



The Changing Global Environment Part III

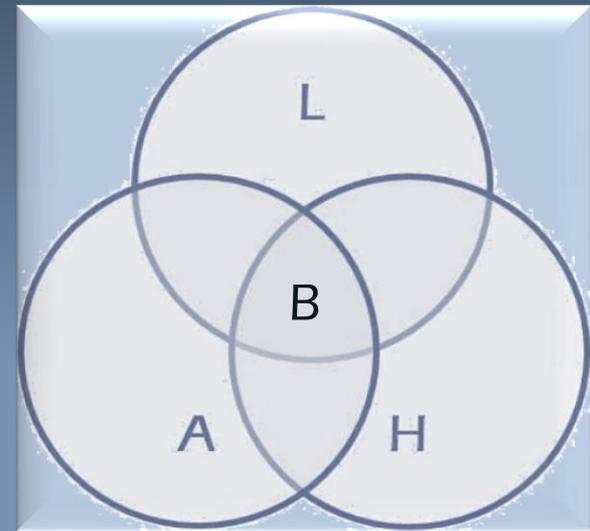
Those who dwell among the beauties
and mysteries of the earth are never
alone or weary of life.

Rachel Carson



The Environmental Spheres

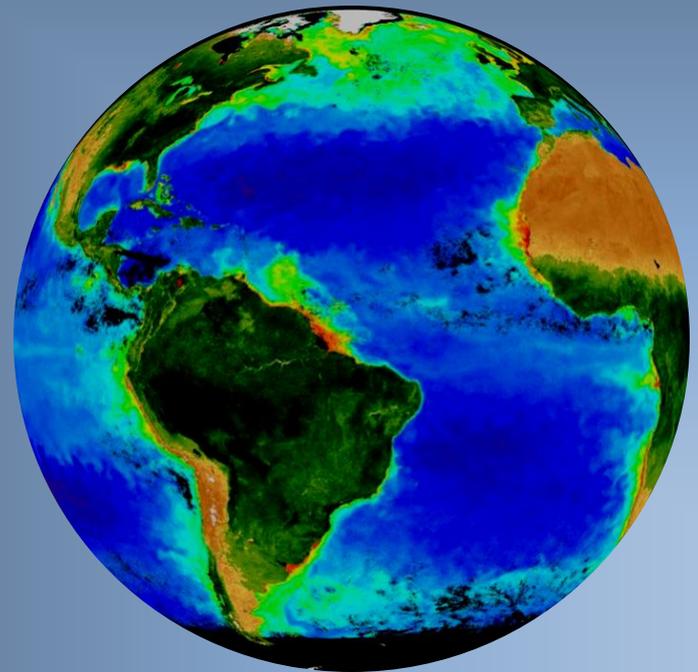
- › Atmosphere
 - › *atmo*, Greek for air
- › Hydrosphere
 - › *hydro*, Greek for water
- › Biosphere
 - › *bio*, Greek for life
- › Lithosphere
 - › *litho*, Greek for stone



interacting spheres



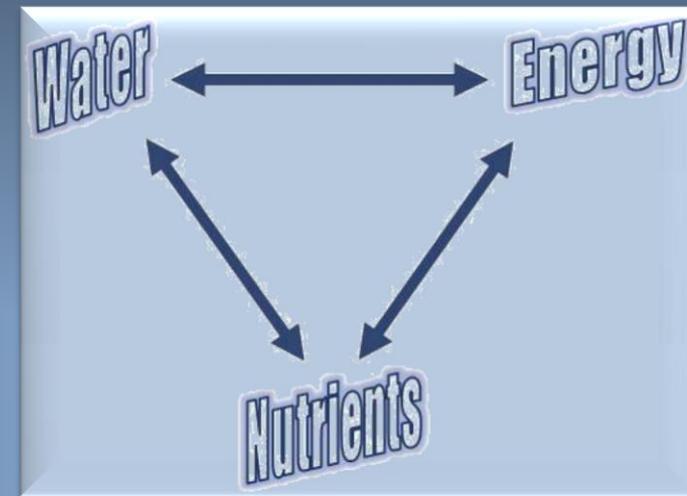
III. THE BIOSPHERE





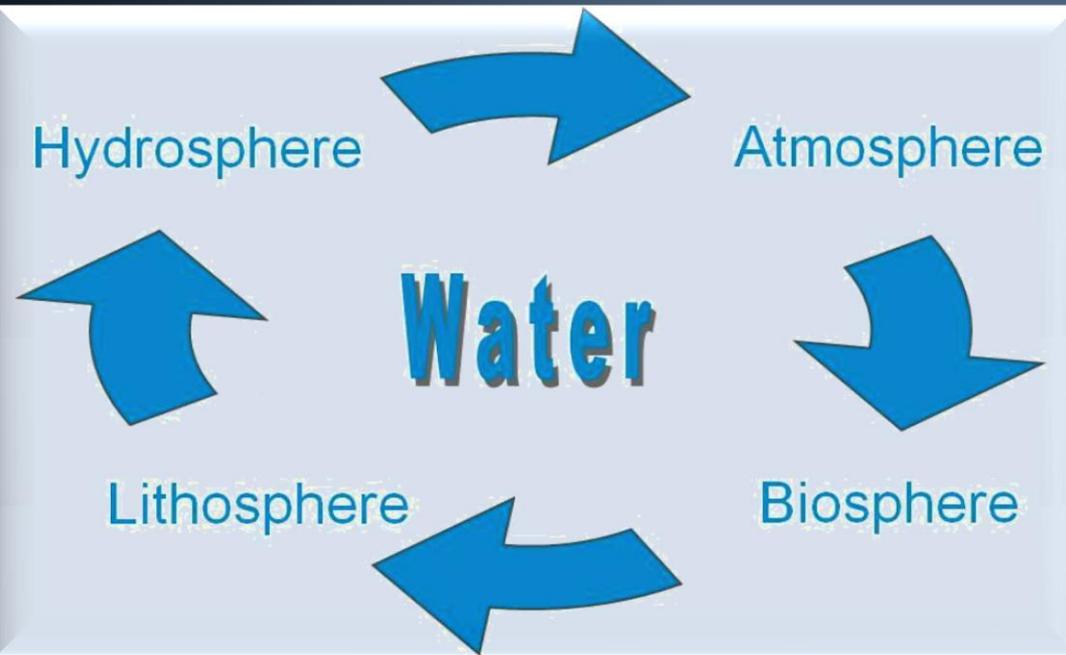
Biochemical Cycles

- › The biosphere consists of **all plant and animal life** forms on Earth. It **overlaps** with the other three environmental spheres.
- › Organisms survive in the biosphere through systemic flows of energy, water and nutrients. These flows involve **biochemical cycles**.
- › All life forms depend on three ingredients: solar **energy**, **water** and **nutrients**. These ingredients are unevenly distributed on Earth's surface.
- › The three ingredients continuously cycle through the biosphere, as organisms absorb and return them to the other three spheres.





