2.1 Food Chains, Food Webs, and Energy Flow

Did you ride your bike to school today? Did you play a sport in gym class? Have you ever mowed the lawn or shovelled the snow? Do you sleep, breathe, grow? All of these activities require energy, and to get energy you must take in food. Food contains stored energy, but how did the energy get there in the first place? Grass and other plants grow by using energy from the Sun and nutrients in the soil as sources of food. The energy of the Sun is then "stored" in plants. When an animal, such as a cow eats a plant, it obtains the Sun's energy indirectly in a useful form. When a meat-eating animal — perhaps a person sitting down to a steak dinner — later consumes the cow, the energy is passed on to the consumer.

Skill POWER

To find out how to use models in science, turn to page 493.

Food Chains

A **food chain** is a model which shows how energy stored in food passes from organism to organism. Figure 2.1 shows some examples of food chains, in a lawn, a forest, and a pond. In a food chain, arrows show the direction in which energy flows through the chain.

Figure 2.1 Food chains in a lawn, a forest, and a pond

Off the Wall

An average adult human weighs as much as 1 000 000 ants. An ant is so strong that it can lift 50 times its own body weight. If adult humans were equally strong for their size, they could easily raise an elephant into the air.

Energy Flow

How does energy move through a food chain? At each step along the chain, energy is taken in by an organism. Some of this energy fuels the organism, and it is burned up and released as heat. Some energy is stored in the organism's body tissues, while some energy cannot be used and passes out of the animal as waste.

For example, when a grazing cow eats several kilograms of grass in one day, it does not gain mass equivalent to the mass of the grass it eats. Why not? Figure 2.2 shows a cow digesting the grass. About 4 percent of the stored energy in the grass goes to build and repair the cow's body tissues. A little over 30 percent fuels the cow's normal activities, such as breathing, mooing, and pumping blood through its body. Much of the grass — over 60 percent — cannot be used by the cow and passes out of its body as waste. Only the 4 percent that is used to build and repair the cow's body stays in the cow's body tissues. This is the "stored" energy, and it becomes available to the organism that eats the cow. You can see most of the energy in the grass eaten by the cow is not passed along the food chain.

Energy flow is the movement of energy, starting from the Sun, and passing from one organism to the next. In a food chain, as you saw with the cow, very little energy that is stored in one organism is passed on to the next organism.

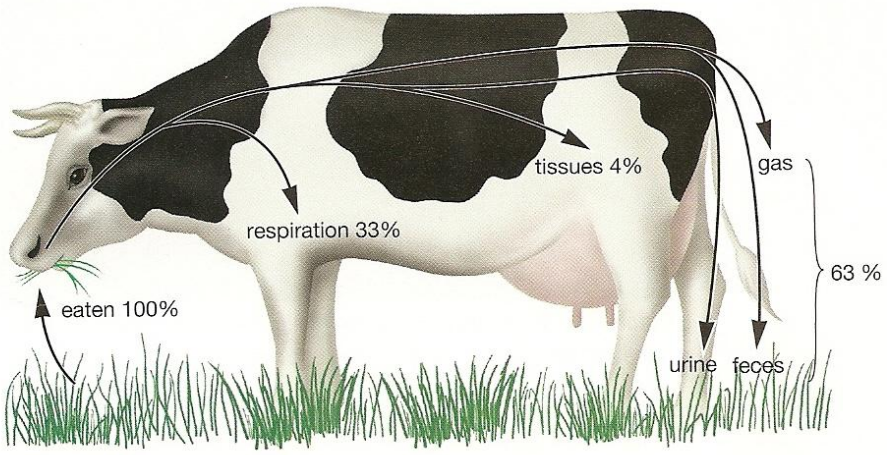

Figure 2.2 How a cow uses food energy

Pause& Reflect

Can you find out if food energy is used at every stage in a food chain? How will you determine how much energy stays in the food at each stage? Write the steps of your procedure in your Science Log.

