CONCEPT 1

Producers transfer energy to consumers and decomposers.

producers living things that make their own food to get the energy they need

consumers living things that eat producers or other consumers to get the energy they need

decomposers living things that break down dead organic material to get the energy they need

food chain a model that describes how food energy is passed from one living thing to another

Many interactions between living things in ecosystems involve food and feeding. Because of this, you can describe living things based on how they get energy from food.

- **Producers** produce (make) their own food to get the energy they need to live. Most producers use photosynthesis to do this. Only green plants and some kinds of single-celled living things can carry out photosynthesis. So these kinds of organisms are producers in most ecosystems.
- **Consumers** consume (eat) producers or other consumers to get the energy they need to live. Animals and most other kinds of living things are consumers.
- **Decomposers** break down dead organic material, such as dead plant or animal tissue, to obtain the energy they need to live.

Food Chains Chart the Flow of Energy from Producers to Consumers

A **food chain** is a model that describes how the stored energy in food is passed on from one living thing to another. You can use a food chain to show how energy flows in any ecosystem. An example of a food chain in a mountain ecosystem is shown in Figure 4.12. Notice that the flow of energy always goes from a producer to a consumer, and then on to one or more other consumers.

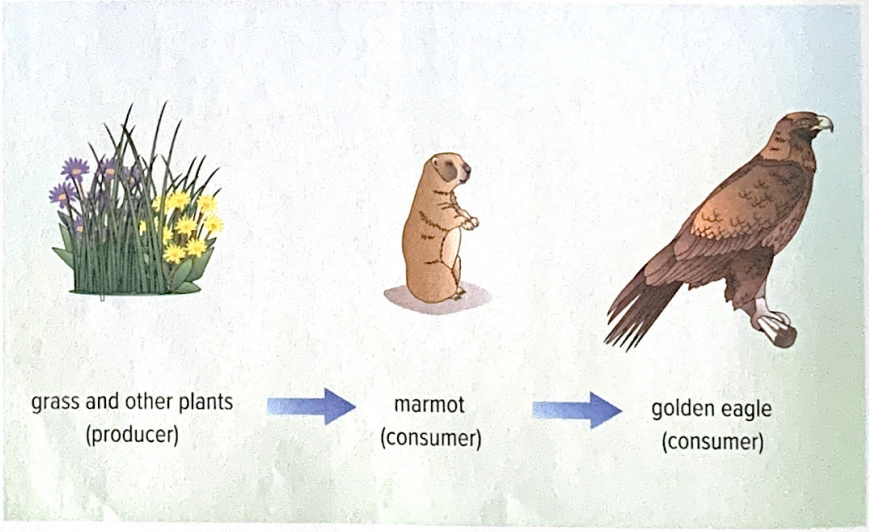

Figure 4.12 The terrestrial mountain ecosystem food chain has three links, with one producer and two consumers.

Food Webs Show How Food Chains Are Connected

You eat many different kinds of organisms that are producers and consumers. In other words, you are part of many different food chains. The same is true for other organisms. In any ecosystem, a more realistic model of feeding relationships shows a network of interacting and overlapping food chains. Such a model is called a food web. A **food web** weaves together two or more food chains within any given ecosystem. Refer to Figure 4.13. All organisms in a food web are connected to each other through their feeding relationships. As a result, a change in the number of one organism could affect several food chains within the food web. In this sense, all organisms in an ecosystem are connected to and depend on each other for survival. Their interactions are key factors to sustaining life in aquatic and terrestrial ecosystems.

food web a model of feeding relationships shows a network of interacting and overlapping food chains

