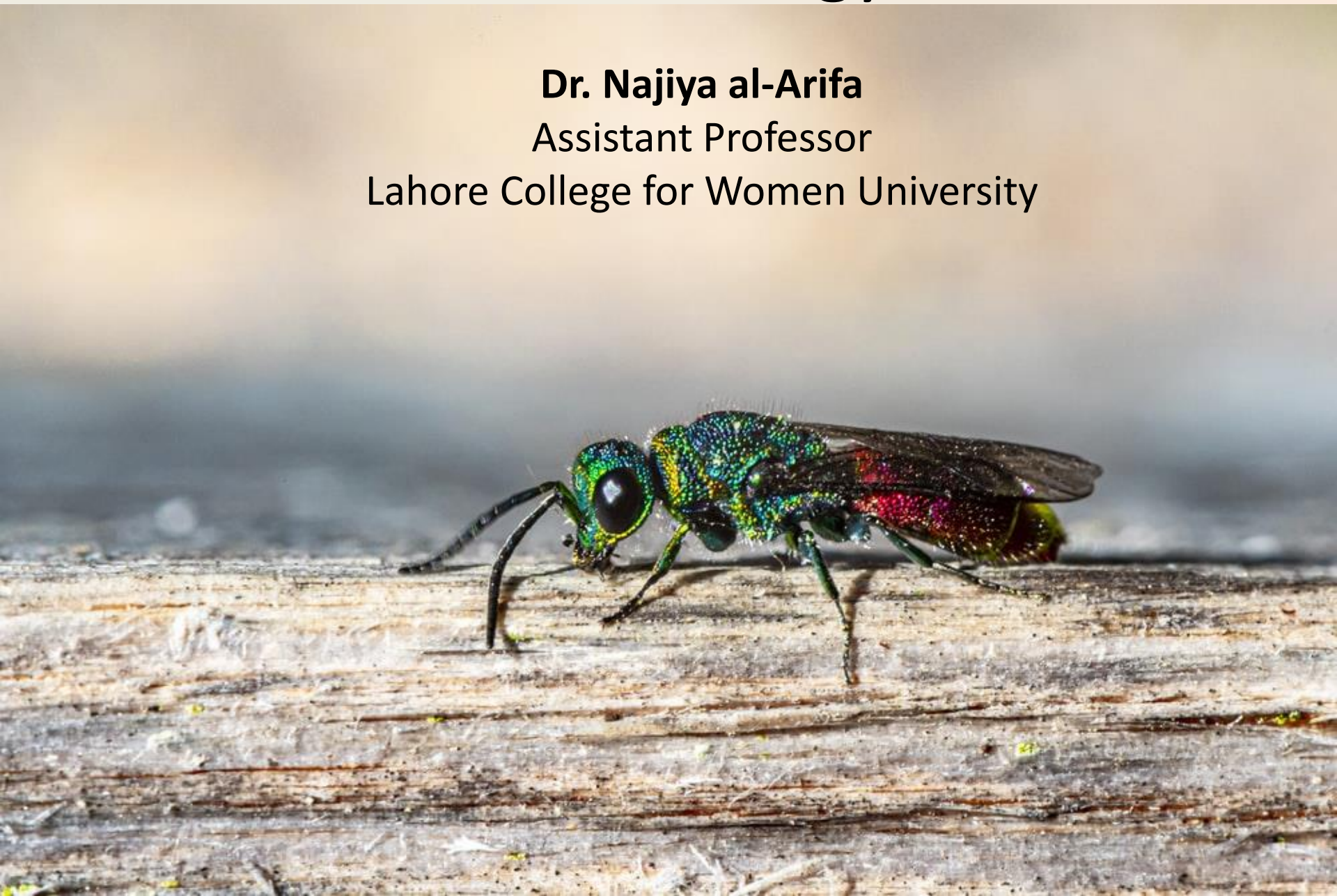
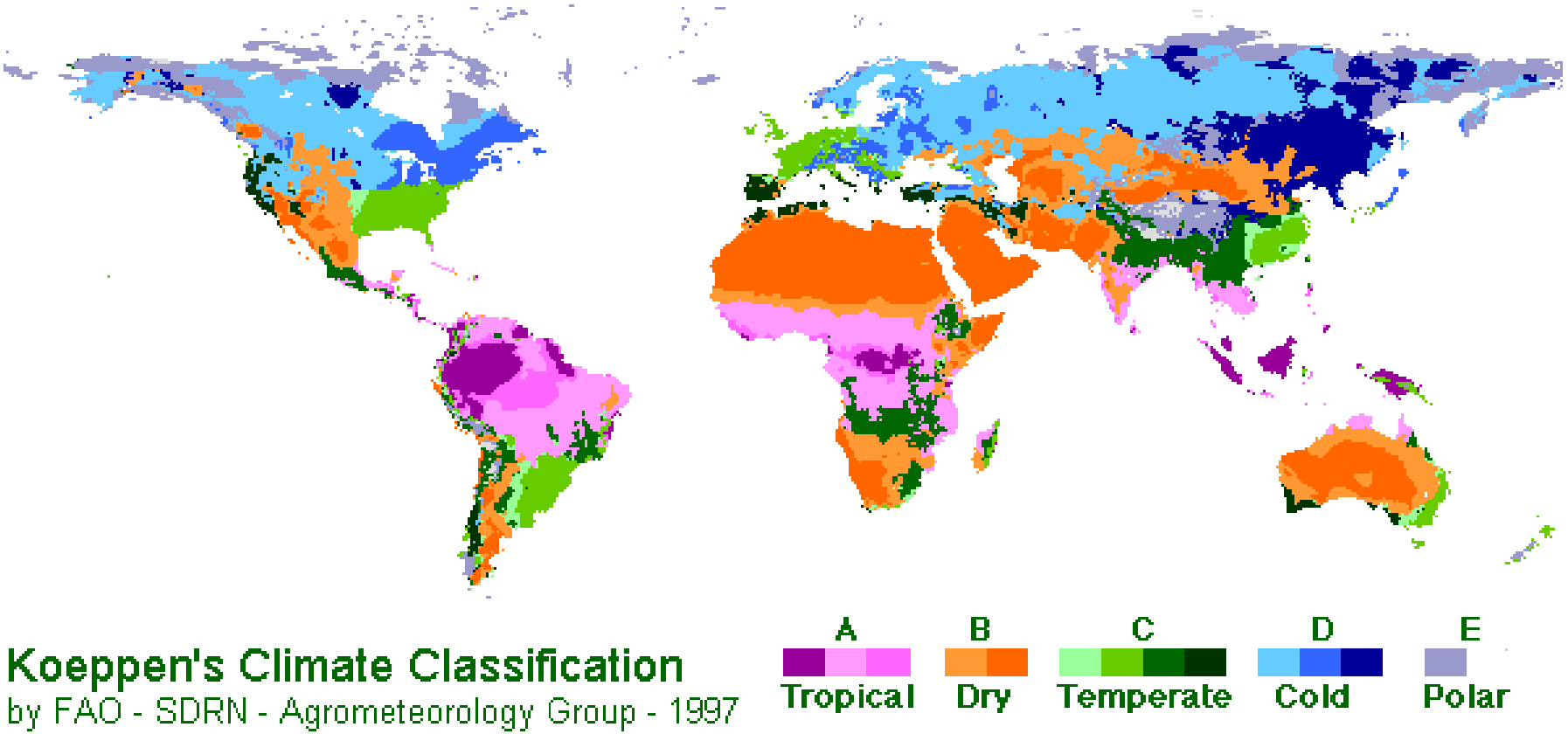
EcoZoology

Dr. Najiya al-Arifa
Assistant Professor
Lahore College for Women University



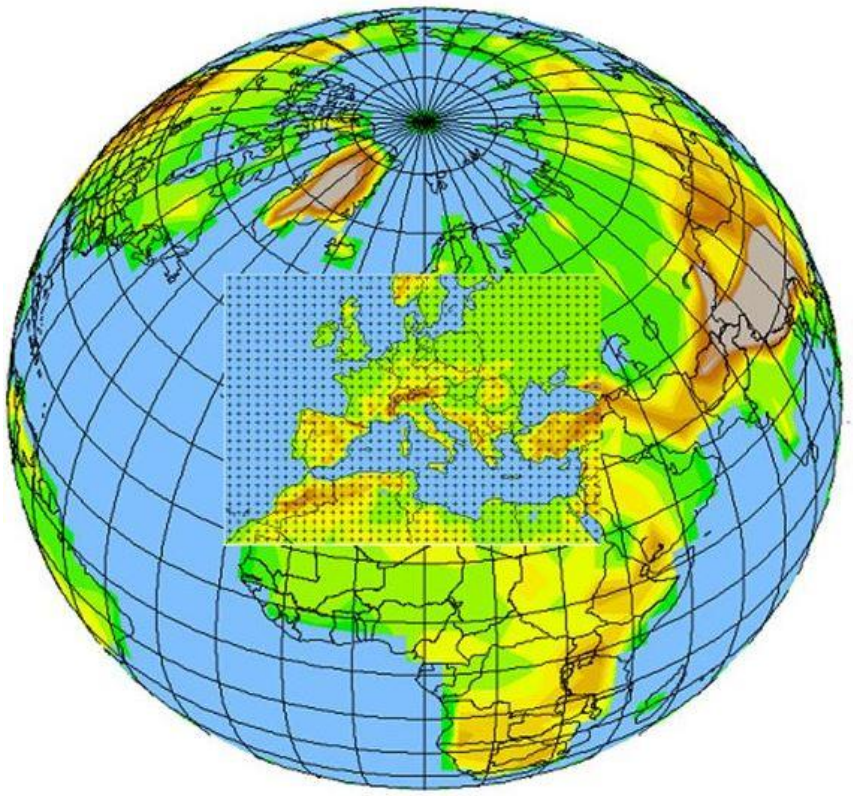
Weather

Day-to-day conditions of Earth's atmosphere.



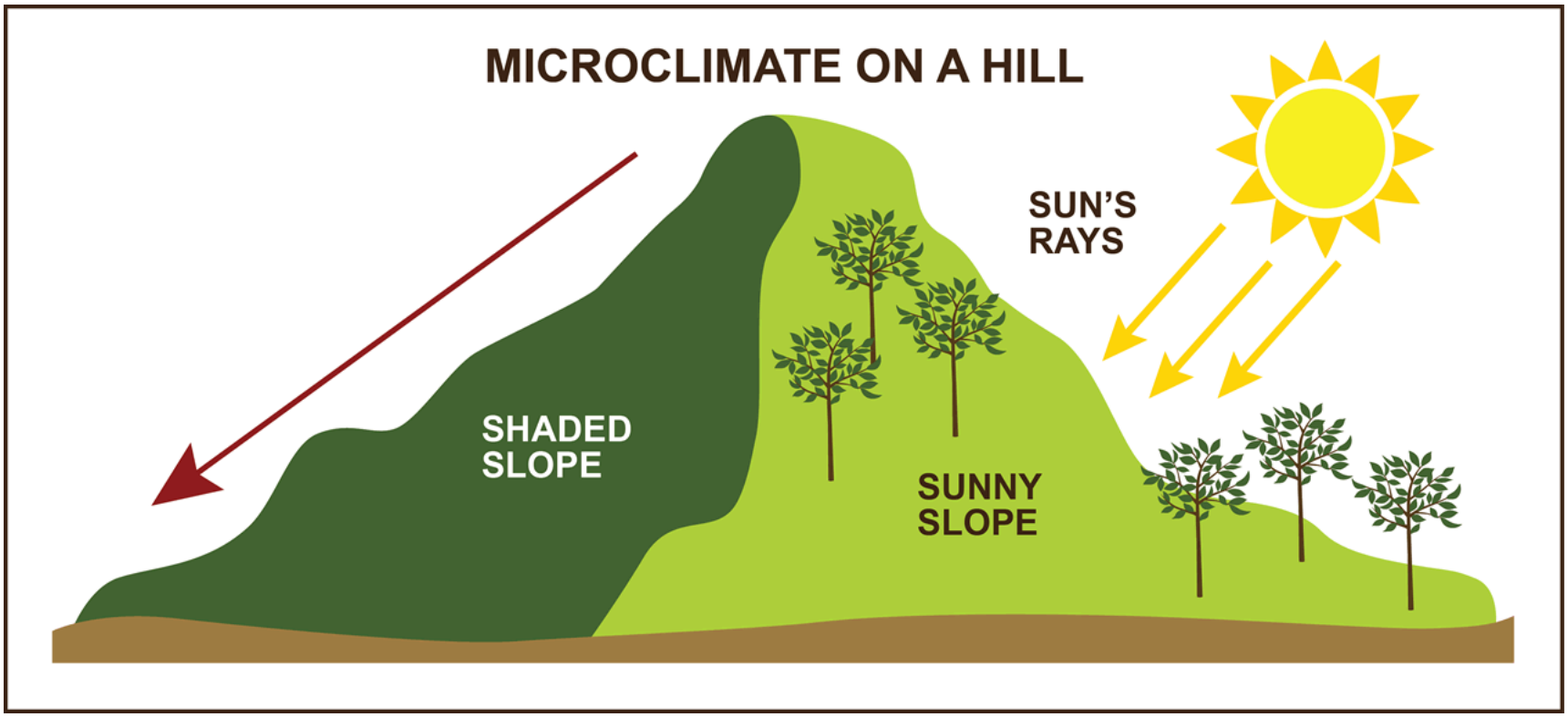
Climate

Average conditions over long periods.



Regional climate

Year-after-year patterns of temperature and precipitation



Microclimates

Environmental conditions that can vary over small distances

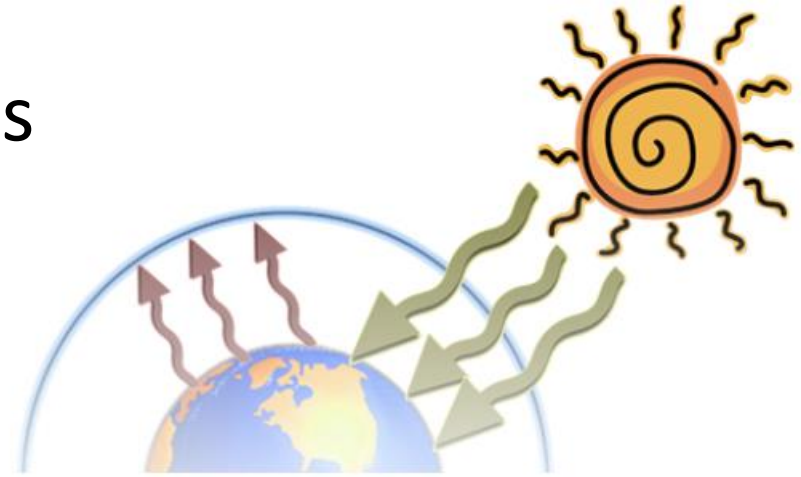
e.g. south- facing side of trees and buildings receive more sunlight, and are often warmer and drier than north-facing sides.

