



Life Science

Animals and Plants in Their Environment

On Level

# Energy in Ecosystems

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•  
Assessments and  
Reading Activities

# Energy in Ecosystems

What roles do plants and animals play in their environments?

## CORE CURRICULUM STATEMENTS

### **Plants and animals depend on each other and their physical environment.**

Green plants are producers because they provide the basic food supply for themselves and animals.

All animals depend on plants. Some animals (predators) eat other animals (prey).

Animals that eat plants for food may in turn become food for other animals. This sequence is called a food chain.

Decomposers are living things that play a vital role in recycling nutrients.

Plants manufacture food by utilizing air, water, and energy from the Sun.

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# Student Book

*Energy in Ecosystems*

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# Energy in Ecosystems

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## CORE CURRICULUM STATEMENTS

**Plants and animals depend on each other and their physical environment.**

Green plants are producers because they provide the basic food supply for themselves and animals.

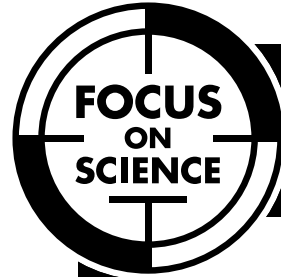
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# Energy in Ecosystems

by  
Linda Barr





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– Predict –

*What do you think you will  
learn from this book?*

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## INTRODUCTION

# Energy on the Move

Are you full of energy today, or do you feel hungry and need more fuel?

You and every other living thing needs energy to keep on living. How you get your energy makes you either a producer, a consumer, or a decomposer.

In this book, you'll learn how the energy that keeps you, other animals, and plants alive starts with the sun. You'll read about how plants turn sunlight into food energy. You'll find out how energy flows from plants, to animals, and then to more animals, including you.

Did you know that you are part of a food chain? You also have a place in an energy pyramid. If you weren't part of these things, you could not survive!

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## CHAPTER 1

# Plants and Sunlight

Plants make their own food. They use a process called **photosynthesis**. Photo means "light." Synthesis means "put together." During photosynthesis, plants use sunlight to put things together.

Sunlight is one type of light energy. Green matter in leaves traps this light energy. Then the leaves use this energy, carbon dioxide from the air, and water from the soil to make a kind of sugar. This sugar is rich in chemical energy. The plant uses this energy to live and grow.

When an animal eats the plant, its body changes the chemical energy from the plant into other forms of energy. One is heat energy. The food we eat helps keep our bodies warm. It also gives us the energy we need to move.

**photosynthesis:** the process by which plants use sunlight, carbon dioxide, and water to produce food energy

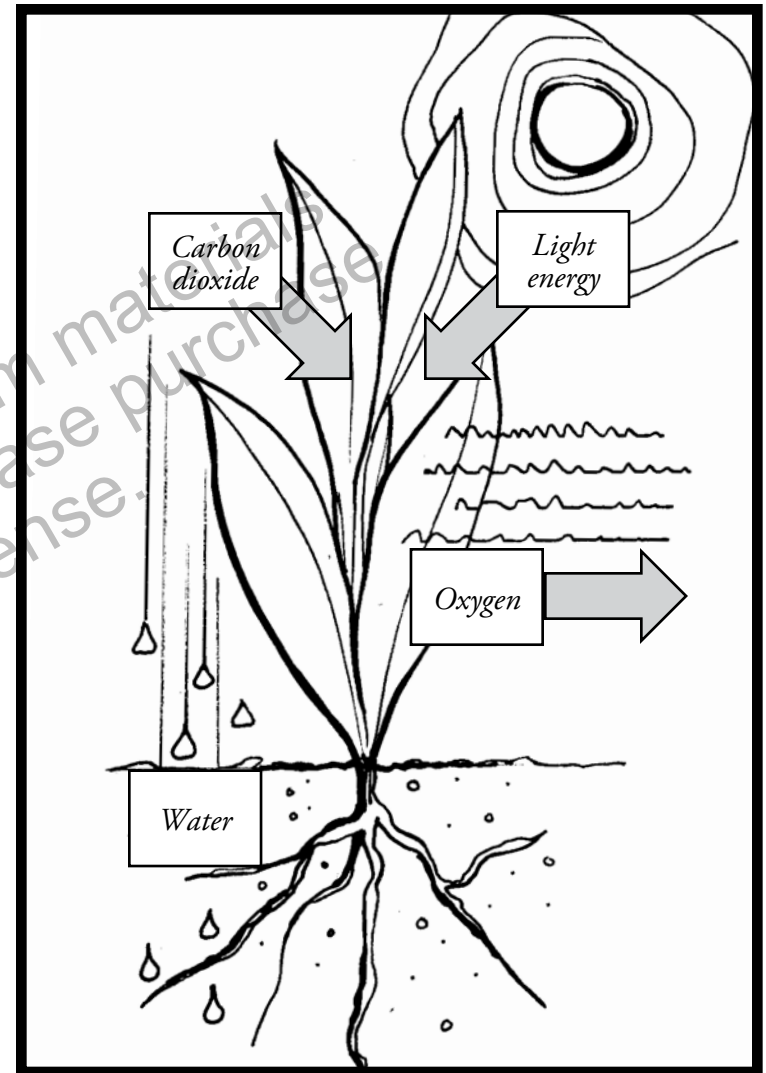
The diagram of photosynthesis on the next page shows that plants also produce oxygen, which we must breathe to survive. As grass, trees, and other plants make food for themselves, they also make oxygen for us.

