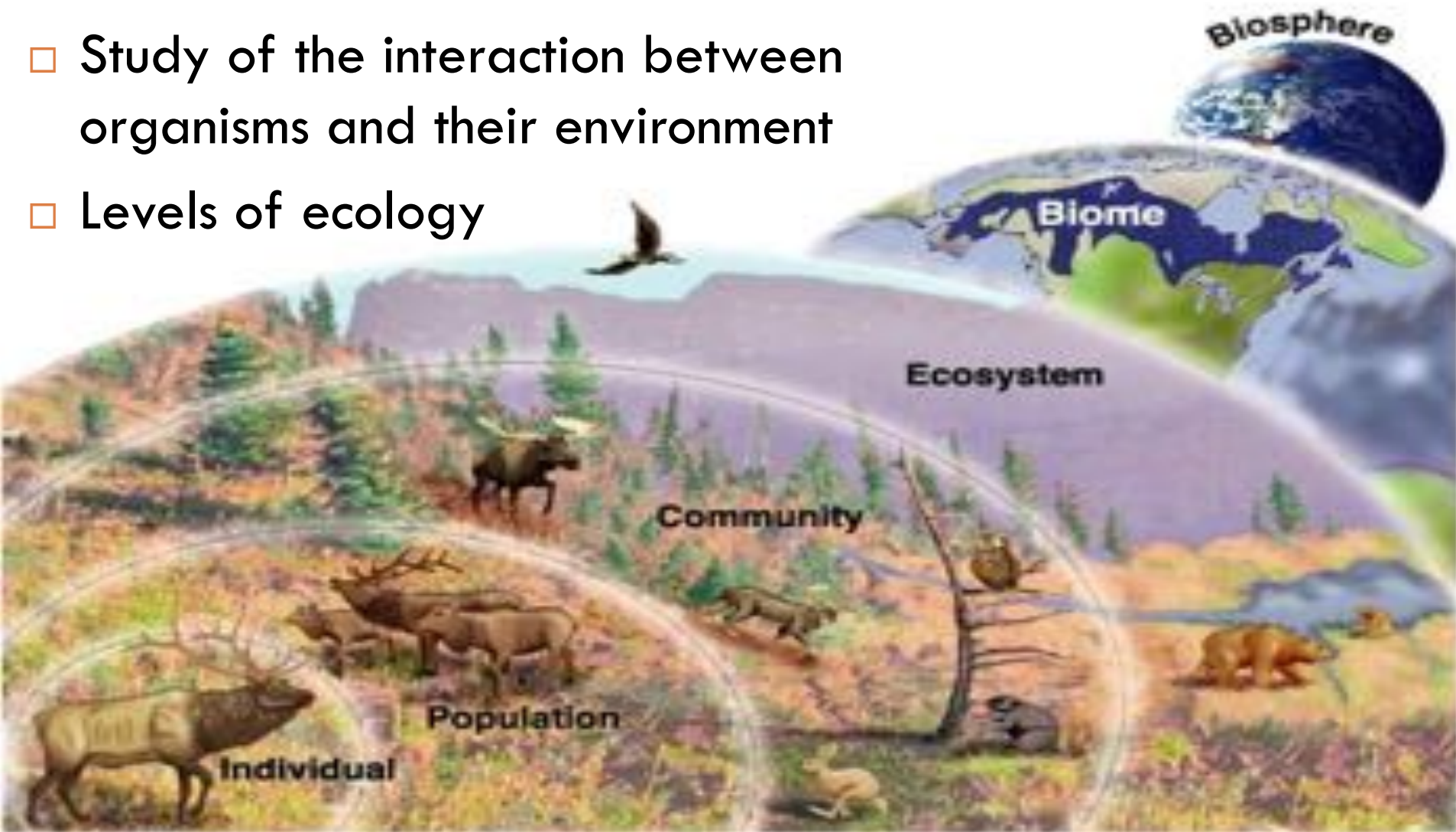


# INTRODUCTION TO ECOLOGY

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# Ecology overview

- Study of the interaction between organisms and their environment
- Levels of ecology



# Fields of ecology

- Organismal ecology
  - ▣ Study of morphological, physiological, and behavioral adaptations of individuals



How do individuals interact with each other and their physical environment?

Salmon migrate from saltwater to freshwater environments to breed

# Fields of ecology

- Population ecology
  - ▣ Study of how numbers of individuals in a population change over time



**How and why does population size change over time?**

Each female salmon produces thousands of eggs. Only a few will survive to adulthood. On average, only two will return to the stream of their birth to breed

# Fields of ecology

- Community ecology
  - ▣ Study interaction among species within an area



**How do species interact, and what are the consequences?**

**Salmon are prey as well as predators**



# Fields of ecology

## □ Ecosystem ecology

- ▣ Study how nutrients and energy move b/n organisms and the abiotic environment



