Forest ecosystem

- Ecosystem is a functional in which living organisms interact among themselves as well as with the surrounding physical environment.
- Size varies: small pond to a sea or a large forest.
- Types:
  - Terrestrial ecosystem (desert, grassland, and forest)
  - Aquatic ecosystem (pond, lake, wetland and river)
- A **forest ecosystem** is a natural woodland unit consisting of all plants, animals and micro-organisms (Biotic components) in that area functioning together with all of the non-living physical (abiotic) factors of the environment.

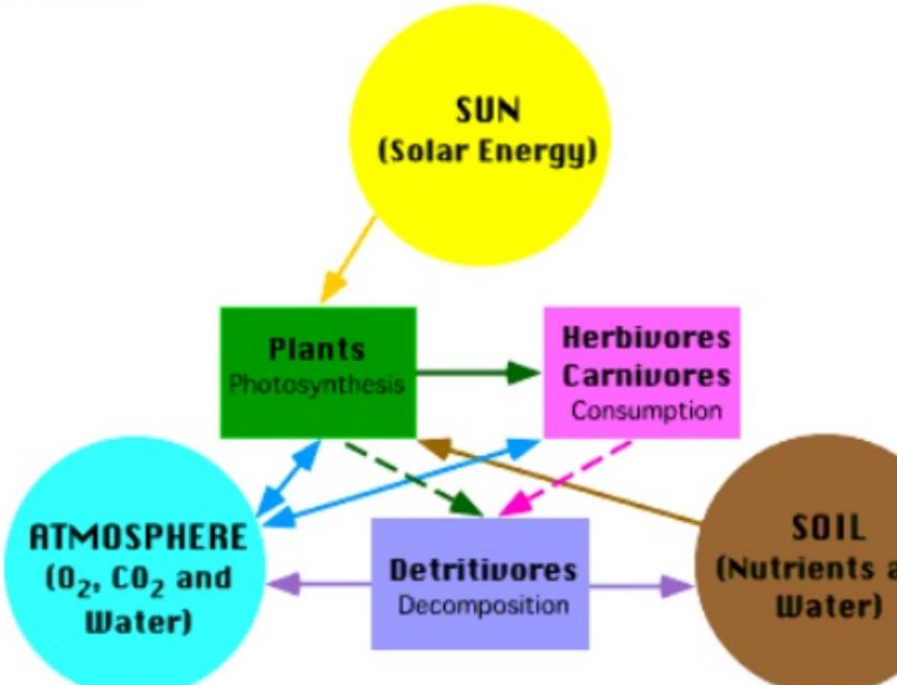
Factors of forest ecosystem

Biotic (living)

- Includes plants, animals, micro-organisms (producers, consumers, decomposers)

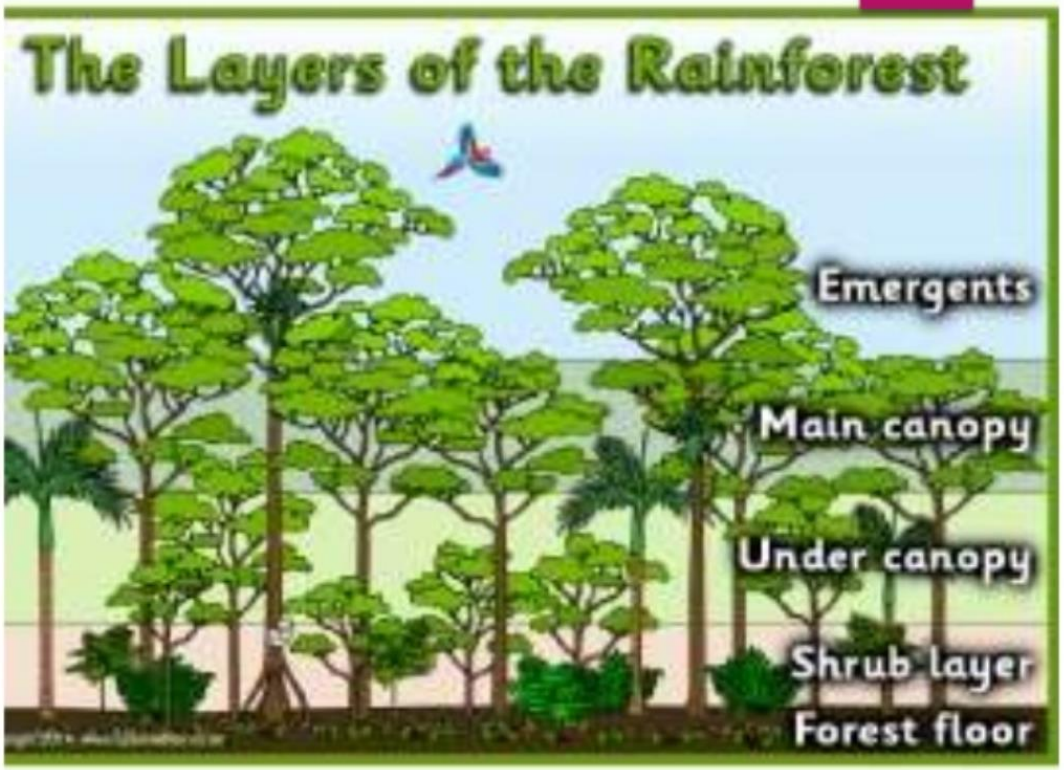
Abiotic (non-living)

- Rocks, mountain, soil, sunlight, water, air..



Generally..

- Has three main layers:
  - *canopy*
  - *Understory*
  - *forest floor*
- In rainforests, coniferous, coastal, mangrove forests.



- It is a functional unit or a system which comprises of soil, trees, insects, animals, birds, and man as its interacting units.
- As it is a large and complex system and hence has greater species diversity.

