

# 8

## ***Eating for Matter and Energy***

READING

**O**NE IMPORTANT PART of every organism's habitat is its source of food. Food provides both the matter and energy organisms need to grow and reproduce. Understanding how matter and energy move in an ecosystem is a major goal of ecologists.

### **GUIDING QUESTION**

**How do matter and energy move in an ecosystem?**

### **MATERIALS**

*For each group of four students*

- 1 large sheet of paper
- markers or colored pencils



## READING

In the activity “Coughing Up Clues,” you learned that the owls you investigated eat small mammals like voles and shrews. After the owl consumes the mammal, the owl’s digestive system breaks down the mammal’s matter into smaller pieces. Some of the matter is converted into other kinds of matter, including all the stuff the owl needs to build its body, including proteins, carbohydrates, and fats. As some of the matter is broken down, energy stored in the food is released. The food’s released energy is needed by the owl’s cells for life processes, including growth, movement, and reproduction.

You also learned that voles consume primarily plant material. The matter in the plants is broken down into different kinds of matter to build the vole’s body, including its skeleton, muscles, and fur. The energy stored in the plants’ molecules is used to allow the vole to breathe, search for more food, build tunnels, and produce offspring.



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### STOP TO THINK 1

Why are owls and voles called consumers?

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Where do the plants that voles eat get their food? Unlike animals, plants make their own food instead of getting it from other organisms. They have special structures (chloroplasts) that allow them to use energy from the sun to convert some matter—carbon dioxide and water—into other kinds of matter—sugars and oxygen. This process is known as **photosynthesis**. The sugars that they produce through this process become their food. Some of the sugars are eventually used in chemical reactions

that produce other kinds of matter, including the proteins, carbohydrates, and fats needed to build leaves, roots, and seeds. The rest of the sugar is used in chemical reactions that break the sugars down. The plants' process of breaking down the matter in food releases energy. In both plants and animals, the series of chemical reactions that breaks down sugars and releases energy is called **cellular respiration**.

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### STOP TO THINK 2

Why are plants called producers?

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Because plants can store the food they make for later use, other types of organisms are able to take advantage of this stored food by eating the plants. In fact, voles consume only plants, getting nearly all of the matter and energy they need to survive and reproduce from them. The matter and energy stored in the plant's food is converted to matter and energy for use by the animal. However, some animals, like crows, eat both plants and other animals, getting matter and energy from both sources of food. Crows can live in numerous ecosystems, including that of owls.

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### STOP TO THINK 3

Return to your food web from Analysis item 2 in the activity "Coughing Up Clues." Add crows to the food web, and label each component of the food web as a consumer or producer. What kind of a relationship do crows have with owls?

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Your food web is a model of the feeding relationships in an ecosystem. The arrows show the direction that energy and matter are moving within the ecosystem. When you drew an owl and a vole, and an arrow pointing from the vole to the owl, you were indicating the type of interaction between these two components in the ecosystem. The owl is a predator of the vole, and the vole is the prey of the owl. Both are consumers because neither makes its own food. When you added crows to your ecosystem, your model became more complex because crows get matter and energy from both plants and animals.



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### STOP TO THINK 4

Return to your food web model. Where does the energy come from to support plants making their own food?

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Nearly every ecosystem on Earth today relies on the sun's energy as its initial energy source. Energy from the sun flows into ecosystems through plants, then into the animals that eat plants, and then into the animals that eat animals. Eventually, there is no more useable energy in the ecosystem. What happens to all of the energy?

Initially, plants absorb only 1% of the sun's energy. The rest of the sun's energy is released as heat. Of the solar energy that plants absorb, only 10% of it is stored in the plant. The remaining 90% flows out of the food web as heat energy, and the energy is no longer available to organisms. After the vole eats the plant, once again, 90% of the energy stored in the plant leaves the food web as heat energy and only 10% of it is transferred to the vole. This pattern continues until the top level of the food web is reached, when there is not enough energy stored to support any additional levels.

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### STOP TO THINK 5

Describe how energy flows into, through, and out of the owl's food web.

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Where do plants get the matter they use to produce their own food? As you read earlier, through photosynthesis, plants combine carbon dioxide and water and rearrange the molecules to create sugar and oxygen. The water used in photosynthesis can come from any source, including rain water, ground water, surface water, and even moisture in the air. Aquatic plants are surrounded by water! The carbon dioxide that plants use is found in the air or is dissolved in water. It may seem strange to think that a gas we can't see or feel can be converted through a chemical process into an oak tree over 100 feet tall.

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### STOP TO THINK 6

Describe how matter moves throughout the owl's food web.

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You may be asking yourself what happens to the matter after an organism dies, or when it reaches the top of the food web. We'll address this question in a later activity.