Herbison Woods School Library
3147 W. Herbison Road
DeWitt, MI 48820

KIDS DISCOVER

Ecology

HOME, HOME IN THE BIOME

YOUR MINERAL MAKEUP

Where Have All the Flowers Gone ?

NATURE'S CLEAN-UP SQUAD

DOMESTIC CAT VIOLENCE

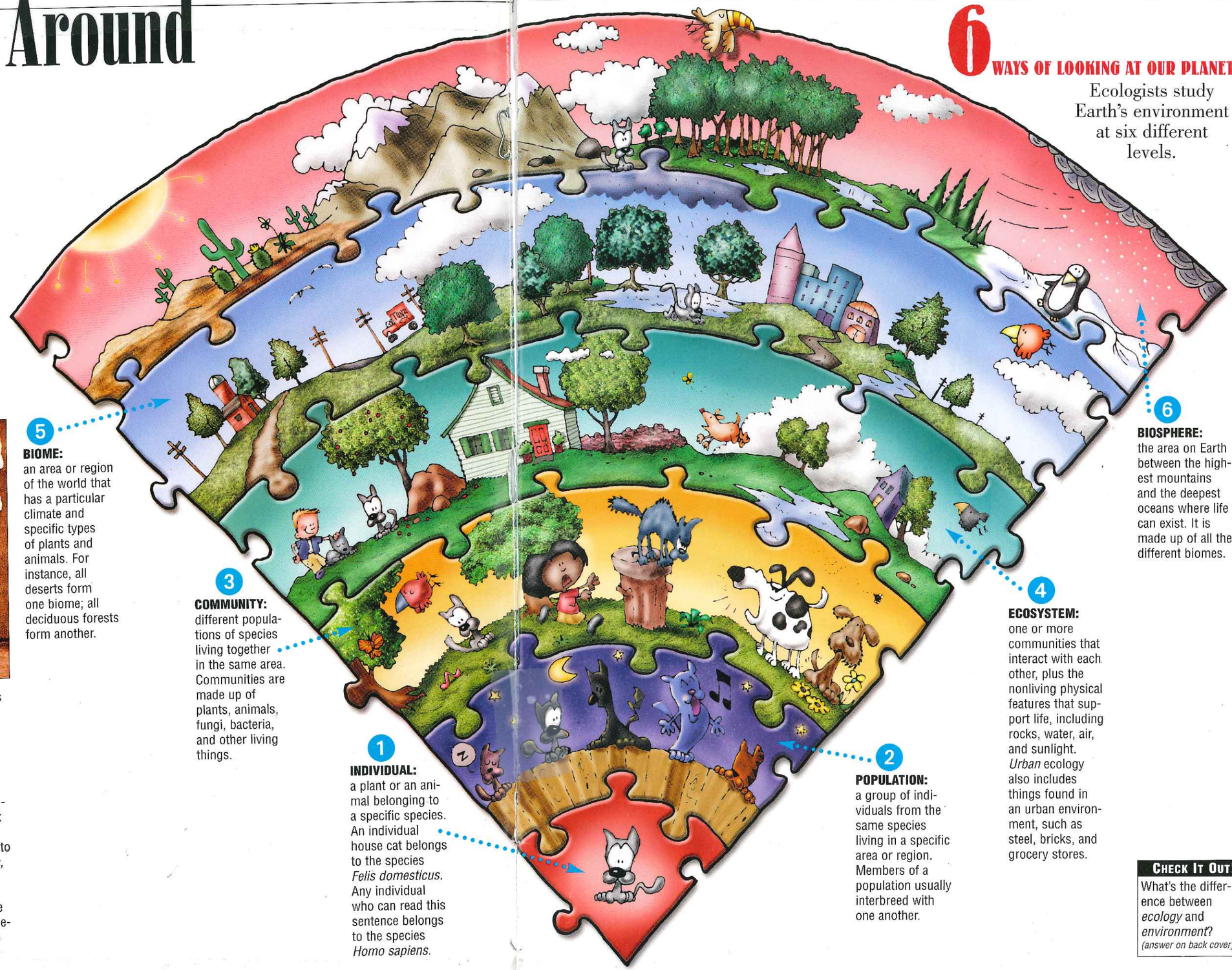
Look Around

That's the first step in ecology—looking around. Your house, for instance, is an ideal place to start. It's perfect for a big mammal like you. Yet, it's also home to spiders, insects, and maybe the occasional mouse. Just outside are birds, squirrels, frogs, grasses, trees, flowering plants, rocks, dirt, and even more insects. When you look around at living things and their environment, you are involved in the study of ecology.

ECOLOGY STARTED as a branch of biology. One of the first people to put natural history observations down on paper was an ancient Greek named Theophrastus (372–288 B.C.). A pupil of Aristotle's, Theophrastus wrote the most important scientific books about plants in ancient times. But it was not until 1866 that German biologist Ernst von Haeckel (above right) coined the word *ecology,* by combining the Greek word *oikos,* meaning "place to live," with *logos,* which means "the study of something." The term wasn't widely used until the early 1900s.

6 WAYS OF LOOKING AT OUR PLANET

Ecologists study Earth's environment at six different levels.



5 BIOME: an area or region of the world that has a particular climate and specific types of plants and animals. For instance, all deserts form one biome; all deciduous forests form another.

6 BIOSPHERE: the area on Earth between the highest mountains and the deepest oceans where life can exist. It is made up of all the different biomes.

3 COMMUNITY: different populations of species living together in the same area. Communities are made up of plants, animals, fungi, bacteria, and other living things.

4 ECOSYSTEM: one or more communities that interact with each other, plus the nonliving physical features that support life, including rocks, water, air, and sunlight. *Urban* ecology also includes things found in an urban environment, such as steel, bricks, and grocery stores.

