

Flow of Energy

Douglas Wilkin, Ph.D.
Jean Brainard, Ph.D.

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AUTHORS

Douglas Wilkin, Ph.D.

Jean Brainard, Ph.D.

CHAPTER 1

Flow of Energy

- Describe energy flows through ecosystems.
- Distinguish photoautotrophs from chemoautotrophs.
- Distinguish herbivores from carnivores and omnivores.
- Explain the role of decomposers.
- Compare scavengers to detritivores and to saprotrophs.



What is happening inside each leaf and blade of grass?

Photosynthesis. Maybe the most important biochemical reaction of Earth. As sunlight shines down on this forest, the sunlight is being absorbed, and the energy from that sunlight is being transformed into chemical energy. That chemical energy is then distributed to all other living organisms in the ecosystem.

Flow of Energy

To survive, ecosystems need a constant influx of energy. Energy enters ecosystems in the form of sunlight or chemical compounds. Some organisms use this energy to make food. Other organisms get energy by eating the food.

Producers

Producers are organisms that produce food for themselves and other organisms. They use energy and simple inorganic molecules to make organic compounds. The stability of producers is vital to ecosystems because all organisms need organic molecules. Producers are also called **autotrophs**. There are two basic types of autotrophs: photoautotrophs and chemoautotrophs.

1. **Photoautotrophs** use energy from sunlight to make food by photosynthesis. They include plants, algae, and certain bacteria (see **Figure 1.1**).
2. **Chemoautotrophs** use energy from chemical compounds to make food by chemosynthesis. They include some bacteria and also archaea. Archaea are microorganisms that resemble bacteria.

Photoautotrophs and Ecosystems Where They are Found



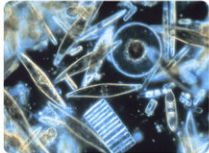

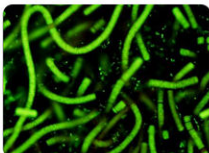

Type of Photoautotroph	Examples		Type of Ecosystem(s)
Plants	 <i>Trees</i>	 <i>Grasses</i>	Terrestrial
Algae	 <i>Diatoms</i>	 <i>Seaweed</i>	Aquatic
Bacteria	 <i>Cyanobacteria</i>	 <i>Purple Bacteria</i>	Aquatic Terrestrial

FIGURE 1.1

Different types of photoautotrophs are important in different ecosystems.

Consumers

Consumers are organisms that depend on other organisms for food. They take in organic molecules by essentially “eating” other living things. They include all animals and fungi. (Fungi don’t really “eat”; they absorb nutrients from other organisms.) They also include many bacteria and even a few plants, such as the pitcher plant shown in **Figure 1.2**. Consumers are also called heterotrophs. Heterotrophs are classified by what they eat:

- **Herbivores** consume producers such as plants or algae. They are a necessary link between producers and other consumers. Examples include deer, rabbits, and mice.
- **Carnivores** consume animals. Examples include lions, polar bears, hawks, frogs, salmon, and spiders. Carnivores that are unable to digest plants and must eat only animals are called obligate carnivores. Other carnivores can digest plants but do not commonly eat them.
- **Omnivores** consume both plants and animals. They include humans, pigs, brown bears, gulls, crows, and some species of fish.

Decomposers

When organisms die, they leave behind energy and matter in their remains. **Decomposers** break down the remains and other wastes and release simple inorganic molecules back to the environment. Producers can then use the

**FIGURE 1.2**

Pitcher Plant. Virtually all plants are producers. This pitcher plant is an exception. It consumes insects. It traps them in a sticky substance in its “pitcher.” Then it secretes enzymes that break down the insects and release nutrients. Which type of consumer is a pitcher plant?

molecules to make new organic compounds. The stability of decomposers is essential to every ecosystem. Decomposers are classified by the type of organic matter they break down:

- **Scavengers** consume the soft tissues of dead animals. Examples of scavengers include vultures, raccoons, and blowflies.
- **Detritivores** consume **detritus**—the dead leaves, animal feces, and other organic debris that collects on the soil or at the bottom of a body of water. On land, detritivores include earthworms, millipedes, and dung beetles (see **Figure 1.3**). In water, detritivores include “bottom feeders” such as sea cucumbers and catfish.
- **Saprotrophs** are the final step in decomposition. They feed on any remaining organic matter that is left after other decomposers do their work. Saprotrophs include fungi and single-celled protozoa. Fungi are the only organisms that can decompose wood.

**FIGURE 1.3**

Dung Beetle. This dung beetle is rolling a ball of feces to its nest to feed its young.

KQED: Banana Slugs: The Ultimate Recyclers

One of the most beloved and iconic native species within the old growth redwood forests of California is the Pacific Banana Slug. These slimy friends of the forest are the ultimate recyclers. Feeding on fallen leaves, mushrooms or even dead animals, they play a pivotal role in replenishing the soil. QUEST goes to Henry Cowell Redwoods State Park near Santa Cruz, California on a hunt to find *Ariolimax dolichophallus*, a bright yellow slug with a very big personality. See <http://www.kqed.org/quest/television/science-on-the-spot-banana-slugs-unpeeled> for more information.



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Summary

- Ecosystems require constant inputs of energy from sunlight or chemicals.
- Producers use energy and inorganic molecules to make food.
- Consumers take in food by eating producers or other living things.
- Decomposers break down dead organisms and other organic wastes and release inorganic molecules back to the environment.

Explore More

Use this resource to answer the questions that follow.

- **The Theme of Ecosystem Energy Flow in Ecology: Organisms and Their Environments** at <http://www.shmoop.com/ecology/ecosystem-energy-flow.html> .

1. What is the ultimate source of most energy in most ecosystems?
2. How does most energy enter ecosystems?
3. What is the role of a producer? Give an example of a producer.
4. What do primary consumers eat?
5. How much energy does an organism pass to the organism that eats it?
6. If a plant captures 1000 calories of solar energy, how much energy is passed to the bird that ate the bug that ate the plant?

Review

1. Identify three different types of consumers. Name an example of each type.
2. What are photoautotrophs? Give an example of one.
3. What can you infer about an ecosystem that depends on chemoautotrophs for food?
4. What is the role of decomposers?
5. What do scavengers do? Give an example of a scavenger.

References

1. Tree: User:Haabet/Wikimedia Commons; Grass: User:Polishname/Wikipedia; Diatoms: Gordon T. Taylor/Stony Brook University/NOAA; Seaweed: User:Flyingdream/Wikipedia; Cyanobacteria: Barry H. Rosen/USGS; Purple bacteria: Janice Carr/CDC. [Photoautotrophs include plants, algae, and bacteria and can be found in terrestrial and aquatic ecosystems](#) . Public Domain
2. Tim Mansfield. [A pitcher plant is different from other plants because it is not a producer, it is a consumer](#) . CC BY 2.0
3. Amy Goldstein. [A dung beetle is an example of a detritivore](#) . CC BY 2.0