In fact, our survival depends on plants. We eat plants when we munch on an apple or enjoy a peanut butter sandwich. Of course, many of us also eat meat, eggs, milk, and cheese. Those foods come from animals that eat grass, corn, and other plants. If those animals did not have plants to eat, we would not have hamburgers or scrambled eggs. If there were no plants to make oxygen, we would not have to worry about eating.

– Conclude –

*If there were no plants, we would not have to worry about eating? Why not?*

## Photosynthesis



*Plants combine sunlight, carbon dioxide, and water to make food. As they make food, they release oxygen into the air. We need to breathe in oxygen to survive.*



## Classifying Consumers

Plants are called **producers** because they produce, or make, their own food. Living things that cannot make their own food, including you, are called **consumers**.

It's true that you can make yourself a sandwich. However, you start with two slices of bread and a jar of peanut butter, not sunlight and carbon dioxide. You and all other animals must eat, or consume, something to get the energy you need to live. There are four types of consumers.

### Herbivores

An herbivore is an animal that eats only producers (plants). *Herb* means “plant.” *Vor* is from a Latin word that means “to eat.” Herbivores include such things as grasshoppers, rabbits, and deer.

**producer:** a living thing that makes its own food energy  
**consumer:** a living thing that gets its energy by eating other living things

### Carnivore

A carnivore is an animal that eats only other animals. *Carne* means “meat.” Wolves, hawks, and lions are carnivores.

### Omnivore

Omnivores eat both plants and other animals. You are probably one of them.

*Omni* means “all.” Other omnivores include bears and raccoons.

### Decomposers

Decomposers get their energy by breaking down dead plants and animals. Decomposers help decay, or decompose, dead things. Mushrooms, buzzards, worms, and bacteria are decomposers. They use some of the nutrients they get from dead things to live and grow. The “leftover” nutrients become part of the soil. Then producers can absorb them through their roots and use them again.