1 INDIVIDUAL: a plant or an animal belonging to a specific species. An individual house cat belongs to the species *Felis domesticus.* Any individual who can read this sentence belongs to the species *Homo sapiens.*

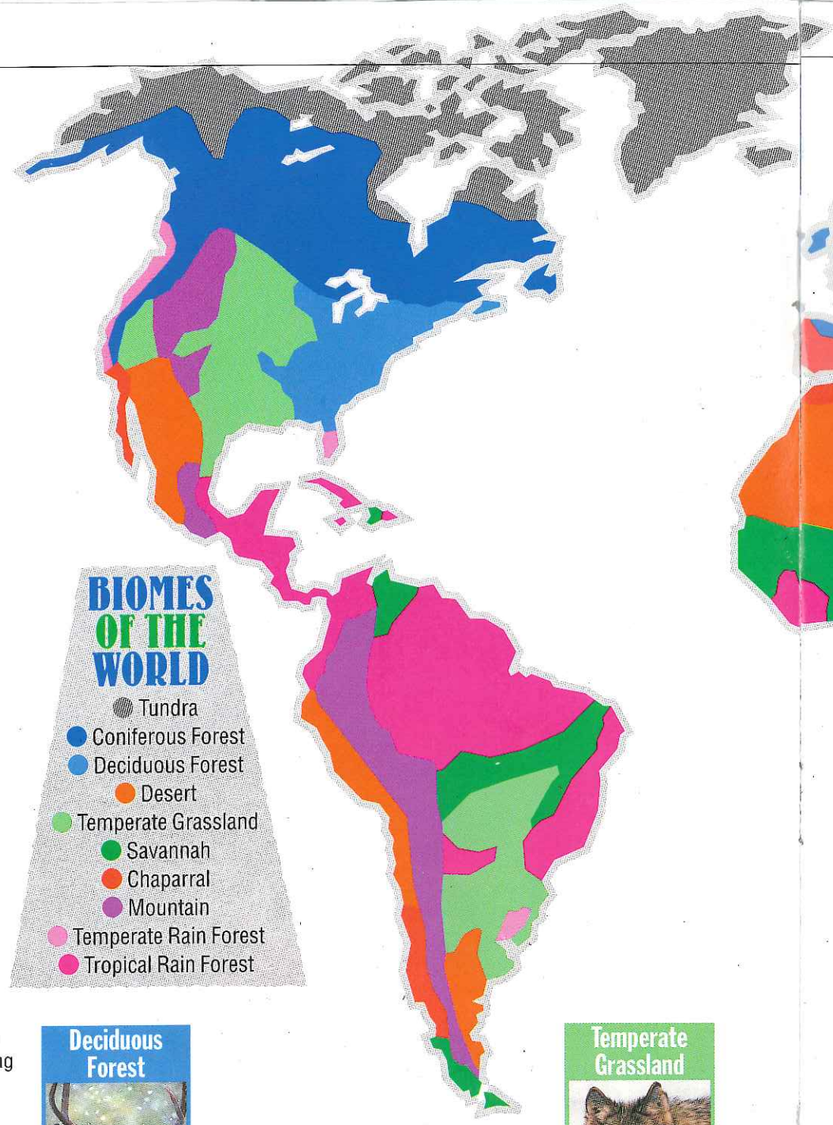
2 POPULATION: a group of individuals from the same species living in a specific area or region. Members of a population usually interbreed with one another.

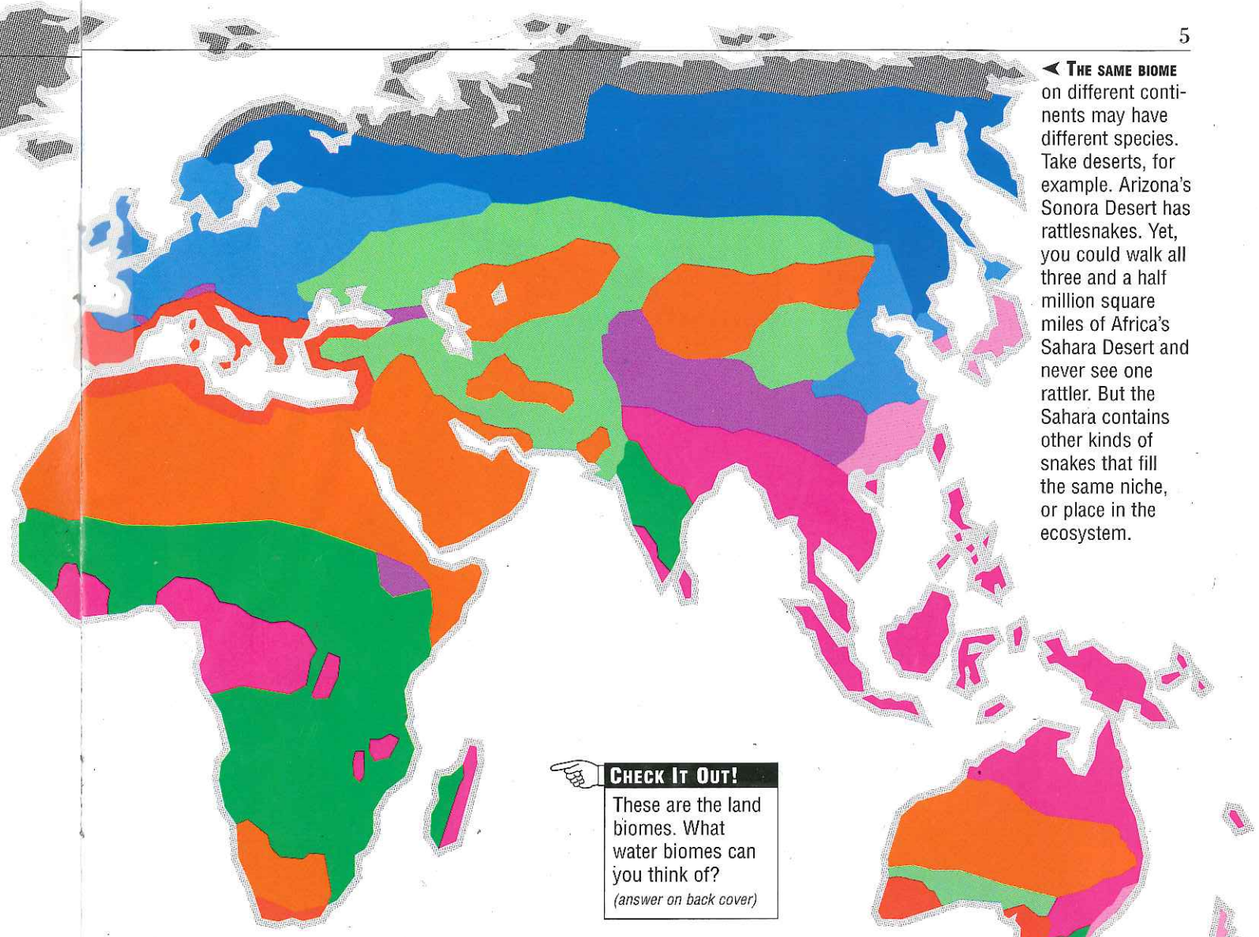
CHECK IT OUT!

