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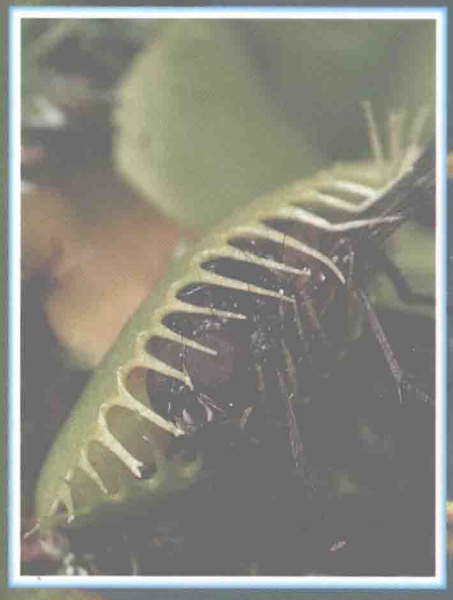
ECOSYSTEMS AROUND THE WORLD



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ECOSYSTEMS AROUND THE WORLD

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LIFE SCIENCES

REFERENCE SECTION

UNIT 6

ECOSYSTEMS AROUND THE WORLD

CHAPTER 11

ECOSYSTEMS

The water around you, the air above you, the rocks and soil under your feet, and all living things around you make up your ecosystem. Living things in an ecosystem depend on each other and on the nonliving things around them. Animals, for example, depend on plants for food and for the oxygen plants make.

Do plants depend on animals? In Chapter 11 you will learn how animals provide materials needed for the plants to grow. How does this plant depend on animals?

In Chapter 11 you will have many opportunities to read diagrams for information.

Topic 1 LIFE SCIENCE

Living Things and Their Environment

WHY IT MATTERS

Both living and nonliving things in an area interact with each other.

SCIENCE WORDS

ecosystem all the living and nonliving things in an area interacting with each other

ecology the study of how living things and their environment interact

abiotic factor a nonliving part of an ecosystem

biotic factor a living part of an ecosystem

population all the organisms of one species that live in an area at the same time

community all the populations living in an area

habitat the area in which an organism lives

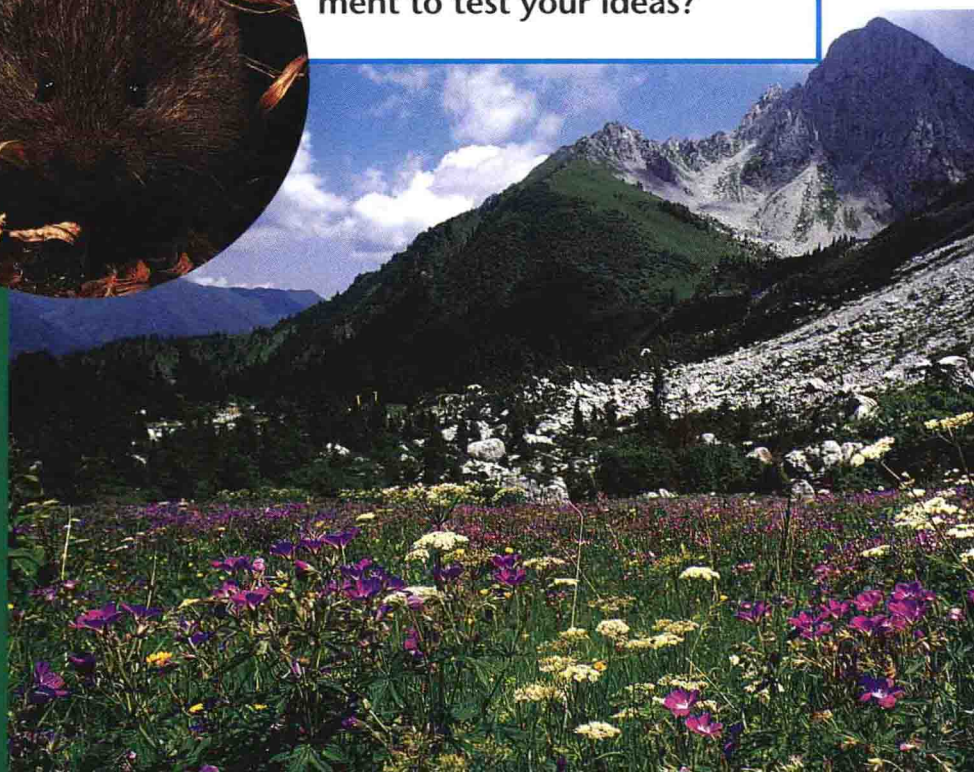
niche the role an organism has in its ecosystem

What do you need in order to survive? Your answers could include food, water, the right temperature, and a place to live.

