Chapter 18

Ecosystems

Summary of Terms

- **Biogeochemical cycles** The movement of substances such as water, carbon, and nitrogen between living organisms and the abiotic world.
- **Biomass** The amount of organic matter in an ecosystem.
- **Biome** Earth's major types of ecosystems.
- **Climax community** The stable community in which a particular habitat with which ecological succession ends.
- **Ecological succession** Changes over time in the community of species living in an ecosystem .
- **Energy pyramid** A diagram that shows the energy flow through an ecosystem from producers to primary consumers, secondary consumers, and any higher-level consumers.
- **Nekton** Organisms that swim actively through their aquatic habitat.
- **Plankton** Organisms that float passively in their aquatic habitat rather than swimming actively through it.
- **Primary productivity** The rate at which producers build biomass in an ecosystem.

Detailed Chapter Summary

An ecosystem consists of all the organisms that live in a specific area, as well as all the abiotic features of their environment. The major types of ecosystems are known as biomes. Earth's land area is divided into eight major terrestrial biomes. Each biome is characterized by specific types of biological communities -- particularly, specific types of plant life. Plant life, in turn, typically depends on climate. For this reason, latitude and elevation are major influences on what biome is found in a particular habitat. The major biomes are: tropical forest, temperate forest, coniferous forest, tundra, savanna, temperate grassland, chaparral, and desert.

Aquatic biomes include freshwater and marine habitats. Lakes are divided into a littoral zone, limnetic zone, and profundal zone. Phytoplankton are the main producers in lakes, ponds, and rivers. Estuaries are habitats where freshwater rivers flow into oceans. Estuaries are characterized by changing salinity. Marine habitats include the pelagic zone and the benthic zone. The pelagic zone describes the water itself and consists of the photic zone near the water surface and the deeper aphotic zone. Pelagic species may be either plankton or nekton. The benthic zone is found on the ocean bottom. Ocean habitats can also be described based on their closeness to shore. The intertidal zone is alternately underwater and exposed to air. The neritic zone describes coastal marine habitats. The oceanic zone is far from land.

Many of the resources that organisms need cycle between Earth and living things in a series of biogeochemical cycles. The water cycle involves evaporation from the oceans, movement by wind, precipitation, and a return to the oceans in rivers, streams, and groundwater. Organisms swallow or absorb water and lose it through processes such as respiration, perspiration, excretion, elimination, and evaporation.

Carbon enters the biotic world through photosynthesis. Carbon is converted back to inorganic carbon dioxide during cellular respiration, as well as through burning, such as during forest fires. The burning of fossil fuels by humans has added carbon dioxide to the atmosphere and resulted in dangerous global warming.

Nitrogen enters the biotic world after nitrogen-fixing bacteria convert nitrogen gas into ammonium ions. Nitrifying bacteria then convert ammonium ions into nitrates that can be used by plants. Nitrogen returns to the abiotic world when denitrifying bacteria turn it back into nitrogen gas. Legumes have evolved a mutualistic relationship with nitrogen-fixing bacteria that they house in special root nodules.

In nearly all ecosystems on Earth, energy comes ultimately from the Sun. Sunlight energy enters the biotic world when plants and other photosynthetic organisms use it to build organic molecules during photosynthesis. The rate at which producers build biomass is called primary productivity. From the producers, energy moves up the food chain. About 10% of the energy at one level of the food chain moves up to the next level. This percentage is rather low for several reasons. First, not all the organisms at one level of the food chain are eaten by organisms at the next level of the food chain. In addition, energy is lost in feces or goes into maintenance. This leaves only about 10% that contributes to the building of biomass (through growth and reproduction) at the next level of the food chain. The flow of energy through an ecosystem can be diagrammed using an energy pyramid.

Ecological succession describes how the community of species living in an ecosystem changes over time. Primary succession occurs when bare land (without soil) is colonized by successive waves of organisms. Secondary succession begins when existing life in a habitat is destroyed, but soil remains intact. As ecological succession proceeds, the biomass and biodiversity present in an ecosystem typically increase. The intermediate disturbance hypothesis argues that regular disturbances actually contribute to biodiversity, as long as these disturbances are not too extreme.