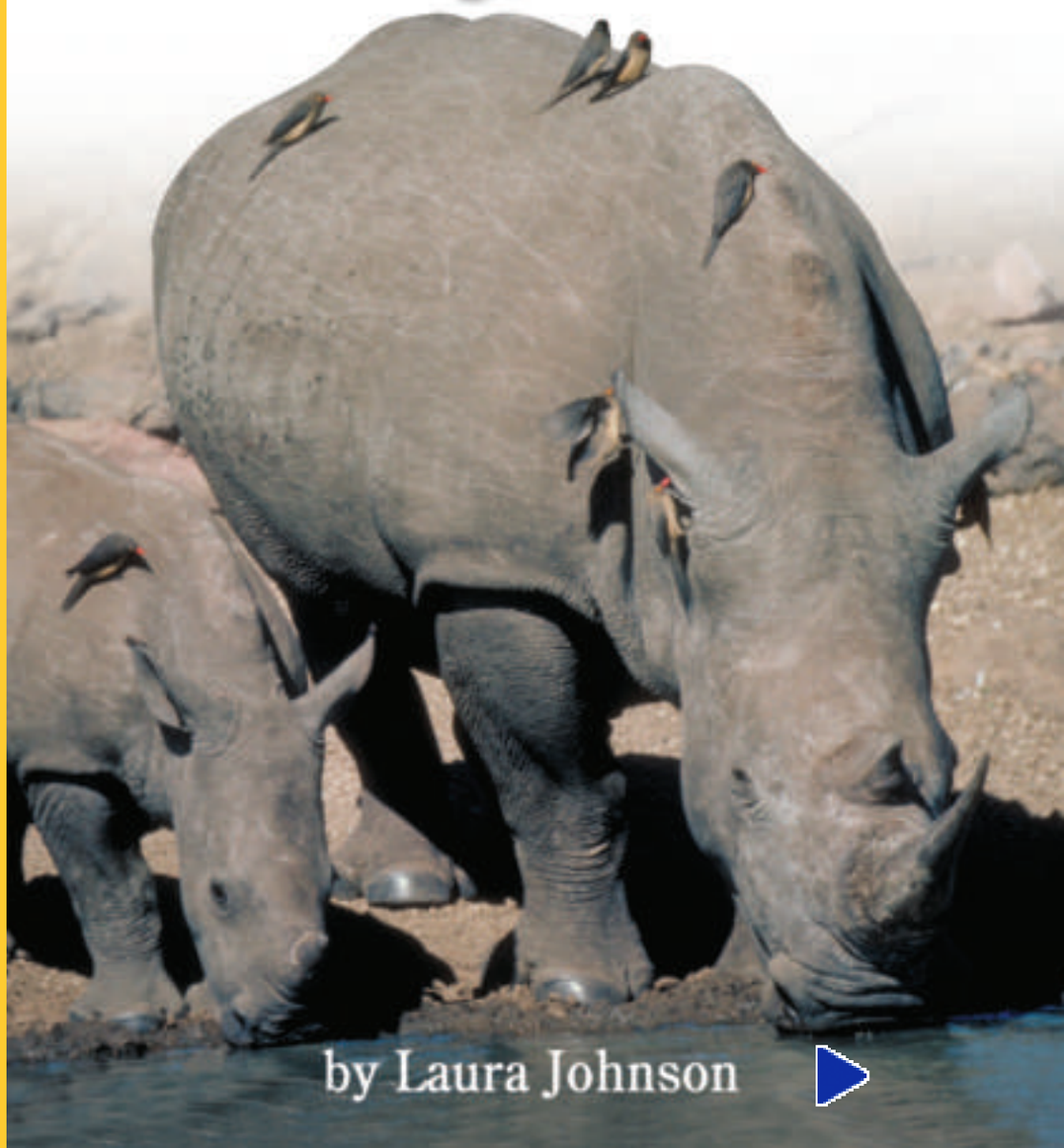
Science

Science

Life Science

Earth's Ecosystems



by Laura Johnson

Genre	Comprehension Skill	Text Features	Science Content
Nonfiction	Predict	• Captions • Charts • Diagrams • Glossary	Ecosystems

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Vocabulary

competition
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energy pyramid
host
parasite
succession
symbiosis

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How do species adapt to their environment?

