


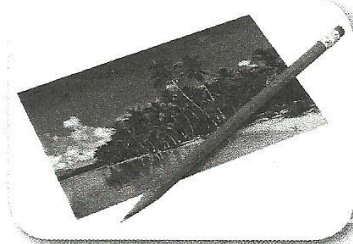
What is an environment?

Earth contains many different environments. What makes these environments different?

- 1 Select a **postcard** from the ones provided. Look at the picture of the location on it.
- 2 Plan a vacation to the location on your postcard. In your Science Journal, describe the type of transportation you will need to use to get there, the clothing and other accessories you will need to pack, and the types of activities you will participate in at the location.
- 3 Write a note to a friend describing the environment that you might visit on your vacation. Describe the living and nonliving things you might find.

Think About This

1. How is your vacation environment different from the one where you live?
2. What types of living organisms will you see in your vacation environment? How are these organisms suited to this environment? What organisms are not suited to your vacation environment? Explain.
3.  **Key Concept** What are the different ways you can describe the environment of your vacation spot?



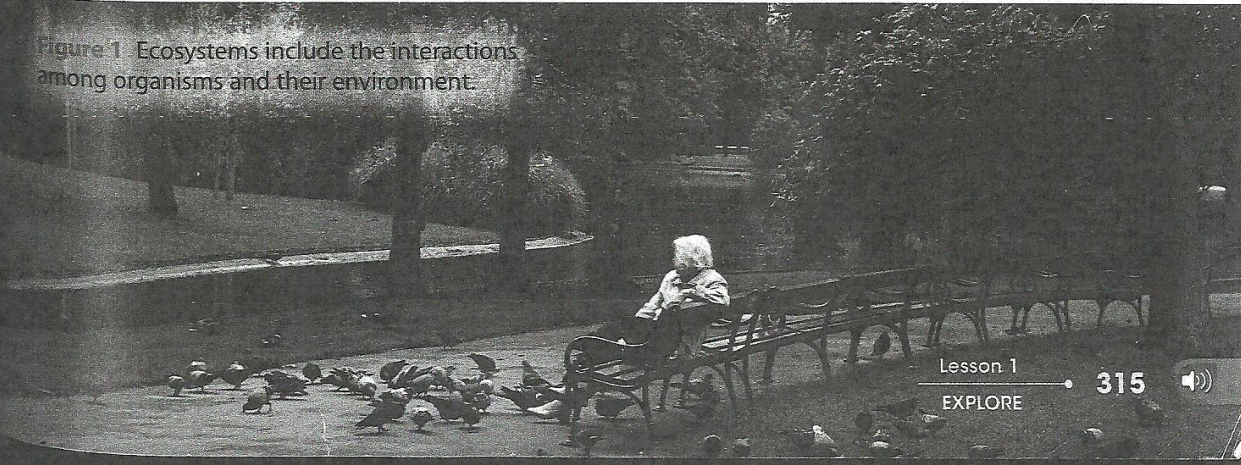
What is an ecosystem?

Imagine that you are visiting a park. You sit on the grass in the warm sunshine. You watch a squirrel run down a tree trunk and chew an acorn. A robin pulls an earthworm from the soil. Traveling in a line, ants carry bits of dead insects to their underground nest. A breeze blows dandelion seeds through the air. These interactions are just a few of the many that can happen in an ecosystem, such as the park shown in **Figure 1**. An **ecosystem** is all the living things and nonliving things in a given area.

There are many kinds of ecosystems on Earth, including forests, deserts, grasslands, rivers, beaches, and coral reefs. Ecosystems that have similar climates and contain similar types of plants are grouped together into biomes. For example, the tropical rain forest biome includes ecosystems full of lush plant growth located near the equator in places where rainfall averages 200 cm per year and the temperature averages 25°C.

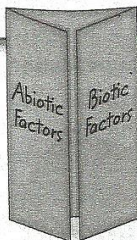
 **Key Concept Check** How can you describe an ecosystem?

Figure 1 Ecosystems include the interactions among organisms and their environment



FOLDABLES®

Make a vertical shutter-fold book. Label it as shown. Use it to organize your notes about abiotic and biotic factors.



