CALIFORNIA Standards Preview

California Science

Standard Set 2. Life Sciences

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

2.a. *Students know* plants are the primary source of matter and energy entering most food chains.

2.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.

2.c. *Students know* decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.

Standard Set 3. Life Sciences

3. Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept:

3.d. *Students know* that most microorganisms do not cause disease and that many are beneficial.

Genre	Comprehension Skill	Text Features	Science Content
Nonfiction	Follow Instructions	• Captions • Diagrams • Labels • Glossary	The Roles of Living Things

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California Science

Life Sciences

Energy and Matter in Living Things

by Susan Turner

Vocabulary

carnivore
consumer
decomposer
ecosystem
food chain
food web
herbivore
microorganism
omnivore
producer

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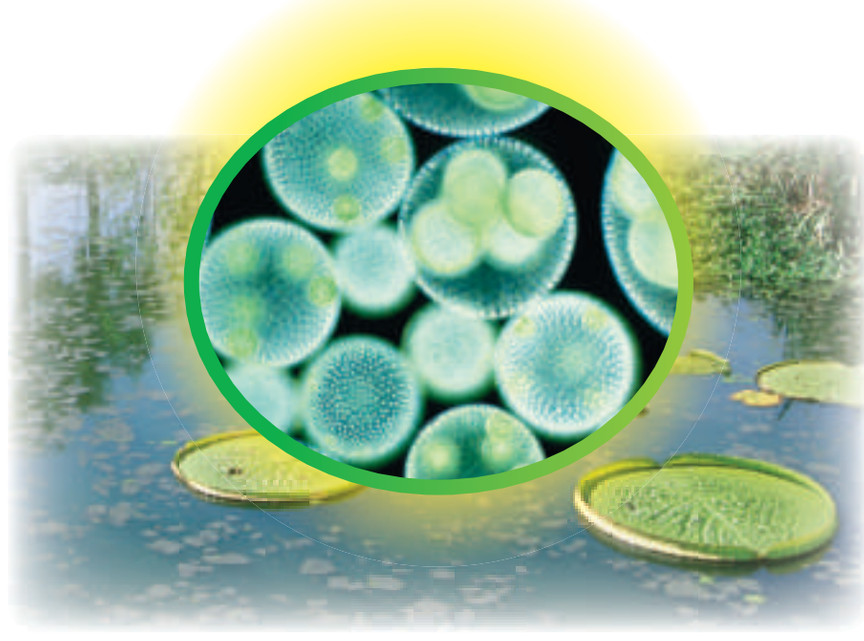
Energy *and* Matter *in* Living Things



by Susan Turner

PEARSON
Scott Foresman

The Flow of Energy

The tropical rain forest is one kind of ecosystem. An **ecosystem** is all the living and nonliving things in an environment and the many ways they interact. An ecosystem's living things need energy, water, nutrients, growing space, and the right temperatures.

The main source of energy in ecosystems is sunlight. *Photosynthesis* in plants starts the flow of energy from one living thing to another. Green plants use energy from sunlight to change carbon dioxide and water into food and oxygen. Plants use the energy that they make to grow and live. Because plants are able to make their own food, they are called **producers.**

Many green plants live in tropical rain forest ecosystems.

Energy Flowing Through Living Things

Unlike plants, animals cannot get energy by making their own food. This makes them consumers. **Consumers** are living things that eat other living things as food. Animals use the energy they get from eating to live and grow. Some of the energy they get from eating gets stored in their bodies.

Herbivores, carnivores, and omnivores are consumers. Animals that eat only plants are **herbivores.** Tropical rain forest gorillas are herbivores. They eat stems and leaves.