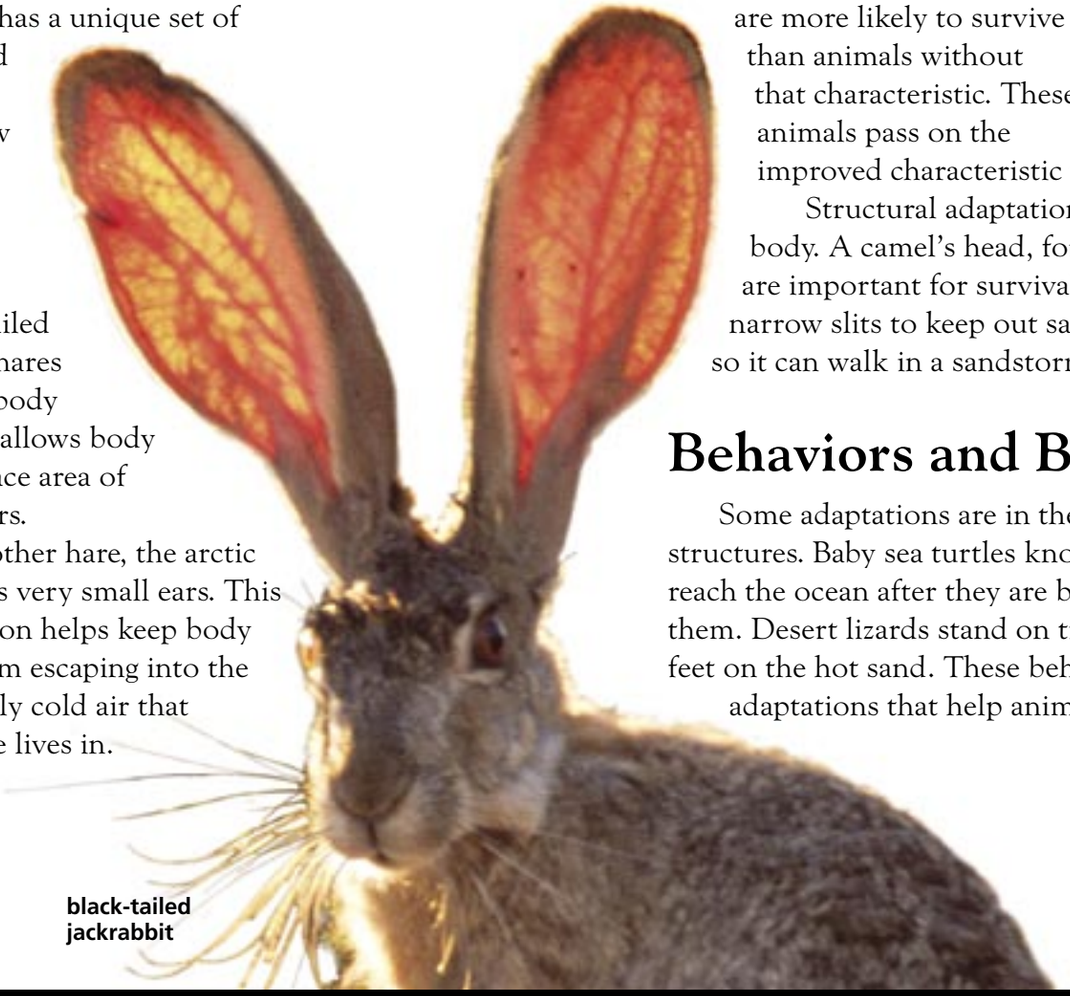
Surviving in the Environment

You know that different species of animals are found all over the world. Animals live in cold oceans, hot deserts, steamy rain forests, and on windblown mountaintops. Each one of them has a unique set of adaptations. You may be surprised to learn that animals of the same species have adaptations that allow them to survive in very different environments. Hares—animals closely related to rabbits—are a good example.

One kind of hare, the black-tailed jackrabbit, lives in deserts. These hares have enormous ears. When their body temperature rises, this adaptation allows body heat to escape from the large surface area of these ears.

Another hare, the arctic hare, has very small ears. This adaptation helps keep body heat from escaping into the extremely cold air that this hare lives in.

arctic hare



black-tailed jackrabbit

Structural Adaptations

Some frogs and toads bury themselves in mud during hot or dry periods. This is a behavioral adaptation.

Adaptations do not develop during a single animal's lifetime, but over generations. When animals are born with a characteristic that helps them live in an environment, they are more likely to survive than animals without that characteristic. These animals pass on the improved characteristic to their offspring.

Structural adaptations have to do with an animal's body. A camel's head, for example, has adaptations that are important for survival in the desert. Its nostrils become narrow slits to keep out sand, and its eyelids let light through so it can walk in a sandstorm with its eyes closed.

Behaviors and Body Processes

Some adaptations are in the form of behaviors, not structures. Baby sea turtles know in which direction to crawl to reach the ocean after they are born, even though no one shows them. Desert lizards stand on tiptoe to keep from burning their feet on the hot sand. These behaviors are examples of behavioral adaptations that help animals survive.