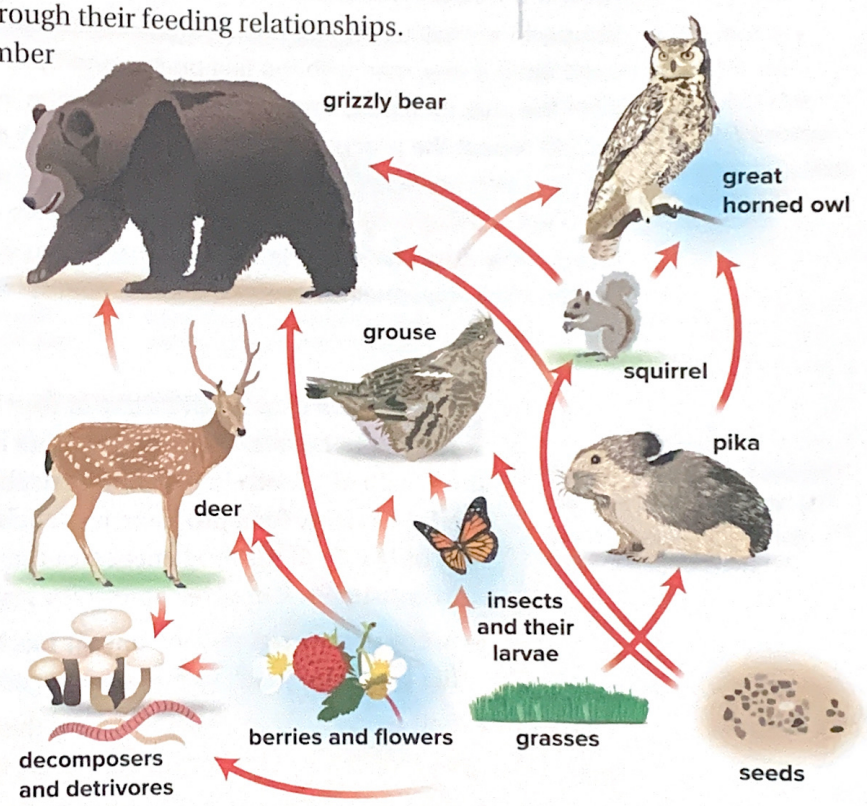

Figure 4.13 An example of a food web that might be found in B.C.'s alpine regions

Activity

Analyzing a Food Web

In Figure 4.13, what makes the grasses and other plants that make seeds, berries, and flowers different from other organisms in the food web? Identify four food chains in the food web in Figure 4.13.

Before you leave this page . . .

1. Compare and contrast producers, consumers, and decomposers.
2. A food web is a more realistic model for feeding relationships in an ecosystem than a food chain. Explain why.

CONCEPT 2

Interactions are needed to provide a constant flow of energy to sustain the biosphere.

Activity

Model a Food Chain

Start with a small paper cup containing five dried beans. With your classmates lined up in a row, start with the first person and have them remove one bean from the cup, then pass the cup to the next person in line. The next person should repeat the process, removing one bean and then passing the cup to the next person, and so on until there are no beans left. How many people were left without beans? Food chains in nature have between two and five levels. How does this fact relate to what happened in your food chain? Why do you think food chains have a limit to the number of levels in them?

Most food chains have three or four links. Some food chains might have as many as five or six links. Why are there limits to the length of a food chain? Limits exist because only about 10% of the food energy for a producer is available to a consumer that eats it. And only 10% of the food energy for that consumer is available to the next consumer. Here are some of the reasons why.

- Some of the original food energy has been used already to support life functions, such as growth and cellular respiration.
- Some energy is changed into heat that is given off into the environment. This energy cannot be used by other living things.
- Some energy is stored in wastes (urine and feces) that are excreted into the environment.

Bacteria, fungi, and other decomposers extract some of this energy, but most is lost to the environment as heat. The transfer of energy along a food chain is like a bucket-toss relay game. **Figure 4.14** illustrates this idea. As each player tosses a bucket of water to the next player, some of the water spills from the bucket. There is only a little water left when the bucket reaches the last player, because some of the water spilled out each time the bucket was tossed. In a food chain, each time energy is transferred some of it is lost as unusable heat. The energy that is lost cannot be used by other living things. So a constant supply of energy is needed to sustain living things in terrestrial and aquatic ecosystems.

