

On Level



SCIENCE • GRADE 4

California Content Standards
Life Sciences: 2.A
Life Sciences: 2.B
Life Sciences: 2.C

Energy in Ecosystems

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Energy in Ecosystems

California's Content Standards Met

GRADE 4 SCIENCE

LIFE SCIENCES: 2—All organisms need energy and matter to live and grow. As a basis for understanding this concept:

- a. Students know plants are the primary source of matter and energy entering most food chains.
- b. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.
- c. Students know decomposers, including many fungi, insects, and micro-organisms, recycle matter from dead plants and animals.

GRADE 4 ENGLISH LANGUAGE ARTS

1.0 WORD ANALYSIS, FLUENCY, AND SYSTEMATIC VOCABULARY DEVELOPMENT

Vocabulary and Concept Development 1.3—Use knowledge of root words to determine the meaning of unknown words within a passage.

Vocabulary and Concept Development 1.4—Know common roots and affixes derived from Greek and Latin and use this knowledge to analyze the meaning of complex words (e.g., international).

2.0 READING COMPREHENSION

Structural Features of Informational Materials 2.1—Identify structural patterns found in informational text (e.g., compare and contrast, cause and effect, sequential or chronological order, proposition and support) to strengthen comprehension.

Comprehension and Analysis of Grade-Level-Appropriate Text 2.2—Use appropriate strategies when reading for different purposes (e.g., full comprehension, location of information, personal enjoyment).

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Student Book

Energy in Ecosystems

Print pages 5 – 18 of this PDF for the student book.

How to Make the Student Book

- The student book is contained on pages 5–18 of this PDF. It begins on the next page.
- To make one student book, or a two-sided master copy that can be photocopied, you will print on both sides of seven sheets of 8.5" x 11" paper.
- Do a test printout of one book first to familiarize yourself with the procedure.
- Follow these instructions carefully.

First—Select the Paper

Since you will be printing on both sides of the sheets of paper, select a good quality white paper. We recommend using at least a 22lb sheet.

Second—Check Printer Settings

Be sure you have the correct page setup settings for your computer and printer. You will print these pages in landscape format.

Third—Print EVEN Pages

Open the PDF of the book you want to print. Select print from your file menu. In your printer's dialogue box enter pages 5–18 to print. Then select EVEN pages only. It is important to print only the EVEN pages first. Click "Print" to print the even pages. (**Important note:** The first page that prints will be blank. DO NOT discard this page. It will be needed to print the cover in the next step.)

Forth—Print ODD Pages

When the even pages have printed, flip the stack of pages over to print the odd pages. Place the stack back in your printer. Select print from the file menu again. In your printer's dialogue box, select ODD pages. Click "Print" to print the odd the pages.

Fifth—Fold the Book

You now have a complete book. Check to be sure the pages are in the correct order with the book's cover as the top page. Then fold the stack of paper in half.

Sixth—Staple the Book

Use an extended-length stapler to staple the pages together. Place three staples in the spine of the book.

Please note that printers vary in how they output pages. Do a test printing with one book and adjust the procedure as necessary.

If you want to make a one-sided master copy, print ALL pages 5–18 at once. Then select "one-sided to two-sided" on the copy machine.

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by
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Table of Contents

Introduction:

Energy on the Move 4

Chapter 1:

Plants and Sunlight 5

Chapter 2:

Classifying Consumers 8

Chapter 3:

Food Chains and Food Webs . . 10

Chapter 4:

The Energy Pyramid 15

Chapter 5:

DDT and Food Chains 20

Glossary 22

To Find Out More 23

Index 24

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

INTRODUCTION

Energy on the Move

Are you full of energy today? All living things need energy to keep on living. How you get your energy makes you a producer, a consumer, or a decomposer. In this book, you'll learn which one you are.

You'll also learn how the energy that keeps all living things alive starts with the sun. Plants turn sunlight into food energy. That energy flows to animals. Some of it flows from plants and animals to you.

Did you know that you are part of food chains? You also have a place in an energy pyramid. If you didn't, you could not live!

CHAPTER 1

Plants and Sunlight

Plants use energy from the sun to 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.

