

## Dynamics of Ecosystems

### What is Ecology?

**Ecology** is the scientific study of interactions among organisms and their environments. **Ecologists** are scientists who study ecology.

Some examples of things that an ecologist might study include:

- What does a coyote eat?
- How does the length of the day affect the behavior of migrating birds?
- How do tiny shrimp help rid ocean fishes of parasites?
- How does acid rain threaten some of Earth's forests?

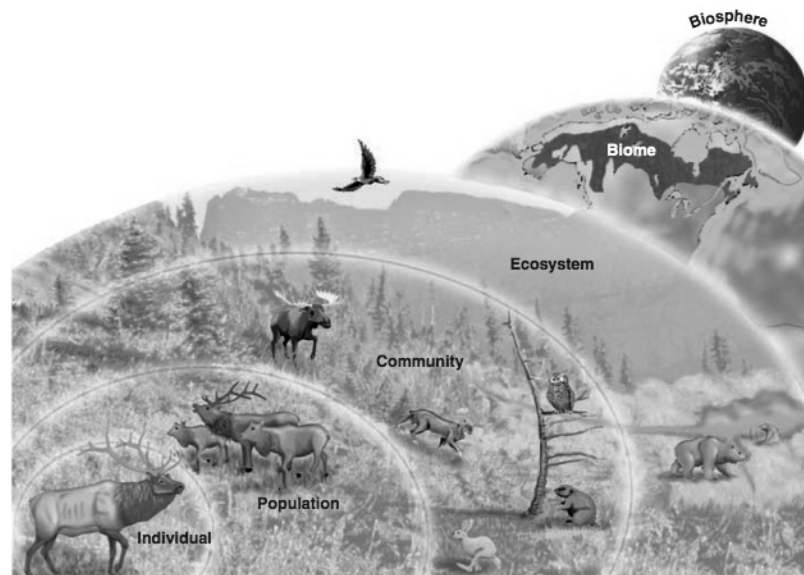
Ecological study reveals relationships among the living and nonliving parts of the world. The nonliving parts of an organism's environment are the **abiotic factors**. Examples of abiotic factors include:

- air currents (wind)
- temperature
- moisture
- light
- soil

All the living organisms that inhabit an environment are called **biotic factors**. Both biotic and abiotic factors can have obvious effects on living things and are, therefore, part of ecological study.

### Levels of Organization in Ecology

To help them understand the interactions of the biotic and abiotic parts of the world, ecologists have organized the living world into levels, as shown below:



An **individual** is a single member of a species.

A **population** is a group of individuals of the same species that interbreed and live in the same place at the same time. The members of a population may compete for food, water, and other resources. This will usually only happen if resources are in short supply.

A **community** is a collection of interacting populations. A change in one population in a community will cause changes in the other populations. For example, if the population of hawks in an area increases, the population of mice in the same area will decrease.

An **ecosystem** is made up of the interactions among the populations in a community (e.g. bird eats insect) and the community's physical surroundings (or abiotic factors). There are three major kinds of ecosystems:

1. Terrestrial
  - located on land
  - e.g. forests, meadows, deserts
2. Freshwater
  - located in freshwater
  - e.g. ponds, lakes, rivers
3. Marine
  - located in saltwater
  - e.g. oceans

Areas that are similar in climate and other physical factors are often inhabited by similar communities. Such areas are known as biomes. A **biome** is an area of the planet that can be classified according to the plants and animals that live in it. A biome is often made up of several ecosystems. For example, an aquatic biome might contain ecosystems such as coral reefs and kelp forests.

Earth is made up of two main types of biomes:

1. Land
  - e.g. tundra, taiga, temperate deciduous forest, grassland, tropical rain forest, and desert
2. Aquatic
  - e.g. freshwater, marine, and estuaries

The **biosphere** is the portion of Earth that supports life. It extends from high in the atmosphere to the bottom of the oceans.

## Organisms in Ecosystems

A **habitat** is the place where an organism lives out its life. Although several species may share a habitat, they often use the resources of that habitat in different ways. A **niche** is the role a species has in its environment — how it meets its needs for food and shelter, how it survives, and how it reproduces.

A species' niche includes all of its interactions with the biotic and abiotic parts of its habitat. It is an advantage for one species to occupy a different niche from those of other species. For example, two species might live in the same habitat but if one of them eats fish and the other eats plants (2 different niches), then they do not have to compete for food. This lack of competition makes life easier for both species.

## Interactions Within (and Between) Communities

The species in a community interact with one another in many ways. Plant species, for example, compete with each other for water, nutrients, and sunlight. Herbivores compete with each other to eat the plants. Carnivores compete with each other to eat the herbivores (and, possibly, other carnivores).

The examples above are known as **predator-prey relationships**. A predator is an animal that kills and eats other animals (called prey).

In addition to predation, there are several other relationships that play an important role in nature. These relationships between organisms are called **symbiosis**.

**Commensalism** is a form of symbiosis in which one member benefits and the other is not harmed. For example, shrimp live in the tentacles of sea anemones. The shrimp receive protection from predators. The anemones are neither helped nor harmed by the presence of the shrimp.

**Mutualism** is a form of symbiosis in which both members benefit. For example, clownfish (Nemo) also live among the tentacles of sea anemones. The clownfish receive protection from predators. The anemones benefit because the clownfish chase away several species of fish that eat anemones.

**Parasitism** is a form of symbiosis in which one member benefits and the other is harmed. For example, mosquitos feed off of the blood of animals. The mosquito benefits (food), but the animal is potentially harmed by exposure to diseases carried by the mosquito (e.g. West Nile).



## Worksheet

1. Give two examples of biotic factors in an ecosystem.

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2. Give two examples of abiotic factors in an ecosystem.

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3. Explain the difference between a community and a population.

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4. Give an example that illustrates the difference between a habitat and a niche.

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5. A leaf-eating caterpillar turns into a nectar-eating butterfly. How is this feeding behavior an advantage for this species?

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