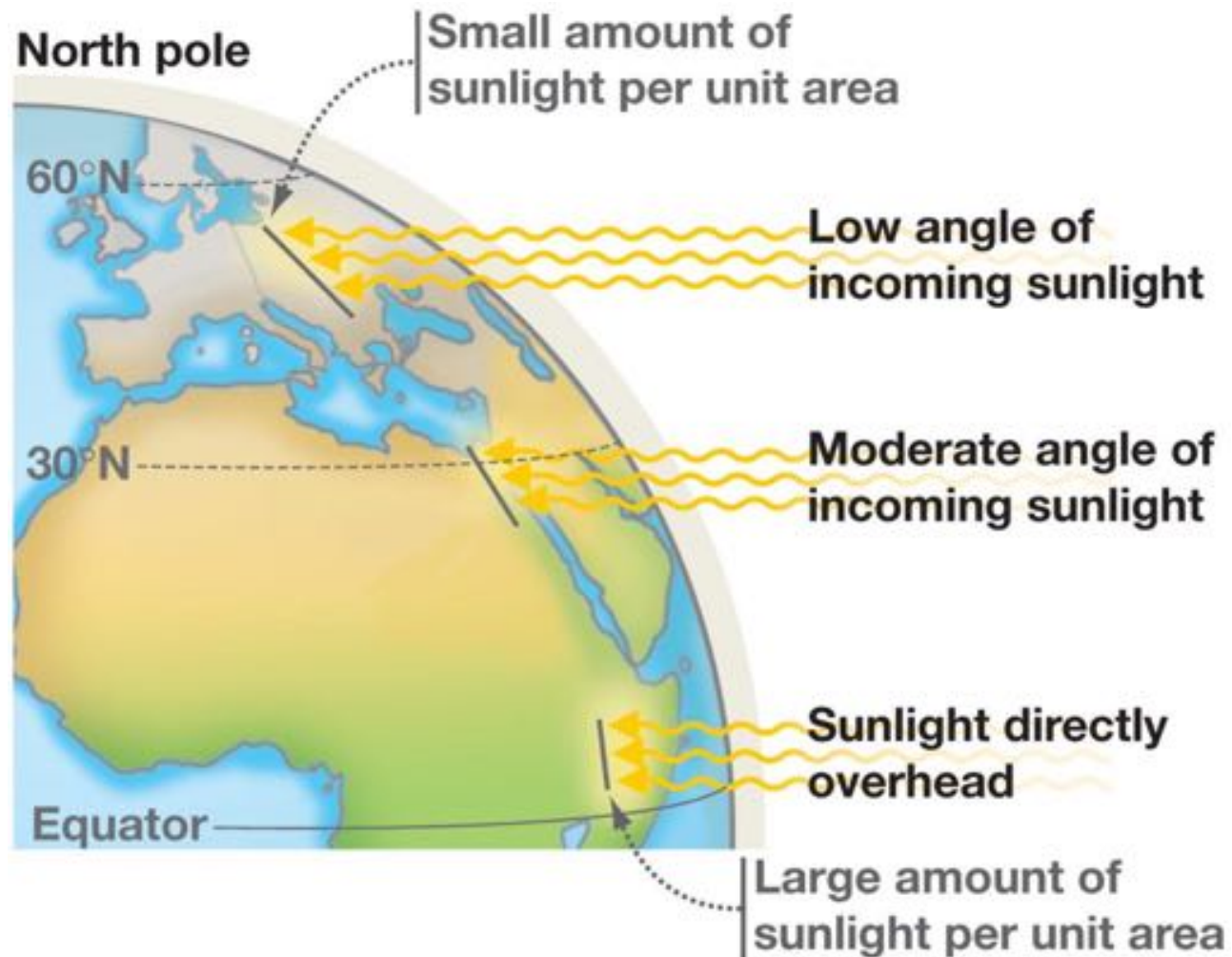
**How do energy and nutrients cycle through the environment?**

Salmon die and then decompose, releasing nutrients that are used by bacteria, archaea, plants, protists, young salmon, and other organisms

# Abiotic and biotic factors

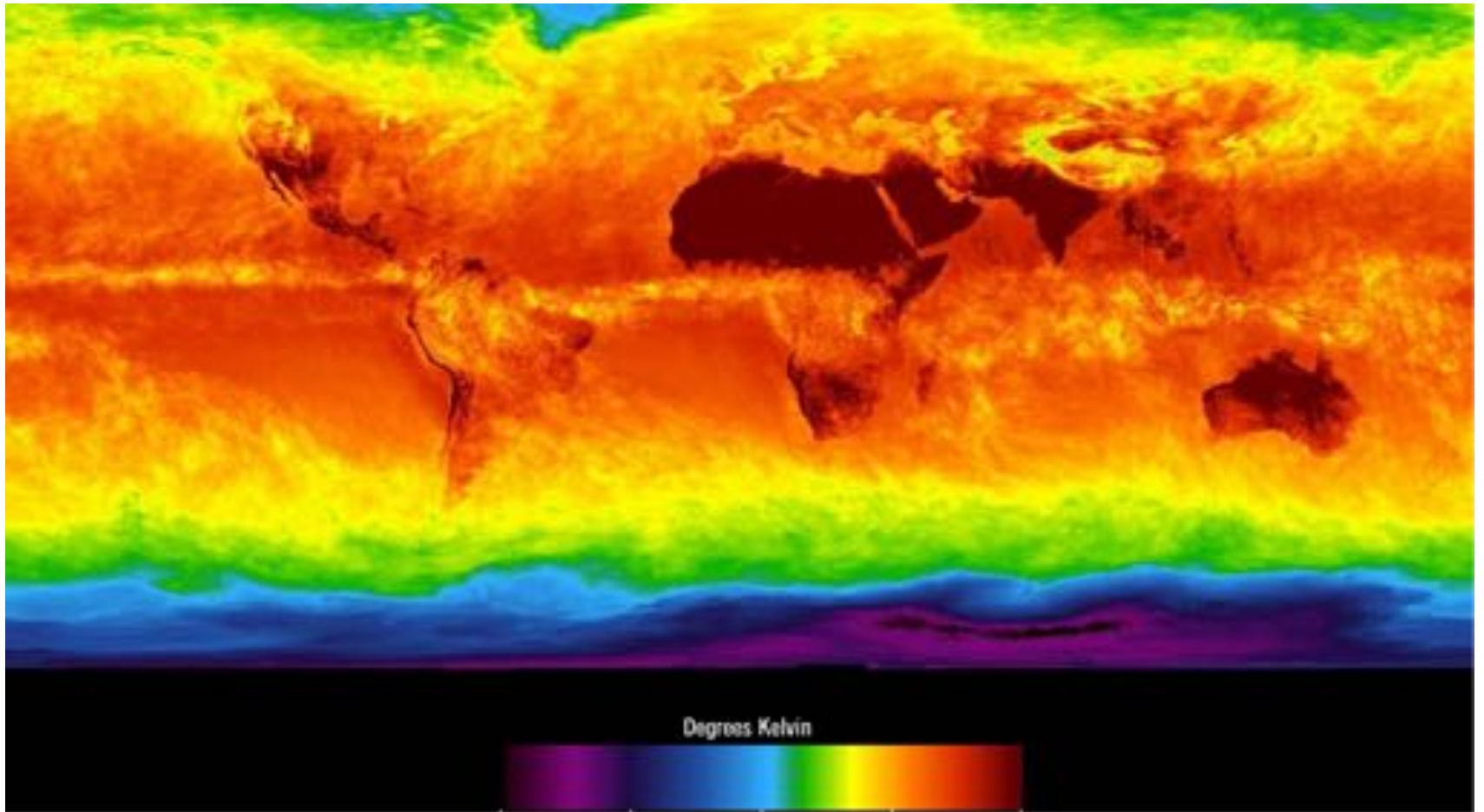
- *Ranges* (species distributions) of most species
  - ▣ Primarily determined by physical (*abiotic*) factors
  - ▣ Because of fitness tradeoffs, organisms are adapted to limited set of abiotic factors
- Biotic factors also play a role
  - ▣ Competition
  - ▣ Parasitism/disease

