

Ecosystem

Introduction



Figure 1: A Roosevelt elk (*Cervus canadensis roosevelti*) grazes in the Hoh Rainforest in Olympic National Park in the state of Washington.

An ecosystem consists of all the living and nonliving things that occur together within a particular area. An ecosystem can be small, such as a family garden, or large, such as the Amazon rainforest. It may be terrestrial, such as a grassland, or aquatic, such as a pond or a coral reef. All of the organisms living within an ecosystem rely on each other for their survival.

An ecosystem includes abiotic, or nonliving, components, such as minerals, climate, soil, water, and sunlight. It also includes biotic, or living, elements, such as plants, animals, fungi, protists, and bacteria. The living and nonliving parts of an ecosystem are linked together by two major forces: the flow of energy through the ecosystem and the cycling of nutrients within the ecosystem.

Autotrophs and Heterotrophs

The fundamental source of energy in almost all ecosystems is the Sun. The energy of sunlight is used by plants, algae, and certain microorganisms to convert carbon dioxide and water into simple, energy-rich carbohydrates. This process is called photosynthesis. Organisms that can undergo photosynthesis are called autotrophs. They use the energy stored within the simple carbohydrates to produce complex organic compounds, such as proteins, lipids, and starches. These compounds maintain the organisms' life processes.

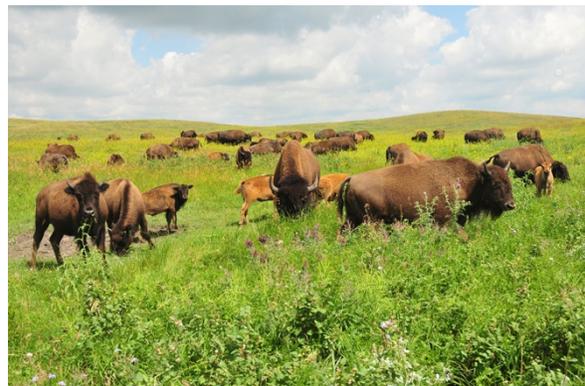


Figure 2: Grasses, flowers, and shrubs are autotrophs—organisms that make their own food through photosynthesis. Bison and other animals are heterotrophs, meaning they depend on other organisms for food.



Figure 3: A wetland ecosystem is characterized by poorly drained mineral soils and by plant life dominated by grasses.

The organic matter that is generated by autotrophs sustains heterotrophs. These are the consumers of the ecosystem. Heterotrophs cannot make their own food. Instead, they use, rearrange, and ultimately decompose the complex organic materials synthesized by the autotrophs. All animals and fungi are heterotrophs, as are many protists and most bacteria.

Trophic Levels

Together, autotrophs and heterotrophs form various trophic (feeding) levels in the ecosystem. The first level contains the producers—organisms that make their own food. This level is occupied by the ecosystem’s autotrophs. The next level contains the primary consumers—organisms that feed on producers. Then comes the secondary consumer level, which contains organisms that feed on primary consumers. The next level contains tertiary consumers, which feed on secondary consumers. The amount of available energy decreases as it flows from one level to the next, so most ecosystems can only support four trophic levels (producers through tertiary consumers). The relationship among trophic levels is often described using a model called an energy pyramid.

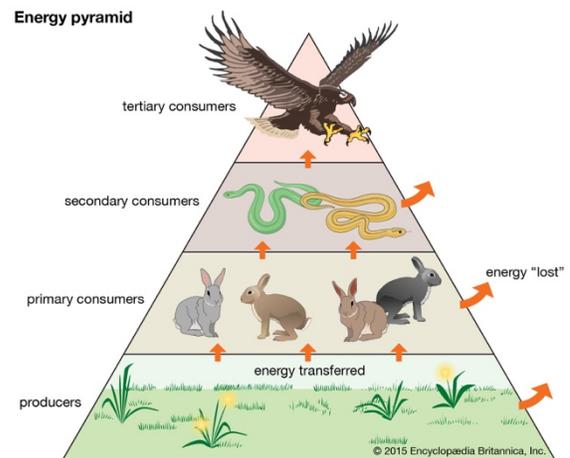


Figure 4: An energy pyramid is a model that shows the flow of energy from one trophic level to the next along a food chain. The pyramid base contains producers—organisms that make their own food from inorganic substances. All other organisms in the pyramid are c

