Section 4

Biodiversity

CALIFORNIA Standards Focus

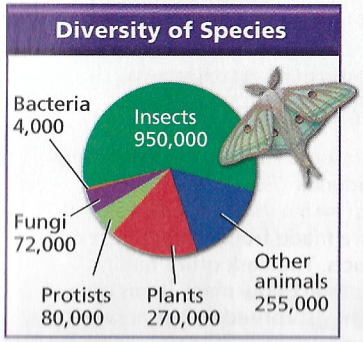
S 6.6.b Students know different natural energy and material resources, including air, soil, rocks, petroleum, fresh water, wildlife, and forests, and know how to classify them as renewable or nonrenewable.

- In what ways is biodiversity valuable?
- What factors affect an area's biodiversity?
- Which human activities threaten biodiversity?
- How can biodiversity be protected?

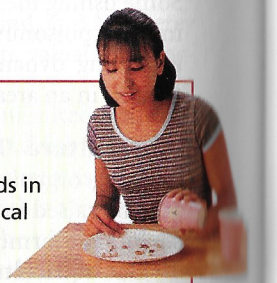
Key Terms

- biodiversity
- keystone species
- extinction
- endangered species
- threatened species
- habitat destruction
- poaching
- captive breeding

FIGURE 17
Organisms of many kinds are part of Earth's biodiversity.



Lab zone Standards Warm-Up



How Much Variety Is There?

1. You will be given two cups of seeds. The seeds in cup A represent the trees in a section of tropical rain forest. The seeds in cup B represent the trees in a section of deciduous forest.
2. Pour the seeds from cup A onto a plate. Sort the seeds by type. Count the different types of seeds. This number represents the number of different kinds of trees in that forest.
3. Repeat Step 2 with the seeds in cup B.
4. Share your results with your class. Use the class results to calculate the average number of different kinds of trees in each type of forest.

Think It Over
Inferring How does the variety of trees in the two forests differ? Can you suggest any advantages of having a wide variety of species?

No one knows exactly how many species live on Earth. As you can see in Figure 17, more than 1.5 million species have been identified so far. The number of different species in an area is called its **biodiversity.** It is difficult to estimate the total biodiversity on Earth because many areas of the planet have not been thoroughly studied. Some experts think that the deep oceans alone could contain 10 million new species!

Preserving biodiversity is important. **People value wildlife and ecosystems for their beauty and as a source of recreation. In addition, biodiversity has both economic value and ecological value within an ecosystem.**

Many plants, animals, and other organisms can be valuable resources. They provide food and raw materials for medicines, clothing, and other products. For example, forests provide wood for fuel and building material, and fisheries provide fish for food. But these resources can only be renewable if they are used in a sustainable way. If habitats and species are lost when a resource is harvested, then the resource can become nonrenewable. Ecosystems themselves can also be valuable. People enjoy wildlife tours in rain forests and other locations.

Factors Affecting Biodiversity

Biodiversity varies from place to place on Earth. **Factors that affect biodiversity in an ecosystem include area, climate, and diversity of niches.**

Area Within a given biome, a large area will contain more species than a small area. For example, a large island such as New Guinea is home to more bird species than a smaller island such as Bali.

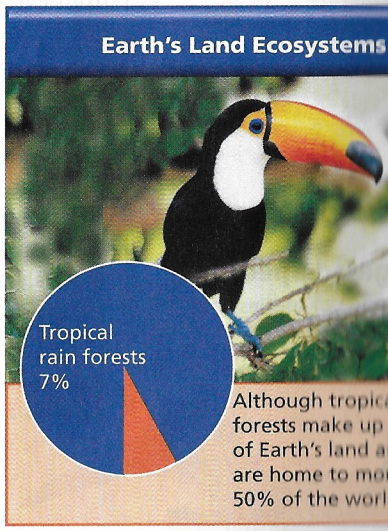
Climate Many scientists hypothesize that the great biodiversity in the tropics may be related to climate. The number of species generally increases from the poles toward the equator. Tropical rain forests are the most diverse ecosystems in the world. Why is this? Tropical rain forests have fairly constant temperatures and large amounts of rainfall throughout the year. Many plants in these regions grow year-round, providing a continuous food supply for other organisms.

