CAREERS IN BIOLOGY

Science Reporter

Does science fascinate you? Can you explain complex ideas and issues in a clear and interesting way? If so, you should consider a career as a science reporter.

Skills for the Job

As a science reporter, you are a writer first and a scientist second. A degree in journalism and/or a scientific field is usually necessary, but curiosity and good writing skills are also essential. You might work for newspapers, national magazines, medical or scientific publications, television networks, or Internet news services. You could work as a full-time employee or a freelance writer. You must read constantly to stay up-to-date. Many science reporters attend scientific conventions and events to find news of interest to the public. Then they carefully and accurately translate what's new so nonscientists can understand it.

*inter*NET CONNECTION For more careers in related fields, be sure to check the Glencoe Science Web Site.
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A key consideration of ecology is that living organisms affect other organisms. All the living organisms that inhabit an environment are called **biotic factors** (by AHT ihk). Ecologists investigate how biotic factors affect different species. To help them understand the interactions of the biotic and abiotic parts of the world, ecologists have organized the living world into levels.

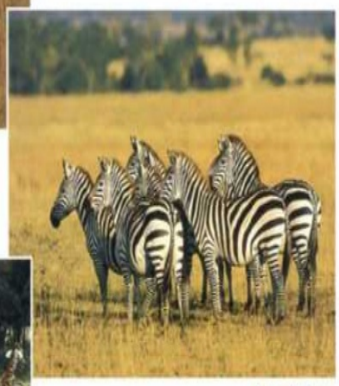
Levels of Organization in Ecology

The study of an individual organism, such as a male deer, known as a buck, might reveal what food items it prefers, how often it eats, and how far it roams to search for food or shelter. Although it spends a large part of its time alone, it does interact with other individuals of its species. For example, it periodically goes in search of a mate, which may require battling with other bucks.

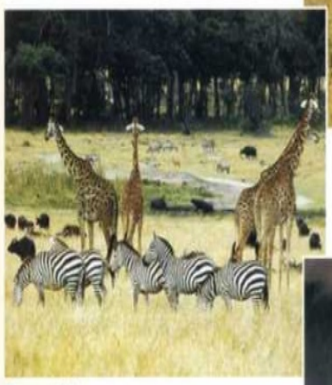
All organisms depend on others for food, shelter, reproduction, or protection. So you can see that the study of an individual would provide only part of the story of its life cycle. To get a more complete picture requires studying its relationships with other organisms.

Ecologists study interactions among organisms at several different

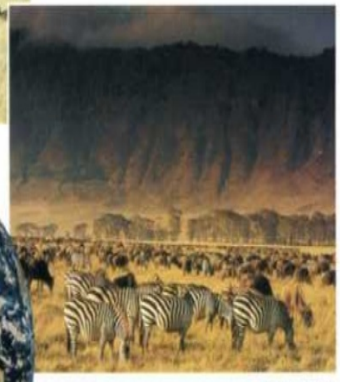
Organism



Populations



Communities



Ecosystems

Biosphere

Figure 2.4
Ecology deals with several levels of biological organization, including organisms, populations, communities, ecosystems, biomes, and the biosphere.

levels, as shown in ***Figure 2.4.*** They study individual organisms, interactions among organisms of the same species, and interactions among organisms of different species. Ecologists also study how abiotic factors affect groups of interacting species.

Figure 2.5
These marsh marigolds represent a population of organisms. What characteristics are shared by this group of flowers that make them a population?

Interactions within populations

The marsh marigolds shown in *Figure 2.5* form a population. A **population** is a group of organisms of one species that interbreed and live in the same place at the same time.

Members of the same population may compete with each other for food, water, or other resources. Competition occurs only if resources are in short supply. How organisms in a population share the resources of their environment determines how far apart organisms live and how large the populations become.

Some species have adaptations that reduce competition within a population. An example is the life cycle of a frog, shown in *Figure 2.6*. The juvenile stage of the frog, called the tadpole, not only looks very different from the adult but also has completely different food requirements. Many species of insects, including dragonflies and moths, also produce juveniles that differ from the adult in body form and food requirements.

Individuals interact within communities

No species lives independently of other species. Just as a population is made up of individuals, a community is made up of several populations. A **community** is a collection of interacting populations. An example of a community is shown in *Figure 2.7*.

A change in one population in a community will cause changes in the other populations. Some of these changes can be minor, such as when a small increase in the number of individuals of one population causes a small decrease in the size of another population.

