KEY CONCEPT

13.1 Groups of living things interact within ecosystems.

BEFORE, you learned

- Abiotic and biotic factors interact in an ecosystem
- Matter and energy necessary for life move through the environment

NOW, you will learn

- How groups of organisms interact in an ecosystem
- About levels of organization in an ecosystem
- About living patterns of different groups of organisms

VOCABULARY

species p. 429
population p. 430
habitat p. 430
niche p. 431
community p. 432

EXPLORE Counting Animals

How can you use a grid to estimate the number of animals in an area?

PROCEDURE

1. Mark off an area on the graph paper as shown. Count the number of large squares in that area.
2. Use a handful of rice to represent a group of animals. Spread the rice evenly within the area you marked. Count the number of "animals" inside one large square.
3. Use a calculator to multiply the counts from steps 1 and 2. This will give you an estimate of the total number of "animals." Check your answer by counting all the grains of rice.

MATERIALS

- handful of rice
- large-grid graph paper
- marker
- calculator

WHAT DO YOU THINK?

- How close was your estimate to the actual number?
- What would prevent a scientist from making an actual count of animals in an area?

Organisms occupy specific living areas.

On a walk through the woods, you may see many different plants and animals. These organisms, like all living things, depend on their environment to meet their needs. The particular types of living things you see will depend on the characteristics of the area you are visiting.

Scientists group living things according to their shared characteristics. The smallest grouping is the species. Scientists consider organisms to be members of the same **species** (SPEE-sheez) if the organisms are so similar that they can produce offspring that can also produce offspring. Members of a species can successfully reproduce.

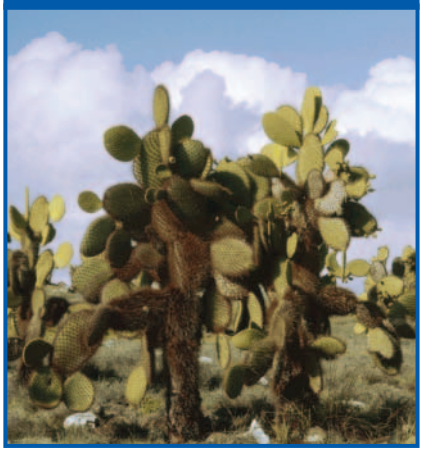
READING TiP

The terms *species, specific,* and *special* come from the same Latin root meaning "kind." A species is a kind, or type, of organism.

Galápagos Island Populations

A population is a group of the same organisms that live in the same area.

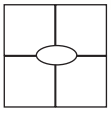
Cacti



Crabs

Iguanas

VOCABULARY
Add a four square for *population* to your notebook. Include the word *habitat* in your diagram.



Populations

Scientists use the term **population** to mean a group of organisms of the same species that live in a particular area. In a way, this is similar to the population of people who live in a particular city or town. You can then think of those people who live in different cities or towns as belonging to different populations. It is the boundary of an area that defines a population. In the study of ecology, members of the same species that live in different areas belong to different populations.

A biological population can be a group of animals or a group of plants. It can be a group of bacteria or fungi or any other living thing. Populations of many different species will be found living in the same area. For example, the photographs above show different populations of organisms that all live in the same place—on one of the Galápagos Islands. The island has a population of cacti, a population of crabs, and a population of iguanas.

CHECK YOUR READING What is the difference between a species and a population?

Habitats and Niches

The Galápagos Islands are a small group of volcanic islands, off the coast of South America, that are famous for their unusual plant and animal life. These islands are the **habitat**—the physical location—where these plants and animals live. Island habitats have certain physical characteristics that describe them, including the amount of precipitation, a range of temperatures, and the quality of the soil. Different habitats have different characteristics.

Galápagos Island Habitat

This island habitat is home to many different populations.

READING VISUALS What resources are available in this habitat?

A habitat is filled with different species, each of which depends on the habitat's resources to meet its needs. The characteristics of a habitat determine the species of plants that can grow there. The species of plants found in a habitat, in turn, determine the species of animals and other organisms that will do well there.