Food Chains and Food Webs

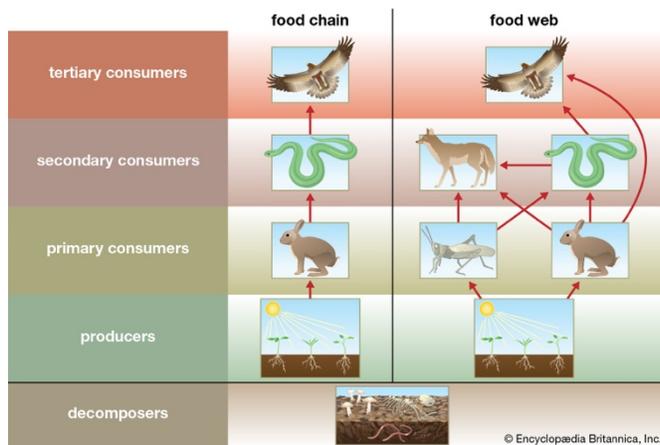
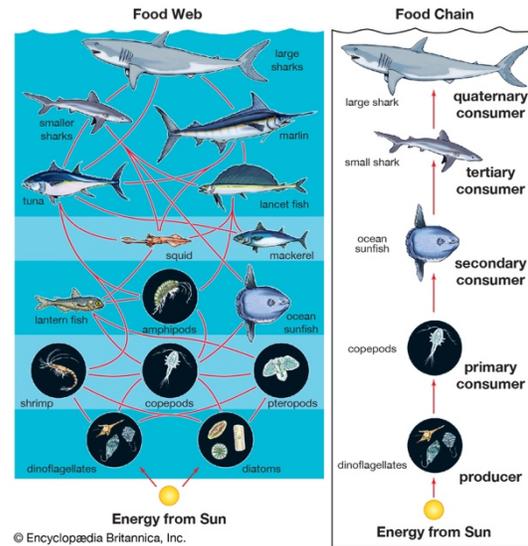


Figure 5: A food chain shows how matter and energy from food are transferred from one organism to another. In a natural ecosystem, many food chains intertwine to form a complex food web.

The final link in the food web leads to the decomposers—those heterotrophs that break down dead organisms and organic wastes. Fungi, bacteria, insects, and worms are among the most important decomposers.

The movement of energy and organic matter from one organism to another makes up a food chain. A typical food chain in a grassland might move from grasses (producer) to rabbits (primary consumers that eat grasses) to snakes (secondary consumers that eat rabbits) to hawks (tertiary consumers that eat snakes). Ecosystems contain many food chains that overlap and interconnect to form a food web.



Human Impacts on Ecosystems

Human activities have profound effects on ecosystems. For example, removing vegetation and exhausting surface water and groundwater stores disrupts food webs. It can also lead over time to desertification, or the spread of a desert environment into nondesert areas. Deforestation, specifically clear-cutting or burning forests for agriculture or for other human uses, removes habitat for woodland organisms. The practice of burning forests also releases carbon dioxide, a greenhouse gas, into the atmosphere in vast quantities.



Figure 6: Organisms in a community are linked through what they eat and what eats them. A food chain is a single pathway connecting a producer with several levels of consumers. In a typical marine food chain, dinoflagellates convert energy from sunlight into food web.

Urbanization, the development of natural lands for towns and roads, degrades and destroys habitats. It also contributes to air, water, and soil pollution. The release of chemical wastes and of many tons of garbage, especially plastic materials, into the environment threatens the very survival of all organisms in an ecosystem, including humans. Many governments and other authorities now recognize the threat that environmental pollution poses to natural ecosystems and work toward responsible ecosystem management. In addition, conservationists work toward the dual goal of preserving natural ecosystems while insuring that human needs for resources are met.

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