Hydrologic Cycle

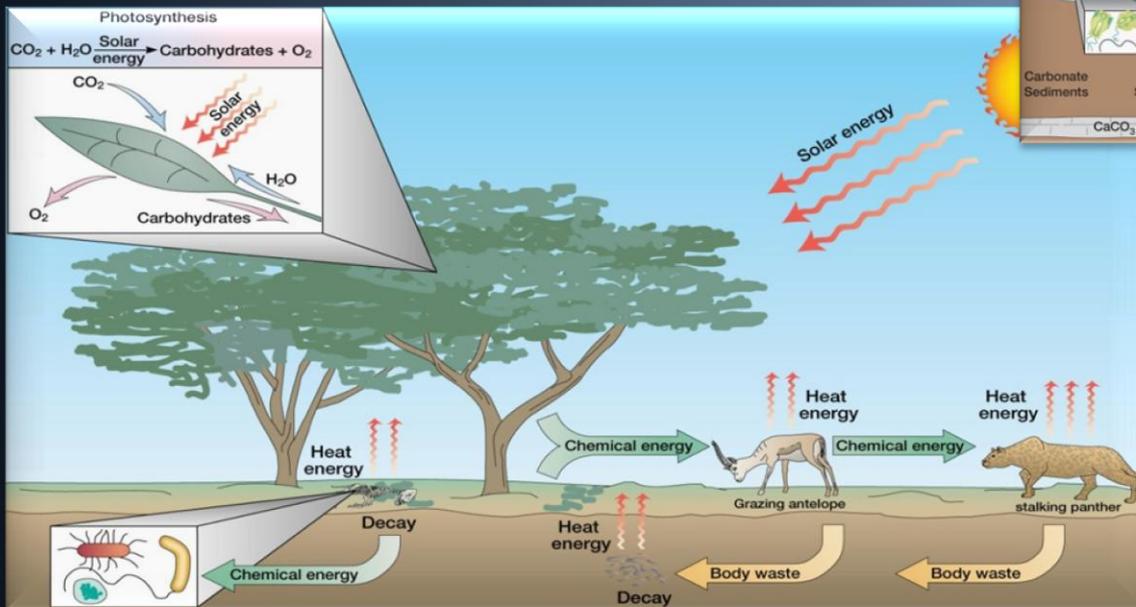
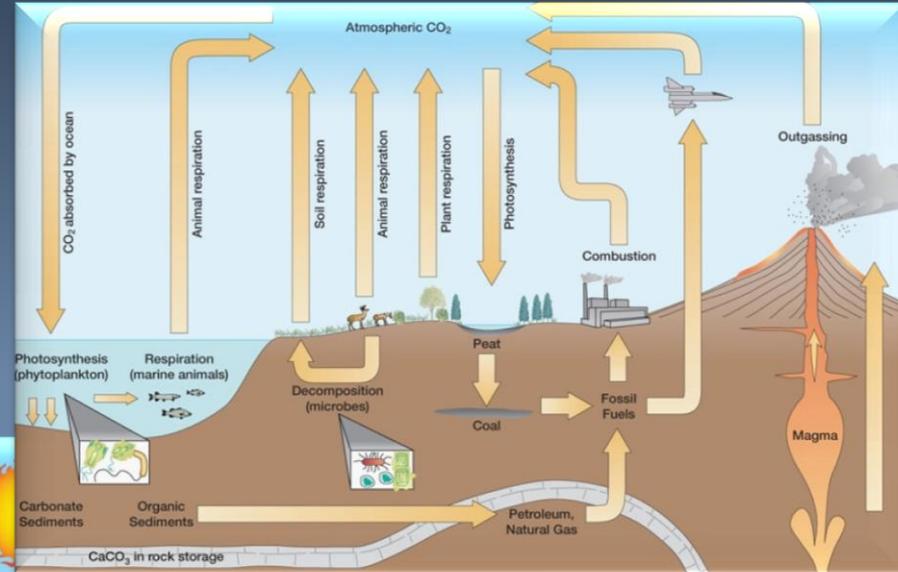


- › Water is the most abundant substance of the biosphere.
- › We find it in two locations:
 - › *In residence* in plant and animal tissues
 - › *In transit* from one sphere to another (i.e., in the hydrologic cycle)



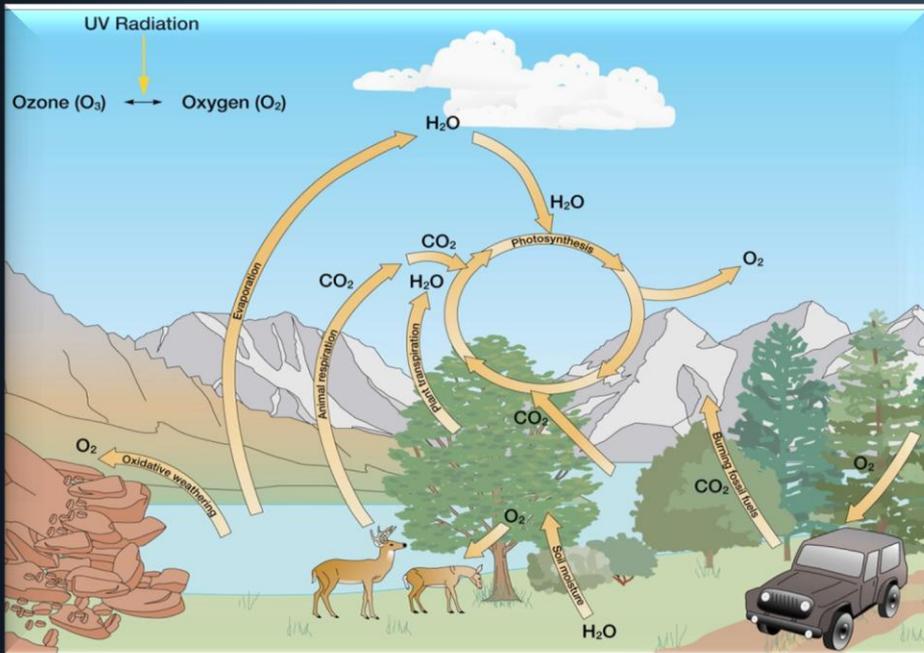
Carbon Cycle

Photosynthesis “pulls” atmospheric carbon into the biosphere.
Carbon moves constantly from the living system to organic reservoirs and back.



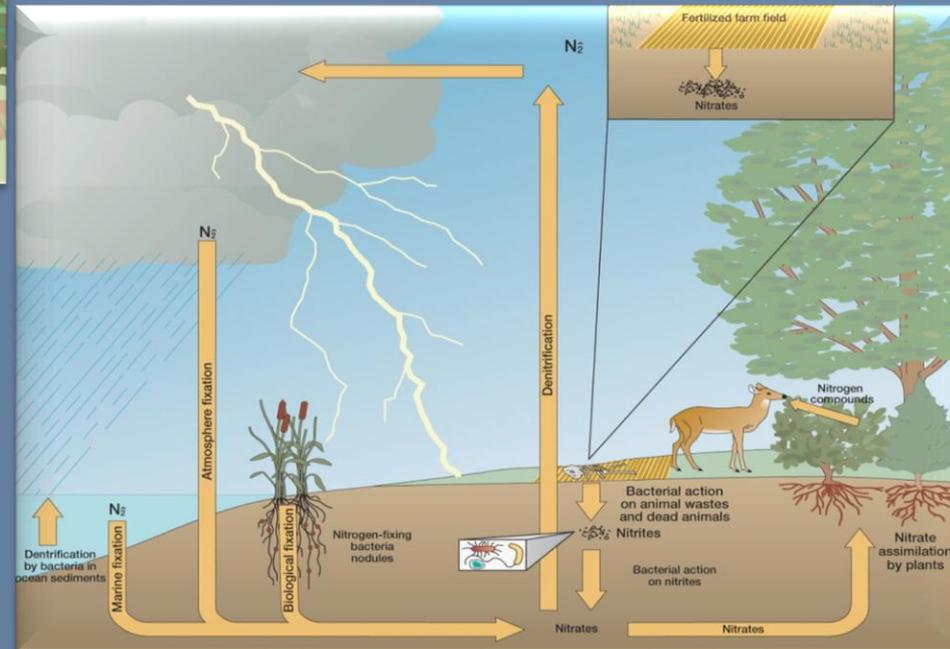


Oxygen and Nitrogen Cycles



Oxygen is mainly a by-product of photosynthesis.

