

# Energy Flow in Ecosystems

Textbook pages 56–67

## Before You Read

In this section, you will explore food chains and food webs, as well as food pyramids. What are the main differences between a chain and a web? Record your ideas below.

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### Mark the Text

#### In Your Own Words

Define the bold terms in this summary in your own words.



### Reading Check

1. What are the different steps in a food chain called?
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### How does energy flow in an ecosystem?

**Energy flow** is the transfer of energy from one organism to another in an ecosystem. Every organism interacts with its ecosystem in two ways:

1. the organism obtains food energy from the ecosystem
2. the organism contributes energy to the ecosystem

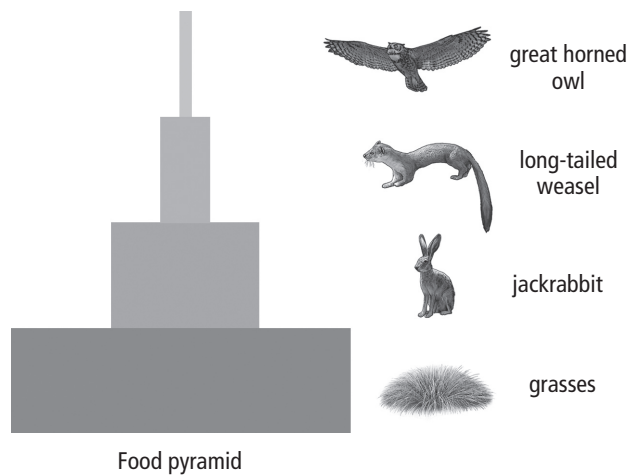
### How are energy flow and feeding relationships in ecosystems modelled?

Ecologists use three models to illustrate energy flow and feeding relationships in an ecosystem:

1. Food chains: **Food chains** show the flow of energy from plant to animal and from animal to animal. Plants are called **producers** because they “produce” food in the form of carbohydrates during photosynthesis. **Consumers** eat plants and other organisms. Each step in a food chain is called a **trophic level**. ✓

| Trophic Level   | Type of Organism          | Energy Source                          | Example                                   |
|-----------------|---------------------------|--|---|
| 1 <sup>st</sup> | <b>primary producer</b>   | obtain energy from the Sun             | grass, algae (plants)                     |
| 2 <sup>nd</sup> | <b>primary consumer</b>   | obtain energy from primary producers   | grasshoppers, krill ( <b>herbivores</b> ) |
| 3 <sup>rd</sup> | <b>secondary consumer</b> | obtain energy from primary consumers   | frogs, crabs ( <b>carnivores</b> )        |
| 4 <sup>th</sup> | <b>tertiary consumer</b>  | obtain energy from secondary consumers | hawks, sea otters (top carnivores)        |

2. Food webs: Many animals are part of more than one food chain in an ecosystem because they eat or are eaten by several organisms. Interconnected food chains are illustrated in a model called a **food web**. Animals that eat plants and other animals are called omnivores.
3. Food pyramids: A **food pyramid** (or **ecological pyramid**) is a model that shows the loss of energy from one trophic level to another. When one organism consumes another, the energy stored in the food organism is transferred to the consumer. However, not all of this energy is incorporated into the consumer's tissues. Between 80 and 90 percent of it is used for chemical reactions and is lost as heat. This means ecosystems can support fewer organisms at higher trophic levels, as less energy reaches these levels. ✓



### How do dead organisms contribute to energy flow?

**Decomposition** describes the breakdown of organic wastes and dead organisms. Energy is released in decomposition. When living organisms carry out decomposition, it is called **biodegradation**.

- ◆ **Detritivores**, such as small insects, earthworms, bacteria, and fungi, obtain energy and nutrients by eating dead plants and animals, as well as animal waste.
- ◆ **Decomposers**, such as bacteria and fungi, change wastes and dead organisms into nutrients that can once again be used by plants and animals.

Detritivores and decomposers feed at every trophic level.

### ✓ Reading Check

1. What does a food pyramid demonstrate?

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Name \_\_\_\_\_

Date \_\_\_\_\_

Use with textbook pages 56–64.

## Energy flow

### Vocabulary

biodegradation  
biomass  
consumer  
decomposers  
decomposition  
energy flow  
food chains  
food pyramids

food webs  
photosynthesis  
primary consumers  
primary producers  
secondary consumers  
tertiary consumers  
trophic

Use terms in the vocabulary box to fill in the blanks. Use each term only once.

- \_\_\_\_\_ refers to the total mass of living plants, animals, fungi, and bacteria in a given area.
- The flow of energy from an ecosystem to an organism and from one organism to another is called \_\_\_\_\_.
- Plants are called producers because they “produce” food in the form of carbohydrates during \_\_\_\_\_.
- An insect, such as a bee, that feeds on a plant is called a \_\_\_\_\_.
- \_\_\_\_\_ is the breaking down of organic wastes and dead organisms.
- The action of living organisms, such as bacteria, to break down organic matter is called \_\_\_\_\_.
- \_\_\_\_\_ change waste and dead organisms into usable nutrients.
- \_\_\_\_\_ are models that show the flow of energy from plant to animal and from animal to animal. Each step is called a \_\_\_\_\_ level.
- Plants and phytoplankton, such as algae, are at the first trophic level and are referred to as \_\_\_\_\_.
- \_\_\_\_\_ obtain their energy from primary producers.  
\_\_\_\_\_ obtain their energy by eating primary consumers.
- In the fourth trophic level are \_\_\_\_\_ that feed on secondary consumers to obtain energy.
- \_\_\_\_\_ are models of the feeding relationships within an ecosystem.  
\_\_\_\_\_ show the loss of energy from one trophic level to another.