What's the difference between *ecology* and *environment*?
(answer on back cover)

OUR WORLD

Our planet is varied. There are deserts, rain forests, oceans, and mountains. There are places where the temperature rarely rises above 0°F, and other places where the temperature hardly ever dips below 100°F. Some places are home to rhinoceroses, while others include elk or polar bears or kangaroo rats. Areas with similar climates, geography, animals, and vegetation are called biomes. Each biome on Earth has a unique combination of conditions that allow certain life forms to thrive there. Not all scientists agree on exactly how to divide Earth into biomes, but here is one popular way.





◄ The same biome on different continents may have different species. Take deserts, for example. Arizona's Sonora Desert has rattlesnakes. Yet, you could walk all three and a half million square miles of Africa's Sahara Desert and never see one rattler. But the Sahara contains other kinds of snakes that fill the same niche, or place in the ecosystem.

Check It Out!
These are the land biomes. What water biomes can you think of?
(answer on back cover)

Tundra

▲ Animals like the Arctic fox and musk oxen live in the tundra, a treeless and very cold biome. The tundra supports such plants as mosses and short grasses.

▼ Wolverines and moose are among the animals that inhabit this, the world's largest, biome. The chilly landscape is dominated by evergreen trees, such as spruce and pine.

Coniferous Forest

Deciduous Forest

▲ These areas of warm summers and cold winters contain abundant wildlife. Typical species are deer in the U.S. and koalas in Australia. Deciduous trees, like oaks, have leaves that change with the seasons.

Desert

▲ Because of the extreme weather, desert animals tend to be small and hardy, though some large animals, such as camels, thrive here. Plants, like the cactus, are also usually short and hardy.

Temperate Grassland

▲ This is the grassy home where millions of buffalo once roamed and where wolves now call home. With hot summers, cold winters, and few trees, these prairies in the U.S. today support farms and suburbs.

▼ Kangaroos in Australia and zebras in Africa make savannahs their home. Savannahs are similar to temperate grasslands in that both undergo seasonal droughts and fires, which are important factors in creating

Savannah

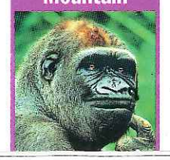
Chaparral

biodiversity. However, savannahs have more trees and shrubs than temperate grasslands, as well as more rain. Winters in savannahs tend to be warm and wet.

◄ Chipmunks, wood rats, lizards, and other small animals can be found in chaparrals. These zones of stubby trees are generally found right beside deserts in areas in or near "Mediterranean" climates, including Chile, California, Southwest Australia, and the Mediterranean itself. Summers are hot and dry, and winters bring some rainfall.

▼ Mountains are home to a wide variety of animals, from mountain gorillas in Africa to bighorn sheep in North America. A mountain biome may emcompass other biomes. As you travel up a mountain, soon, only coniferous trees can survive; then tundra; and finally there's nothing but rocks and snow.

Mountain



Temperate Rain Forest

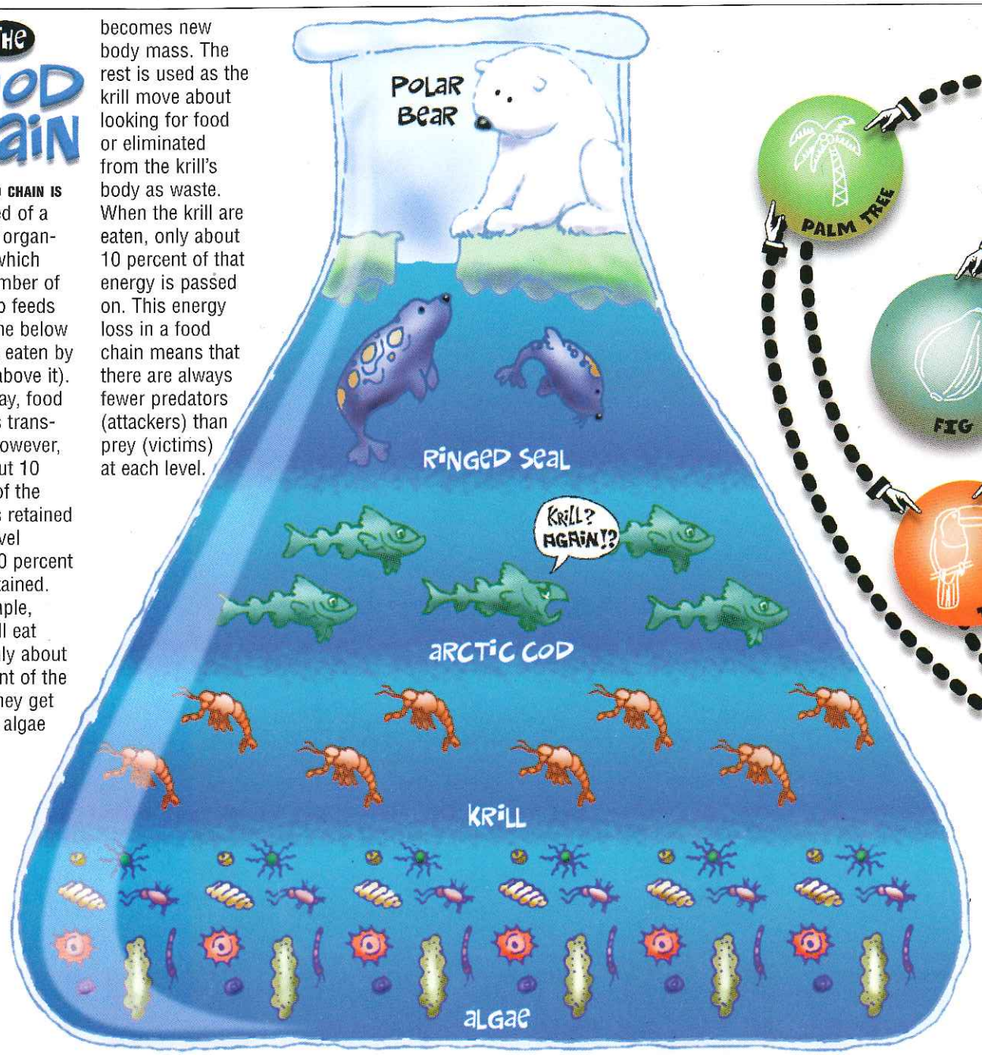
▲ The largest tem-perate rain forests are found along the Pacific coast, from Oregon to Alaska. Black bears, cougars, and raccoons thrive in this rainy biome, as well as spruce and hemlock.