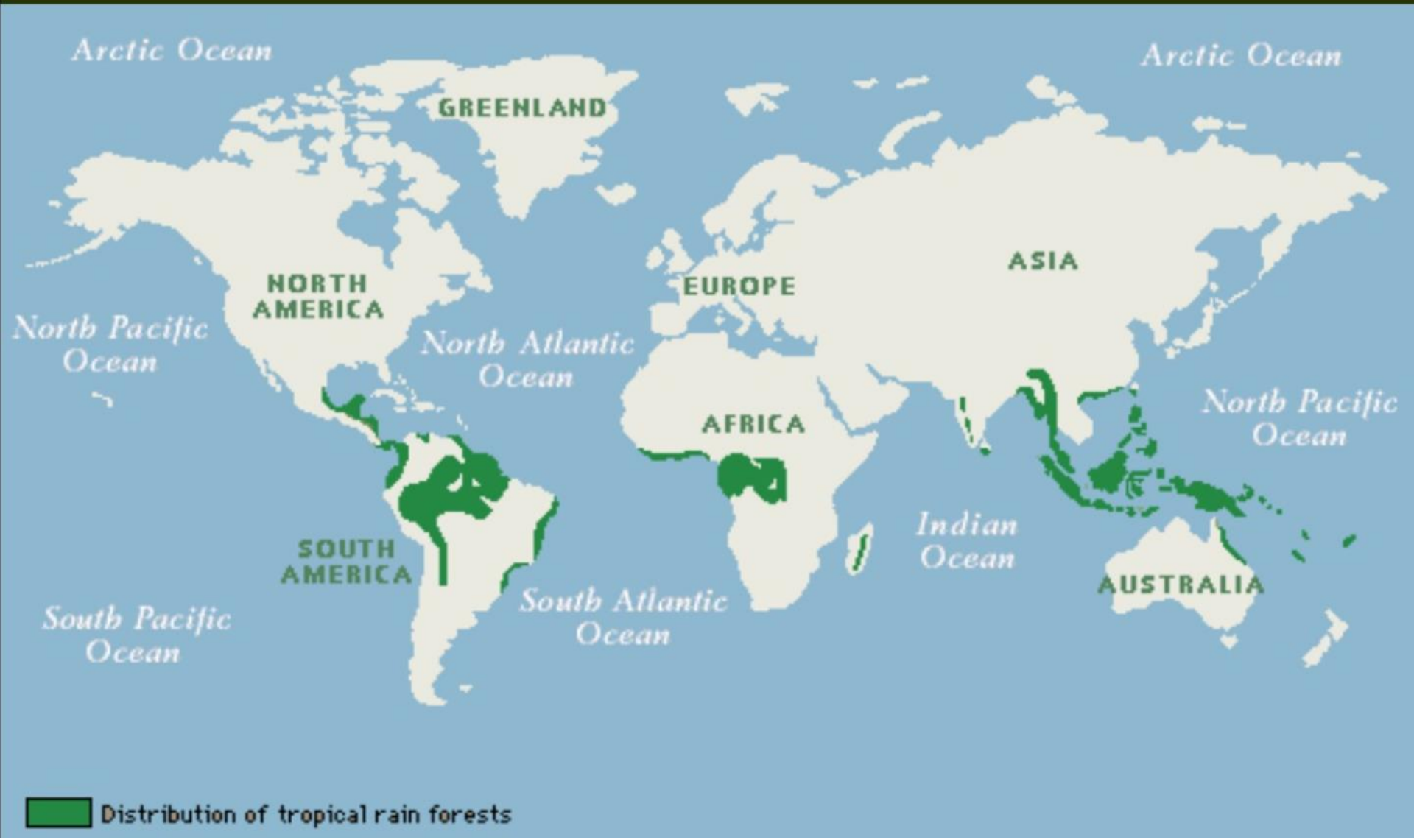
- Structural features
  - Species composition
  - Stratification
- Components of forest ecosystem
  - Productivity
  - Decomposition
  - Energy flow
  - Nutrient cycling

- Three major types of forest ecosystems are:
  - Tropical rain forest ecosystem
  - Temperate forest ecosystem
  - Boreal or taiga forest ecosystem