Different populations within a habitat interact. They are part of the flow of energy and matter through an ecosystem. For example, in the Galápagos Island scene above, the cacti capture the Sun's energy and store fresh water. They also provide food for the iguana, who eats the cactus leaves. The cactus is a producer and the iguana is a primary consumer. The crabs of the Galápagos are secondary consumers that feed on other shellfish. Each of these organisms has a role to play in the habitat, a role which is referred to as its **niche** (nihch).

The niche an organism fills in a habitat is not limited to its place in a food web. Plants provide nesting sites as well as food. The droppings left behind by animals fertilize soil and often spread seed. Generally, no two species will fill exactly the same niche in a habitat.

Communities

Take a mental tour of your school. Note that you share space with people who do many different things—students, teachers, custodians, librarians, counselors, and many others. They all work together and help each other. We often say that a school is a community.

Scientists use the term *community* in a slightly different way. A biological **community** is a group of populations that live in a particular area and interact with one another. Cacti, iguanas, and crabs are part of the Galápagos Island community. This community also includes populations of tortoises, finches, fleas, bacteria, and many other species.

CHECK YOUR READING How is a school community similar to a community of living things?

The environment can be organized into five levels.

OUTLINE
Add the different levels of the environment to your outline. Make sure to explain each term in the supporting details.

The five terms—biome, ecosystem, community, population, and organism—describe the environment at different levels.

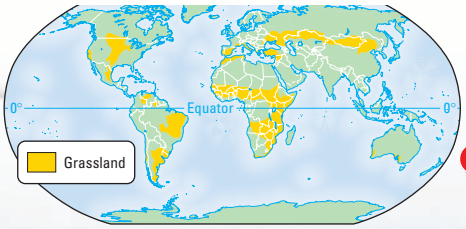
1. **Biome** A biome describes in very general terms the climate and types of plants that are found in similar places around the world.
2. **Ecosystem** Within each biome are many ecosystems. Inside an ecosystem, living and nonliving factors interact to form a stable system. An ecosystem is smaller than a biome and includes only organisms and their local environment.
3. **Community** A community is made up of the living components of the ecosystem. In a community, different plants, animals, and other organisms interact with each other.
4. **Population** A population is a group of organisms of the same species that live in the same area.
5. **Organism** An organism is a single individual animal, plant, fungus, or other living thing. As the picture on page 433 shows, an organism plays a part in each level of the environment.