– Describe –

*What would a meal for an omnivore be like?*

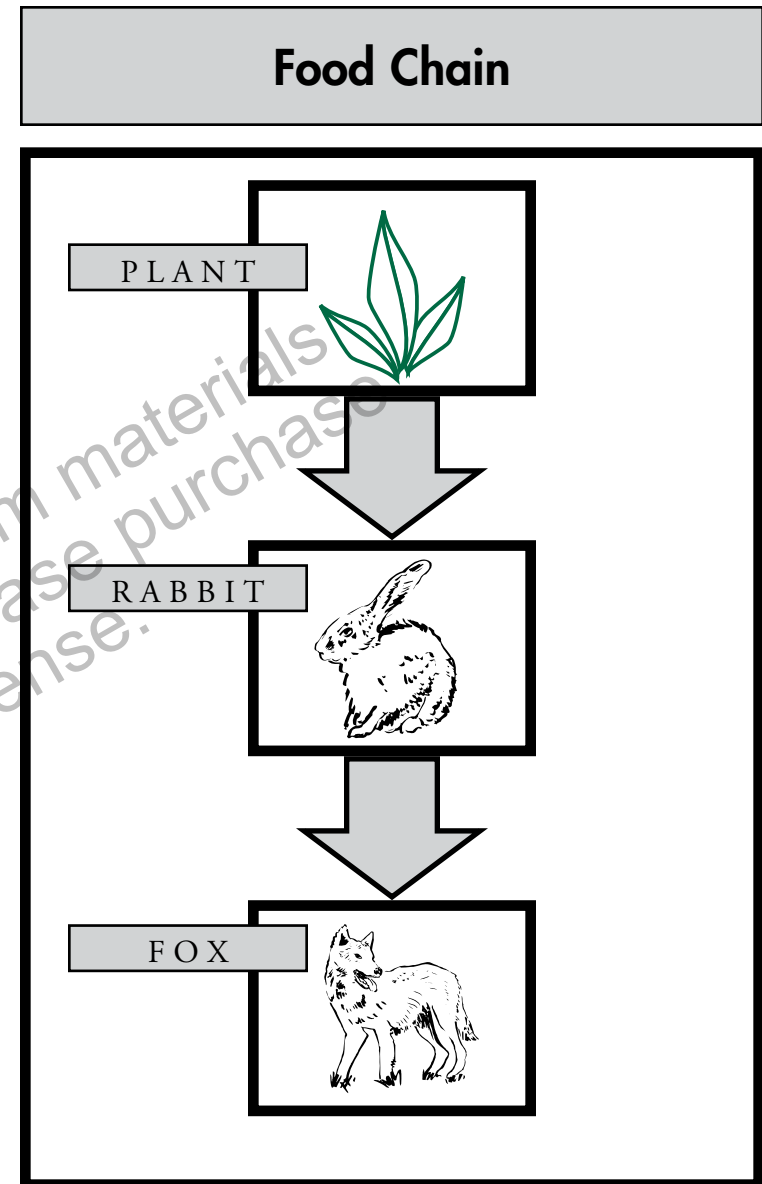
## Food Chains and Food Webs

Energy flows through an **ecosystem**. Plants, such as grass, use the energy from sunlight to make food energy for themselves. The plant uses much of this energy to live and grow and then stores the rest of it.

When a rabbit eats the plant, the energy stored in the plant enters the rabbit's body. The rabbit uses much of this energy to live and grow and stores the rest. When a fox eats the rabbit, the energy stored in the rabbit's body passes to the fox. The fox uses much of the energy to live and grow and stores the rest.

Food chains, like those on the next page, show this flow of energy.

**ecosystem:** all living and nonliving things that live in a certain location



– Apply –  
Describe a food chain that ends with you.

Food chains also exist in the water. Ocean food chains begin with **microscopic** organisms that float on top of the water. (These organisms produce most of the oxygen that you breathe!) These plant-like organisms are eaten by microscopic consumers that also float on the ocean's surface. Then small fish eat the microscopic consumers and are, in turn, eaten by larger fish. An ocean food chain may end with a killer whale!

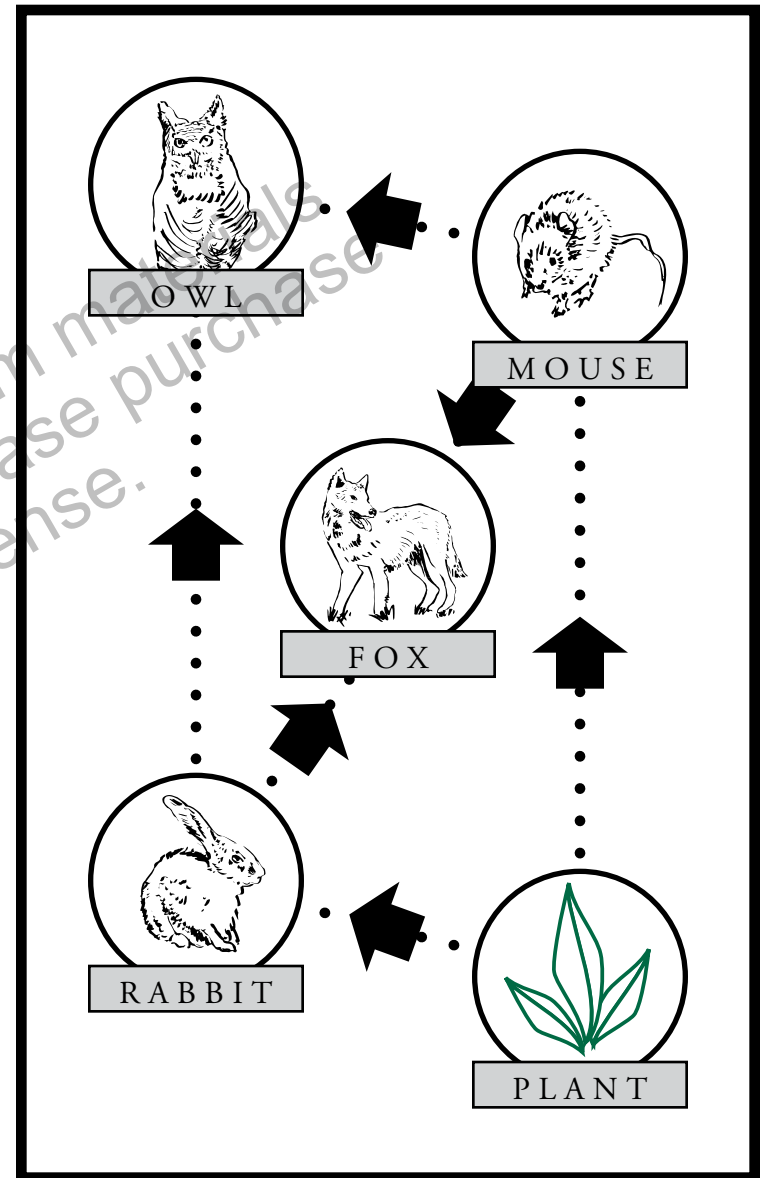
However, a food chain does not explain the whole story. A hawk, for example, eats snakes, frogs, mice, and birds. Most all animals are part of several food chains. Together, these chains make a food web.