What kinds of things do the animals and plants shown here need to survive? Where do you think they get these things?

EXPLORE

HYPOTHESIZE How do living things interact with each other and their environment? What do living things need in order to survive? Write a hypothesis in your *Science Journal*. How would you design a special environment to test your ideas?



EXPLORE ACTIVITY

Design Your Own Experiment

WHAT DO LIVING THINGS NEED TO SURVIVE?

MATERIALS

- wide-mouthed, clear 3.8-L (1-gal) container with lid
- washed gravel
- pond water or aged tap water
- water plants such as *Elodea* or duckweed
- 2 large water snails or 8 small water snails
- soil
- small rocks
- grass seed and small plants
- 2 earthworms, 2 land snails, 4 sow bugs, or other small land animals that eat plants
- *Science Journal*

PROCEDURES

1. For a water environment, add 4 cm (1.5 in.) of thoroughly washed sand or gravel to the jar. Fill the jar to about 4 cm (1.5 in.) from the top with water. Add a few floating plants, rooted plants with floating leaves, and submerged plants. Do not crowd the plants. Add two large or eight small water snails.
2. For a land environment, place a 2-cm (0.75-in.) layer of gravel on the bottom of the jar. Cover the gravel layer with a 5- to 7-cm (2- to 2.75-in.) layer of moistened soil. Add plants, and plant grass seeds. Add earthworms, sow bugs, and snails.
3. Place each jar in a lighted area but not in direct sunlight.
4. Cover each jar with its own lid or with a piece of plastic wrap. Record in your *Science Journal* how many and what kinds of living things you used.
5. **OBSERVE** Examine your jars every other day, and record your observations.

CONCLUDE AND APPLY

1. **INFER** What are the nonliving parts of your system? What are the living parts of your system?
2. **INFER** What do the living things need to survive? How do you know?

GOING FURTHER: Problem Solving

3. **EXPERIMENT** How could you design an environment that contains both land and water areas?

What Do Living Things Need to Survive?

What or whom do you interact with every day? Make a list. The Explore Activity showed how living things and nonliving things interact in an **ecosystem**. An ecosystem is all the living and nonliving things in an area interacting with each other. **Ecology** is the study of how all these things interact in order to survive.

Most ecosystems are much larger than a jar. Some, like the prairie ecosystem of North America, the deserts of Africa, and the rain forests of Brazil, cover large areas of a country or continent. Freshwater ecosystems cover less space than saltwater ecosystems. Saltwater ecosystems can cover entire oceans. It doesn't matter where they are or what they look like, all ecosystems have the same parts.

