Lesson 1

What are ecosystems?

Envision It!

Tell how the organisms in this picture interact.

I will know the parts of ecosystems and some examples of ecosystems. I will know how specific structures of organisms help them live in their habitats.

Words to Know

ecosystem population habitat

my planet DIARY

Let's Blog!

by Emma
Middleburg, FL

Today we went to the Alligator Farm in St. Augustine. We saw American alligators. One alligator was an albino. Did you know they feed them rodents called Cavia? The worker that fed them said they only need 80 pounds of food a year. I was surprised when she walked among the alligators in the exhibit as she fed them. One of them kept hissing at her. I would have been scared.

Although we saw many crocodiles and alligators, my favorite was the albino alligator. It was all white. I learned that the parents of albino alligators don't always have to be albino themselves. We rarely see these in the wild because they can't camouflage themselves from their predators.

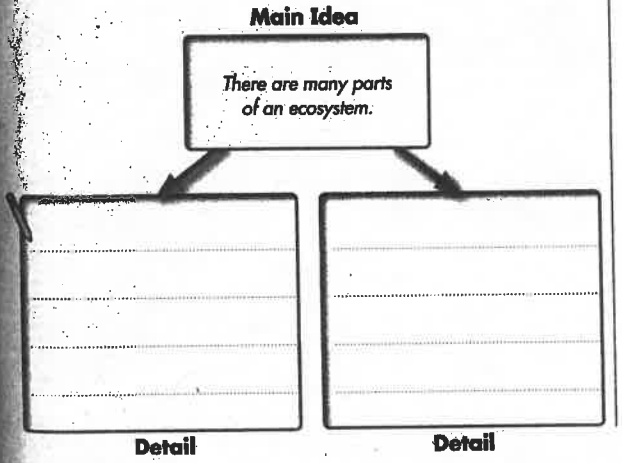
It was an exciting day and a great way to spend the afternoon learning.

Write a response to Emma's blog. Talk about an animal you have seen or read about.

Parts of an Ecosystem

An **ecosystem** is all the living and nonliving things in an environment and the many ways they interact. An ecosystem may be large like the ocean or small like a park. Animals and plants are living parts of an ecosystem. These organisms interact with each other and with the nonliving parts of the system. The nonliving parts of an ecosystem include air, water, soil, sunlight, and landforms.

1. **Main Idea and Details** Complete the graphic organizer below. Write details about ecosystems.



2. **Infer** The seahorse interacts with its ocean ecosystem by holding on to the coral. Why do you think the seahorse holds on to the coral?

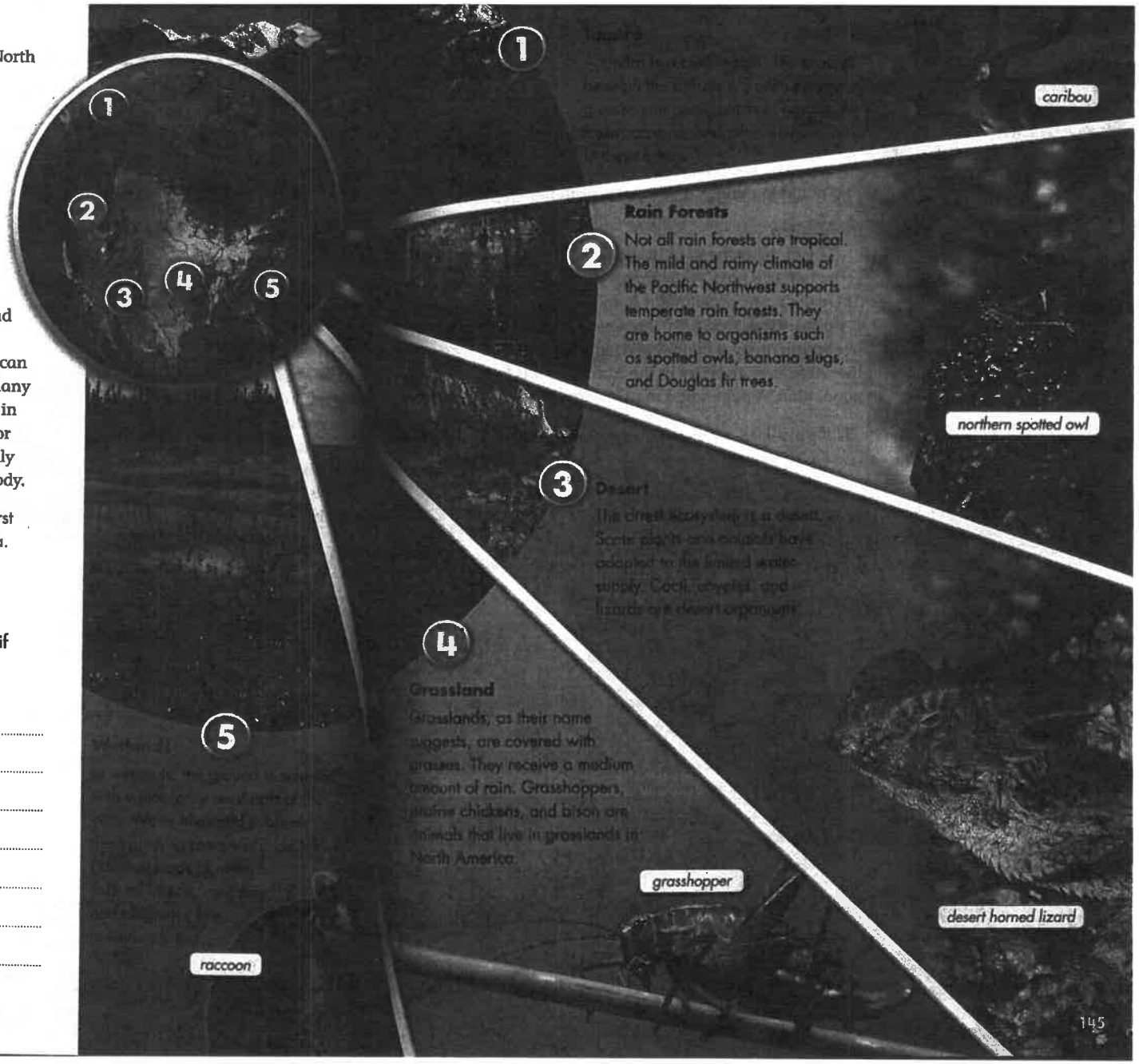
Kinds of Ecosystems

There are several different ecosystems in North America, such as tundra, rain forest, desert, grassland, and forest. Many factors, such as climate and soil, make ecosystems different. Some ecosystems are cold and dry, while others are warm and wet. Some ecosystems have sandy soil while others have fertile soil. The kinds of plants and animals that live in an area depend on the climate and soil. Organisms can survive only in environments in which their needs are met. In any environment, some kinds of plants and animals survive better than others.

For example, you may think that nothing can live in a desert ecosystem, but deserts have many organisms living there. Cacti and lizards live in deserts. Sandy soil is used as a hiding place for the desert horned lizard. The lizard can quickly become invisible by throwing sand over its body.

3. **Main Idea and Details** Read the first paragraph again. **Underline** the main idea. Circle the details.

4. CHALLENGE How might a grassland change if very little precipitation falls on the area for several years?



At-Home Lab

Picture This!
Pick an ecosystem. Cut out pictures of its habitats and populations. Write a description of the ecosystem. Glue your pictures and description onto construction paper. Label the populations.

