Ecology

"In My Father's house are many mansions; if it were not so, I would have told you. I go to prepare a place for you." John 14:2

- Ecology/Behavior/Evolution (EBE): This major includes the fields of population biology, ecology, conservation biology, animal behavior, population genetics, biogeography, and evolution. These fields have in common a focus on evolutionary processes and whole organisms in relation to each other and to their environments. (UCSD)
- ecology: study of how living things interact with one another and their physical environment (Greek "oikos": study of houses)
- habitat: organism's environment or home
- biotic factors: living things in a habitat
  abiotic factors: nonliving things in a habitat

Levels

- biosphere: layer of earth where life exists; atmosphere+lithosphere+hydrosphere
- biomes: larger geographic regions (deserts, grasslands, forests); climax vegetation is species of plants that dominate region used to identify region
- ecosystem: interrelated network of all organisms and their environment within a limited area; either terrestrial or aquatic (aquatic = 70% of earth's surface)
- community: all living things in an ecosystem
- population: group of organisms in same species living in same ecosystem; populations are interdependent with each other
- organism: individual living things

Influences

- biodiversity: number and variety of species living within an ecosystem
- carrying capacity: ability of ecosystem to support organisms; dependent on energy supply/renewal and recycling of nutrients
- main abiotic factors:
  1. radiation - sun provides all basic energy; photosynthesis; geographic location
  2. temperature - influences plant activities and animal activities and metabolism (animals expend much of metabolic energy regulating body temp)
  3. water - required for all life; moves from higher --> lower elevation
  4. atmosphere - availability of gases (O_2, N, CO_2, H_2O vapor) determines variety and growth of plants and animals
  5. wind - global wind patterns result in differences in temp, rainfall; wind also disperses plant pollen and seeds and produces nutrient-releasing currents in bodies of water
  6. soil - type and quality determines kinds of plants
  7. other - weather, climate, topography, mineral content, natural disturbances

- tolerance range: range of values needed for organism's survival; ideal = optimum range; any factor outside an organism's tolerance range becomes a limiting factor
- biotic factors: several thousand different species/organisms may live together in a single ecosystem

Nutritional relationships in an ecosystem

- Producers: organisms which make their own food using an inorganic energy source
  -photoautotrophs (green plants) obtain energy from sunlight
  -chemoautotrophs (bacteria) obtain energy from chemicals like N and S
- consumers: heterotrophs that are unable to produce their own food and must obtain energy from organic things
  -herbivores feed on plants
  -carnivores feed on other animals
  -omnivores feed on both plants and animals
- decomposers: bacteria and fungi that feed on detritus (dead organic matter) by secreting enzymes that break it down into simpler molecules
- trophic level: classification which describes feeding relationship to other organisms in its ecosystem
  first - producers (plants)
  second - herbivores / primary consumers
  third - carnivores / secondary consumers
  fourth - carnivores (top carnivore) / tertiary consumers
- food chain: nutritional relationships among organisms in an ecosystem; one-way
- food web: model which shows all possible feeding relationships at each trophic level
- niche: function or occupation of living thing; how it entirely contributes to its habitat
- energy pyramid: energy transferred from one trophic level to the next (kcal/m2/yr)
- biomass pyramid: total mass of living matter per unit area (lb/acre)
- number pyramid: #organisms at each trophic level; population size usually decreases at each higher trophic level

Special nutritional relationships

- symbiosis: close relationship between two different species over a period of time; species dependent on each other for survival
- mutualism: both organisms benefit
- parasitism: parasite benefits while host is harmed (mosquitos, virus)
- commensalism: one organism benefits while other neither harmed nor helped (remora)
- predation: predator hunts and kills prey
- competition: two organisms compete for same limited resources such as food, water, shelter

- amensalism; one organism inhibits another (molds produce antibiotics that inhibit bacterial growth)
- neutralism: organisms share indirect relationship (producers - carnivores)
- herbivory: grazing animals feed on plants by cropping portions
- Hydrologic cycle: evaporation, condensation, precipitation
- CO-O_2 cycle: photosynthesis, respiration
- Phosphorous cycle: P from soil --> producers --> consumers --> returns to soil when dead consumers are decomposed (P needed for nucleic acids)

Ecosystems

- Polar ice caps: dome-shaped sheets of ice found near the North and South Poles; formed because high-latitude polar regions receive less heat from the Sun than other areas on Earth; averagete mperatures at the poles can be very cold; contain the majority of Earth's supply of freshwater → estimation that 70 percent of Earth's freshwater supply remains in an ice sheet at the South Pole
- Arctic tundra: long winters, freezing temps/snow/ice/high winds; winter days are short; summer days are long and sunny; "tundra" (Fin. tunturia): treeless plains; permafrost: permanent frozen layer of soil found 2-3ft. below surface
- Northern coniferous forest: also boreal forest/taiga; harsh, long winters, heavy snowfalls; trees prosper bc summer is longer; conifers are dominant vegetation; natural forest fires common bc of dry air and flammability of conifers; trees provide shelter for great flocks of migratory birds; taiga animals large which allows for heat conservation
- Temperate deciduous forest: cold winters and hot summers; deciduous trees lose their leaves completely each year; great amount of deadwood provide for diversity of microorganisms, fungi and insects
- Grassland: prairies and plains of N. America dominated by grasses; when leaves and stems of grasses die each year, they add rich organic matter which accumulates quickly in topsoil; fire promotes recycling of nutrients by burning dead plant material on surface; no forests due to low rainfall and high evaporation
- Savanna: largest found in Africa; trees widely distributed, grasses grow rapidly providing food
- Desert: more water lost through evaporation than gained from rain; hottest and driest biomes in the world; world's largest desert is the Sahara in N. Africa; perennial deserts plants (cactus), annual plants germinate quickly and grow rapidly
- Tropical rainforest: found near equator; hot, humid regions receive abundant rain and have year-round growing season; more than half of world's species of plants and animals found in rainforests; many creatures are arborial
- Aquatic biomes: larger than terrestrial biomes and show great variations in temp, dissolved nutrients/gases, sunlight penetration

1) freshwater: no/low amounts of salt; flowing water contain high levels of O_2; aquatic plants and animals in standing freshwater usually found in upper layers of pond water where O_2 most abundant
2) marine: ocean; estuary occurs where nutrient-rich freshwater mixes with seawater; diluted salinity results in productive ecosystems;
-coral reef formed from the remains of stony corals and algae; found in warm, shallow water parallel with shoreline and near volcanic islands; longest is Great Barrier Reef along east coast of Australia

- intertidal, neritic, oceanic zones

<u>Ecological succession</u>

- after ecosystem disturbance, variety of plant and animal species colonize disturbed area; ecological succession: replacement of early pioneer species by later species in orderly progression until climax community established
- pioneer species: first organisms that colonize disturbed ecosystem; plants and animals enrich soil and prepare way for other species to come in and repopulate the area
- primary succession: starts with barren ground
- secondary succession: starts with ready soil and pioneer species; occurs more rapidly
- man has dominion over nature
- man has responsibility to manage creation and wisely use natural resources