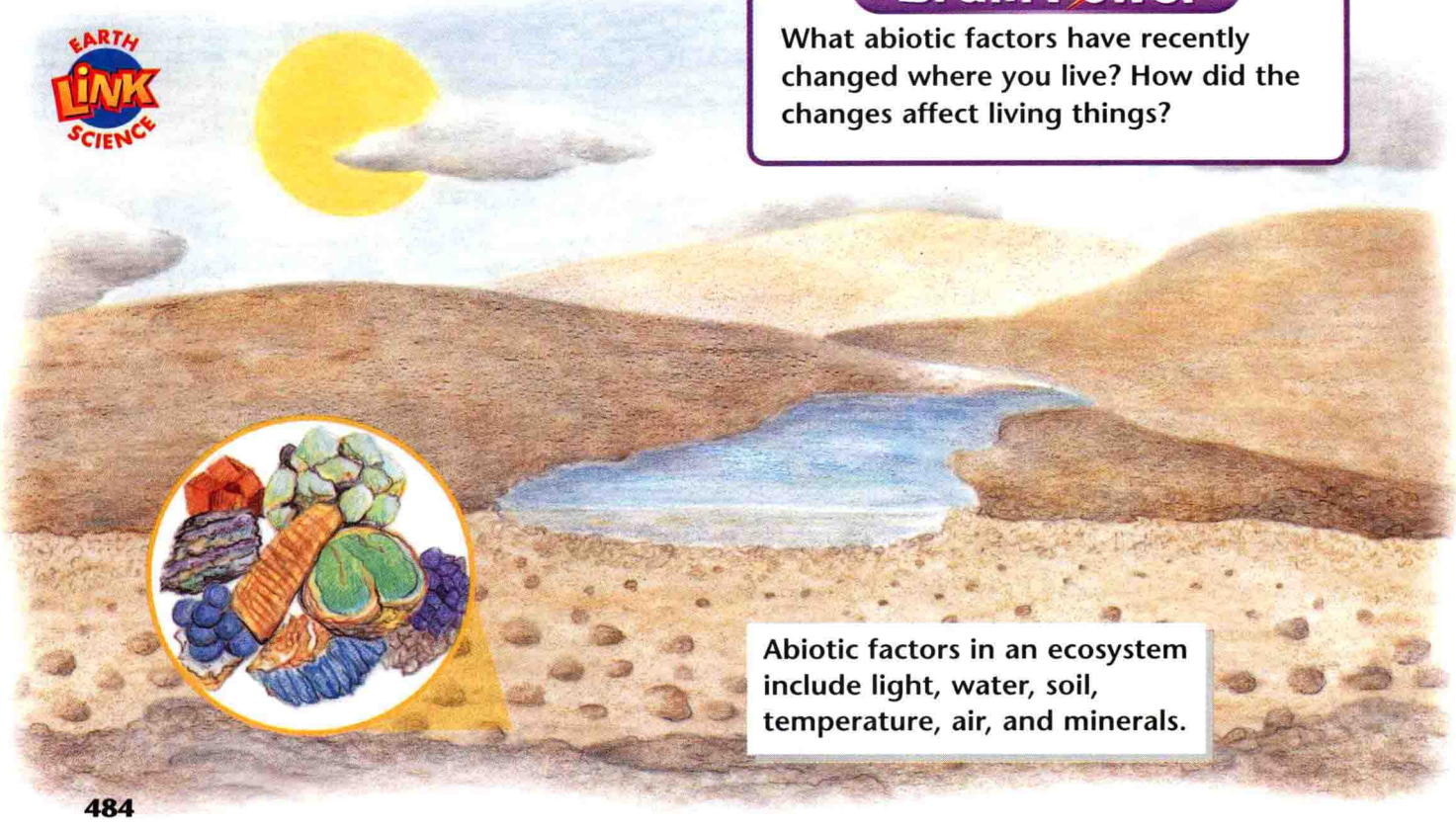
The nonliving parts of an ecosystem are the ecosystem's **abiotic** (ā'bī ot'ik) **factors**. All living things need certain nonliving things in order to survive. Abiotic factors include water, minerals, sunlight, air, climate, and soil.

All organisms need water. Their bodies are 50 to 95 percent water. The processes that keep living things alive—like photosynthesis and respiration—can only take place in the presence of water. Living things need minerals, such as calcium, iron, phosphorus, and nitrogen. Some living things, like plants and algae, need sunlight to make food. Animals need oxygen to produce the energy for their bodies. Plants and algae need carbon dioxide. The environment must also have the right temperature for organisms to survive.

Brain Power

What abiotic factors have recently changed where you live? How did the changes affect living things?

EARTH LINK SCIENCE



Abiotic factors in an ecosystem include light, water, soil, temperature, air, and minerals.

What Do Living Things Contribute?

The right abiotic factors help make it possible for the *organisms*, or living things, in an ecosystem to survive. The living parts are animals, plants, fungi, protists, and bacteria. Mushrooms and molds are fungi. Protists include one-celled organisms. Microscopic bacteria live everywhere.