– Analyze –

*How do you know that you are part of a food web?*

**microscopic:** too small to be seen without a microscope

## Food Web



---

## Food Webs

People are the top level of many food webs. For example, cows eat grass, and then we drink milk and eat steaks and hamburger, which are made from cow's meat. Chickens eat corn and grain, and then we eat eggs and chickens. The energy from sunlight is passed from plants to the cow, or to the chicken and then on to us.

All of the energy that keeps our bodies alive starts with plants, and all of the energy that is stored in plants starts with sunlight. Our lives depend, in many ways, on the sun that shines on us every day. Without the sun, Earth would soon become a very cold, dark, lifeless place.

– Infer –

*How can plants continue to grow when the sky is cloudy?*

---

## CHAPTER 4

# The Energy Pyramid

You know that energy flows through a food chain. Each link in the chain uses most of the energy it receives to live, grow, and reproduce. Animals also use energy to move around and stay warm. In fact, each link in the chain uses up 90 percent of the energy that it receives. Thus, each link passes along only 10 percent of the energy it receives.

For example, let's say that a rabbit eats a leaf. It gets only 10 percent of the energy that the leaf received from sunlight. Thus, the rabbit must eat many leaves to get all the energy it needs. Then a wolf eats the rabbit. It gets only 10 percent of the energy that the rabbit received from eating leaves. Therefore, the wolf must eat many rabbits to get the energy it needs.

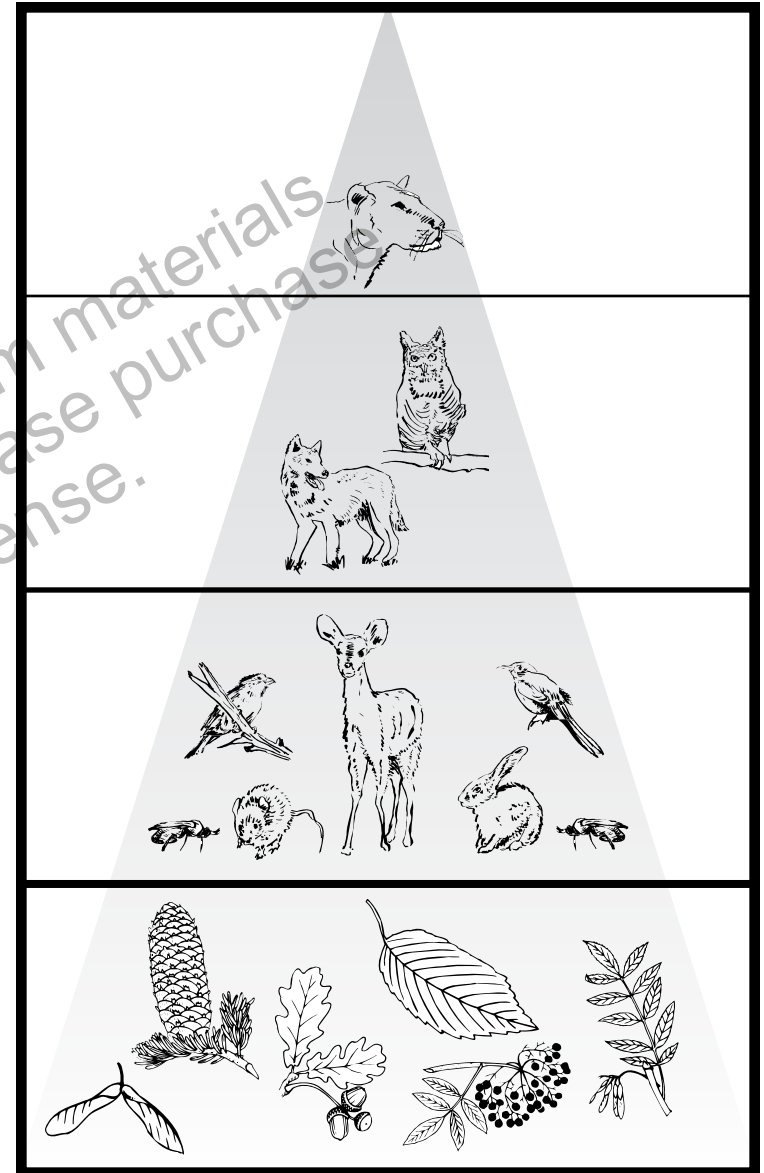
An energy pyramid is a diagram showing the amount of energy that is passed from one level of a food chain to the next. You can see a forest energy pyramid on the next page. Notice that each level has fewer animals. It takes all these living things to support one cougar!

What would an energy pyramid look like in the Antarctic? The bottom level would contain millions of the tiny plant-like organisms that float on the ocean's surface. The next level would contain a much smaller number of fish that eat those plants. The third level up might contain seals, penguins, and squids. At the top might be killer whales.

– Infer –

*Why is an energy pyramid big at the bottom and small at the top?*

## Forest Energy Pyramid



---

An energy pyramid in a desert would include other living things. Yet all pyramids begin with plants and show the flow of energy. They also show that it takes many producers to support a few consumers!