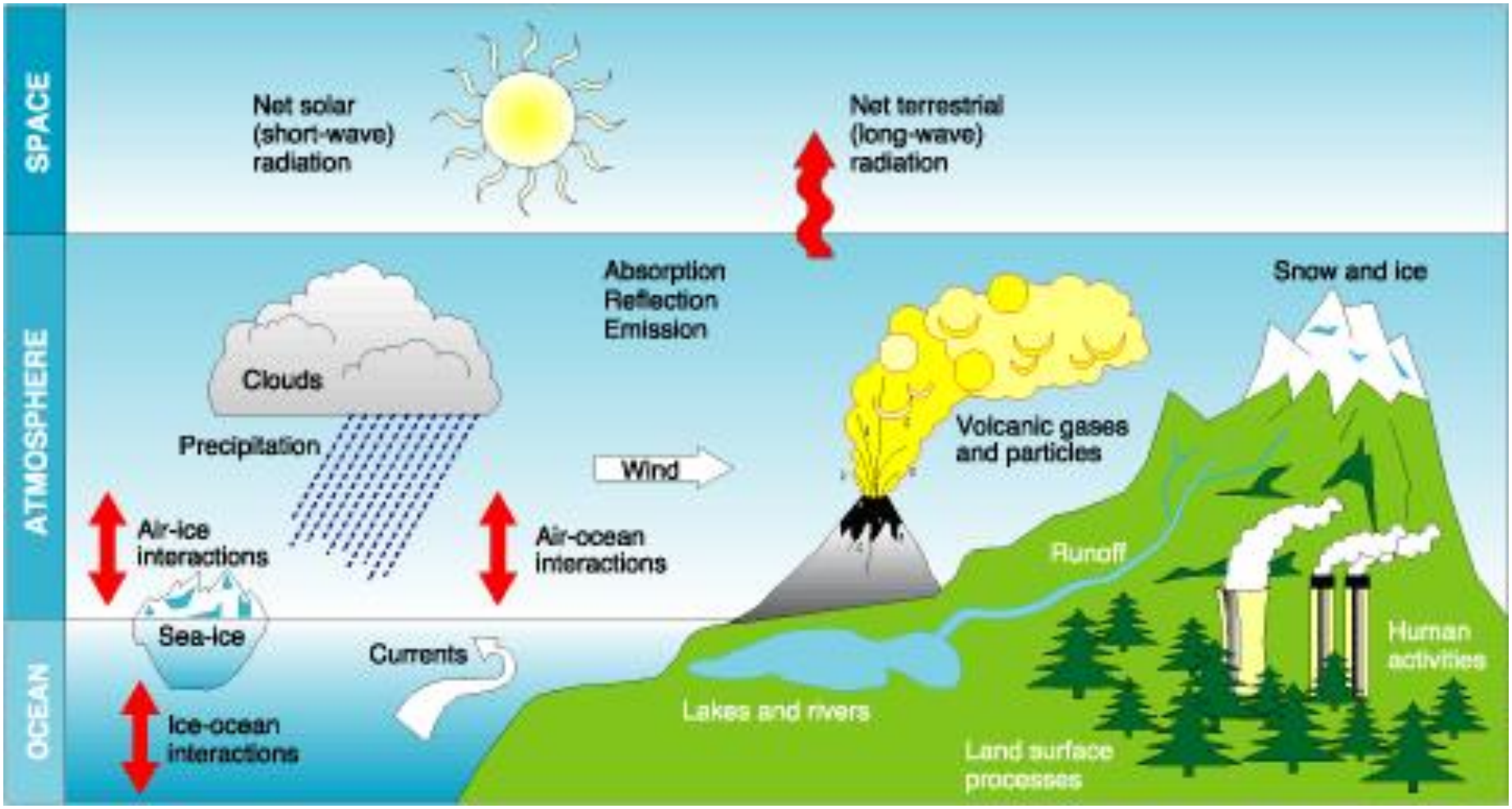
Why is the man on the left warmer than the man on the right?

Factors That Affect Climate

- Solar energy trapped in the biosphere
  - Greenhouse Effect

- Latitude
- Transport of Heat by winds
- Ocean Currents




SPACE
ATMOSPHERE
OCEAN
Net solar (short-wave) radiation
Net terrestrial (long-wave) radiation
Absorption
Reflection
Emission
Snow and ice
Clouds
Precipitation
Wind
Volcanic gases and particles
Air-ice interactions
Air-ocean interactions
Runoff
Sea-ice
Currents
Human activities
Lakes and rivers
Ice-ocean interactions
Land surface processes

Solar Energy

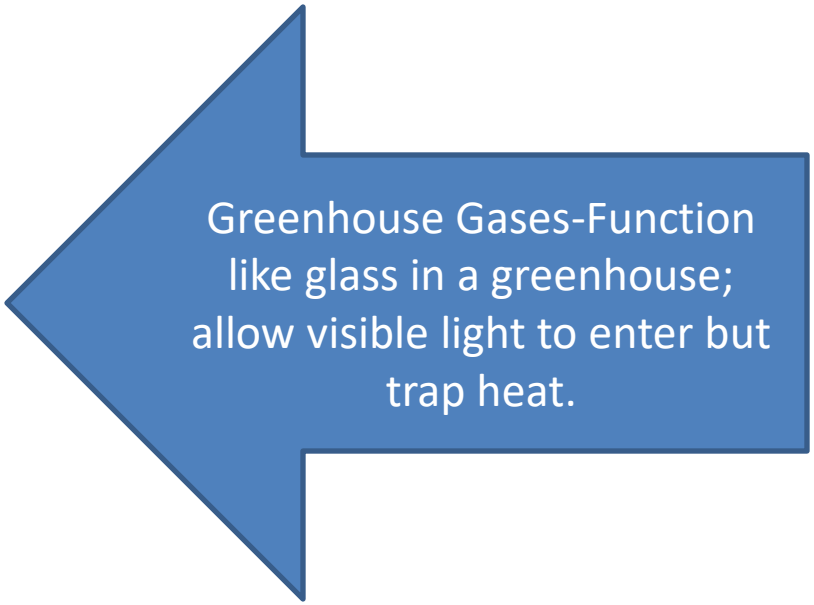
- Main force that affects climate-Solar Energy (sunlight)
  - Reflected back into space
  - Absorbed
  - Converted into heat

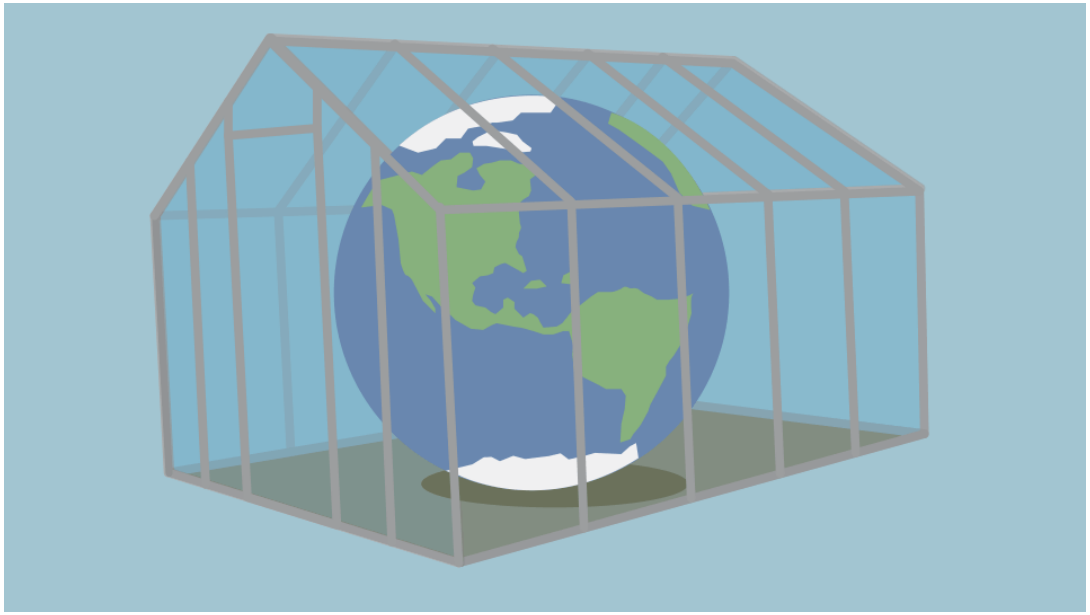
Earth’s average temperature

Balance b/w heat that stays in biosphere and heat lost to space

Balance controlled by concentrations of:

- Carbon Dioxide
- Methane
- Water Vapor



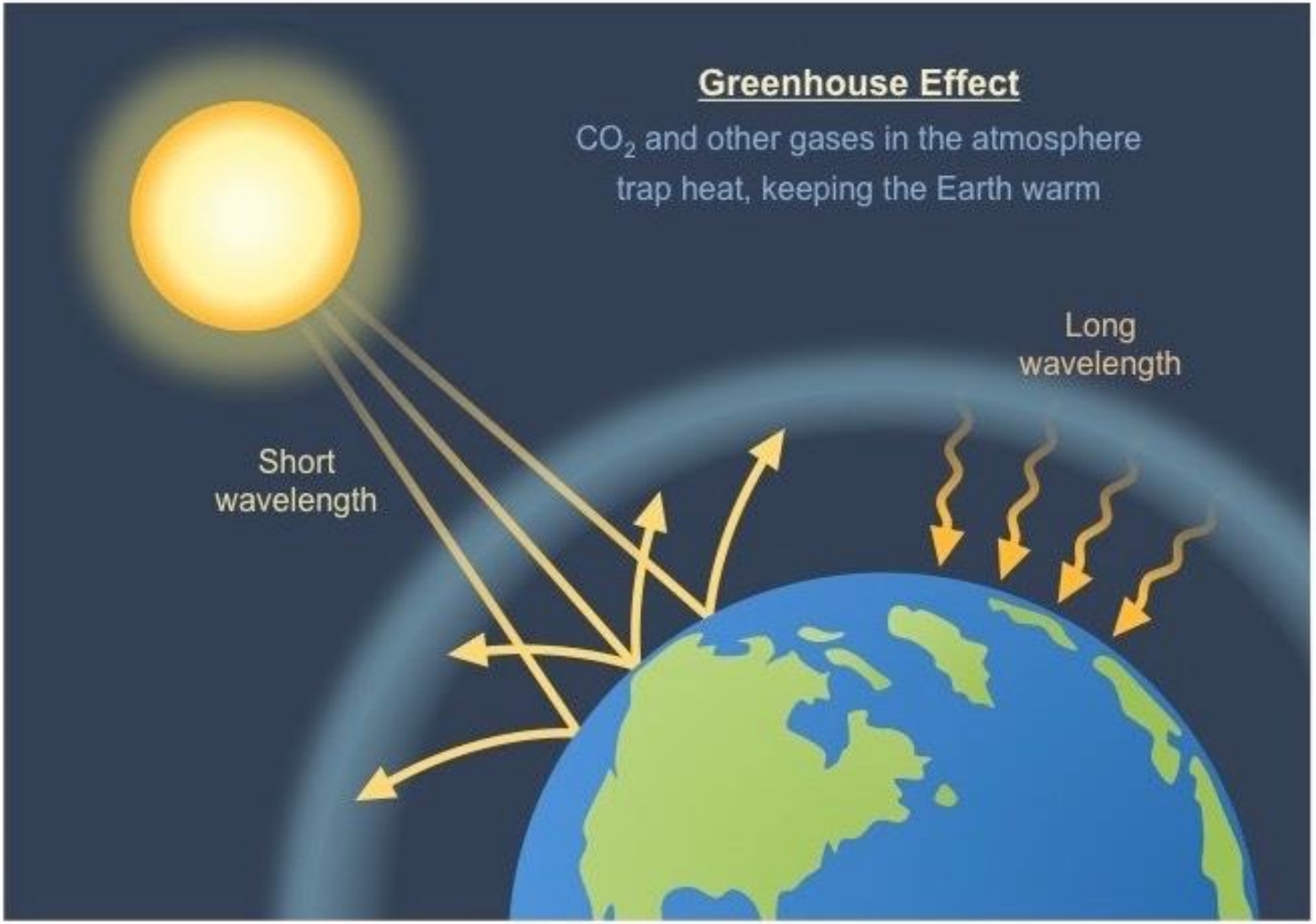


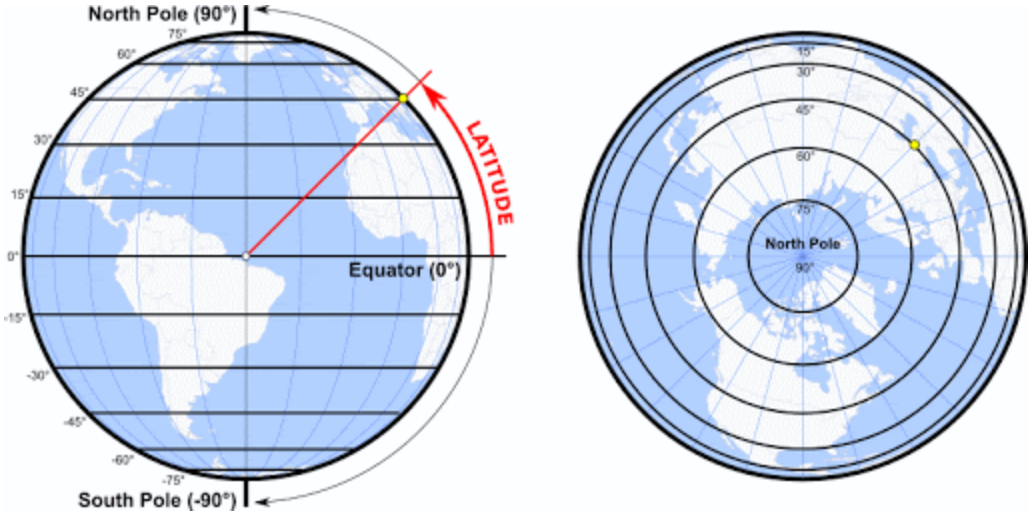
Greenhouse Effect

Process in which gases trap sunlight energy in Earth's atmosphere as heat.