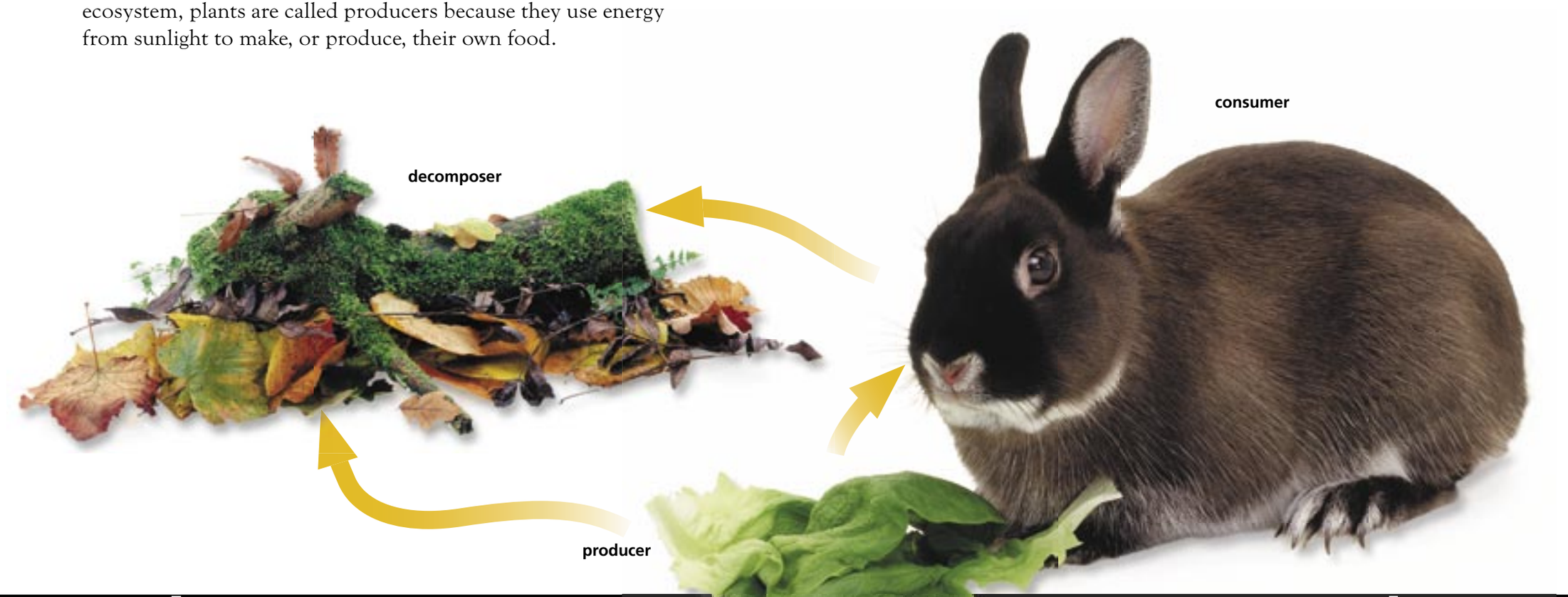
How do organisms get energy?

Energy Flow in Ecosystems

All organisms need energy to grow, move, repair, and reproduce. How do living things get the energy they need? Most organisms get their energy from sunlight. This can happen either directly or indirectly. Lettuce, and most other plants, get energy directly from sunlight through photosynthesis. During photosynthesis, plant leaves produce glucose. The plants use the chemical energy in glucose to carry out life functions. In an ecosystem, plants are called producers because they use energy from sunlight to make, or produce, their own food.

A rabbit, however, cannot get energy directly from sunlight. But as the rabbit eats the lettuce, it indirectly gets energy from the Sun that is stored in the leaves. Organisms that get energy by eating other organisms are called consumers.

Do you see the fungus growing in the picture on page 4? The fungus cannot make its own food from sunlight, but it doesn't eat other organisms either. So how does this organism get energy? It gets it by breaking down the remains of organisms that were once alive, such as trees that have fallen down. Organisms such as the fungus are called **decomposers.** They release materials from dead plants and animals back into the environment, where other consumers can use them. Without decomposers, nothing would decay.