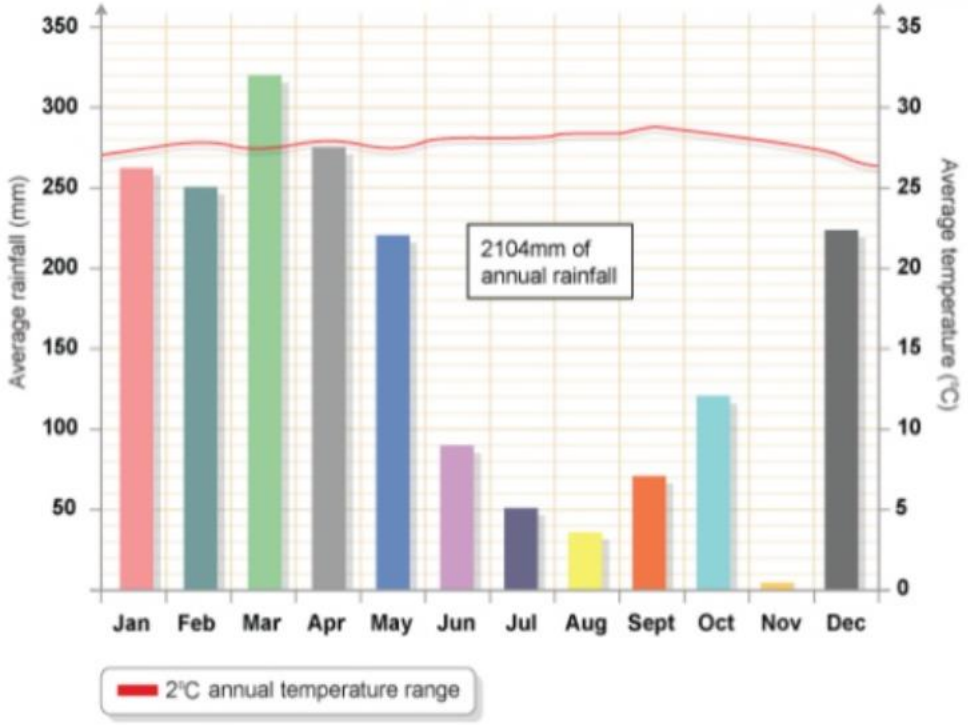
Tropical rain forest

- The tropical rainforest occurs in a broad zone outside the equator.
- Temperature and humidity are relatively high through the year.
- Rainforests grow in the tropics, close to the equator and the plants have a twleve month growing season.
- As a resultant, the rainforest is the most fertile vegetation system in the world. It is abundant with many species of wildlife and vegetation.
- Rainforest cover less than two percent of the earth's surface.

Distribution



Climate



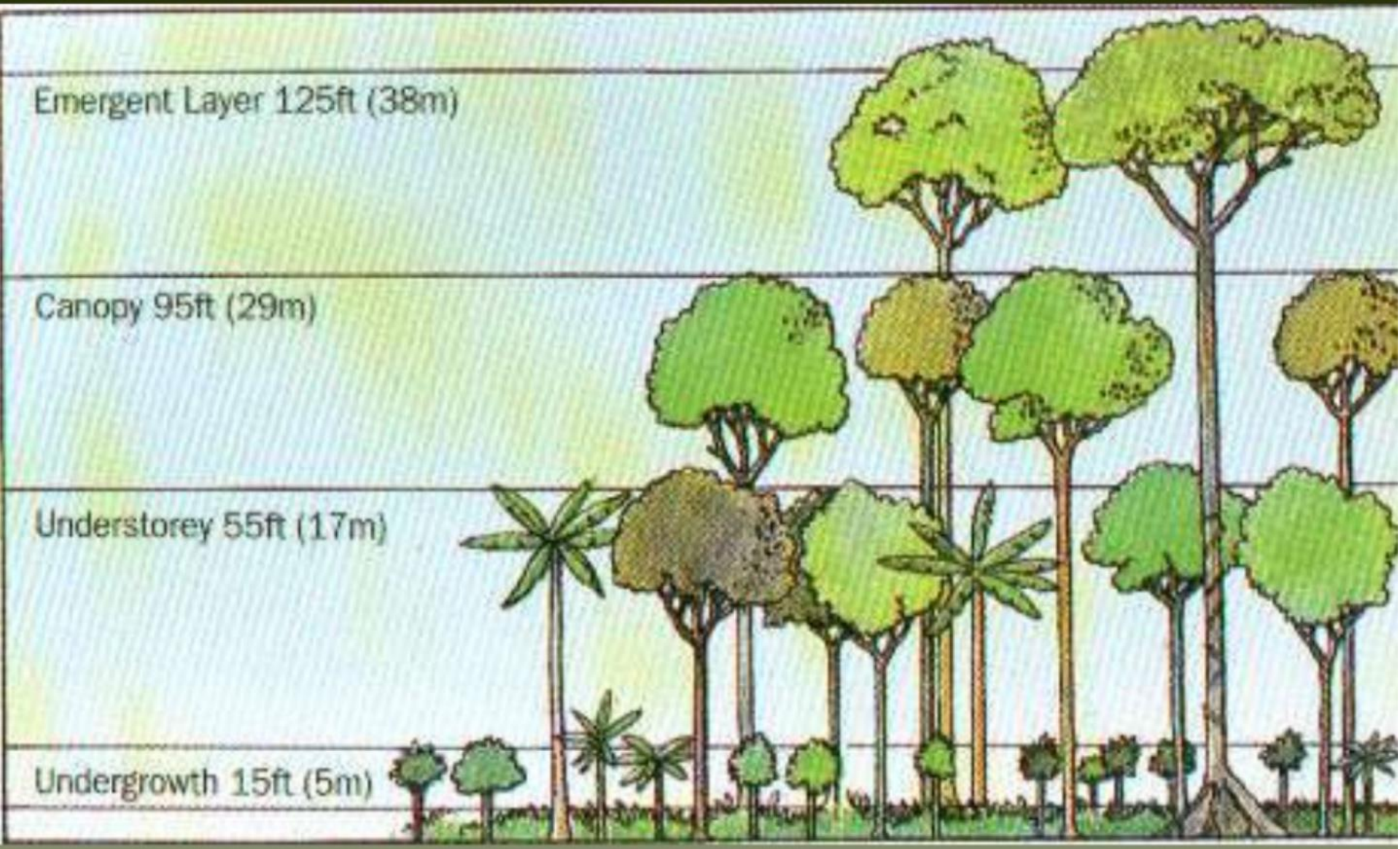
The graph shows average rainfall and temperature in Manaus, Brazil, in the Amazon rainforest

- **Warm and wet** describes the tropical rain forest climate. The average annual **temperature is above 30 C**; there is never a frost
- **Annual rainfall, which exceeds 2000 to 2250 millimeters**, is generally evenly distributed throughout the year.
- In general, tropical rainforests have **hot and humid climates where it rains virtually every day**.
- The rainy season is from December to May. Notice how much the rainfall varies over the year - the highest monthly rainfall is in March with over 300mm, while the lowest is in August with less than 50mm. Over the year, the temperature only varies by 2°C.