Heat trapped-temps to rise

Heat escapes-temps cool


Greenhouse Effect
CO_2 and other gases in the atmosphere trap heat, keeping the Earth warm
Long wavelength
Short wavelength

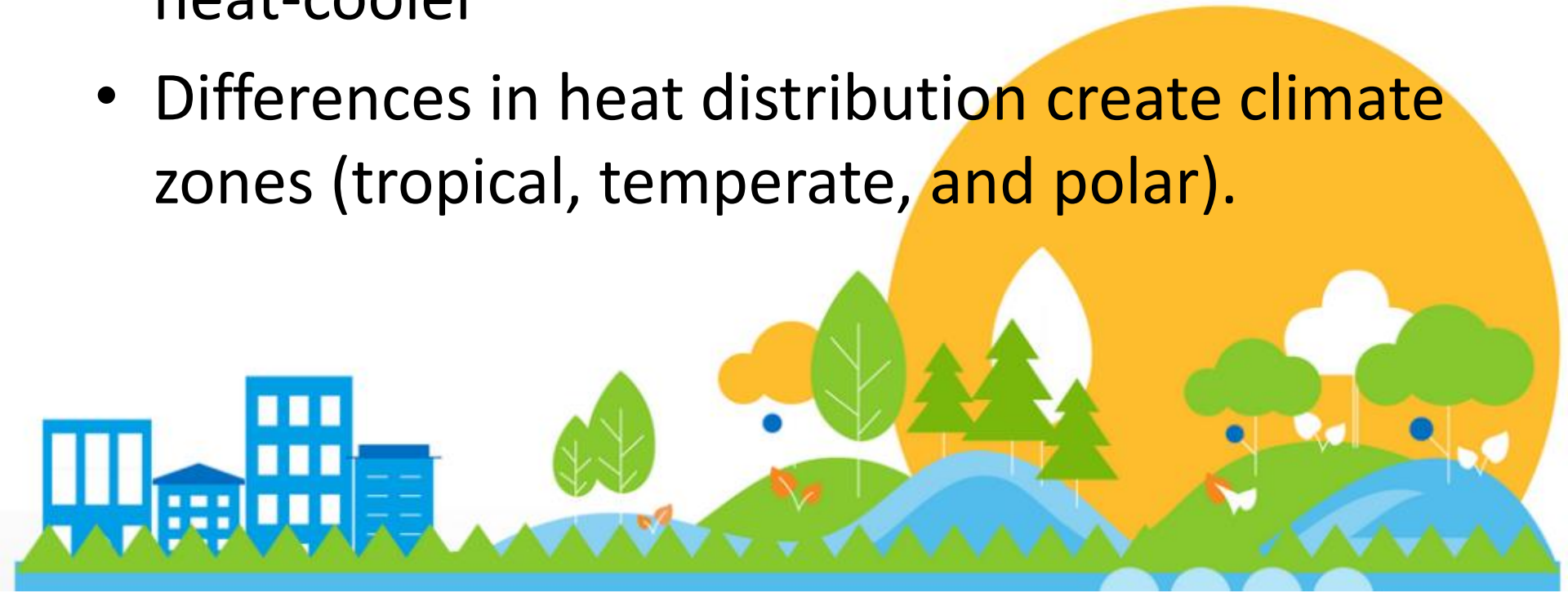


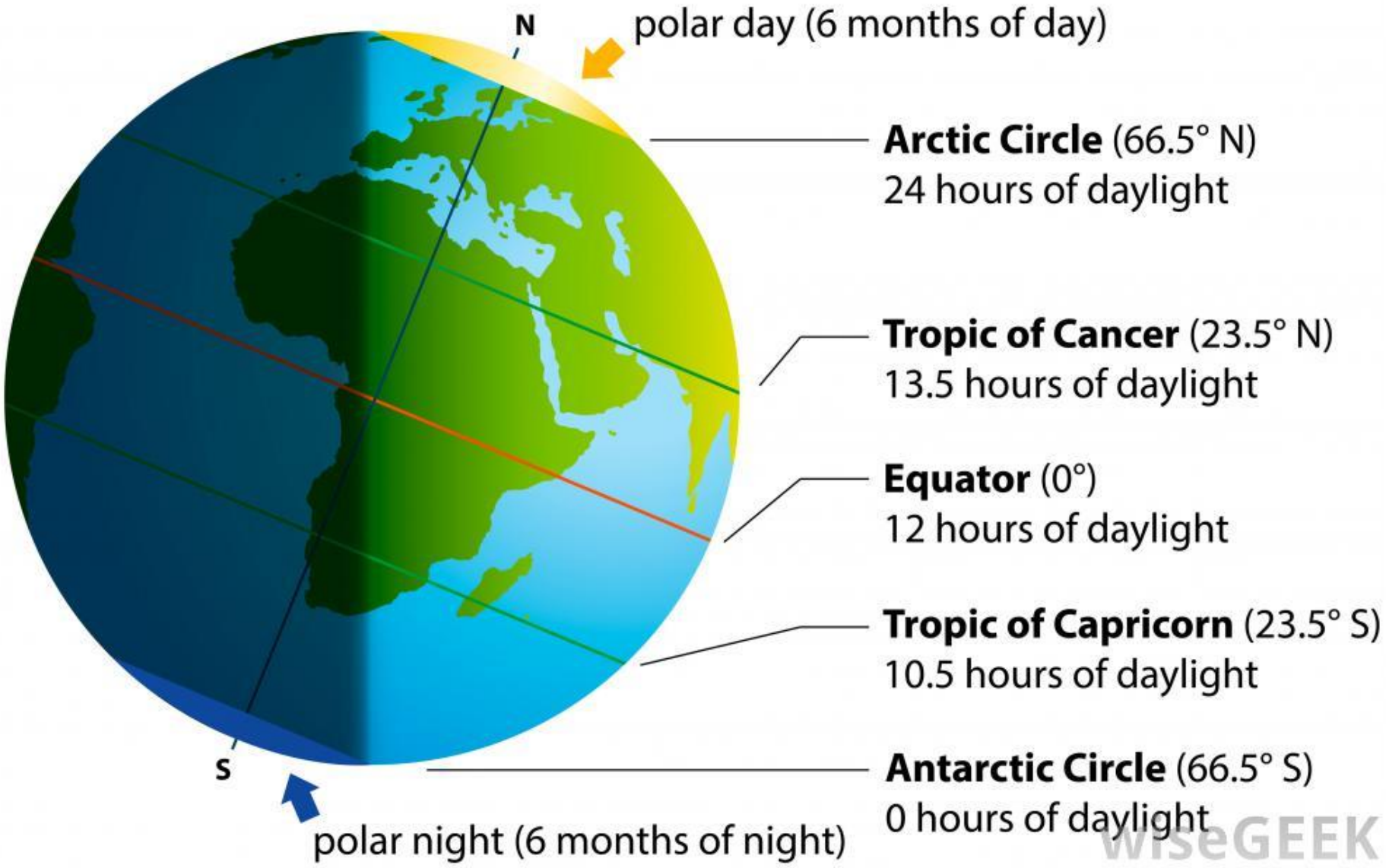
Latitude

A measure of relative position north or south on the Earth's surface, measured in degrees from the equator, which has a latitude of 0°, with the poles having a latitude of 90° north and south.

Solar Energy

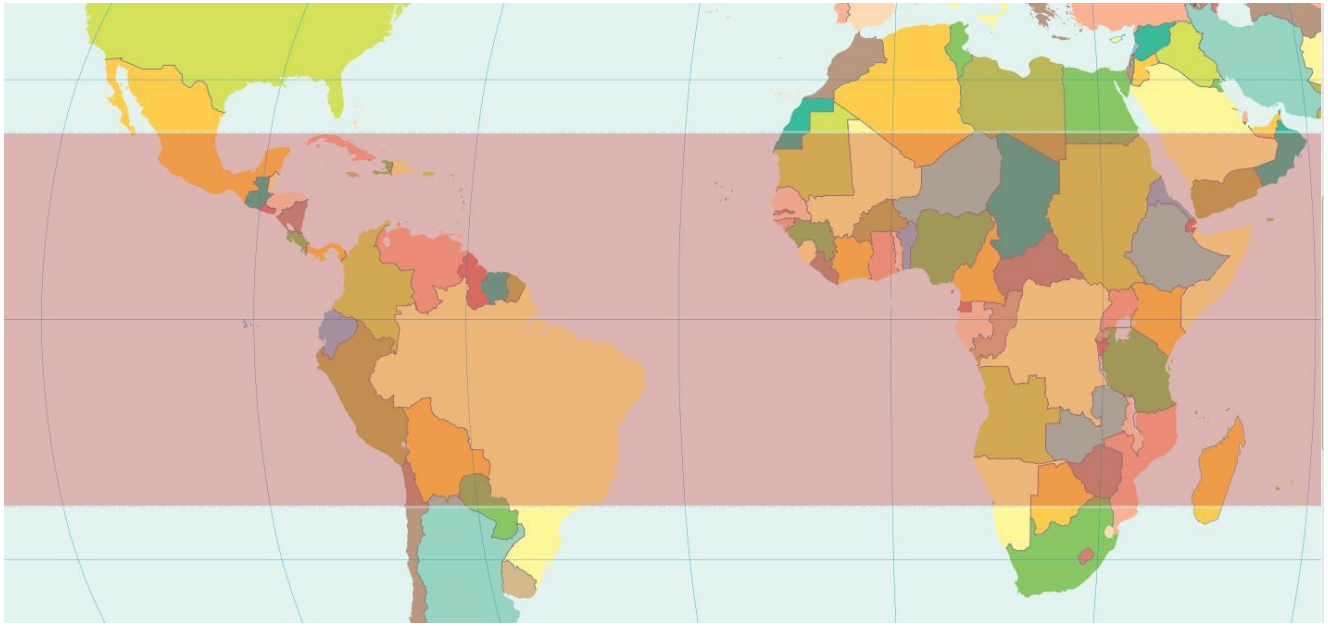
- Equator-Sun almost directly overhead at noon all year long-generally warm
- Poles-Receive less intense solar energy, less heat-cooler
- Differences in heat distribution create climate zones (tropical, temperate, and polar).




N
polar day (6 months of day)
Arctic Circle (66.5° N)
24 hours of daylight
Tropic of Cancer (23.5° N)
13.5 hours of daylight
Equator (0°)
12 hours of daylight
Tropic of Capricorn (23.5° S)
10.5 hours of daylight
Antarctic Circle (66.5° S)
0 hours of daylight
S
polar night (6 months of night)
WiseGEEK

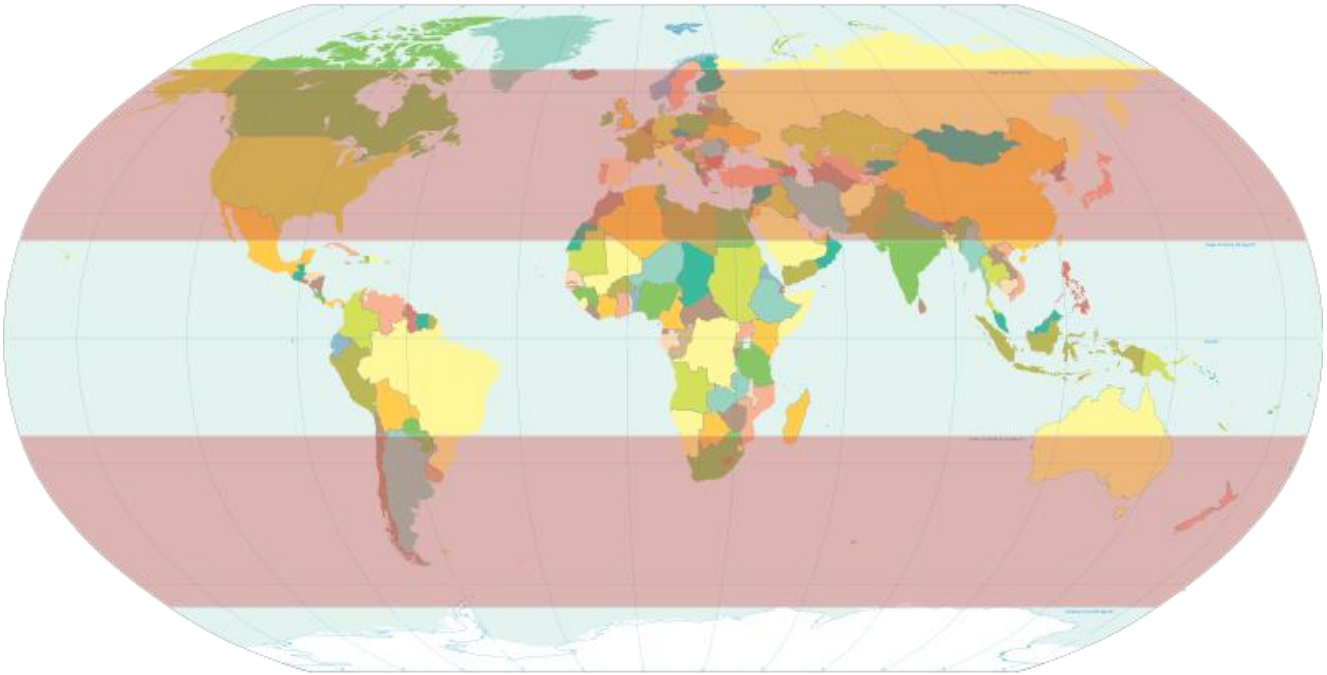
Tropic Zone

- Equator
- B/w 23.5° North and 23.5 ° South Latitudes
- Direct sunlight all year