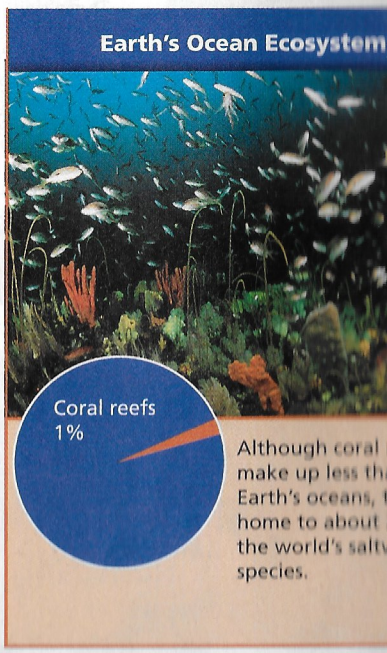
Niche Diversity Coral reefs are the second most diverse ecosystems in the world. Found only in shallow, warm waters, coral reefs are often called the rain forests of the sea. A reef supports many different niches for organisms that live under, on, and among the coral. More species are able to live in the reef than in a more uniform habitat, such as a flat sandbar.

Keystone Species All the species in an ecosystem are interconnected. Some species play a particularly crucial role. A **keystone species** is a species that influences the survival of many other species in an ecosystem. For example, the sea otter, which eats sea urchins, is a keystone species in kelp forests. In the 1800s, hunters on the Pacific coast killed most of the sea otters for fur. The sea urchins were able to reproduce without control and ate up all the kelp. When sea otters were reintroduced, the kelp population recovered. The ecosystem's balance was restored.

Reading Checkpoint **What is a keystone species?**

FIGURE 18
Land and Ocean Ecosyst
Three factors that affect the biodi of an ecosystem are area, climate, niche diversity. **Inferring** *Which f most likely responsible for the bio of coral reefs? Of tropical rain for*





Lab zone Standards Warm-Up

Universal Access

Biodiversity in Danger

In the 1800s, there were millions of passenger pigeons in the United States. Then, in less than a century, people hunted the birds until there were no passenger pigeons left.

Extinction The disappearance of all members of a species from Earth is called **extinction**. Extinction is a natural process. But in the last few centuries, the number of species becoming extinct has increased dramatically. Species in danger of becoming extinct in the near future are called **endangered species**. Species that could become endangered in the near future are called **threatened species**. Threatened and endangered species are found on every continent and in every ocean.

A natural event, such as an earthquake or a volcanic eruption, can damage an ecosystem, wiping out populations or even species. **Human activities can also threaten biodiversity. These activities include habitat destruction, poaching, pollution, and the introduction of nonnative species.**

Reading Checkpoint **What is an endangered species?**

Habitat Destruction The major cause of extinction is **habitat destruction**, the loss of a natural habitat. This can occur when forests are cleared to create grazing land or when wetlands are filled in to build towns. Some species are not able to survive such changes to their habitat.

Poaching **Poaching** is the illegal killing or removal of wildlife from their habitats. Many endangered animals are killed and sold for their skin or fur. Others are taken and sold as pets.

Pollution Some species are endangered because of pollution. Substances that cause pollution, called pollutants, may reach animals through the water or air. Pollutants may harm or kill organisms.

Nonnative Species Introducing a nonnative species, or exotic, into an ecosystem threatens biodiversity. Without its natural predators and consumers, the introduced species often outcompetes or harms the native organisms.