▼ Most tropical rain forests lie near the equator. They contain about half the world's species of land plants and animals. A rich forest has little on the forest floor as the thick canopy blocks out much of the light.

Tropical Rain Forest

The Food Chain

➤ **A food chain is** composed of a group of organisms in which each member of the group feeds on the one below it (and is eaten by the one above it). In this way, food energy is transferred. However, only about 10 percent of the energy is retained by the level above; 90 percent is not retained. For example, when krill eat algae, only about 10 percent of the energy they get from the algae becomes new body mass. The rest is used as the krill move about looking for food or eliminated from the krill's body as waste. When the krill are eaten, only about 10 percent of that energy is passed on. This energy loss in a food chain means that there are always fewer predators (attackers) than prey (victims) at each level.



Who's Eating Whom?

Do you like to play soccer? How about watching TV? Whatever you are doing, you need energy to do it. All living things get energy from the food they eat. As food passes through the body, some is digested. This releases energy. Energy is passed along in a community by way of food chains and food webs. Here's how they work:

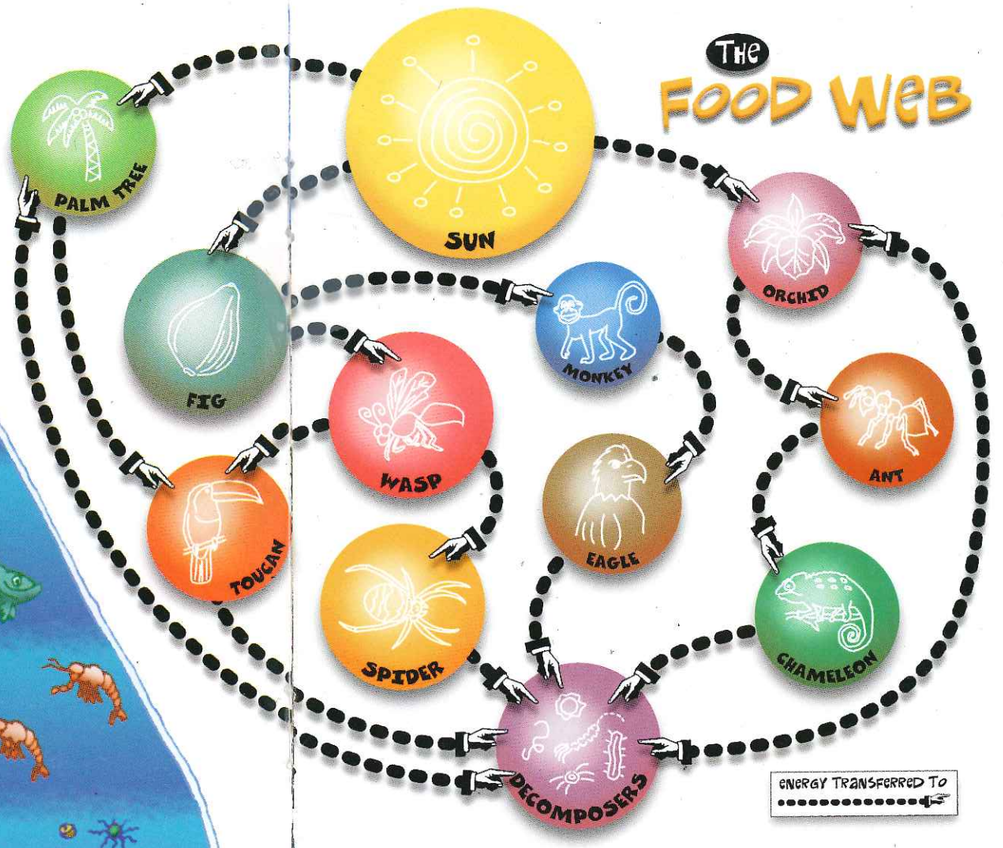
1. Plants use the sun's energy to make their own food—starch—which they store in their leaves.

2. Some of this energy is passed along as food for animals. For example, many plants are eaten by herbivores (plant-eaters), animals such as rabbits.

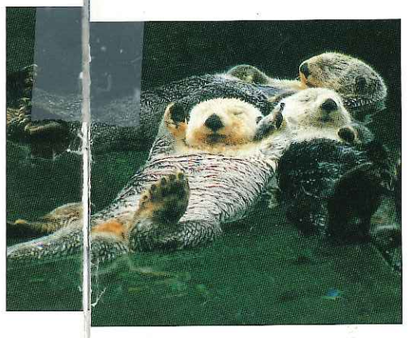
3. Herbivores, in turn, are eaten by carnivores (meat-eaters), like snakes, or omnivores, like bears.

4. They, in turn, are eaten by other animals.

The Food Web



▲ **In order to meet** their energy requirements, most animals are a part of more than one food chain. Not many animals feed on only one kind of food. The risk of becoming overly dependent would be too great. These interconnected food chains form a food web. Food webs are more accurate than food chains in representing what actually goes on in nature.



➤ **What happens if** just one animal is removed from a food chain? From the 1700s to the early 1900s, sea otters off the Pacific coast were hunted nearly to extinction for their rich, soft fur. Without otters around to eat them, the number of sea urchins soared. They, in turn, devoured underwater plants called kelp, which wiped out the food supply for hundreds of other marine animals. Sea otters have rebounded somewhat, along with their ecosystems. But they remain an endangered species.

Relationships in Nature

Parasites

▲ **The predator-**prey relationship is not the only way to get energy in nature. Parasites, for instance, are small animals that live off larger "host" animals. Parasites must be careful though. If they sap too much energy from a host, it will die.

Commensalism

▲ **Commensalism** means "eating at the same table." This relationship occurs when one species mooches off another and gives nothing back. For example, silverfish inhabit the nests of army ants and live by scavenging on their hosts' waste without affecting the ants.

Decomposers

▲ **Nature's clean-**up squad is called decomposers. When a plant or animal dies or leaves behind waste matter, insects, like beetles, and fungi, like mushrooms, work with microscopic organisms. Together, they break down the matter into minerals that enrich the soil and serve as food for new plants.