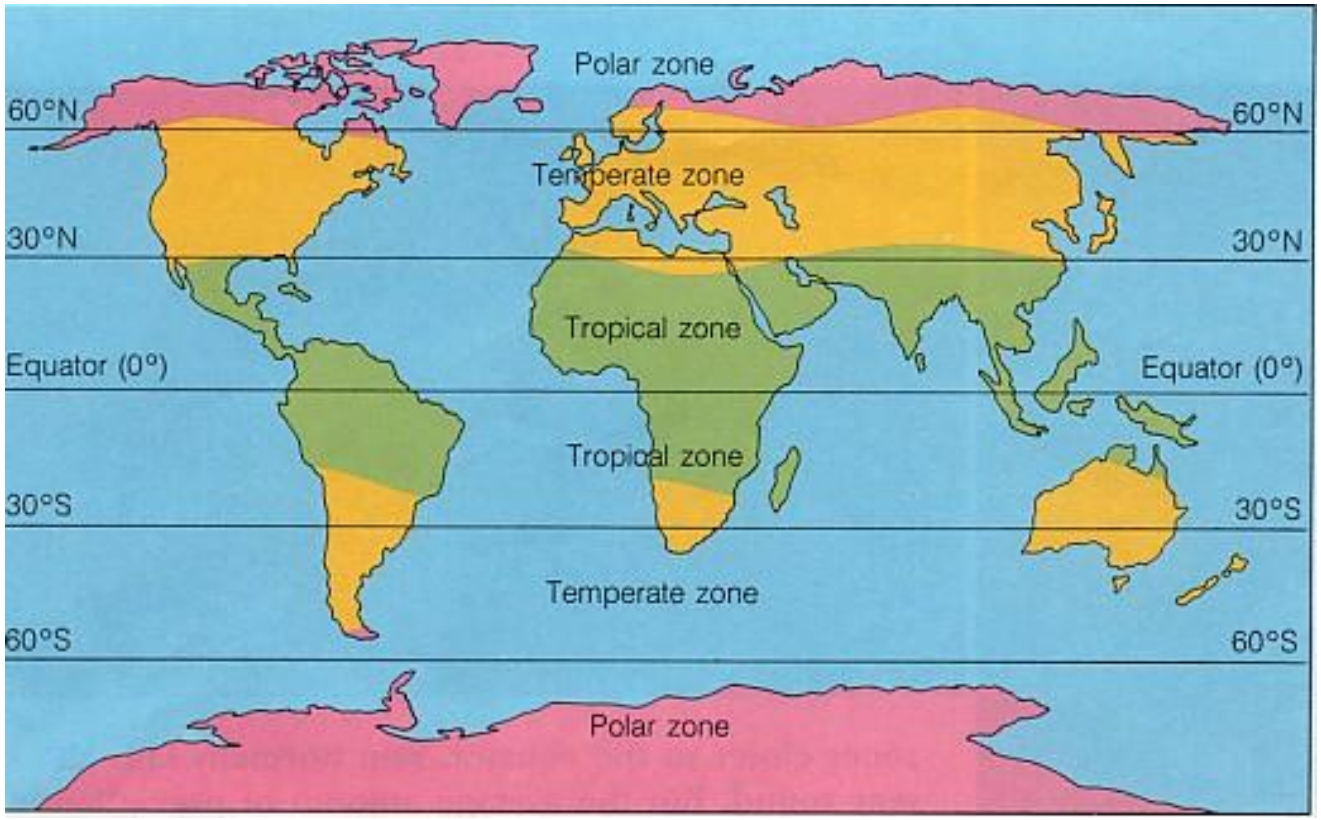
Temperate Zone

- B/w 23.5°and 66.5 ° North and South Latitudes



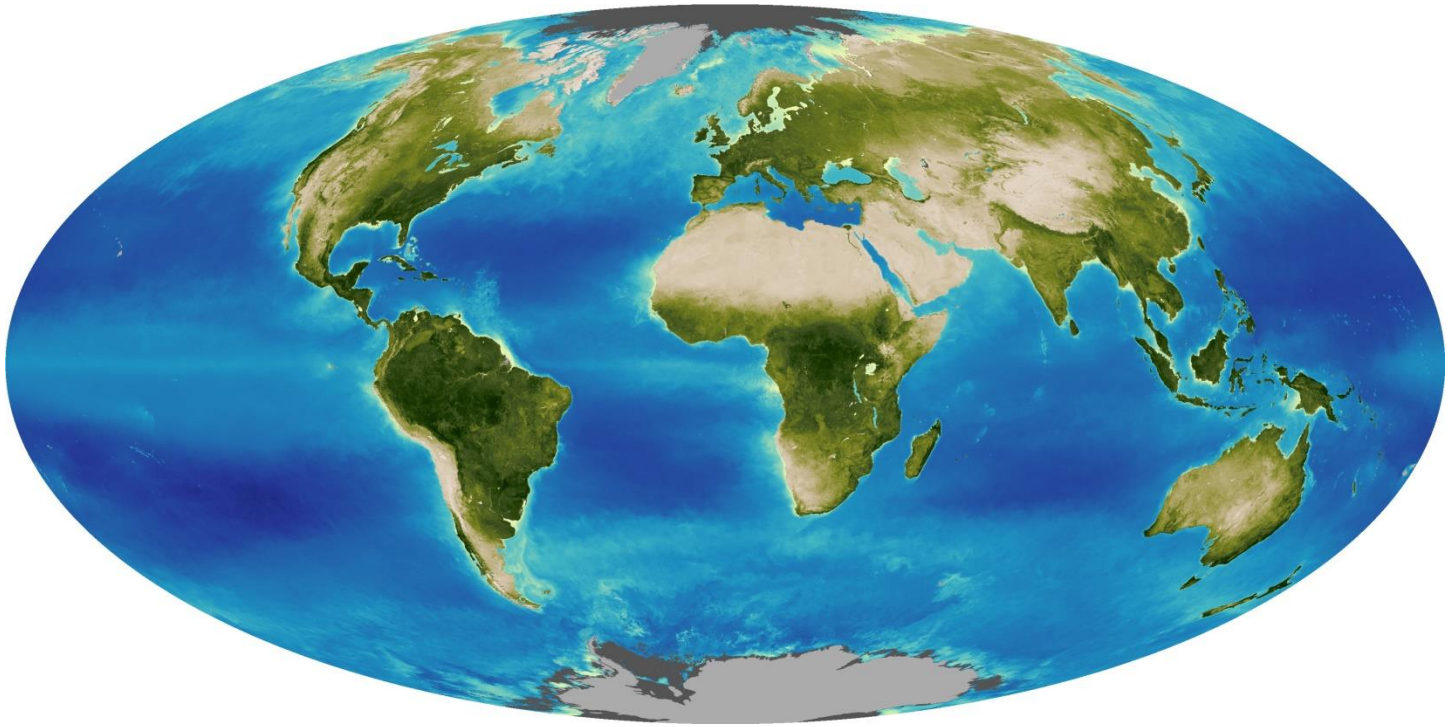
Polar Zone

- B/w 66.5°and 90 ° North and South Latitudes



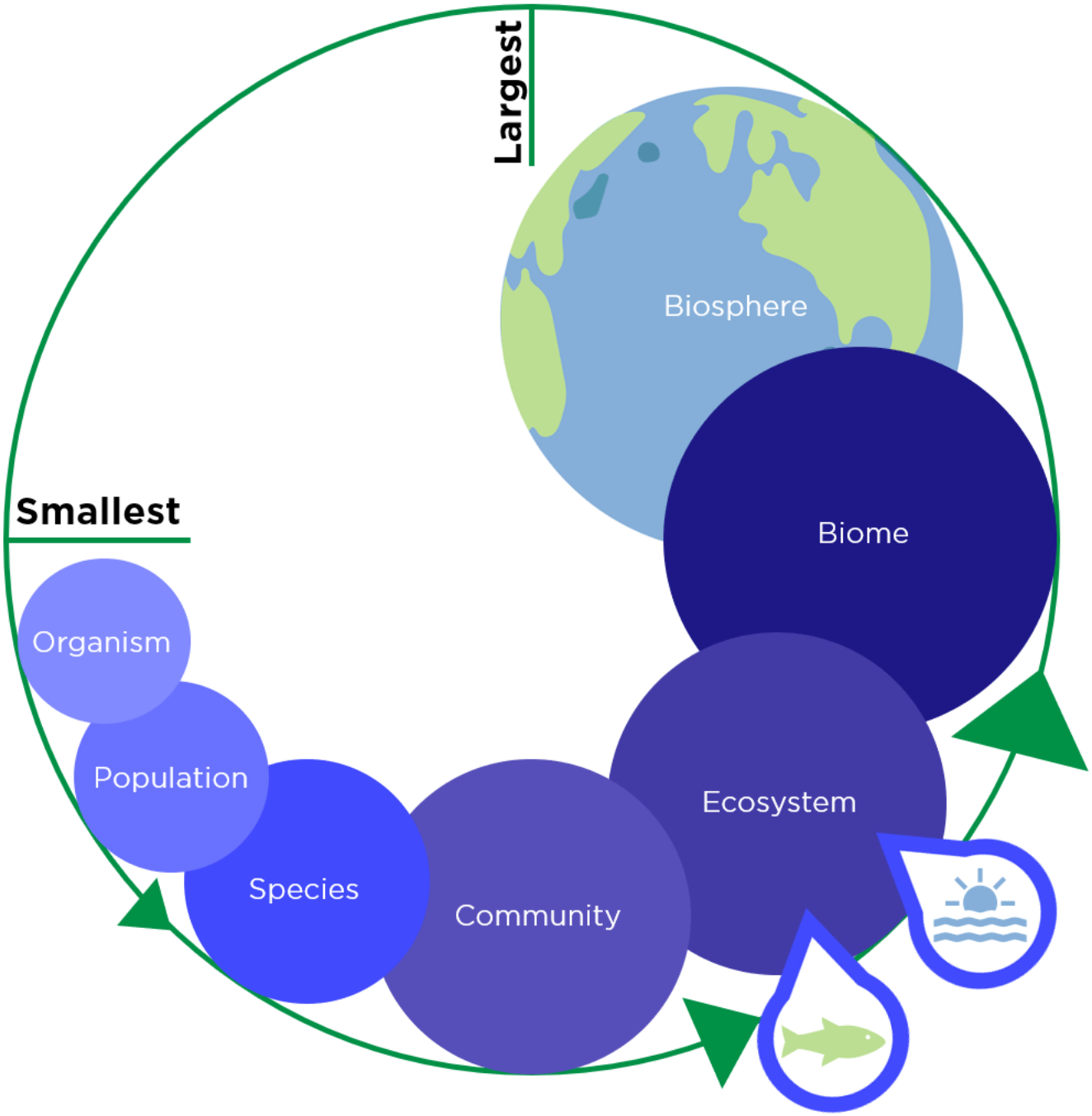
Climates

- Varied amounts of solar energy at different times of year because of Earth's axis is tilted
- As earth revolves around sun, solar radiation strikes different regions at angles that vary from summer to winter.
- Winter-sun lower in sky; shorter days and solar energy less.



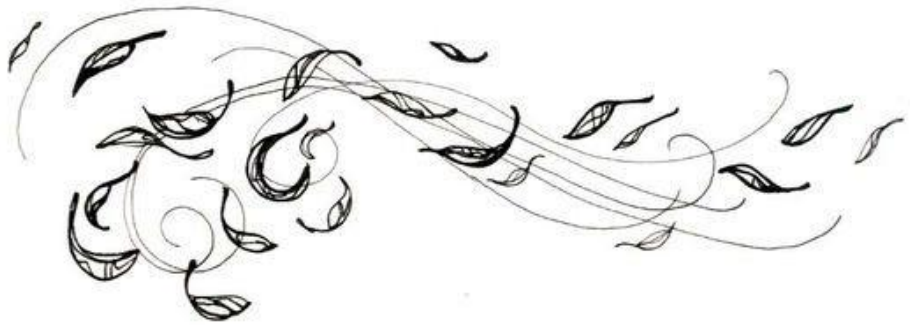
Heat transport in the biosphere

Unequal distribution of heat across globe create winds and ocean currents; transport heat and moisture


Largest
Biosphere
Biome
Smallest
Organism
Population
Species
Community
Ecosystem

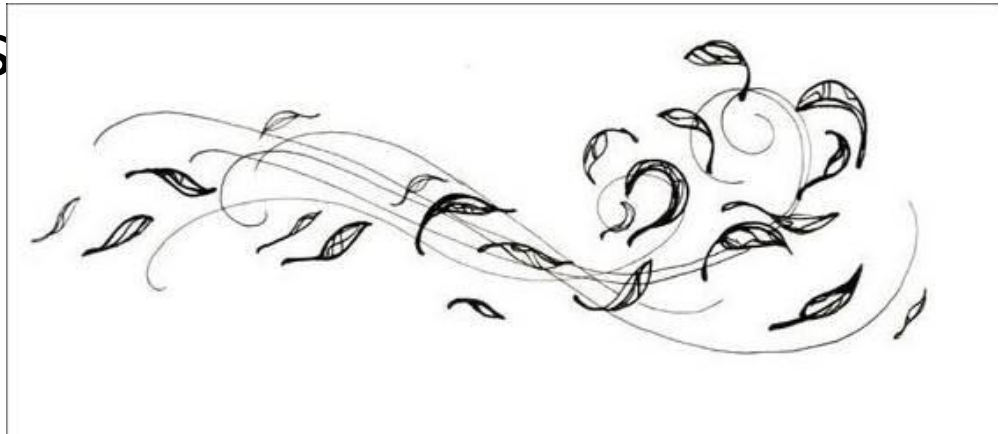
Creation of winds

- Warm air less dense and rises
- Cool air more dense and sinks
- Air heated by warm area of Earth's Surface (equator) rises.
- Warm air rises-spreads north and south, losing heat along way. Cool air sinks