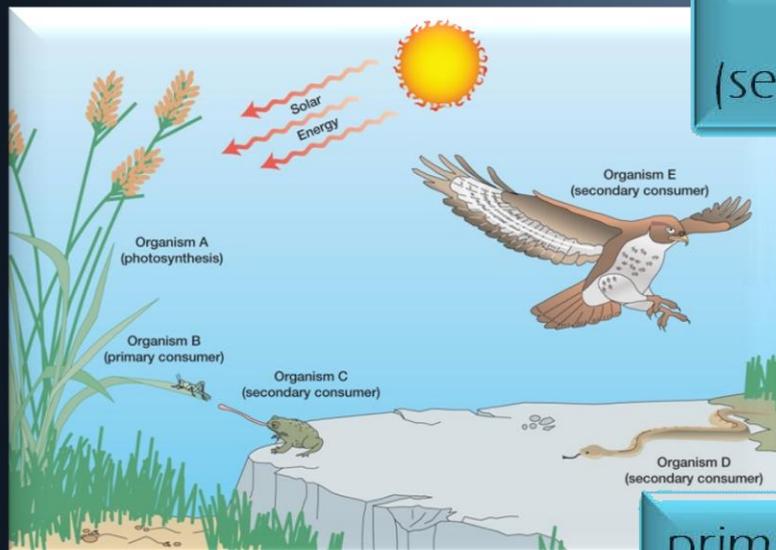
- › N₂ – atmospheric nitrogen (78% of air)
- › nitrogen fixation
- › other mineral cycles
- › trace minerals (eg, phosphorous, sulfur and calcium)





Food Chains

Food chains are the pathways of energy, water and nutrients on which organisms depend for their survival.



Plants are Autotrophs
(self-feeders that fix carbon–storing solar energy).

Animals are Heterotrophs
(consumers).

primary consumers:
herbivores
(plant eaters)

secondary consumers:
carnivores
(meat eaters)



Environmental Relationships

Plants and animals compete with one another for natural resources in a dynamic environment.

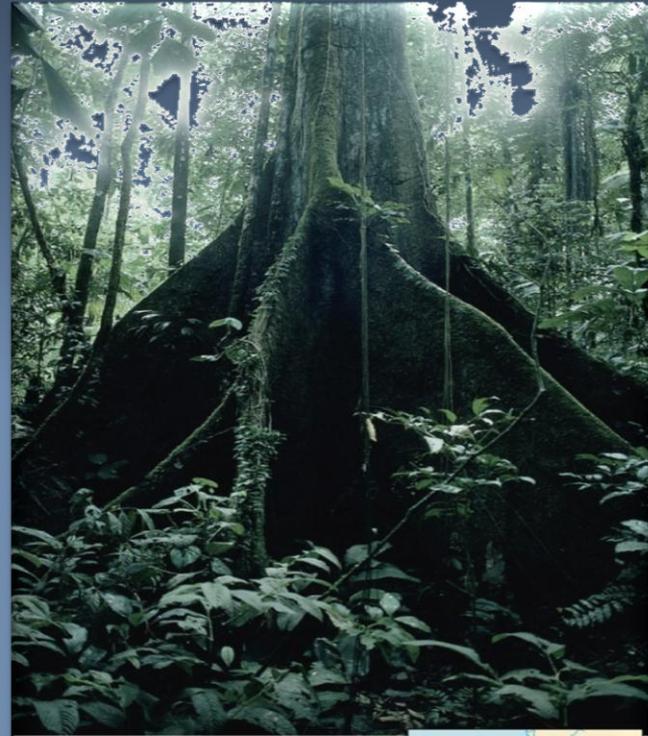
Limiting factors of the environment are the factors in the environment that determine the survival of plants and animals.

- › Limiting factors include things such as light, water, shelter and nutrients.
- › **Climate** is the main influence on how limiting factors vary from place to place.
- › Soils, topography and wildfires also influence local plant and animal distributions.



Example: Selva

- › climate – af
- › flora – tropical rainforest
- › fauna – flyers, crawlers, creepers and climbers
- › soil – laterization
- › hydrography – abundance of runoff, heavy sediment loads in river



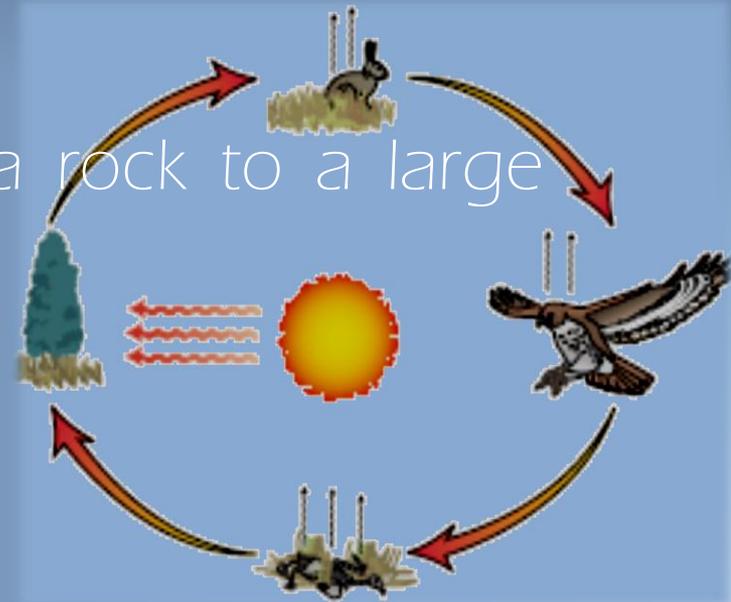
tropical rainforest scene in Ecuador.





Ecosystems

- › Ecosystem: interactions among organisms and between organisms and their non-living environment
- › function: depends on flow of energy among components of the ecosystem
- › scale: from the underside of a rock to a large area of a continent