Mutualism

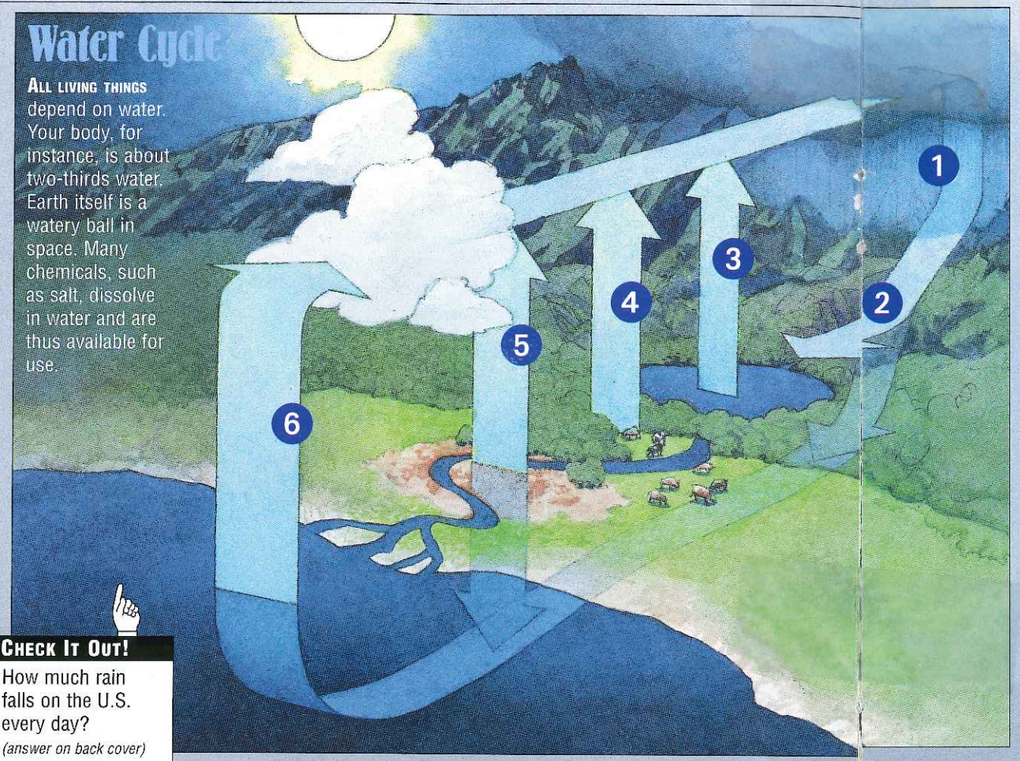
▲ **Sometimes two** types of animals live together in a way that works out for both. All humans, for instance, harbor bacteria in their guts. In fact, the bacteria digest food that we otherwise could not. In return, they get a warm, comfy home and food. This type of arrangement is called mutualism.

Life Cycles

Nature is the ultimate recycler: Nothing goes to waste. Right this minute, the chemicals and minerals that make all life possible are spinning around in the air. All of them are being reused for the umpteen billionth time in a series of cycles that are as old as life on Earth. What are these cycles of life and death? Here are two.

Water Cycle

All living things depend on water. Your body, for instance, is about two-thirds water. Earth itself is a watery ball in space. Many chemicals, such as salt, dissolve in water and are thus available for use.



Check It Out!

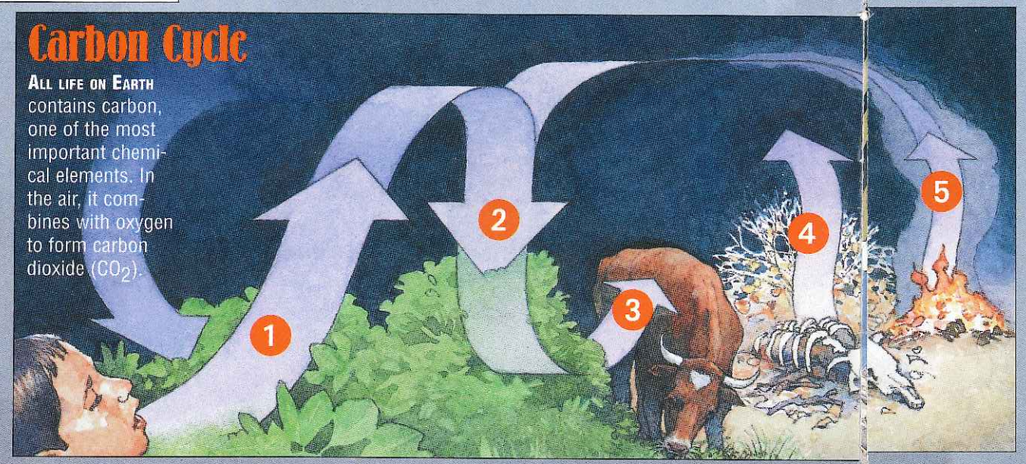
How much rain falls on the U.S. every day?

(answer on back cover)

1. **Water falls from** clouds in the form of rain, snow, sleet, or hail.
2. **It runs into rivers,** lakes, and oceans. Some of it seeps into the ground and becomes part of underground water pools, called aquifers.
3. **The sun's heat** causes water to evaporate. It rises through the air as a gaseous vapor.
4. **Plants soak up** water from the ground. Some of this water evaporates through the plants' leaves.
5. **The water in plants** and animals evaporates or returns to the ground after they die.
6. **Water vapor in the** air cools and condenses into droplets of liquid water, which form clouds.

Carbon Cycle

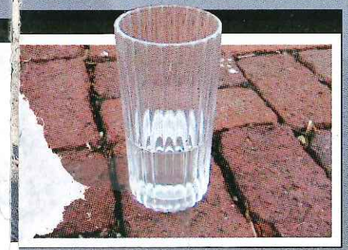
All life on Earth contains carbon, one of the most important chemical elements. In the air, it combines with oxygen to form carbon dioxide (CO_2).



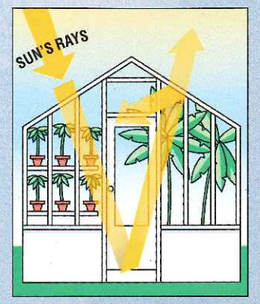
1. **The air contains** several gases, including carbon dioxide.
2. **Plants take in** carbon dioxide.
3. **Animals eat plants,** and carbon becomes a part of their bodies.
4. **Animals exhale** carbon dioxide. Rotting plants and animal carcasses release carbon dioxide into the air.
5. **The burning of** wood and fossil fuels, like oil and coal, releases large amounts of carbon dioxide into the air.