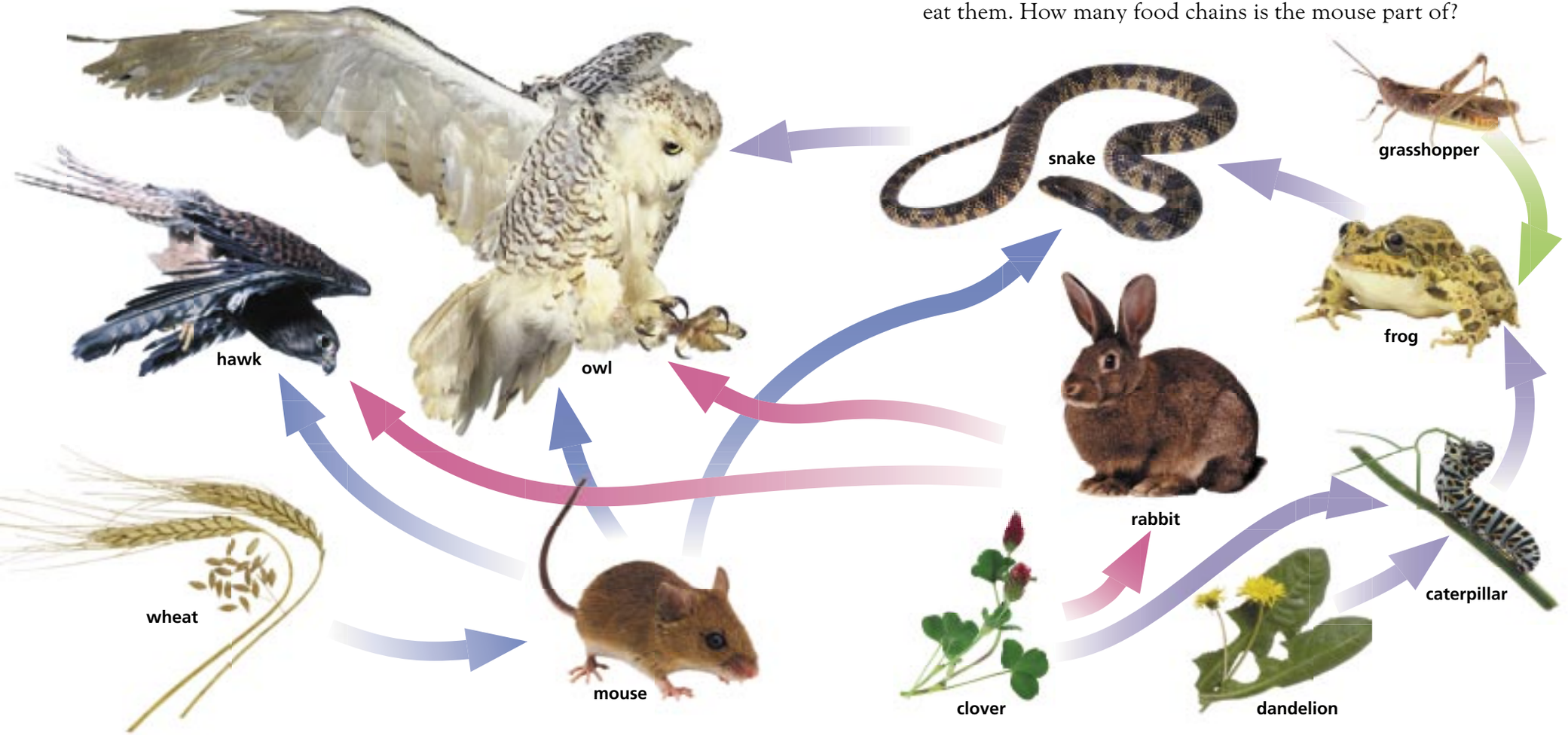


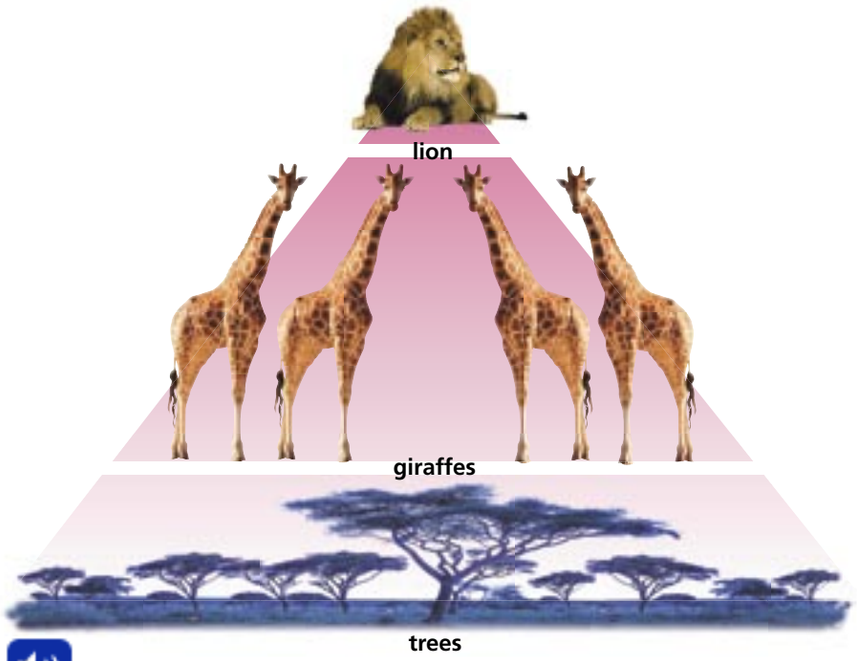
Food Chains

As you know, organisms either use energy from sunlight to produce their own food or they eat other organisms that have energy. A food chain shows one possible path of how organisms within an ecosystem get their food. Because the original source of energy is sunlight, a food chain begins with plant life and ends with an animal. Notice that the arrows in a food chain always point toward the organism that receives the energy. In the diagram below, find the food chain that connects the path of energy from wheat, to the mouse, to the snake, and on to the owl.

Food Webs

Every chain has a producer that makes its own food and consumers that eat other organisms. Most organisms are part of more than one food chain and eat more than one kind of food. Because organisms in an ecosystem often belong to more than one food chain, the food chains become interconnected, or mixed. These interconnected food chains form a food web. Study the food web shown here. Wheat, clover, and dandelions are the producers at the bottom of this food web. The owl and the hawk are the consumers at the top because no animals in this ecosystem eat them. How many food chains is the mouse part of?





Energy Pyramid

A food chain shows the path that energy takes from producers to consumers. However, it does not give any information about how much energy moves from organism to organism. Not all of the energy that plants receive from sunlight is available to be passed on to animals that eat the plant. This is because the plant uses some energy to stay alive. The same is true for animals. They use energy to grow, move, and reproduce. They pass on only the energy that is left over.

An **energy pyramid** shows how energy moves through an ecosystem. In this pyramid, the greatest amount of energy is available from the trees and bushes on the bottom level. Giraffes eat these plants, then use most of the energy they get to carry out life processes. When a lion eats a giraffe, there is little energy stored in the giraffe's body to pass on to the lion. Because of this, an ecosystem needs many giraffes to support a small number of lions.

