



## Lesson 1

# Earth's Ecosystems

Chebe National Park, Botswana

### Look and Wonder

Think about the different living organisms that you see each day. How do living things, such as these African elephants, interact with one another and with nonliving things in their environments?

## Read and Learn

### Essential Question

What relationships and cycles exist in an ecosystem?

### Vocabulary

ecosystem, p.186

population, p.187

community, p.187

biotic factor, p.187

abiotic factor, p.187

symbiosis, p.190

competition, p.192

niche, p.192

### Reading Skill

Main Idea and Details

Main Idea	Details

### Technology

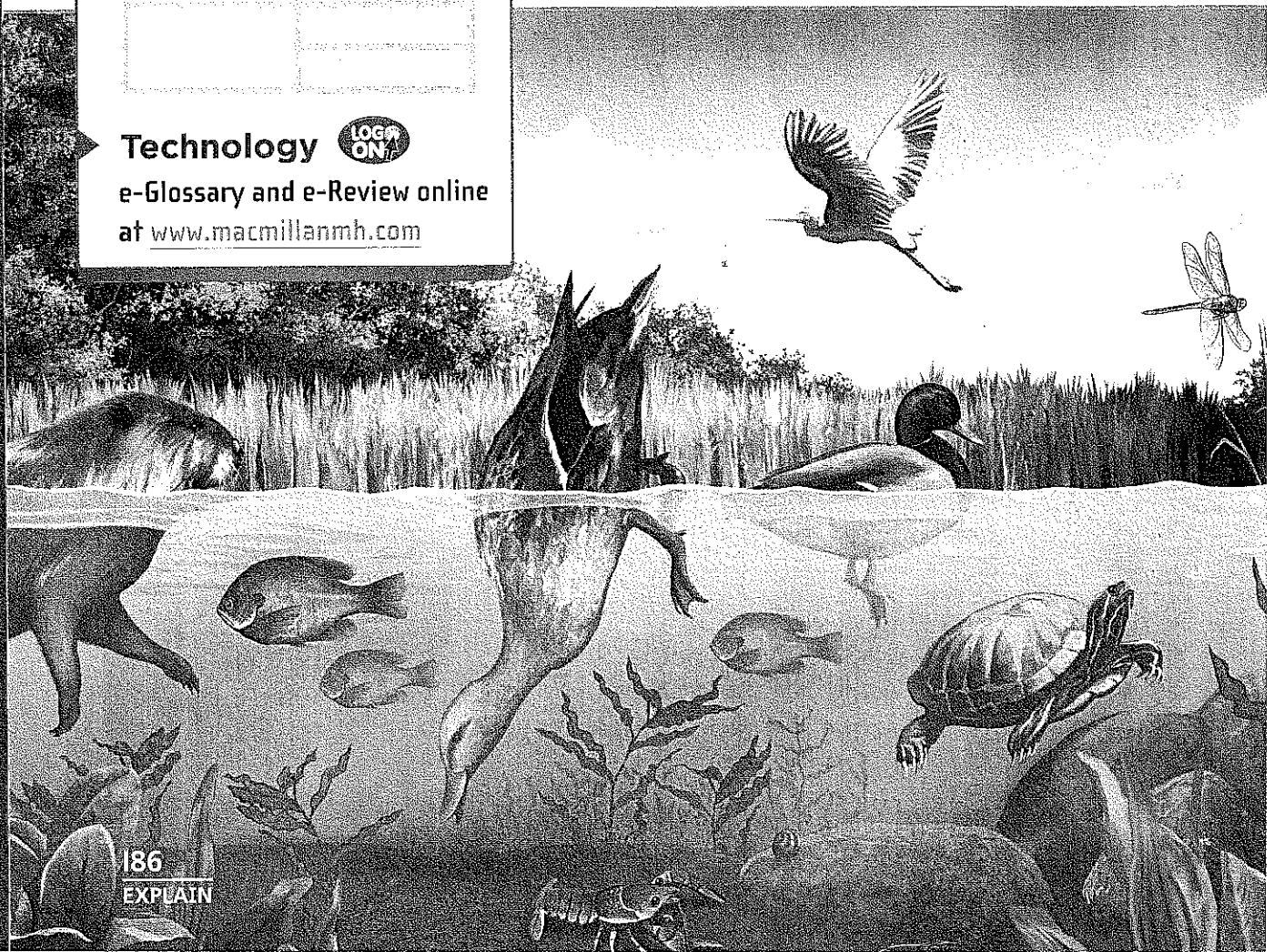
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## What makes up an ecosystem?

