Biology 10

Ch 3, 4, 5 Notes (Communities and Population Ecology)

What is Ecology?

- **ecology**: *the study of the*
  - *1)* _____
  - *2)* _____
- **biotic factors**: the _____ components of an environment
- **abiotic factors**: the _____components of an environment
  - ex: air quality, water quality, temperature, pH, soil type, etc

Levels of Organization Beyond the Organism

- **population**: a group of organisms of the **_____** living in the same place at the same time

- **community**: groups of organisms from **_____** living in the same place at the same time

- **ecosystem**: all of the organisms living in a certain place, _____ factors in their environment

- **biome**: a _____ with similar _____ and typical _____

- **biosphere**: _____, with all organisms and physical environments

Organisms Role in Energy Transfer

- **producer**: _____
  _____
  - i.e.- autotroph (either chemoautotroph, or photoautotroph)
- **consumer**- organism that _____ for food

  - **primary consumer**- organism that eats _____ ("1st consumer")
  - **secondary consumers**- organism that eats _____ (predators, carnivores)
  - **ominvores**- eat plants or animals, thus, may be primary or secondary consumer
  - **parasites**- _____, may or may not kill the host
  - **parisitoid**- an organism that parasitizes a host, and kills it
  - **hyperparisitoids**- an organism that parisitizes a parisitoid
  - **decomposer/detritus feeder**- organism that eats _____ _____ (= scavenger)
  - play an absolutely essential role in a community, they recycle nutrients that

would otherwise be “locked up” in corpses, wastes, etc.

Nutrient Cycles

- nutrients must move throughout the community and be recycled, or else they are lost to life on Earth
- we’ll cover the carbon, nitrogen, and phophorus cycles (assuming you remember the water cycle…)

Carbon Cycle (Fig Fig 3-17, p 83)

- **carbon fixation-** carbon is absorbed (**fixed**) _____ _____ (carbon dioxide)
- carbon passed on to other organisms through the food chain
- carbon released back to plants through _____
- carbon is lost from life when organisms die and their bodies are not decomposed entirely
- carbon is also lost when it is incorporated into shells of marine animals (calcium carbonate)
- only way to reclaim is through _____
- human activity has drastically increased the amount of carbon in the atmosphere, which has led to global warming (_____)

Carbon Cycle Diagram

Nitrogen Cycle- (Fig 3-18, p 84)

- nitrogen in the atmosphere is in the form of N_2, which is unusable by organisms, it must be in the form of NH_4 (_____) or NO_3 (_____)
- ammonium or nitrate can be converted to amino acids or nucleic acids (=**fixed nitrogen**)
- Where do we get nitrate from?
  - lightning can convert N_2 to NO_2 (**nitrite**), which then can form nitrate by combining with water
  - _____- can convert NO_2 to NO_3
    nitrite may be formed by other nitrifying bacteria, which convert NH_3 (**ammonia)** into NO_2
  - the fixing of nitrogen is made possible through an enzyme called **nitrogenase**
    nitrogenase only functions in anaerobic conditions, thus, nitrogen-fixing bacteria are obligate anaerobes
  - in marine ecosystems, specialized cyanobacteria cells (_____) fix nitrogen for the entire colony
  - in terrestrial ecosystems, nitrifying bacteria are mainly found in the soil, and in specialized growths on the roots of legumes, called _____

Nitrogen Cycle Diagram

Phosphorus Cycle- (fig 3-19, p 85)

- phosphorus is usually absorbed in the form of _____ (PO_4)
- phosphates are first found in minerals, but are constantly being eroded by _____
- aquatic _____ can absorb the phosphate from the water, which are then eaten by consumers
- when consumers die, the phosphate in their bodies returns to the sea floor to complete the cycle

- how do land organisms get phosphorus?
  - phosphorus on the sea floor may become available when _____ _____ uplift the ocean, forming new land habitats
  - terrestrial plants then absorb the phosphorus
  - consumers and decomposers then can get the phosphorus, returning it to the soil so the plants can again absorb it
  - runoff of phosphorus returns it to marine ecosystems

Ecological Niches

- **ecological niche**- _____ _____ _____
  - "an organism's way of life"
- **fundamental niche**- _____ ecological niche an organism has
- **realized niche**- the _____ niche an organism occupies
  - ex: Carolina anole once occupied many habitats, upon introduction of the Cuban anole, the Carolina anole is now restricted to the tops of the trees
  - competition has reduced the fundamental niche of the Carolina anole to the tree tops (realized niche)
- When two species with the same realized niche interact, inevitably one or the other will have to adapt, of face dying out
  - **competitive exclusion**- when two species have the same niche, evolutionary forces (_____) will drive the two apart if they share the same habitat
  - they may acquire new adaptations or behaviors in order to change their niche = _____