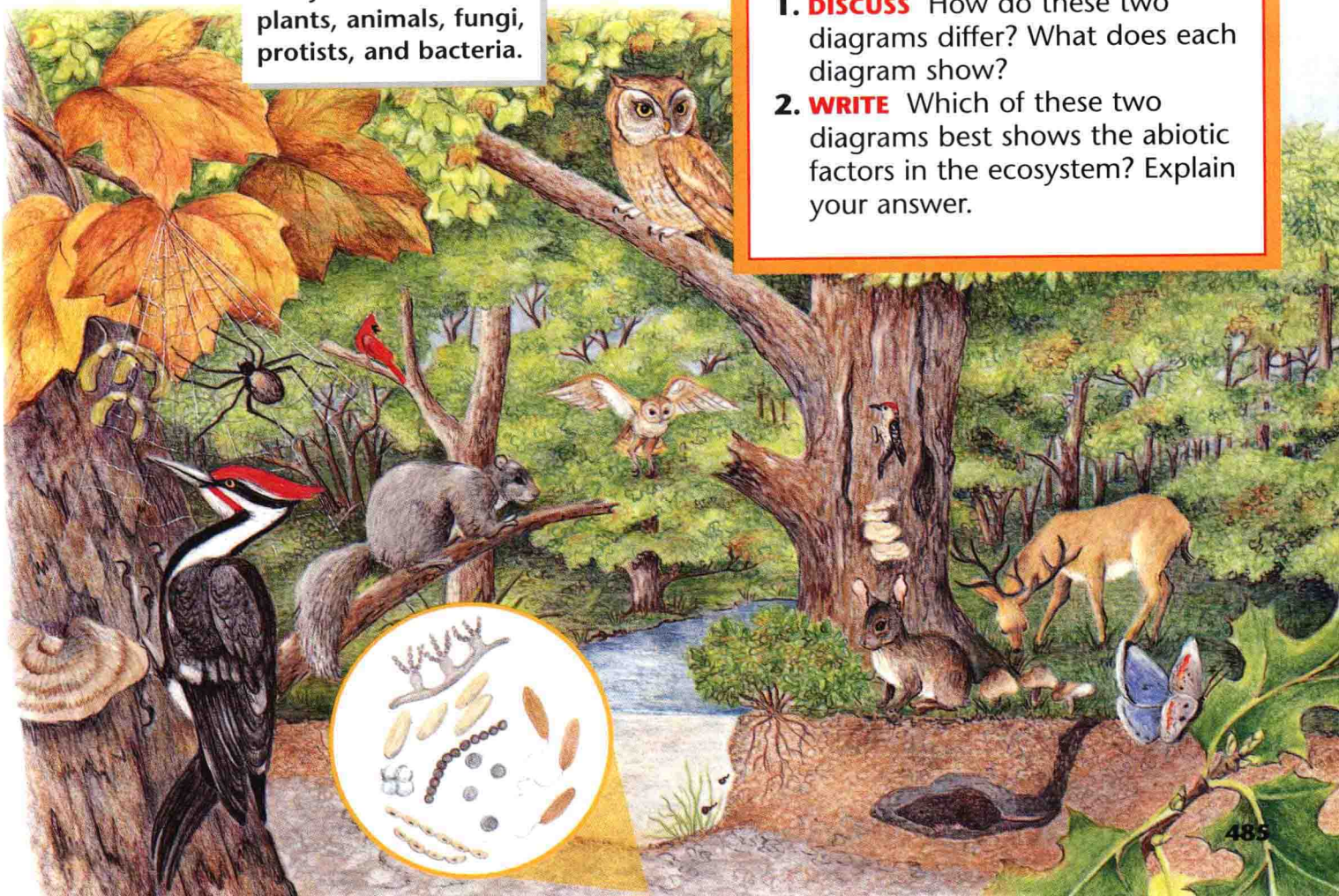
These organisms—animals, plants, fungi, protists, and bacteria—make up the **biotic** (bī ot'ik) **factors**, or living parts, of an ecosystem.

Each organism contributes something to the others in the ecosystem. Plants and algae are called *producers*. They produce oxygen and food that animals need. Animals are *consumers*. Animals consume, or eat, plants or animals that eat plants. Animals also give off carbon dioxide that plants need to make food.

What do the fungi and bacteria contribute? They are a very important part of any ecosystem. Fungi and bacteria are *decomposers*. They *decompose*, or break down, dead plants and animals into useful things like minerals that enrich soil. Plants need these in order to grow.

Each of these kinds of organisms helps the others survive.

Biotic factors in an ecosystem include plants, animals, fungi, protists, and bacteria.



READING DIAGRAMS

1. **DISCUSS** How do these two diagrams differ? What does each diagram show?
2. **WRITE** Which of these two diagrams best shows the abiotic factors in the ecosystem? Explain your answer.

What Were the Prairies Like?