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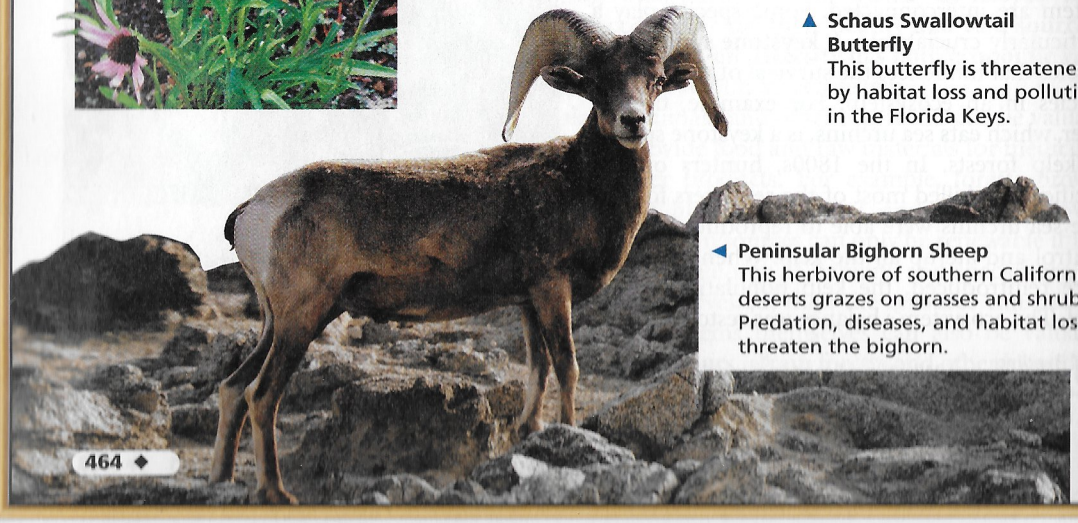
FIGURE 19
Endangered Species
A broad range of species and habitats are represented on the endangered list in the United States.

◀ **Tennessee Purple Coneflower**
These daisy-like plants grow only in cedar forests in central Tennessee. Conservation organizations and landowners are working together to protect these plants.

▲ **Schaus Swallowtail Butterfly**
This butterfly is threatened by habitat loss and pollution in the Florida Keys.

California Tiger Salamander ▲
This salamander is threatened by habitat loss.

Whooping Crane ▶
Threatened by habitat destruction and disease, about half of the remaining whooping cranes are in zoos. The species is recovering well since its lowest point in the 1940s.



◀ **Peninsular Bighorn Sheep**
This herbivore of southern California's deserts grazes on grasses and shrubs. Predation, diseases, and habitat loss threaten the bighorn.

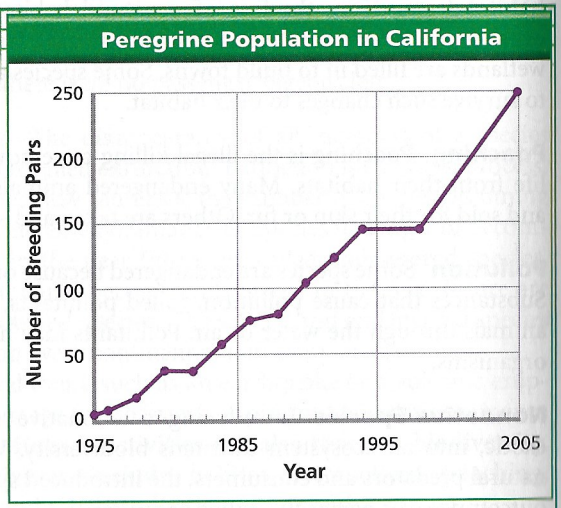
Steller's Sea Lion ▶
Overfishing has led to a decline in this mammal's sources of food. Other factors may also be threatening this species.

Reviewing Math: Statistics, Data Analysis, and Probability 6.3.2

Math Analyzing Data

California Peregrine Falcon Recovery

The peregrine falcon, the world's fastest bird of prey, was nearly extinct in the United States in 1970. The pesticide DDT weakened peregrine eggshells, so the eggs rarely hatched. In 1972, the United States banned DDT. Use the graph to answer the questions.



