

# 6-3 Biodiversity

## Guide for Reading

### Key Concepts

- What is the value of biodiversity?
- What are the current threats to biodiversity?
- What is the goal of conservation biology?

### Vocabulary

biodiversity  
ecosystem diversity  
species diversity  
genetic diversity  
extinction  
endangered species  
habitat fragmentation  
biological magnification  
invasive species  
conservation

### Reading Strategy:

**Asking Questions** Before you read, rewrite the headings in the section as *how*, *why*, or *what* questions about biodiversity. As you read, write brief answers to your questions.



Those of us who love nature find much to admire in the many forms of life that surround us. We marvel at the soaring flight of an eagle, the majestic movements of a whale, and the colors of spring wildflowers. “Variety,” the saying goes, “is the spice of life.” But variety in the biosphere gives us more than just interesting things to look at. Human society takes part in local and global food webs and energy cycles, and depends on both the physical and biological life-support systems of our planet. For that reason, our well-being is closely tied to the well-being of a great variety of other organisms—including many that are neither majestic nor beautiful to our eyes.

## The Value of Biodiversity

Another word for variety is diversity. Therefore, biological diversity, or **biodiversity**, is the sum total of the genetically based variety of all organisms in the biosphere. **Ecosystem diversity** includes the variety of habitats, communities, and ecological processes in the living world. **Species diversity** refers to the number of different species in the biosphere. So far, biologists have identified and named about 1.5 million species and estimate that millions more may be discovered in the future.

**Genetic diversity** refers to the sum total of all the different forms of genetic information carried by all organisms living on Earth today. Within each species, genetic diversity refers to the total of all different forms of genes present in that species. You will read about genetic information later in the book.

**Biodiversity is one of Earth’s greatest natural resources. Species of many kinds have provided us with foods, industrial products, and medicines—including painkillers, antibiotics, heart drugs, antidepressants, and anticancer drugs.** For example, the rosy periwinkle plant in **Figure 6-14** is the source of substances used to treat certain cancers. The biodiversity represented by wild plants and animals is a kind of “library” of genetic information upon which humans can draw for future use. For example, most crop plants have wild relatives with useful traits such as resistance to disease or pests. When biodiversity is lost, potential sources of material with significant value to the biosphere and to humankind may be lost with it.

◀ **Figure 6-14** Biodiversity is one of Earth’s greatest natural resources. Species of many kinds have provided us with foods, industrial products, and medicines. The rosy periwinkle is a pink-petaled flowering plant native only to an island off the coast of Africa. The substances produced by this plant are used in modern medicine.



## Threats to Biodiversity

Human activity can reduce biodiversity by altering habitats, hunting species to extinction, introducing toxic compounds into food webs, and introducing foreign species to new environments.

As human activities alter ecosystems, this may lead to the extinction of species. **Extinction** occurs when a species disappears from all or part of its range. A species whose population size is declining in a way that places it in danger of extinction is called an **endangered species**. As the population of an endangered species declines, the species loses genetic diversity—an effect that can make it even more vulnerable to extinction.

## Habitat Alteration and Fragmentation

When land is developed, natural habitats may be destroyed. As habitats disappear, the species that live in those habitats perish. In addition, development often splits ecosystems into pieces, a process called **habitat fragmentation**. As a result, remaining pieces of habitat become biological “islands.” We usually think of islands as bits of land surrounded by water. But a biological island can be any patch of habitat surrounded by a different habitat. New York’s Central Park is an island of trees and grass in a sea of concrete. In suburbs, patches of forest can be surrounded by farms, houses, and shopping malls. Habitat islands are very different from large, continuous ecosystems. The smaller the “island,” the fewer species can live there, the smaller their populations can be, and the more vulnerable they are to further disturbance or climate change.

**CHECKPOINT** What is habitat fragmentation?

## Demand for Wildlife Products

Throughout history, humans have pushed some animal species to extinction by hunting them for food or other products. During the 1800s, hunting caused the extinction of species such as the Carolina parakeet, shown in **Figure 6–15**, and the passenger pigeon.

Today, in the United States, endangered species are protected from hunting. Hunting, however, still threatens populations of rare animals in parts of Africa, South America, and Southeast Asia. Some species are hunted for meat, fur, or hides. Others are hunted because people think that their body parts such as horns or gall bladders have medicinal properties. The Convention on International Trade in Endangered Species, often referred to as CITES, bans international trade in products derived from an agreed-upon list of endangered species. It is, however, often difficult to enforce laws in remote wilderness areas.



▲ **Figure 6–15** Human activity can reduce biodiversity by altering habitats, hunting species to extinction, introducing toxic compounds into food webs, and introducing foreign species to new environments. The Carolina parakeet was once common in the southeastern United States. This colorful bird was hunted to extinction by the early twentieth century because its feathers were in demand to decorate hats.




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## Conserving Biodiversity

Most people would like to preserve Earth's biodiversity for future generations. In ecology, the term **conservation** is used to describe the wise management of natural resources, including the preservation of habitats and wildlife. The modern science of conservation biology seeks to protect biodiversity. To do so requires detailed information about ecological relationships—such as the way natural populations use their habitats—and integrates information from other scientific disciplines, such as genetics, geography, and natural resource management.

**Strategies for Conservation** Many conservation efforts are aimed at managing individual species to keep them from becoming extinct. Some zoos, for example, have established captive breeding programs, in which young animals are raised in protected surroundings until the population is stable, then are later returned to the wild. This strategy has succeeded with a few species, including the black-footed ferret.

 **Today, conservation efforts focus on protecting entire ecosystems as well as single species. Protecting an ecosystem will ensure that the natural habitats and the interactions of many different species are preserved at the same time.** This effort is a much bigger challenge. Governments and conservation groups worldwide are working to set aside land, or expand existing areas, as parks and reserves.