REVIEW VOCABULARY

atmosphere

the whole mass of air surrounding Earth

Abiotic Factors

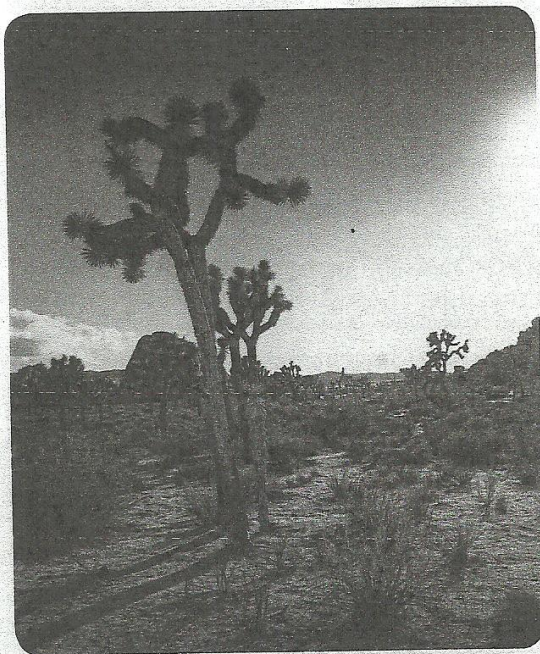
The nonliving parts of an ecosystem are called **abiotic factors**. They include sunlight, temperature, air, water, and soil. Abiotic factors provide many of the resources organisms need for survival and reproduction.

Sunlight and Temperature Sunlight is essential for almost all life on Earth. It supplies the energy for photosynthesis—the chemical reactions that produce sugars and occur in most plants and some bacteria and protists.

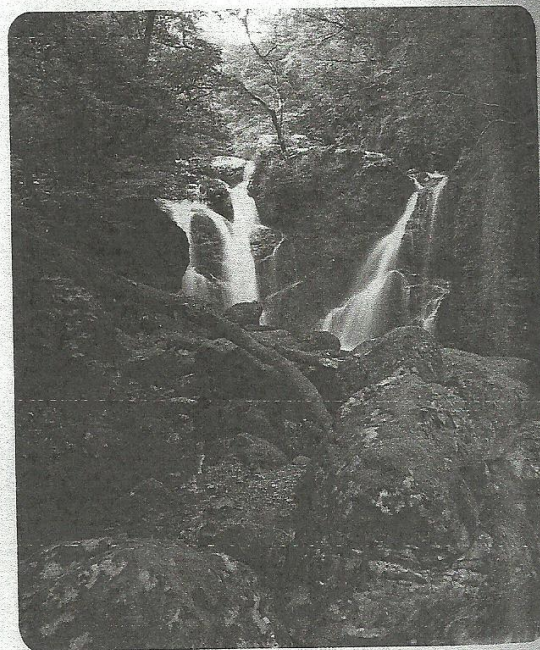
Sunlight also provides warmth. An ecosystem's temperature depends in part on the amount of sunlight it receives. In some ecosystems, such as the hot, dry desert shown in **Figure 2**, temperatures can be around 49°C during the day and below freezing at night.

Atmosphere The gases in Earth's **atmosphere** include nitrogen, oxygen, and carbon dioxide. Nitrogen is needed for plant growth. Some bacteria in the soil take nitrogen from the air and convert it to a form that plants can use. Oxygen is needed by most organisms for cellular respiration—the process that releases energy in cells. Air also contains carbon dioxide that is needed for photosynthesis.

Figure 2 Abiotic factors in an ecosystem determine what kinds of organisms can live there.



Desert life is limited to organisms that can survive with little water. Shade from plant life provides shelter from the heat of the Sun.



Stream life depends on a constant supply of water. Plants along stream banks provide shelter and food for hundreds of species.




Water Without water, life would not be possible. Water is required for all the life processes that take place inside cells, including cellular respiration, digestion, and photosynthesis. The stream ecosystem shown in **Figure 2** can support many forms of life because water is plentiful. Areas with very little water support fewer organisms.

Soil If you ever have planted a garden, you might know about the importance of soil for healthy plants. Soil contains a mixture of living and nonliving things. The biotic part of soil is humus (HEW mus)—the decayed remains of plants, animals, bacteria, and other organisms. Deserts have thin soil with little humus. Forest soils usually are thick and fertile, with a higher humus content. Abiotic factors include minerals and particles of rock, sand, and clay. Many animals, including gophers, insects, and earthworms, such as those shown in **Figure 3**, make their homes in soil. Their tunnels help move water and air through the soil.

Biotic Factors

*Living or once-living things in an ecosystem are called **biotic factors**.* They include all living organisms—from the smallest bacterium (plural, bacteria) to the largest redwood tree. Biotic factors also include the remains of dead organisms, such as fallen leaves or decayed plant matter in soil.

Species are adapted to the abiotic and biotic factors of the ecosystems in which they live. Algae, fungi, and mosses live in moist ecosystems such as forests, ponds, and oceans. Many cactus species can survive in a desert because they have thick stems that can hold stored water. Gophers live in burrows underground. They have large front claws for digging and strong teeth for loosening soil and chewing plant roots.