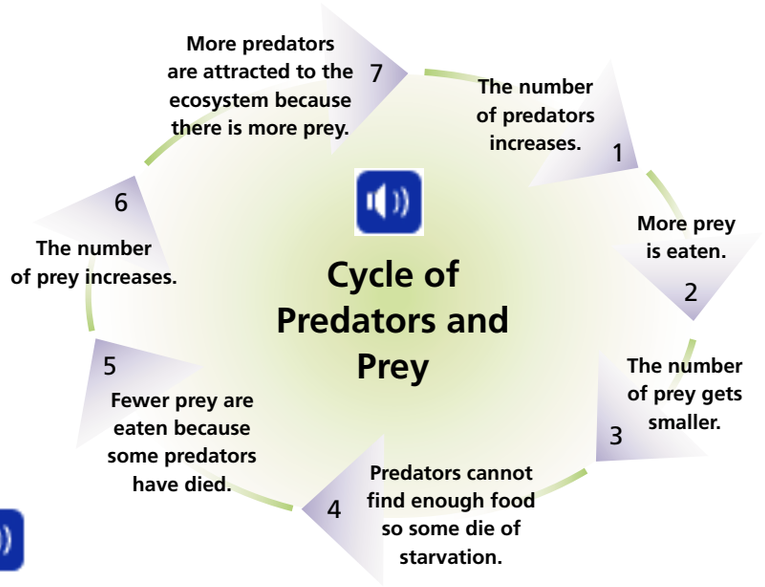
How do organisms compete for resources?

Competition for Resources

All plants and animals need food, water, and space. Within an ecosystem, these resources are limited, so there is always a **competition** for them. Animals with different needs can live side by side with little competition. Look at the bills on the birds in the illustration. Do you see how each kind of bird has a differently shaped bill? This is because the birds eat different foods. These birds do not need to compete for food in this ecosystem.

Competition occurs only when organisms of an ecosystem have the same needs. Sometimes competition is between members of the same species, such as two herons. If there is a drought and the marsh becomes dry, the herons that can survive with less food and water have a better chance of survival than those who need more.

Sometimes competition is between different species. Suppose a stork came to this marsh to find food. Since storks and herons eat the same kind of fish and frogs, the two species would compete for the same resources.



Predators and Prey

An animal that hunts and eats other animals is called a predator. The animal that is eaten by a predator is called a prey animal. In a healthy ecosystem, the populations of predators and prey have a natural cycle that works like this.

The eyes and nostrils of the sidewinding viper are on top of its head. This allows the snake to bury itself almost completely in the sand and snatch unsuspecting prey.

Adaptations Of Predators And Prey

Many predators have structural and behavioral adaptations that help them catch their prey. An alligator snapping turtle, for example, has a tongue that looks like a worm. It sits on the river bottom with its mouth wide open. When a fish arrives to eat what appears to be a worm, the turtle's mouth snaps shut and it eats the fish.

As you probably guessed, many prey also have adaptations that help them avoid—and even trick—their predators. The frilled lizard is an example. This lizard cannot defend itself from predators, but it can scare them away. When it senses danger, the lizard opens its mouth wide and a frill, or collar of skin, stands out around its head. This makes the lizard look so large that predators usually run away.

frilled lizard

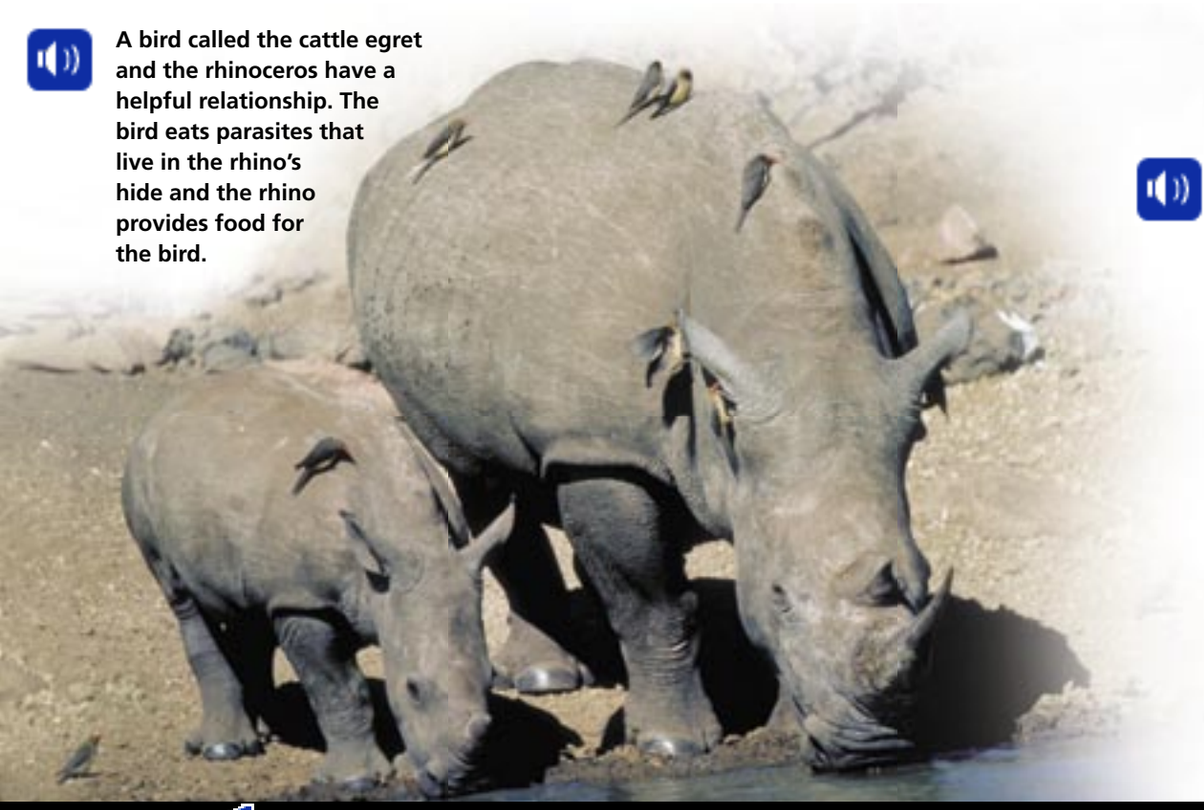
Katydids look amazingly like leaves. By keeping still, the katydid can fool many predators.