A *system* is a group of things that work together as a whole. Our bodies contain many different organ systems. Planets are part of a solar system. In each case the system is made up of parts that interact closely and affect one another.

The living things and nonliving things in an area make up an **ecosystem**. These things interact with their environment and with one another in a number of ways. For example, you depend on grocers for food, on your teachers for an education, and on stores for clothes and other necessities. All living things need water and nourishment to survive, and they depend on their environments for the basic requirements of life.

Organisms depend on one another and on their environments for the nutrients they need. Notice how the living things and the nonliving things in this pond environment affect the ecosystem. ▼



## Parts of an Ecosystem

All organisms of the same kind that live in a particular area make up a **population**. For example, the zebras living on an African savanna in Tanzania make up a population. Different ecosystems support different types of populations. Some populations of species are unique to a particular habitat. You would not find polar bears in Africa or a cactus at the South Pole. If populations do not have adaptations that enable them to survive in their ecosystems, they will disappear from the area or die out.

An ecosystem contains many populations. All the populations that live together in the same place make up a **community**. For example, populations of perch, frogs, turtles, algae, trees, and other organisms that live in or near a pond make up a pond community.

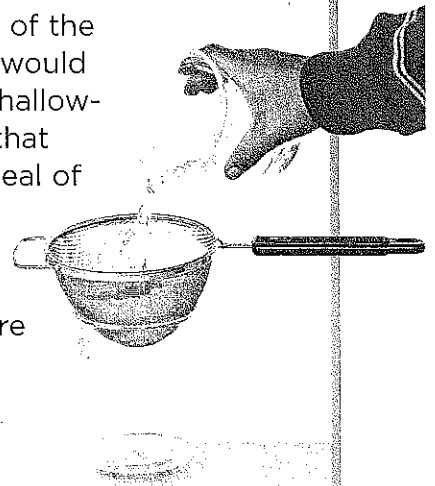
The various living things in an ecosystem, such as plants, animals, and bacteria, are known as **biotic factors**. The nonliving parts of an ecosystem, such as water, minerals, sunlight, air, and soil, are **abiotic factors**. Abiotic factors determine which kinds of organisms can live in a particular area.

Together, the biotic and abiotic factors in an ecosystem help determine the sizes of the populations that live there. What if a drought reduced the number of plants growing in a forest area? The deer population might decrease because of a lack of food. What would then happen to the coyotes that fed on the deer? Scientists measure biotic and abiotic factors in an ecosystem to calculate the ecosystem's health and productivity.

## Quick Lab

### Properties of Soil

- 1 **Experiment** Place a small amount of soil in a filter-lined strainer. Set the strainer on top of a beaker. Repeat this setup for the same amount of a different type of soil.
- 2 **Use Variables** Pour an equal amount of water into each of the soil samples. Watch both setups for the same amount of time. What are the dependent and independent variables in this experiment?
- 3 **Measure** Which soil sample allowed more water to pass through in the same amount of time?
- 4 **Predict** Which of the two soil types would be better for shallow-rooted plants that need a great deal of water? Design an experiment to test your idea. Then share your results.



### Quick Check

**Main Idea and Details** What makes up an ecosystem?

**Critical Thinking** Describe the ways in which a system in your community depends on the interaction of many of its parts.

## What kinds of interactions exist in an ecosystem?

A relationship between two kinds of organisms that lasts over time is called **symbiosis** (sim•bee•OH•suhs). Symbiosis can take many forms. Sometimes one organism benefits at the expense of another organism. At other times, one organism benefits, but the other is unaffected. In some cases both organisms benefit.

### Parasitism

How would you feel if someone took something from you? In nature this type of interaction occurs often. In a *parasitic* relationship, an organism of one species benefits at the expense of an organism of another species. The organism that benefits from the relationship is called a parasite, and the organism that is harmed is called a host.

Many species of wasps are parasitic. Parasitic female wasps lay their eggs in the bodies of other insects or spiders. As the young wasps develop, they feed on the host. Eventually, this kills the host. In time the young wasps are able to survive on their own. They then emerge from the host and complete their life cycle.