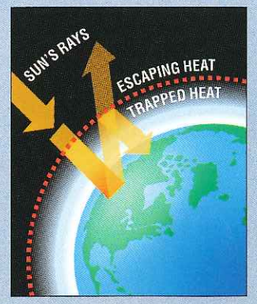
Try This!

To see how part of the water cycle works, next time it rains, leave a clear plastic glass outside to catch some rainwater. After it has stopped raining, mark the water level in the glass using tape. Leave the glass outside again. Check it at regular intervals. How long does it take for the water to evaporate completely?



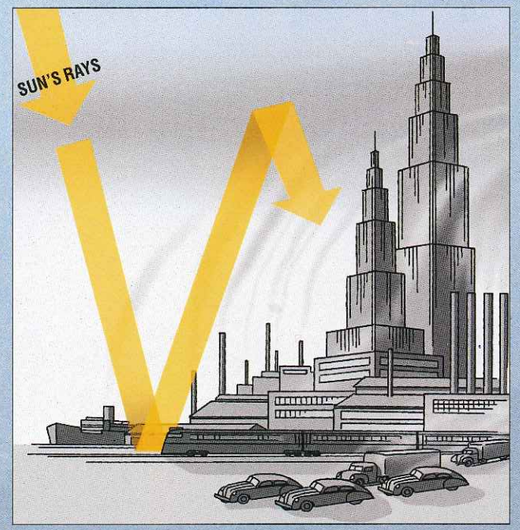
The Greenhouse Effect





Carbon dioxide plays an important role in the greenhouse effect. Earth's atmosphere—the layer of gases that surround the planet—acts like the glass in a greenhouse. It lets in some of the sunlight to heat Earth. When that energy bounces off our planet, it gets trapped by gases like carbon dioxide. Without the greenhouse effect, Earth's surface would be nearly 60°F colder.

Global Warming



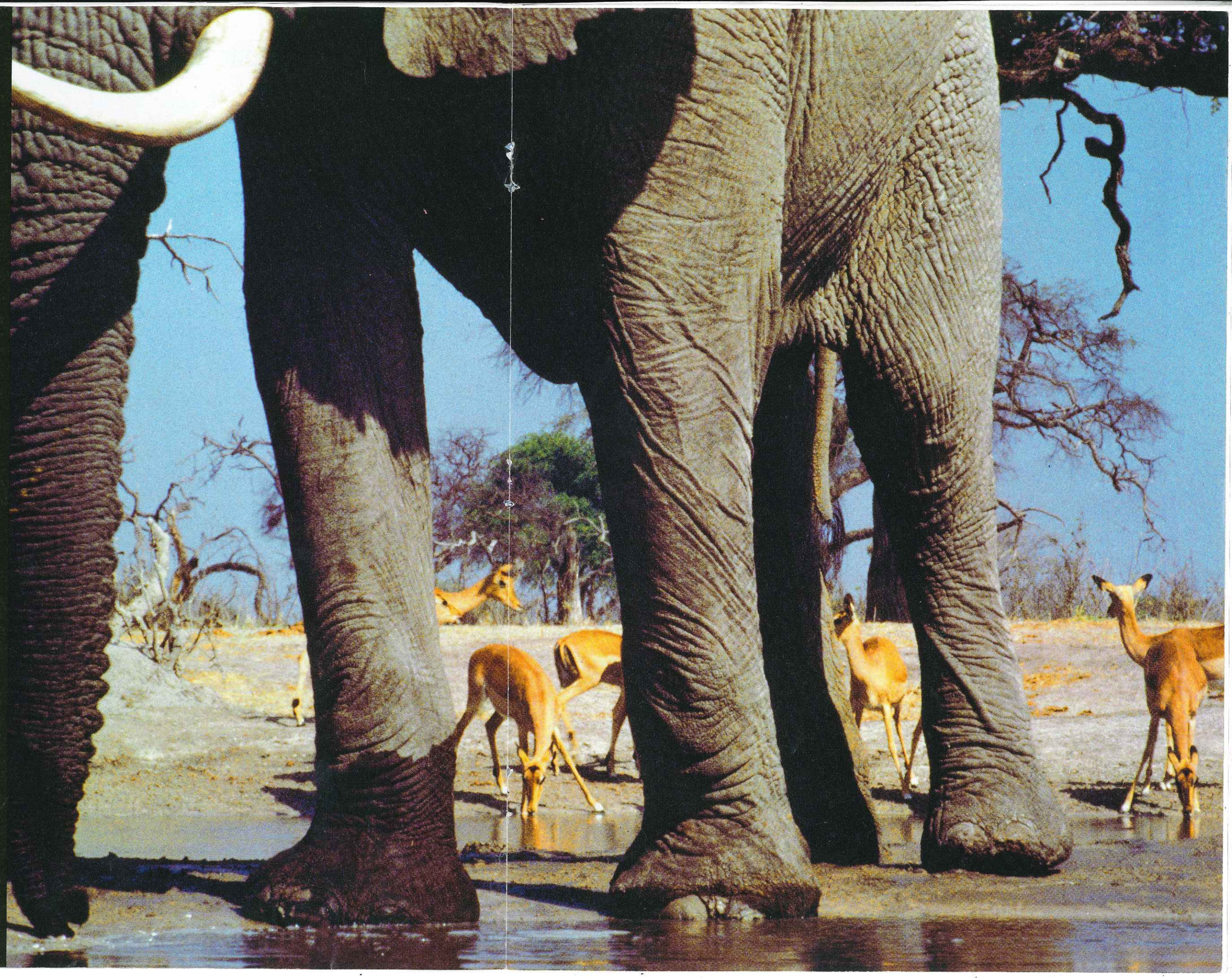
Human activity seems to be turning the greenhouse effect against us. Burning fossil fuels dumps greenhouse gases, like carbon dioxide, into the atmosphere. Meanwhile, the trees and plants that soak up carbon dioxide are being destroyed. As more of the Sun's heat gets trapped by the build-up of carbon dioxide, global warming heats up Earth. In the last hundred years, overall temperatures rose by as much as 1°F. They are expected to rise several more degrees in this century. Global warming will probably cause polar ice sheets to melt. As the seas rise, coastal cities, like Miami and New Orleans, could face heavy flooding.