Symbiosis

Symbiosis is a close relationship between organisms of two different species. A symbiotic relationship must be helpful to at least one of the organisms. There are three types of symbiosis: parasitism, mutualism, and commensalism.

Parasitism is a type of symbiosis in which one of the organisms is helped and the other organism is harmed. The organism that is helped is called a **parasite.** The organism that is harmed is called a **host.** Tapeworms are parasites that can live in the digestive systems of humans and animals. They absorb the host's digested food.

Mutualism is a symbiotic relationship in which both organisms are helped. A bird called the cattle egret and the rhinoceros have this kind of relationship. The bird eats parasites that live in the rhino's hide. This helps the rhino by removing the harmful parasites and helps the bird by providing food.

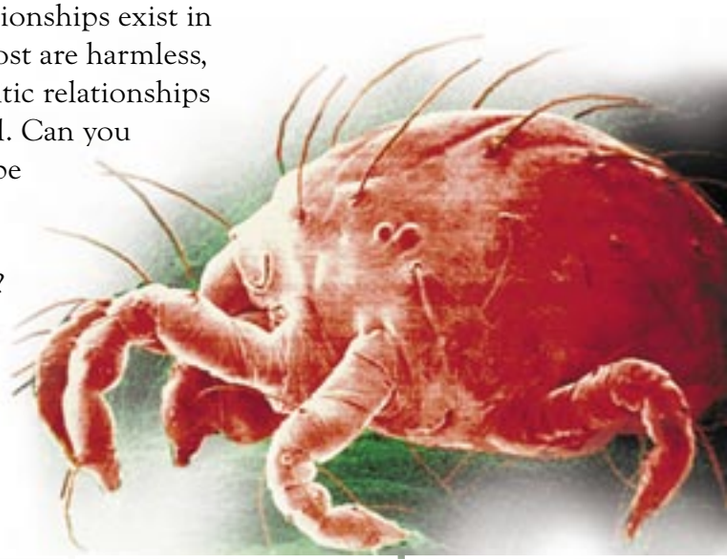


A bird called the cattle egret and the rhinoceros have a helpful relationship. The bird eats parasites that live in the rhino's hide and the rhino provides food for the bird.

Commensalism is a type of symbiosis that helps one organism, but doesn't help or harm the other. There is a worm that lives inside shells used by hermit crabs. When the crab catches food, the worm comes out of the shell to eat some of the prey. The worm does not do anything to harm or help the crab.

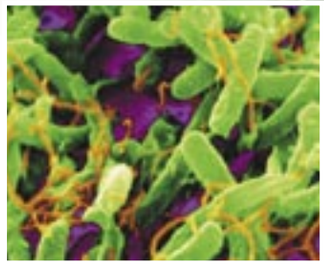
Symbiosis in the Human Body

Symbiotic relationships exist in your own body. Most are harmless, but some are parasitic relationships that can be harmful. Can you recognize which type of symbiosis each of these organisms share with humans?

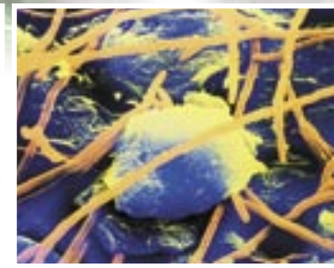


Mites that cover your skin and live at the base of your eyelashes get food by eating dead skin cells.

Fleas and ticks get food by piercing the skin and sucking out blood.



E. coli **bacteria live in the intestine and feed on digested food. They make vitamin K, which helps your blood clot.**



Athlete's foot is caused by a fungus. A foot infected with athlete's foot looks dry and cracked, and it itches.

How do materials cycle in ecosystems?

Nature depends on a recycling system so resources can be used over and over. The nitrogen cycle, the carbon cycle, and the water cycle are very important in nature.

Recycling Matter

When you hear the word *recycling* you probably think of materials such as paper and glass. People recycle these materials to conserve resources. For the same reason, nature has its own recycling system. Organisms need nitrogen, carbon, and water. If these were not recycled, they would be used up. Because of Earth's cycles, organisms are able to use these same materials over and over again.