For example, if the population of mouse-eating hawks increases slightly, the population of mice will, as a result, decrease slightly. Other changes might be more extreme, as when the size of one population

Figure 2.6
Adult frogs and their young have different food requirements. This limits competition for food resources for the species.

A Eggs that adult frogs lay in the water hatch into tadpoles. Tadpoles have gills, live in water, and eat algae and small aquatic creatures.

B Adult frogs live both on land and in the water. They breathe air and eat insects such as dragonflies, grasshoppers, and beetles.

grows so large it begins affecting the food supply for another species in the community.

Interactions among living things and abiotic factors form ecosystems

In a healthy forest community, interactions among populations might include birds eating insects, squirrels eating nuts from trees, mushrooms growing from decaying leaves or bark, and raccoons fishing in a stream. In addition to population interactions, ecologists also study interactions among populations and their physical surroundings in ecosystems. An **ecosystem** is made up of the interactions among the populations in a community and the community's physical surroundings, or abiotic factors.

There are three major kinds of ecosystems. Terrestrial ecosystems are those located on land. Examples include forests, meadows, and desert scrub. Aquatic ecosystems occur in both fresh- and saltwater. Freshwater ecosystems include ponds, lakes, and streams. Saltwater ecosystems, also called marine ecosystems, make up approximately 75 percent of Earth's surface. ***Figure 2.8*** shows a marine and a freshwater ecosystem.

Figure 2.7
Beech and maple trees dominate this forest community; therefore, it is called a beech-maple forest. Beech-maple forests are found in the eastern United States, Europe, and northeast China.

Figure 2.8
There may be hundreds of populations interacting in a pond or tide pool. How do you think the abiotic factors in these environments affect the biotic factors?

A Dragonflies live near moist meadows and ponds. They feed on small insects they catch while flying. Dragonflies lay their eggs in the pond or on pond plants.

B Organisms living in tide pools must survive dramatic changes in abiotic factors. When the tide is high, ocean waves replenish the water in the pool. When the tide is low, water in the pool evaporates.

Organisms in Ecosystems

A prairie dog living in a grassland makes its home in burrows it digs underground. Some species of birds make their homes in the trees of a beech-maple forest. In these forests, they find food, avoid enemies, and reproduce. The grassland and beech-maple forests are examples of habitats. A **habitat** (HAB uh tat) is the place where an organism lives out its life. Organisms of different species use a variety of strategies to live and reproduce in their habitats. Habitats can change, and even disappear, from an area. Examples of how habitats change due to both natural and human causes are presented in *Biology and Society* at the end of this chapter.

Niche

Although several species may share a habitat, the food, shelter, and other essential resources of that habitat are often used in different ways. For example, if you turn over a log like the one shown in ***Figure 2.9,*** you will find millipedes, centipedes, insects, and worms living there. At first, it looks like this community of animals is competing for food because they all live in the same habitat. But close inspection reveals that each feeds in different ways, on

Figure 2.9
This series of photographs shows how a habitat can be seen as a collection of several niches. As you can see, each species uses the available resources in a different way.

A A worm obtains nourishment from the organic material it eats as it burrows through the soil.

B A centipede is a predator that captures and eats beetles and other animals.

different materials, and at different times. These differences lead to reduced competition.

Each species is unique in satisfying all its needs; each species occupies a niche. A **niche** (nich) is the role and position 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 its interactions with the biotic and abiotic parts of its habitat. It is an advantage for a species to occupy a niche different from those of other species. Life may be harsh in the polar regions, but the polar bear, with its thick coat, flourishes there. Nectar may be deep in the flower, inaccessible to most species, but the hummingbird, with its long beak, gets it. Unique strategies and structures are important to a species' niche and important for reducing competition with other species.

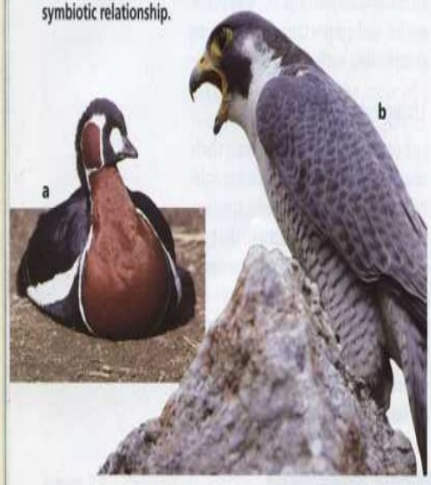
Living relationships

Some species enhance their chances of survival by forming relationships with other species. Biologists once assumed that all organisms living in the same environment are in a continuous battle for survival. Some interactions are harmful to one species, yet beneficial to another. Predators are animals such as lions and insect-eating birds that

D These ants eat dead insects.