1. **Reading Graphs** What variable is plotted on the *x*-axis? What variable is plotted on the *y*-axis?
2. **Interpreting Data** How did California's peregrine population change from 1976 to 1998?
3. **Inferring** Why do you think the peregrine population grew fairly slowly at first?
4. **Predicting** What might this graph have looked like if DDT had not been banned?

Protecting Biodiversity

Some people who work to preserve biodiversity focus on protecting just one endangered species. Others try to protect entire ecosystems, such as the Great Barrier Reef in Australia. **Three successful approaches to protecting biodiversity are captive breeding, laws and treaties, and habitat preservation.**

Captive Breeding Captive breeding is the mating of animals in zoos or wildlife preserves. Scientists care for the young and then release them into the wild when they are grown.

Captive breeding was the only hope for the California condor, the largest bird in North America. Condors became endangered due to habitat destruction, poaching, and pollution. By 1984, there were only 15 California condors. Scientists captured all the condors and brought them to zoos to breed. Today, there are more than 200 California condors.

FIGURE 20
Captive Breeding
California condor chicks raised in captivity need to learn what adult condors look like. Here, a scientist uses a puppet to feed and groom a chick.

Laws and Treaties Laws can help protect species. In the United States, the Endangered Species Act prohibits trade in products made from threatened or endangered species. Internationally, wildlife is protected by the Convention on International Trade in Endangered Species. This treaty lists more than 800 species that cannot be traded for profit.

Habitat Preservation The best way to preserve biodiversity is to protect whole ecosystems. Protecting whole ecosystems saves endangered species and the other species in their community. Many countries have set aside wildlife habitats as parks, reserves, and refuges.

To succeed, reserves must have the characteristics of diverse ecosystems. For example, they must be large enough to support the populations that live there. The reserves must contain a variety of niches. And of course, it is still necessary to keep the air, land, and water clean, control poaching, and remove nonnative species.

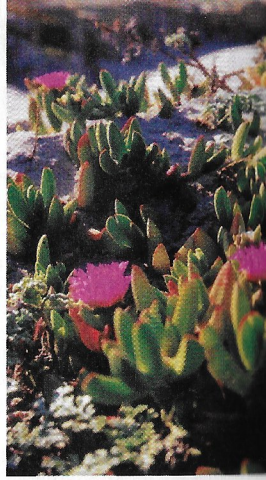


FIGURE 21
Habitat Preservation
Habitat preservation is the
national parks such as Char
National Park in California.

Section 4 Assessment

S 6.6.b

Target Reading Skill **Identify Main Ideas**
Reread the paragraphs under the heading The Value of Biodiversity. Identify two or three details that support the main idea that preserving biodiversity is important.

Reviewing Key Concepts

1. a. **Identifying** What are three factors that affect the biodiversity in an ecosystem?
   b. **Explaining** How does each of these factors affect biodiversity?
   c. **Developing Hypotheses** Would you expect to find great biodiversity in the tundra biome? Why or why not?
2. a. **Listing** Name four human activities that can threaten biodiversity.
   b. **Applying Concepts** Black bears are roaming through a new housing development in search of food, even though the housing development is still surrounded by forest. How can you account for the bears' behavior?
3. a. **Reviewing** What are three ap
   protecting biodiversity?
   b. **Relating Cause and Effect** Fo
   approach to protecting biodiv
   least one factor that might lim
   c. **Making Judgments** List some
   which those limitations might

Lab zone At-Home Activit

Species Refuges Obtain a map of
community or state. With a family
identify any city, state, or nationa
refuges in your area. Choose one
find out whether there are endan
threatened species living there. R
ecological role of these organism
prepare a five-minute presentatio
class on what you learned.

breeding pairs of birds in a particular year)

the number of breeding pairs remained the same for the four following years.

Lab zone Standards Investigation

Lab zone At-Home A