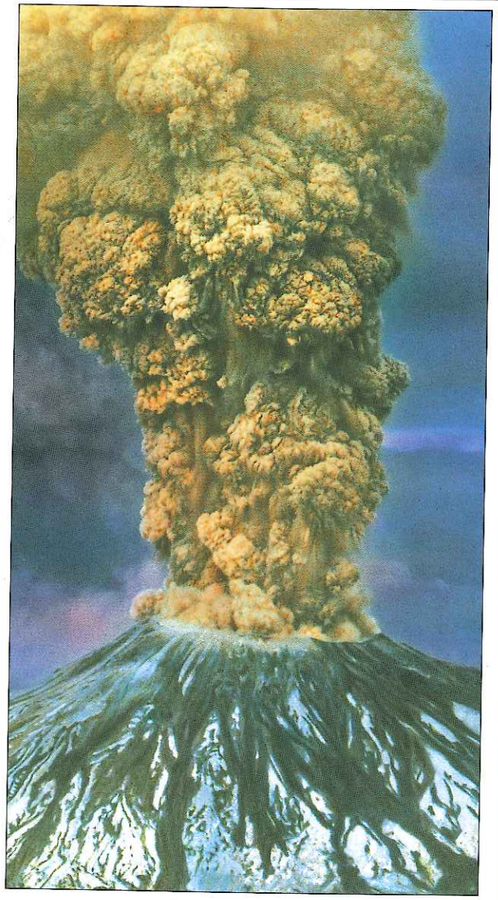
Water and carbon are not the only substances that are recycled by nature. Ecologists have identified separate cycles for oxygen, nitrogen, hydrogen, phosphorous, and sulfur. Sadly, humans are not as thrifty as nature. We produce vast amounts of wastes that have no place in nature's cycles. Some, like plastics, cannot be broken down naturally. Others, like nuclear waste, are harmful to people and wildlife.

Going... Going... GONE!

The diversity of life on Earth is astonishing—from impala and elephants on land to plankton and algae in the oceans. However, many species of plants and animals are endangered, including the African elephant, because of the activities of one species—*Homo sapiens*. Human beings' activities, from our energy use to our urbanization, have caused entire populations of plants and animals to be wiped off the face of the Earth forever. At least 99 percent of all the billions of species that have ever existed are now extinct!

We must find ways to meet our needs without destroying the beauty and diversity of our spectacular planet.





Balance of Nature

On Sunday, May 18, 1980, Mount St. Helens blew its top. Approximately a two-hour drive from downtown Seattle, the volcano erupted with the force of several atomic bombs, blowing down and scorching 230 square miles of surrounding forest. In many places, no life survived at all. Yet, two decades later, plants and animals are already sprouting up around Mount St. Helens. It will be another two hundred years before hardwood forests dominate the area once more. But as it turns out, the volcano's destruction was another way in which nature renews itself.

Succession

An area that's been destroyed by a volcano, forest fire, or other natural disaster undergoes a process that ecologists call succession.

Grasses, ferns, and weeds cover the once sterile ground. Small animals, such as groundhogs, mice, and rabbits, return. Because there's so little life around, the food chain is very short.

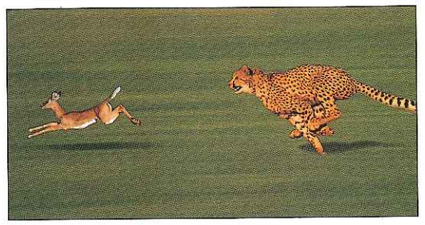
As bushes take over from the grass and weeds, larger animals return, and the food chain becomes more complex.

After two hundred years or so, the area once again becomes a thriving woodland. The final, or climax, ecosystem has many animals and a complicated food chain.

When humans clear an area for farming or housing, they stop the process of succession. The longer an area is cleared of its natural habitat, the more its original plants and animals die out or move away.

➤ It's often difficult to see the benefits in a natural disaster like a volcano or forest fire. But from the planet's perspective, volcanoes are an absolute necessity. They help recycle rocks and minerals that are vital for life. Most of the molecules in your body came out of the ground through a volcano at one time or another. Here's how it happens: Weather chips molecules off rocks, which, over time, become part of the soil. Soil also contains organic material. Plants take up nutrients from the soil through roots, and the nutrients become part of the plant tissue. When you eat a plant, the nutrients become part of you.

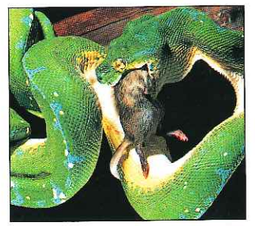
▲ Every ecosystem has its limits. A forest can support only so many badgers; a river only so many fish. This limit is called its carrying capacity. Ecosystems tend to have a balance among plants, the animals that eat them, and predators. For instance, if there's plenty of grass, then more deer will be born and more wolves will be born to hunt them. A lack of grass will cause both deer and wolves to die off.



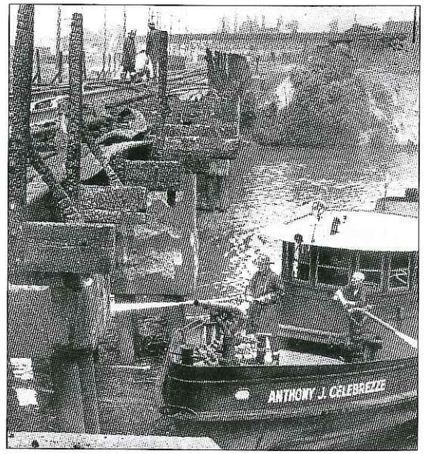
▲ Each plant and animal has its own unique niche in its community. At first glance, some animals seem to share the same niche, but they don't. For instance, cheetahs and lions both hunt antelope. But the weaker cheetahs tend to favor young antelope and other smaller animals. The stronger lions tend to favor larger animals, such as zebras.

▲ The animals that adapt best are the ones that survive. These adaptations include slight physical changes—perhaps in size or eyesight. Over three and a half billion years, such changes have created a rich variety of life on Earth, which ecologists call biodiversity. For instance, nobody mistakes a chimpanzee for a human. Yet, humans and chimps share 98.5 percent of their genetic coding, which makes them close cousins genetically.

