Introduction to Ecosystems

As its name suggests, an ecosystem is a system—it has boundaries, components, inputs, and outputs. Every living thing requires specific resources and conditions. The gray fox shown in Figure 2 requires certain types of food, shelter, temperatures, and other factors to survive. Gray foxes live in dens located in underground burrows, under rock crevices, or in caves. They eat plants, insects, and small mammals, such as mice and rabbits. Many types of internal and external parasites live on and in gray foxes, including ticks and tapeworms. Coyotes prey upon gray foxes, but the foxes can climb trees to escape.

FIGURE 2: A gray fox emerges from its den.

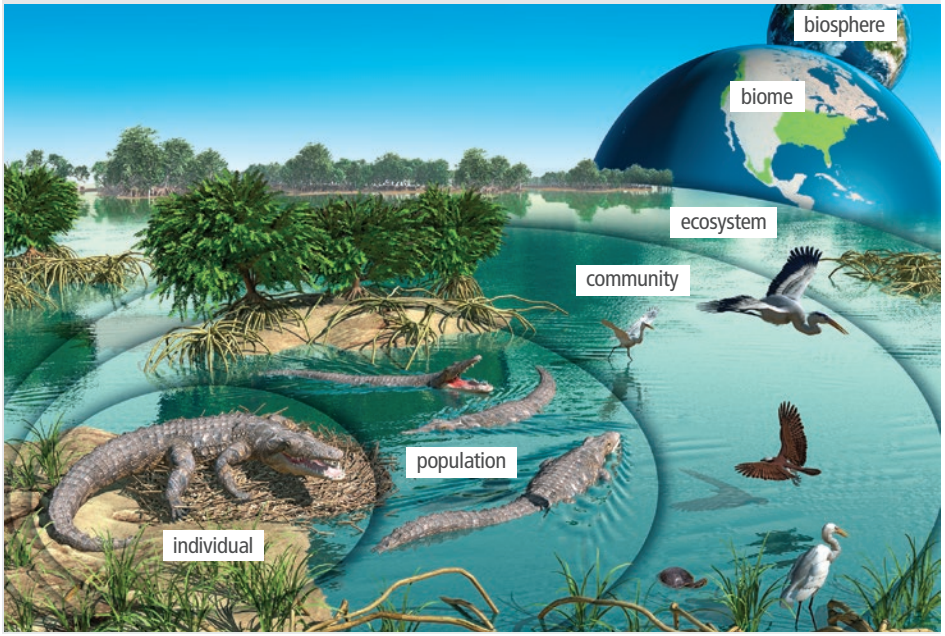
Analyze What types of living and nonliving things does a gray fox's ecosystem include?

Living - fox, grass non living - temperature, soil

Ecosystem Structure

The Florida Everglades, illustrated in Figure 3, is an example of a complex ecosystem that can be difficult to study as a whole. To understand the complicated relationships that make up ecosystems, scientists break them down into smaller parts.

FIGURE 3: The Florida Everglades is an aquatic ecosystem that is found in the temperate deciduous forest biome.



Ecologists can study ecosystems at different scales. They may study an individual alligator to learn more about factors that affect that species. They may also study an entire population of alligators. A population is a group of the same species that lives in the same area. Multiple populations of different species form a community. In the Everglades, an ecologist may study how a community of alligators, turtles, and birds in a certain area Interacts with one another.

Language Arts Connection Before they were listed as an endangered species, alligators in the Florida Everglades were hunted to near extinction. Use library and Internet resources to find information and write a report about how human activities have affected organisms, populations, and communities in the Florida Everglades ecosystem.

An ecosystem includes all of the biotic, or living, and abiotic, or nonliving, components in a given area. Energy and matter cycle through these various components during processes such as photosynthesis, cellular respiration, and decomposition. Similar to other systems, an ecosystem also has feedback mechanisms that keep it in equilibrium and restore it to a balanced state when equilibrium is disrupted.

Explain What biotic and abiotic components are found in the ecosystem where you live, and how do they interact?

Biomes and Biodiversity

A biome is a major regional or global distribution of organisms adapted to living in that particular environment. Many different ecosystems make up a biome, and changes in one ecosystem may significantly affect the entire biome. At the largest scale, all life on Earth is part of the biosphere.