As energy moves through a food chain, it is mostly used for living or released as heat energy. Most food chains have no more than four links because so little energy is available by the fourth link. That's why we need sunshine to help more plants grow. Sunlight provides new energy to flow through food chains.

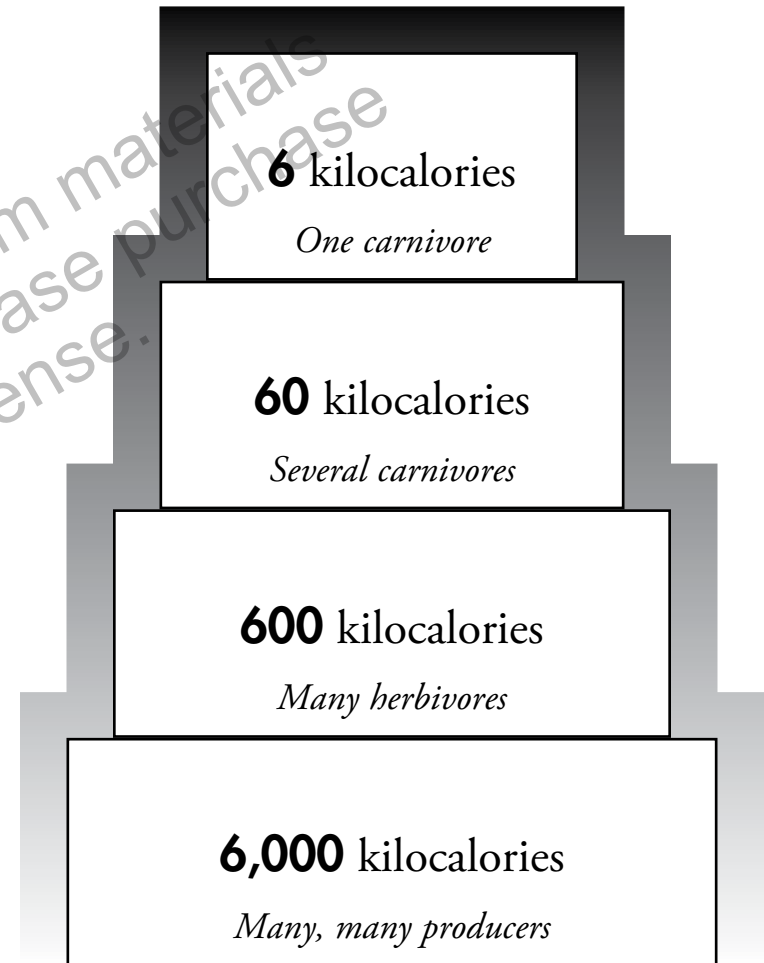
Look at the diagram on the next page. It shows how little energy is left at the top of a pyramid.

– Apply –

What would one energy pyramid on a farm look like?

---

A calorie is a measure of energy. A **kilocalorie** is 1,000 calories. You probably eat food containing 1.5 to 2 kilocalories each day.



**kilocalorie:** a measure of energy; equal to 1,000 calories

## Humans Affect Food Chains

For years, the chemical DDT was used to kill harmful insects. In 1959, 79 million pounds of DDT were sprayed on crops. In time, scientists realized that DDT was also wiping out helpful insects, such as bees, along with fish and birds. In fact, DDT killed nearly all of the bald eagles.

DDT did not kill the eagles directly. The chemical worked its way through the food chain. For example, rain washed DDT off crops and into lakes. In one large lake, scientists found that the amount of DDT in the water was only 0.002 parts per billion. That's very little DDT, less than one drop.

However, algae in the lake absorbed the DDT. The amount of DDT in those plants rose to 2.5 parts per million, a huge increase. As small fish ate algae, the DDT in their bodies rose to 2 parts per million. Bigger fish ate many smaller fish and ended up with 5 to 10 parts per million of DDT in their bodies.

Eagles ate many bigger fish. The high amounts of DDT in their bodies did not kill the eagles. Instead, it made their eggshells too thin, so few chicks hatched.

As scientists learned more about DDT, they warned people not to use it. In 1972, DDT was banned in the United States, but other nations still use it.

– Apply –

*Can you think of another example of how conclusions and ideas change as new knowledge is gained?*

---

## Glossary

**consumer**—a living thing that gets its energy by eating other living things

**ecosystem**—all living and nonliving things that live in a certain location

**kilocalorie**—a measure of energy; equal to 1,000 calories

**microscopic**—too small to be seen without a microscope

**photosynthesis**—the process by which plants use sunlight, carbon dioxide, and water to produce food energy

**producer**—a living thing that makes its own food energy

---

## To Find Out More . . .

Want to learn more about energy in ecosystems?

### Try these books

*Desert Food Chains* by Louise Spilsbury. Heinemann, 2004.

*Food Chains* by Peter Riley. Franklin Watts, 1999.

*Food Chains and Webs* by Holly Wallace. Heinemann, 2006.