Structure

- Most of life in the tropical rainforest exists vertically in the trees, above the shaded forest floor - in the layers.
- Each tropical rainforest canopy layer harbors its own unique plant and animal species interacting with the ecosystem around them.
- The primary tropical rainforest is divided into at least five layers: the overstory, the true canopy, the understory, the shrub layer, and the forest floor.

Structure


Emergent Layer 125ft (38m)
Canopy 95ft (29m)
Understorey 55ft (17m)
Undergrowth 15ft (5m)

Forest Floor

- The area is mostly shade. Barely and direct light reaches this level, thus almost no plants grow in this area as a result.
- Since hardly any sun reaches the forest floor things begin to decay quickly.
- A leaf that might take one year to decompose in a regular climate will disappear in 6 weeks.
- Giant anteaters live in this layer.

Forest Floor

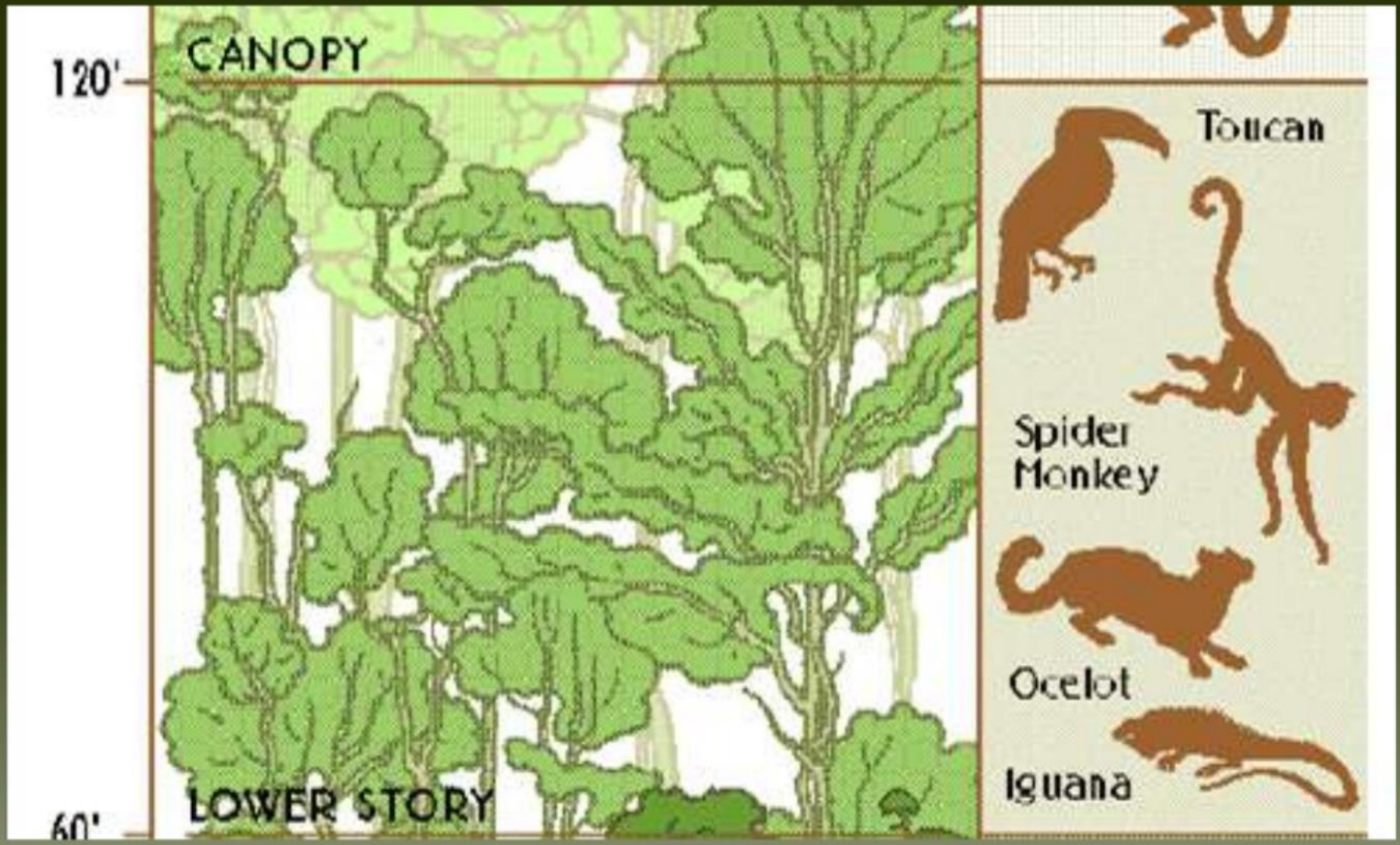
Understory Layer

- Little sunshine reaches this area so the plants have to grow larger leaves to reach the sunlight.
- The plants in this area seldom grow to 12 feet.
- Many animals live here including jaguars, red-eyed tree frogs and leopards. There is a large concentration of insects here.

Canopy Layer

- This is the primary layer of the forest and forms a roof over the two remaining layers.
- Most canopy trees have smooth, oval leaves that come to a point. It's a maze of leaves and branches.
- Many animals live in this area since food is abundant. Those animals include: snakes, toucans and treefrogs.

