46.1B: Food Chains and Food Webs

Learning Objectives

- Distinguish between food chains and food webs as models of energy flow in ecosystems

In ecology, a food web describes the feeding connections between organisms in a biotic community. Both energy and nutrients flow through a food web, moving through organisms as they are consumed by an organism above them in the food web. A single path of energy through a food web is called a food chain.

Trophic Levels

Each organism within a food web can be classified by trophic level according to their position within the web. Depending on an organism’s location in a food web, it may be grouped into more than one of these categories. Energy and nutrients move up trophic levels in the following order:

1. Primary producers
2. Primary consumers
3. Secondary consumers
4. Tertiary and other high-level consumers

In both food webs and food chains, arrows point from an organism that is consumed to the organism that consumes it. In many ecosystems, the bottom of the food chain consists of photosynthetic organisms, such as plants or phytoplankton, known as primary producers. The organisms that consume the primary producers are herbivores: the primary consumers. Secondary consumers are usually carnivores that eat the primary consumers, while tertiary consumers are carnivores that eat other carnivores. Higher-level consumers feed on the next lower trophic levels, and so on, up to the
organisms at the top of the food chain, which are called the apex consumers. Some lines within a food web may point to more than one organism; those organisms may occupy different trophic levels depending on their position in each food chain within the web.

![Food web](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/46%3A_E...

The Loss of Energy in Tropic Levels

It is rare to find food chains that have more than four or five links because the loss of energy limits the length of food chains. At each trophic level, most of the energy is lost through biological processes such as respiration or finding food. Only the energy that is directly assimilated into an animal's consumable mass will be transferred to the next level when that animal is eaten. Therefore, after a limited number of trophic energy transfers, the amount of energy remaining in the food chain cannot support a higher trophic level. Although energy is lost, nutrients are recycled through waste or decomposition.
A scientist named Howard T. Odum demonstrated the loss of energy in each trophic level in the Silver Springs, Florida, ecosystem in the 1940s. He found that the primary producers generated 20,819 kcal/m²/yr (kilocalories per square meter per year), the primary consumers generated 3368 kcal/m²/yr, the secondary consumers generated 383 kcal/m²/yr, and the tertiary consumers only generated 21 kcal/m²/yr. In each successive trophic level, the energy available to the next level decreased significantly.
Figure 

Types of Food Webs

Two general types of food webs are often shown interacting within a single ecosystem. As an example, a grazing food web has plants or other photosynthetic organisms at its base, followed by herbivores and various carnivores. A detrital food web consists of a base of organisms that feed on decaying organic matter (dead organisms), called decomposers or detritivores. These organisms are usually bacteria or fungi that recycle organic material back into the biotic part of the ecosystem as they themselves are consumed by other organisms. As all ecosystems require a method to recycle material from dead organisms, most grazing food webs have an associated detrital food web. For example, in a meadow ecosystem, plants may support a grazing food web of different organisms, primary and other levels of consumers, while at the same time supporting a detrital food web of bacteria, fungi, and detrivorous invertebrates feeding off dead plants and animals.

Key Points

- Organisms can be organized into trophic levels: primary producer, primary consumer, secondary consumer, and tertiary or higher-order consumer.
- Energy decreases in each successive trophic level, preventing more than four or five levels in a food chain.
- An ecosystem usually has two different types of food webs: a grazing food web based on photosynthetic plants or algae, along with a detrital food web based on decomposers (such as fungi).
- There are different types of food webs including grazing food webs based on photosynthetic plants (such as algae) or detrital food webs based on decomposers (such as fungi).

Key Terms

- detritivore: an organism that feeds on detritus; a decomposer
- food chain: the feeding relationships between species in a biotic community; a linear path through a food web
- trophic level: a particular position occupied by a group of organisms in a food chain (primary producer, primary consumer, secondary consumer, or tertiary consumer)