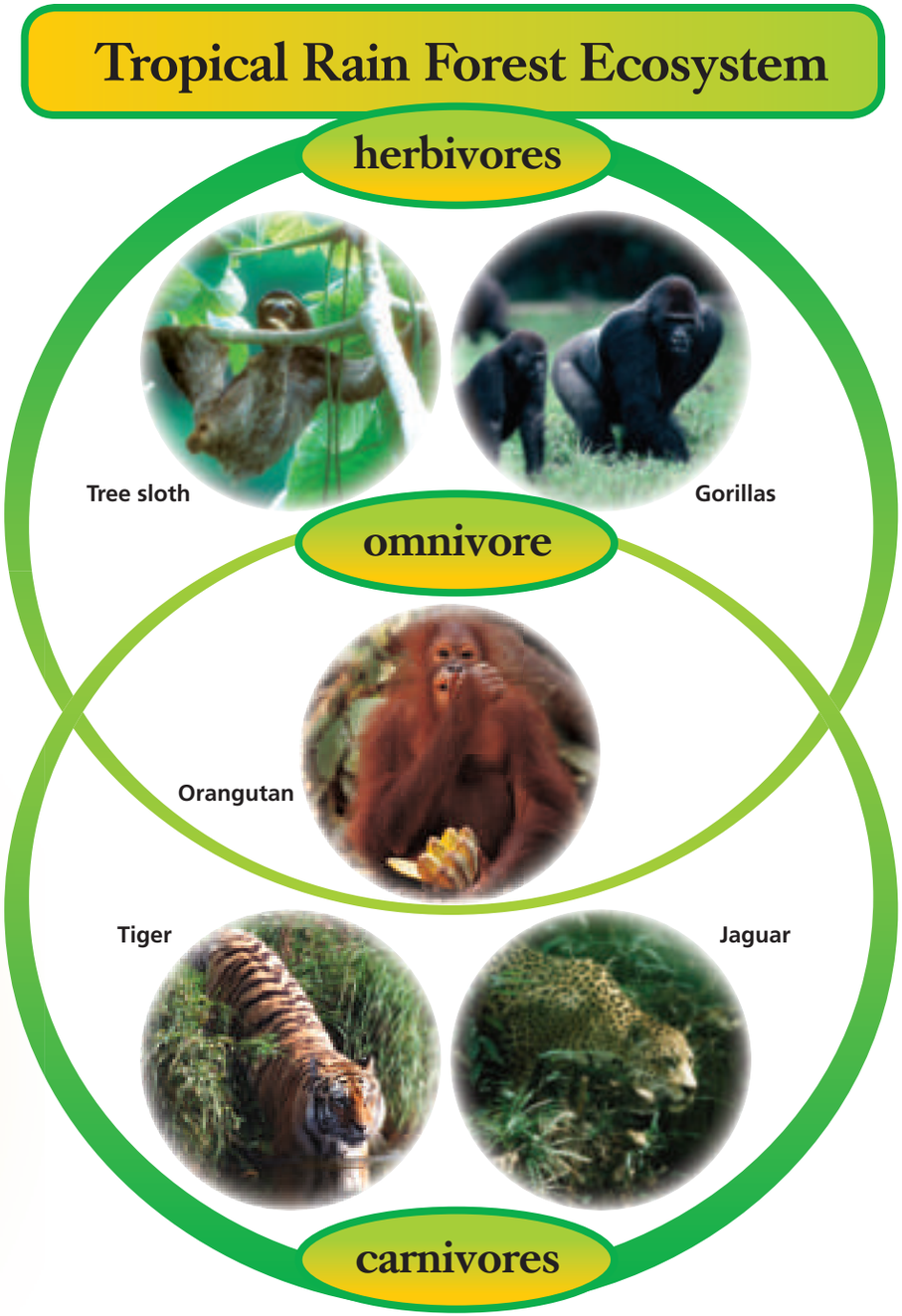
This chimpanzee is eating berries. Chimpanzees and gorillas are closely related, but chimpanzees also eat meat.

Animals that eat other animals are **carnivores.** The Bengal tiger is a carnivore of the tropical rain forest. It eats boars, wild oxen, and monkeys. When animals eat other animals, the energy stored in the one animal's body gets transferred to the other animal. When a Bengal tiger eats a boar, it gets the boar's stored energy.

Animals that eat both plants and other animals are **omnivores.** Tropical rain forest orangutans are omnivores. They eat leaves, fruits, insects, and birds.

When plants and animals die or leave wastes, some insects, fungi, and bacteria break the material down and use it as energy. Organisms that break down plant and animal waste and remains are **decomposers.** A mushroom is one type of decomposer. It is a fungus that breaks down the remains of dead trees and returns their nutrients to the soil.

