13.3 Energy in Ecosystems

KEY CONCEPT Life in an ecosystem requires a source of energy.

Producers provide energy for other organisms in an ecosystem.

In Section 13.2 you read that ecosystems are made up of both biotic and abiotic factors. Another important part of an ecosystem is the flow of energy. All organisms need a source of energy in order to survive.

- **Producers** are organisms that make their own food. Plants and other photosynthesizing organisms are producers. Producers are also called **autotrophs.**

- **Consumers** are organisms that get their energy by eating other organisms, including plants and animals. Consumers are also called **heterotrophs.**

Producers provide the basis for an ecosystem's energy. Some consumers eat producers. For example, moose and elk eat plants. Some consumers eat other consumers. For example, the grey wolf eats moose and elk. But all consumers depend on producers. Without producers, moose and elk could not survive and without moose and elk, the wolf could not survive.

VOCABULARY

The suffix –troph comes from a Greek word meaning "nourishment," or food.
- The prefix auto– means "self."
- The prefix hetero– means "different."

Plants are producers, or autotrophs.

Animals are consumers, or heterotrophs.

INSTANT REPLAY Circle the names of three consumers in the paragraph above.

Almost all producers obtain energy from sunlight.

Most producers on Earth use sunlight as their energy source. Photosynthesis is the process by which plants and some protists, such as green algae, use energy from the Sun to make sugars. Plants use these sugars as energy for cellular respiration.

Not all producers rely on the Sun for energy. In 1977 scientists first visited deep-sea vents on the floor of the ocean. They were very surprised to find many different organisms living in an ocean floor ecosystem, far from the reach of sunlight.

The producers in this ocean floor ecosystem are prokaryotes that make their own food, using chemicals as an energy source, not the Sun. This process is called **chemosynthesis** (KEE-moh-SIHN-thih-sihs). Chemosynthetic organisms also live in hot springs.

INSTANT REPLAY Underline two places that chemosynthetic organisms live.

13.3 Vocabulary Check	Mark It Up
producer heterotroph autotroph chemosynthesis consumer	Go back and highlight each sentence that has a vocabulary word in **bold**.

Fill in the blanks with the correct term from the list above.

1. Which two words describe an organism that eats other organisms as food? _____

2. Which two words describe an organism that makes its own food?

_____

13.3 The Big Picture

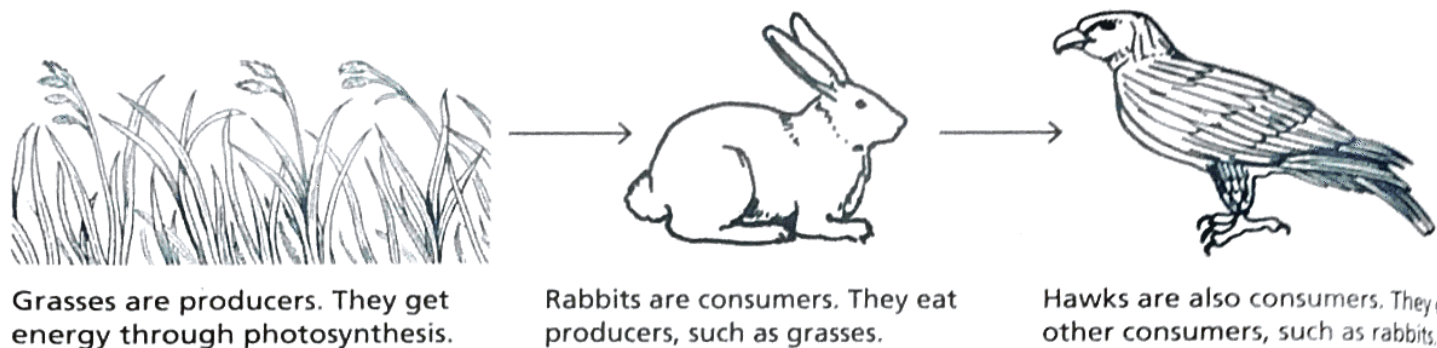3. List two different energy sources for producers. Circle the one that is the source for most producers.

_____

13.4 Food Chains and Food Webs

KEY CONCEPT Food chains and food webs model the flow of energy in an ecosystem.

A food chain is a model that shows a sequence of feeding relationships.

As you have read, energy flows through an ecosystem from producers to consumers. A simple way to represent this flow of energy is with a food chain. A **food chain** shows the feeding relationships for a single chain of producers and consumers.

Grasses are producers. They get energy through photosynthesis.

Rabbits are consumers. They eat producers, such as grasses.

Hawks are also consumers. They eat other consumers, such as rabbits.

Types of Consumers

As you can see in the food chain above, not all consumers are alike. Different types of consumers have different food sources.

- **Herbivores,** such as the rabbit above, are organisms that eat only plants.
- **Carnivores,** such as the hawk above, are organisms that eat only animals.
- **Omnivores** are organisms that eat both plants and animals. Most humans are omnivores.
- **Detritivores** (dih-TRY-tuh-VOHRZ) are organisms that eat dead plant and animal matter. Earthworms, for example, are detritivores.
- **Decomposers** are detritivores that break down plant and animal matter into simpler compounds. Fungi, for example, are decomposers. Decomposers return nutrients to the ecosystem.

Some organisms eat only one or a few specific types of organisms. For example, a bird called the Florida snail kite eats mostly one particular type of snail. Organisms that have a very selective diet are called **specialists.** Because specialists eat only one or a few particular organisms, they are very sensitive to changes in the populations of organisms they eat. For example, if the snail population drops, the Florida snail kite does not have another main food source.