Living Things Within Their Ecosystems

Habitat

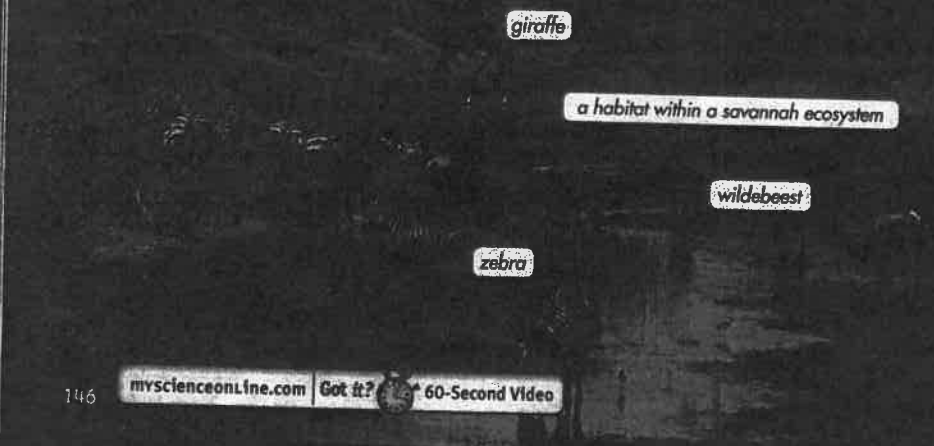
The area or place where an organism lives in an ecosystem is its **habitat**. You can think of a habitat as an "address." The habitat of the lion is open grassland with shrubs, trees, and water. A habitat contains all the living and nonliving things that an organism needs to survive.

Population

Look at the picture on this page. It shows a savannah ecosystem in Africa. A savannah is a kind of grassland. There are many populations found in this savannah. A **population** is all the members of one species that live within an area of an ecosystem. For example, the wildebeests that live in the African plains form a population. A population may be large or small.

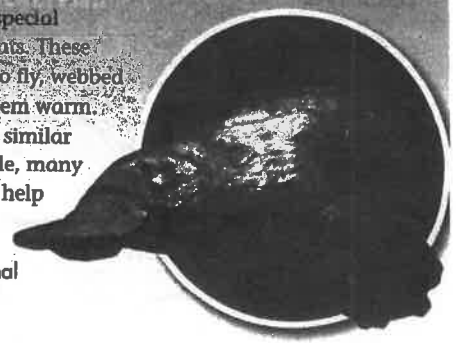
5. Apply Find another population in the picture and draw an X on each member of that population.

6. Identify Write the names of two other populations that you think could be part of the ecosystem shown here.



Structures for Survival

Many organisms such as the platypus have special structures that help them survive in their habitats. These structures may include wings that allow them to fly, webbed feet that help them swim, and fur that keeps them warm. Different organisms in an ecosystem may have similar structures that help them live there. For example, many organisms that live in the ocean have fins that help them move easily through water.



7. Infer What kind of ecosystem might this animal live in? Explain how you know.

Got it?

8. Identify What kind of habitat do you think an animal with long, thick fur would most likely live in?

9. Explain What structures might monkeys have that help them to live in trees?

Stop! I need help with .....

Wait! I have a question about .....

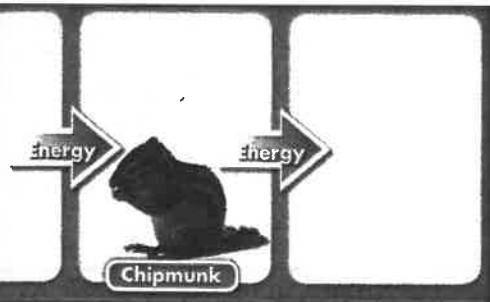
Go! Now I know .....

Lesson 2

How do living things get energy?

Envision It!

Animals get energy from the food they eat.



Draw what the chipmunk gets energy from and what gets energy from the chipmunk.

I will know that animals get energy from the plants and animals they eat. I will know the consequences of the removal of one component in a balanced ecosystem.

Words to Know

producer
consumer
herbivore
carnivore
omnivore
decomposer

Inquiry Explore It!

What do yeast use for energy?

Yeast are tiny living things. They cannot make their own food.

- ☑ **1.** Put $\frac{1}{2}$ spoonful of yeast in a cup. Fill the cup half full with warm water. Stir. **Observe** for 10 minutes.
- ☑ **2.** Add 1 spoonful of sugar. Stir. Observe for 10 minutes.

Materials

Explain Your Results

3. Compare what you **observed** before and after adding the sugar.

4. Infer What did the yeast use for energy? Cite your evidence.

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Producers

All living things in an ecosystem need water, nutrients, growing space, and temperatures that allow them to grow and reproduce. Above all, they need energy to survive. But where does this energy come from? It comes mainly from sunlight. The sun's energy enters the ecosystem and flows through all living things. It changes form as it moves through the ecosystem.

The energy flow starts in plants. During a process called photosynthesis, green plants use energy from sunlight to change carbon dioxide and water into food and oxygen. Plants use energy from the food they make to grow and live. Plants are called **producers** because they make, or produce, **their own** food. In almost all ecosystems, green plants are the only producers.

Some of the energy in plants is stored in their roots.

1. **Locate Underline** the main source of energy in an ecosystem.
2. **Infer** Write a sentence that describes how energy flows into the vegetables.

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3. **Infer** What kind of consumer is a rabbit?

4. **Word Structure** The suffix *-vore* means "eating." What do you think a spongivore like the hawksbill turtle eats?

At-Home Lab

For the Birds!
Make a bird feeder. Work with an adult. Hollow out half of an orange. Make 3 small, equally spaced holes 1 cm from the edge. Put a different string through each hole and tie the string to make a loop. Hang the 3 loops on a branch. Fill the orange with bird seed. Observe for several days. Record the number and types of birds you see.

Consumers

Can you make your own food like a plant? No, and neither can any other animal. Animals get energy by eating, or consuming, plants or other animals. Living things that eat other living things are called **consumers.**