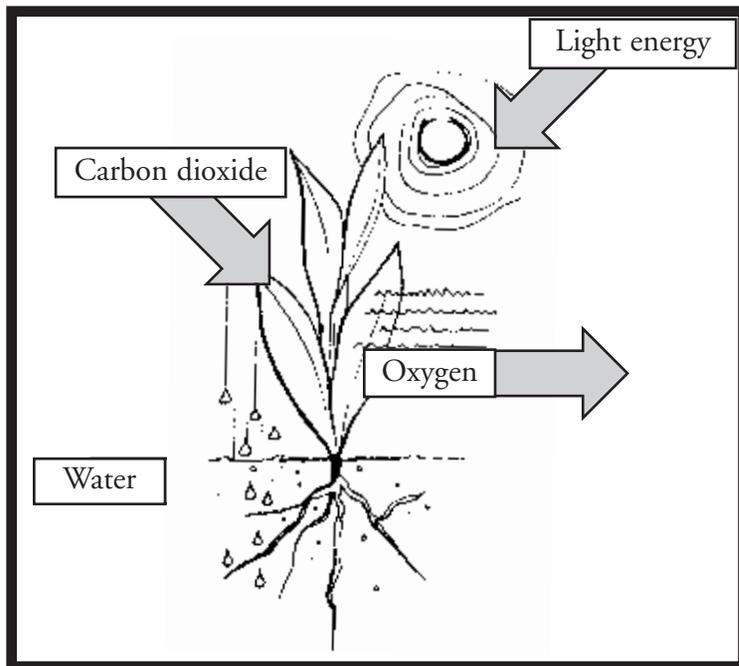
Sunlight has energy. You can feel the energy in sunlight. Did you ever walk across a sunny beach in your bare feet? The energy in sunlight heated that sand.

Plant leaves are filled with green matter. It traps the energy in sunlight. The leaves use this energy to “put together” carbon dioxide from the air and water from the soil. This produces a type of sugar. This sugar is rich in chemical energy. Plants use this chemical energy to grow and produce seeds.

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

During photosynthesis, plants also produce a gas called oxygen. Plants do not need this gas. Animals do. We must breathe oxygen. Most of our oxygen comes from billions of tiny plants. They are floating on the ocean.

Photosynthesis



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

What if a rabbit eats a plant? The rabbit's body changes the plant's chemical energy into other forms of energy. The rabbit uses this energy to stay warm, grow, and reproduce.

In the same way, the food we eat keeps our bodies warm. It gives us the energy we need to stay warm, grow, and move.

We depend on plants in several ways. We eat them when we munch on a carrot, eat a peanut butter sandwich, or enjoy some popcorn. Many of us also eat meat, eggs, milk, and cheese. Those foods come from animals that ate plants, such as grass and corn. If those animals had no plants to eat, we would not have hamburgers or scrambled eggs.

In fact, without the sun, we would not have food or oxygen. The sun is the main source of energy for Earth's plants and animals, including you. In the end, our survival depends on the sun.

Classifying Consumers

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

Since you cannot make your own food, you and all other animals must consume plants and/or animals. There are four main types of consumers.

Herbivores

An herbivore eats only producers (plants). *Herb* means “plant.” *Vor* is from a Latin word that means “to eat.” So an herbivore is a plant-eater. Herbivores include grasshoppers, rabbits, and mice.

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 eats only other animals. *Carne* means “meat.” Wolves, hawks, and lions are carnivores.

Omnivore

Omnivores eat both plants and other animals. *Omni-* means “all.” Omnivores include bears and raccoons.

Decomposers

Decomposers get their energy by breaking down dead plants and animals. They help decay, or decompose, dead things. Buzzards, mushrooms, 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 absorb these nutrients through their roots. In this way, decomposers recycle nutrients.