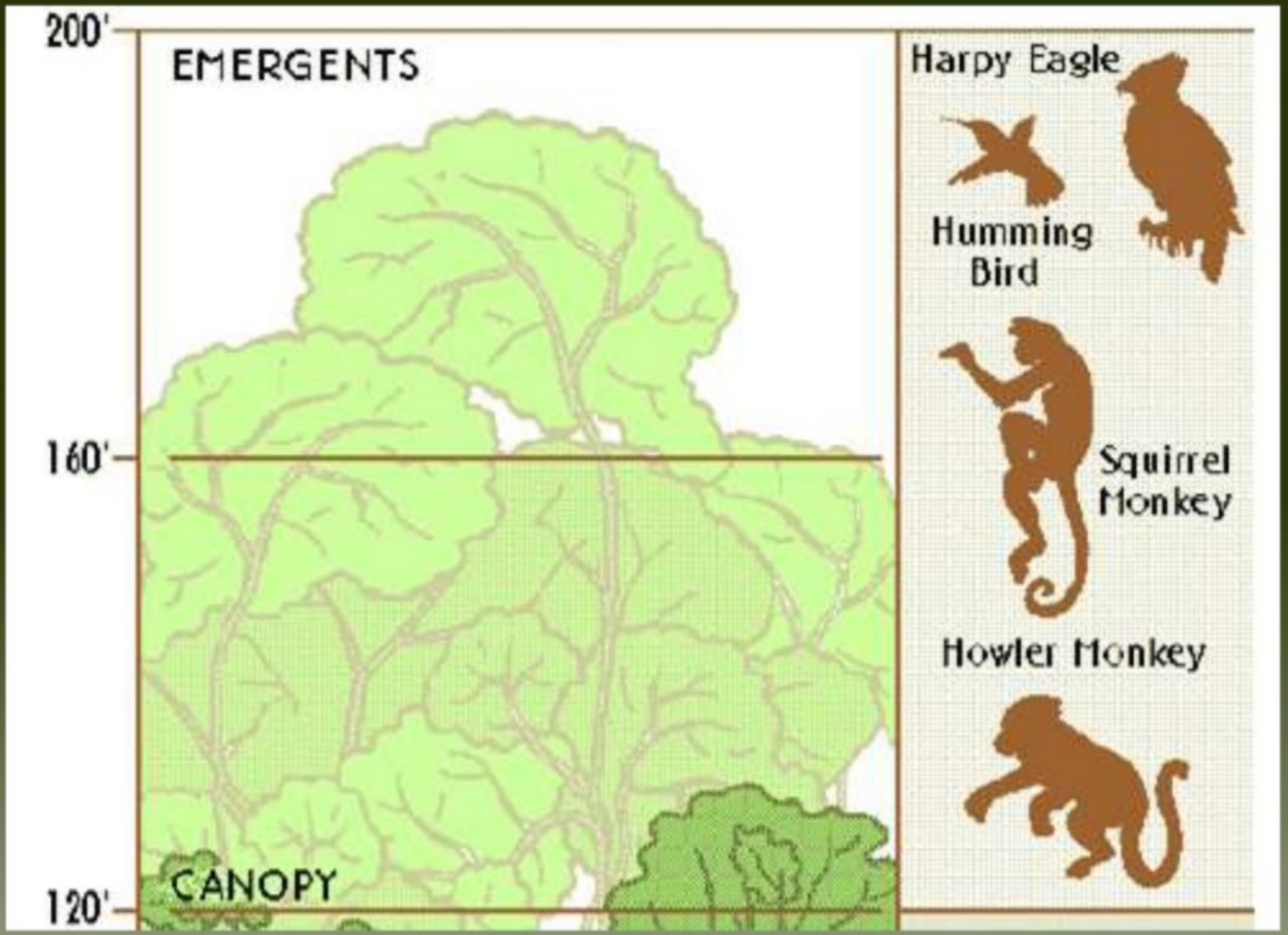
Canopy Layer



Emergent Layer

- The tallest trees are the emergents, towering as much as 200 feet above the forest floor with trunks that measure up to 16 feet around.
- Most of these trees are broad-leaved, hardwood evergreens. Sunlight is plentiful up here.
- Animals found are eagles, monkeys, bats and butterflies.

Emergent Layer



Tropical Rainforests

Subtypes of Rainforests

- **Lowland rainforest** – abundant of trees, ferns, and small plants. Lowland rainforests contain the tallest trees of all the types of rainforest, with the largest variety of species
- **Cloud forests** – forest that is wrapped in clouds and mists.
- **Swamp forests –** occupy perennially wet soils and peat forests grow on nutrient poor ones.
- **Gallery forests –** a stretch of forest along a river in an area of otherwise open country and follow river courses into savannah.

- **Lowland Rainforest**

Swamp forest

Cloud Forest

Gallery forest

Biotic Factors

Animal Adaptations

- The tropical rainforest is a wet, warm forest of trees that grow very closely together. The canopy in the rainforest can release gallons of water each year into the atmosphere. The resulting moisture hangs over the forest, keeping the interior warm and humid. Animals living in the rainforest have had to adapt to these wet, warm conditions and have had to find niches that allow them to thrive. They do this by altering species characteristics to fit the tall trees, the constant humidity and the rainforest floor.

Animals in the canopy: Primates

- Long arms to swing from tree to tree in the canopy, avoiding predators on the ground

- Many animals are nocturnal feeder to avoid dangerous predators by day.
- Large eyes allow more light in at night.
- Builds nests on top of trees in the canopy.
- Have a longer middle finger to reach within holes in the tree trunk.