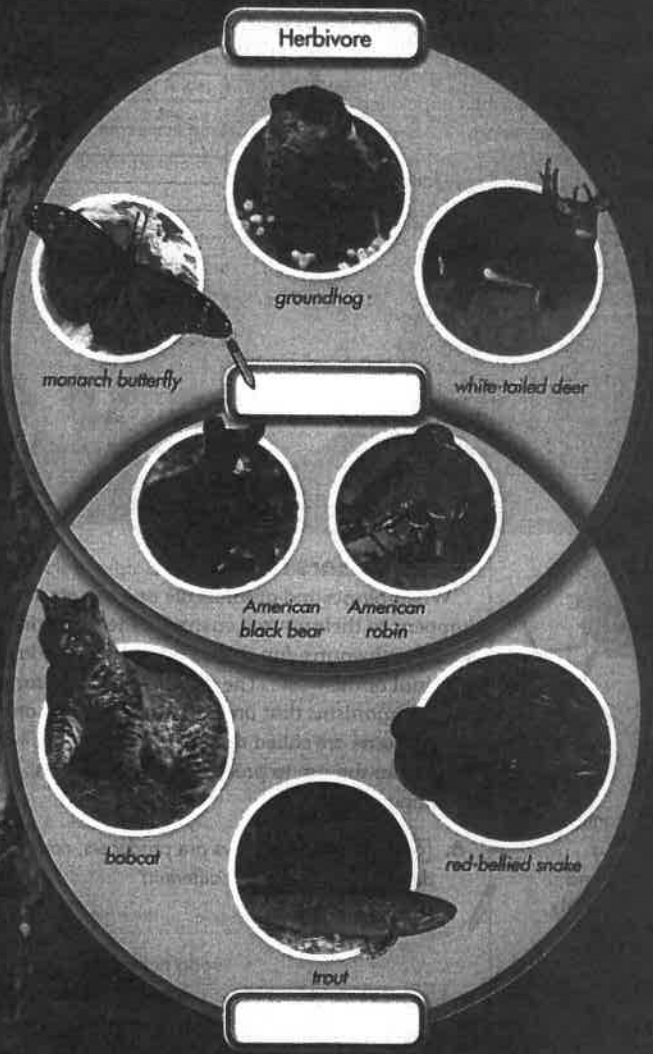
The sun's energy stored in plants flows into the animals that eat the plants. **Herbivores** are animals that eat plants. Each herbivore uses some energy to live and grow. Some energy is released as heat, but some energy is stored in its body. The unused, stored energy is transferred when the herbivore is eaten.

Animals that get food by eating other animals are **carnivores.** The carnivore uses some of the transferred energy to live and grow. The unused energy is stored in the carnivore's body. When the carnivore is eaten, whatever stored energy is left is passed on. Some animals, called **omnivores,** eat plants and other animals.

The red-bellied woodpecker is an omnivore. It eats beetles, grasshoppers, acorns, fruits, and seeds. Red-bellied woodpeckers search for insects in trees.

5. **Classify** Write words to fill in the diagram. Use words that describe each kind of consumer.

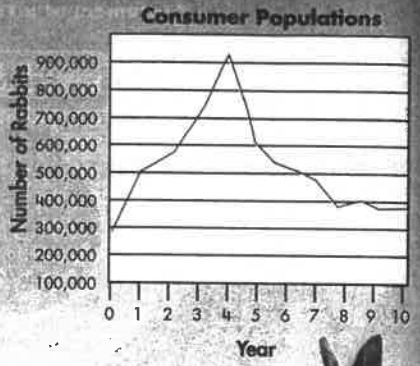
Consumers of a Forest Ecosystem



Do the math!

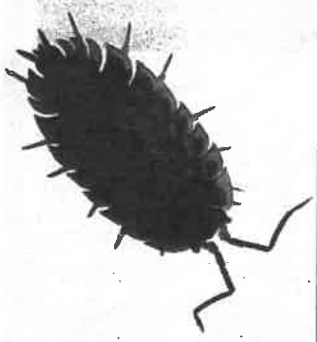
Read a Graph

A rabbit is a kind of consumer. Scientists sometimes conduct studies on how rabbit populations change over time. The graph shows how the size of one rabbit population changed over a 10-year period.



1. What was the size of the population in year 9?
   A. 200,000 C. 600,000
   B. 400,000 D. 850,000

2. Draw a dot on the graph for the year when the population of rabbits was about 700,000.



7. **Draw** The common wood louse is a decomposer found in gardens. It is only 1.5 cm long. Draw a 1.5-cm line to show the actual length of the wood louse.

Decomposers

When plants and animals die or leave wastes, what happens to their unused energy? Other organisms such as some earthworms, fungi, and bacteria break down the dead material or the waste. The unused energy is transferred to them. Organisms that break down plant and animal waste and remains are called **decomposers.** In this way, energy flows from the sun to producers, to consumers, and to decomposers.

6. CHALLENGE In what ways are producers, consumers, and decomposers alike and different?

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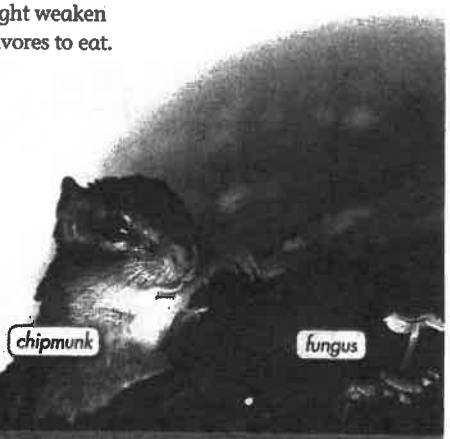
Removal of One Component

A change in a living or nonliving part of an ecosystem upsets the balance in the ecosystem. For example, the materials that decomposers break down become nutrients in the soil that plants need. If a group of decomposers dies out in an ecosystem, the nutrients they would have put in the soil are not available for plants to use. The plants might weaken or die. Then there might be fewer plants for herbivores to eat.

8. **Predict** How might this chipmunk be affected if the decomposers in this ecosystem decrease a lot?



Got it?

9. **Describe** How might a carnivore be affected if an herbivore were removed from a balanced ecosystem?

10. UNLOCK Think about what you learned in this lesson. How do living things interact in their environments?

Stop! I need help with .....

Wait! I have a question about .....

Go! Now I know .....

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Lesson 3

What are food chains and food webs?

Envision It!

Draw and label producers and consumers found in an ecosystem near your school.

Tell how you think they get food.

I will know how energy flows in a food chain and a food web. I will know how some organisms compete for the same resources.

Words to Know

food chain food web

Inquiry Explore It!

How do food webs show connections?

Materials

Food Web Cards

yarn

☑ **1.** Choose a card. Hold it so it can be seen. Stand in a circle with your group. Look for organisms that your organism eats or that eat you. Toss the ball of yarn to one of them, but hold onto the end of the yarn.

☐ **2.** Take turns until everyone is connected. You have made a **model** of a food web.

☐ **3.** Lay down the yarn and the cards. Using the names of the organisms, draw your food web in the space to the right.

Explain Your Results

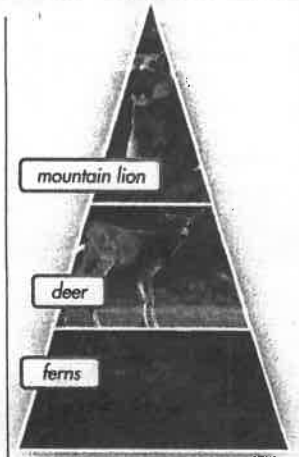
4. Interpret Data Look at your food web. Explain the relationships the web shows. Give examples.

Energy Pyramids

In an ecosystem, energy flows from the sun to producers, to herbivores, carnivores, and decomposers. However, most of the energy within an organism that is consumed does not reach the next organism.

An energy pyramid is a diagram that shows the amount of energy that flows from producers to consumers. The base of the energy pyramid is widest. This shows the energy in the producers. Producers have the greatest amount of energy in an ecosystem. Notice that the pyramid becomes narrower at the upper levels. This shows that less energy flows upward from the lower levels to the higher ones.

1. Explain Why is an animal's food and energy traced back to plants and the sun?



2. Infer Some energy cannot flow upward in the pyramid because most of the energy has changed. For example, energy is used to warm the organism's body. What other ways might animals use energy?

Food Chains

The energy stored by producers can be transferred along a food chain. A **food chain** is the transfer of energy from one organism to another by eating and being eaten.