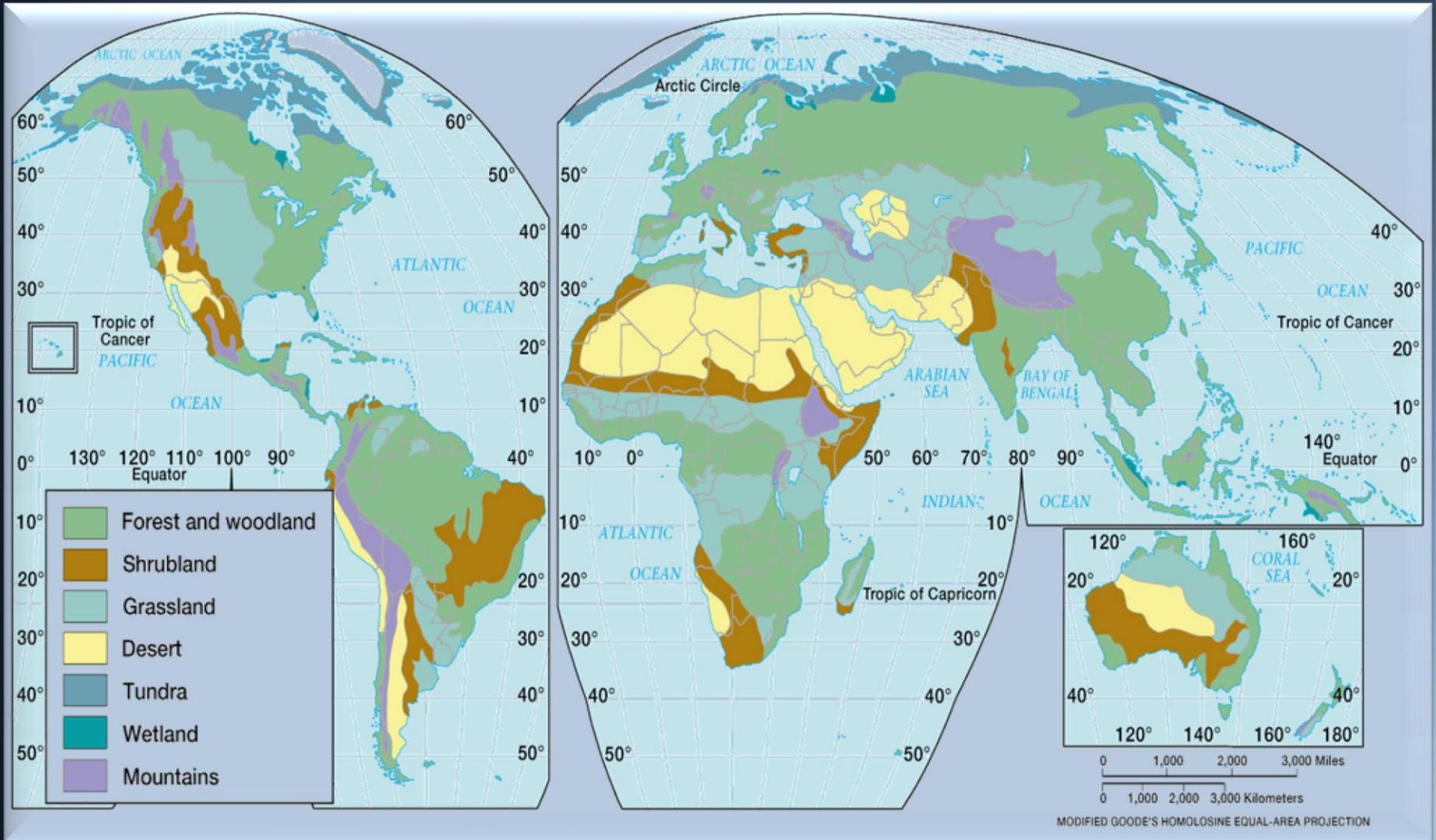
Flora

- › Significance:
 - › a biome's main landscape component
 - › an indicator of other environmental attributes
 - › a prominent influence on human settlement
- › characteristics of plants, represent survival adaptations to the environment's limiting factors:
 - › perennial versus annual life cycle
 - › root system
 - › stems
 - › leaves
 - › reproductive organs





Vegetation Types





Fauna

- › Often ignored as a geographical object of study.
- › less prominent than vegetation
- › more adaptable to environmental variability
- › Significance:
 - › prominent landscape element in certain cases
 - › sensitive indicators of the health of ecosystems
- › Environmental adaptations:
 - › physiological
 - › behavioral
 - › reproductive





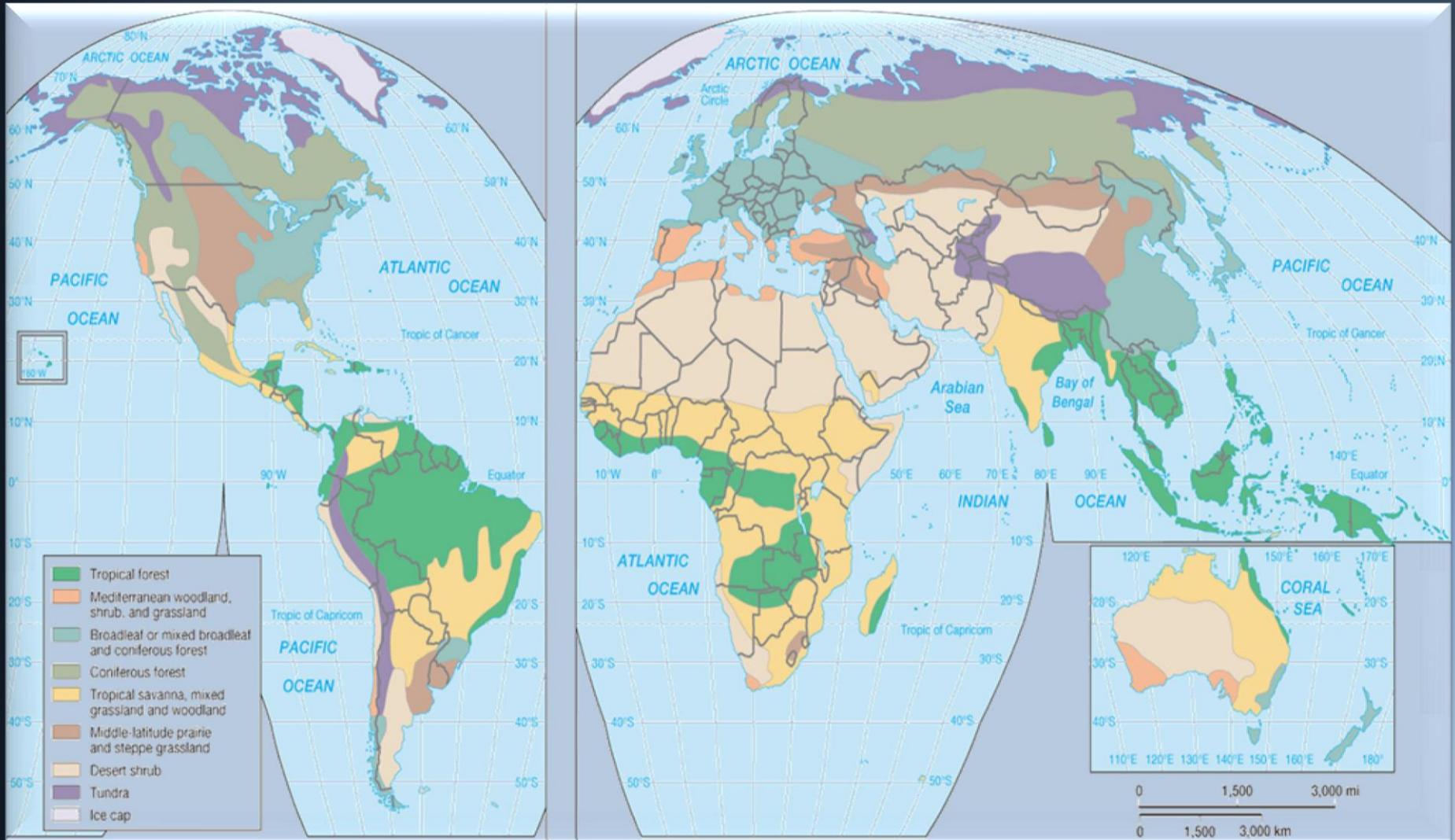
Biomes

- › A **biome** is a large terrestrial ecosystem.
- › recognizable assemblage of plants and animals
- › **ecotone** – transitional boundary between adjacent biomes
- › **vegetation** – basis for biome names
- › ten major biomes
 1. tropical rainforest
 2. tropical deciduous forest
 3. tropical scrub
 4. tropical savanna
 5. desert
 6. Mediterranean woodland & shrub
 7. midlatitude grassland
 8. midlatitude deciduous forest
 9. boreal forest
 10. tundra