 **Key Concept Check** What are the similarities and differences between abiotic and biotic factors?

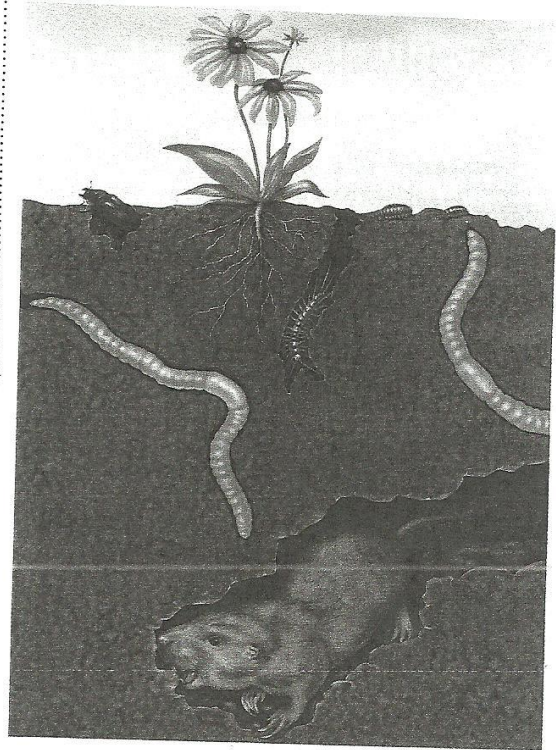



Figure 3  Plant roots and soil-dwelling organisms need oxygen and water. Gophers, earthworms, and insects loosen the soil. This helps move air and water through soil.

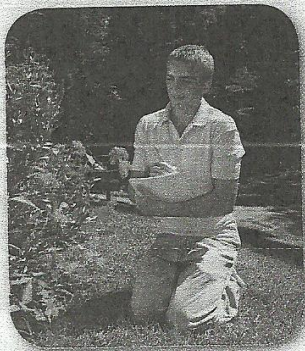
WORD ORIGIN

biotic
from Greek *bios*, means “life”

How do you describe an ecosystem?


An ecosystem can be a small area or a very large environment. What makes up the ecosystem around your school yard?

- 1 Read and complete a lab safety form.
- 2 Walk around the outside of your school. Note the general appearance of your ecosystem.



- 3 In your Science Journal, list the abiotic factors you find around your ecosystem. Describe as many of the abiotic factors, in as much detail, as you can.
- 4 List and describe the biotic factors in your ecosystem. Examine the soil and the ground area closely for smaller organisms.
- 5 In your Science Journal, illustrate your ecosystem.

Analyze and Conclude

1. **Summarize** the interactions that occur between biotic and abiotic factors within your ecosystem.
2. **Define** the populations within your ecosystem.
3. **Describe** the community that inhabits your ecosystem.
4.  **Key Concept** Diagram your ecosystem in terms of populations, community, and abiotic factors.

Habitats

Every organism in an ecosystem has its own place to live. A **habitat** is the place within an ecosystem that provides food, water, shelter, and other biotic and abiotic factors an organism needs to survive and reproduce.

Organisms have a variety of habitats. For example, house martins such as the ones shown in **Figure 4** sometimes live in meadows or grasslands, but these birds have found a habitat under the eaves of a building. Crickets live in damp, dark places with plenty of plant material and fungi to eat. Skunks live in areas where they can find food such as mice, insects, eggs, and fruit. During the day, skunks take shelter near their food supply—in hollow logs, under brush piles, and underneath buildings.

Plants have their own habitats, too. You have read that cacti live in desert habitats. The wood sorrel is a plant species that grows in deep shade beneath redwood trees.

When biotic or abiotic factors in an ecosystem change, habitats can change or disappear. A wildfire quickly can destroy the habitats of thousands of animals that live in forests or grasslands. Erosion or flooding can wash away soil, destroying plant habitats.


 **Reading Check** What is a habitat?



Figure 4 An organism's habitat provides shelter, food, and all the other resources it needs for survival.

Populations

Every ecosystem includes many individuals of many species. A **population** is all the organisms of the same species that live in the same area at the same time. For example, all the dandelions growing in a vacant lot form a population. All the ants in the vacant lot make up another population. All the populations living in the same area at the same time form a **community**. As shown in **Figure 5**, a vacant-lot community might include populations of grasses, dandelions, spiders, ants, and pigeons. A community combined with all the abiotic factors in the same area forms an ecosystem. The populations that make up the community interact in the ecosystem.

Figure 5 The community living in this vacant lot includes populations of dandelions, grasses, ants, spiders, and pigeons.

