Populations and Communities

Populations

Read to Learn

The Biosphere and Ecological Systems

Earth's **biosphere** (BI uh sfihr) *is the parts of Earth and the surrounding atmosphere where there is life*. The biosphere includes all the land of the continents and islands. It also includes all of Earth's oceans, lakes, and streams. It includes the ice caps at the North Pole and the South Pole. Parts of the biosphere with large numbers of plants or algae often contain many other organisms.

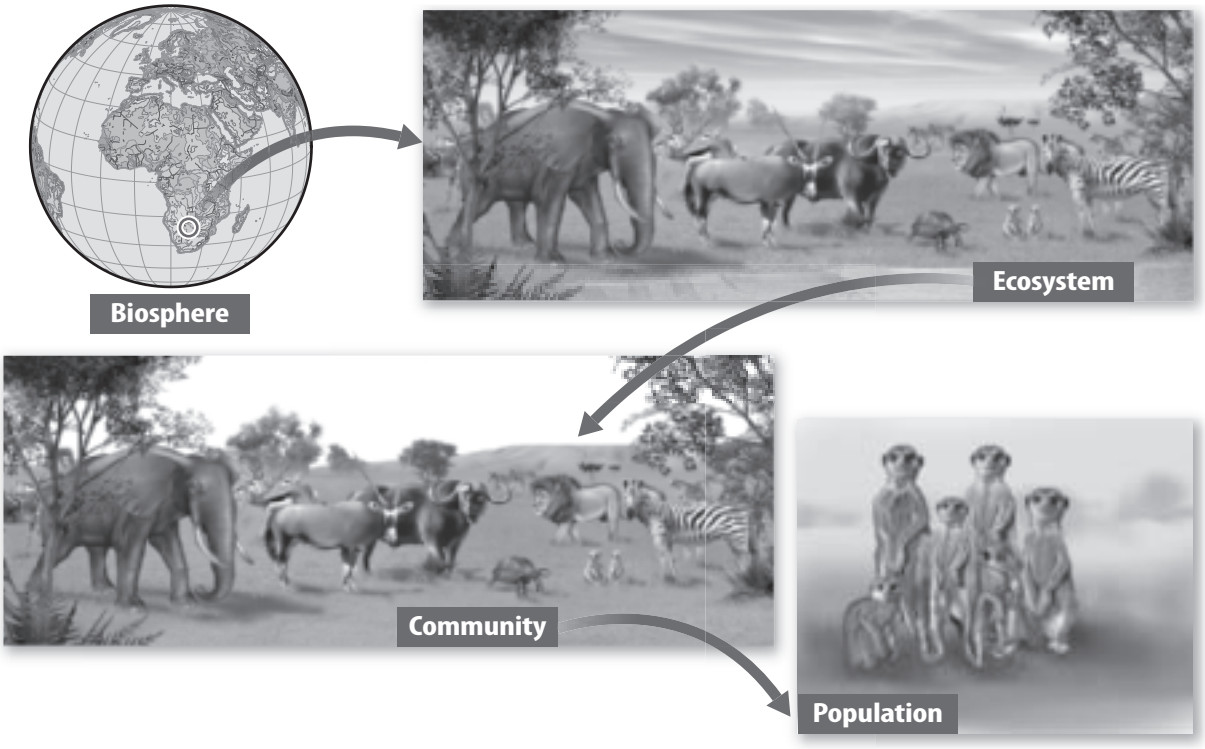
What is a population?

The Kalahari Desert in Africa is a part of Earth's biosphere. Several groups of meerkats live there in a wildlife refuge. Meerkats are small mammals that live in family groups and help each other care for their young. Meerkats interact with each other for survival. They sleep underground in burrows. They hunt for food during the day. They stand upright to watch for danger and call out warnings to others.

Meerkats are part of an ecosystem. An ecosystem is a group of organisms that live together in an area at one time. It also includes the climate, soil, water, and other nonliving parts of the environment. The Kalahari Desert is one of many ecosystems that makes up Earth's biosphere. The study of all ecosystems on Earth is ecology.

