

1.2

KEY CONCEPT

Matter cycles through ecosystems.

◀ BEFORE, you learned

- Ecosystems support life
- Living and nonliving factors interact in an ecosystem
- Temperature, light, soil, and water are important nonliving factors in ecosystems

▶ NOW, you will learn

- How matter is exchanged between organisms and their environment
- About the water, carbon, and nitrogen cycles

VOCABULARY

cycle p. 16
water cycle p. 17
carbon cycle p. 18
nitrogen cycle p. 19

EXPLORE The Water Cycle

Do plants release water?

PROCEDURE

- 1 Cover a branch of the plant with a plastic bag. Tape the bag firmly around the stem.
- 2 Water the plant and place it in a sunny window or under a lamp. Wash your hands.
- 3 Check the plant after ten minutes, at the end of class, and again the next day.

WHAT DO YOU THINK?

- What do you see inside the plastic bag?
- What purpose does the plastic bag serve?

MATERIALS

- 1 small potted plant
- 1 clear plastic bag
- tape
- water



All ecosystems need certain materials.

Living things depend on their environment to meet their needs. You can think of those needs in terms of the material, or matter, required by all living things. For example, all organisms take in water and food in order to survive. All of the materials an organism takes in are returned to the ecosystem, while the organism lives or after it dies.

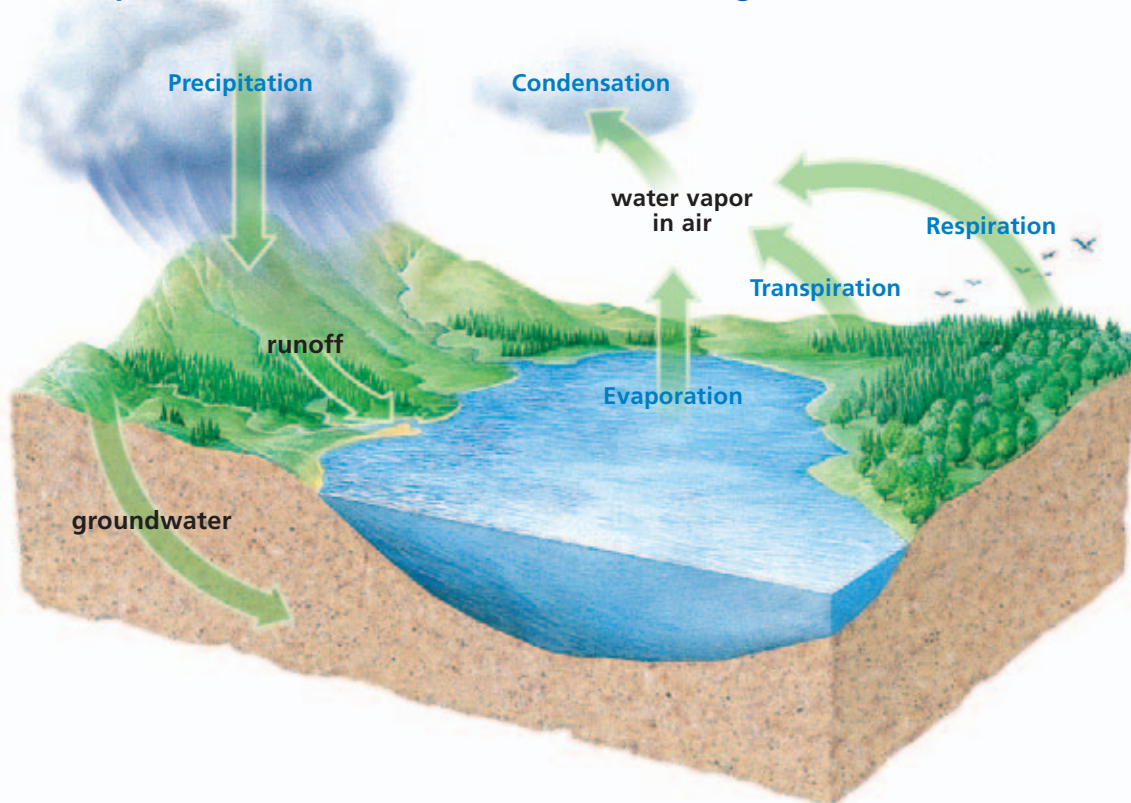
The movement of matter through the living and nonliving parts of an ecosystem is a continuous process, a cycle. A **cycle** is a series of events that happens over and over again. Matter in an ecosystem may change form, but it never leaves the ecosystem, so the matter is said to cycle through the ecosystem. Three of the most important cycles in ecosystems involve water, carbon, and nitrogen.



Explore cycles in nature.

Water Cycle

Different processes combine to move water through the environment.



Water cycles through ecosystems.

Water is stored on Earth's surface in lakes, rivers, and oceans. Water is found underground, filling the spaces between soil particles and cracks in rocks. Large amounts of water are stored in glaciers and polar ice sheets. Water is also part of the bodies of living things. But water is not just stored, it is constantly moving. The movement of water through the environment is called the **water cycle**.