Visual Check What abiotic factors are included in this ecosystem?

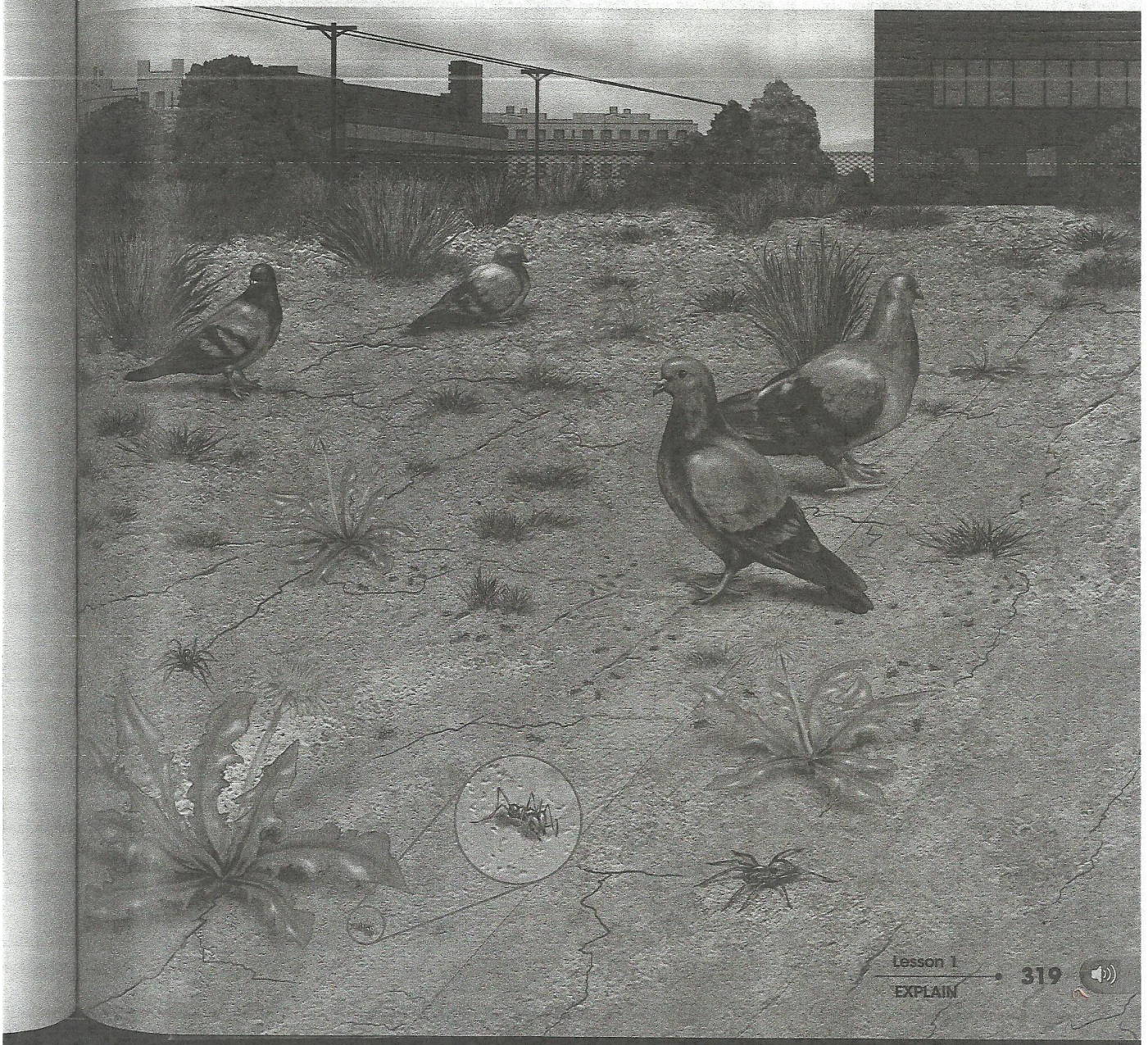
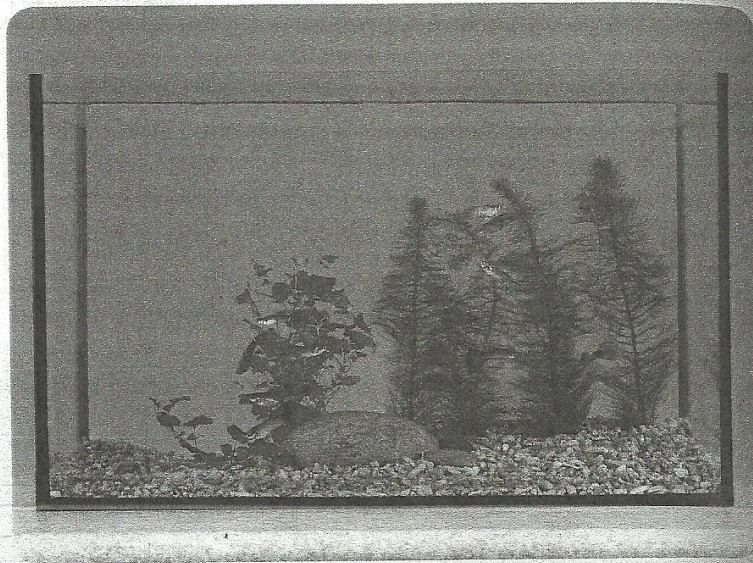