A food chain always begins with energy from sunlight. Producers are the next link in the chain. Sunlight is absorbed by the green parts of plants. In a process called photosynthesis, plants use carbon dioxide, water, and sunlight to make food.

When animals eat plants, both energy and matter are passed to other living things. The flow of energy through the chain happens in one direction. In a diagram of a food chain, arrows show the flow of energy. Arrows point from the "eaten" to the "eater."

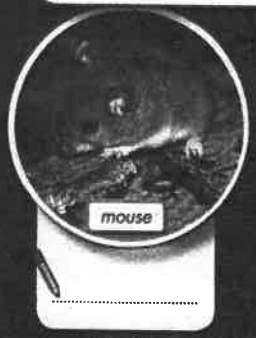
In a forest ecosystem, a food chain might consist of the sun, plants, a deer, and a mountain lion. Mountain lions are predators. Predators get the energy they need by hunting and killing prey. Deer are prey for the mountain lion. The mountain lion uses the food energy that was stored in plants and passed to the deer.

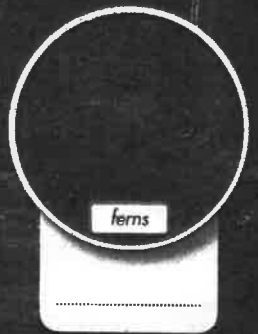
Decomposers such as fungi and bacteria are at each level of a food chain. They get what they need from dead organisms and other waste. Decomposers return matter to the soil, air, and water. Producers can then reuse this matter.

4. Discuss Tell why decomposers, such as the banana slug, are important in a food chain.

The banana slug is a decomposer. It gets its energy from leaves, animal waste, and dead plant materials. Then, it recycles what it eats into the soil.

3. Arrange Write a number below each picture to show the flow of energy in the food chain.





At-Home Lab

Decomposers Delight
Sprinkle yeast on a banana slice. Put it in a resealable bag. Close tightly. Observe every day for 1 week. Record your observations.

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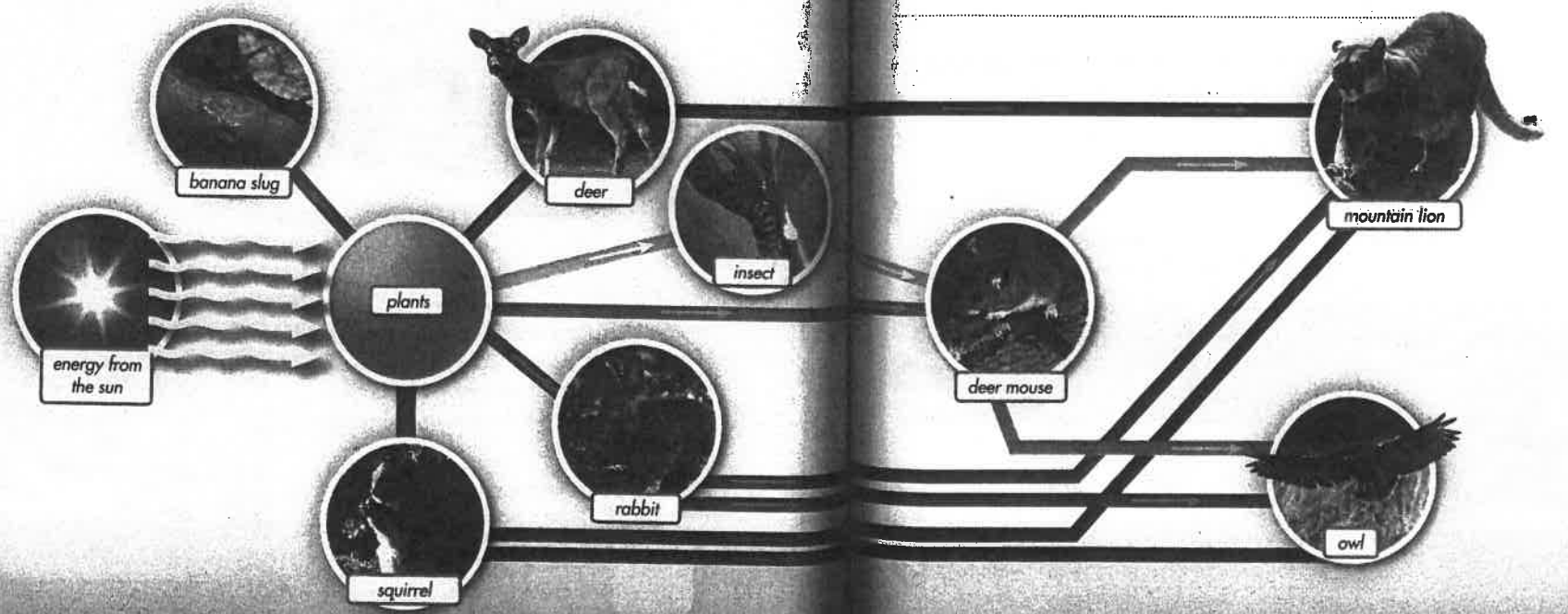
Food Webs

An ecosystem has many food chains. The same food source can be part of more than one food chain. As a result, one food chain often overlaps other food chains. Many food chains combine to form a food web. A **food web** is a system of overlapping food chains in which the flow of energy branches out in many directions.

In any ecosystem, producers and consumers can be eaten by more than one kind of organism. Some predators eat more than one prey. In a forest ecosystem, owls compete for food with mountain lions. Both populations hunt rabbits, mice, and squirrels.

All living things are connected in some way. A change in one part of a food web can affect all parts. All living things depend on other living things for what they need to survive. Anything that affects the size of a population of organisms also affects the food web. Disease, storms, pollution, and hunting are events that can affect a food web.

5. Show Circle a producer on this food web. Draw an X on three consumers. Trace with your finger the flow of energy from the sun as it is transferred along the food chain through producers to the consumers.



6. CHALLENGE Which animal is both a predator and a prey?

7. Identify For what same resource do the mountain lion and the owl compete?

8. Explain Give an example of how changing one part of a food web to the left can change other parts of the web.

Balance in Ecosystems

Populations in ecosystems can change naturally as the amount of resources changes. A population of deer mice will grow where food is plentiful. As the population increases, more food, more water, and more living space are needed. Eventually, the population may use up these resources. Then, each deer mouse will have less food to eat, less water to drink, and less space in which to live. As resources decrease, some deer mice will die or move out of the area. As the population decreases, more resources will be available to the remaining deer mice. The population begins to grow, and the cycle starts again.

9. Main Idea and Details Read the paragraph again. **Circle** the main idea. **Underline** details that support the main idea.

10. Predict Look at the food web on the previous page. Suppose the population of mountain lions in an ecosystem decreases. What effect might this decrease have on the deer mouse population? Why?

Mountain lions often hunt for prey alone.

11. Design Think about an ecosystem near where you live. Draw and label the living and nonliving parts in that ecosystem in the space provided.

Got it?

12. Explain What is one result of organisms competing for the same resources in an ecosystem?

13. Describe How is a food web different than a food chain?

Stop! I need help with .....

Wait! I have a question about .....

Go! Now I know .....

Lesson 4

How do living things affect the environment?

Envision It!

Tell how humans have affected this deer's environment.

I will know the effect of a sudden change of one group of organisms on another group.

Word to Know

competition

Inquiry Explore It!