Community The figure below shows a family group of meerkats on the bottom right. Many species besides meerkats also live in a wildlife refuge in the Kalahari Desert. They include scorpions, spiders, insects, snakes, birds, zebras, giraffes, lions, shrubs, grasses, small trees, and melon vines. All these plants and animals form a community. *A* **community** *is all the populations of different species that live together in the same area at the same time*.

Population All the family groups of meerkats that live in this refuge form a population. *A* **population** *is all the organisms of the same species that live in the same area at the same time*. A species is a group of organisms that have similar traits and are able to produce fertile offspring.



Competition

At times, there is not enough food for every organism in a community. Members of a population must compete with other populations and each other for enough food to survive. **Competition** *is the demand for resources, such as food, water, and shelter, in short supply in a community*. When there are not enough resources available to survive, there is more competition in a community. In the Kalahari Desert, where water is scarce, the meerkats compete with other animals for resources such as food and water.

Population Sizes

When there is less food available, a population of meerkats gets smaller. Female meerkats cannot raise as many young. Some meerkats might leave the area to find food elsewhere.

If there is plenty of food, the size of a population of meerkats grows larger. More meerkats survive to adulthood and live longer. Changes in environmental factors can result in changes to the size of a population.

Limiting Factors

Environmental factors, such as available food, water, shelter, sunlight, and temperature, are possible limiting factors for a population. *A* **limiting factor** *is anything that restricts the size of a population*. If there is not enough sunlight, green plants cannot make food by photosynthesis. A lack of green plants affects organisms that eat green plants.

Temperature is a limiting factor for some organisms. When the temperature drops below freezing, many organisms die because it is too cold for them to survive. Disease and predators—animals that eat other animals—can be limiting factors for organisms. Natural disasters such as fires and floods also limit the size of populations.

Measuring Population Size

Measuring the size of a population can be difficult. Biologists often use the capture-mark-and-release method to count and observe animal populations. A population of lynx in Poland is counted and monitored using this method. To use the capture-mark-and-release method, biologists capture several animals of a species. They sedate the animals and put a radio collar on each one. Then they release the animals back into the wild. The radio collars help biologists estimate the size of the population and track the animals' movements.

Population density *is the size of a population compared to the amount of space available*. Biologists estimate population density by a sample count. Suppose you want to know how closely together Cumberland azaleas (uh ZAYL yuhz), a type of flower, grow in the Great Smoky Mountains National Park. Rather than counting every azalea shrub, you would count only the azalea shrubs in an area, such as 1 km^2. By multiplying the number of square kilometers in the park by the number of azaleas in 1 km^2, you would find the estimated population density of azalea shrubs in the entire park.

Biotic Potential

Imagine that a population of raccoons has plenty of food, water, and den space. The population has no disease and is not in danger from other animals. The only limit to the size of this population is the number of offspring the raccoons can produce. **Biotic potential** *is the potential growth of a population if it could grow in perfect conditions with no limiting factors*. No population on Earth ever reaches its biotic potential because no ecosystem has an unlimited supply of natural resources.

Carrying Capacity

What happens when a population reaches its biotic potential? It stops growing when the available resources in the ecosystem are used up. *The largest number of individuals of one species that an environment can support is the* **carrying capacity.** A population grows until it reaches the carrying capacity of an environment. Disease, space, food, and predators are some of the factors that limit the carrying capacity of an ecosystem.

The carrying capacity of an environment does not stay the same. It increases and decreases as the amount of available resources increases and decreases. At times, a population can briefly grow beyond the carrying capacity of an environment.

Overpopulation

Populations can grow so large that they cause problems for other organisms in the community. Overpopulation occurs when a population becomes larger than the carrying capacity of its ecosystem. For example, meerkats eat spiders. An overpopulation of meerkats causes a decrease in the size of the spider population in that community. Populations of birds and other animals that eat spiders also decrease when the number of spiders decreases.

Elephants in Africa's wild game parks present another example of overpopulation. Elephant herds searching for food can cause tree damage. They push over trees to feed on treetops. Other animals that use those trees for food and shelter must compete with the elephants. Also, the loss of trees can damage the soil. This might prevent other trees and plants from growing in that area.