World Biomes

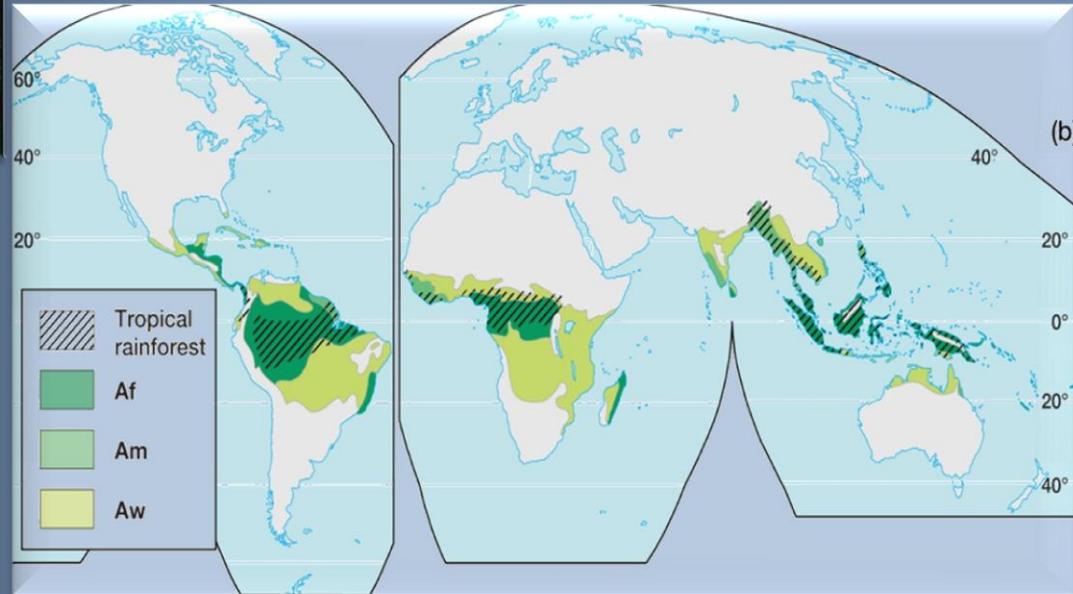




Example: Tropical Rainforest



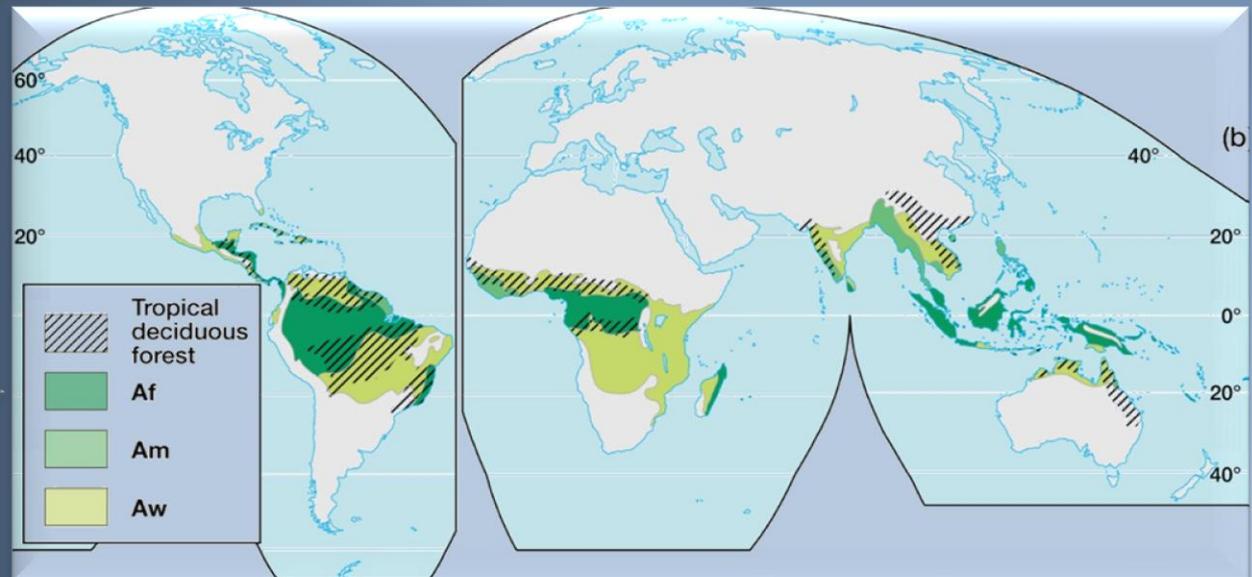
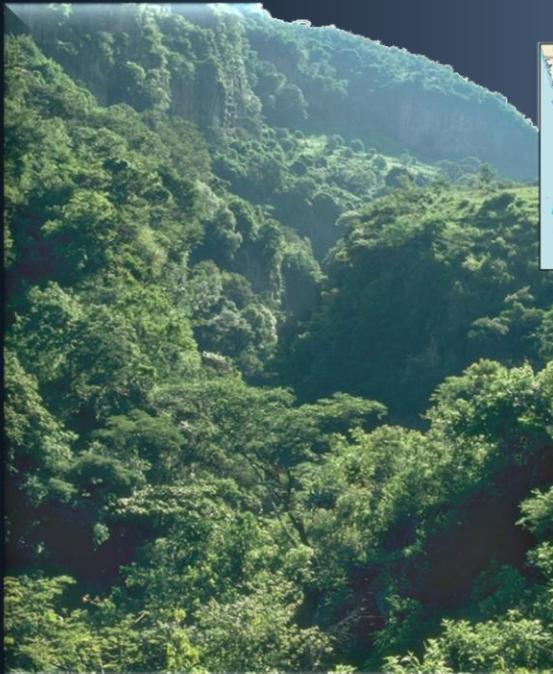
- › water - very wet
- › temperature - always warm
- › soil - poor, thin
- › flora - many and varied
- › fauna - many and varied





Example: Tropical Deciduous Forest

- › mostly found in equatorial climate zones
- › covers app. 7% of the world's land area
- › three-layered canopy
- › As you move farther from the tropics, a distinct dry season forms and the tropical forest becomes more open.

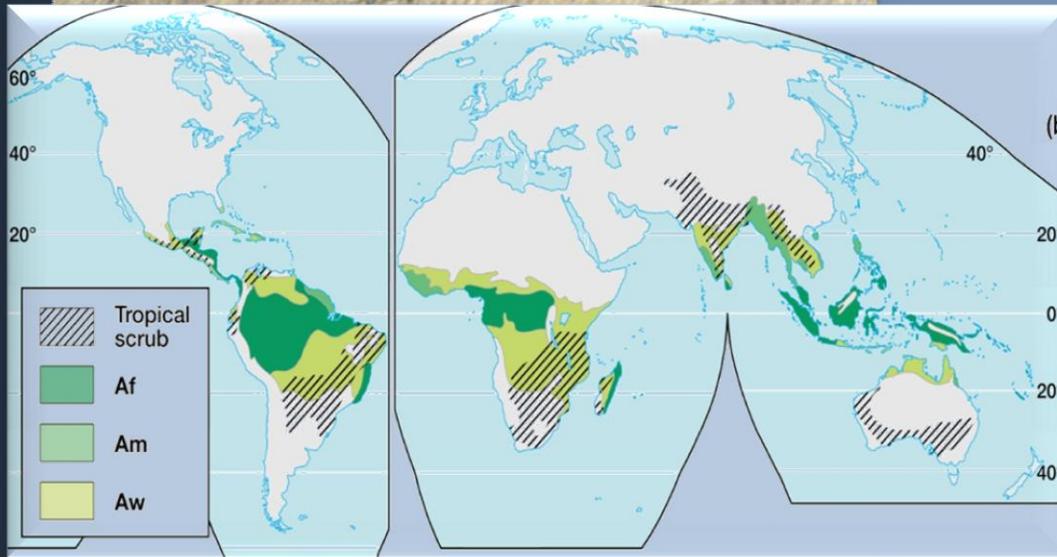




Example: Tropical Scrub



- › water - wet winter, dry summer
- › temperature - cool winter, hot summer
- › soil - poor
- › flora - shrubs, some woodland (like scrub oak)
- › fauna - drought- and fire-adapted animals

