

Ecosystems

What is an ecosystem?

An ecosystem is made up of the living creatures and the nonliving things that those creatures need within an area. Energy moves through an ecosystem in one direction. Nutrients cycle through different parts of the ecosystem and can enter or leave the ecosystem at many points.

Populations, communities, ecosystems

A **population** consists of all individuals of a single species that occur together at a given place and time. A **species** is a single type of organism that can interbreed and produce fertile offspring. All the populations living together in the same area make up a **community**. An ecosystem is all the living things in a community and the physical and chemical factors that they interact with. The living organisms within an ecosystem are its **biotic factors**. Living things include bacteria, algae, fungi, plants, and animals.

Physical and chemical features are **abiotic factors**. Abiotic factors include resources living organisms need like light, oxygen, water, carbon dioxide, good soil, and nitrogen, phosphorus, and other nutrients. Abiotic factors also include environmental features that are not materials or living things, like living space and the right temperature range.

An organism's habitat is where it lives. The important characteristics of a habitat include climate, the availability of food, water and other resources, and other factors, such as weather. A habitat may be a hole in a cactus or the underside of a fern in a rainforest. It may be a large area of savanna.

Roles in ecosystems

There are many different types of ecosystems. A few examples of some ecosystems are a rainforest, chaparral, tundra, and desert. Different organisms live in different ecosystems, which is largely due to climate. Reptiles thrive in deserts but would not survive in polar ecosystems. Despite the differences in location and climate, each ecosystem has roles that living organisms fill. Here are the main roles in each ecosystem:

Producers – these organisms produce their own energy. There are two types of producers. Most producers take energy from the Sun and convert it into chemical energy through **photosynthesis**. Photosynthesizing organisms use carbon dioxide (CO₂) and water (H₂O) to produce sugar (C₆H₁₂O₆) and oxygen (O₂). This food can be used immediately or stored for future use. Another tiny group of producers can create usable chemical energy from chemicals, without relying on sunlight. This process is known as **chemosynthesis**. This typically takes place at the bottom of the ocean, where bacteria can break down chemicals to produce food energy.

Consumers – these organisms use the food energy created by the producers. There are many types of consumers. **Herbivores** (deer) eat producers directly, breaking down plant structures to get energy.

Carnivores (tigers) eat other animals. **Omnivores** (bears) eat plants and animals, as well as fungi, bacteria, and organisms from other kingdoms.

There are also many different feeding relationships between organisms in an ecosystem. **Predators** are animals that kill other animals. **Prey** is the animal a predator kills. **Scavengers** (hyenas) eat animals that are already dead. **Decomposers** (mostly bacteria but also some fungi) break apart dead organisms and return the nutrients to the ecosystem for living organisms, acting as recyclers.

Energy and food chains

Energy flows through an ecosystem in one direction beginning with the producers, whose main source of energy is the Sun. This energy passes through the ecosystem from organisms at one **trophic level** to organisms in the next trophic level. Trophic level is each of several hierarchical levels in an ecosystem, comprising organisms that share the same function in the food chain and the same nutritional relationship to the primary sources of energy. Producers are the first trophic level, herbivores the second, carnivores the third, etc.

Organisms in each trophic level consume about 90% of the energy that reaches that level. This energy is used for movement, staying warm, and reproduction. Animals at the second trophic level have only about 10% as much energy available to them as those in the trophic level below. This 10% rule continues all the way up through each trophic level as energy is passed up the **food chain**. Because only 10% of the energy is passed up the food chain, each level can support fewer organisms. This makes a typical food chain look like pyramid as there are far fewer organisms at the top trophic level than at the bottom.

Of course, the idea of a food chain is a simple one as it means that one level only eats what is directly in the level below. Many organisms feed at more than one trophic level, meaning the concept of a **food web** is more accurate than a food chain. A food web recognizes that many organisms eat at multiple trophic levels. A food web includes the relationships between producers, consumers, and decomposers.

Relationships between species

Species have different types of relationships with each other. **Competition** happens when different species are trying to use the same resources. Too much competition means that one species needs to move or adapt. If this does not work and the competition continues, one species will die out.

Some relationships between species are beneficial to at least one of the two interacting species. These relationships are known as **symbiosis** and there are three types.

Mutualism – the relationship benefits both species. Most plant-pollinator relationships are mutually beneficial. Birds get food from plants and the bird then spreads the seeds of the plant.

Commensalism – the relationship benefits one of the species but does not harm or help the other. An example is a bird building a nest in a tree.

Parasitism – the parasite species benefits, and the host is harmed. Parasites do not usually kill their hosts as they need the host's body to survive. An example is a tapeworm attaching itself to the intestines of a cow, eating the cow's partly digested food and depriving the host of nutrients.