Water is made up of just two elements: oxygen and hydrogen. As water moves through an ecosystem, it changes in physical form, moving back and forth between gas, liquid, and solid. Water in the atmosphere is usually in gaseous form—water vapor. Water that falls to Earth's surface is referred to as precipitation. For precipitation to occur, water vapor must condense—it must change into a liquid or solid. This water can fall as rain, snow, sleet, mist, or hail.



CHECK YOUR READING

What are the three physical forms of water in the water cycle?

Water returns to the atmosphere when heated, changing back into vapor, a process called evaporation. Living things also release water vapor. Animals release water vapor when they breathe, or respire. Plants release water vapor through a process called transpiration.

COMBINATION NOTES
Make notes and draw a diagram to show how water cycles through ecosystems.

--	--

Carbon cycles through ecosystems.

Carbon is an element found in all living things. Carbon moves through Earth's ecosystems in a cycle referred to as the **carbon cycle**. It is through carbon dioxide gas found in Earth's atmosphere that carbon enters the living parts of an ecosystem.

READING TIP

Notice that photosynthesis is a process that brings carbon into living matter and respiration is a process that releases carbon.

Plants use carbon dioxide to produce sugar—a process called photosynthesis. Sugars are carbon compounds that are important building blocks in food and all living matter. Food supplies the energy and materials living things need to live and grow. To release the energy in food, organisms break down the carbon compounds—a process called respiration. Carbon is released and cycled back into the atmosphere as carbon dioxide. When living things die and decay, the rest of the carbon that makes up living matter is released.

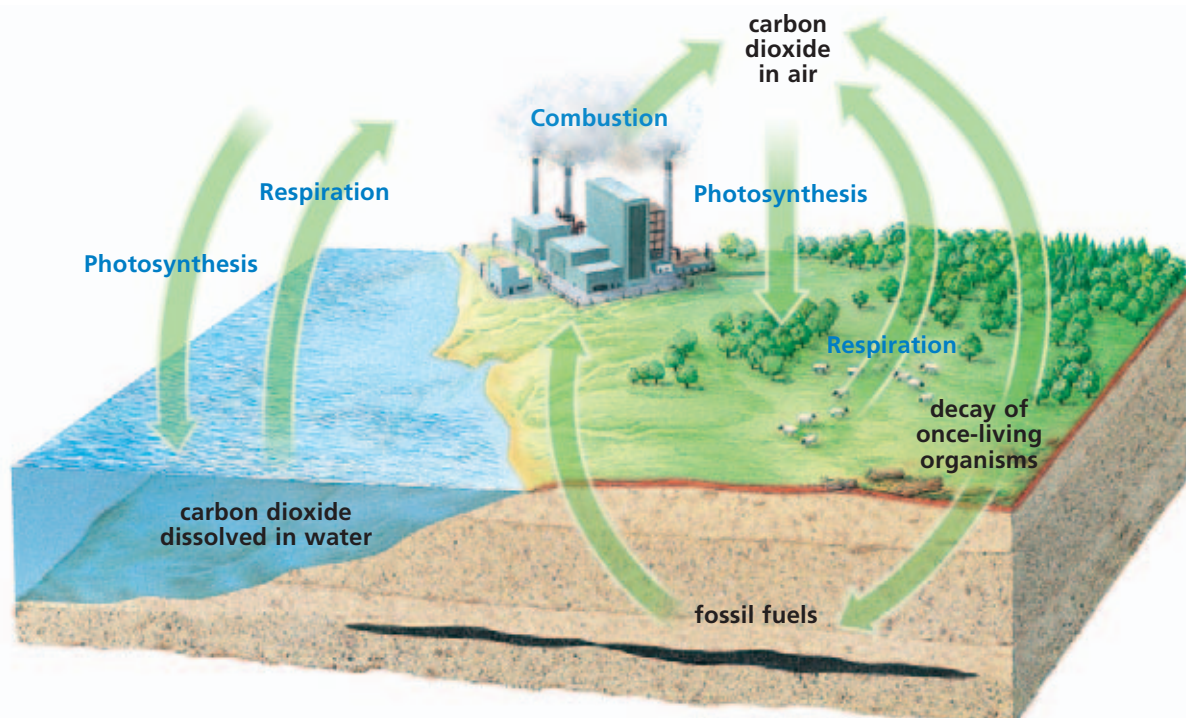
CHECK YOUR READING

Name three ways that living things are part of the carbon cycle.

Earth's oceans contain far more carbon than the air does. In water ecosystems—lakes, rivers, and oceans—carbon dioxide is dissolved in water. Algae and certain types of bacteria are the photosynthetic organisms that produce food in these ecosystems. Marine organisms, too, release carbon dioxide during respiration. Carbon is also deposited on the ocean floor when organisms die.

Carbon Cycle

Different processes combine to move carbon through the environment.



INVESTIGATE Carbon

What is one form in which carbon is stored on the ocean floor?

PROCEDURE

- 1 Use the mortar and pestle to crush the seashell into a powder.
- 2 Pour the powder into a small beaker.
- 3 Add enough white vinegar to cover the powder.

WHAT DO YOU THINK?