Populations

- **population-** a group of organisms of the **same** species occupying the same place at the same time
- Two things govern the size of a population:
  - **biotic potential**- the _____ at which a population could _____, under ideal conditions
    - many factors affect biotic potential- eg: birth rate (_____), growth rate, fecundity (frequency of reproduction and # of offspring produced)
  - **mortality**- the _____ of a species
    - mortality can be represented by a **survivorship curve**

Survivorship Curve Example

Population Growth Curve (fig 5-5, p134)

- **lag phase**- initially, population growth is slow, curve is not very steep
- **logarithmic phase**- 2nd phase, very fast growth of the population
  - usually, actual growth is limited by various factors (food shortage, predation, disease, etc)
  - limiting factors = **environmental resistance**

- environmental resistance typically limits the population at some maximum = **carrying capacity**
- **population crash**- a sudden severe drop in population

Growth Curve examples

sketch a survivorship curve below and label **lag phase, logarithmic phase, carrying capacity**

Density-independent Factors (Ch 5-2)

- events which reduce a population _____ of the population
  - ex: blizzard, hurricane, asteroid collision, forest fire, etc

Density-Dependent factors

- factors that limit population size that _____ of the population
  - ex: resource shortages, competition, predation, parasitism
  - resources are usually able to be recycled (**ie: renewable resources**), but population size still limited by how fast they can be recycled

Food Chains and Food Webs

- **food chain**- a simple list of organisms based on _____
  - usually a food chain is not a true representation of the complexity of energy flow
- **food web**- a model of the flow of energy from producers to consumers, consisting of _____ (3-9, p75)
- **food pyramid**- a model showing the relative **biomass** (total mass of all organisms in a population) at each **trophic level**
  - 1st trophic level- **primary producer** (plant, algae, chemosynthetic organism, etc)
    - 1st trophic level usually has the greatest biomass, and largest population
  - 2nd trophic level- **primary consumer**
  - 3rd trophic level- **secondary consumer**
  - numbers and biomass generally go down as you go from level to level, as energy available to the next level decreases (see fig 3-12, p78)

Sketch and label a food pyramid below (label **primary producer, primary consumer, secondary consumer, tertiary consumer**)

Ecosystem Production

- production of an ecosystem is dependent on the ability of the primary producers to fix _____ (see fig 3-11, p 77)
- thus, productivity is affected by many variables (solar energy, carbon dioxide, water, etc)
- **gross productivity**- the _____ at which organic matter is produced during photosynthesis for a particular ecosystem
- **net productivity**- the rate at which organic matter is _____ into the growth of the organism
- only the _____ is available for the next trophic level to use for energy
  - about _____ of the energy available within one trophic level is transferred to organisms at the next trophic level.

Diversity

- **diversity-** _____
- diversity affected by many factors
  - # of ecological niches- the more niches, the more diversity
  - degree of isolation- the more isolated a habitat, the less diversity (due to difficulty in getting there, and increased chance of localized extinctions)
  - stress/extreme environmental conditions-
    - diversity decreases under stress, extreme environmental conditions, as only part of the community will be able to handle the stress
  - **edge effect**- diversity is usually highest at the _____ of an ecoystems, due to the margins having characteristics of all the ecosystems they are next to
  - dominance- diversity _____ when one species dominates a particular resource
  - biotic history- stable environments have _____ diversity, unstable environments have lower diversity

Succession (see fig 4-12, 4-3, p 106-107)

- **succession-** _____
- **primary succession**- succession that starts on a _____
  - usually _____are first to habitat new environments

    - mosses, ferns, tough grasses next to make it in
    - eventually trees, forest community if enough soil is present (=_____ , when no further change takes place)
- **secondary succession-** takes place on a habitat that once underwent primary succession
    - usually a habitat that has been disturbed (forest fire, logging, etc)

Why does Succession Occur?

- organism that is currently there may make conditions favorable for next organism, who displaces the first one
- secondary organism may damage the conditions so that the first organisms cannot survive there

Climax Community

- the concept may be outdated, it is apparent that the community that is present is typically the result of past history in the environment
- _____!