# Temperature variations



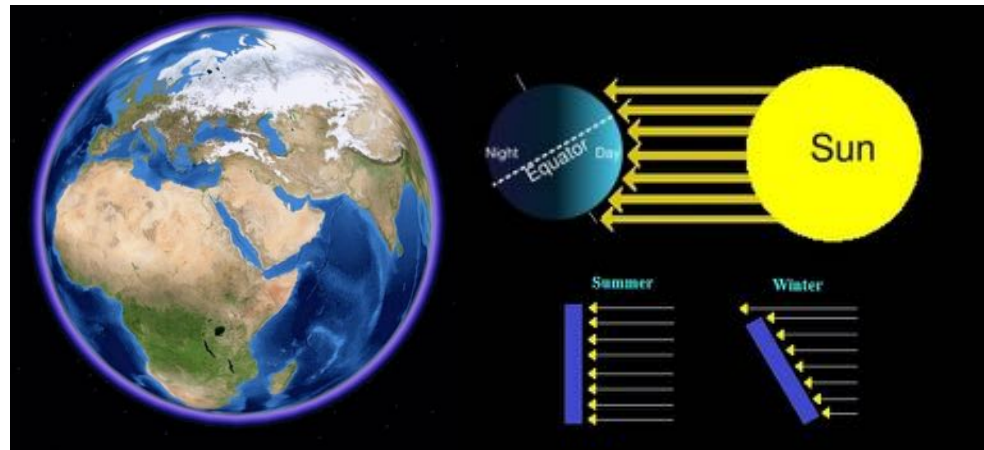


# Global Light Intensity



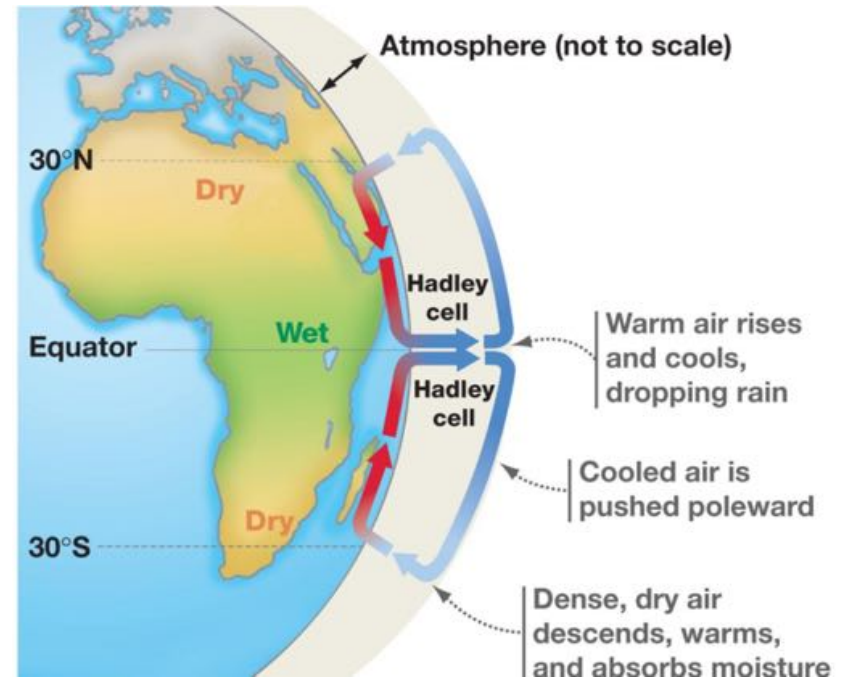
# Temperature variations

- Seasons caused by
  - Earth's  $23.5^\circ$  on its axis
  - Angle of incidence
- Winter vs. summer solstice
- Equinoxes