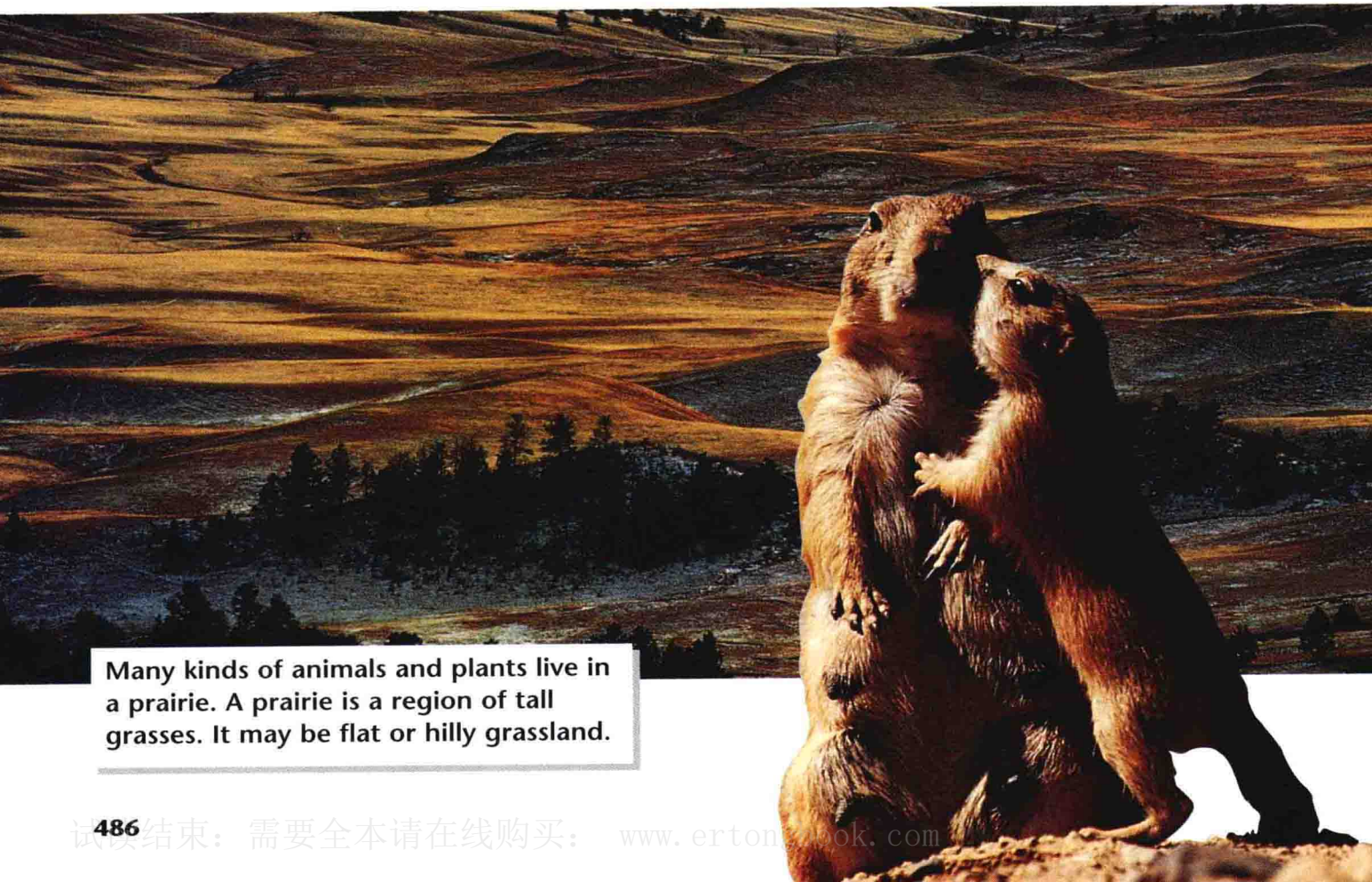
Long ago a "sea of wild grasses" covered North America from central Texas in the south to North Dakota in the north. These are America's prairie lands, the "range" of the famous song "Home on the Range."

Native Americans once hunted buffalo on prairie lands. Later, ranchers and farmers grazed cattle and planted crops such as corn and wheat.

Plants and animals of all kinds lived there. Many still do. Although most of the buffalo are gone, the cattle and the crops that provide much of our food are still there.

In Texas the Blackland Prairie stretches 483 kilometers (300 miles) from Austin in the south to Clarksville in the north. The Blacklands got their name from the rich black soil the early settlers found there. These settlers discovered that the summers were hot and long. However, there was enough rain to grow profitable crops, like cotton.

Before the land became farms and ranches, huge herds of buffalo grazed on the prairie grasses. Buffalo were not the prairie's only inhabitants. At least 50 different kinds of tall and short grasses provided food for plant-eating animals. Many kinds of wildflowers painted the landscape with beautiful colors. These wildflowers included purple coneflowers, bluebells, yellow sunflowers, and golden daleas. Near streams a traveler might come across oak, hickory, elm, or cedar trees.



Many kinds of animals and plants live in a prairie. A prairie is a region of tall grasses. It may be flat or hilly grassland.

What Animals Live in the Blacklands?

About 500 species, or different kinds, of animals still live on this prairie. The spotted chorus frog sings in the night near the streams and rivers. Rattle-snakes and lizards seek shelter under rocks.

Birds like pipits, longspurs, and horned larks, as well as 300 other kinds of birds, still live in the Blackland Prairie.

Raccoons, opossums, coyotes, white-tailed deer, and striped skunks live in the Blacklands. Cotton rats, white-footed mice, eastern cottontails, red bats, and bobcats live there, too.