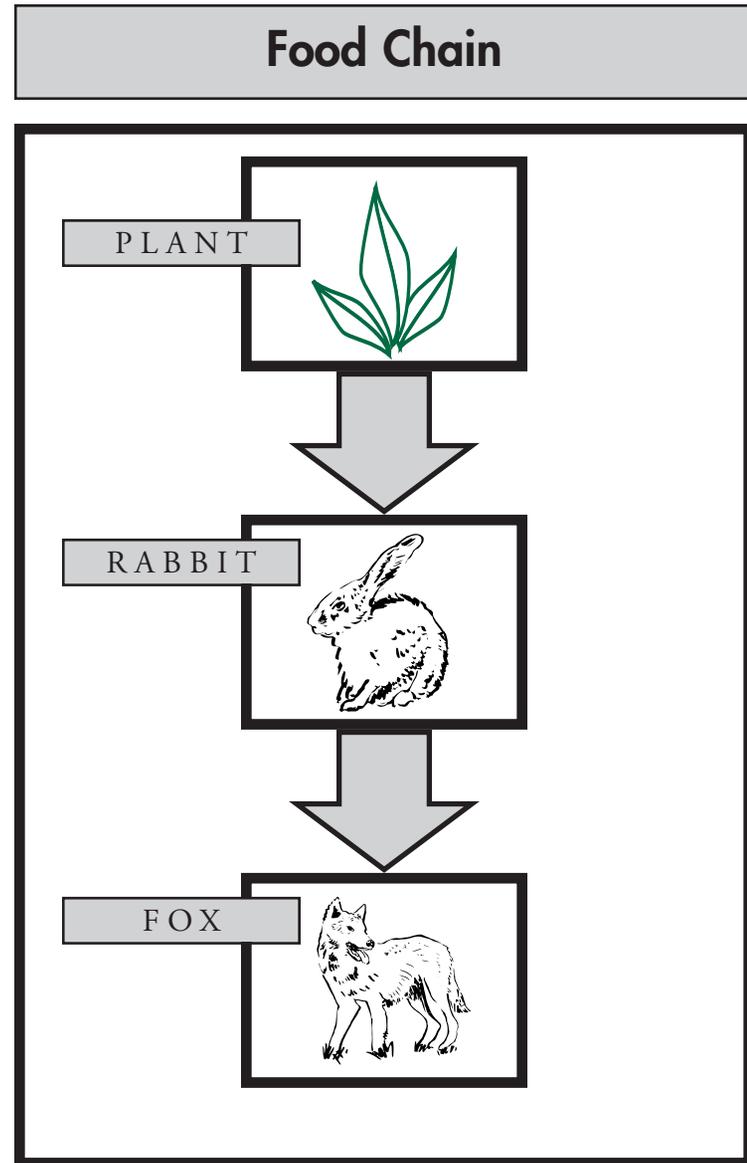
Describe a meal for an omnivore.

Food Chains and Food Webs

How does energy flow through an **ecosystem**? Plants use energy from sunlight to make food energy for themselves. They use much of this energy to live and grow. They store the rest.

When a rabbit eats a plant, the energy stored in it enters the rabbit's body. The rabbit uses much of this energy to live and grow. It stores the rest. When a fox eats the rabbit, the fox uses much of the energy from the rabbit. It stores the rest. When any living thing dies, decomposers use some of its energy. They return some to the soil.

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



Describe a food chain that ends with you.

In a food chain, plants are eaten by primary consumers. (One meaning of *primary* is “first.”) They can be herbivores, such as rabbits. They can also be omnivores, such as raccoons.

Then some primary consumers are eaten by secondary consumers. Let’s say that an owl eats a rabbit (a primary consumer). The owl is a secondary consumer. You eat plants, so you are a primary consumer. Do you eat meat, eggs, and milk? Then you are a secondary consumer, too.

Decomposers are at all levels of a food chain. They help break down dead producers and consumers of all kinds.