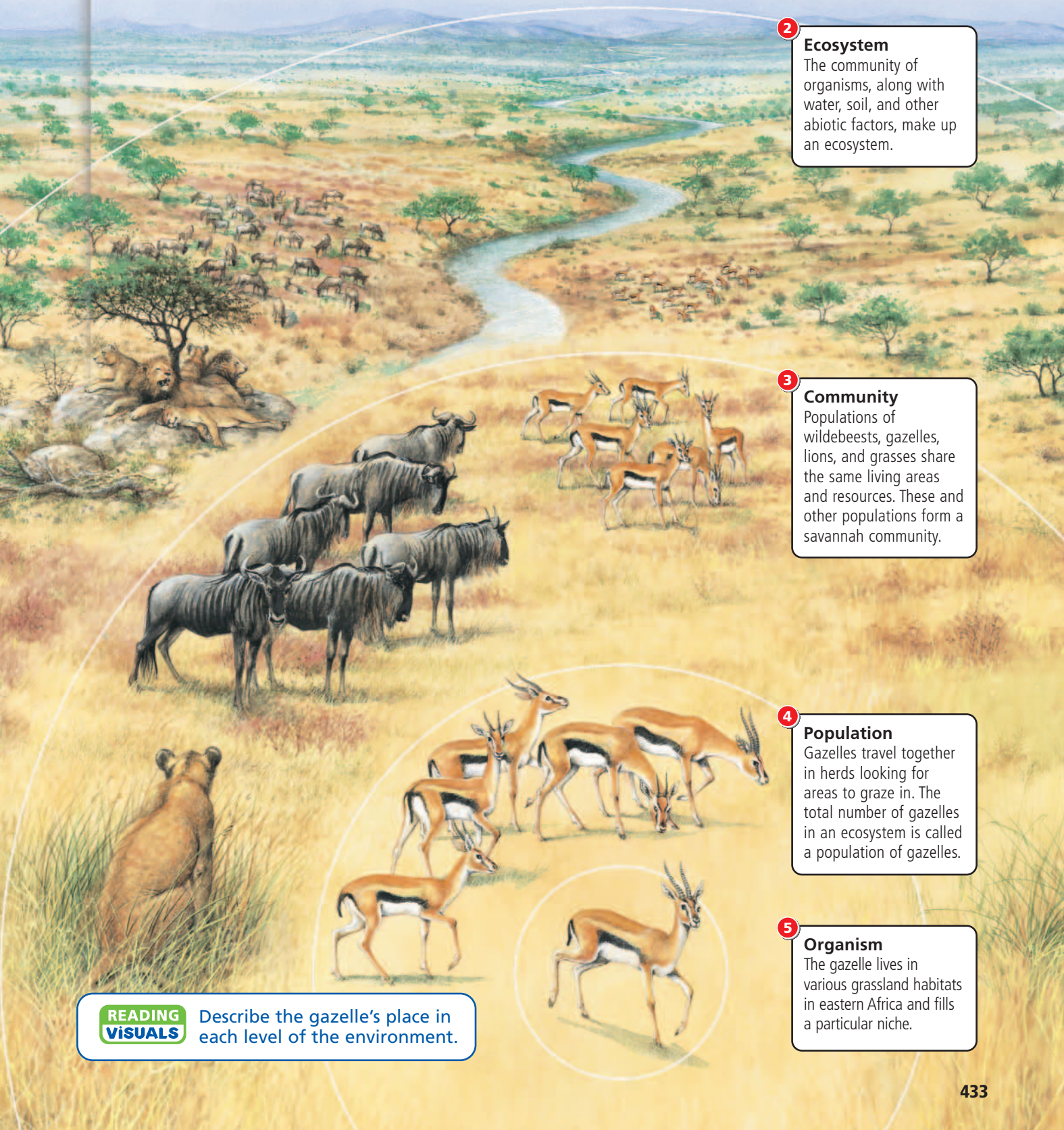
Patterns exist in populations.

Members of a population settle themselves into the available living space in different ways, forming a pattern. Populations may be crowded together, be spread far apart, or live in small groups. A population may also show a pattern over time. The number of individuals in the population may rise and fall, depending on the season or other conditions, or as a result of interactions with other organisms.

Levels in the Environment

Organisms living in an African savannah illustrate the different levels of the environment.





1 Biome
The African savannah is part of a grassland biome.

2 Ecosystem
The community of organisms, along with water, soil, and other abiotic factors, make up an ecosystem.

3 Community
Populations of wildebeests, gazelles, lions, and grasses share the same living areas and resources. These and other populations form a savannah community.

4 Population
Gazelles travel together in herds looking for areas to graze in. The total number of gazelles in an ecosystem is called a population of gazelles.

5 Organism
The gazelle lives in various grassland habitats in eastern Africa and fills a particular niche.

READING VISUALS Describe the gazelle's place in each level of the environment.

Patterns in Living Space

The patterns formed by a population often show how the population meets its needs. For example, in California's Mojave desert the pale soil is dotted with dark-green shrubs called creosote bushes. A surprising thing about the bushes is their even spacing. No human shaped this habitat, however. The bushes are the same distance from each other because the roots of each bush release a toxin, a type of poison, that prevents the roots of other bushes from growing.