What happens when one part of an ecosystem is removed?

In this model of an ecosystem, you will find out what can happen to animals when a resource decreases.

Materials

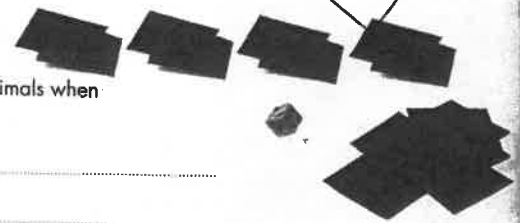
Water Holes and Animals Chart

red squares (animals)

dot cube

blue squares (water holes)

- ☑ **1. Make a Model** Lay out blue paper squares. Lay two red squares of paper to overlap each blue square.
- ☐ **2.** Roll the dot cube. Remove that number of water holes.
- ☐ **3.** Roll the cube five times. After each roll, match animals with water holes.
- ☐ **4.** No more than two animals can be at a water hole. Remove extra animals. **Record** information on the Water Holes and Animals Chart.



Explain Your Results

5. Infer What might happen to animals when there is a long drought?

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Changes to the Environment

The environment is like a balance. One side holds what lives in the environment. The other side holds resources that the environment provides. If the environment provides enough resources to support life, the balance is level.

Change often tips the balance. For example, tree seeds may sprout on a log and start to grow. The young trees need light and space to grow. The young trees are in competition. **Competition** occurs when two or more living things need the same resources in order to survive. Some trees get enough light. As their branches grow, they shade nearby plants. The environment changes. Other young trees may not get enough light to survive.

1. **Identify** In the paragraphs on this page **underline** what young trees are competing for against other living things.
2. **Examine** How can the fallen tree in this picture change a forest habitat?

Plants Cause Change

Changes can help some living things and harm others. For example, a plant called purple loosestrife was brought to the United States. No animals eat this plant. It is spreading to new places. That is great for the loosestrife! However, there is less space for other plants to grow. Some kinds of plants are completely pushed out of the environment.

A plant called kudzu was originally brought to the United States from Japan. At first, kudzu was thought to be beneficial to the environment. Kudzu was used in gardens for its beauty and in many open spaces as a cover over soil to prevent erosion. The plant, however, grows very well in the southeastern United States. Because the vines grow so well, they destroy forests by blocking trees' sunlight.

3. Summarize How has kudzu both helped and harmed habitats?

kudzu

nimals Cause Change

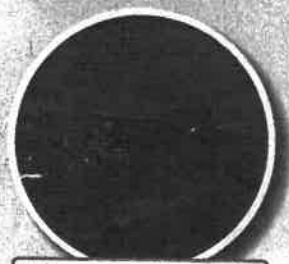
Some animals change the environment to improve their habitat. Beavers, for example, need deep water. If the stream where they live is too shallow, the beavers build a pond. They cut down trees with their teeth. They use the wood to build a dam across the stream. The blocked water forms a pond behind the dam.

The change helps plants and animals that need to live in still water. Also, the trees the beavers cut down no longer shade the ground below. Small plants and shrubs that benefit from direct sunlight grow in their place.

The change harms plants and animals whose homes are flooded. Trees needed to make the dam are lost. The pond also takes homes away from plants and animals that prefer the flowing water of streams.

4. Conclude This habitat was once a grassy meadow. How has this beaver dam changed it?

A beaver can cut down over 200 trees per year!



A beaver can add over 5 feet of length to its dam per day.

Go Green

The Recycling Plan
Sometimes people harm the environment by throwing out a lot of trash. To help the environment, organize a recycling plan for your classroom. Share your ideas with other classes.

5. Visualize This bridge was built in and over an aquatic ecosystem. Discuss how this bridge affected the plants and animals living in the area.

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Humans Cause Sudden Change

People often change the environment to meet their needs. Some changes people make cause sudden changes in the environment. When they build a new group of homes, they may cut down a small forest in days to make room for houses. Some people may build birdhouses in their backyards. This provides shelter and food for certain kinds of birds in the area. But most birds and other animals must move away to find new homes all of a sudden.

Some people use chemicals to kill organisms such as beetles and other insects that eat crops or plants around their homes. These chemicals quickly decrease the number of these organisms. Birds that feed on these organisms might have less to eat and may move away or die.

6. Explain How did this birdhouse affect the environment?

Got it?

7. Describe How do beavers and humans modify their environments?

8. UNLOCK THE QUESTION Think about what you learned in this lesson. Are changes to the environment always harmful?

Stop! I need help with .....

Wait! I have a question about .....

Go! Now I know .....

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Lesson 5

What are fossils?

Envision It!

Compare the tracks. **Tell** what you can conclude about the animals that made them.

UNLOCK

I will know that a fossil is the remains or mark of a living thing from long ago. I will know the ways a fossil can form.

Words to Know

fossil

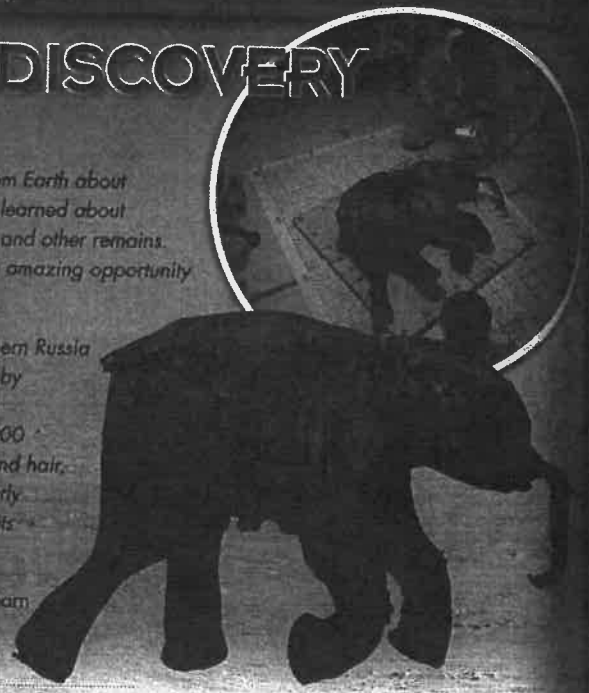
extinct

MY PLANET DIARY DISCOVERY

Woolly mammoths disappeared from Earth about 10,000 years ago. Scientists have learned about mammoths by studying their bones and other remains. In 2007, however, scientists got an amazing opportunity to learn what mammoths were like.

That year, reindeer herders in northern Russia discovered the frozen body of a baby mammoth. The mammoth had been frozen underground for about 40,000 years. Except for missing toenails and hair, the month-old mammoth was in nearly perfect condition. Even the food in its stomach was preserved!

What do you think scientists might learn by studying the baby mammoth?



The baby mammoth has been named Lyuba.

