

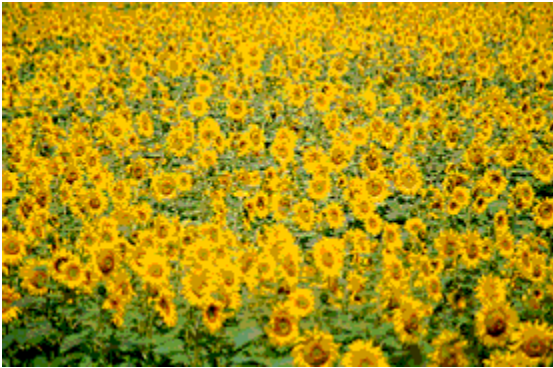
Ecosystems - Trophic Levels

*The organization of communities is based on the use of energy from the Sun within a given ecosystem. Organisms within a community are dependent on the survival of the other organisms because **energy is passed from one organism to another**.*

The Sun's energy cycles through ecosystems from producers through consumers and back into the nutrient pool through decomposers.

A **trophic level** describes the feeding level of an organism. Producer, decomposer, primary consumer, secondary consumer, and tertiary consumer are all trophic levels that can be used to describe an organism's place in an ecosystem.

Producers



Producers are organisms that are able to synthesize food molecules from inorganic compounds. Green plants, such as sunflowers, are producers because they can make their own food using energy from the Sun during a process called *photosynthesis*. Other producers include algae and some kinds of bacteria and protists.

All other organisms in an ecosystem depend on producers for energy.

Consumers

Consumers are organisms that get energy by feeding on producers (e.g., plants) or other consumers.

There are three main kinds of consumers: primary consumers, secondary consumers, and tertiary consumers. The classification given to a consumer depends on where it is located in a food chain.

- *Primary consumers* are animals that eat producers. Primary consumers are also called *herbivores* because they eat only plants. A deer that eats only leaves and grass is a primary consumer and an herbivore.

- *Secondary consumers* are organisms that eat primary consumers. Secondary consumers can be *carnivores* if they eat only animals. Or, they can be *omnivores* if they eat both animals *and* plants. A wolf that kills and eats a deer is a secondary consumer and a carnivore.



Consumers eat other organisms. Deer are primary consumers. Wolves are secondary consumers.

- *Tertiary consumers* eat secondary consumers, and they may be carnivores or omnivores. A bear that eats a fish that has fed on other fish is a tertiary consumer. Since the bear also eats berries and other plants, it is an omnivore.

Decomposers



Decomposers are organisms that consume dead organisms. As they break down dead organic matter, decomposers release nutrients back into the soil, water, and atmosphere.

The role that decomposers play in an ecosystem is crucial. Decomposers are important for the carbon, nitrogen, phosphorus, and oxygen cycles. The nutrients that decomposers release into the soil are also used by producers to make complex organic molecules. Fungi, such as mushrooms, are examples of decomposers. Some kinds of bacteria are also decomposers.

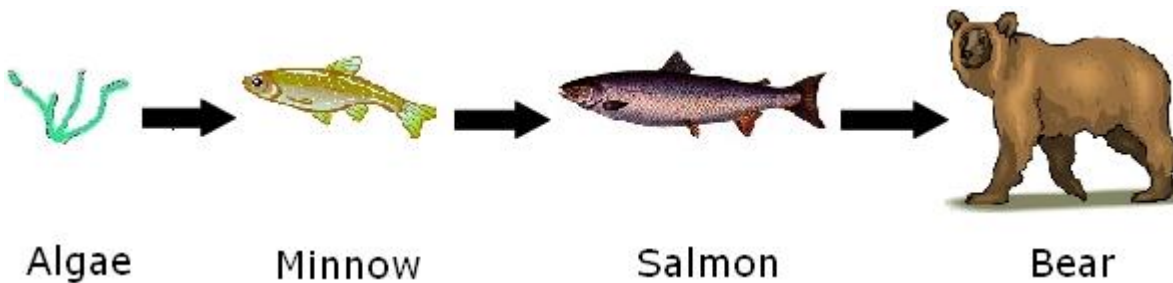
The Flow of Energy Through an Ecosystem

The ultimate source of energy for all ecosystems is the Sun. Only producers can convert solar energy into food energy. Therefore, all other organisms depend on producers for their energy needs.

Food Chains

A **food chain** describes the feeding relationships and energy flow between species within an ecosystem.

Producers receive energy from the Sun and make food. Producers are the beginning of a food chain because all of the other organisms in the food chain depend on the food energy that is made by producers. The next organisms in the food chain are **primary consumers**, which eat producers. Next come **secondary consumers**, then tertiary consumers, and so forth until the top carnivore is reached. All organisms in the food chain are decomposed by decomposers.