Nitrogen Cycle

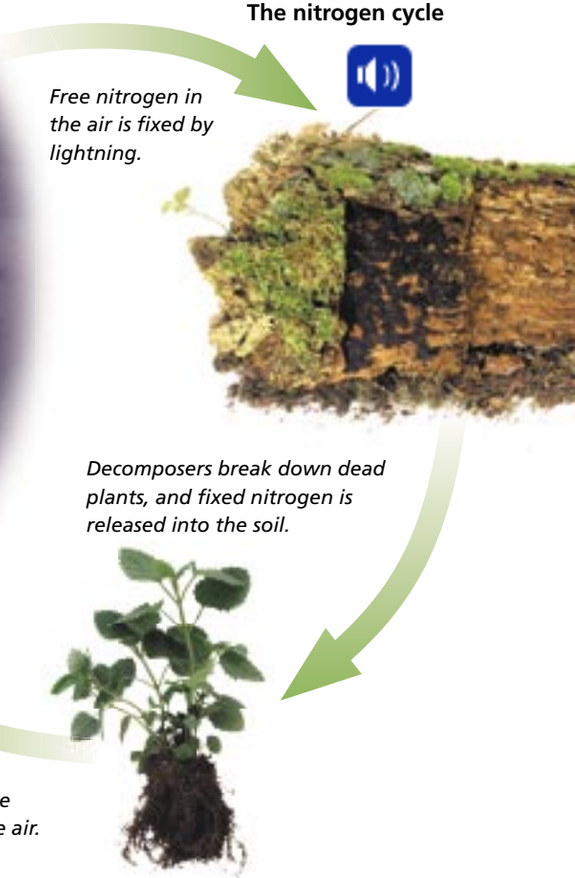
About 78 percent of the air we breathe is nitrogen. The nitrogen in air is free nitrogen, which means it is not combined with other elements. Most plants and animals cannot use nitrogen in this form. They can use it only in a fixed form when it is combined with other elements.

Bacteria that live on the roots of plants fix free nitrogen. The plants and the bacteria have a mutualistic relationship—the bacteria gets food from the plant, and the plant takes nitrogen from the bacteria. Animals get nitrogen indirectly by eating plants or by eating prey that have eaten plants.

A small amount of free nitrogen in the air is fixed by lightning. During a storm, rain carries the fixed nitrogen to the ground. Do you remember how decomposers break down the remains of dead plants and animals? When this happens, the fixed nitrogen in these organisms is released into the soil.

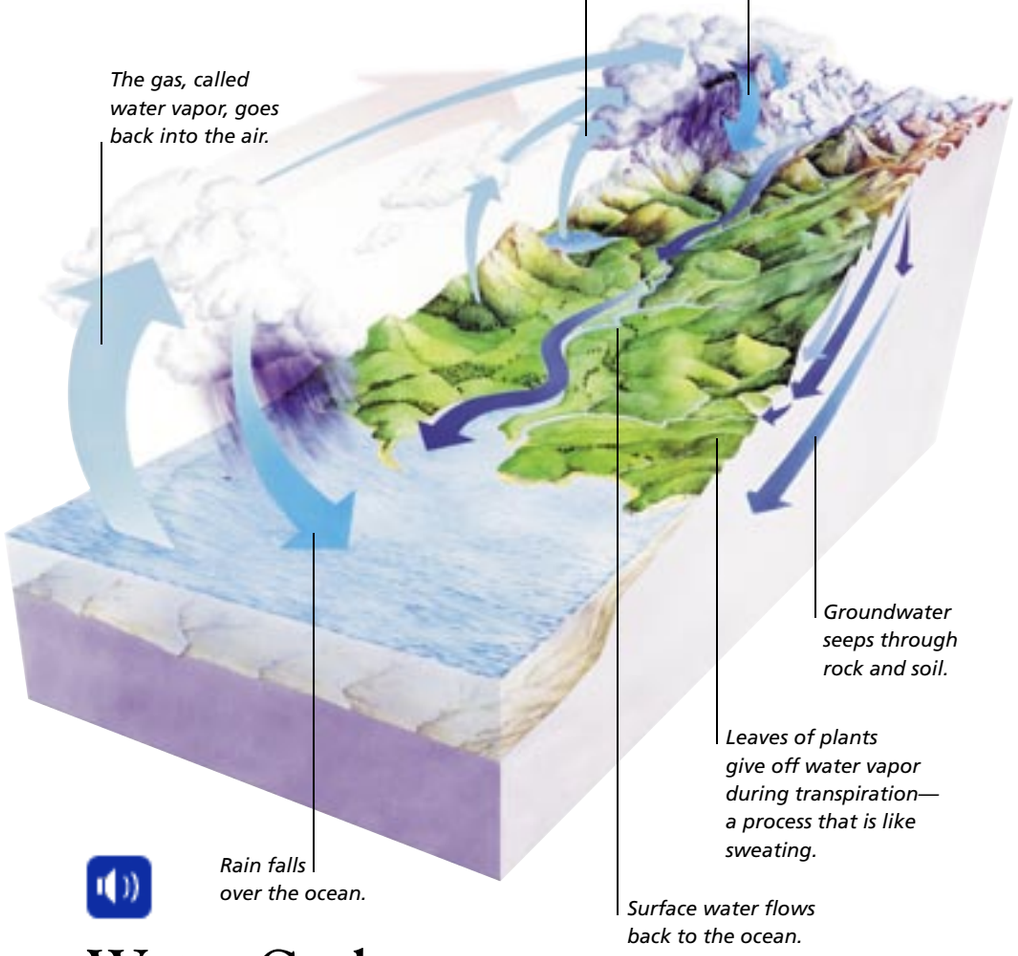
How does nitrogen become part of a cycle? How does nitrogen return to the air? Not all bacteria live on plant roots. Some bacteria live freely in the soil. These bacteria can break down fixed nitrogen and turn it back into free nitrogen. The free nitrogen passes into the air. This movement of nitrogen is called the nitrogen cycle.