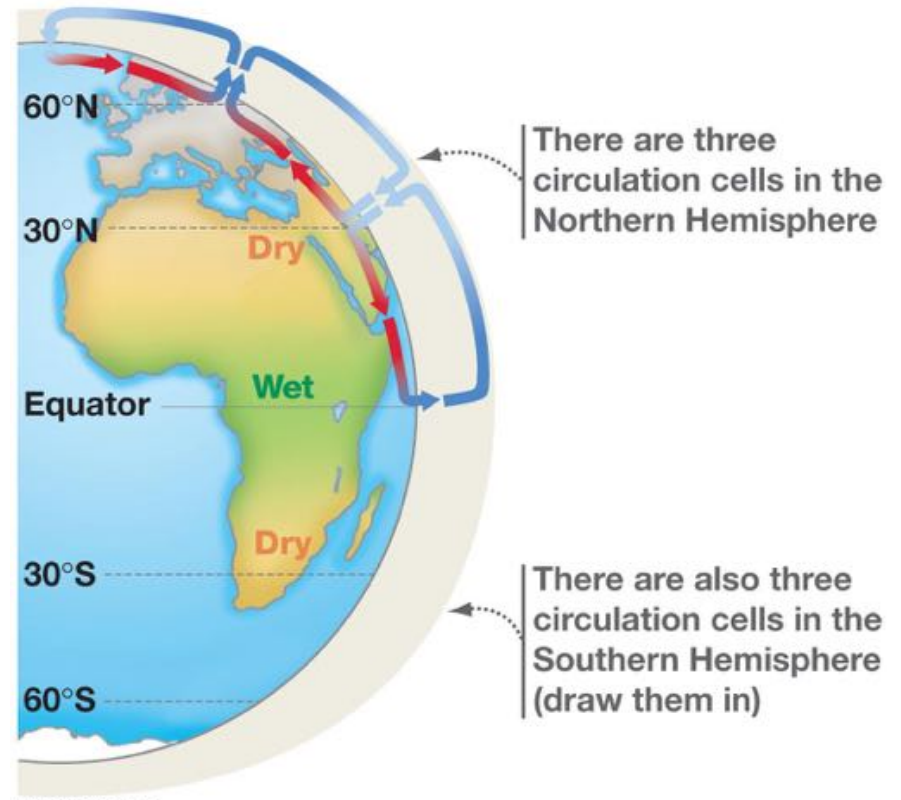
# Hadley cells

- Major cycle of tropical air circulation
- Air hotter at equator
  - ▣ Expands and rises
  - ▣ Warm air holds more moisture (as gas)
- As it rises
  - ▣ Water cools and condenses into liquid
- As it sinks
  - ▣ Absorbs more solar E
  - ▣ Gaining water-holding capacity
  - ▣ Creating 30° deserts



# Global Circulation patterns

- Three cells
  - in each hemisphere
  - Semi-wet at  $60^{\circ}$



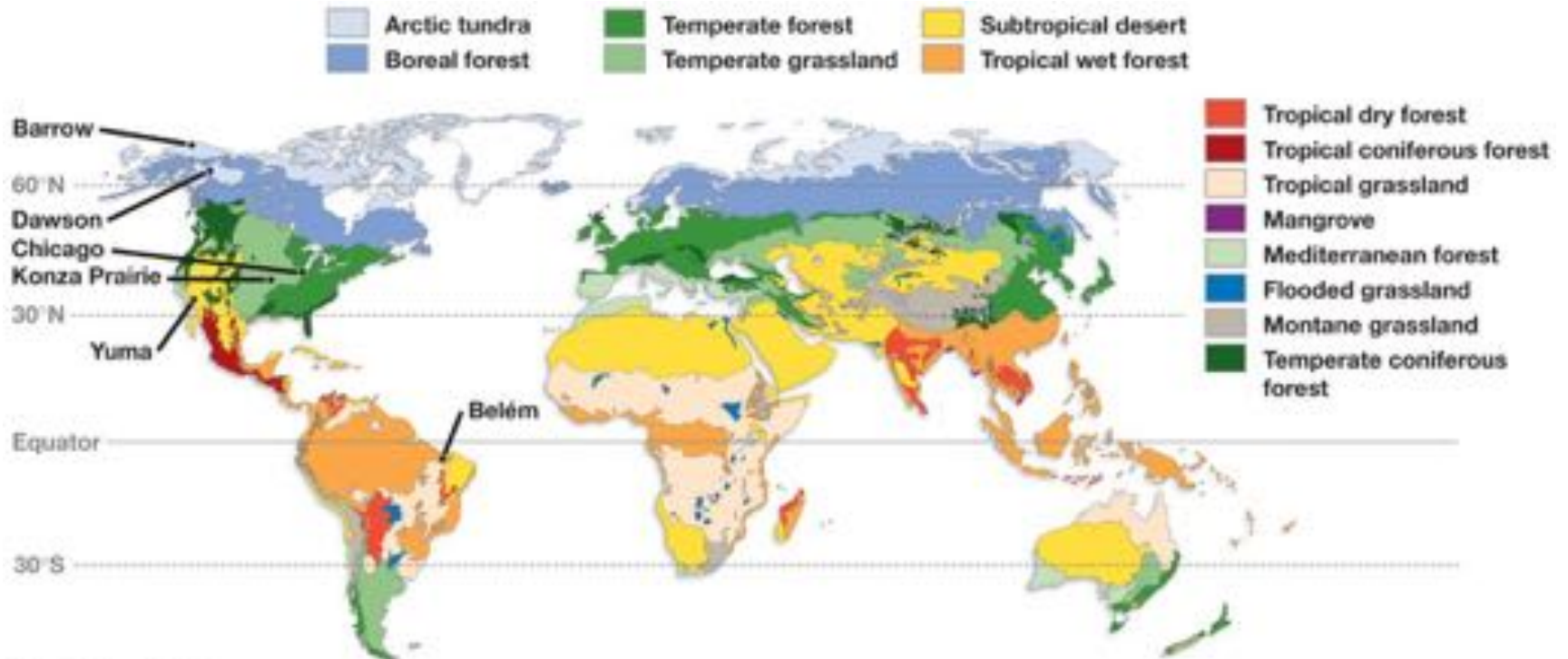
# Regional effects

- Rain shadow effect
  - ▣ Precipitates on one side, but not other
  - ▣ Creates high deserts
- Ocean moderation effect
  - ▣ High capacity for storing E
  - ▣ Moderates temperature

