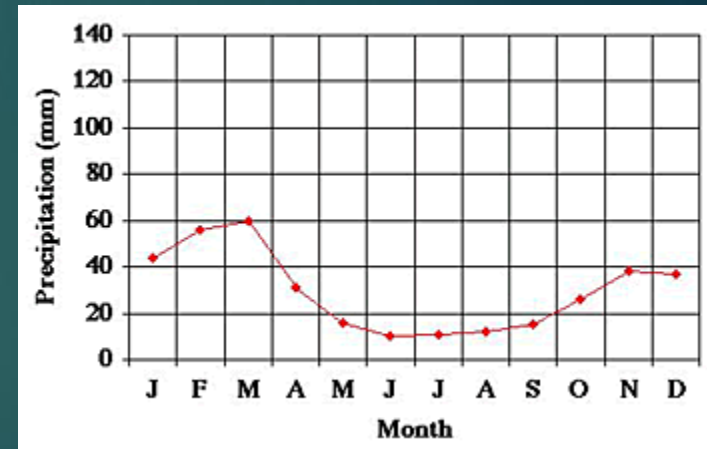


Baja California Peninsula, Mexico.

Summers are very dry and many chaparral plants are dormant during the summertime.

Similar to savannah, chaparral vegetation is dominated by shrubs and has adapted to periodic fires.

The ashes left behind fertilize the soil and promote plant regrowth.



Dormant (plants) - alive but not actively growing



# Tundra

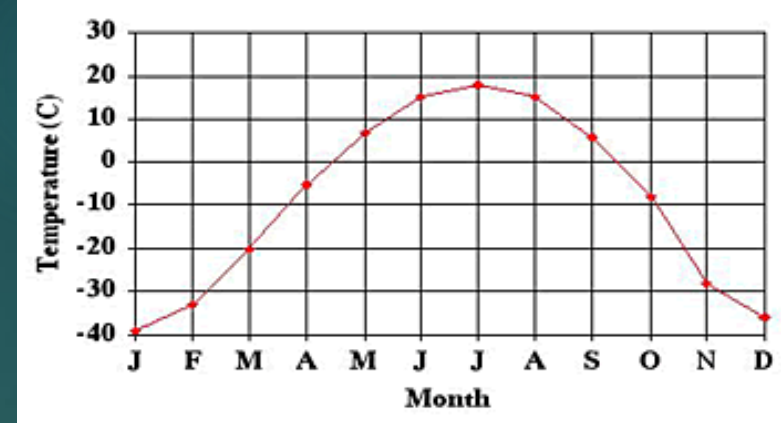
The tundra is the coldest of the biomes. It also receives low amounts of precipitation, making the tundra similar to a desert.

Tundra is found in the regions just below the ice caps of the Arctic, extending across North America, to Europe, and Siberia in Asia.

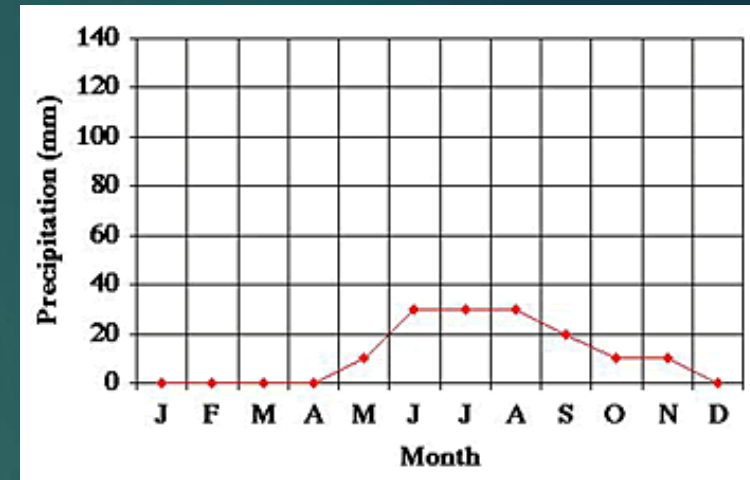
Temperatures are so cold that there is a layer of permanently frozen ground below the surface, called permafrost.

Permafrost is a defining characteristic of the tundra biome.

In the tundra summers, the top layer of soil thaws only a few inches down, providing a growing surface for the roots of vegetation.



Yakutsk, Russia





# Terrestrial Ecosystems



**Tundra** - Conditions = cold, annual average temperature less than 5°C.

**Tropical Rainforests** –  
Found around the equator.



**Deciduous** - Rapid changes.  
Cold/dry to wet/warm.



**Grassland** - dry, temperate to subtropical areas, often with cold winters and hot summers.



**Desert** - Hot. Dry  
(\*but, biggest desert is?)



# Terrestrial Ecosystems

Coniferous forest (Taiga)– cold, lots of rain



## Chaparral

Mediterranean

Wood / shrub-land

temp ranges from 0-30°C throughout the year.