The nitrogen cycle



Carbon Cycle

All living things contain an element called carbon. It is also found in nonliving materials such as air, rocks, and soil. Like nitrogen, carbon cycles through ecosystems. This occurs in several ways, as shown in this diagram.



Water Cycle

You may not have known about the importance of nitrogen and carbon, but you certainly know that all living things need water. This diagram shows how water cycles through an ecosystem.

How do ecosystems change?

All ecosystems sustain natural changes over time. People also cause changes to ecosystems.

Natural Changes

In the summer of 1988, raging forest fires burned throughout Yellowstone National Park. The fires, which were started by lightning, charred one-third of this national park. The park follows a "natural burn" rule. This means that fires started accidentally by humans are put out, but fires started by a natural event, such as lightning, are allowed to burn unless they threaten people's lives and property. Park managers know that natural disasters, such as forest fires, volcanic eruptions, and floods, are an important part of ecology. They change ecosystems by killing old plants and allowing new ones to grow.

Succession is a series of changes that occur in an ecosystem. This is how succession worked in Yellowstone after the fires. Plants called pioneer species began to grow on the damaged land. Pioneer plants can grow under difficult conditions. The following spring, about two dozen different kinds of plants began to grow out of the ashes. Many of these plants had existed before the fires, but only as roots. The forest floor had been so thick that they could not compete for the resources necessary to grow stems and leaves. As the pioneer plants died each season, their bodies decomposed and built up the soil.

After enough soil formed, other organisms were able to live in the ecosystem. Seeds took root and formed new plants in the rich soil. Some of these seeds may have survived the fire because they were buried deep in the ground. Others blew in from unburned areas. For the most part, park rangers did not replant Yellowstone. Yellowstone's forests replanted themselves.

Human Impact on Ecosystems

People have an enormous impact on the ecosystems we live in. Our daily activities change ecosystems in ways that make it difficult, and sometimes even impossible, for other animals and plants to survive.

Landfills that we build to hold our trash change ecosystems. Each person in the United States creates about four pounds of trash every day! Together, we create about 600,000 tons per day! Some is recycled, some is burned, but most is taken to landfills. An advantage of landfills is that they reduce health hazards created by open-air dumps. However, hazardous materials, such as paint, acid from batteries, and chemicals, can leak out of landfills and harm ecosystems.

What Americans Throw Away Every Year

Plastic bottles	90 billion
Glass bottles	28 billion
Foam cups	25 billion
Disposable diapers	18 billion
Tires	200 million

People often harm the environment without even realizing it. When fossil fuels are burned, they create air pollution. Many of our everyday activities, such as driving cars and using electricity, depend on the use of fossil fuels. Think about how many times you rode in a car or a bus this week, and how many times you used electricity.

Another way people harm the environment without realizing it is by using too much water. Water is an important resource in every ecosystem. Do you turn off the water while you brush your teeth? Could you take a shorter shower? People in the United States use more water every year than people in any other country.

Most landfills can be used for about twenty years. Plants and animals are disturbed when each new landfill is started.

Saving Ecosystems

During a winter storm in 1996, an oil barge ran aground off the coast of Rhode Island. About 828,000 gallons of oil spilled into the ocean. The oil spill killed more than nine million lobsters, two thousand marine birds, and about one million pounds of clams, oysters, and scallops in the ecosystem. The oil also damaged the habitat of a bird called the piping plover, which was already on the list of endangered species.

Crews of workers tried to soak up the oil from the water's surface and the beaches. Ninety-seven volunteers spent hundreds of hours in an effort to seed new scallop beds. They carefully placed about eight thousand healthy scallops in the area to try to grow a new scallop population. Similar projects are underway to replace the oyster population. Unfortunately, even with the efforts of scientists and volunteers, much of the damage done to the animals and the ecosystem they live in cannot be undone.

Preventing Problems

Once we understand the effects that we have on the environment, we can find ways to reduce the harm we cause. One important way is to use resources wisely. Conserving resources decreases trash and reduces the need to build more landfills.

Explore ways that you as a citizen can make the environment healthy for all its organisms. Become a recycling "watchdog" at home and at school. More than four billion individual drink boxes are thrown away each year in the United States. These can sit in a landfill for more than three hundred years before they decompose! Setting up a program to recycle just these small items is a good way to begin!

Most products are thrown away. You can save bottles and wrapping paper to use again.

Glossary

competition a struggle among organisms to survive in a habitat with limited resources

decomposers organisms that get energy by breaking down the remains of dead organisms

energy pyramid a triangle-shaped diagram that shows how much energy is present at each level of a food chain

host an organism that is harmed by a symbiotic relationship which helps another organism

parasite an organism that is helped by a symbiotic relationship which harms another organism

succession a series of predictable changes that occur in an ecosystem

symbiosis a close relationship between organisms of two different species that must be helpful to at least one of the organisms

What did you learn?

1. What is the task of decomposers in an ecosystem?

2. What is the difference between a food chain and a food web?

3. What are two ways that carbon can enter an ecosystem?

4. Writing in Science Mutualism and commensalism are two different kinds of symbiosis. Explain the difference between them. Include an example of each.

5. **Predict** Based on what you read about structural adaptations, what kind of adaptation would you predict to find on animals that live in the deepest, darkest areas of the ocean?