

12.1

KEY CONCEPT

Ecosystems support life.

BEFORE, you learned

- Living things need to obtain matter and energy from the environment
- The Sun provides Earth with light and heat

NOW, you will learn

- What factors define an ecosystem
- About living factors in an ecosystem
- About nonliving factors in an ecosystem

VOCABULARY

ecology p. 393
ecosystem p. 393
biotic factor p. 394
abiotic factor p. 394

EXPLORE Your Environment

How much can temperature vary in one place?

PROCEDURE

- 1 Choose three different locations inside your classroom where you can measure temperature.
- 2 Place a thermometer at each location. Wait for at least two minutes. Record the temperatures in your notebook.
- 3 Compare the data you and your classmates have collected.

WHAT DO YOU THINK?

- Which location was the warmest, and which was the coldest?
- Describe what factors may have affected the temperature at each location.

MATERIALS

- thermometer
- stopwatch



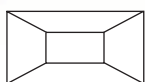
Living things depend on the environment.

You wouldn't find a kangaroo in the Arctic and you won't see a polar bear in Australia. Each of these organisms is suited to a certain environment. The kangaroo and the polar bear are able to survive despite the harsh conditions of their surroundings. **Ecology** is the scientific study of how organisms interact with their environment and all the other organisms that live in that environment.

Scientists use the word **ecosystem** to describe a particular environment and all the living things that are supported by it. An ecosystem can be as small as a pond or as large as a desert. What is important in an ecosystem is how the living parts of the ecosystem relate to the nonliving parts.

VOCABULARY

Add frame game diagrams for *ecology* and *ecosystem* to your notebook.



Let's take a look at a pond. A pond ecosystem is more than just water and fish. Plants grow in and around the water, and animals feed on these plants. A variety of tiny microorganisms in the water are food for fish and for each other. These are just a few of the living parts, or **biotic factors** (by-AHT-ihk), of a pond ecosystem. The nonliving parts, or **abiotic factors** (AY-by-AHT-ihk), include the air that supplies oxygen and carbon dioxide, the soil that provides nutrients, the water in the pond, and the sunlight that plants need to grow.



CLASSIFY Name three living and three nonliving factors that are part of this pond ecosystem.

Biotic factors interact with an ecosystem.

Living things depend upon an ecosystem for food, air, and water, as well as other things they need for survival. In turn, living things have an impact on the ecosystem in which they live. Plants, as a biotic factor in land ecosystems, affect other biotic and abiotic parts of ecosystems. Plants are an important source of food. The types of plants found in a particular ecosystem will determine the types of animals that can live there. Plants can affect temperature by blocking sunlight. Plant roots hold soil in place. Even the atmosphere is affected by plants taking in carbon dioxide and releasing oxygen.

Animals, as biotic factors, also affect an ecosystem. A beaver that builds a dam changes the flow of a river and so affects the surrounding landscape. Large herds of cattle can overgraze a grassland ecosystem and cause the soil to erode. In an ocean biome, corals form giant reefs that provide food and shelter for marine organisms.

Many abiotic factors affect ecosystems.

Abiotic factors include both the physical and chemical parts of an ecosystem. Physical factors are factors that you can see or feel, such as the temperature or the amount of water or sunlight. Important chemical factors include the minerals and compounds found in the soil and whether the ecosystem's water is fresh or salty. It is the combination of different abiotic factors that determines the types of organisms that an ecosystem will support.

READING TIP

The word *biotic* means "living." The prefix *a-* in *abiotic* means "not," so *abiotic* means "not living."

CHECK YOUR READING

List four different abiotic factors that can affect an ecosystem.

Temperature

Temperature is an important abiotic factor in any ecosystem. In a land ecosystem, temperature affects the types of plants that will do well there. The types of plants available for food and shelter, in turn, determine the types of animals that can live there. For example, a tropical rain forest has not only a lot of rain but it has consistently warm temperatures. The wide variety of plants that grow in a tropical rain forest supports a wide variety of monkeys, birds, and other organisms.

Animals are as sensitive to temperature as plants are. Musk oxen with their thick coat of fur can survive in very cold environments, where temperatures of -40°C (-40°F) are normal. The water buffalo, with its light coat, is better suited to warm temperatures. The wild water buffalo lives where temperatures can reach 48°C (118°F).



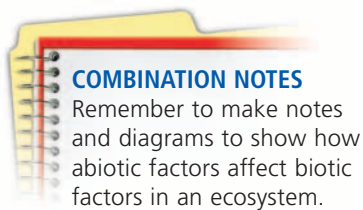
This musk ox's thick fur keeps it warm in the cold temperatures of northern Canada.



A water buffalo cools itself in a shallow stream during a hot day in India.

READING VISUALS

COMPARE AND CONTRAST How are these animals alike? How are they different?



COMBINATION NOTES

Remember to make notes and diagrams to show how abiotic factors affect biotic factors in an ecosystem.

Light

You can easily understand how abiotic factors work together when you think about sunlight and temperature. Sunlight warms Earth's surface and atmosphere. In addition, energy from sunlight supports all life on Earth. The Sun provides the energy that plants capture and use to produce food in a process called photosynthesis. The food produced by plants, and other photosynthetic organisms, feeds almost all the other living things found on Earth.