*Learning About Food Chains and Food Webs with Graphic Organizers* by Jonathan Kravetz. PowerKids Press, 2006.

### Access these Web sites

You can learn more about food chains and the energy pyramid at this Web site. You can even create your own food web.

[www.vtaide.com/png/foodchains.htm](http://www.vtaide.com/png/foodchains.htm)

This Flying Turtle Web site will tell you more about food chains, the energy pyramid, and the flow of energy through plants and animals.

[www.ftexploring.com/me/me2.html](http://www.ftexploring.com/me/me2.html)



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# Assessments

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*Energy in Ecosystems*

Print pages 20–22 of this PDF for the assessments.

# Check Understanding

Shade the circle next to the correct answer or write your answer on the lines provided.

1. Which of the following organism is a producer?

- Ⓐ plant
- Ⓑ herbivore
- Ⓒ carnivore
- Ⓓ decomposer

2. In a forest, how do decomposers help other organisms?

- Ⓐ Decomposers release oxygen into the air.
- Ⓑ Decomposers provide shelter for animals.
- Ⓒ Decomposers put nutrients back into the soil.
- Ⓓ Decomposers use sunlight to make food for other plants and animals.

3. Our survival depends on plants. Explain two ways that humans are dependent on plants.

(1) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Because green plants make their own food, they are called?

- Ⓐ decomposers
- Ⓑ herbivores
- Ⓒ carnivores
- Ⓓ producers

# Check Understanding

**Draw your web in the box.**

5. A class was sent outside to observe a grassy field. They observed several animals and their eating behaviors in the field. Their teacher told them that all the animals were part of the same food web. Students combined their observations into a table.

Draw a food web that describes the flow of energy among the organisms the students observed. Be sure to use at least four organisms and draw arrows to trace the energy flow. You may use pictures or words to draw the web.

Animal Eating Behaviors	
Organism	Behavior
rabbits	eats plants
fox	eats rabbits and mice
mice	eats plants
owl	eats rabbits and mice

This is a large, empty rectangular box intended for the student to draw a food web based on the information provided in the table. The box is currently blank, except for a faint watermark that reads "To use FocusCurriculum materials with your students, please purchase a school license."

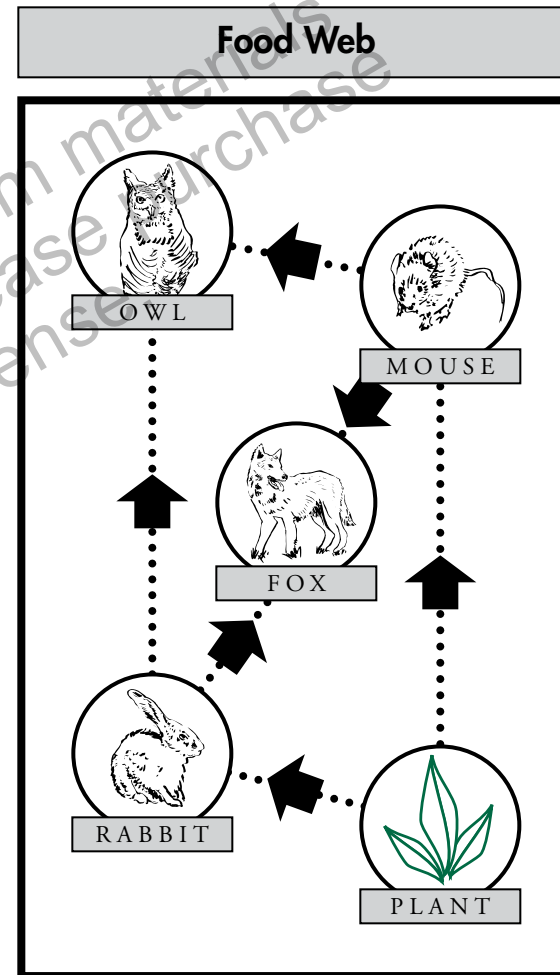
# Assessment Scoring Guidelines

1. Answer A is correct.
2. Answer C is correct.
3. Plants produce oxygen and release it in the air which humans need to survive.

Humans eat plants and animals that eat plants to obtain energy to stay warm, grow, and move.

4. Answer D is correct.

5. Four organisms showing the correct flow of energy should be shown.





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# English Language Arts Activities

*Energy in Ecosystems*

Print pages 24–28 of this PDF for the reading activities.

# Word Origins

## TRY THE SKILL

Many English words are based on Latin and Greek prefixes, suffixes, and roots. If you know their meanings, you can often figure out the meanings of the English words. These word parts were used in this book.

*anim* meaning “life or spirit”; examples: animal, animation

*photo* meaning “light”; examples: photosynthesis, photograph

*micro* meaning “small”; examples: microscope, microwave

*sci* meaning “know”; examples: science, conscious

*vor* meaning “eat”; examples: herbivore, carnivore

Read each sentence, and think about the meanings of the word choices. Shade the letter of the word that correctly completes the sentence.