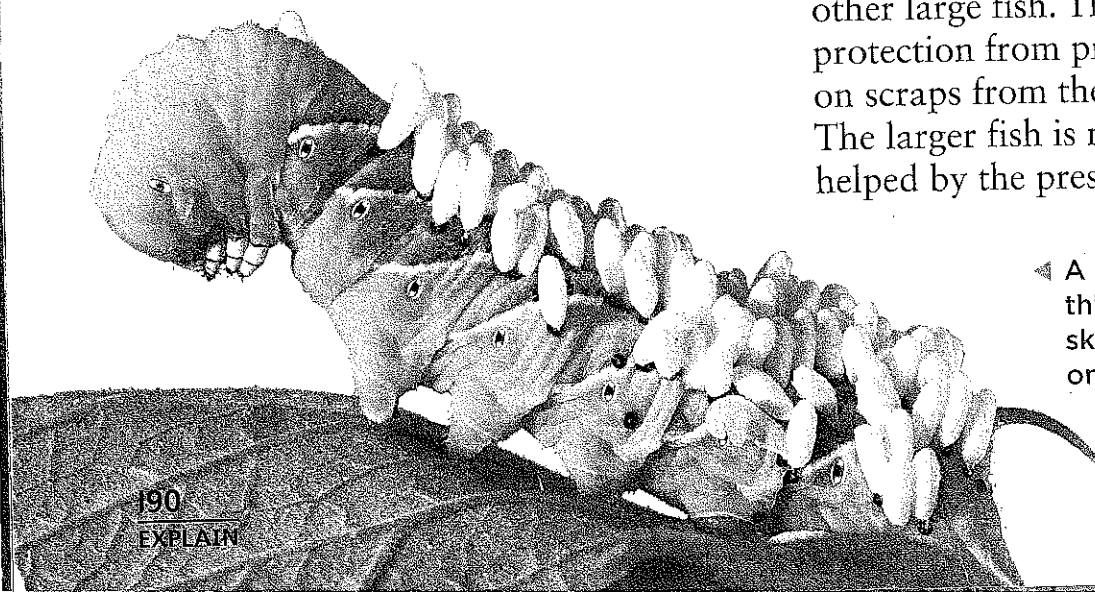
However, most parasites do not kill their hosts. For example, the sea lamprey (LAM•pree) is a fish that uses its mouth to attach itself to the sides of other fish. The lamprey carves a hole in the host with its sharp teeth and sucks out some of the host's blood. Both fish can live for a long time this way.

Parasites can affect humans as well. Trichinas are worms that live in the muscle tissue of some pigs. When meat from an infected pig is not fully cooked, the parasitic worms may survive. If people then eat this undercooked meat, the worms may invade their muscle tissue and cause a painful disease called trichinosis (trih•kuh•NOH•suhs).

### Commensalism

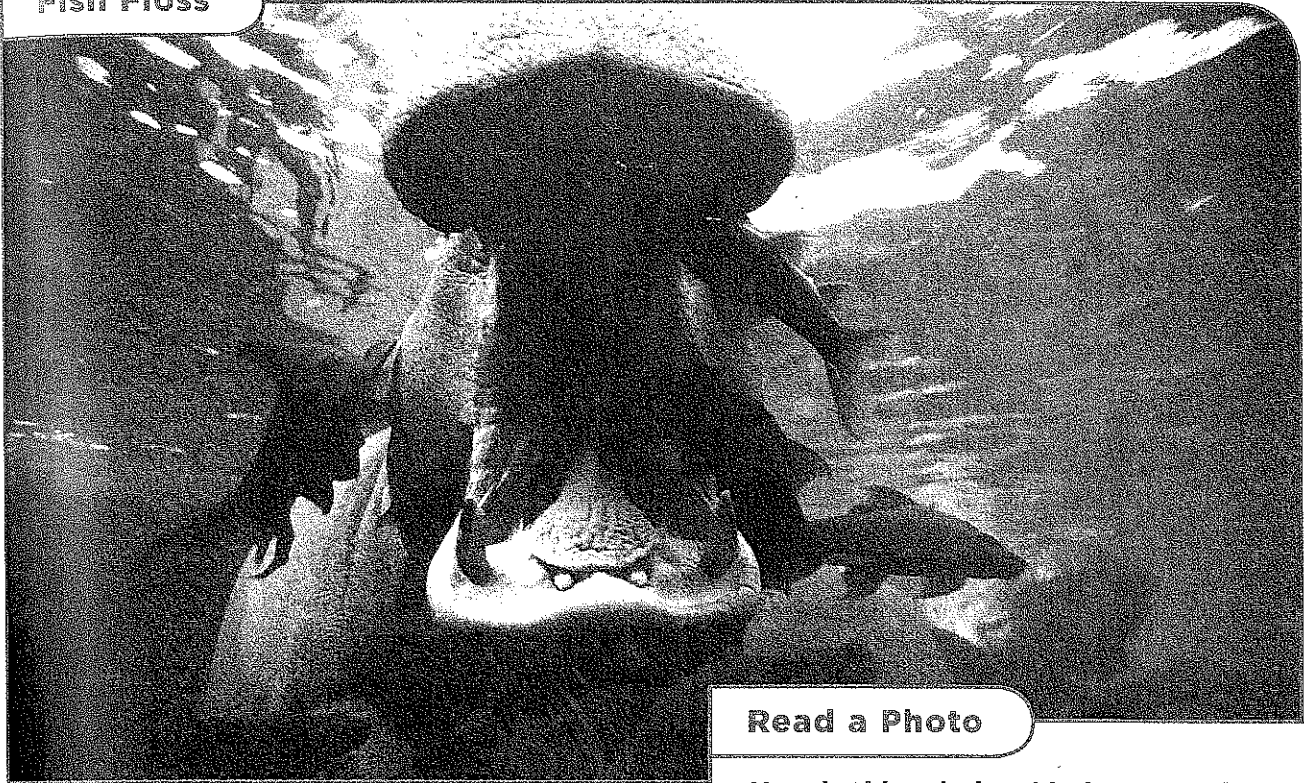
When one organism benefits without harming the other, a *commensal* (kuh•MEN•suhl) relationship results. One species may use another for transportation, shelter, or some other purpose. Clownfish use sea anemones for protection. The stinging cells on the tentacles of sea anemones do not harm clownfish, so they protect these fish from predators.