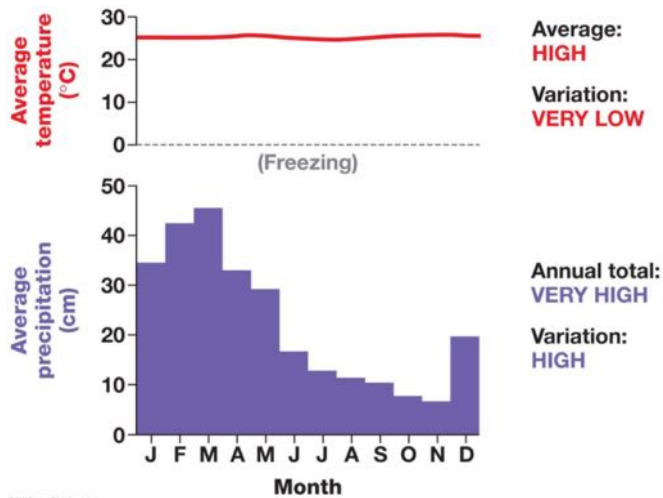




# Terrestrial Biomes



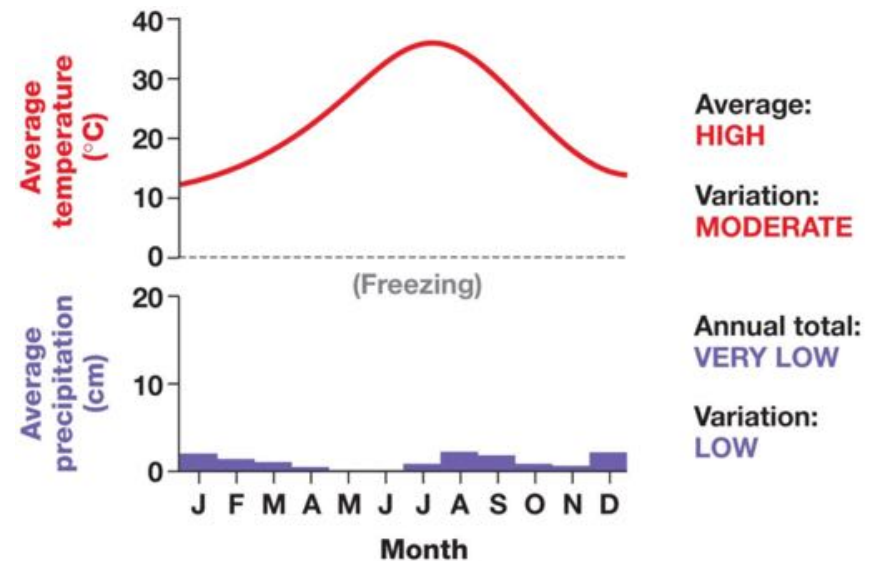
# Tropical rain forests



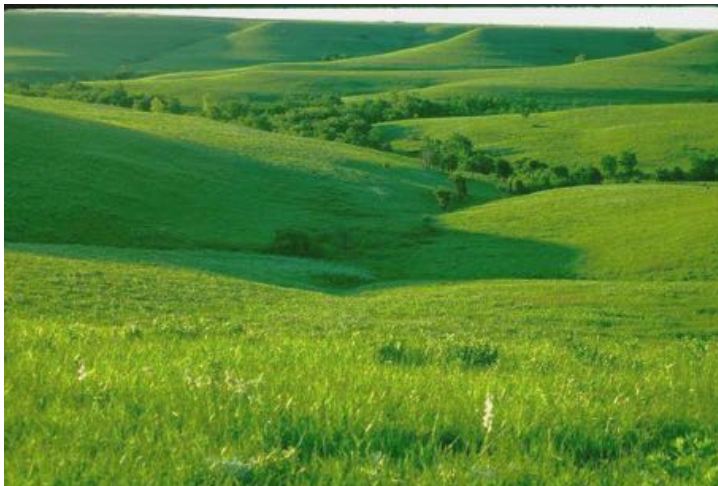
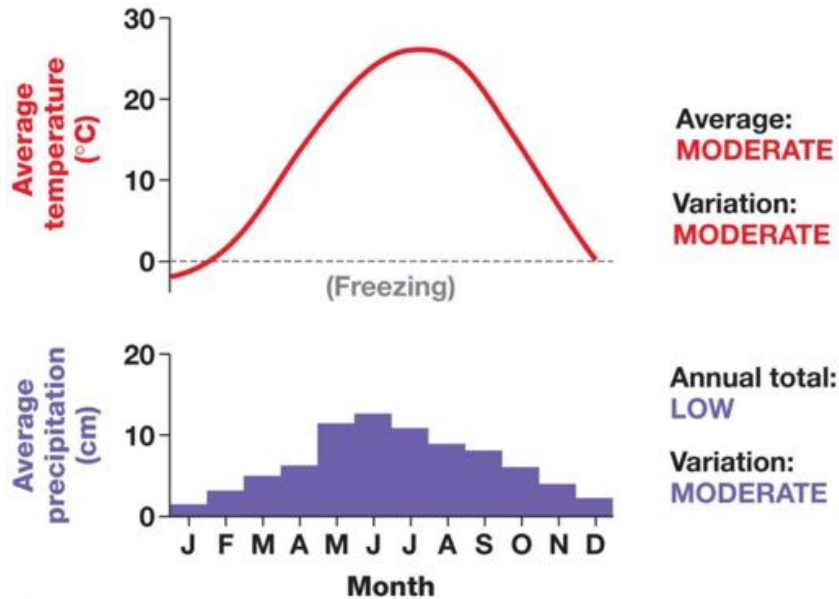
- Equatorial
- Rainfall very high
  - Seasonal: wet & dry
- Temperature invariable
- Very high biomass
- Very high biodiversity
- Multilayered canopy