Biodiversity is a measure of the number of different species found within a specific area. An area with a high level of biodiversity, such as a tropical rain forest, has a large assortment of species living near one another. The amount of biodiversity found in an area depends on many factors, including moisture and temperature. The complex relationships in ecosystems mean that a change in one biotic or abiotic component can have many effects, both small and large, on a number of different species.

FIGURE 4: World Biomes

a Desert

b Tropical grassland

c Temperate grassland

d Tropical rain forest

e Temperate deciduous forest

f Temperate rain forest

g Taiga

h Tundra

There are many different types of biomes. Scientists categorize biomes in several ways, such as by the climate conditions and plant communities that thrive in them. This makes each biome's biodiversity different and unique. For the most part, the plants and animals that live in one biome are not found in any other biome. Although biomes can be categorized separately, they are still connected. Each of these broad biome types can be further divided into more specific zones. For example, a prairie is a type of temperate grassland. Frozen polar ice caps and high, snow- and ice-covered mountain peaks are not considered biomes because they lack specific plant communities.

Model Using your knowledge of photosynthesis, cellular respiration, and ecosystem structure, model how cutting down a tropical rain forest will affect surrounding biomes. Consider how the loss of the rain forest will affect the rate of photosynthesis in the area and how habitat loss will affect the rate of cellular respiration by animals in the forest. Then, model how the change in amounts of CO_2 and O_2 could affect surrounding ecosystems. What other ways might ecosystems be affected by such a loss?

Not all ecosystems are terrestrial, or land-based. About 71 percent of Earth's surface is covered with water, and it, too, is home to animal and plant life. These water-based ecosystems are called *aquatic ecosystems.* There are two main categories of aquatic ecosystems: salt water, or marine, and freshwater.

Collaborate Biodiversity tends to decrease the farther an ecosystem is located from the equator. Discuss this pattern of biodiversity in terms of different biomes and climate characteristics.

