

13.2 Biotic and Abiotic Factors

VOCABULARY

biotic
abiotic
biodiversity
keystone species

KEY CONCEPT Every ecosystem includes both living and nonliving factors.

MAIN IDEAS

- ▶ An ecosystem includes both biotic and abiotic factors.
- ▶ Changing one factor in an ecosystem can affect many other factors.

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A vegetable garden is a small ecosystem, and its success depends on many factors. You can probably list several without too much thought. You might think of sunlight, fertilizer, or insects to pollinate the plants' flowers. Gardeners usually don't think of themselves as scientists, but they must take into account how these factors affect their plants in order for the plants to flourish.

▶ MAIN IDEA

An ecosystem includes both biotic and abiotic factors.

All ecosystems are made up of living and nonliving components. These parts are referred to as biotic and abiotic factors.

- **Biotic** (by-AHT-ihk) factors are living things, such as plants, animals, fungi, and bacteria. Each organism plays a particular role in the ecosystem. For example, earthworms play a key role in enriching the soil.
- **Abiotic** (ay-by-AHT-ihk) factors are nonliving things such as moisture, temperature, wind, sunlight, and soil. The balance of these factors determines which living things can survive in a particular environment. In the Caribbean Sea, scientists found that coral reefs located near salt-water marshes have more fish than do reefs farther out at sea. As shown in **FIGURE 2.1**, the key biotic factor is the mangrove trees that live in the marshes. The trees provide food and shelter for newly hatched fish, protecting them from predators. After the fish mature, they swim to the reefs. Abiotic factors that affect the growth of mangrove trees include low levels of oxygen in the mud where they grow and changing levels of salinity, or saltiness, due to daily tidal changes.

An ecosystem may look similar from one year to the next, with similar numbers of animals and plants. However, an ecosystem is always undergoing some changes. For example, a long period of increased precipitation might allow one plant species to grow better than others. As the plant continues to grow, it may crowd out other plant species, changing the community's composition. Though the total number of plants in the community may remain the same, the species have changed. As these cyclic changes occur, an ecosystem falls into a balance, which is known as approximate equilibrium.

Contrast What is the difference between biotic and abiotic factors?

FIGURE 2.1 The underwater roots of mangrove trees camouflage young coral-reef fish from predators.



▶ **MAIN IDEA**

Changing one factor in an ecosystem can affect many other factors.

An ecosystem is a complex web of connected biotic and abiotic factors. You may not always think of yourself as part of the ecosystem, but humans, like other species, rely on the environment for survival. All species are affected by changes to the biotic and abiotic factors in an ecosystem.

Biodiversity

The relationships within an ecosystem are very complicated. If you attached a separate string between a forest tree and each of the living and nonliving things in the ecosystem that influenced it, and did the same for each of those living and nonliving things, the forest would quickly become a huge web of strings. The web would also reveal the biodiversity in the forest. **Biodiversity** (BY-oh-dih-VUR-sih-tee) is the assortment, or variety, of living things in an ecosystem. An area with a high level of biodiversity, such as a rain forest, has a large assortment of different species living near one another. The amount of biodiversity found in an area depends on many factors, including moisture and temperature.

Some areas of the world have an unusually large amount of biodiversity in comparison to other locations. For example, tropical rain forests, which are moist and warm environments, cover less than 7 percent of Earth's ground surface. However, they account for over 50 percent of the planet's plant and animal species. This large amount of biodiversity emphasizes the importance of conserving such areas. Tropical rain forests are one of several areas referred to as hot spots. These hot spots, located across the globe, are areas that are rich in biodiversity, but are threatened by human activities.

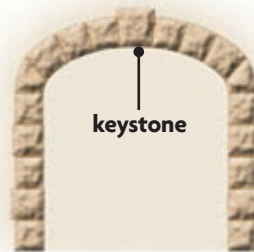
Keystone Species

The complex relationships in ecosystems mean that a change in a single biotic or abiotic factor—a few broken strings in the web—can have a variety of effects. The change may barely be noticed, or it may have a deep impact. In some cases, the loss of a single species may cause a ripple effect felt across an entire ecosystem. Such an organism is called a keystone species. A **keystone species** is a species that has an unusually large effect on its ecosystem.

One example of a keystone species is the beaver. By felling trees to construct dams, beavers change free-flowing stream habitats into ponds, wetlands, and meadows. This modification leads to a cascade of changes within their ecosystem.

VISUAL VOCAB

Like a keystone that holds up an arch, a **keystone species** holds together a dynamic ecosystem.



CONNECT TO

BIODIVERSITY

The discovery of potential medicines and new species are two reasons why it is important to maintain biodiversity. In **Human Impact on Ecosystems**, you will learn how human activities impact biodiversity and how the loss of biodiversity affects us all.

FIGURE 2.2 Keystone Species

Beavers are a **keystone species**. By constructing dams, beavers create an ecosystem used by a wide variety of species.



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PREMIUM CONTENT

Keystone Species

As **FIGURE 2.2** shows, beavers cause changes that create an ecosystem used by a variety of different species, leading to an overall increase in biodiversity.

- A greater number and wider variety of fish are able to live in the still waters of the pond.
- The fish attract fish-eating birds, such as herons and kingfishers.
- Insects inhabit the pond and the dead trees along the shore, attracting insect-eating birds, such as great-crested flycatchers, that nest in the tree cavities.
- Waterfowl nest among the shrubs and grasses along the pond's edge.
- Animals that prey on birds or their eggs are also attracted to the pond.

Keystone species form and maintain a complex web of life. Whatever happens to that species affects all the other species connected to it.

Connect Explain why the Pacific salmon, introduced in Section 1, could be considered a keystone species.



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PREMIUM CONTENT

13.2 Formative Assessment

REVIEWING MAIN IDEAS

1. Select an ecosystem that is familiar to you and describe the biotic and abiotic factors that exist there.
2. How would the removal of a keystone species affect an ecosystem's biodiversity?

CRITICAL THINKING

3. **Predict** Explain how a change in an abiotic factor such as sunlight would affect biodiversity.
4. **Analyze** Humans are sometimes described as being a keystone species. Does this label fit? Why or why not?

CONNECT TO

EVOLUTION

5. What role might an abiotic factor such as temperature play in the evolution of a species?