Mountain lions, gray wolves, black bears, and jaguars used to come in search of prey. When people came and built towns, cities, and farms, the buffalo left. The animals that fed on the buffalo left, too. Some animals, however, came to the Blacklands from other places, and stayed. Armadillos arrived from Mexico as the Blacklands' climate warmed up over the past 150 years. Badgers invaded from northwestern Texas when their natural homes were cleared for development.

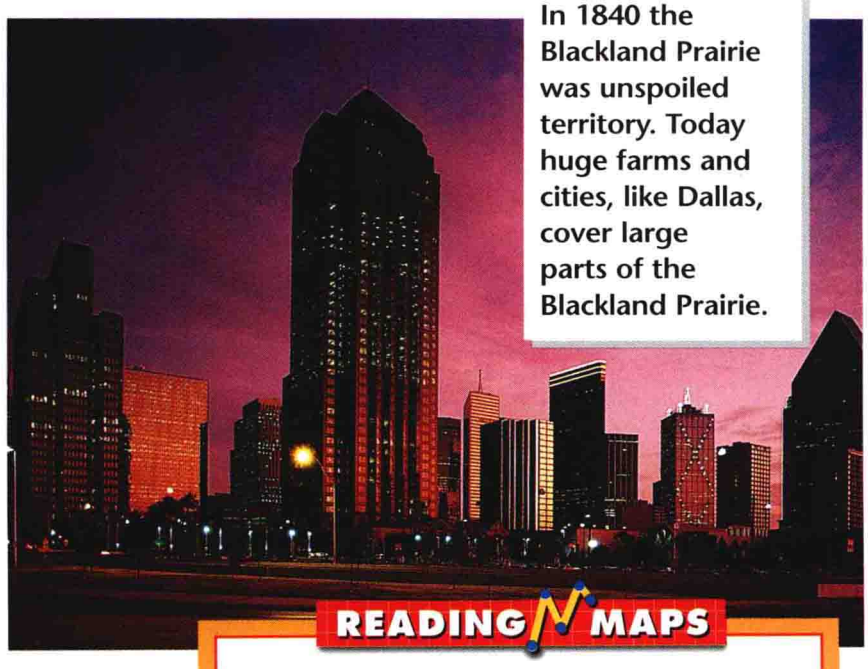
Armadillo

Coyote

Rattlesnake

Cottontail

The Blackland Prairie of Texas is 300 miles long and covers almost 13 million acres.



In 1840 the Blackland Prairie was unspoiled territory. Today huge farms and cities, like Dallas, cover large parts of the Blackland Prairie.

READING MAPS

1. **DISCUSS** What large cities are on the Blackland Prairie?
2. **WRITE** Why do you think those cities are located where they are?

How Are the Living Things Organized?

The Blackland Prairie, like all ecosystems, is home to many different organisms. Each kind of organism, whether an animal, plant, fungus, protist, or bacterium, is a member of a single species. All the organisms of a species living in the same area make up a **population**.

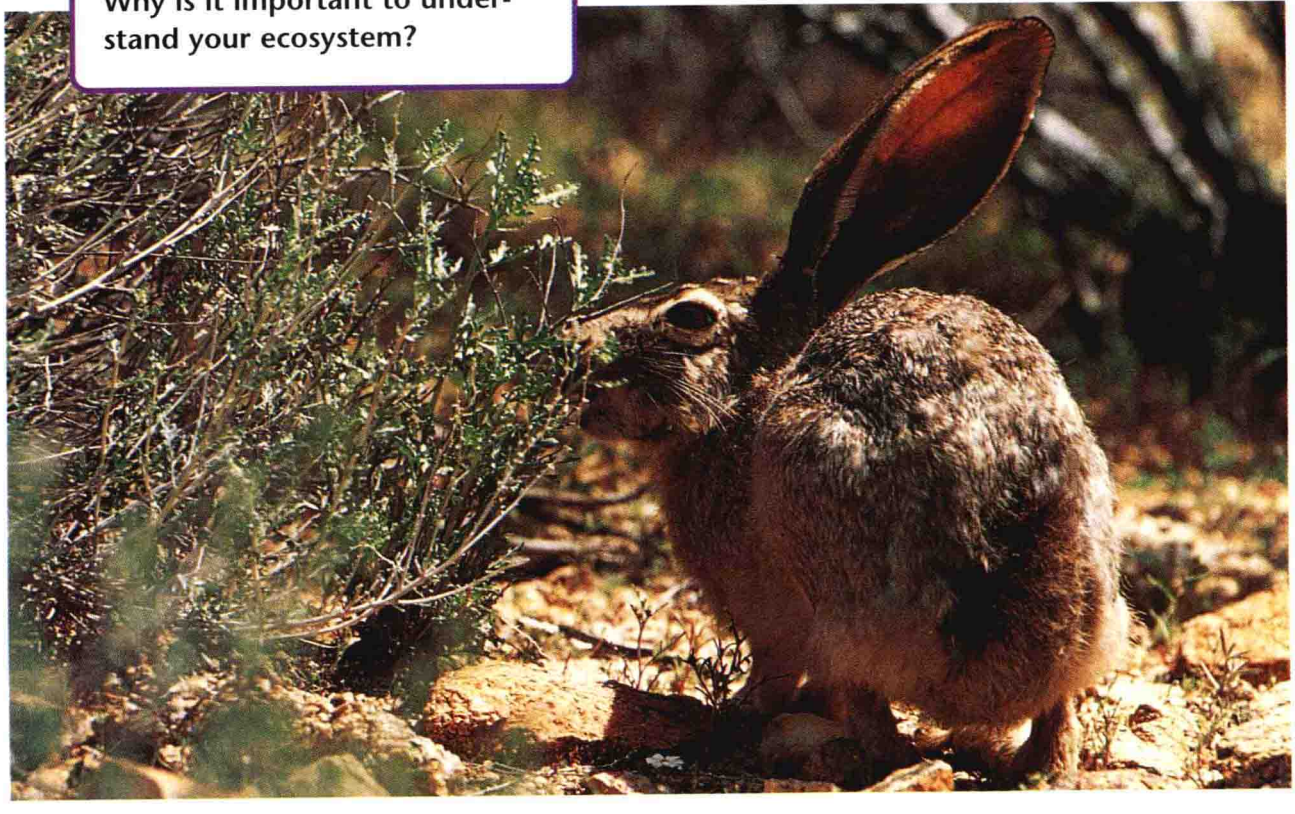
The Blackland Prairie has populations of armadillos and badgers. It has little bluestem grass and Indian grass. It has elm trees. It also has pond algae, soil bacteria, and fungi.