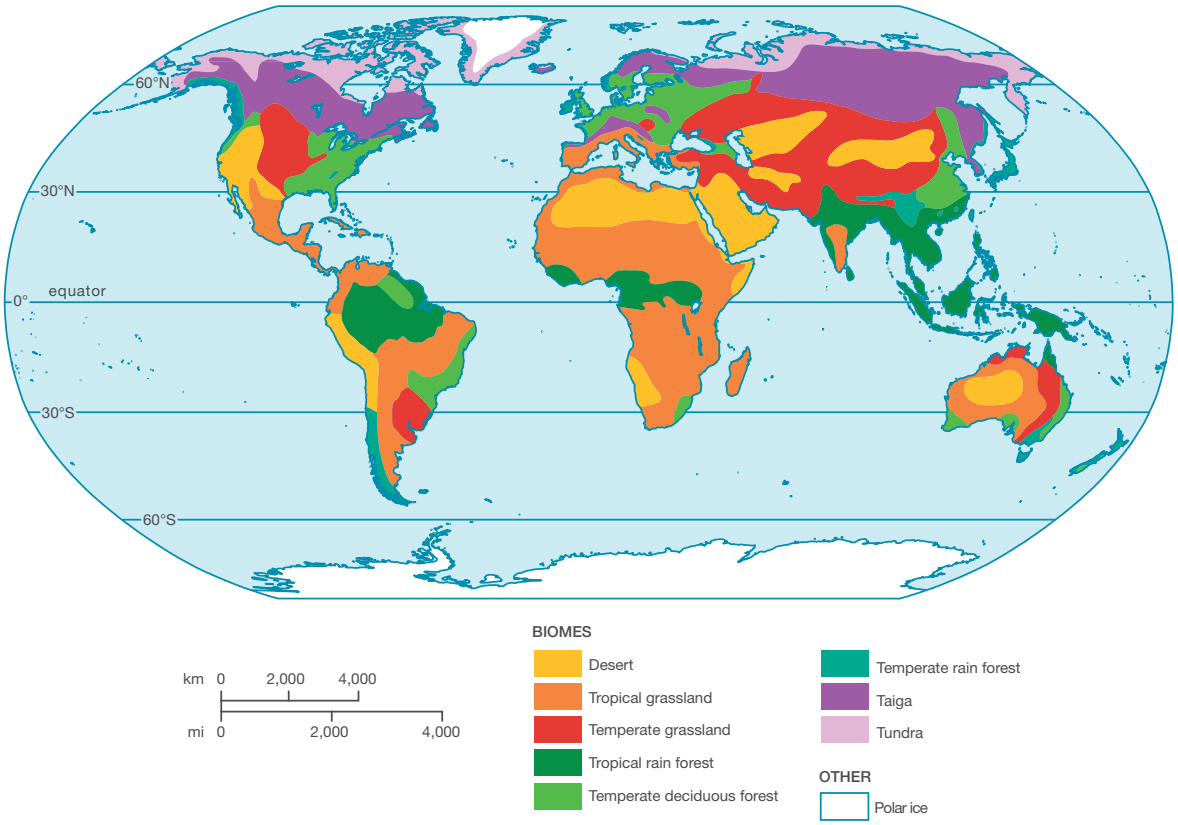
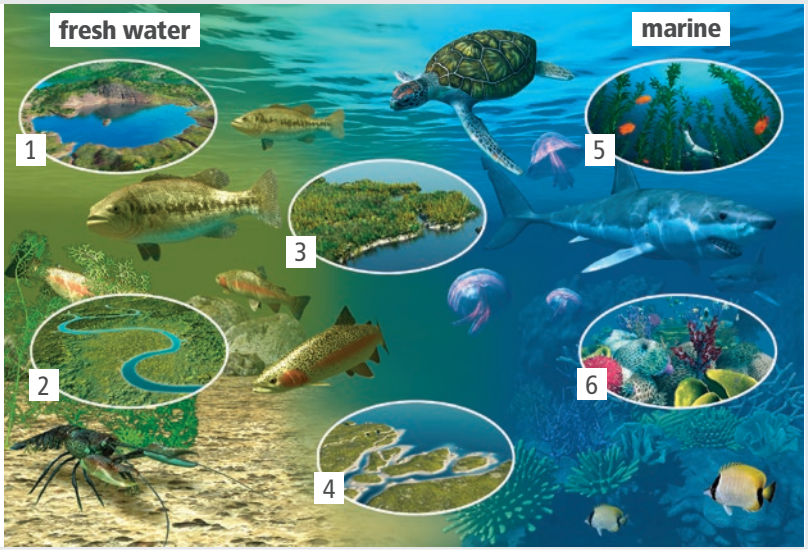


FIGURE 5: Like terrestrial ecosystems, aquatic ecosystems vary widely in size, location, and abiotic and biotic components.

1 lakes and ponds
2 rivers
3 wetlands
4 estuaries
5 kelp forests
6 coral reefs



Some types of aquatic ecosystems are shown in Figure 5. Marine ecosystems include the open ocean, coral reefs, kelp forests, and estuaries. Oceans spread from coastal shallows to the great depths of deep-sea vents. Most coral reefs grow within tropical zones. Kelp forests exist in cold, nutrient-rich waters. Estuaries occur where freshwater and salt water mix together.

Analyze How could rising ocean temperatures affect coral reef ecosystems?

Freshwater ecosystems include rivers, streams, lakes, ponds, and wetlands. Rivers and streams are flowing freshwater, while lakes and ponds are standing bodies of water. Wetlands are land that is saturated by surface water for at least part of the year.

Each of these ecosystems has unique groups of plants and animals that inhabit them. The plants and animals that live in these ecosystems are often highly specialized. Remember that aquatic plants utilize photosynthesis to convert sunlight into usable energy. They can only grow to water depths where sunlight can penetrate.

Cause and Effect

FIGURE 6: Discarded plastics pollute Bicaz Lake in Romania.

Analyzing Human Impacts

Human activities impact ecosystems, sometimes in severe ways. We produce wastes, such as plastics, that are a major source of pollution. Humans destroy habitats to build cities, grow crops, and mine resources. Most of these activities impair the air, water, soil, and biodiversity in ecosystems. How do you impact your ecosystem?

Explain Describe how changing a biotic or abiotic factor can influence an entire biome. Could changing biotic or abiotic factors be responsible for the decrease in phytoplankton populations introduced at the beginning of this lesson? Explain.