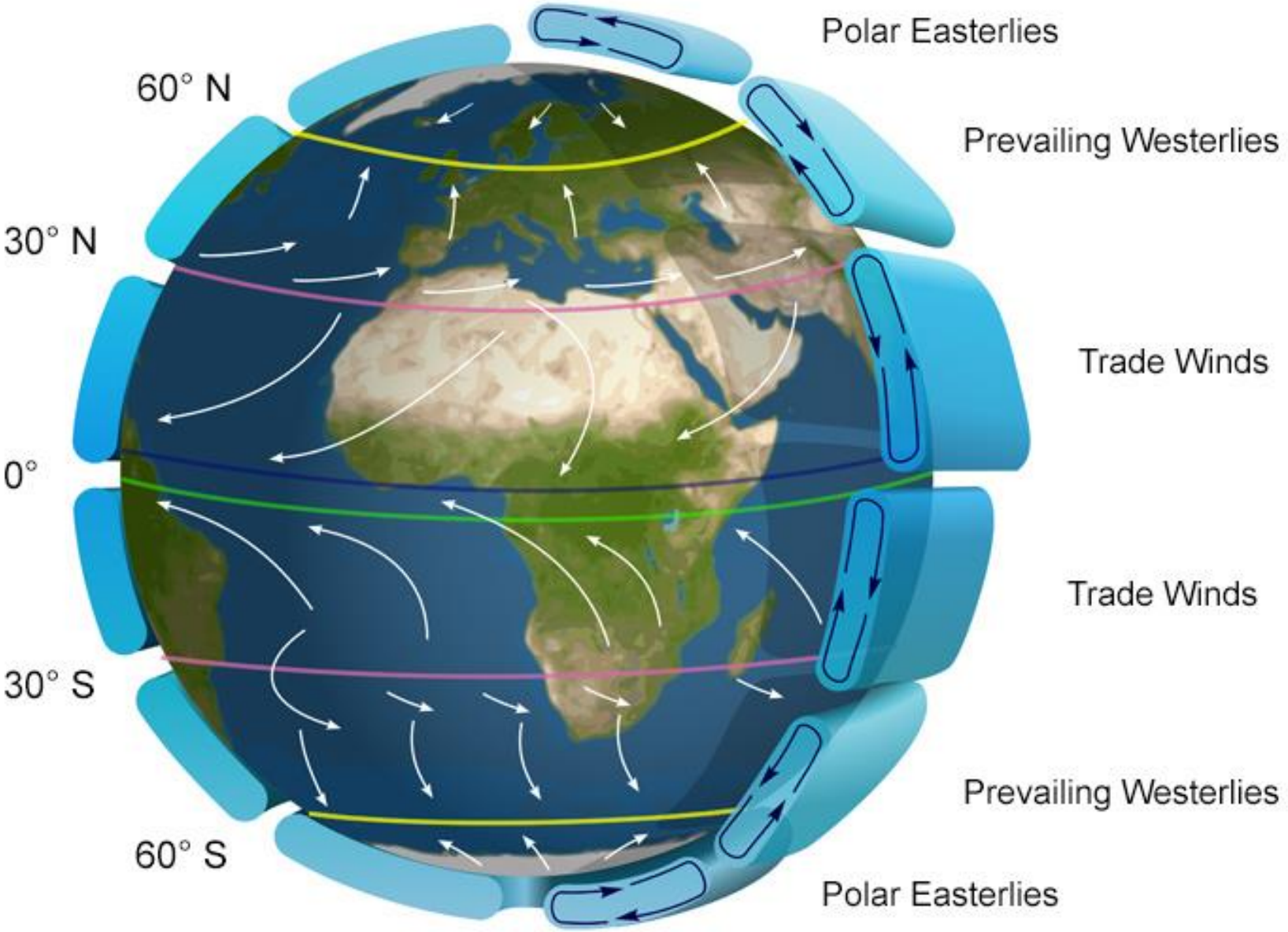
Creation of Winds

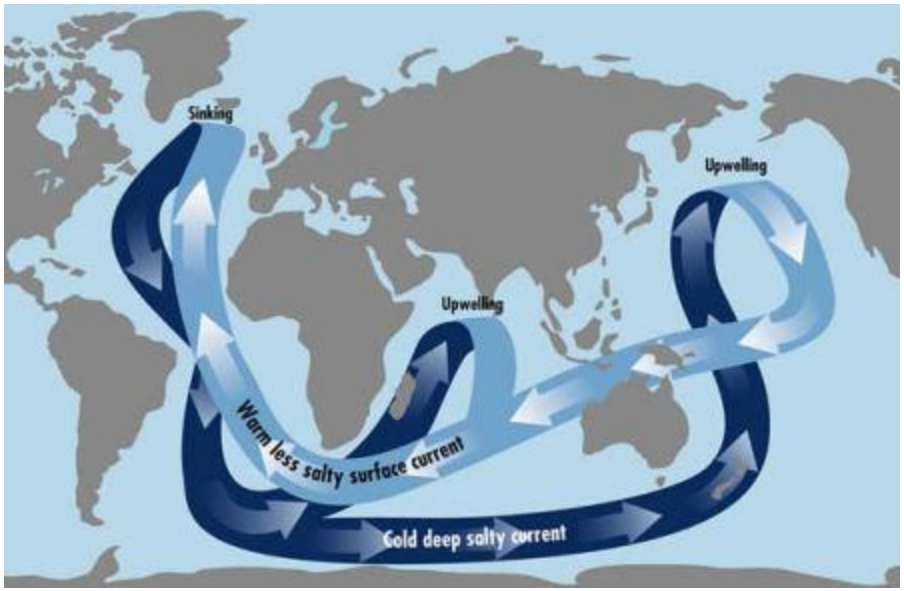
- (Same time) Cooler regions (poles)-chilled air sinks towards earth surface; pushing air at surface outward
- Air warms as travels over surface; as warms it rises.
- Upward and downward movement of air creates



Winds

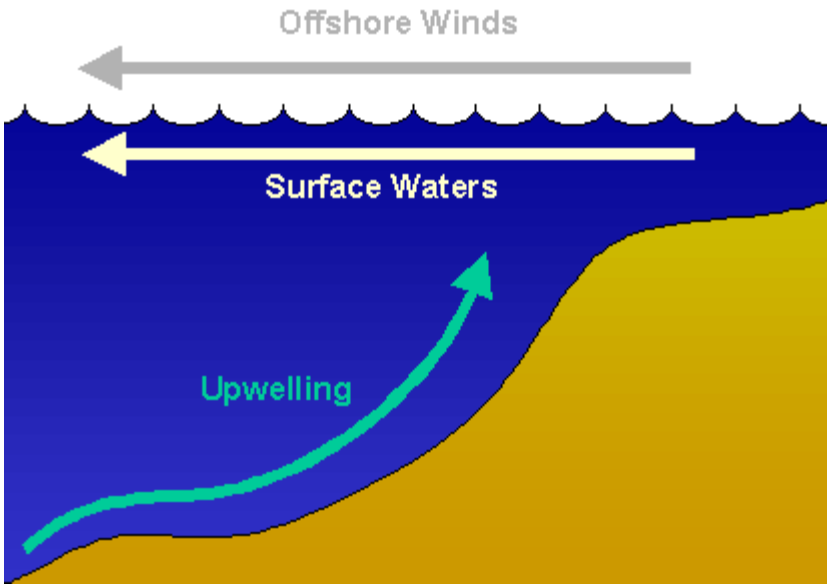
- Winds transport heat
- Warm air rises
- Cool air sinks
- Earth's rotation causes winds to blow generally from
  - west to east-temperate zones
  - East to west over tropics and the poles


Polar Easterlies
60° N
Prevailing Westerlies
30° N
Trade Winds
0°
Trade Winds
30° S
Prevailing Westerlies
60° S
Polar Easterlies



Heating and Cooling in Oceans

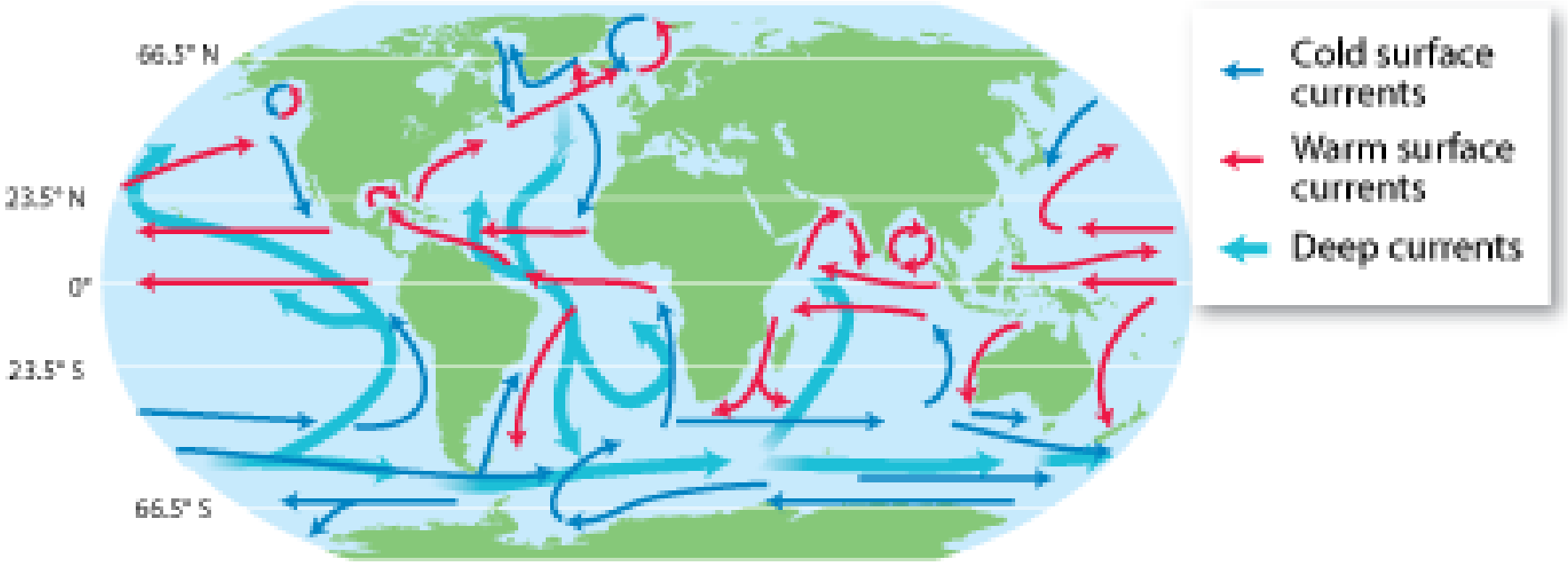
- Surface water pushed by winds.
- Currents carry lots of heat
- Warm surface currents add moisture and heat to air; Cool surface currents cool air- affecting climate and weather of nearby land.



Currents

Deep ocean currents caused by cold water near the poles sink and flowing along ocean floor.

Water rises in warmer regions through a process called upwelling.



Niches and Community Interactions

Species Success

- Each species has a range of conditions under which it can grow and reproduce.
- Conditions define where and how an organism lives.

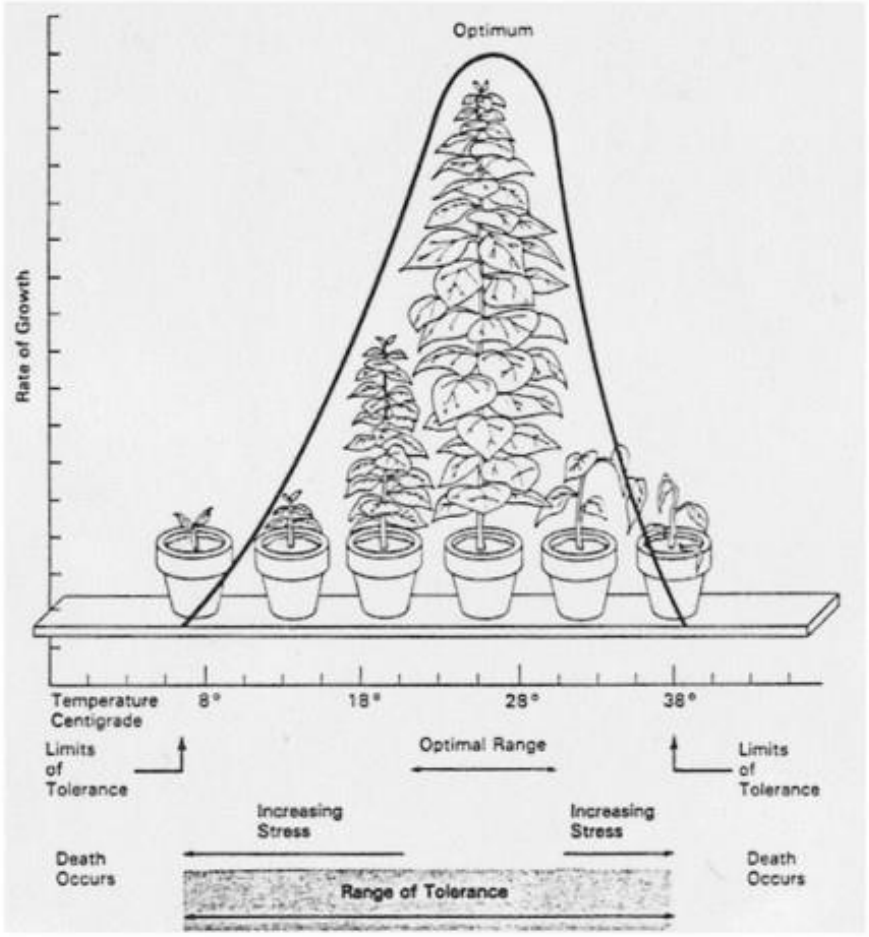
Tolerance

Species ability to survive and reproduce under a range of environmental circumstances.