1. An animal with a huge appetite is \_\_\_\_\_.

- Ⓐ animated
- Ⓑ voracious
- Ⓒ photogenic
- Ⓓ omniscient

2. A person who is all knowing is \_\_\_\_\_.

- Ⓐ animated
- Ⓑ voracious
- Ⓒ photogenic
- Ⓓ omniscient

3. \_\_\_\_\_ is the smallest of all of these.

- Ⓐ A microbe
- Ⓑ A conscience
- Ⓒ An inanimate object
- Ⓓ A photograph

4. \_\_\_\_\_ is not alive.

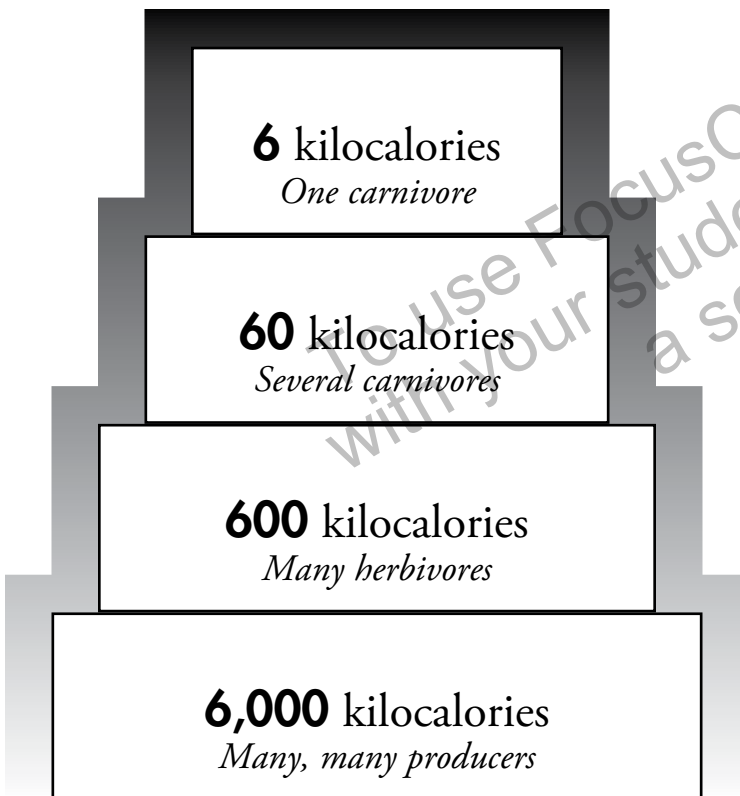
- Ⓐ A microbe
- Ⓑ A carnivore
- Ⓒ An inanimate object
- Ⓓ A herbivore