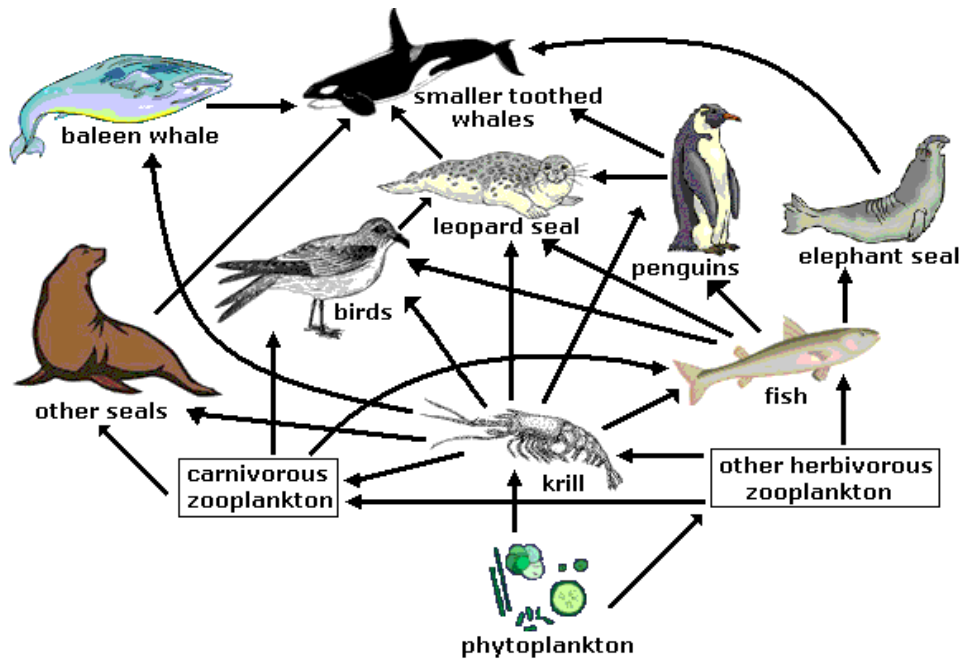


This food chain shows the flow of energy from a producer, algae, to the consumers in the ecosystem. Minnows are primary consumers, salmon are secondary consumers, and bears are tertiary consumers.

The arrows in a food chain or a food web represent the direction of energy flow. The arrow points from the organism that is being consumed to the organism that is receiving energy. For example, in the food chain above, the arrow points from the algae to the minnow. This means that the minnow is consuming the algae and receiving energy.

Food Webs

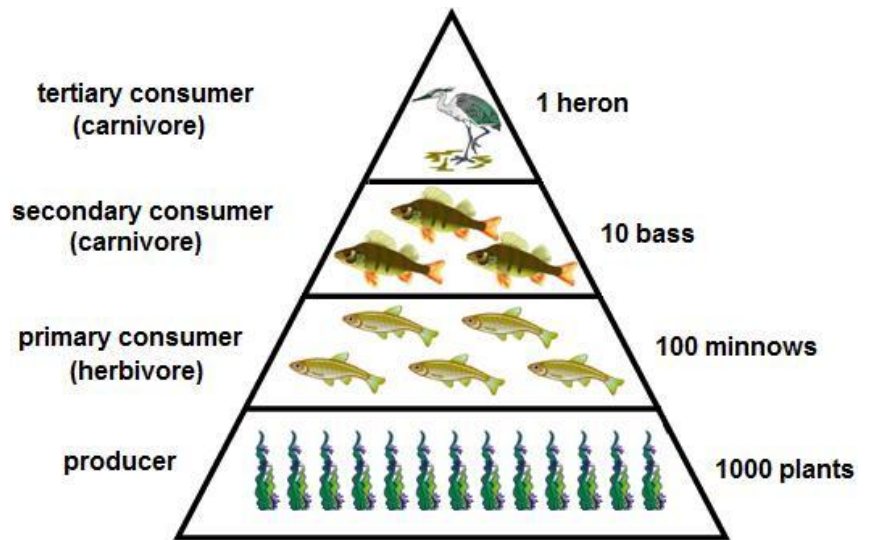
A **food web** is a group of interconnected food chains. Organisms within a food web can belong to more than one trophic level, or feeding level. For example, in the food web below, krill are both primary and secondary consumers. Krill are primary consumers because they eat phytoplankton, which are producers. Krill are also secondary consumers because they eat carnivorous zooplankton, which are primary consumers.



An Antarctic food web is shown in the picture above. Organisms in food webs can belong to more than one feeding level.

Energy Pyramid

An **energy pyramid** is a diagram that shows the relative amounts of energy located within each trophic level. The trophic levels are stacked one on top of another, with the producers on the bottom. Each level in an energy pyramid has less energy available to it than the level below.



Most of the stored energy in an ecosystem is in plants and other producers. This is because most of the energy in an energy pyramid is used or lost as heat energy as it moves up the pyramid. In fact, only about 10% of the energy produced at each level is available to the one above it. This is the reason that consumers in an ecosystem cannot outnumber producers and predators cannot outnumber prey.

The size of each level of the energy pyramid is determined by the amount of energy stored in the organisms at that trophic level.

An average of only 10% of the energy from the previous level moves to the next level. The rest is used up or **lost as heat energy**.