Other organisms, called **generalists,** eat a variety of different organisms. For example, the grey wolf eats many different animals, including elk, moose, deer, beavers, and mice.

A bird called the Florida snail kite is a specialist. It eats mostly one type of snail, like the organism shown above.

Trophic Levels

The figure on page 228 shows a food chain of grasses (producers)—rabbit (herbivore)—hawk (carnivore). You can think of each link in a food chain as a level of feeding, or a **trophic level.** Energy flows up the food chain from the lowest trophic level to the highest.

- Producers are the first, or bottom, trophic level.
- The next trophic level is made of primary consumers—herbivores that eat producers.
- The next trophic level is made of secondary consumers—carnivores that eat herbivores.
- Continuing up the food chain, tertiary consumers are carnivores that eat secondary consumers.

Omnivores, such as most humans, can be listed at different trophic levels in different food chains. A person is at the level of primary consumer when eating vegetables. A person is at the level of secondary consumer when eating beef or chicken.

INSTANT REPLAY   At what trophic level are herbivores found?

_____

A food web shows a complex network of feeding relationships.

A food chain shows a simple sequence of feeding relationships. But most feeding relationships are not very simple. For example, a generalist such as the grey wolf may be a part of several food chains that involve elk, deer, mice, and other organisms. This complex network of feeding relationships and the related flow of energy can be represented by a **food web.**

FOOD WEB

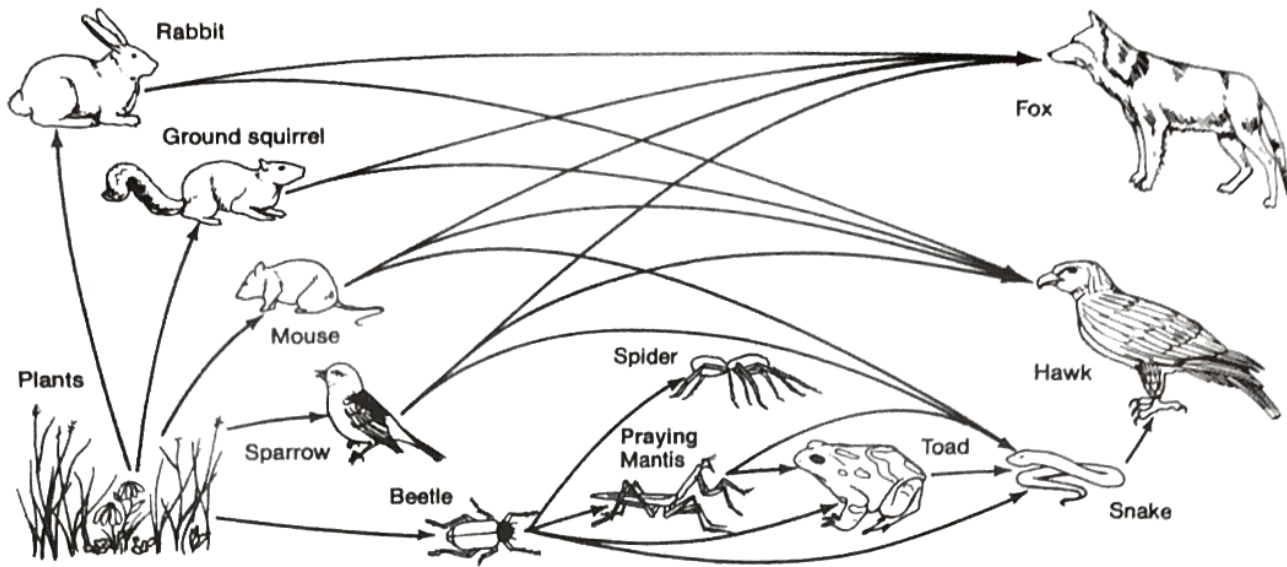A food web shows the network of feeding relationships between trophic levels in an ecosystem. Food webs can be quite complex, because many organisms feed on a variety of other species.

This rabbit is a primary consumer and gets its energy by eating plants.

This fox is a secondary consumer and gets its energy by eating rabbits, squirrels, mice, or sparrows.

Rabbit

Ground squirrel

Fox

Mouse

Plants

Spider

Hawk

Sparrow

Praying Mantis

Toad

Beetle

Snake

Plants are producers and get their energy from the Sun.

This hawk may be a secondary consumer, a tertiary consumer, or even at a higher trophic level, depending on what it eats.

The stability of a food web depends on producers. Notice that the feeding chains of all organisms can be traced back to producers. In the food web above, a variety of prairie plants are the base of the food web.

Also notice that some organisms can be involved with the food web at different trophic levels, depending on what they eat. When the hawk eats a mouse, it is a secondary consumer. But when it eats a snake—that ate a beetle that ate plants—it is a tertiary consumer. At each link in a food web, some energy is stored within an organism but most energy is lost to the environment as heat.

INSTANT REPLAY In the food web shown above, at what trophic level does the spider feed?

_____

food chain   decomposer

herbivore   specialist

carnivore   generalist

omnivore   trophic level

detritivore   food web

Mark It Up

Go back and highlight each sentence that has a vocabulary word in **bold**.

1. What is the difference between a food chain and a food web?

_____

_____

2. What is the difference between a specialist and a generalist?

_____

_____

3. What is the difference between a detritivore and a decomposer?

_____

_____

13.4   The Big Picture

4. Fill in the chart below to describe your place in the food web.

LIST THE LAST THREE TYPES OF FOOD THAT YOU ATE.	WHAT TYPE OF CONSUMER WERE YOU?	AT WHAT TROPHIC LEVEL DID YOU EAT?