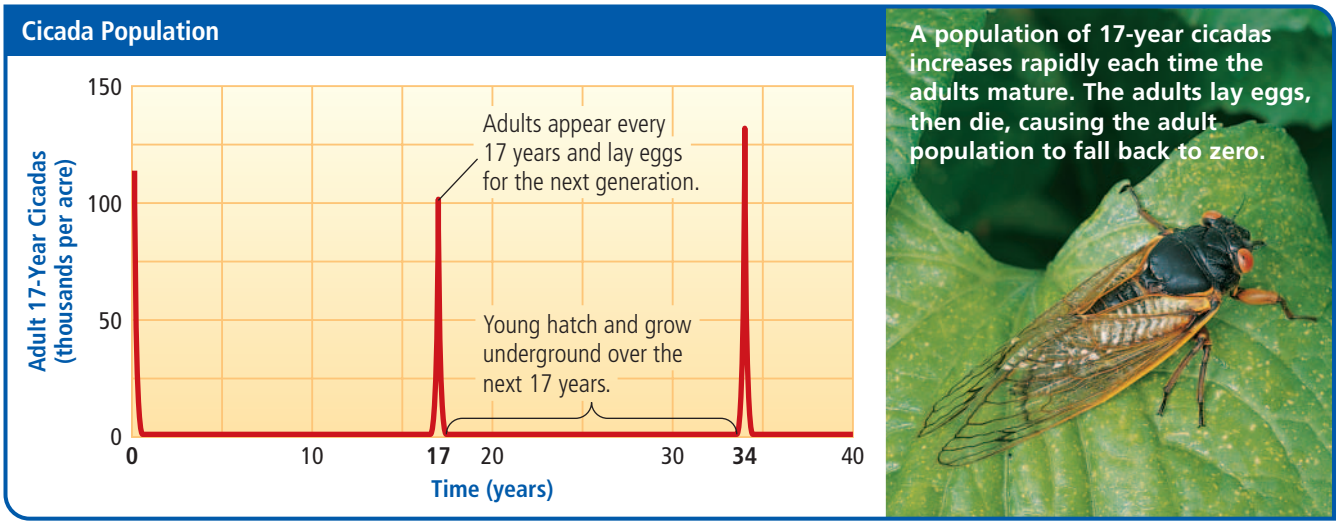
The distribution of animals in a habitat is often influenced by how they meet their needs. Animals must be able to reach their food supply and have places to raise their young. If you put up bird houses for bluebirds on your property, they must be spaced at least a hundred meters apart. Bluebirds need a large area of their own around their nest in order to collect enough insects to feed their young.

READING TIP
As you read this paragraph, note the pattern of wildebeests and elephants in the photograph.

Sometimes, the particular pattern of individuals in a living space helps a population survive. Herring swim in schools, with the individual fish spaced close together. Wildebeests roam African grasslands in closely packed herds. These animals rely on the group for their safety. Even if one member of the group is attacked, many more will survive.

CHECK YOUR READING What are some reasons for the spacing patterns observed in different populations?

READING VISUALS **COMPARE AND CONTRAST** How would you describe the spacing of these elephants and wildebeests?



A population of 17-year cicadas increases rapidly each time the adults mature. The adults lay eggs, then die, causing the adult population to fall back to zero.

Patterns in Time

At a spring picnic, you would rarely see the wasps called yellow jackets. At a fall picnic, however, they swarm to the food. This is an example of a population whose size changes with time. In spring, the queen wasp lays eggs and new wasps hatch. She continues to lay eggs all summer and the population grows. When winter comes, all the wasps except the queen die, and the population decreases.

Many birds that nest in North America in summer fly south to Central and South America in winter. There they find enough food and good nesting sites. In North America, this seasonal pattern leads to small bird populations in winter and large ones in summer.

The graph above shows an unusual pattern of population growth. Certain species of cicadas appear only every 17 years. Because no other species can rely on these insects as their main source of food, the cicadas survive long enough to lay eggs when they do appear.

13.1 Review

KEY CONCEPTS

1. What are two characteristics of a population?
2. Order these terms from the simplest to the most complex: biome, community, ecosystem, organism, population.
3. How do the terms *habitat* and *niche* relate to each other?

CRITICAL THINKING

4. **Apply** Choose a biological community in your region. Describe some of the populations that make up that community.
5. **Infer** How might the seasonal patterns of insect populations relate to the seasonal patterns of bird populations?

CHALLENGE

6. **Apply** The Explore activity on page 429 shows one way in which scientists sample a population to determine its total size. Would this method work for estimating the size of a population of 17-year cicadas? Why or why not?