Birds

- Have large beaks to lose more heat. Birds in tropical regions can afford to have larger beaks than birds in temperate regions.
- Differently sized beaks allow for different adaptations according to use

- Large beaks for cutting up pieces of fruit and nuts
  - Toucan

- Hooked beaks to tear small prey apart

- Long thin beaks to reach within small holes on trees
  - Black-cheeked Woodpecker

Human impact on rainforest

- The biggest causes of rainforest destruction are:
- Deforestation
  - Cutting down trees
  - Illegal logging
- Mining
- Environmental impact
  - Loss of biodiversity
  - Soil erosion
  - Flooding
  - Global warmining

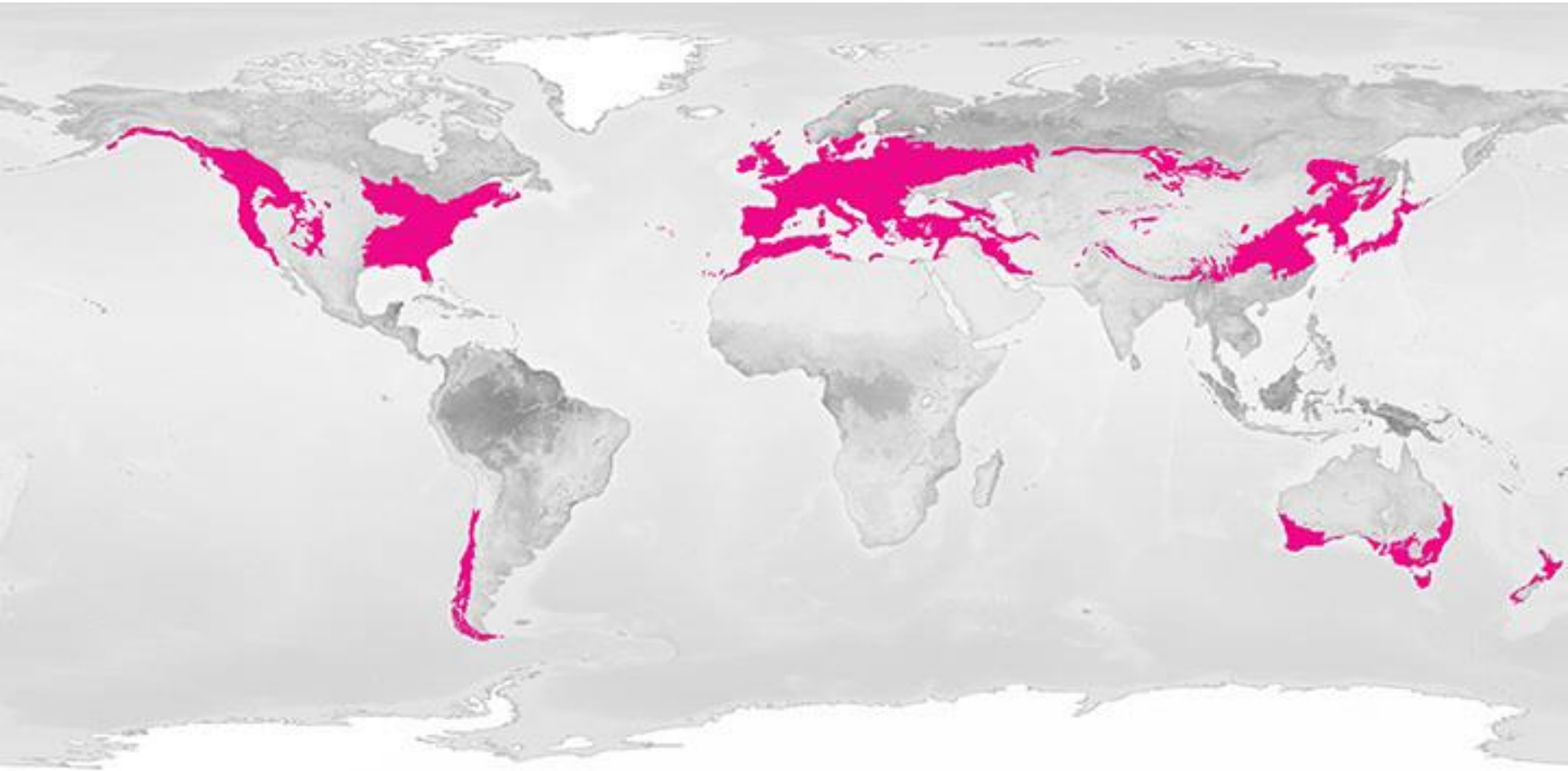
Temperate Forest Ecosystems

- The temperate forest biome is one of the world's major habitats.
- Temperate forests are characterized as regions with high levels of precipitation, humidity, and a variety of deciduous trees.
- Deciduous trees are trees that lose their leaves in winter.
- Decreasing temperatures and shortened daylight hours in fall mean decreased photosynthesis for plants.
- Thus, these trees shed their leaves in fall and bud new leaves in spring when warmer temperatures and longer hours of daylight return.

- **Climate**
- Temperate forests have a wide range of temperatures that correlate with the distinctive seasons.
- Temperatures range from hot in the summer, with highs of 86 F, to extremely cold in the winter, with lows of -22 F.
- Temperate forests receive abundant amounts of precipitation, usually between 20 and 60 inches of precipitation annually.
- This precipitation is in the form of rain and snow.

Location

- Deciduous forests are typically found in the Northern Hemisphere. Some locations of temperate forests include:
- Eastern Asia
- Central and Western Europe
- Eastern United States



Vegetation

- Due to abundant rainfall and thick soil humus, temperate forests are able to support a wide variety of plant life and vegetation.
- This vegetation exists in several layers, ranging from lichens and mosses on the ground layer to large tree species like oak and hickory that stretch high above the forest floor.
- Other examples of temperate forest vegetation include:
  - **Forest canopy tier:** Maple trees, walnut trees, birch trees
  - **Small tree tier:** Dogwoods, redbuds, shadbush
  - **Shrub tier:** Azaleas, mountain laurel, huckleberries
  - **Herb tier:** Blue bead lily, Indian cucumber, wild sarsaparilla
  - **Floor tier:** Lichens and mosses

Wildlife

- Temperate forests are home to a diverse wildlife biosystem including various insects and spiders, wolves, foxes, bears, coyotes, bobcats, mountain lions, eagles, rabbits, deer, skunks, squirrels, raccoons, squirrels, moose, snakes, and hummingbirds.
- Temperate forest animals have many different ways to deal with the cold and lack of food in winter.
- Some animals hibernate during the winter and arise in spring when food is more plentiful.
- Other animals store food and burrow underground to escape the cold.
- Many animals escape the harsh conditions by migrating to warmer regions in winter.