Brown fungi, called conk, are breaking down this tree's bark. Fungi are decomposers.



The Flow of Matter

Strangler fig trees live in tropical rain forests. They have a huge amount of *biomass*, or mass of living matter. An ecosystem's living things depend on plant biomass.

Plants get energy from the Sun. They take in carbon, nitrogen, and hydrogen from the soil, air, and water to make their living parts. A plant's energy and matter get passed on to an animal when it eats the plant.

Organisms transfer energy by eating and being eaten in a **food chain.** A tropical rain forest food chain starts with strangler figs and other plants. These plants make energy from sunlight. Howler monkeys and other herbivores get that energy by eating plants. Harpy eagles and other carnivores get energy from eating howler monkeys and other herbivores.

Food Chain Links

Producers are the first links in food chains. In the tropical rain forest, and almost all other ecosystems, the producers are plants. Producers include trees, vines, and flowering plants.

Parrots are herbivores. They eat the tropical rain forest's green plants or tree leaves. This makes parrots first or *primary* consumers in the food chain. They gain energy from the green leaves that they have eaten.

Animals that hunt other animals for food are called *predators*. The harpy eagle is a predator of parrots. The hunted animals, in this case parrots, are called *prey*. The harpy eagle gets its energy from eating parrots and other prey.

Food chains may have many levels of consumers. The harpy eagle has few predators. It is at the top of the tropical rain forest's food chain.

Parrots and other herbivores are primary consumers.

Predators such as the harpy eagle prey on parrots and other primary consumers.

Food Chains into Food Webs

In most ecosystems, there are many different interconnected food chains. In a tropical rain forest, for example, a sloth eats more than one type of food. It can eat leaves, fruit, and small animals. It also has to watch out for more than one predator. Harpy eagles and pumas prey on sloths. The sloth has to be smart in order to survive.

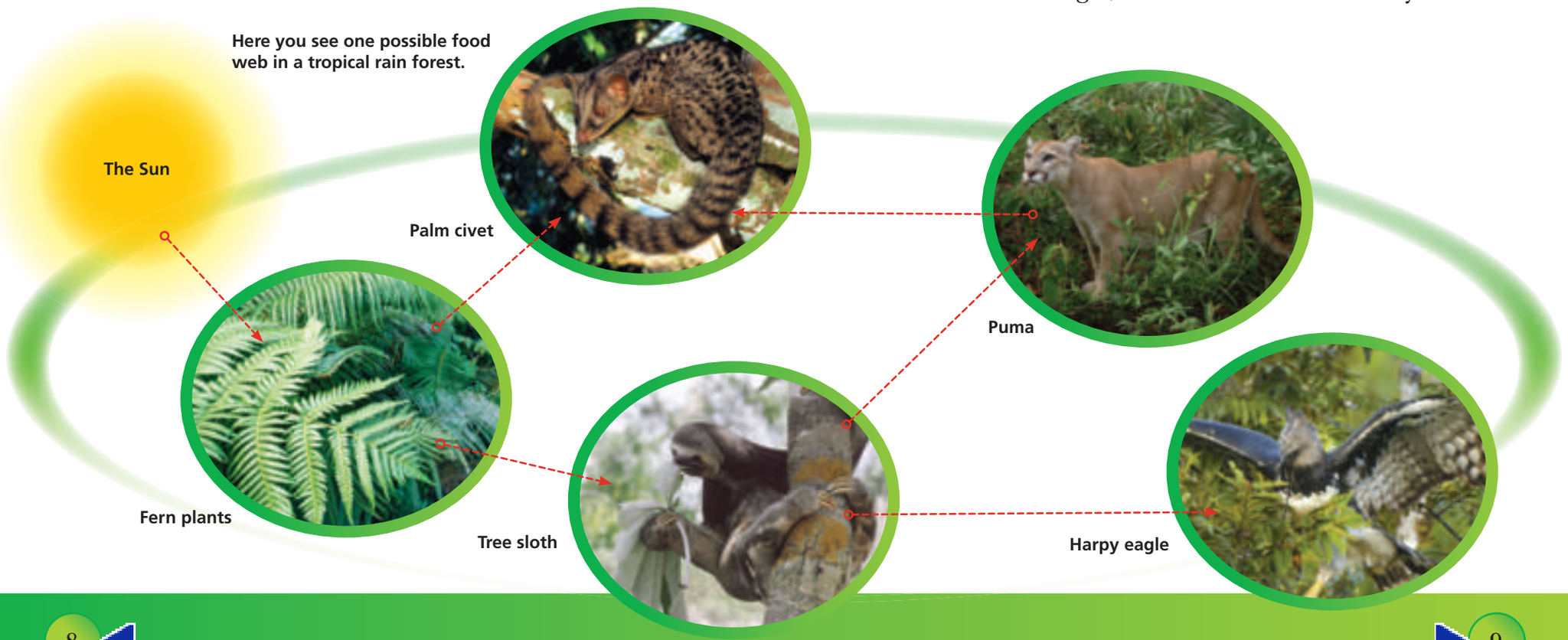
Sloths, harpy eagles, and pumas belong to the tropical rain forest's food web. A **food web** is a system of overlapping food chains. The flow of energy and matter can travel in many directions in a food web.