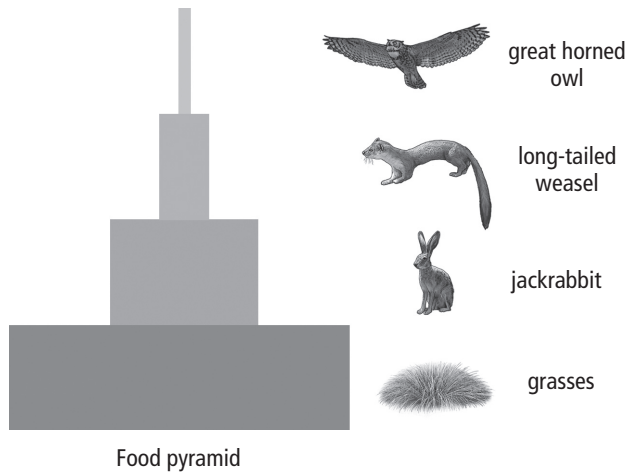
Use with textbook pages 60–64.

# Food chains, food webs, and food pyramids

Use the diagrams to help you answer the questions.

| Scientific model  | Questions   |
|---|---|
| <p>food chain</p> <p>Terrestrial food chain</p> <p>Aquatic food chain</p>   | <ol style="list-style-type: none"> <li>1. What plants or animals are the primary producers in this food chain?<br/>_____</li> <li>2. What trophic level do the frogs and crabs belong to?<br/>_____</li> <li>3. What do tertiary consumers feed on to obtain energy?<br/>_____</li> </ol> |
| <p>food web</p> <p>grizzly bear</p> <p>red-tailed hawk</p> <p>deer</p> <p>grouse</p> <p>chipmunk</p> <p>marmot</p> <p>decomposers and detritivores</p> <p>berries and flowers</p> <p>grasses</p> <p>seeds</p> | <ol style="list-style-type: none"> <li>4. What term is used to describe a chipmunk that eats seeds or fruit?<br/>_____</li> <li>5. What kind of consumers do omnivores eat?<br/>_____</li> <li>6. Give two examples of detritivores.<br/>_____</li> </ol>                                 |

food pyramid



7. What is a food pyramid?

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8. Which level of a food pyramid stores the most energy?

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9. Which level of a food pyramid stores the least amount of energy?

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*Use with textbook pages 58–64*

## **Modelling a local ecosystem**

**Reflect on the plants and animals that exist in your local ecosystem.**

1. List 12 plants and animals. Remember to represent each of the trophic levels.

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2. Organize four of these plants and animals into a food chain.

3. Using all 12 of the plants and animals, design a food web that illustrates the feeding relationships within your selected ecosystem.

4. Organize the plants and animals into a food pyramid that demonstrates the loss of energy as you move from one trophic level to the next.

Use with textbook pages 56–64.

## Energy flow in ecosystems

Match each Term on the left with the best Descriptor on the right. Each Descriptor may only be used once.

| Term                    | Descriptor  |
|-------------------------|---|
| 1. _____ biodegradation | <b>A.</b> a model that shows the flow of energy from plant to animal and from animal to animal<br><b>B.</b> organisms that produce food in the form of carbohydrates during photosynthesis<br><b>C.</b> the breaking down of dead organic matter by organisms, such as bacteria<br><b>D.</b> steps in a food chain that show feeding and niche relationships among organisms<br><b>E.</b> a model that shows the loss of energy from one trophic level to another<br><b>F.</b> an organism that eats other organisms<br><b>G.</b> a model of the feeding relationships within an ecosystem<br><b>H.</b> organisms that break down wastes and dead organisms and change them into usable nutrients |
| 2. _____ consumers      |   |
| 3. _____ decomposers    |   |
| 4. _____ food chain     |   |
| 5. _____ food pyramid   |   |
| 6. _____ food web       |   |
| 7. _____ producers      |   |
| 8. _____ trophic levels |   |

Circle the letter of the best answer.

9. In a food chain, primary producers are usually:
- |               |            |
|---------------|------------|
| A. amphibians | C. mammals |
| B. bacteria   | D. plants  |

10. What product of photosynthesis supplies energy for life forms?
- A. carbohydrates  
B. carbon dioxide  
C. oxygen  
D. water
11. Which of the following organisms are likely to be found in the third trophic level of a food chain?
- A. algae  
B. frog  
C. grasshopper  
D. hawk
12. Which of the following describes the process of biodegradation?
- A. plants using photosynthesis to create food  
B. primary consumers eating plants  
C. bacteria breaking down organic matter  
D. omnivores eating plants and animals
13. In a food pyramid, how much energy is lost from trophic level to trophic level?
- A. 20 %  
B. 50 %  
C. 70%  
D. 90%
14. In a food pyramid:
- A. as the trophic level decreases, the number of organisms supported by the ecosystem decreases  
B. as the trophic level increases, the number of organisms supported by the ecosystem increases  
C. as the trophic level increases, the number of organisms supported by the ecosystem decreases  
D. as the trophic level decreases, the number of organisms supported by the ecosystem increases