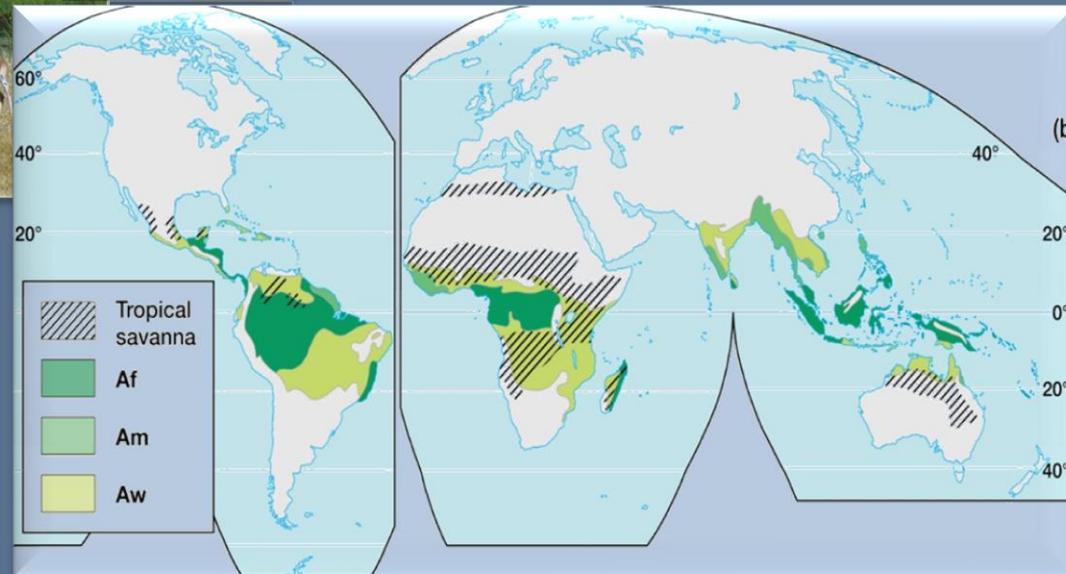




Example: Tropical Savanna



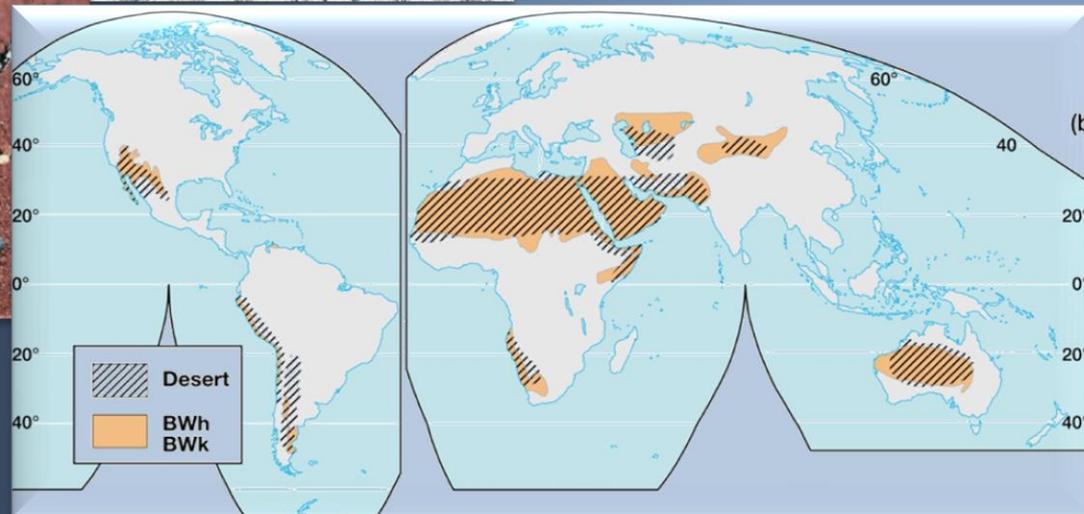
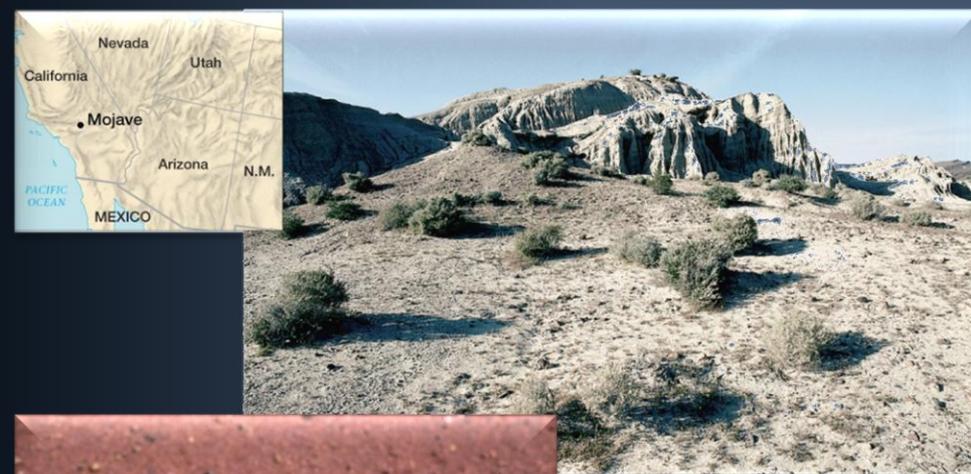
- › water - wet and dry seasons
- › temperature - warm to hot
- › soil - fertile
- › flora - grasses, few or no trees
- › fauna - many and varied





Example: Desert

- › large areas of arid and semi-arid climate that lie poleward (north and south) of the tropics
- › comprise $\frac{1}{3}$ of earth's land surface
 - › **desert**: - areas receive under 10 inches of rainfall a year
 - › **prairie**: - such as the North American grassland
 - › **steppe**: - shorter, less dense grassland found in Russia and Southwest Asia