(RANGE)

Tolerance Graphs

Shows the response of an organism to different values of a single environmental variable



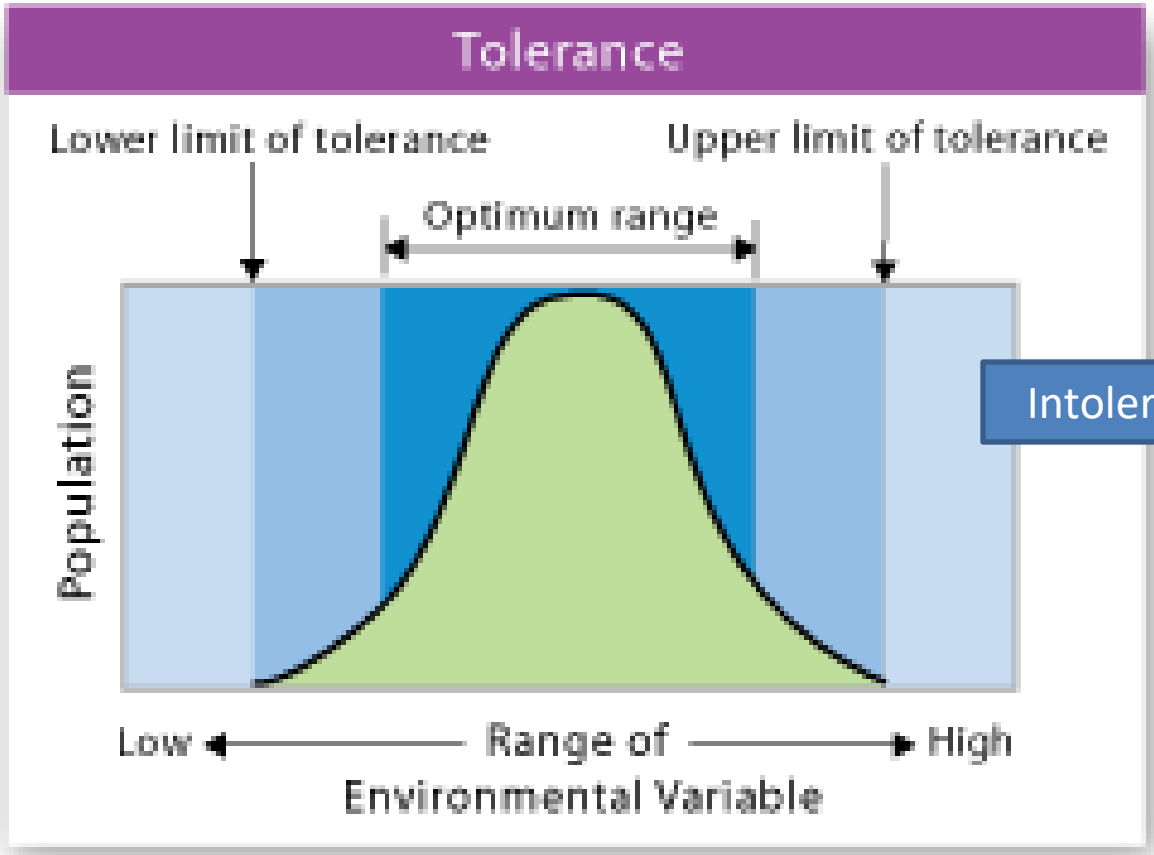
Tolerance Graphs

Zone of Tolerance

- Optimal Range (center) organisms most likely to be most abundant
- Physiological stress zone (edges of curve) organisms stressed and numbers decline
  - Expend more energy to maintain homeostasis
  - Less energy available for growth and reproduction

Zone of Intolerance

- Outside tolerance zone; No organisms



Intolerance Zone

Habitat

- General place where an organism lives.
- Determined by species tolerance for specific environmental conditions

Niche (organisms occupation)

The range of physical and biological conditions in which a species lives and the ways the species obtains what it needs to survive and reproduce.

Aspect = parts

Two aspects of an organism's niche

Physical

Biological

Niches

- Resources – Necessity of life such as food, water, light, nutrients or space.
  - Plants- sunlight, water and soil nutrients
  - Animals- nesting, space, shelter, food, places to feed
- Physical Aspects – Abiotic factors it requires for survival. E.g amphibians lose and absorb water through skin::must live in moist places.
- Biological – Biotic factors required for survival. E.g. when/how reproduces, food it eats, way obtains food.

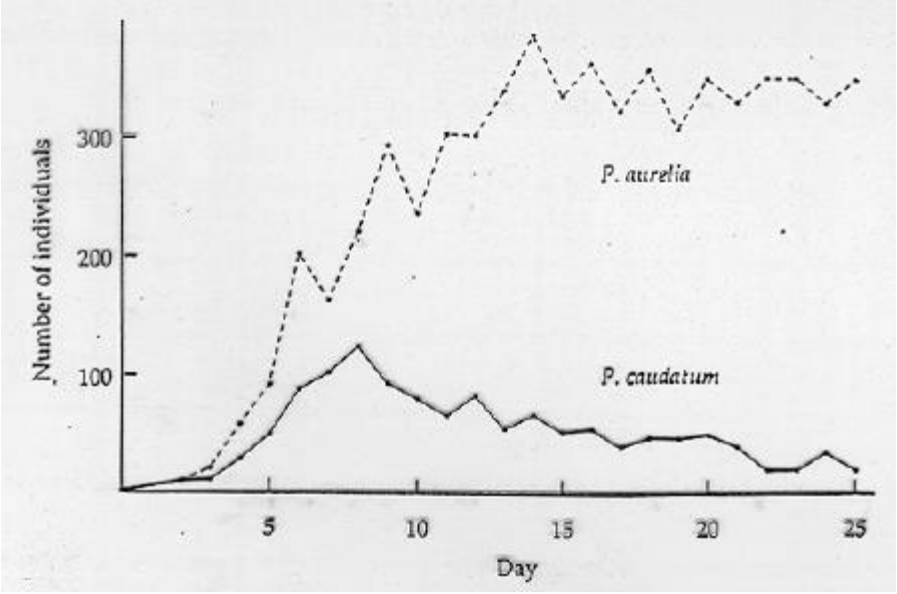
Competition

- Community-more than one kind of organism attempting to use various essential resources.
- Same resources at same time and place = competition
- Intraspecific competition-same species competing
- Interspecific competition- competing b/w different species.

What do you think these two males are fighting over?

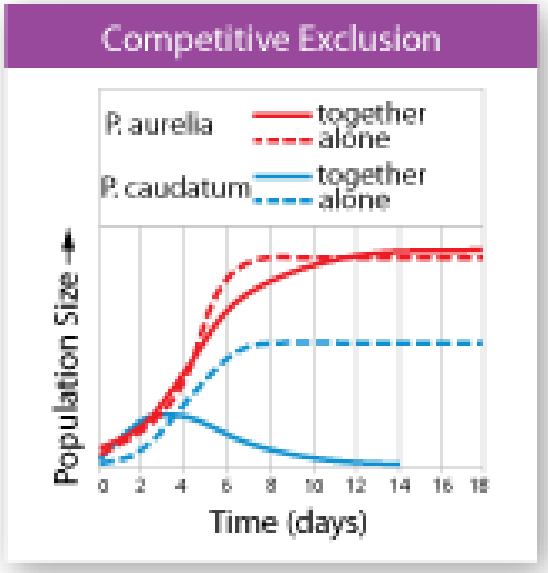
Direct Competition

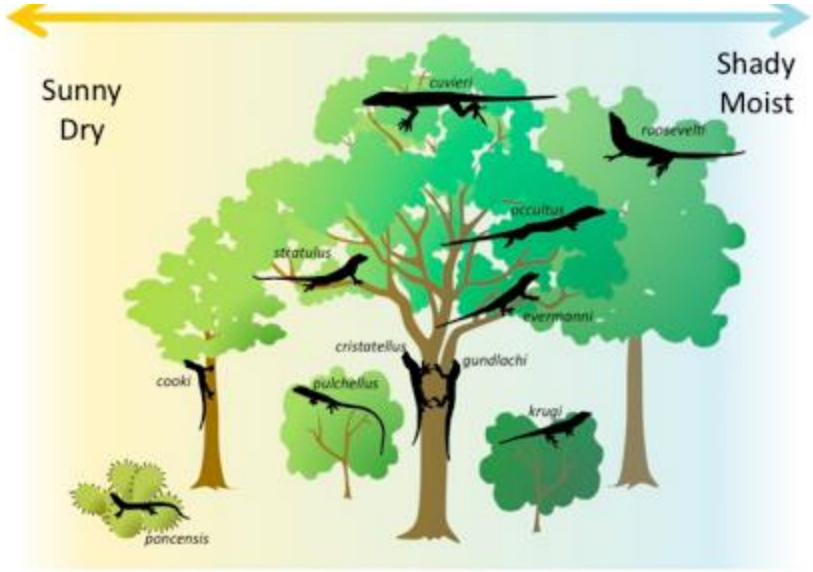
- Competition = almost always a winner and loser (losing species dies out)



Competitive Exclusion Principle

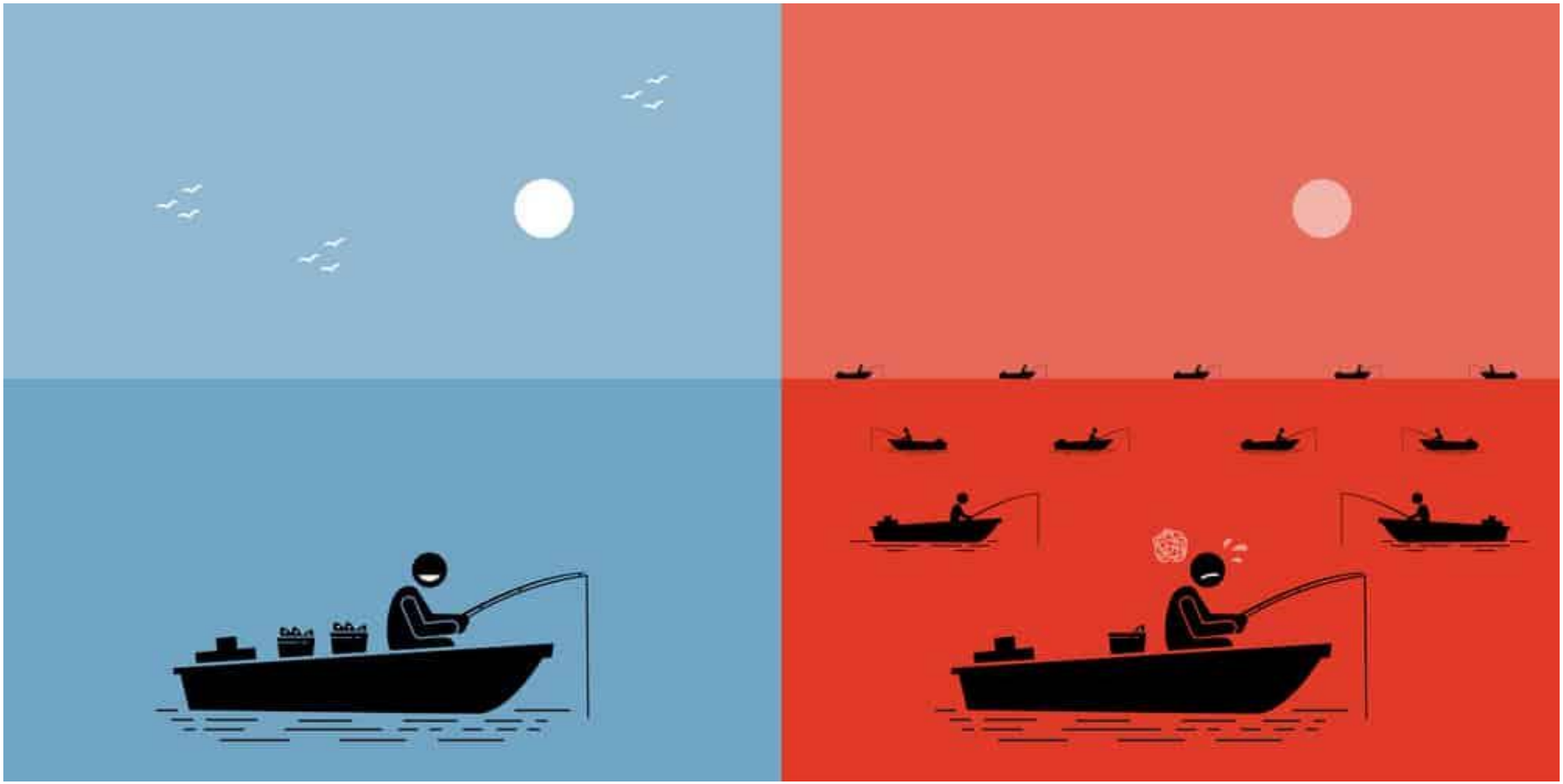
States no two species can occupy exactly the same niche in exactly the same habitat at exactly the same time.





Species with same niche

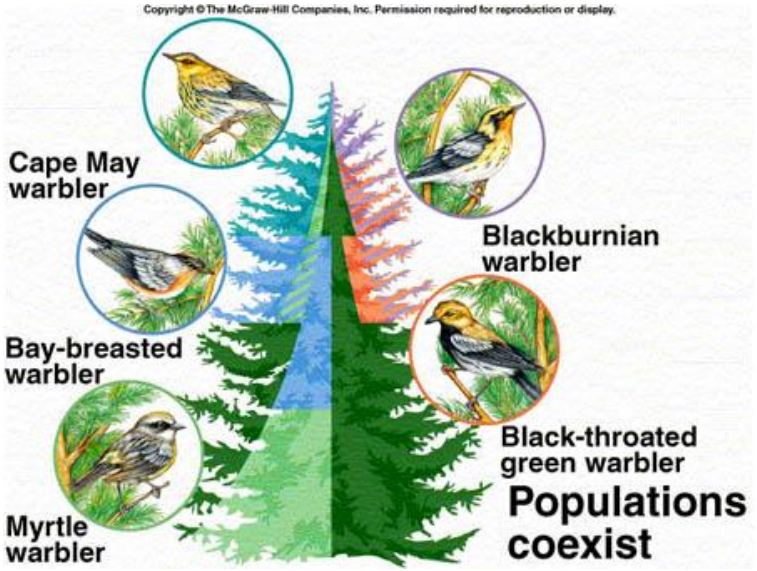
One species will be better at competing for limited resources and will eventually exclude other species.

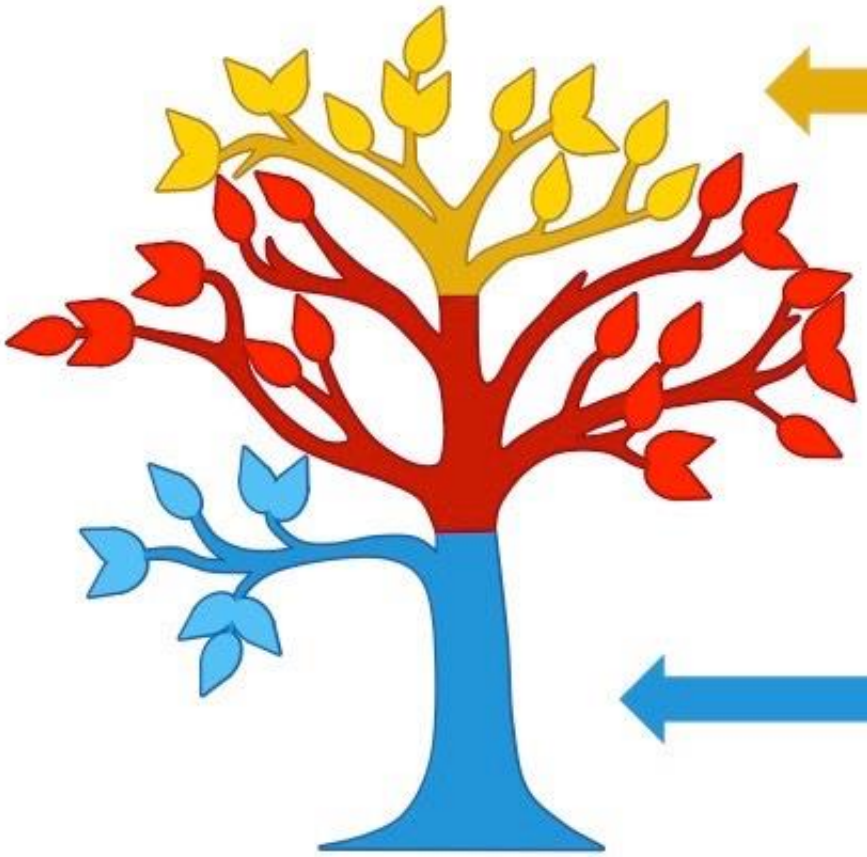


Competing for limited resources

Dividing Resources

- Instead of competing resources divided
- By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies.