Niches in a Community

Pause& Reflect

Think about the raccoon, the lynx, and the snowshoe hare that were discussed earlier in the chapter. How would you describe the niche each animal occupies? Do any of these animals occupy more than one niche in their community? Write answers to these questions in your Science Log.

You, like all other members of human communities, play several different roles in your daily life. When you are at school, you are a student. On the weekend, you might be a member of a sports team, or a volunteer at a food bank. The organisms in a community of plants and animals play different roles, too. Each of these roles is known as a **niche**.

One organism usually fills several niches. For instance, snails can act as both scavengers and herbivores, and gulls can be both scavengers and carnivores. To understand an organism's niche, you must look at what it eats, where it lives, and how it interacts with other organisms in its ecosystem.

Food Webs

Food chains are rarely as simple as the models you saw in the early pages of this chapter. Producers are usually eaten by many different consumers, and most consumers are eaten by more than one kind of predator. For example, a mouse, which may have eaten several kinds of plants and seeds, may be eaten by a hawk, a raccoon, or a snake. The raccoon may also eat berries, frogs, and birds' eggs. Figure 2.10 shows a typical food web. A network of inter-connected food chains is called a **food web**.

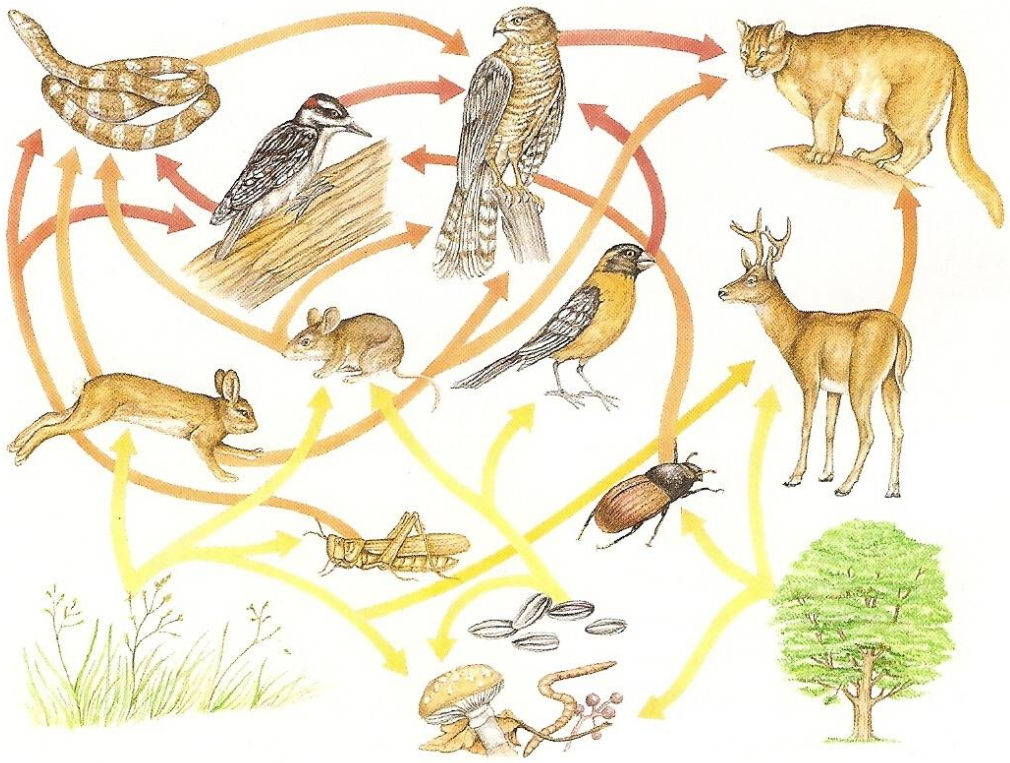

Figure 2.10 Food webs are a combination of several food chains. They show the connections among the food chains.

To draw a food web for a community, you can begin by drawing the food chains in the community. Next, look for organisms that are common to more than one of these food chains. Perhaps grass, a producer, is found in several chains. Grass can then be used to link the two chains together. Food webs, understandably, can quickly become very large and very complex.