The strength of sunlight and the amount of sunlight available in a land ecosystem determine the types of plants in that ecosystem. A desert ecosystem will have plants like cacti, which can survive where sunlight is very strong. Meanwhile, mosses and ferns grow well on the forest floor, where much of the light is blocked by the trees above.

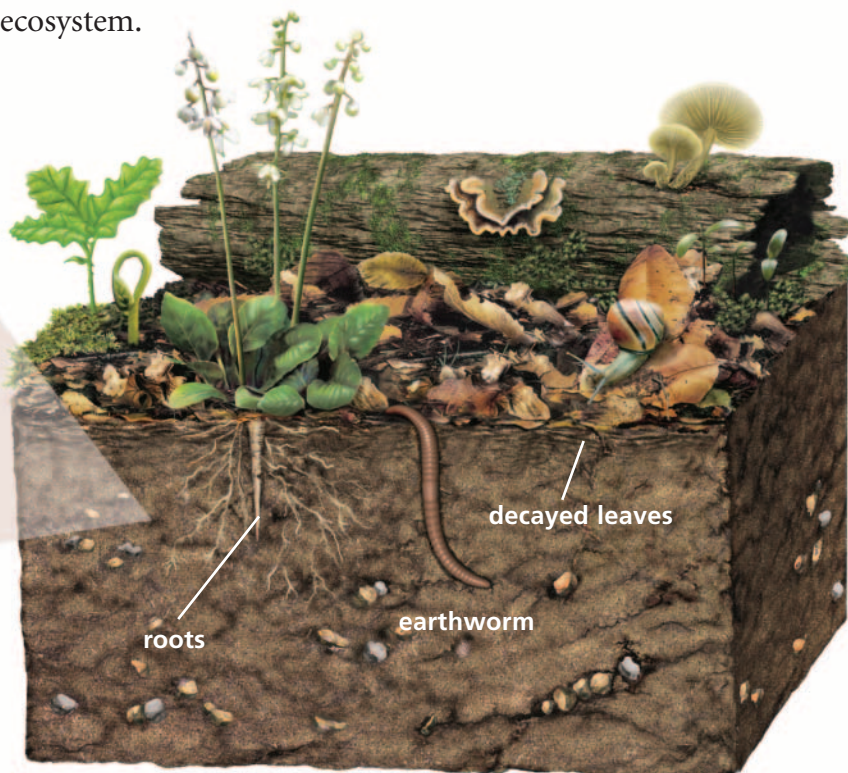
Light is a factor in ocean ecosystems as well. The deeper the water is, the less light there is available. In the shallow water near the shore, photosynthetic organisms can survive at the surface and on the ocean floor. In the open ocean, light is available for photosynthetic organisms only in the first hundred meters below the surface.

Soil

Soil, which is a mixture of small rock and mineral particles, is an important abiotic factor in land ecosystems. Organisms within the soil break down the remains of dead plants and animals. This process of decay provides important raw materials to the living plants and animals of an ecosystem.



The size of soil particles affects how much air and water the soil can hold.



Different ecosystems have different types of soil. The characteristics of the soil in an ecosystem affect plant growth. Soils that have a lot of decaying, or organic, matter can hold water well and allow air to reach the plant roots. Sandy soils usually do not hold water well because the water flows through too easily. Clay soil, which has small, tightly packed particles, will not allow water to move through easily at all. Minerals in the soil also affect plant growth.

CHECK YOUR READING

Explain how soil can affect plant life in an ecosystem.

Water

Another important abiotic factor in land ecosystems is the amount of water available to support life. All living things need water to carry out life processes. Plants need water as well as sunlight for photosynthesis. Animals need water to digest food and release the energy stored in the food. Look at the photograph to see the effect that an underground water source has on an otherwise dry, desert ecosystem. Trees could not survive there without a plentiful supply of water.

Ecosystems that have a lot of water can support a large number of different types of plants. These different types of plants can then support a large number of different types of animals. Tropical rain forests, the wettest of all ecosystems on land, are also the most diverse. Desert ecosystems, which are the driest land ecosystems, have far fewer types of plants and animals. The types and number of living things in a land ecosystem will always be related to the amount of fresh water available for its inhabitants.



INFER An oasis forms in the desert when underground water comes to the surface. How can you identify the boundary of this oasis?

12.1 Review

KEY CONCEPTS

1. Draw a diagram of an ecosystem near where you live. Label the factors "biotic" or "abiotic."
2. Give two examples of how plants and animals affect their environment.
3. Describe how temperature, light, and soil affect an ecosystem.

CRITICAL THINKING

4. **Predict** Think of a forest ecosystem. Now imagine that a large volcanic eruption throws large amounts of dust and ash into the air, blocking out sunlight. How might the forest ecosystem be affected if the sunlight is blocked for a day? For a year?

CHALLENGE

5. **Apply** Think of how you fit into your local environment. List ways in which you interact with biotic and abiotic factors within your ecosystem.