Nature's Recycling!

Lesson Overview

Students develop the basic understanding that all matter on Earth is neither created nor destroyed. Life on Earth is dependent on processes that continuously cycle key nutrients (e.g., carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur) in the environment, allowing them to be used by living organisms. Producers, consumers, and decomposers all obtain these nutrients either directly from the Earth's water, soil, and air—and/or indirectly through foodwebs. These nutrients are then ultimately returned to the nonliving part of the ecosystem through the process of decomposition. These concepts are central to understanding how ecosystems function both in Michigan and around the world.

This lesson is divided into three parts, focusing on the role of the water cycle, photosynthesis, and decomposition in maintaining the Earth's ecosystems. Students should understand that these processes are all dependent on energy from the sun.

One extension lesson, *Nature's Recycling Detective Hunt,* is included in this notebook, immediately following Lesson 3C. In this extension, students find evidence of the water cycle, photosynthesis, and decomposition within the schoolyard.

Throughout three parts of Lesson 3, students answer the essential question: How do the water cycle, photosynthesis, and decomposition help maintain life on Earth?

Background Information

Ecosystems, like other systems, follow the physical principles of conservation of matter and energy. Matter is neither created nor destroyed. Materials move among and between living things and the physical environment, often being transformed in the process. For example, during **photosynthesis**, plants use energy from the sun to combine water and carbon dioxide to make food (sugar). Plants use energy from these simple sugars to produce materials needed for plant growth, maintenance, and reproduction. All animals depend directly or indirectly on plants for food, incorporating it into their bodies for their own growth, maintenance, reproduction, and energy needs. **Herbivores** are animals that directly eat plants, **carnivores** eat other animals, and **omnivores** eat both plants and animals. Waste products released by animals contain the plant and/or animal materials that could not be used by the animal. These waste products, along with dead plants and animals, are consumed by **decomposers**. Decomposers break down these organic materials and return the nutrients to the soil, air, and water. Thus, most of the food produced by plants (with the exception of a small amount that becomes fossil fuels) is ultimately broken down into carbon dioxide, water, and soil minerals and returned for reuse in the ecosystem.

The availability of matter and energy in an appropriate and useable form regulates the size of populations. If resources in an ecosystem are not being used, a niche becomes available for "new" organisms that may, in turn, use other resources that existing plants and animals were using, compete for these resources, and gradually force out earlier plant and animal forms.

These ideas are often not well understood by K-12 students. Although most students understand that animals must eat in order to grow, they do not necessarily understand that the materials in food *become* the materials from which animals are made. Although most students know that decomposing plants and animals make soil richer, or more fertile, they often do not associate soil fertility with minerals that are released by decomposition. Similarly, many students do not associate the *cycling* of carbon from carbon dioxide in the air into *food* and back again. Middle school students should be able to recognize and trace the path of selected materials such as water, carbon dioxide, and soil nutrients through ecosystems.

Source: Adapted from Michigan State Board of Education. (1991). *New Directions for Science Education in Michigan: State Objectives for K-12 Science (MEGOSE).* Lansing, MI: Michigan Department of Education. Retrieved July 8, 2005, from http://elsci.lansingschools.net/MEGOSE/.