## Savannah -

grassland with individual or groups of trees – typically over 30°C

Alpine - does not fit into a simple climatic scheme.





# Aquatic Ecosystems

Ecosystems found in water – Oceans, lakes, ponds and rivers

*The three main types of aquatic ecosystems...*



**Lentic** Still water  
(lakes, ponds)



**Lotic** -Running water  
(rivers, streams)



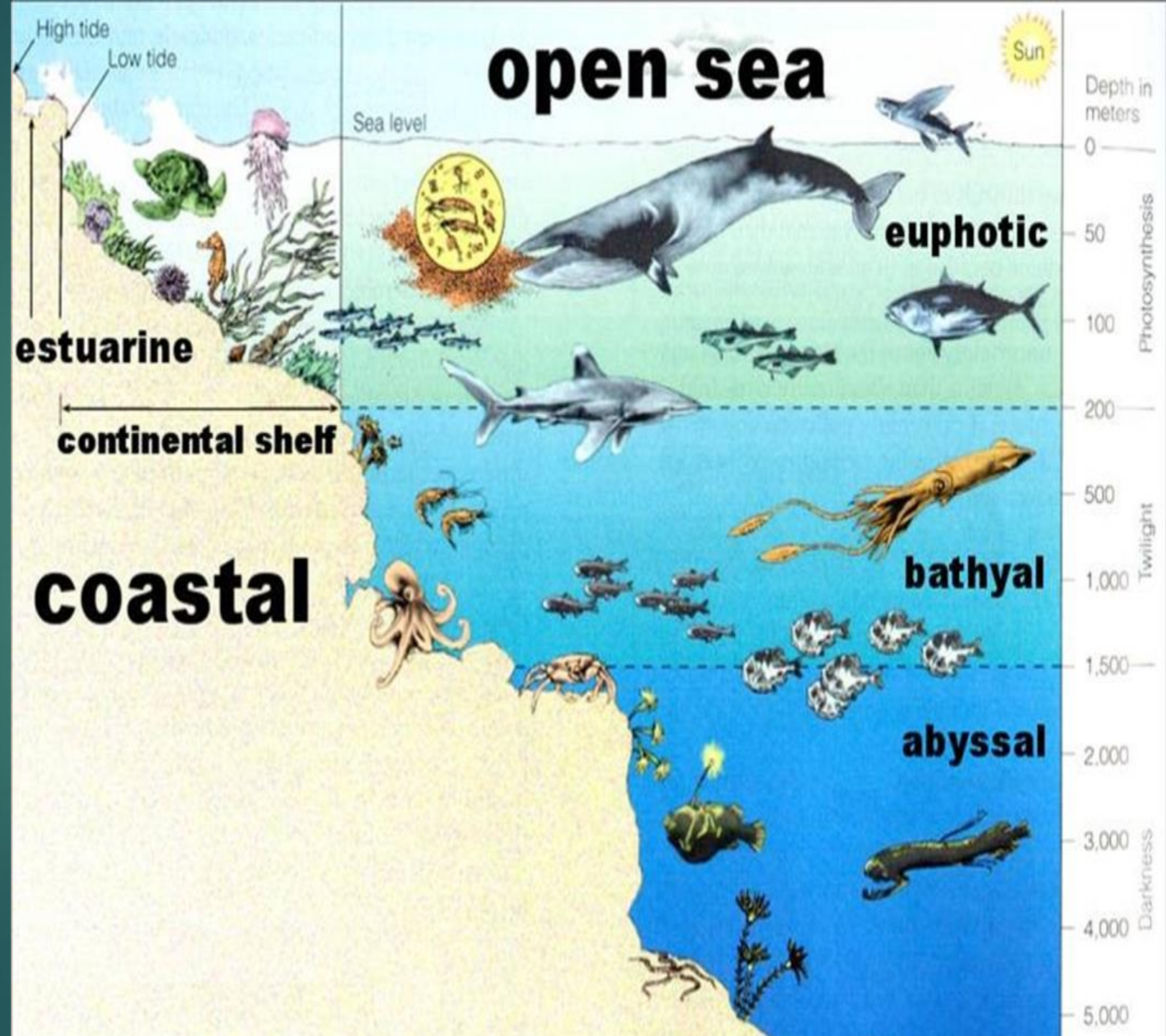
**Oceanic** - Salt water  
(seas/different depths)



# Aquatic Ecosystems

But even the three types of aquatic ecosystem are also divided into further sub-types. For example oceanic ecosystems:

Estuarine  
Euphotic  
Bathyal  
Abyssal



# The Biosphere

The Biosphere is all the parts of land, sea and atmosphere whereby organisms can live.

**Ecosphere**  
**Lithosphere**  
**Hydrosphere**  
**Atmosphere**

All 4 mix together in different places but they each have their own distinct attributes

