

Principles of Ecology

section 1 Organisms and Their Relationships

● Before You Read

On the lines below, list the organisms that you have encountered today. You share the same environment with these organisms. In this section you will learn how many organisms exist in the same environment.

MAIN Idea

Biotic and abiotic factors work together in an ecosystem.

What You'll Learn

- the differences between biotic and abiotic factors
- the levels of biological organization
- the difference between an organism's habitat and its niche

● Read to Learn

Ecology

Each living organism depends on nonliving factors for survival in its environment. Each living organism also depends on other living organisms in its environment. Green plants are a food source and can be a place where other organisms live. The animals that eat plants provide food for other organisms. Organisms depend on each other in all types of environments—deserts, tropical rain forests, and grassy meadows. **Ecology** is the study of the interactions between organisms and their environments.

What do ecologists do?

Scientists who study ecology are called ecologists. The German biologist Ernst Haeckel introduced the word *ecology* in 1866. Eventually, it became a separate field of study.

Ecologists use various tools and methods to observe, experiment, and create models. Ecologists conduct tests to learn why and how organisms survive. For example, tests might help explain how some organisms survive in cold water. ✓

Ecologists also learn about the interactions between organisms by observing them in their environments. Sometimes observations are made over long periods of time. This process is called longitudinal analysis.

Study Coach

Make an Outline Create an outline of this section. Use the headings to organize your outline. List details from what you have read to complete your outline.


✓ Reading Check

1. **List** three ways ecologists study interactions between organisms.

Why do ecologists use models?

Studying organisms in their environments is not always possible. Ecologists use models to represent a process or system in the environment. By using models, ecologists can control the number of variables. Scientists can measure the effect of each variable one at a time, on the model.

The Biosphere

The **biosphere** (BI uh sfhr) is the portion of Earth that supports life. Ecologists study what takes place in the biosphere. The biosphere includes the air, water, and land where organisms can live, both above and below the ground. 

The biosphere supports a wide variety of organisms in a wide range of conditions. Climates, soils, plants, and animals differ in different parts of the world. Frozen polar regions, deserts, and rain forests contain organisms. The organisms are adapted to survive in the conditions of their environments. The factors in all environments can be divided into two groups—living factors and nonliving factors.

What are biotic factors?

Biotic (bi AH tihk) **factors** are the living factors in an organism's environment. For example, the algae, frogs, and microscopic organisms in the stream are biotic factors for salmon in a stream. Other biotic factors live on the land bordering the stream. These include plants, insects, and small animals. Birds that feed on organisms in the stream are also part of the salmon's biotic factors. These factors interact directly or indirectly. The salmon depend on biotic factors for food, shelter, reproduction, and protection, and in turn can provide food for other organisms.

What are abiotic factors?

The nonliving factors in an organism's environment are called **abiotic** (ay bi AH tihk) **factors**. The abiotic factors for the salmon might be the temperature range of the water, the pH of the water, and the salt concentration of the water. For a plant, abiotic factors might include the amount of rainfall, the amount of sunlight, the type of soil, the range of air and soil temperatures, and the nutrients available in the soil.

Organisms are adapted to the abiotic factors in their natural environment. If an organism moves to a different location with a different set of abiotic factors, the organism must adjust, or it will die.

Reading Check

2. **Define** the biosphere.

Think it Over

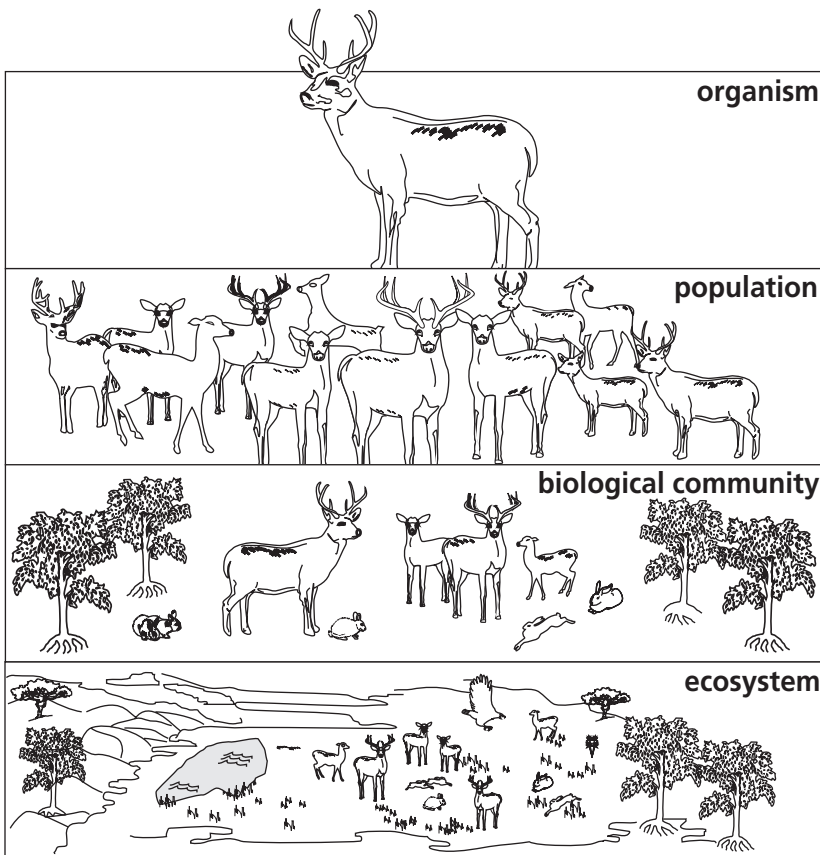
3. **Evaluate** Describe the abiotic factors in the environment where you currently live.