# Subtropical deserts

- Found at  $30^{\circ}\text{N}$  &  $30^{\circ}\text{S}$
- High ave. temperature
- Moderate variation in temperature
- Very low precipitation
- Very low biomass
  - ▣ Plants widely spaced



# Temperate grasslands

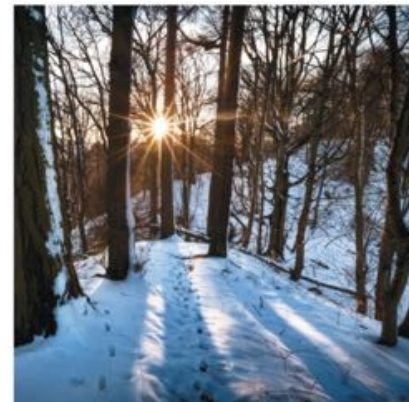
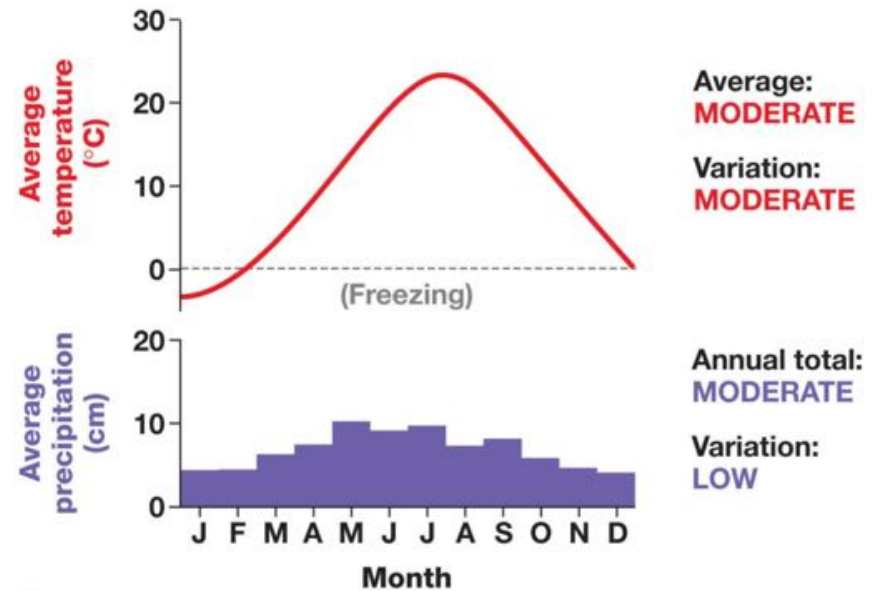


- Long, warm summers
- Short, cold winters
- Low precipitation
- Moderate temp. variation
- High productivity
- Low biomass
- Moderate productivity
- Few to no trees
  - ▣ Too dry
  - ▣ Fire is common



# Temperate forests

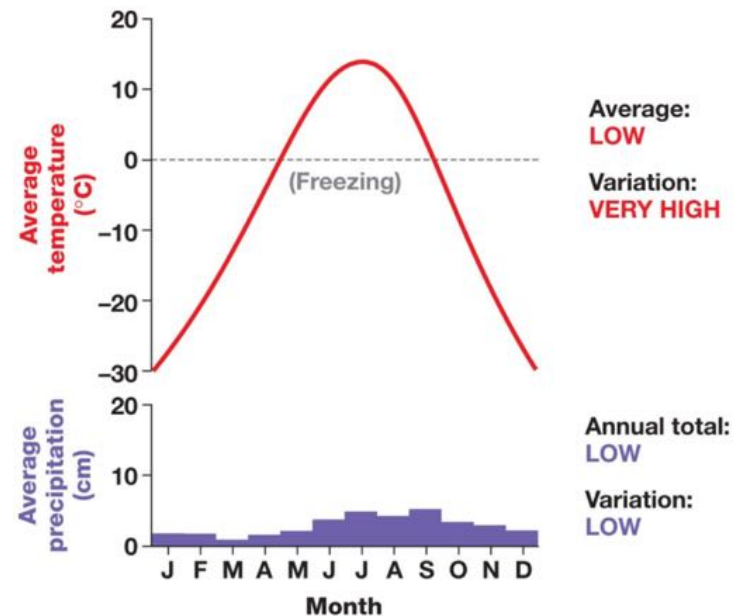
- Same temp. scheme as temperate grasslands
  - ▣ Higher precipitation
- Defined winter
- Deciduous trees
- Moderate productivity
- High biomass
- Moderate diversity