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

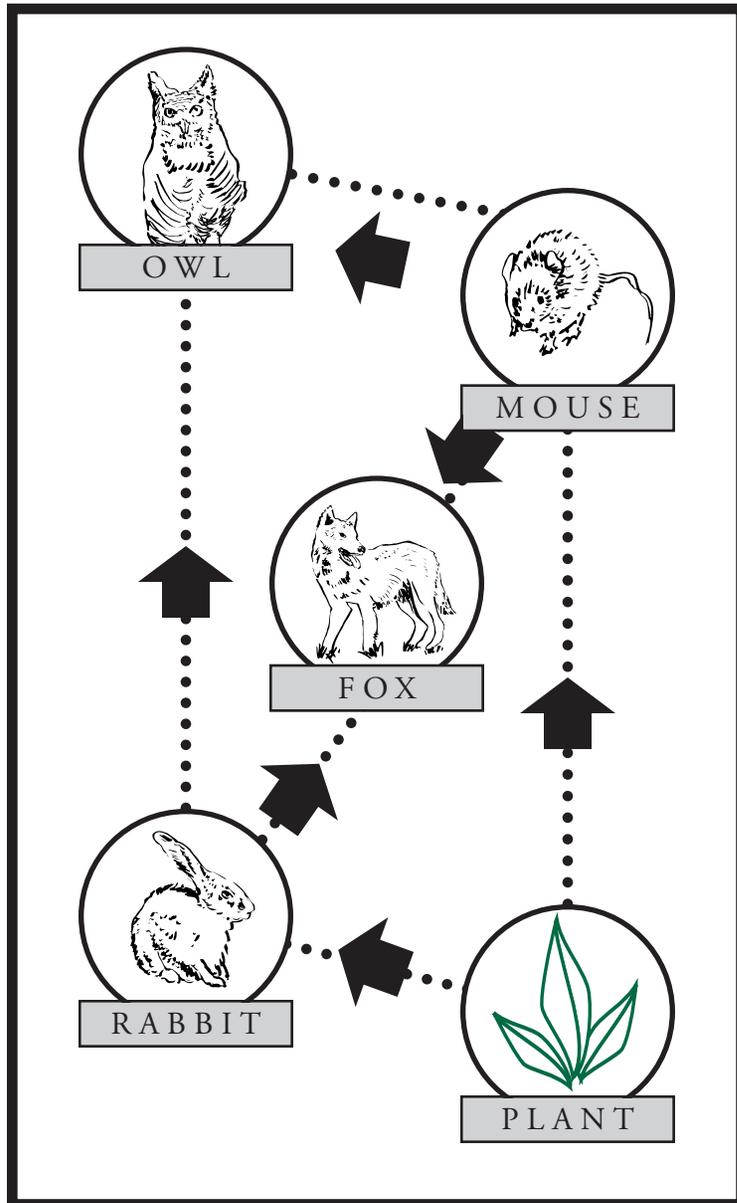
Ocean food chains begin with **microscopic** living things. You have read about them before. These tiny floating plants produce most of the oxygen you breathe. They are eaten by tiny floating consumers.

Then small fish eat the tiny consumers. In turn, they are eaten by larger fish. An ocean food chain may end with a killer whale!

However, one food chain does not tell the whole story. For example, foxes do not eat just rabbits. They also eat mice, birds, and other animals. Foxes, like most animals, are part of several food chains. Together, these chains make a food web.

microscopic: too small to be seen without a microscope

Food Web



Food Webs

In a forest, a bear might end at the top of a food web. However, many food webs end with people. For example, cows eat grass, and then we drink milk and eat hamburgers. Chickens eat corn, and then we eat eggs and chickens. Energy from sunlight is passed from plants, to the cow and chicken, and on to us.

All of the energy that keeps your body alive starts with plants. All of the energy that is stored in plants comes from sunlight. All living things, including you, depend on the sun. Without it, Earth would soon become a very cold, dark, lifeless place.

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

The Energy Pyramid

Not much energy passes through a food chain. Why? Each living thing uses most of the energy it receives. It passes along only 10 percent of that energy.

For example, a leaf uses up most of the energy it receives from sunlight to live and grow. When a rabbit eats the leaf, it gets only 10 percent of the energy that the leaf received from sunlight.