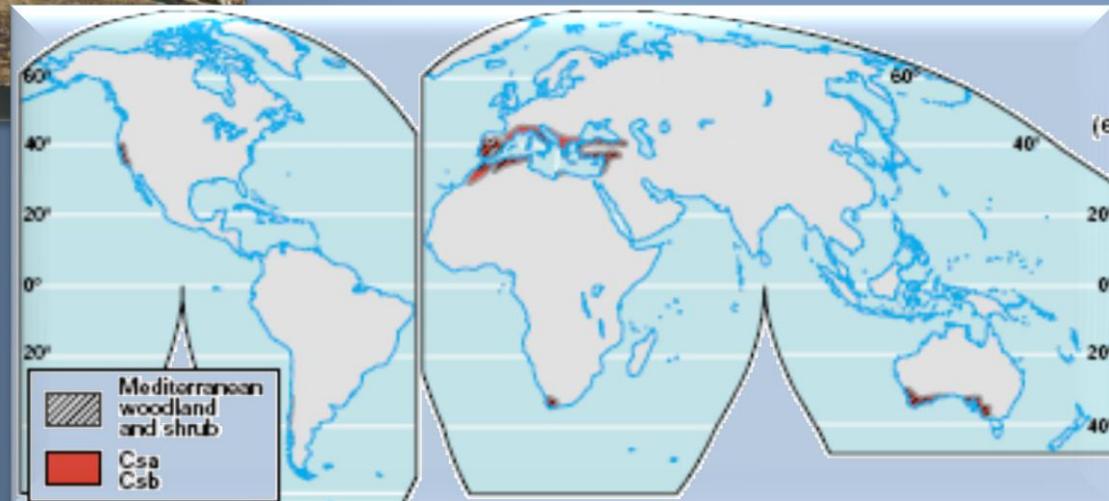




Example: Mediterranean Woodland and Shrub

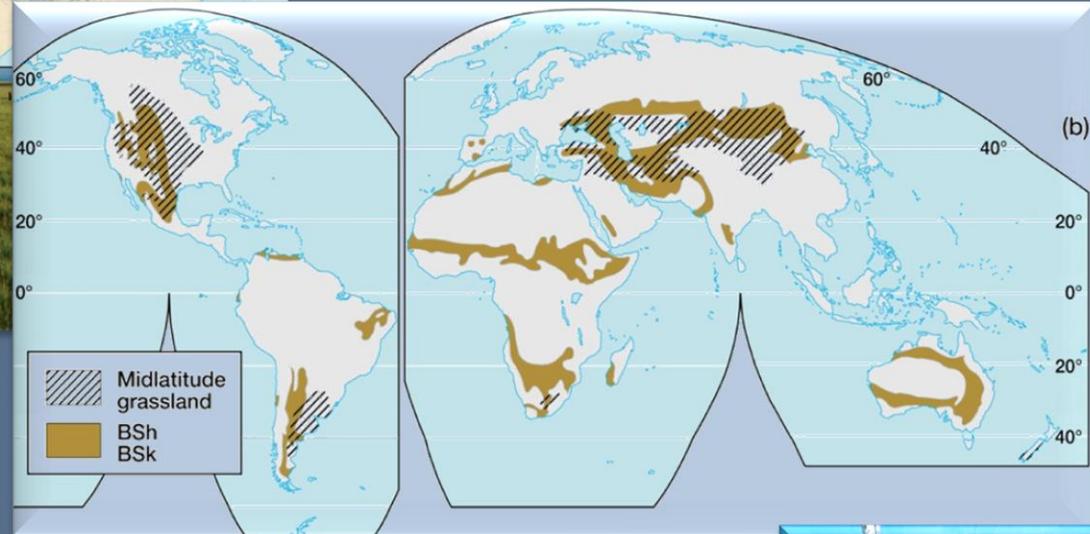


- › moist winter
- › early summer, hot
- › summer fire season
- › fire aftermath





Example: Midlatitude Grassland



- › **desertification** - the spread of desert-like conditions
- › caused by poor agricultural practices on marginal land, overgrazing, build-up of salts in soil from irrigation
- › UN estimate - 60% of world's rangelands threatened by desertification



desertification

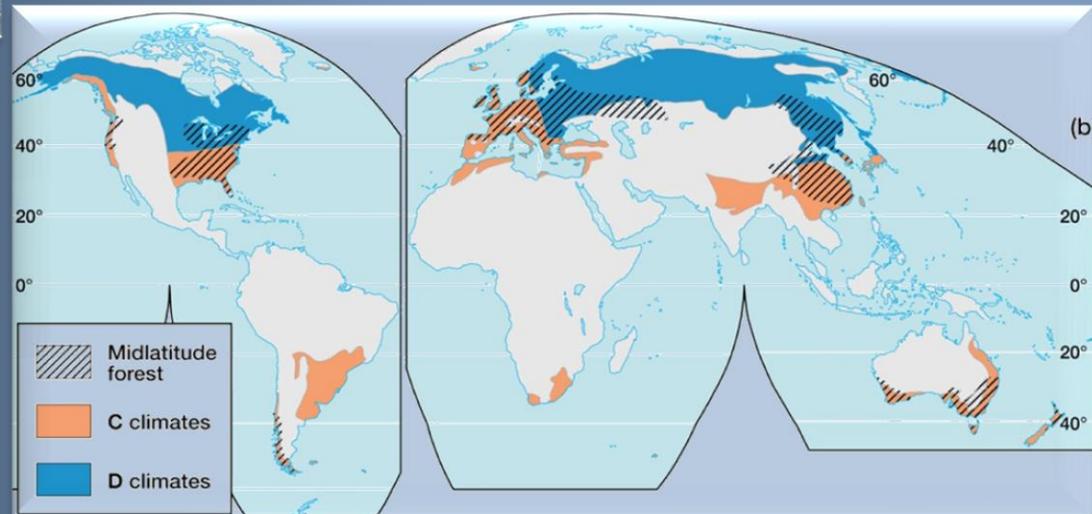


Example: Midlatitude Deciduous Forest



- › large tracts of forests found in middle and high latitudes (nearer the poles)
- › two major tree types - conifers or evergreens (pine, spruce, fir) and deciduous trees that lose leaves in winter (elm, maple, beech)

- › many forests cleared for agricultural purposes
- › commercial logging interests threaten forests globally

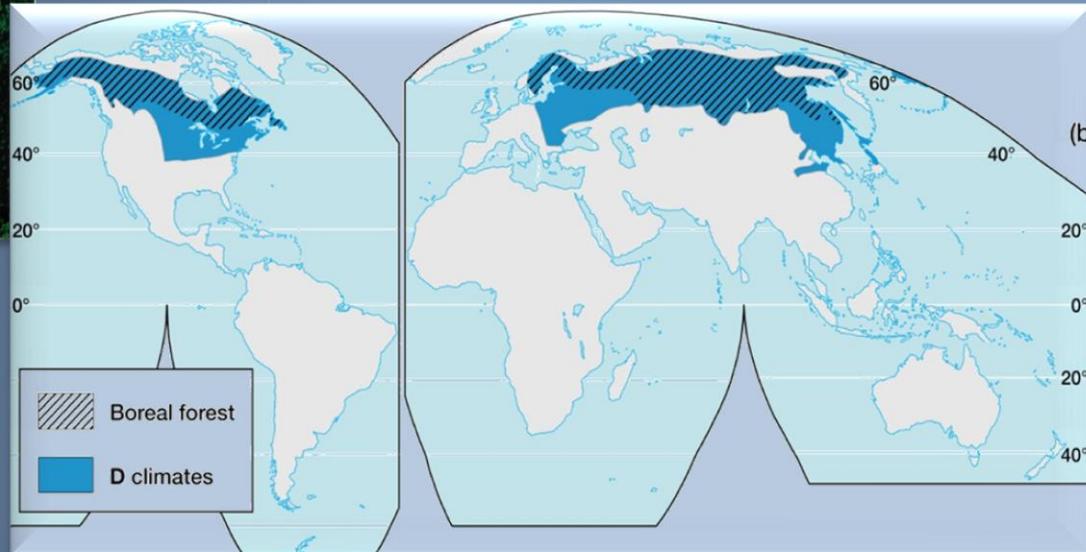




Example: Boreal Forest



- › water - adequate
- › temperature - cool
- › soil - poor, rocky
- › flora - conifers
- › fauna - many and varied





Human Impacts

- › Earth is unique because of its rich **diversity** of plants and animals.
- › **Vegetation** is the “green glue” that binds together Earth’s life and atmosphere. Vegetation is both a product of and an influence on climate, geology and hydrology.
- › **Humans** play a big part in this interaction.
 - › domestication of plants and animals
 - › change natural patterns of flora and fauna on the land - plow, pave over, cut down, overgraze, burn, poison, shoot or trap to extinction



Human Impacts

- › Some environmental change is natural, some is anthropogenic.
- › **Globalization** both helps and hinders world environmental problems.
 - › Today the world's nation-states are more willing to sign environmental treaties (whaling, ocean pollution, fisheries, wildlife protection).
 - › Superheated global economic activity aggravates global environmental problems.