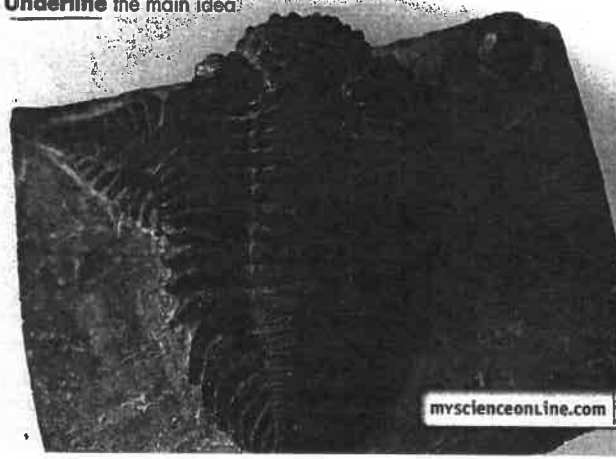
Fossil Clues

Some plants and animals that lived millions of years ago have left clues about their lives. A line of footprints preserved in rock can show how an animal walked. The skeleton of a small animal can help scientists understand what the animal looked like.

Skeletons and footprints are examples of fossils. A **fossil** is the remains or mark of an animal or plant that lived long ago. Scientists can study fossils to learn about species that are extinct. An **extinct** species no longer exists. More than one million species currently live on Earth, but many more have become extinct. In fact, most types of organisms that have lived on Earth no longer exist.

1. **Main Idea and Details** Read the first paragraph again. **Underline** the main idea.

2. **Explain** Read the caption below. What is one thing scientists might learn by examining a trilobite fossil?



Trilobites are now extinct. These animals had hard shells and lived in the sea hundreds of millions of years ago.

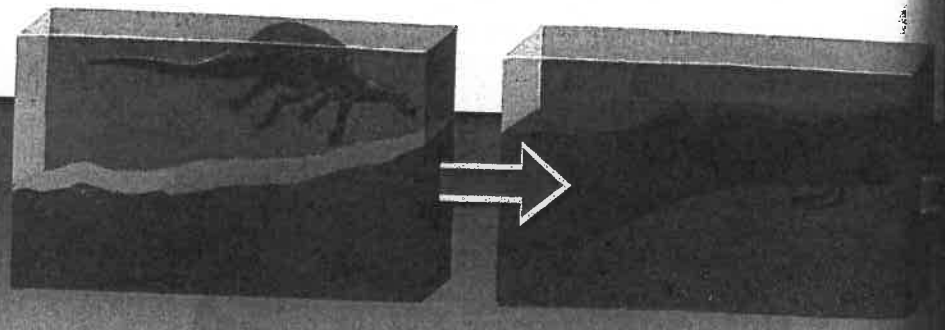
Most fossils are found within sedimentary rock, or rock that forms in layers.

How Fossils Form

Fossils form in different ways. Most fossils form when a plant or animal dies and becomes buried under layers of sediments. Sediments are bits of rock, sand, shell, and other material. Over time, the sediments harden into rock and preserve the shape of the buried plant or animal. The diagram below shows this process.

Usually only the hard parts of animals, such as bones and shells, become fossils. The soft parts decay or may be eaten by other animals. Once the remains of an animal are buried, different things can happen. Sometimes the buried remains break down and disappear, leaving an empty space in the sedimentary rock. A space in rock in the shape of a living thing is called a *mold fossil*. Later, minerals from the surrounding rock might fill the mold fossil. Over time, these minerals harden into the shape of the mold. This type of fossil is called a *cast fossil*. Dinosaur "bones" that come from cast fossils are not bones at all! They are hardened minerals.

3. Fill in the Blanks Complete the captions in the diagram below. Fill in each blank with the correct word.



An animal dies and sinks to the bottom of a lake or shallow sea. The _____ parts of its body decay.

Sand, mud, and other _____ settle on top of the animal's remains.

4. Identify **Draw** an X on the mold fossils. **Circle** the cast fossil.

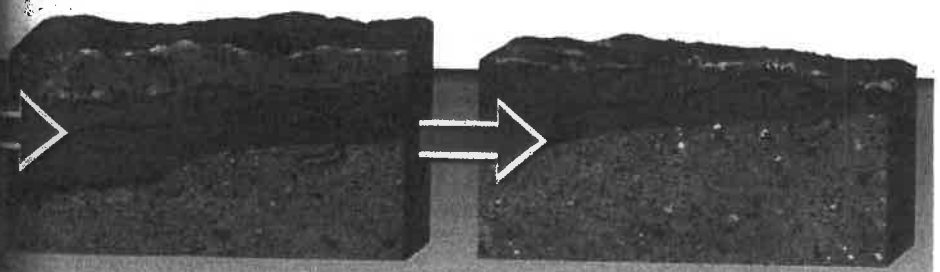
5. Infer Many dinosaurs once roamed Earth, but fossils do not exist for all of them. Look at the diagram. What might be some reasons why not all dinosaurs left fossils?

_____

_____

_____

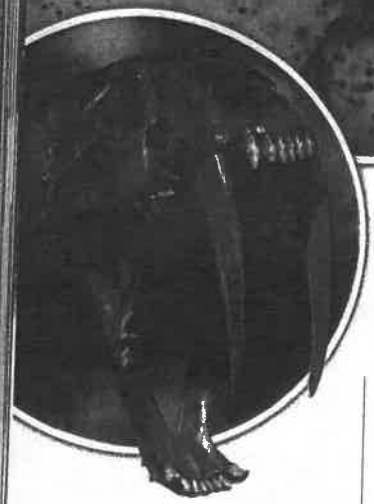
These are Ammonite fossils.



More layers of sediments form. The sediments harden into _____, preserving the shape of the animal's parts.

Over time the rock layers above the fossil wear away. The fossil appears at or near Earth's surface.

This fly has been preserved in amber.



The skull of this saber-toothed cat was preserved in a tar pit.

Other Types of Fossils

Casts and molds are called *body fossils* because they are formed from the body parts of living things. There are several other types of body fossils. Sometimes, the whole body of an animal may be preserved in a fossil. For example, insects can become trapped in sticky tree sap. The sap surrounds the insect and hardens over time. The hardened sap is called amber. Amber preserves all of an insect's remains—both the hard parts and the soft parts.

Parts of an animal's body, such as teeth or bones, make up another type of body fossil. The bones of some animals were preserved in tar pits. Tar pits are oily pools that exist on Earth's surface. Animals that fell into tar pits became trapped. The soft parts of their bodies broke down, but their bones remained. Fossils of these animals are actual bone and not hardened minerals.

7. Contrast How are the fossils of the saber-toothed cat different from cast fossils?

6. CHALLENGE What do you think scientists can learn from an insect preserved in amber?

Trace Fossils

Most fossils show what the parts of a plant or animal looked like. *Trace fossils* give clues about a living thing's activities. Footprints, or tracks, are a kind of trace fossil. Preserved burrows, nests, and eggshells are also trace fossils. Studying trace fossils can help scientists answer questions about where an animal lived, what it ate, and how fast it moved.

8. Identify Draw an X on the photo of a trace fossil.

Lightning Lab

Tell-Tale Footprints

Take several steps on a long piece of paper. Have a partner trace your feet with each step. Then do the same for your partner. Compare the footprints. Why are they different? Write a short paragraph explaining what scientists can learn by studying different fossil footprints.

Got it?

9. Infer Explain how a mold fossil of a footprint would form.

10. Conclude Suppose you are a scientist studying saber-toothed cats. Would you be more excited to find cast fossils or fossils from a tar pit? Explain your answer.

Stop! I need help with .....

Wait! I have a question about .....

Go! Now I know .....

Lesson 6

What can fossils tell us?

Envision It!

Tell what clues this fossil gives about what this dinosaur ate.

I will know how scientists use fossils to learn about the past.