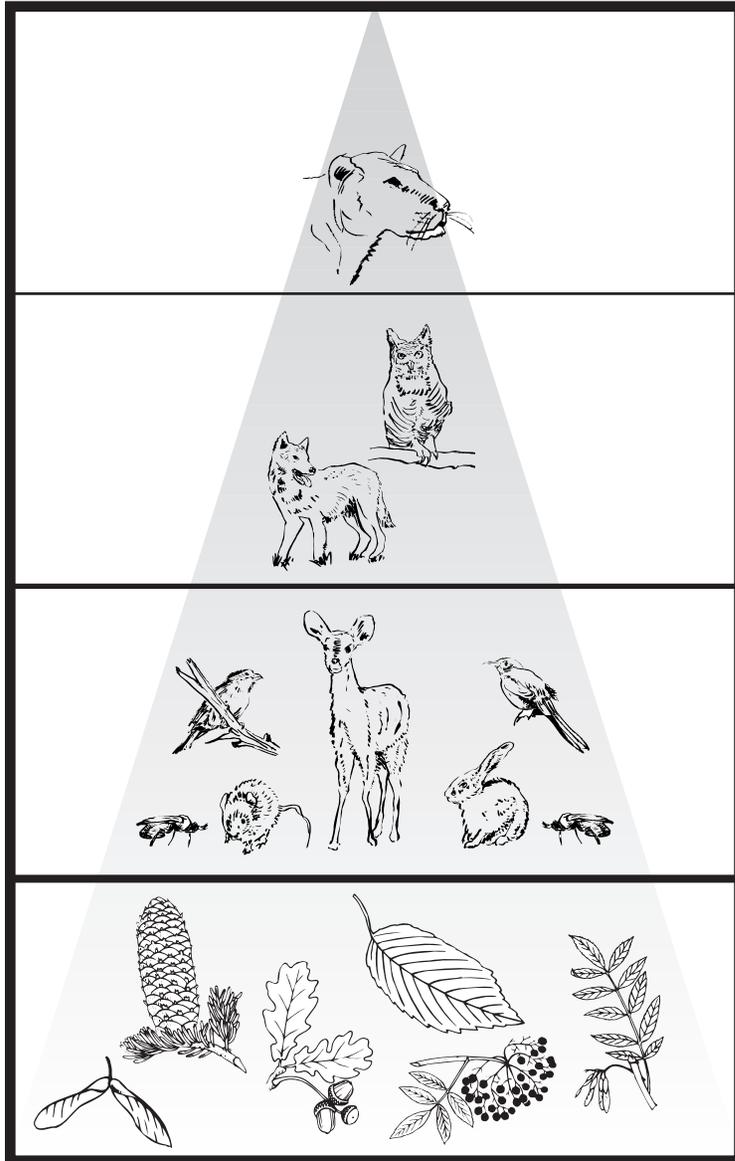
The rabbit must eat many leaves to get the energy it needs. The rabbit, in turn, uses up most of that energy. So a wolf must eat many rabbits to get the energy it needs.

An energy pyramid shows how energy passes through a food chain. Page 18 shows a forest energy pyramid. Each level has fewer living things than the level below it. Why? Each living thing passes only a small amount of energy up to the next level. Look at the plants and animals in this pyramid. The energy from all of them keeps only one cougar alive!

Sometimes one level of a food chain has too many living things. They must compete for the available food. For example, deer in a large herd must compete with each other for grass and leaves.

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

Forest Energy Pyramid



Not all energy pyramids look alike. In the ocean, the bottom level contains billions of tiny, floating plants. They are the same plants that produce most of the oxygen you breathe.

Most pyramids have no more than four levels. As energy flows through food chains, little is available by the fourth level. That level is often one animal. It might be a cougar, an owl—or you.

All energy pyramids begin with plants. It takes millions of producers to support a few animals. The producers provide the energy that moves through food chains. The source of this energy is sunlight.

What would one energy pyramid on a farm look like?

DDT and Food Chains

For many years, the chemical DDT was used to kill harmful insects. By the early 1970s, scientists realized that DDT was also wiping out helpful insects, fish, and birds. In fact, DDT killed nearly all of the bald eagles.

DDT did not kill the eagles directly. Instead, it worked its way through the food chain. A large lake in Africa showed how that happened. The lake was sprayed with DDT to kill mosquitoes. They can carry disease. The amount of DDT in the water was only 0.002 parts per billion. That's about one drop of DDT in the entire lake.