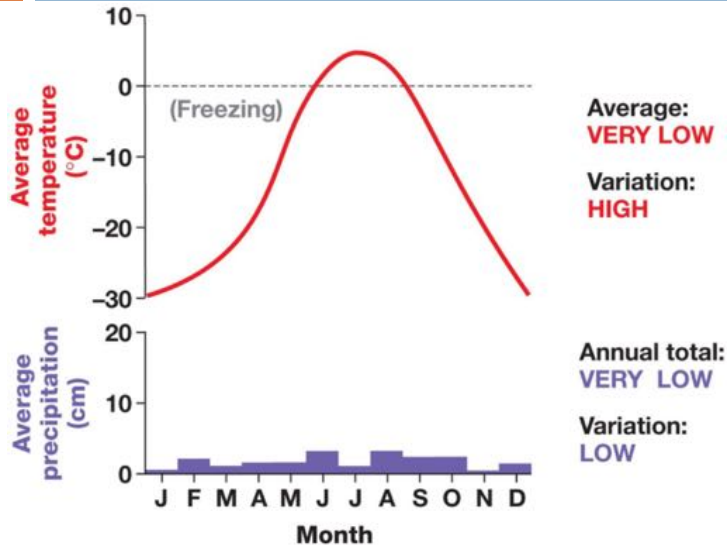


# Boreal forests (Taiga)

- Just S of Arctic Circle
  - ▣ Subarctic
- Very cold winter
- Short, cool summers
- Extreme temp. variation
- Low annual precipitation
  - ▣ Evaporation in minimal
- Conifers dominate
- Low productivity
- High biomass
- Extremely low biodiversity



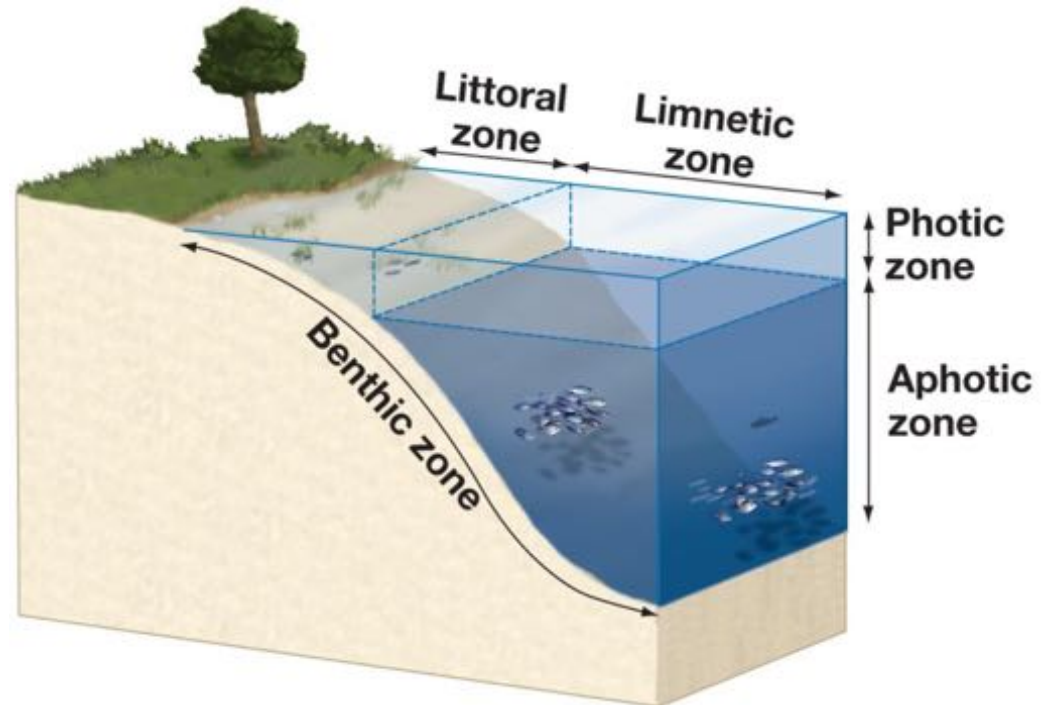
# Tundra



- Artic areas
  - ▣ not covered by ice
- Very low temperature
- Very low precipitation
- Growing season
  - ▣ 6-8 weeks
- Permafrost
- Small woody shrubs, lichens, herbs
- Low diversity
- Low productivity
- Low biomass

# Lakes and ponds

- Littoral zone
  - ▣ Rooted plants
- Limnetic zone
  - ▣ Offshore w/ light
- Benthic zone
  - ▣ Bottom
  - ▣ Detritivores
    - (eat dead matter)
- Photic
  - ▣ Light and photosynthetic plankton
- Aphotic
  - ▣ No light