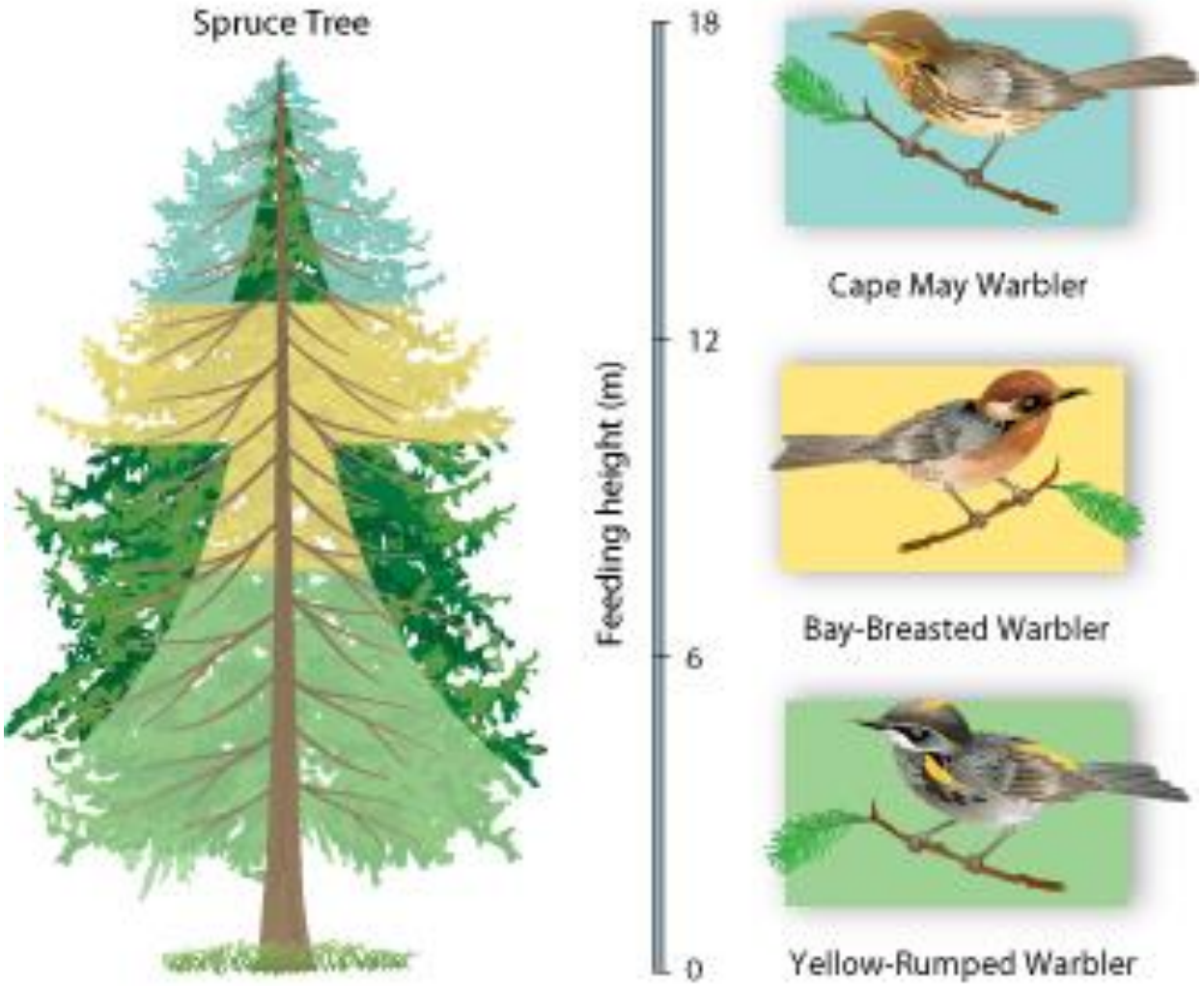
Yellow bird inhabits upper tree regions

Red bird inhabits middle boughs of tree

Blue bird inhabits trunk and lower branches

Fundamental Niche = Whole Tree

Realised Niche = Specific Elevations



What would happen if two of the warlber species tried to occupy the same niche in the same tree at the same time?

Predation, Herbivory, and Keystone Species

Predation

An interaction in which one animal (the predator) captures and feeds on another animal (the prey)

- Predators can affect prey population in a community
- Can determine the places prey can live and feed.
  - E.g. birds can play important role in regulating mouse population sizes

Herbivore-Plant Relationship

An interaction in which one animal (herbivore) feeds on producers (plants) is called HERBIVORY

Herbivores

- Affect size and distribution of plant populations in a community
- Determine the places that certain plants can survive and grow
- E.g- Very dense populations of white-tailed deer are eliminating their favorite food plants across US.

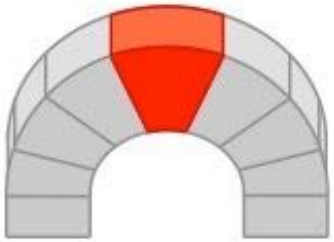
Keystone Species

A change in a single species that can cause a dramatic change in the structure of a community

Keystone Species

- E.g.- Sea otters devour large amounts of sea urchins; Urchins are herbivores that eat kelp (giant algae that grows undersea “forests”.
- Sea otters almost eliminated by hunting; urchins population increased; devoured kelp.
- Other organisms also disappeared.
- Sea otters went on endangered species, populations recovered

Removal of the keystone sea otter : sea urchins overgraze kelp and destroy the kelp forest community.

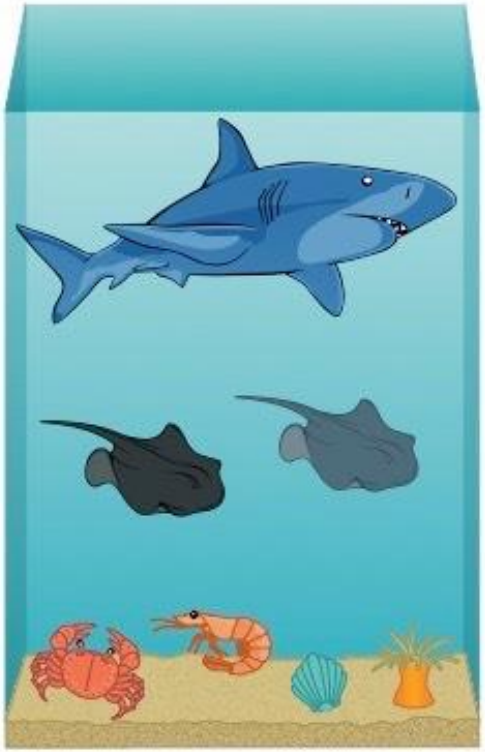


Sharks are apex predators and feed on cownose rays

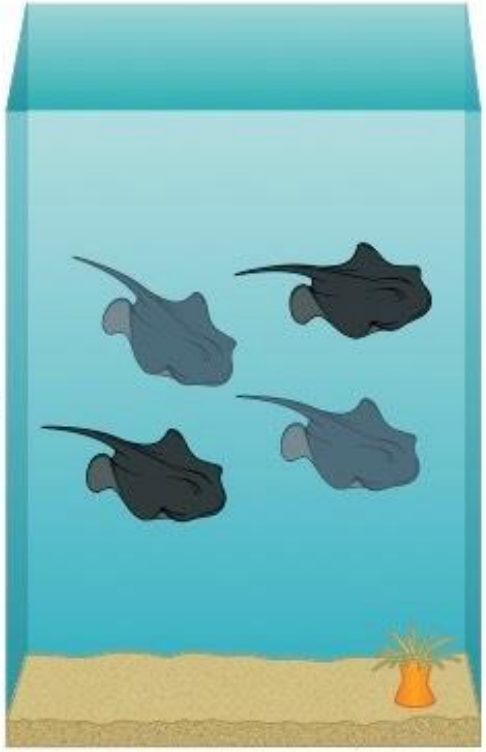
Cownose rays feed on bivalves and arthropods

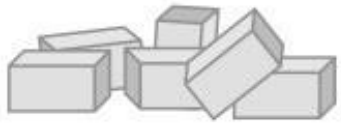
Bivalve and arthropod populations are stable

KEYSTONE (SHARK)



NO KEYSTONE



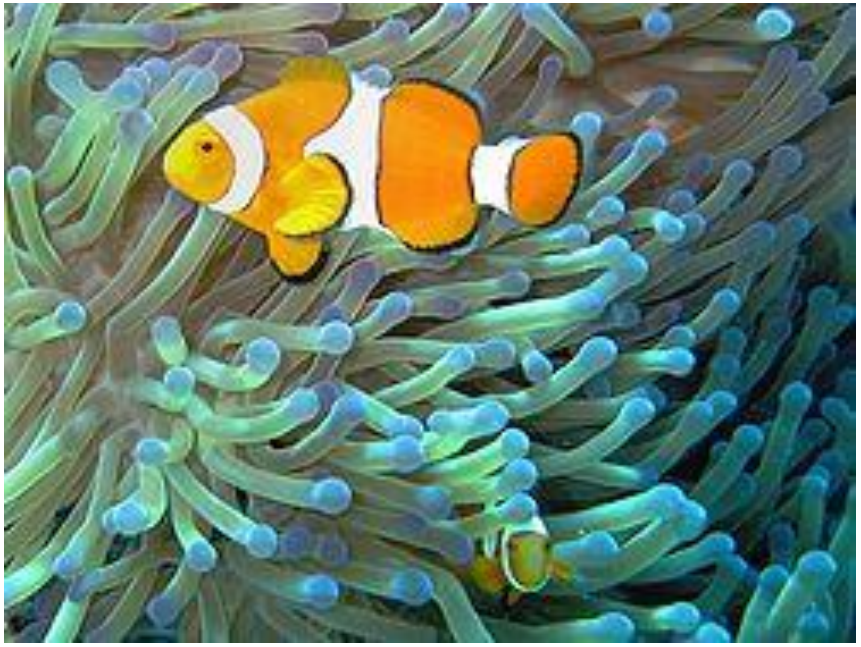


Overfishing decimates the shark population

Cownose rays increase in numbers (overpopulate)

Bivalve and arthropod populations collapse

(this will then impact the cownose ray population)



Symbioses

Any relationship in which two species live closely together

(Three main classes: mutualism, parasitism, and commensalism)

Mutualism

- Relationship in which both species benefit
- E.g. – Sea anemone (sting functions-capture prey and protect anemone from predation) and clownfish (immune to stings)

Sea anemone-offers shelter; clownfish darts out and chases other fish away (protects for preditors)

Parasitism

A relationship in which one organism lives inside or on another organisms and harms it.

Parasites

- E.g. Tapeworms live in the intestines of mammals; absorb large amounts of hosts food
- E.g. Fleas, ticks and lice live on mammals feeding on blood and skin.
- Parasites obtains all or part of its nutritional needs
- Parasites weaken but generally do not kill hosts.

Commensalism

Relationship in which one organism benefits and another organism is neither harmed or helped

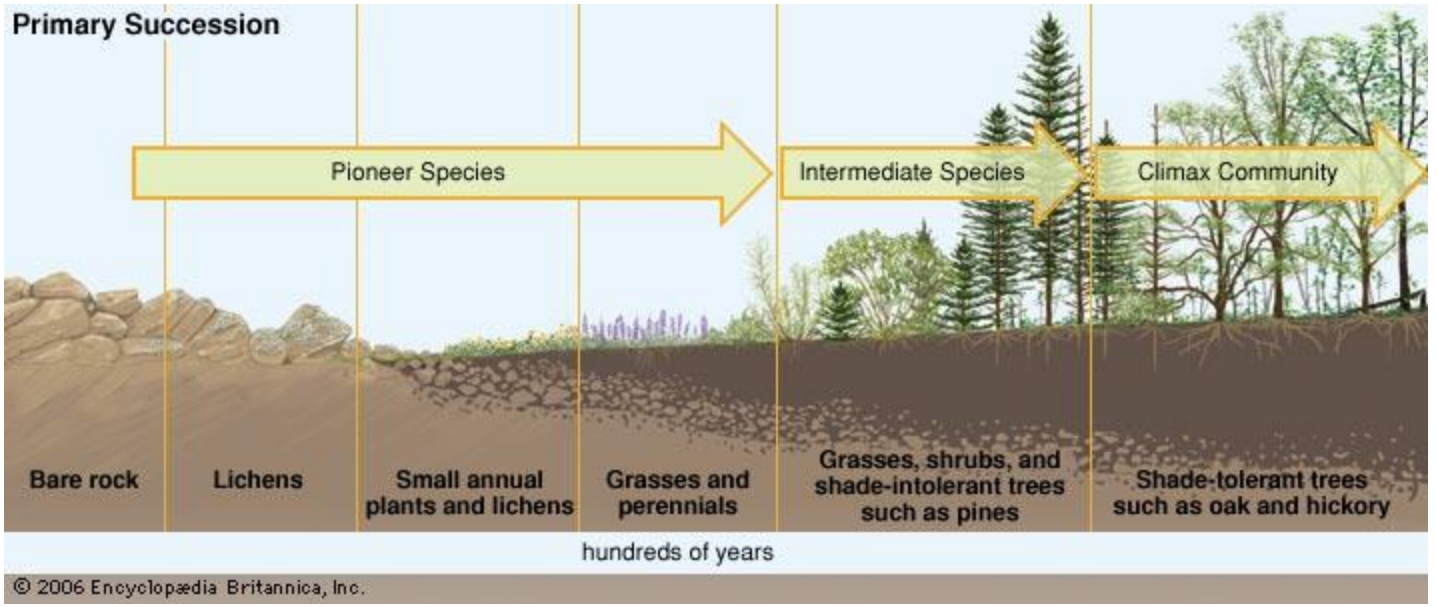
Commensalism

- E.g. Grey whale and barnacles-
  - Grey whale not harmed and no benefits
  - Barnacles- benefit from flow of water from moving whale that provides food

Sloth and lichen, what type of relationship?