Most people are satisfied with identifying the populations around them. Scientists want to know how populations interact. Scientists investigate the activities of animals, plants, fungi, protists, and bacteria in the ecosystem. They want to know which animals prey on others, which animals eat plants, and which insects eat crops. They are interested in how bacteria and fungi make the soil fertile. All these questions need to be answered to understand how an ecosystem stays healthy.

Scientists have to do more than study individual organisms in an ecosystem, or even individual populations in the ecosystem. They have to study the interactions of all the populations in an area. All the populations living in an area make up a **community**.

Brain Power

What are some populations in the ecosystem where you live? Why is it important to understand your ecosystem?



To understand what makes an ecosystem productive, scientists must study the interactions of different populations in the ecosystem's community of living things.

Where Do They Live? What Do They Do?

The place where an organism lives is called its **habitat**. The chorus frog's habitat is in the scattered ponds of the Blacklands.

Each species in an ecosystem also has a role or place in the activities of its community. The role of an organism in the community is its **niche**.

A species' niche includes many factors. It includes what a species eats and what eats that species. It includes the kind of environment the species needs to live in. It even includes whether the species is active by day or night.

Scientists study the habitats and niches of organisms in a community. They do this to see if the community is healthy or in trouble. What would happen if farmers used powerful insecticides to kill pests on Blacklands crops? What might happen if these pesticides also killed some harmless ants?

Ants live in the same habitat as Texas horned lizards. Since the lizards eat ants, what happens to the ants may tell a lot about the future of the lizards. The relationship doesn't stop there. Birds of prey, such as hawks, feed on the lizards. What happens to the ants will also affect the lives of these birds.

The red bat's habitat is above the ground. During the day it hangs from tree branches like a red leaf. At night it streaks through the air looking for food. The habitat of the Texas horned lizard (below) is the dry soil of the Blackland Prairie.

Nonliving factors also affect organisms' lives. If conditions of an organism's niche change, it may have trouble surviving. If a drought hits the Blacklands, ponds may dry out. Chorus frogs reproduce in water, so a drought would mean fewer young frogs. This would also mean trouble for animals that feed on the frogs. However, it would increase the populations of organisms the frogs eat.

The eastern spadefoot toad can survive in a dry, hot habitat by burrowing into the soil and absorbing water through its skin.

How Do Organisms Survive Changes?

The world is a place of changes. One day the weather may be dry and cold. The next day it may be wet and warm. Heavy rains may drench the land one spring and summer. The next year's spring and summer may have cloudless skies day after day. This makes habitats change. A good habitat for a certain organism at one time may be a threatening one at another time. How do populations survive difficult times?

The Eastern Spadefoot Toad

The eastern spadefoot toad lives in the Blackland Prairie. This animal reproduces in water and needs water for its daily life. What happens if a drought strikes the Blacklands?