# Freshwater wetlands

**(a) Bogs are stagnant and acidic.**



- Shallow-water habitats
- Soil is saturated
- Have *emergent* plants

**(b) Marshes have nonwoody plants.**

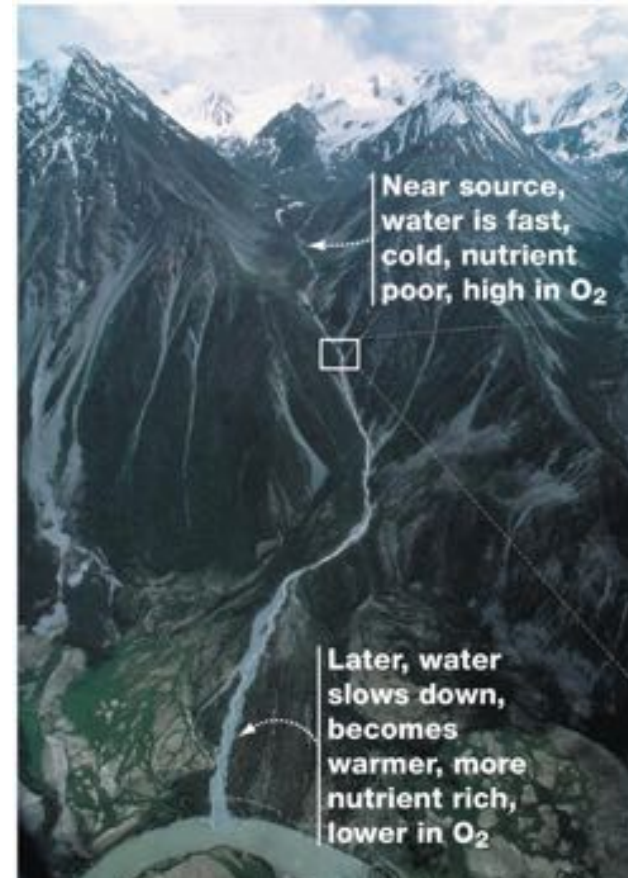


**(c) Swamps have trees and shrubs.**



# Streams and Rivers

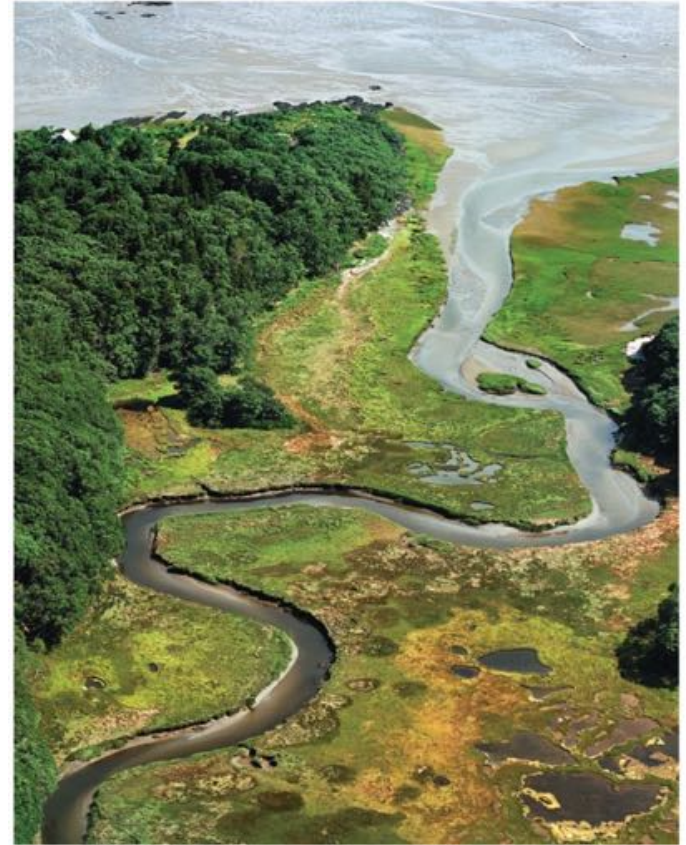
- Flow in one direction
- Source
  - ▣ Cold, narrow, fast
  - ▣ Fewer organisms
    - Mostly animals
- Mouth
  - ▣ Warm, wide, slow
  - ▣ More organisms
    - Plants & animals





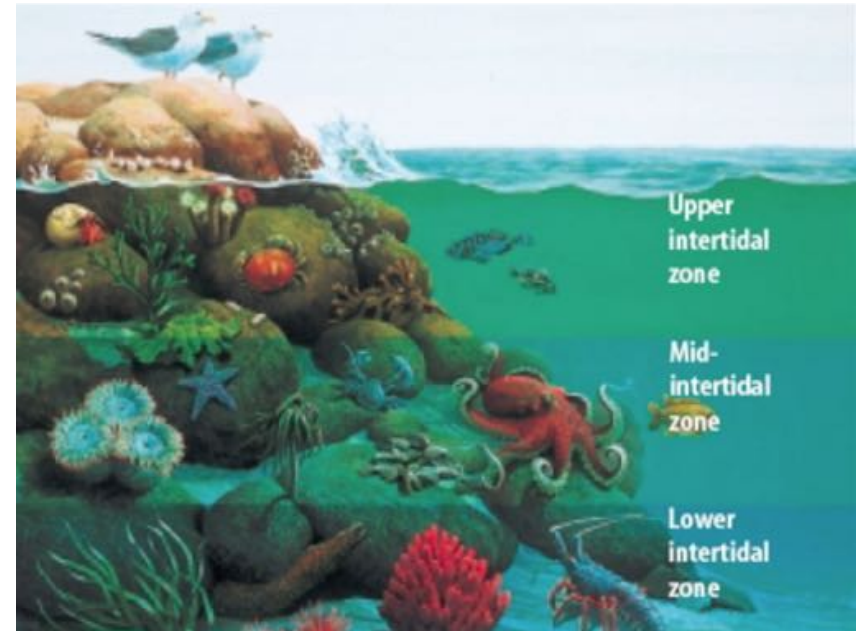
# Estuaries

- Where river meets ocean
  - ▣ Slightly saline
- Salinity varies with
  - ▣ River flow (tides, storms)
  - ▣ Proximity to oceans
- Salinity changes effect
  - ▣ Osmosis & water balance
  - ▣ Species have adaptations



# Intertidal zones

- Land meets the sea
- Tides
  - ▣ Submerged, then exposed
- Huge variations
  - ▣ Temperature
  - ▣ Light intensity
- Plant life limited
- Animal life abundant/diverse



# Coral reef



- Warm water ( $20^{\circ}$ - $30^{\circ}$ C)
- Shallow
  - ▣ Limited to photic zone
- Coral
  - ▣ Symbiosis with dinoflagellates
- Most diverse ecosystem

# Open ocean

- Pelagic zone
- Low nutrient concentration
  - ▣ Exception: upwellings
- Phytoplankton
  - ▣ Photic zone
- Zooplankton
- Nekton
  - ▣ i.e. whales





# Benthic zone

- Floor of the ocean
- Benthos
  - ▣ Organisms
  - ▣ Mostly detritivores