Deforestation

Annually, an area of tropical forest the size of Wisconsin is deforested. The land is cleared for wood sale, cattle grazing and settlement. Plants, animals and native peoples who live in these forests are negatively impacted.



clear-cutting on
Washington's
Olympic Peninsula



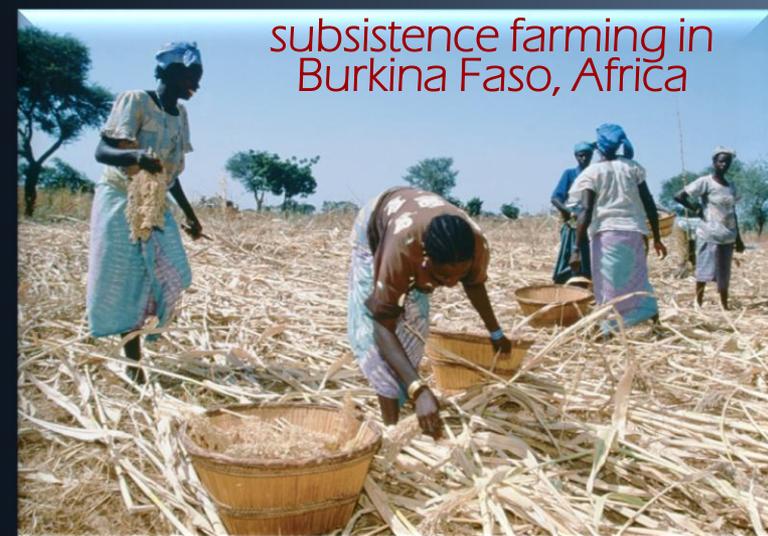
burning in Brazil's
Amazon rainforest



Food Resources

Food production must double by 2025 to keep pace with expected human population growth rates. Every minute, 170 people are born and 10 acres of existing cropland are lost to erosion, desertification or urban sprawl.

subsistence farming in
Burkina Faso, Africa



subsistence farming in
Andhra Pradesh, India





The Green Revolution: Stage 1

- › increased global food production 1950s-1970s
- › stage 1 changes included:
 - › shift from mixed crops to **monocrops**; single-crop, high-yield fields using genetically altered seeds
 - › intensive application of water, fertilizer, pesticides
 - › **intensification of farming** through reduction in fallow periods or field-resting time between planting seasonal crops

Industrial farming





The Green Revolution: Stage 2

- › second stage of Green Revolution since 1970s
 - › new types of **fast-growing** wheat and rice specifically bred for tropical and subtropical climates
 - › With irrigation, fertilizers and pesticides, farmers can grow 2 or 3 crops each year instead of just one.
 - › India doubled food production between 1970 and 1992.



The Green Revolution: Problems

- › The heavy use of **fossil fuels** makes Green Revolution agriculture more vulnerable to oil price fluctuations.
- › **environmental damage**
- › **social costs**, especially associated with the higher cost of this approach

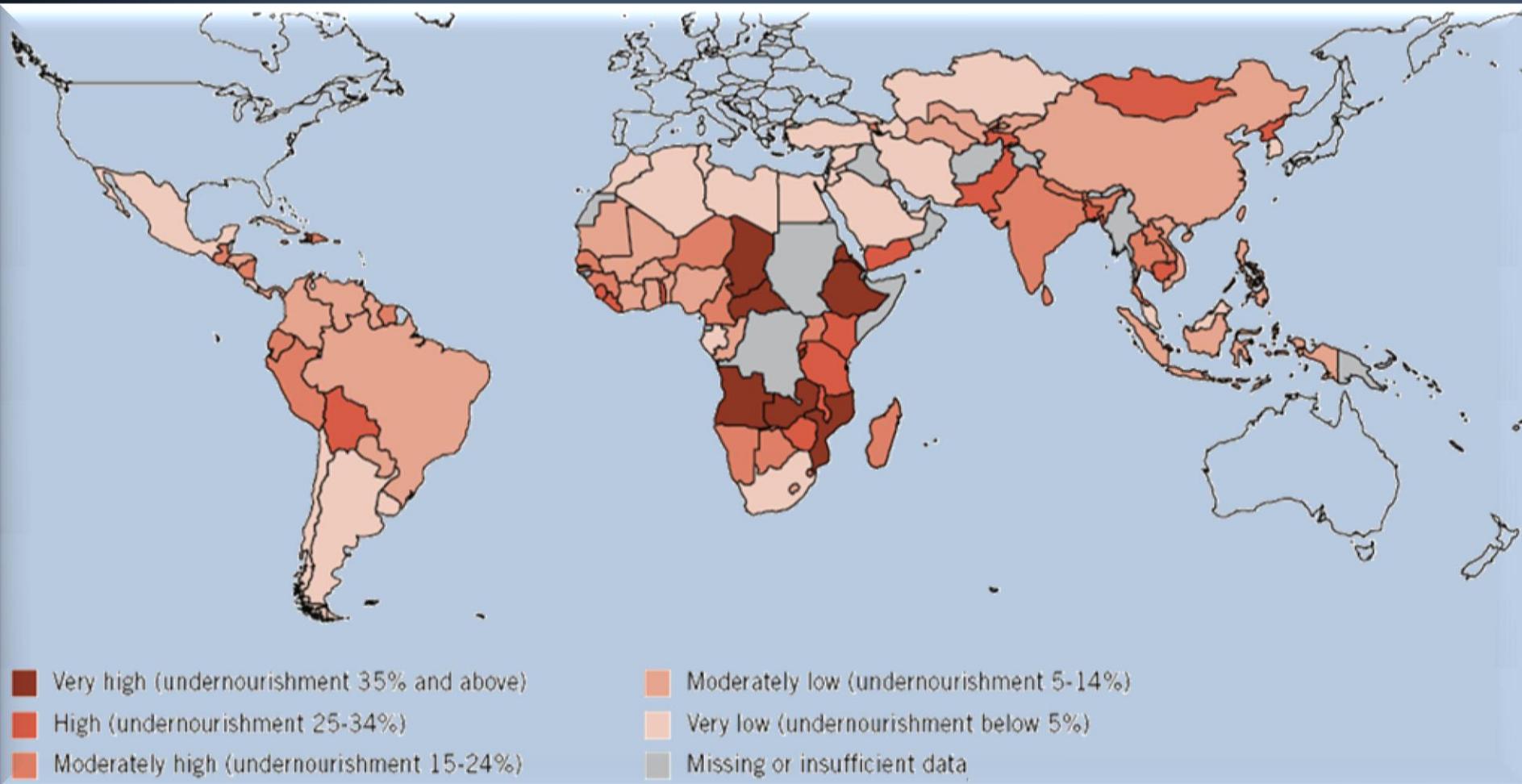


Food Resources: Problems and Projections

- › **Local and regional problems** are usually responsible for food unavailability. Poverty and civil unrest at local levels impede food distribution.
- › **Political problems** are usually more responsible for food shortages as compared to natural events. Food distribution is highly politicized.
- › **Globalization** is causing a worldwide change in food preferences, specifically a shift from vegetarian to meat-based diets, which carries a number of Implications.
- › Africa and South Asia are most threatened by food shortages. The UN predicts that during this century, almost 200 million in southern Africa will suffer from chronic undernourishment.



Proportion of Undernourished Population (2006-2008 Percentage)





CONTINUED IN
THE CHANGING GLOBAL ENVIRONMENT
PART IV

COUNTERTHINK