The remora (rih•MAWR•uh) is a fish that attaches itself to sharks and other large fish. The remora receives protection from predators, and it feeds on scraps from the larger fish's meal. The larger fish is neither harmed nor helped by the presence of the remora.



◀ A wasp laid its eggs under this tomato hornworm's skin. The young wasps fed on the hornworm, then emerged and made these cocoons.

## Fish Floss



### Read a Photo

**How is this relationship between the fish and the hippopotamus mutualistic?**

**Clue:** What benefit does each organism appear to receive?

## Mutualism

A relationship that is *mutualistic* (myew•chuh•wuh•LIS•tik) benefits both participants. Interactions in the nitrogen cycle provide an example of mutualism. The bacteria that grow on the roots of legumes obtain nutrients from the plants. The plants can then build proteins using the fixed nitrogen produced by the bacteria. Both participants help each other survive, and each benefits from the presence of the other. Mutualism is a positive form of symbiosis, because the relationship benefits both species.

Another example of mutualism is found in coral reefs. Millions of tiny coral polyps produce coral skeletons with the help of unicellular algae. The algae produce food for the coral polyps, and the coral skeletons provide shelter for the algae.

Various species of “cleaner fish” display mutualism when providing a service to larger fish and other animals. These cleaner fish eat parasites or dead skin off larger fish. Larger fish provide a source of nourishment and protect the cleaner fish from enemies. Divers have found cleaning “stations” where larger animals line up to let these smaller animals clean them off. Both types of animals benefit from this relationship.

### ✓ Quick Check

**Main Idea and Details** How does mutualism differ from commensalism?

**Critical Thinking** In what ways might a parasite benefit from its host?

## How do organisms compete and survive in an ecosystem?

An ecosystem can support only so many living things. The amounts of food, water, sunlight, shelter, and other resources are limited. As a result, organisms struggle against one another to obtain what they need to survive. This struggle is competition. **Competition** is the attempt by organisms to obtain a resource that is available in a limited supply.

Each species has a different **niche** (nich), or role in the community. The niche of a particular species includes what the species eats as well as what eats the species. Each species has adaptations that help it survive in its own particular niche. For example, animals that eat plants normally have teeth that are good for grinding fibers. Animals that eat meat often have claws and teeth that are good for tearing through flesh. Animals that hunt or gather food at night often see well in the dark. These adaptations help the organisms survive and reproduce.

Competition among species is reduced because different species obtain resources in unique ways. All the species in a forest do not eat exactly the same diet or want to build their homes or nests in exactly the same locations. Some organisms hunt by day, and others hunt by night. Some meat-eating species may not hunt at all, relying instead on eating animals that have been killed by other predators.

Organisms also look for different types of shelter. Some species nest on the ground, in tree branches, or in holes in the trunks of trees. Others nest underneath exposed tree roots, in caves, or even underground.

### ✓ **Quick Check**

**Main Idea and Details** What is a niche? Provide examples.

**Critical Thinking** Different species eat different foods and hunt at different times. How does this help the populations of an ecosystem survive?

This beaver has its own special role in its ecosystem.