# Analyze Graphic Information

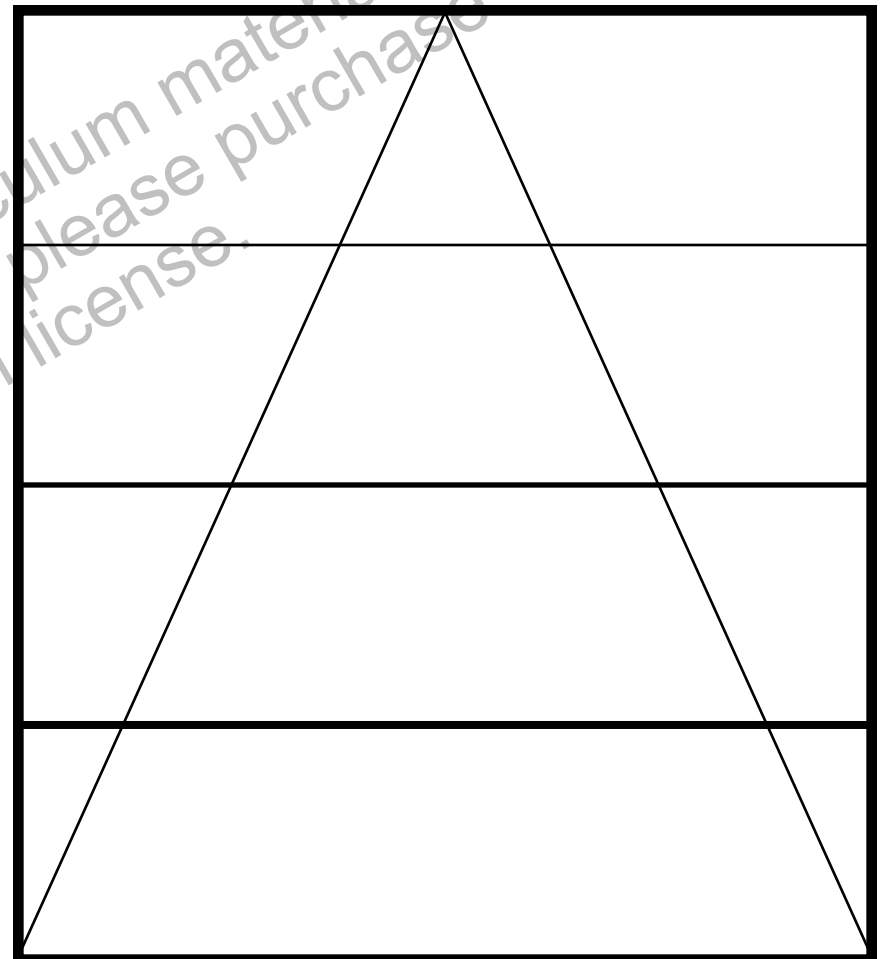
## TRY THE SKILL

Graphic information is another way to communicate ideas. Reading graphics can also help you understand and remember what you read.

A diagram is one kind of graphic. It's a clear way to show food chains, food webs, and energy pyramids. You have seen several examples in this book.



Draw your own energy pyramid. Show how energy flows from producers to carnivores. Include producers, herbivores, and carnivores. Label each group.





# Locate Information Online

## TRY THE SKILL

Search engines can help you find information on the Internet. However, look at how many results each of these keywords produced:

- ecosystem (14,500,000)
- food webs (744,000)
- energy transfer in energy pyramid (124,000)

Did you notice what happened as the keywords got more specific? The number of hits got smaller. Using specific keywords will narrow your search. Yet even if you narrow your search to 100,000 sites, you must choose carefully among them. Here are some tips:

1. Avoid personal Web sites. No one makes sure the information on the Web is accurate. Many personal Web sites include someone's name or members, users, or people. Some sites are sponsored by elementary school classes. Their address often includes the code k12 and the state abbreviation. The information on these sites might be excellent—or not.
2. Seek out sites sponsored by government agencies (.gov), colleges and universities (.edu), or other reliable organizations.

You are writing a report about food chains in the ocean. Answer these questions.

1. Which keyword or phrase is most likely to produce helpful Web sites?  
Ⓐ ocean animals      Ⓒ marine food webs  
Ⓑ phytoplankton      Ⓓ Arctic food webs
2. Which site is most likely to have helpful information?  
Ⓐ Food Chains Under the Sea!  
How do we use living things from the ocean?  
What do we...  
*www.ptw.k12.tn.us/tools/shared/display*  
Ⓑ Scientists Worry About Ocean Health  
Large fish are a pretty good signal because they are high in the food chain...  
*www.commonhopes.com.html*  
Ⓒ Understanding Ocean Food Chains  
The smallest inhabitants live in the top few inches of ocean water...  
*www.mtn.edu/studnts/forums.htm*  
Ⓓ Queen of the Ocean Food Chain  
One of the wildest bands in the world....  
*www.youtube.com*

# Summarize Information

## TRY THE SKILL

To understand what you read, you must be able to identify the main ideas and supporting details. A paragraph may have one or more important ideas, along with details that support each of them. For example, read this paragraph.

For years, the chemical DDT was used to kill harmful insects. In 1959, 79 million pounds of DDT were sprayed on crops. In time, scientists realized that DDT was also wiping out helpful insects, such as bees, along with killing fish and birds. In fact, DDT killed nearly all of the bald eagles.

**This paragraph has two main ideas.**

- 1) Long ago, people used a lot of DDT.
- 2) It took a while for them to realize that it was harmful. The second sentence has details supporting the first main point: the amount of DDT sprayed on crops in one year. The third and fourth sentences include details to support the second main point: the names of the living things harmed by DDT.

Read this paragraph. Then shade in the circle next to the correct answers.

Decomposers get their energy by breaking down dead plants and animals. Decomposers help decay, or decompose, dead things. Mushrooms, buzzards, worms, and bacteria are decomposers. They use some of the nutrients they get from dead things to live and grow. The “leftover” nutrients become part of the soil. Then producers can absorb them through their roots and use them again.

1. What is the first important idea in this paragraph?
  - (A) Decomposers get energy by breaking down dead things.
  - (B) Decompose means “decay.”
  - (C) Mushrooms, worms, and bacteria are decomposers.
  - (D) Decomposers help recycle nutrients.
2. What is the second important idea in the paragraph?
  - (A) Decomposers get energy by breaking down dead things.
  - (B) Decompose means “decay.”
  - (C) Mushrooms, worms, and bacteria are decomposers.
  - (D) Decomposers help recycle nutrients.

# Answer Key

## Word Origins

1. B
2. D
3. A
4. C

## Analyze Graphic Information

Students should draw an energy pyramid with many producers (plants) at the bottom, a number of herbivores (plant-eaters, such as rabbits, deer, mice, birds) at the next level, and a few small carnivores or omnivores (animal-eaters, such as foxes, wolves, owls, hawks, raccoons) at the third level up. The top level should be one large carnivore, such as a bear, cougar, or lion.

## Locate Information Online

1. C
2. C

## Summarize Information

1. A
2. D