Succession

Succedere (latin) “to come after”



Ecological Succession

Ecosystems change over time, especially after disturbances, as some species die out and new species move in.

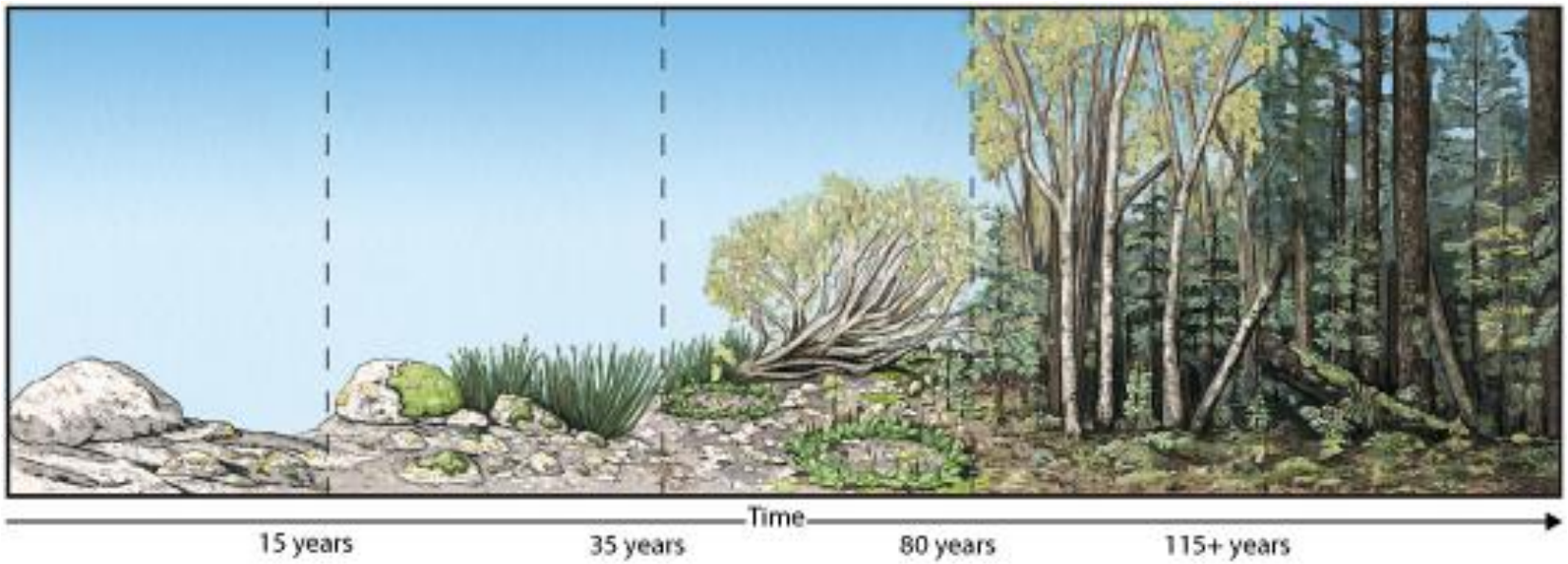
Primary Succession

Succession that occurs in an area in which no trace of a previous community is present.

(newly exposed surfaces)

Primary Succession

- Must create soil
- Occurs over a long period of time



Pioneer Species

1st species to colonize barren areas- named after rugged human pioneers who first settled the wilderness.

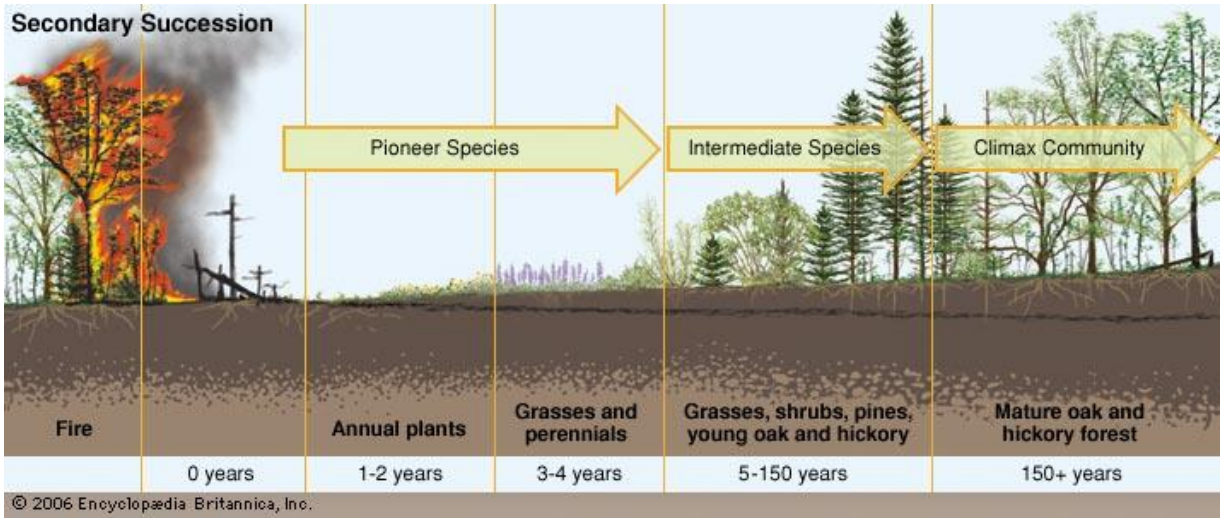
Eg. Lichen (on rock)

Lichen

- Lichen (mutualistic-algae and fungus) converts nitrogen from atmosphere to into useful nitrogen for other organisms
- Break down rock
- Add organic material to form soil

Secondary Succession

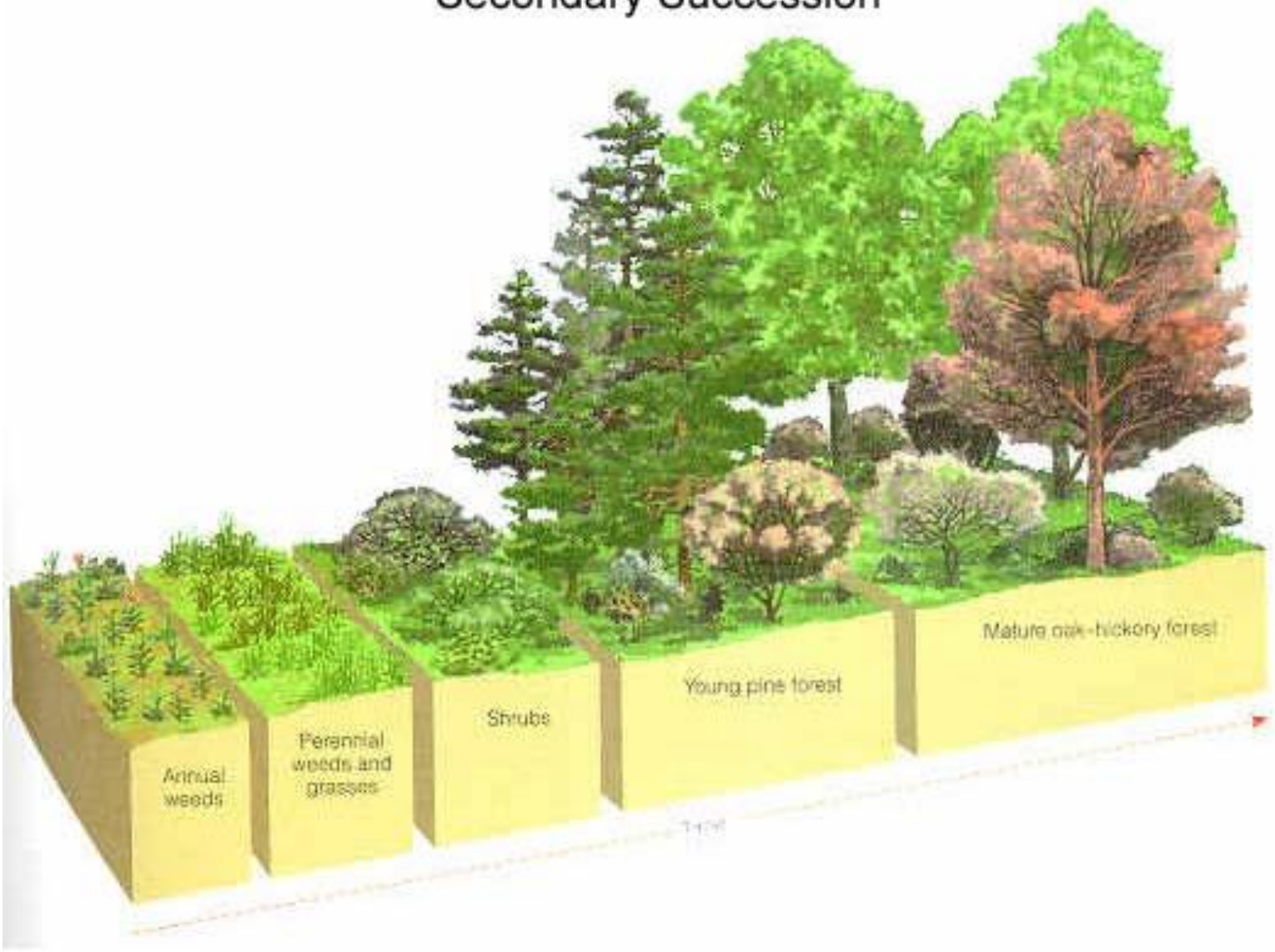
Type of succession that occurs in a n area that was only partially destroyed by disturbances.



Secondary Succession

- Soil already established :: more rapid growth
- E.g of causes-wildfire, hurricane, or other natural disturbance.
- Note-Fires are necessary for some species survival; certain trees need them for seeds to germinate.
- Could have different pioneer species

Secondary Succession



http://project.bio.iastate.edu/Courses/biol123/lectures/Lecture10-Succession/slide03.htm

Why Succession Occurs?

- Every organism changes the environment it lives in.
- As one species alters its environment; other species find it easier to find resources and survive.
    - Lichen-add organic matter, form soil- other plants can colonize and grow; more species move in and further change environment; Over time, more and more species find niches and survive.

Climax Communities

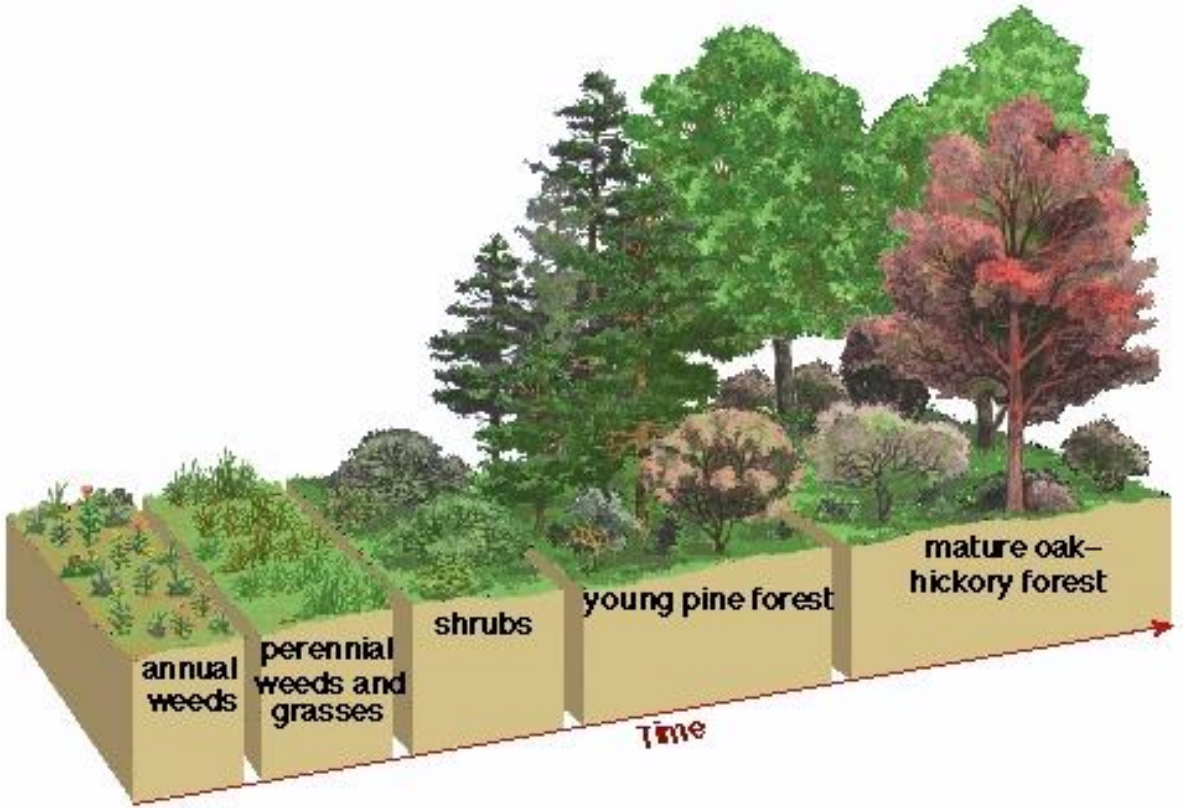
Traditional Definition/view point

An ecological community in which populations of plants or animals remain stable and exist in balance with each other and their environment. A climax community is the final stage of succession, remaining relatively unchanged until destroyed by an event such as fire or human interference.

www.dictionary.com

Modern Idea of a Climax Community

- Succession doesn't always follow same path
- Often reproduces original climax community.
- Are not always uniform and stable (disturbed so often)



Human-Caused Disturbances

- E.g - Farming
- Ecosystems may or may not recover from extensive human-caused disturbances
- E.g farming a Tropical rain forests can change microclimate and soil enough to prevent regrowth of original community.

Studying patterns of succession

- compare different cases
- look for similarities and differences
- Eg. Mount Saint Helens and Krakatau (volcanoes)
  - Both places primary succession proceeded through predictable stages
  - Hardy pioneer species helped stabilize loose volcanic debris
  - Confirmed early stages of primary succession are slow and that chance can play a large role in determining which species colonize at different times.

THINK ABOUT IT

- Why does the character of biological communities vary from one place to another?

- Why, for example, do temperate rain forests grow in the Pacific Northwest while areas to the east of the Rocky Mountains are much drier?

- How do similar conditions shape ecosystems elsewhere?