- What happens when white vinegar is added to the crushed shell?
- What is the material produced in the reaction and where did it come from originally?

CHALLENGE What type of reaction have you observed?



SKILL FOCUS
Observing



MATERIALS

- mortar and pestle
- whole seashell or fragments
- small beaker
- white vinegar

TIME
15 minutes



Large amounts of carbon are stored underground. The remains of plants and animals buried for millions of years decay slowly and change into fossil fuels, such as coal and oil. The carbon in fossil fuels returns to ecosystems in a process called combustion. As humans burn fossil fuels to release energy, dust particles and gases containing carbon are also released into the environment.

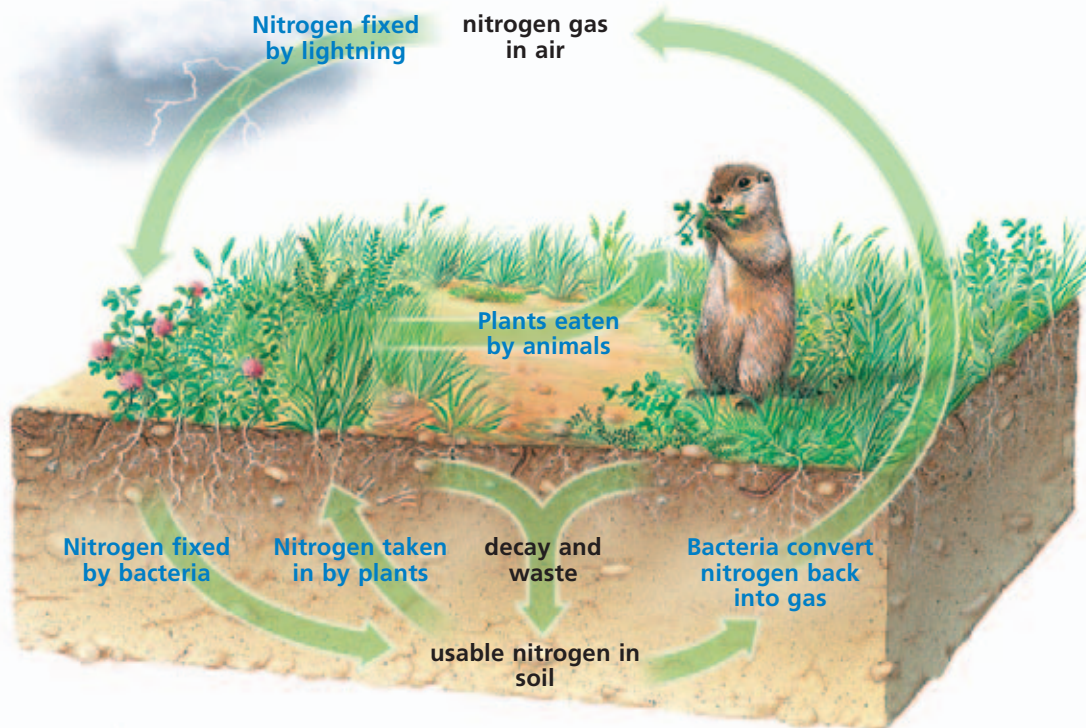
Nitrogen cycles through ecosystems.

Nitrogen is another element important to life that cycles through Earth in the **nitrogen cycle**. Almost four-fifths of the air you breathe is clear, colorless nitrogen gas. Yet, you cannot get the nitrogen you need to live from the air. All animals must get nitrogen from plants.

Plants cannot use pure nitrogen gas either. However, plants can absorb certain compounds of nitrogen. Plants take in these nitrogen compounds through their roots, along with water and other nutrients. So how does the nitrogen from the atmosphere get into the soil? One source is lightning. Every lightning strike breaks apart, or fixes, pure nitrogen, changing it into a form that plants can use. This form of nitrogen falls to the ground when it rains.

Nitrogen Cycle

Different processes combine to move nitrogen through the environment.



VISUALIZATION CLASSZONE.COM

Watch the nitrogen cycle in action.

A far greater source of nitrogen is nitrogen-fixing bacteria. These bacteria live in the oceans as well as the soil. Some even attach themselves to the roots of certain plants, like alfalfa or soybeans. When organisms die, decomposers in the ocean or soil break them down. Nitrogen in the soil or water is used again by living things. A small amount is returned to the atmosphere by certain bacteria that can break down nitrogen compounds into nitrogen gas.

1.2 Review

KEY CONCEPTS

1. Draw a diagram of the water cycle. Show three ways in which water moves through the cycle.
2. Summarize the main parts of the carbon cycle.
3. Explain two ways that nitrogen gas in the atmosphere is changed into nitrogen compounds that plants can use.

CRITICAL THINKING

4. **Predict** When people burn fossil fuels, carbon dioxide gas is added to the atmosphere. How might increased carbon dioxide affect plant growth?
5. **Compare and Contrast** Review the nitrogen and carbon cycles. How are these two cycles similar and different?

CHALLENGE

6. **Apply** Draw a cycle diagram that shows how water is used in your household. Include activities that use water, sources of water, and ways that water leaves your house.