Yet plants in the lake absorbed the DDT. The DDT in them rose to 2.5 parts per million. Small fish ate many plants. Then bigger fish ate many small fish. Some big fish ended up with 5 to 10 parts per million of DDT in their bodies. Crocodiles that ate many big fish had up to 34 parts per million.

Eagles also ate many of these big fish. The DDT did not kill the eagles. Instead, it made their eggshells too thin. Few chicks hatched.

In 1972, DDT was banned in the United States. Other nations still use it.

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

decomposer—an organism that gets its energy by breaking down dead plants and animals

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

herbivore—an animal that gets all of its energy from producers (plants)

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

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

Index

carnivore, 9

consumer, 4, 8–9

decomposer, 4, 9

energy pyramid, 4, 16–19

food chain, 4, 10–13

food web, 14–15

herbivore, 8

omnivore, 9

photosynthesis, 5–6

producer, 4, 8



ENGLISH-LANGUAGE ARTS • GRADE 4

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Vocabulary and Concept Development: 1.3
Vocabulary and Concept Development: 1.4
Structural Features of Informational Materials: 2.1
Comprehension and Analysis of Grade-Level-Appropriate Text: 2.2

English-language Arts Activities

Energy in Ecosystems

Print pages 20–24 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

Cause and Effect

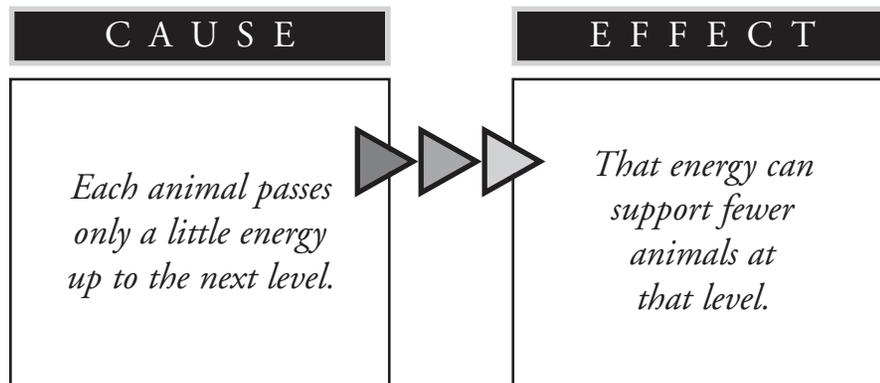
TRY THE SKILL

To identify an effect, you ask, "What happened?"
To identify the cause, you ask, "Why did that happen?"
To practice, read this passage:

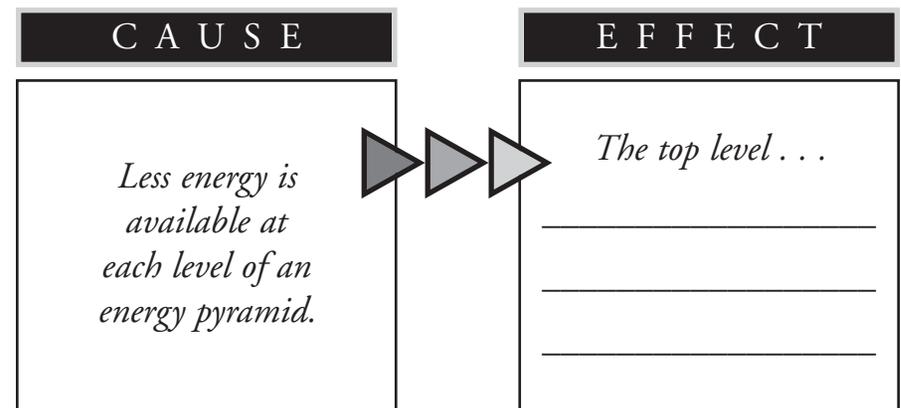
An energy pyramid shows how energy passes through a food chain. Each level has fewer living things than the level below it. Why? Each living thing passes only a small amount of energy up to the next level. The energy from all of the plants and animals in a pyramid supports only one animal at the top!