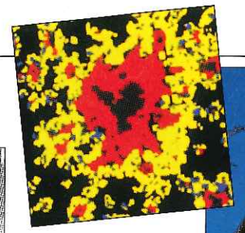
➤ Biodiversity is important because each plant and animal has a niche. Remove bees from an area and flowers can't be pollinated and reproduce. Remove snakes and the mouse population soars. The removal of any species can destroy or weaken other species, causing ripple effects throughout an ecosystem.



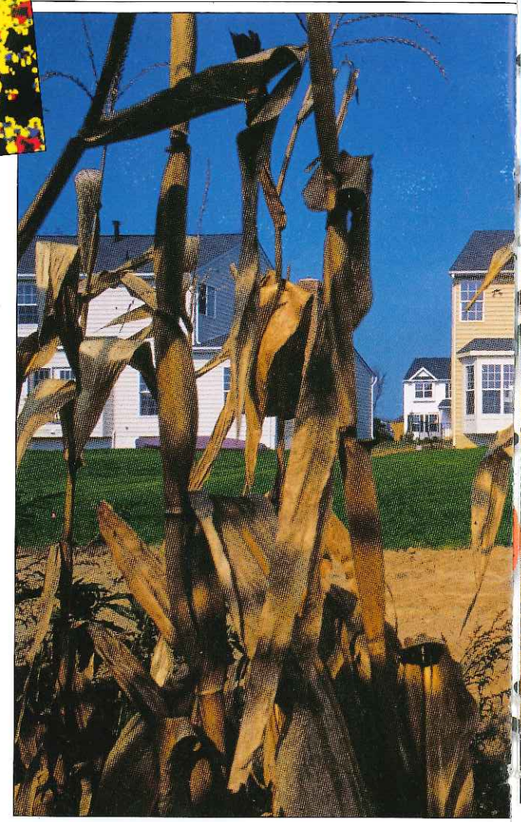
A River of Fire



America's interest in the environment soared after June 22, 1969, when Cleveland's Cuyahoga River suddenly caught fire. It was so polluted with chemicals and garbage that it just burst into flames. The outrage surrounding that incident led to reforms. Soon, new laws helped clean filthy rivers, reduce air pollution, and protect some endangered species. Today, water and air in the U.S. are cleaner, and a few endangered animals, like the bald eagle, have bounced back. But Earth's health remains shaky. Problems such as overpopulation, urban sprawl, and global warming have no easy solutions. Some people even doubt that they are problems at all. Unfortunately, it may take something even more shocking and disastrous than a river catching fire to prove otherwise.

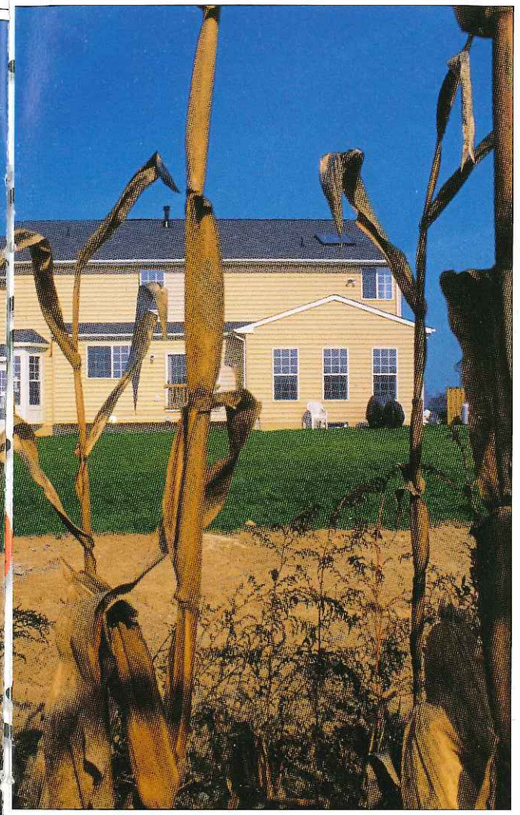


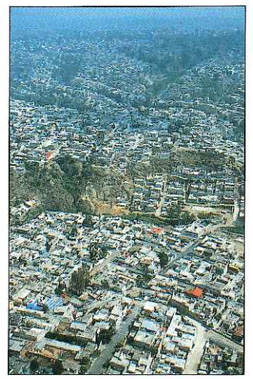
ATLANTA, GEORGIA
EXISTING DEVELOPMENT
- **AS OF 1993**
- **SINCE 1993** INTENSE
- **SINCE 1993** MODERATE



▲ EACH YEAR, URBAN sprawl (spread of housing and business to less developed areas) in the U.S. gobbles up about two million acres of farmland, forests, deserts, and other types of land. Atlanta is one of many cities struggling with sprawl. Air pollution from cars is so bad that asthma is now the number one reason that children go to Atlanta's emergency rooms.

◄ EARTH'S POPULATION is growing rapidly. Today, there are approximately six billion people, about twice as many as there were in 1950. Within the next 20 years, another 1.5 billion will be added to that. Already, at least 500 million people face serious water shortages.





◄ THROUGH HABITAT destruction, hunting, and pollution, humans are crowding some animals off the planet permanently. Humans are killing off plants and animals so fast that one-eighth of all bird and plant species and one-quarter of all mammal species may soon face extinction. Here are a few species that have disappeared in the last century: passenger pigeon, Xerxes blue butterfly, blue pike.

◄ TODAY, FEW scientists dispute that human activity is causing global warming. A hotter planet will likely cause polar ice sheets to melt. The increase in liquid water would upset weather patterns, causing horrific storms in some areas and droughts in others. Worldwide food production could be disrupted. However, precise predictions about global warming are tentative and often conflicting.

▲ TWO DECADES ago, fireflies were just a pretty insect. Today, scientists know that the stuff that makes them glow can be used to detect contaminated food. Nature has also given us hundreds of wonder drugs, including aspirin, morphine, and penicillin. We will never know which extinct plants and animals might have provided new treatments or drugs.

▲ EVEN INNOCENT human activities can have a terrible impact. For instance, buildings and towers that rise above 199 feet must have flashing lights on top to warn pilots. Unfortunately, birds are drawn to the lights and fly into them.

▼ EVEN SEEMINGLY harmless animals like house cats can be a dangerous alien species. In the U.S., more than 60 million cats have been abandoned or have gone wild. Killing for sport as well as food, these cats wipe out millions of wild birds—many of them endangered.