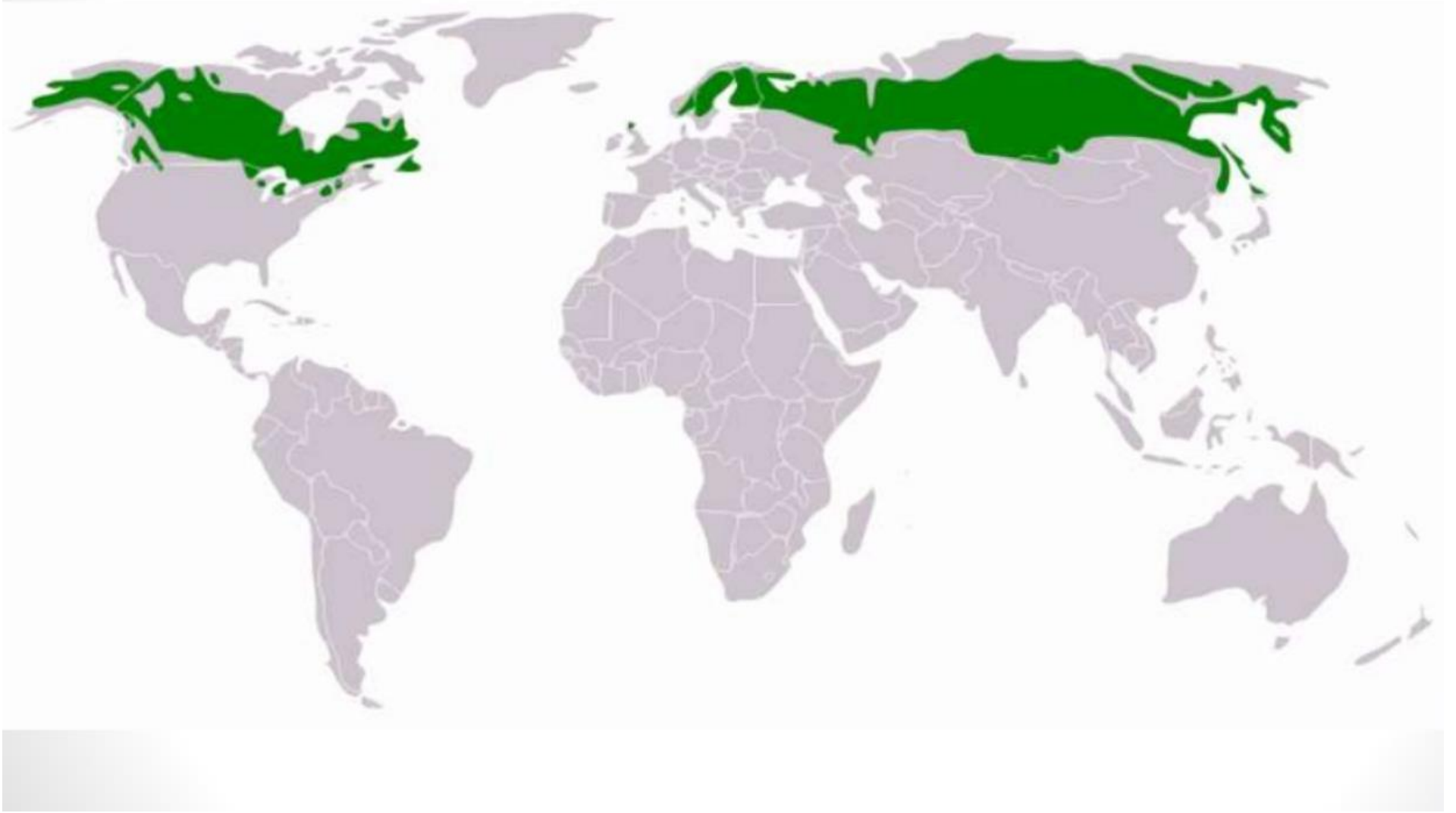
Temperate forests are one of many biomes. Other land biomes of the world include:

- Chaparrals: Characterized by dense shrubs and grasses, this biome experiences dry summers and damp winters.
- Deserts: Did you know that not all deserts are hot? In fact, Antarctica is the largest desert in the world.
- Savannas: This large grassland biome is home to some of the fastest animals on the planet.
- Taigas: Also called boreal forests or coniferous forests, this biome is populated by dense evergreen trees.
- Temperate grasslands: These open grasslands are located in colder climate regions than savannas. They are found on every continent except for Antarctica.
- Tropical rainforests: Located near the equator, this biome experiences hot temperatures year round.
- Tundra: As the coldest biome in the world, tundras are characterized by extremely cold temperatures, permafrost, treeless landscapes, and slight precipitation.

