As energy flows through ecosystems, from producers to consumers to detrivores to decomposers, some energy is lost at each level.

The Sun is life’s main energy supply. Using energy from the Sun, plants make their own food through the process of photosynthesis. Plants need to use most of the energy from the food they make for everyday life processes, such as growing and producing flowers and seeds. On average, only about one-tenth ($\frac{1}{10}$ or 10%) of a plant’s food energy gets stored as nutrients in the roots, leaves, and other parts of the plant. So, when a plant is eaten by a consumer, such as a deer, only one-tenth of its energy is available to the consumer.

Similarly, the deer uses most of the energy from its food (the plant) to support its everyday life functions, such as breathing, moving, and chewing. Energy is also is given off as body heat. Consequently, when the deer is eaten by a consumer, such as a cougar, only about one-tenth of its energy is available to the consumer. Thus, very little energy is passed on from one organism to the next in a food chain (Figure 1).
TRY THIS: MODEL ENERGY LOSS

Skills Focus: creating models

1. Form groups of three and assign the following roles: producer, herbivore, and carnivore.

2. The producer takes ten sheets of paper from the recycling box and spreads them out in a row on the table. This represents the amount of energy from the Sun that the producer has stored as food.

3. The herbivore takes one-tenth of the producer’s energy (one piece of paper) from the producer and puts it on the table above the producer’s papers.

4. The carnivore takes one-tenth of the herbivore’s energy by tearing off one-tenth (a 2-cm strip) of the herbivore’s paper and putting it on the table above the herbivore’s paper.

5. As a group, calculate the percentage of the energy in the producer that was transferred to a) the herbivore b) the carnivore

The model you made to show energy loss in a food chain is called an ecological pyramid (Figure 2).

LEARNING TIP

As you study Figure 2, ask yourself, “What is the purpose of this model? What do scientists use it to illustrate? What am I supposed to notice and remember?”

Figure 2
The base of the pyramid holds producers (plants). At each level above the producers, the amount of available energy is reduced. This explains why, in an ecosystem, you might find a huge number of insects to eat the plants, a much smaller number of shrews to eat the insects, and only a very few owls to eat the shrews.
Each level of an ecological pyramid matches a level of producers or consumers in a food chain. At each level, the amount of available energy is less than the amount of available energy in the level below. Usually the number of organisms also decreases at each higher level of the pyramid (Figure 3).

Figure 3
An ecological pyramid in an ocean ecosystem.

CHECK YOUR UNDERSTANDING
1. Why is some energy lost at each level in a food chain?
2. Using your own words, describe why there are usually fewer large carnivores than herbivores or producers in an ecosystem?