Levels of Organization

The biosphere is too large to study all the relationships at one time. Scientists use smaller pieces, or levels of organization, for their studies. The numbers and interactions among organisms increase at higher levels of organization. The following are levels of organization from simplest to most complex:

1. organism
2. population
3. biological community
4. ecosystem
5. biome
6. biosphere

The first four of these levels of organization are shown in the figure below.



How do available resources affect a population?

The lowest level of complexity that ecologists study is an individual organism. Individual organisms of the same species living in the same geographic location at the same time make up a **population**. A school of fish is a population. Individual organisms in the population must compete to survive. They compete for food, water, mates, and other resources.

Picture This

- 4. Generalize** How do the levels become more complex?

Reading Check

- 5. Identify** Which of the following is a population? (Circle your answer.)
- a. all rabbits living on Earth
 - b. all white-tailed rabbits living in a meadow today
 - c. all white-tailed rabbits that have ever lived in a meadow

 **Reading Check**


6. Draw Conclusions

If a population is growing, what can you conclude about the amount of resources available to the organisms?

 **Think it Over**

7. Explain the difference between a habitat and a niche.

What limits the size of a population?

A population can keep growing as long as resources are available to its members. If a population grows too large, there will not be enough resources for all members of the population. The population will get smaller until it reaches a number that can be supported by the available resources. 

What is a biological community?

A **biological community** is a group of populations that interact in the same geographic area at the same time. Organisms might or might not compete for available resources in a biological community. The plants and animals that live in a park are a biological community.

Who defines the boundaries of an ecosystem?

An **ecosystem** is a biological community and all the abiotic factors that affect it. Water temperature and available light are examples of abiotic factors. An ecosystem can be large or small. The ecologist defines the boundaries of the ecosystem. Boundaries can change or overlap each other.

A **biome** is a large group of ecosystems that share the same climate and have similar types of biological communities. All the biomes on Earth combine to form the biosphere.

Ecosystem Interactions

Organisms increase their chances of survival by using available resources in different ways. Birds might use a tree for shelter, while insects use the tree's leaves for food.

The tree is the habitat for the community of organisms that live there. A **habitat** is an area where an organism lives. An organism such as an insect might spend its entire life on one tree. Its habitat is that tree. A bird flies from tree to tree. Its habitat is the grove of trees.

Organisms also have a niche. A **niche** (NIHCH) is the role an organism has in its environment. It is how the species meets its specific needs for food and shelter. It is how and where the species survives and reproduces.

Community Interactions

Organisms living in biological communities interact constantly. Ecosystems are shaped by these interactions and the abiotic factors. In a biological community, each organism depends on other organisms and competes with other organisms.

When do organisms compete?

Competition occurs when organisms need to use the same resource at the same time. Organisms compete for such resources as food, water, space, and light. When strong organisms compete with weak organisms, the strong organisms usually survive. During a drought, water might be scarce for many organisms. Strong organisms will use the available water. Weak organisms might die or move to another location.

What is predation?

The act of one organism consuming another organism for food is **predation** (prih DAY shun). Most organisms obtain their food by eating other organisms. If you have seen a cat stalk and capture a mouse, you have seen a predator catch its prey. The organism that pursues—the cat—is the predator. The organism that is pursued—the mouse—is the prey. Predators can be plants, animals, or protists.

What is symbiosis?

Some species survive because of relationships with other species. A relationship in which two organisms live together in close association is called **symbiosis** (sihm bee OH sus). The three kinds of symbiosis are mutualism, commensalism, and parasitism.

Mutualism A relationship between two species that live together and benefit from each other is called **mutualism** (MYEW chuh wuh lih zum). A lichen (LI kun) is a mutualistic relationship between algae and fungi. The algae provide food for the fungi. The fungi provide a habitat for the algae. Food and shelter are the benefits of this relationship.

Commensalism A relationship in which one organism is helped and the other organism is not harmed or helped is called **commensalism** (kuh MEN suh lih zum). For example, mosses sometimes grow on tree branches. This does not harm or help the tree, but the mosses benefit from a good habitat.

Parasitism A relationship in which one organism benefits and another organism is harmed is called **parasitism** (PAYR us suh tih zum). When a tick lives on a dog, it is good for the tick but bad for the dog. The tick gets food and shelter, but the dog might get sick. The tick is the parasite and is helped by the relationship. The dog is the host. Usually the parasite does not kill the host, but it might harm or weaken it. If the host dies, the parasite will also die, unless it can find another host.



Think it Over

- 8. Classify** List two more examples of predation that you have seen or of which you have learned.



Think it Over

- 9. Apply** Clown fish live among sea anemones. The anemones provide protection for the clown fish. The clown fish eats food missed by the sea anemones. What term best describes this relationship?