A close look at the toad's hind feet provided scientists with a clue to the answer. Its hind feet are shaped like little spades. They are adapted for digging. That's just what the spadefoot toad does when water is scarce. It digs into the ground and covers itself with soil. This toad can absorb water through its skin. There's a lot of clay in Blacklands soil, and clay holds water well. Usually there is some water in the soil, even though there may not be any water above it. The toad may be able to survive in the soil even during a drought.

Other animals may be adapted to changes in their habitats in different ways. A varied diet can be useful. Texas horned lizards eat mainly ants. They also eat other insects. If the ant population decreases, at least some lizards will survive. If the ant population increases, the lizards will have more food, and their population will increase.

American Bald Eagles

Many years ago there were bald eagles in the Blackland Prairie of Texas. Then they disappeared. A few have returned recently, especially around the lakes created by damming rivers. Why did the eagles disappear for a while?

On the next page, you can analyze data to discover one reason why bald eagles may have vanished from the skies above the Blackland Prairie.

SKILL BUILDER

Skill: Separating and Controlling Variables

VANISHING BALD EAGLES

The chart below shows the average number of bald eagle eggs that hatched in the wild during a 16-year period. It also shows the level of an insecticide in bald eagle eggs during the same period. What is the relationship between these two variables?

MATERIALS
- ruler
- *Science Journal*

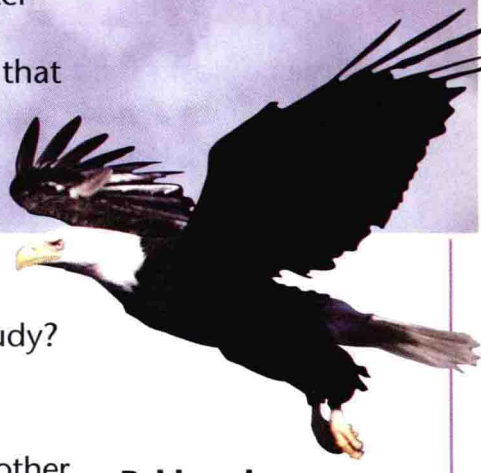
MATH LINK

Bald Eagle Egg-Hatching Data

Year	1966	1967	1968	1969	1970	1971	1972*	1973	1974	1975	1976	1977	1978	1979	1980	1981
Average number of young hatched (per nest)	1.28	0.75	0.87	0.82	0.50	0.55	0.60	0.70	0.60	0.81	0.90	0.93	0.91	0.98	1.02	1.27
Insecticide in eggs (parts per million)	42	68	125	119	122	108	82	74	68	59	32	12	13	14	13	13

* pesticide banned

Variables are things that can change. In order to determine what caused the results of an experiment, you need to change one variable at a time. The variable that is changed is called the *independent variable.* A *dependent variable* is one that changes because of the independent variable.



Bald eagles once were common in the Blackland Prairie.

PROCEDURES

1. **INFER** What is the independent variable in the study? What is the dependent variable in the study?
2. **COMMUNICATE** Make a line graph showing the average number of young that hatched. Make another line graph showing the amount of insecticide in eggs.

CONCLUDE AND APPLY

1. **INFER** Based on the graphs, what appears to be the relationship between the amount of insecticide in eggs and the number of young hatched?
2. **HYPOTHESIZE** Suggest a reason for the relationship.

Most of the Blackland Prairie has been changed into cropland. Should what's left of the natural Blacklands be preserved? Should some of the cultivated lands be turned back to nature? What price do we pay for answering either question with a yes or no?

What Is the Treasure of the Blackland Prairie?

Have you ever read about buried treasure? Unlike those stories the treasure of the Blackland Prairie is not buried underground. The treasure of the Blackland Prairie *is* the ground.

Prairie soils can often be identified by their dark brown to black *topsoil*. Topsoil is the top layer of soil. The dark color shows the presence of *humus*. Humus is partly decayed plant matter. The decay is produced by the Blacklands' tiniest organisms, bacteria and fungi.

The rich topsoil is full of minerals that prairie grasses and crops need. Two of the most important minerals are magnesium and calcium. Plants need magnesium in order to make chlorophyll molecules. Remember, chlorophyll is what allows plants to use the Sun's energy to make food. Calcium is an important element of cell walls in plants.

The nutrients in certain prairie soils tend to stay near the surface. That's true because of the low yearly rainfall in prairies. There isn't enough water to carry the nutrients deep into the ground. Farmers take advantage of this by growing crops that have shallow roots, such as corn, wheat, cotton, and sorghum. Sorghum is a grain that is used to feed livestock.