Word to Know

paleontologist

My Planet Diary

/// MISCONCEPTION ///

Dinosaurs were a group of reptiles that lived on Earth for about 150 million years. That period has been called the Age of the Dinosaurs. A common misconception is that all of the large reptiles alive at that time were dinosaurs. In fact, Earth was home to many other kinds of reptiles during the Age of the Dinosaurs.

Pterosaurs, for example, were a group of flying reptiles. They did not have feathers, but flew on wings made of skin. The largest pterosaur had wings measuring more than 30 feet from tip to tip!

Pterosaurs and dinosaurs shared a common ancestor. But scientists have used fossils to identify important differences between the two. Dinosaurs, for example, had a different hip structure than pterosaurs. Like dinosaurs, pterosaurs became extinct about 65 million years ago.

Pterodactyls are sometimes called "flying dinosaurs." In fact, the pterodactyl was a type of pterosaur.

Write one way in which dinosaurs and pterosaurs were alike and one way in which they were different.

Windows to the Past

Scientists study fossils to learn about plants, animals, and environments of the past. A scientist who studies fossils is called a **paleontologist.**

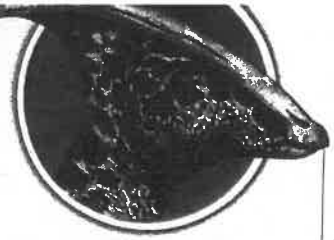
Some fossils show us what extinct organisms looked like and how they lived. For example, paleontologists have found skulls from dinosaurs called sauropods. Sauropods were a group of dinosaurs that had small heads, long necks, and enormous bodies. They ate plants and may have used their long necks to reach tall trees.

Because of their size, these dinosaurs needed huge amounts of food. However, their small heads meant that they could only take small bites. How did they get enough to eat? Paleontologists studied the dinosaurs' skulls and the shape of their teeth. They concluded that some sauropods may have swallowed their food without chewing it. Doing this allowed the dinosaurs to get food to their stomachs more quickly and take more bites.

1. **Recall** What did paleontologists conclude about sauropods by studying their skulls and teeth?

This illustration shows what one kind of sauropod may have looked like.

paleontologist



This illustration shows what one kind of hadrosaur might have looked like.

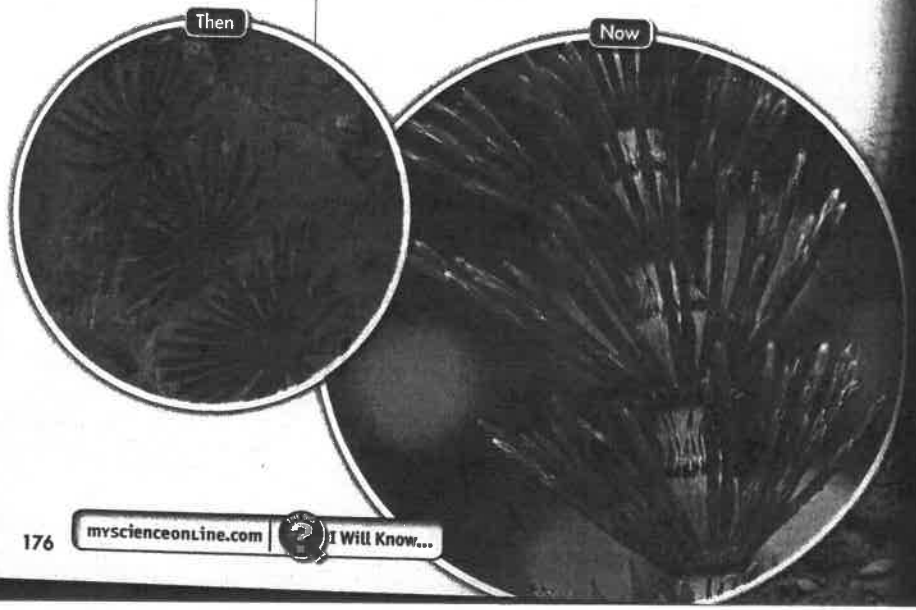
3. Hypothesize What is another possible use of the hadrosaur's hollow crest?

Fossils and Living Organisms

One way paleontologists learn about extinct plants and animals is by comparing them with plants and animals that exist today. For example, fossils show that some dinosaurs called hadrosaurs had large, hollow crests on their heads. Paleontologists have different ideas about the purposes of these crests. One idea came from comparing hadrosaurs to birds called peacocks. Male peacocks have large, brightly colored tails. They use their tails to attract mates. Paleontologists hypothesize that hadrosaurs may have used their crests in the same way.

Fossils can also show how plants and animals have changed over time. Many living things today are related to plants and animals of the past. Fossils show that some extinct plant species looked a lot like modern plants. For example, compare the pictures of the horsetail fossil and the modern horsetail plant. Some horsetail plants of the past grew to the size of trees. Modern horsetail plants are much smaller. This suggests that the plants changed slowly over time.

2. Compare Tell how the horsetail fossil and the modern horsetail plant are alike.

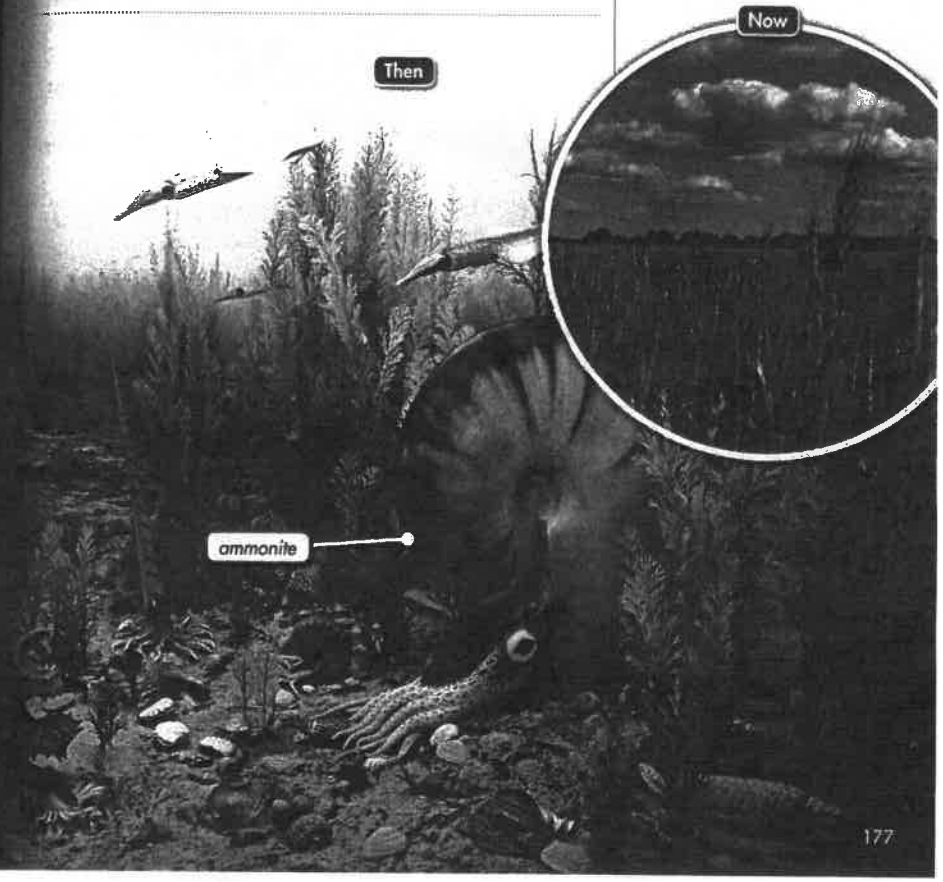


Fossils and the Environment

Fossils also show that Earth's environment has changed. For example, scientists in Kansas have found the remains of sea animals called ammonites. Ammonites are related to modern squids, but they died out 65 million years ago. In South Dakota, scientists have discovered fossils of giant sea turtles. These turtles lived about 70 million years ago but are now extinct. What do these discoveries tell us? They show that areas of present-day states such as Kansas and South Dakota were once covered with water!