Ways Food Webs Change

Look at the picture of the food web. What would happen if the population of harpy eagles dropped? Look to see which animals are connected to harpy eagles. With fewer harpy eagles, more sloths would be able to survive.

If the sloth population were to increase, more food would be available for the pumas. The puma population could increase. But the extra sloths would eat more fruit. This would mean less food for the palm civets. Their numbers would start to decrease. If the palm civet population were to decrease, how would that affect their predators?

All living things are connected to each other. If one part of the food web changes, it can affect the entire ecosystem.



Decomposers

Without decomposers, the producers in an ecosystem would use up all of the nutrients in the soil. This would greatly affect the ecosystem. If decomposers were not constantly returning nutrients to the soil, new plants could not grow. This would cause the herbivores to die off, since they would have no food. Without herbivores, the carnivores would no longer be able to survive, because their food supply would be gone.

Decomposers break down wastes, along with materials from dead plants and animals. They use these materials' stored food energy to grow, reproduce, and stay alive. The breaking down of wastes releases nutrients back into the soil, allowing the cycle to start again.

Decomposers return nutrients to the soil when they break down wastes and remains.

Microorganisms and Decay

Have you ever seen an apple with a brown spot on it? If you looked at the apple later, the brown spot would be larger. Decomposers cause these spots as they break down the apple.

Some decomposers, such as some insects and fungi, are big enough to be seen. But many are microorganisms. A **microorganism** is a living thing that is too small to see without a microscope. Bacteria and some fungi are microorganisms.

Decay is very important to the life of an ecosystem. When decay occurs, nutrients are recycled into the soil and water. This allows new plants to grow and supply the ecosystem with energy. When a leaf falls from a tree in a tropical rain forest, the forest's decomposers get to work digesting it. This makes the leaf's nutrients available for new plant growth.

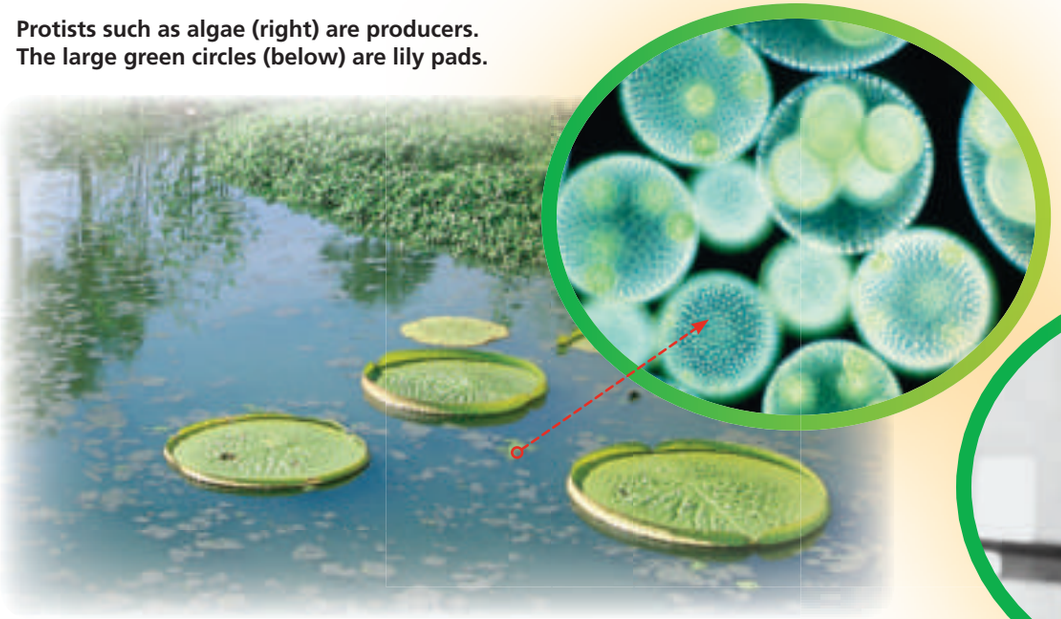
These yeast cells and molds are growing on a rotten apple. Yeast cells and molds are microorganisms.