Figure 6 Guppies are easy to care for, but overcrowding can lead to disease.



Math Skills

Use a Formula

A formula shows the relationship among several factors. The formula for population density determines the number of individuals in a unit area or a volume of space. Population density = **number of individuals / unit area or volume of space**. For example, what is the population density of insects if 140 insects are found in a patch of ground measuring 3.0 m²?

1. Replace the terms in the equation with the given values.

$$\text{Population density} = \frac{140 \text{ insects}}{3.0 \text{ m}^2}$$

2. Solve the problem.

$$\frac{140 \text{ insects}}{3.0 \text{ m}^2} = \frac{46.6 \text{ insects}}{\text{m}^2}$$

3. Round the answer to significant figures.

$$\frac{46.6 \text{ insects}}{\text{m}^2} = \frac{47 \text{ insects}}{\text{m}^2}$$

Practice

There are 20 small tropical fish swimming in a 55-gallon aquarium. What is the population density?

 Review

- Math Practice
- Personal Tutor

Population Density

Suppose your classroom has an aquarium like the one shown in **Figure 6**. It contains guppies, water ferns, and a few algae-eating snails. Keeping your aquarium community healthy includes cleaning the tank and feeding the fish. However, it also means making sure the fish don't get overcrowded. Overcrowding can lead to stress and disease.


How can you determine if the aquarium contains too many fish? You could calculate the population density. **Population density** is the size of a population compared to the amount of space available. It can be calculated using the following formula:

$$\text{Population density} = \frac{\text{number of individuals}}{\text{unit area or volume of space}}$$

An aquarium expert has recommended that you keep no more than 10 guppies in your 20-gallon aquarium. Using the formula, you can calculate the population density:

$$0.5 \text{ fish per gallon} = \frac{10 \text{ fish}}{20 \text{ gallons}}$$

When population density is high, organisms live closer together and might not be able to obtain all the resources needed for life. Diseases also spread more easily when organisms are forced to live too close together.

 **Reading Check** How does population density affect organisms?




Population Change

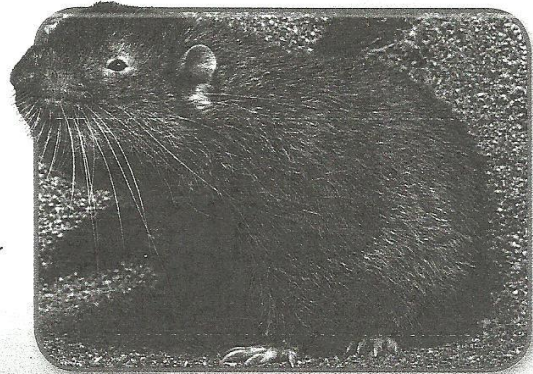
On a hike one summer, you notice a few wild sunflowers growing among grasses in an abandoned field. Two years later you return and find the field completely covered with sunflowers. What caused the population to increase? Each sunflower plant produces hundreds of seeds. Even if only a few of the seeds from each plant sprout and grow, the number of sunflowers will increase. If a drought prevents seeds from sprouting or if a farmer plants the field with corn, soybeans, or another crop, the sunflower population will decrease.

Most populations change over time. Production of offspring increases the size of a population. The death of individuals reduces population size. If births outnumber deaths, the population grows.

Changes in the abiotic or biotic factors in an ecosystem can cause organisms to move away or die out. For example, if there is a forest fire, birds, deer, and other fast-moving animals can escape to another area. Others, such as the mountain beaver in **Figure 7**, could die out.

 **Key Concept Check** In what ways can populations change?

Figure 7  Before fire swept through this forest ecosystem, it provided a habitat for about 5,000 mountain beavers. Fewer than 100 beavers survived the fire, but their habitat slowly grew back and the mountain beaver population increased again.



Mountain beaver