4. Describe How has the environment of Kansas changed?

5. Main Idea and Details What details support the idea that Earth's environment has changed?



Scientists divide Earth's history into time spans of millions of years. These time spans are labeled on the geologic time scale.

Fossil Age

Scientists determine the age of fossils in two ways. Many fossils are located within layers of rock. Older layers of rock are under newer layers of rock. Scientists can conclude that fossils found in deeper or lower layers are older than those found in layers above.

Scientists can also determine the age of fossils by examining how quickly certain materials in the fossils change. These materials change at steady rates after a plant or animal dies. Scientists can measure these materials in a fossil to determine how long ago the organism died.

Geologic Time Scale

Scientists have used information about the ages of fossils and rocks to make a timeline of the history of Earth. This timeline is called the geologic time scale. When they draw the scale, scientists place the earliest time span at the bottom. They put the most recent time span at the top. This matches the way rock layers of different ages are arranged. The time scale helps scientists show when different animals, including the dinosaurs, existed.

6. Infer What era are the sea turtle fossils of South Dakota from?

7. Draw Conclusions Suppose that you found two different fossils in two different layers of rock. How could you tell which fossil was older?

Fossil Fuels

Did you know that fuels such as coal and oil are a kind of fossil? Most of these "fossil fuels" come from the remains of organisms that lived millions of years ago. It took millions of years for the remains to become coal or oil. At power plants, fossil fuels are used to produce the electricity that powers homes and businesses.

8. CHALLENGE What might happen if people use up all the fossil fuels currently available? Explain your answer.

Go Green

Fossil Fuel Use
With a partner, list three things you and your classmates can do to reduce electricity use and conserve fossil fuels. Share your list with the class.

Got it?

9. Draw Conclusions A scientist finds the fossil of a sea creature on top of a mountain range. What can the scientist conclude about the land around the fossil?

10. Summarize What can paleontologists learn from studying fossils?

Stop! I need help with .....

Wait! I have a question about .....

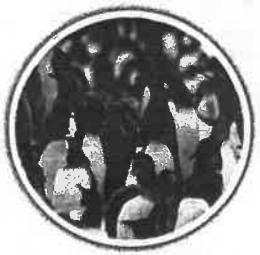
Go! Now I know .....

Chapter Review

Lesson 1

What are ecosystems?

1. **Vocabulary** A group of organisms of the same kind living in an area is a(n)_____.
   A. community.
   B. population.
   C. ecosystem.
   D. habitat.



2. **Explain** How do the fins of a sunfish help it survive in water?

3. **Define** What makes up an ecosystem?

Lesson 2

How do living things get energy?

4. **Main Idea and Details** Circle the main idea and **underline** the details in the following paragraph.

Decomposers have an important role in food webs. They break down and recycle waste and dead organisms. Decomposers recycle the minerals and nutrients that are found in the waste and dead material. These nutrients become available to plants.

Lesson 3

What are food chains and food webs?

Do the **math!**

5. In most food chains, $\frac{9}{10}$ of the energy that an animal gets from its food is used by the animal. What fraction of the food energy is not used?

6. **Infer** Can there be an ecosystem that has only carnivores? Why or why not?

Lesson 4

How do living things affect the environment?

7. **Communicate** People build roads in new areas. How does this activity affect the living things in that environment?

Lesson 5

What are fossils?

8. **Explain** Tell how this mold fossil of an ammonite may have formed.

Lesson 6

What can fossils tell us?

9. **Conclude** Horseshoe crabs are called "living fossils" because they have changed little in 300 million years. How do paleontologists know this?

horseshoe crab

10. **How do living things interact with their environments?**

Think about an ecosystem near where you live. How do the organisms there interact?

Benchmark Practice

Fill in the bubble next to the answer choice you think is correct for each multiple-choice question.

1 What is the main source of energy in an ecosystem?

Ⓐ predators
Ⓑ water
Ⓒ sunlight
Ⓓ plants

2 Which of these things might trees compete for in an environment?

Ⓐ ecosystems
Ⓑ consumers
Ⓒ populations
Ⓓ resources

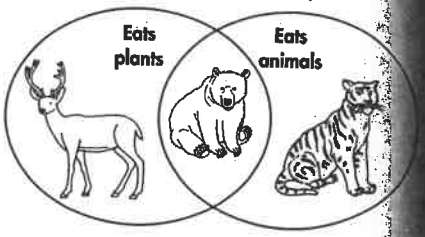
3 In a simple food chain, a frog eats insects and a snake eats the frog. The primary role of the frog in the food chain is

Ⓐ to be a source of energy.
Ⓑ to find a space to live.
Ⓒ to start a new species.
Ⓓ to make an ecosystem.

4 What might a paleontologist conclude about a dinosaur that left fossil footprints of webbed feet?

Ⓐ The dinosaur ran fast.
Ⓑ The dinosaur ate plants.
Ⓒ The dinosaur was large.
Ⓓ The dinosaur could swim.

5 The diagram below shows different consumers in different ecosystems.



Suppose the populations of these consumers are removed from their ecosystems. How might this change affect the ecosystem of each consumer?

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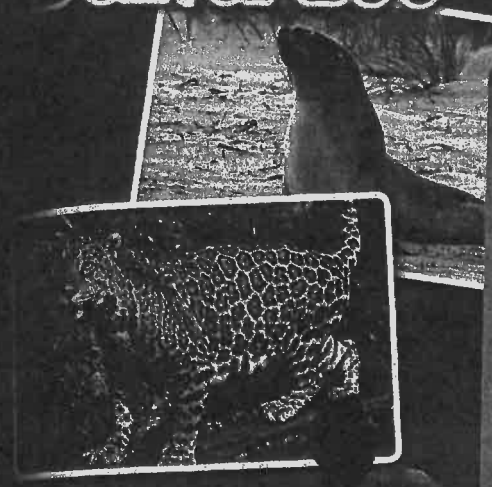
Denver Zoo

Field Trip



You can visit a zoo to learn about many types of animals. Animals that live in different habitats in the wild can all be seen in one place. At the Denver Zoo, you can see Komodo dragons in the Tropical Discovery exhibit. You might see a rhinoceros at the Pachyderm Habitat. These animals live far apart in nature, but you can see them in one day at the zoo!

Animals must find their own food in the wild. At the zoo, zookeepers give the animals the food they need. This food includes fruits, vegetables, meats, fish, and insects. A zoo needs many types of food because it has herbivores, carnivores, and omnivores to feed.

Suppose a zoo gets a new type of animal. What might the zookeepers need to know about the animal?