C A millipede eats decaying leaves near the log.

Figure 2.10
Red-breasted geese (a) and peregrine falcons (b) both nest in the Siberian arctic in the spring. They share a symbiotic relationship.



kill and eat other animals. The animals that predators eat are called prey. Predator-prey relationships such as the one between lions and wildebeests involve a fight for survival. Use the *BioLab* at the end of this chapter to more closely examine a predator-prey relationship. But there are other relationships among organisms that help maintain survival in many species. The relationship in which there is a close and permanent association among organisms of different species is called **symbiosis** (sihm by OH sus). Symbiosis means living together.

There are several kinds of symbiosis. A symbiotic relationship between the peregrine falcon and red-breasted goose has evolved in the cold arctic region of Siberia in Russia, as shown in ***Figure 2.10.*** Normally, the peregrine falcon preys upon the red-breasted goose, but the falcon hunts away from its nesting area. During the nesting season, the falcon fiercely defends its territory from predators. The geese take advantage of this, choosing nesting areas close to those of the falcons, and are thereby protected from predators. The geese benefit from the relationship, and the falcon is neither benefited nor harmed. This is called a commensal relationship. **Commensalism** (kuh MEN suh lihz um) is a symbiotic relationship in which one species benefits and the other species is neither harmed nor benefited.

Figure 2.11
Spanish moss grows on and hangs from the limbs of trees but does not obtain any nutrients or cause any harm to the trees.

Commensal relationships also occur among plant species. Spanish moss, a kind of flowering plant that grows on the branch of a tree, is shown in ***Figure 2.11.*** Orchids, ferns, mosses, and other plants sometimes grow on the branches of larger plants. The larger plants are not harmed, but the smaller plants benefit from the additional habitat.

Sometimes, two species of organisms benefit from living in close association. A symbiotic relationship in which both species benefit is called **mutualism** (MYEW chuh lihz um). Ants and acacia trees living in the subtropical regions of the world illustrate mutualism, as shown in ***Figure 2.12.*** The ants protect the tree by attacking any animal that tries to feed on it. The tree provides nectar and a home

for the ants. In an experiment, ecologists removed the ants from some acacia trees. Results showed that the trees with ants grew faster and survived longer than trees without ants.

Sometimes, one organism harms another. Have you ever owned a dog or cat that was attacked by ticks or fleas? Ticks and fleas, shown in ***Figure 2.13***, are examples of parasites. A symbiotic relationship in which one organism derives benefit at the expense of the other is called **parasitism** (PER uh suh tihz um). Parasites have evolved in such a way that they harm, but usually do not kill, the host. If the host dies, the parasite also will die unless it can quickly find another host. Some parasites, such as tapeworms and roundworms, live inside other organisms.

Figure 2.12
These ants and acacia trees both benefit from living in close association. This mutualistic relationship is so strong that in nature the trees and ants are never found apart.

Figure 2.13
Ticks cause harm to the animals they live on when they obtain nutrients from their host animal. This relationship is called parasitism.

WORD Origin

ecology
From the Greek words *oikos*, meaning "homestead," and *logos*, meaning "the study of." Ecology is the study of how organisms interact with their environments.

Section Assessment

Understanding Main Ideas

1. List several different biotic and abiotic factors in an ecosystem.
2. Compare and contrast populations and communities.
3. Give examples that would demonstrate the differences between the terms niche and habitat.
4. A leaf-eating caterpillar turns into a nectar-eating butterfly. How is this feeding behavior an advantage for this species?

Thinking Critically

5. Clownfish are small, tropical marine fish usually found swimming among the stinging tentacles of sea anemones. What type of symbiotic relationship do these animals have if the clownfish are protected by the sea anemone, but the anemone does not benefit from the clownfish?

Skill Review

6. **Designing an Experiment** Design an experiment to test the hypothesis that clownfish and sea anemones have a mutualistic relationship. For more help, refer to *Practicing Scientific Methods* in the **Skill Handbook.**