The Role Of Microorganisms

You cannot see them without a microscope, but microorganisms are all around us. There are many more microorganisms on Earth than there are plants and animals. Most microorganisms are not harmful. Many of them keep living things alive by carrying out certain roles.

One type of microorganism is a protist. Many protists are one-celled organisms. Some protists, such as algae, are producers. They make their own food much as plants do. Protists such as these are the primary producers in the food webs found in most waters on Earth! Other protists found in the water keep it clean by eating other microorganisms.

Protists such as algae (right) are producers. The large green circles (below) are lily pads.



Microorganisms That Help Us

Some helpful microorganisms are found in your digestive system. Bacteria in your intestines not only help digest food, but also help to eliminate some types of harmful bacteria. Helpful bacteria are found in certain dairy foods such as yogurt, sour cream, buttermilk, and cheese.

Another helpful microorganism is a mold called *Penicillium*. You may have seen some of this mold growing on a rotting orange. In 1928, a Scottish scientist named Alexander Fleming discovered that this microorganism produces an antibiotic. An antibiotic is a substance that kills disease-causing bacteria. Antibiotics such as those based on *Penicillium* have been used to fight harmful bacteria.

The green spots on this bread are *Penicillium* mold. Alexander Fleming's work with *Penicillium* led to a major discovery in antibiotics.

Microorganisms in Soil

Microorganisms are everywhere in the soil. A one-liter jar filled with fertile soil will contain as many as 1 trillion bacteria and 10 to 100 million protists!

Some bacteria found in soil produce natural fertilizer for plants. These bacteria take the element nitrogen and turn it into a compound that plants can use. Plants use this compound to produce proteins that they need to live and grow.

You can see the spider and earthworm without using a microscope. You need a microscope to see the soil's microorganisms.

Microorganisms Under the Microscope

The water in a tropical rain forest contains microorganisms such as flagellates (flah-JEL-ates), plasmodium (PLAZ-moh-DEE-um) and thallasiosira (THALL-ah-cee-oh-SEER-ah). If you filled an eyedropper with rain forest water and observed it over several weeks, the living things inside the eyedropper would change. Each couple of weeks, certain microorganism populations would grow larger, while others would die off.

Plasmodium (bottom left) can be seen through a microscope. Plasmodium live in wet, tropical environments. They are carried by mosquitoes.

Glossary

carnivore	an animal that eats other animals
consumer	a living thing that eats other living things for food
decomposer	an organism that breaks down wastes and remains of other organisms
ecosystem	the living and nonliving things and the ways they interact in an environment
food chain	the transfer of energy and matter from one living thing to another by eating and being eaten
food web	a system of overlapping food chains in which energy and matter flow through many branches
herbivore	an animal that eat plants
microorganism	a living thing too small to be seen without a microscope
omnivore	an animal that eats both plants and animals
producer	a living thing that makes its own food

What did you learn?

1. What is the main source of energy in most ecosystems?
2. How do nutrients get returned to the soil?
3. How are herbivores and carnivores different?
4. **Writing** in Science Use an encyclopedia, dictionary, thesaurus, or other information from the library-media center to write about decomposers in an ecosystem other than the tropical rain forest.
5. **Follow Instructions** Write instructions that another student can follow to show a food chain in an ecosystem other than the tropical rain forest.