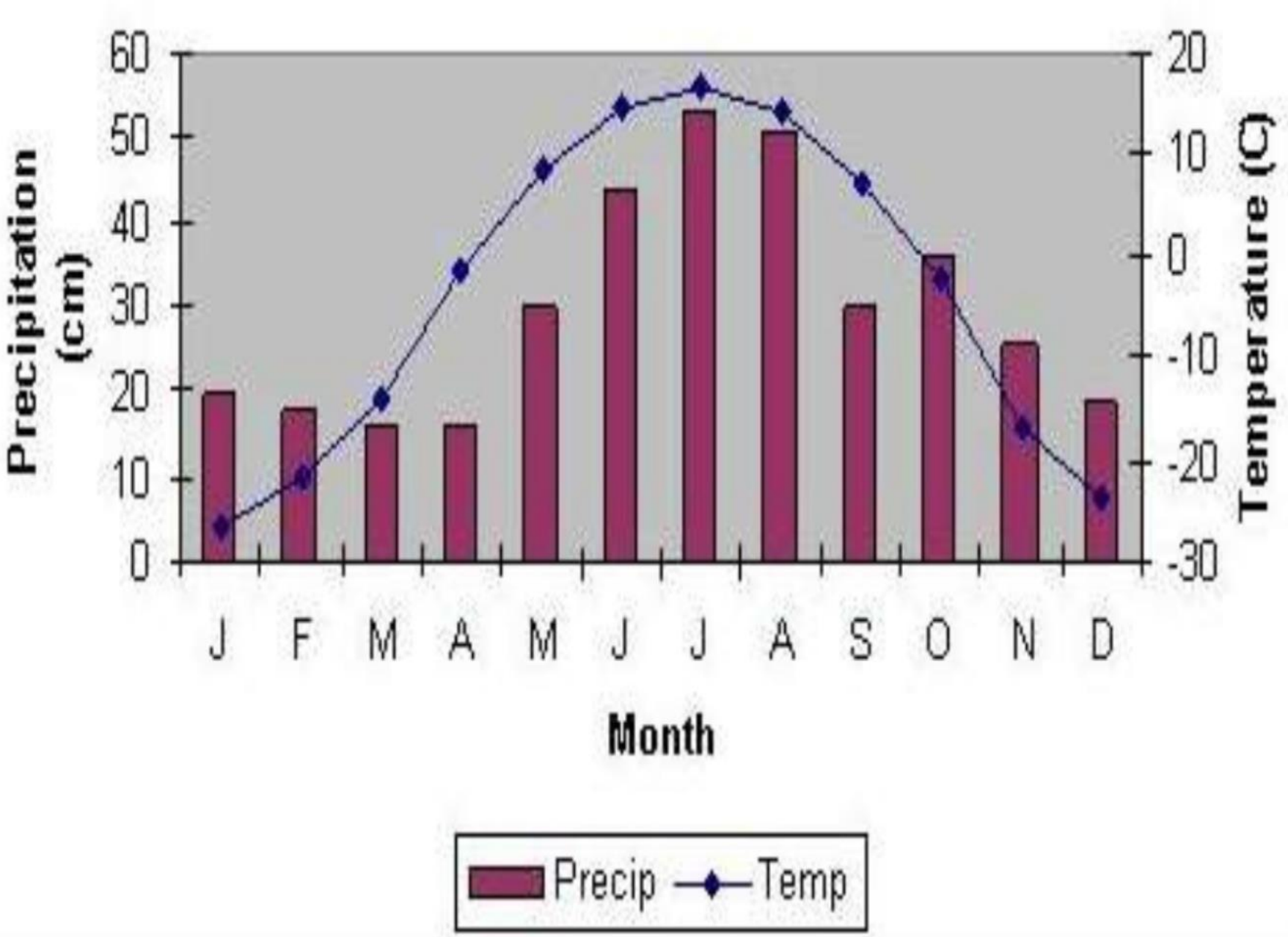
Boreal or taiga forest ecosystem

- Boreal forests are located across north america, europe and asia.
- It lies in the middle of two different biomes, the barren tundra which is located towards the north, and deciduous forests are located farther south of it.
- This biome is located in the northern hemispere.

Taiga ecoregions



- It is known for being in the moderate to cold cold range.
- The temperature in this biome tends to reach ranges between 5°C to -5°C.
- These are some cases where temperature have reached highs and lows of 10°C and -10°C, however in different areas.
- Rainfall tends to be between 20 and, in some cases, 75cm per year.


Precipitation (cm)
60
50
40
30
20
10
0
20
10
0
-10
-20
-30
Temperature (C)
J F M A M J J A S O N D
Month
Precip
Temp

Climate

Subarctic climate

Lowest annual average terrestrial biome after tundra and permanent icecaps

Short humid summers (typically 18˚C) and long cold winters (typically -20˚C)

High latitudes ensure little sun but long summer days (20h)

Polar nights and midnight suns are common in arctic zone

Precipitation 200-750 mm annually some areas 1000mm

Recently glaciated creating depressions in the topography

Soil

- Young and poor in nutrients
- Thinness of the soil is due largely to the cold
- Fallen leaves and moss can remain on the forest floor for a long time
- Acidic due to the falling pine needles
- Clearings in the forest and in areas with more boreal deciduous trees, there are more herbs and berries growing
- Diversity of soil organisms are high

- Mild fires occur once every 20-200 years
- Clears out larger trees

Flora

- Bering land bridge
- Largely coniferous some parts deciduous
- Well adapted
- Wildfire

Fauna

- Bering land bridge
- Small biodiversity
- 85 species mammals
- 300 species birds
- 130 species fish
- 32000 species insects

- Animals hibernate during winter to migrate
- Layers of fur and feathers protect from cold when hibernating.
- Some animals change colours as the seasons change for camouflage
- Examples: lynx, snowshoe hare, grizzly bear, bobcat, wolverine, ermine, marten, mink, moose, elk, red squirrel, vole,

Endangered Animals

- Beavers
- Wood Bison
- Siberian Crane
- Siberian Tiger

Plants

- Needles to reduce water loss
- Branches flexible to withstand the weight of heavy snow
- Shaped to shed snow with ease
- Examples: White spruce, douglas fir, hemlock, birch

Threats

- Human activities
- Climate change
- Insects
- Pollution

Thank you