Sometimes one level of a food chain has too many living things. They must compete for the available food. For example, deer in a large herd must compete with each other for grass and leaves.

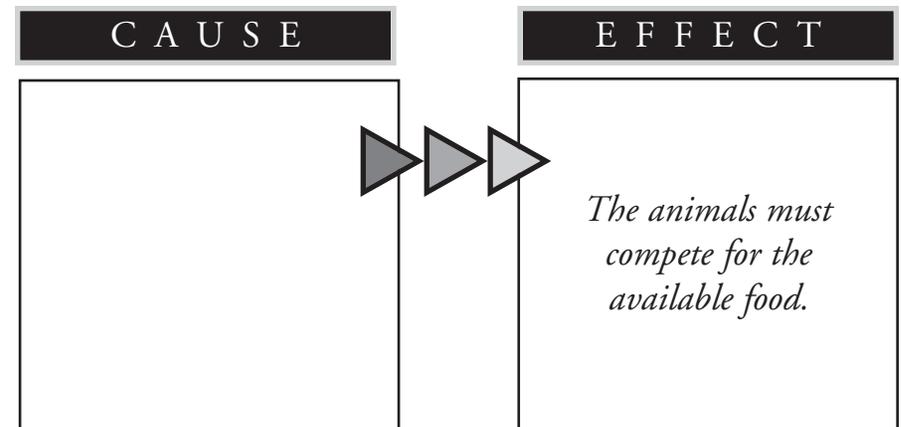
This graphic explains as energy moves through an ecosystem.



Read the passage again. Then complete this graphic.
Tell how this cause affects the top level of an energy pyramid.



Now complete this graphic. Tell one reason why animals must compete for food.



Prefixes

TRY THE SKILL

The prefixes *non-*, *dis-*, *im-*, and *un-* all mean “not.” However, you must use the correct prefix with each root word. You can say, “I am unsure about that,” but not “I am nonsure,” “I am dissure” or “I am imsure.” The last three choices are not real words.

You must use these four prefixes carefully. Here are more examples:

non- nonsense, nonfiction, nonstop

dis- dishonest, disappear, disarm

im- impatient, impolite, immature

un- unsure, unhappy, uncover

Read each sentence and find the word with a line in front of it. Shade in the letter of the prefix that should be added to that word.

1. It is ___possible for any living thing to survive without sunlight.
Ⓐ non- Ⓒ im-
Ⓑ dis- Ⓓ un-
2. Herbivores are ___able to produce their own food.
Ⓐ non- Ⓒ im-
Ⓑ dis- Ⓓ un-
3. Scientists ___agree about the length of food chains in the ocean.
Ⓐ non- Ⓒ im-
Ⓑ dis- Ⓓ un-
4. Too many animals at one level can cause an ___balance in an ecosystem.
Ⓐ non- Ⓒ im-
Ⓑ dis- Ⓓ un-

Read for a Purpose

TRY THE SKILL

Here are some of the main reasons for reading:

- to gain information or understanding
- to learn how to do something
- to be entertained

For example, you read this book to gain information. You learned how energy moves through ecosystems. You did not learn how to do something. The author hoped the content interested you, so you would be entertained. So the main reason you read this book was to gain information. A less important reason was to be entertained.

When you are choosing what to read, pay attention to titles. They can help you decide whether an article or book will fit your purpose in reading.

Read the list of titles. Then write the correct letters beside each purpose for reading.

- A. *Who Eats What? Food Chains and Food Webs*
- B. *Planting a Butterfly Garden*
- C. *My Dog, the Carnivore*
- D. *Dinosaurs to the Rescue: A Guide to Protecting Our Planet*
- E. *My Life at the Top of the Food Chain*
- F. *Coral Reef Food Chains*

1. Which two titles would you read for information?

2. Which two titles would you read to learn how to do something?

3. Which two titles would you read to be entertained?

Answer Key

Word Origins

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

Cause and Effect

Effect: The top level can support only one animal.

Cause: One level of an energy pyramid might have too many living things.

Prefixes

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

Read for a Purpose

1. A, F
2. B, D
3. C, E