Connect to Investigation 4-D on page 318

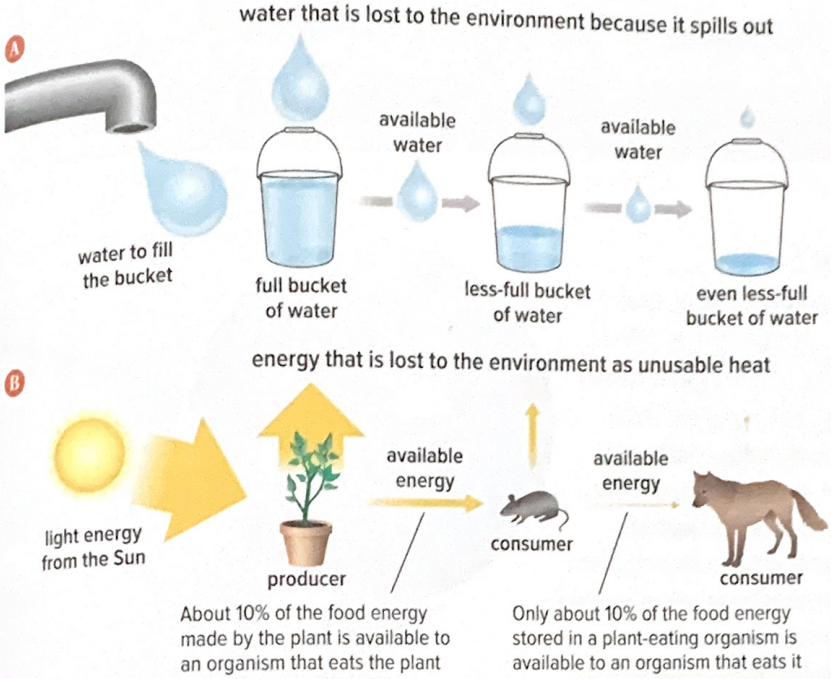

Figure 4.14 A Most of the water in the bucket that is transferred from one player to another in a bucket-toss relay game is lost to the environment. Less and less water is in the bucket for each player in the relay. B Most of the energy that is transferred from one organism to another in a food chain is lost to the environment as unusable heat. Less and less energy is available to each organism in the food chain.

The concept in **Figure 4.14** is also represented by an energy pyramid, shown in **Figure 4.15**. In an **energy pyramid**, each level represents the amount of energy that is available to that level of the food chain.

energy pyramid a model that shows the amount of energy available in each level of a food chain

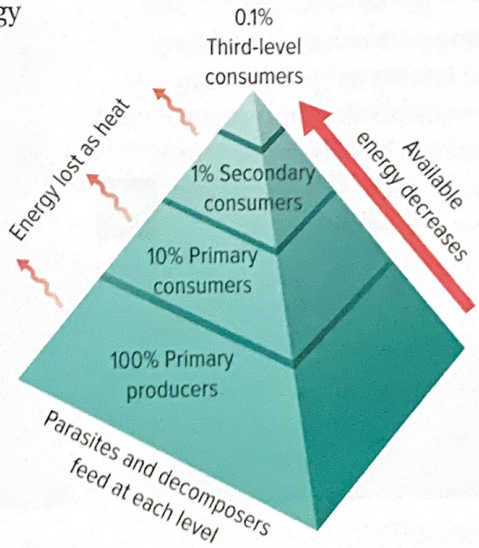

Figure 4.15 In a pyramid of energy, each level represents the amount of energy that is available to that trophic level. With each step up, there is an energy loss of 90%.

Before you leave this page . . .

1. When a mouse eats a plant, only about 10% of the plant's energy is transferred to the mouse. What happens to the rest of the energy?
2. In **Figure 4.14**, the analogy of a bucket-toss relay game is used to explain the transfer of energy through a food chain. Create your own analogy to explain this transfer of energy.