## Biology and History

### Success in Conservation

*Human activity can have a dramatic impact on the biosphere, to the point where other forms of life are threatened. Many efforts have been made to protect and preserve Earth's natural environments.*

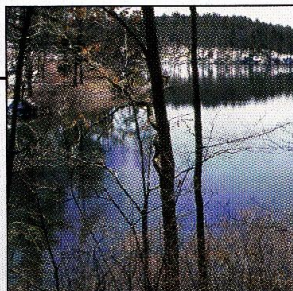
Yellowstone becomes the world's first national park.

1850

1854

#### Henry David Thoreau

Thoreau recommends the preservation of wildlife. In his book *Walden*, he cautions against seeking to dominate nature and suggests living in harmony with it.



1872

#### Harriet Hemenway

Hemenway and her cousin, Minna Hall, petition in Boston for legislation to prevent the extinction of birds due to unregulated hunting. By refusing to buy or wear plumed hats, the two cousins are among the first founders of the conservation movement.

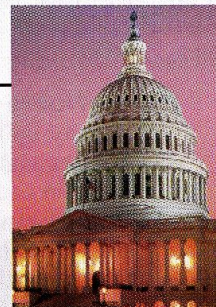


1896

1900

#### Lacey Act

Enacted by the U.S. Congress, the Lacey Act is the first major national conservation law. Transporting illegally killed animals across state borders becomes a federal crime.





The United States has an extensive system of national parks, forests, and other protected areas. Few of these, however, were designed with ecological principles in mind. As a result, these areas may not be large enough, or contain the right resources, to protect biodiversity. Marine sanctuaries are being designated to protect marine resources, such as coral reefs and marine mammals. Ecologists are realizing, however, that even these areas may not be enough to conserve the world's biodiversity.

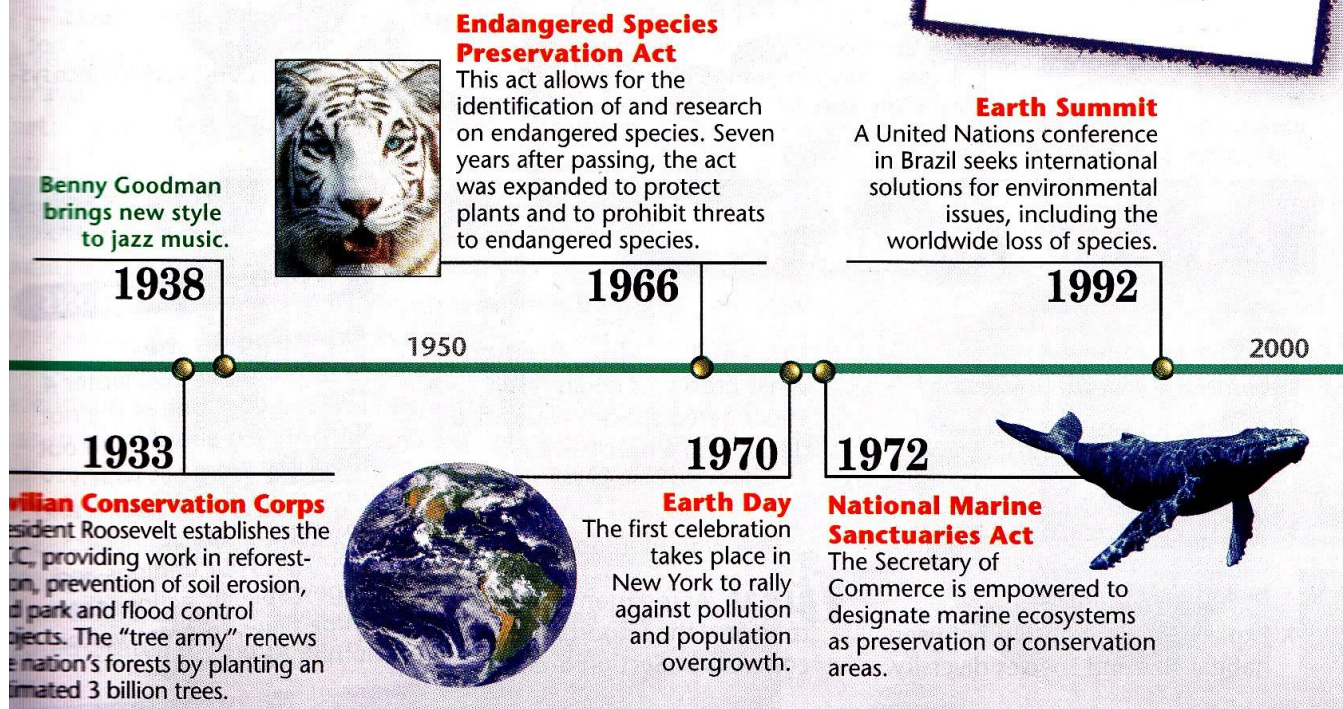
**Challenges in Conservation** Sometimes, the need to protect biodiversity is greatest in countries that are least able to do so. The destruction of tropical rain forests, for example, is the single greatest threat to biodiversity on land. Most rain forests are located in developing countries, where conservation goals must be weighed against the survival needs of the human population.

Protecting species and ecosystem diversity in many places around the world is an enormous challenge. As part of the effort to locate problem areas and set up a list of priorities, conservation biologists often identify "hot spots," 25 of which are shown in **Figure 6-18** on page 156. Each hot spot is a place where significant numbers of habitats and species are in immediate danger of extinction as a result of human activity. The hot-spot strategy may help scientists and governments to focus their efforts to make and enforce laws that protect habitats and prevent or regulate hunting.

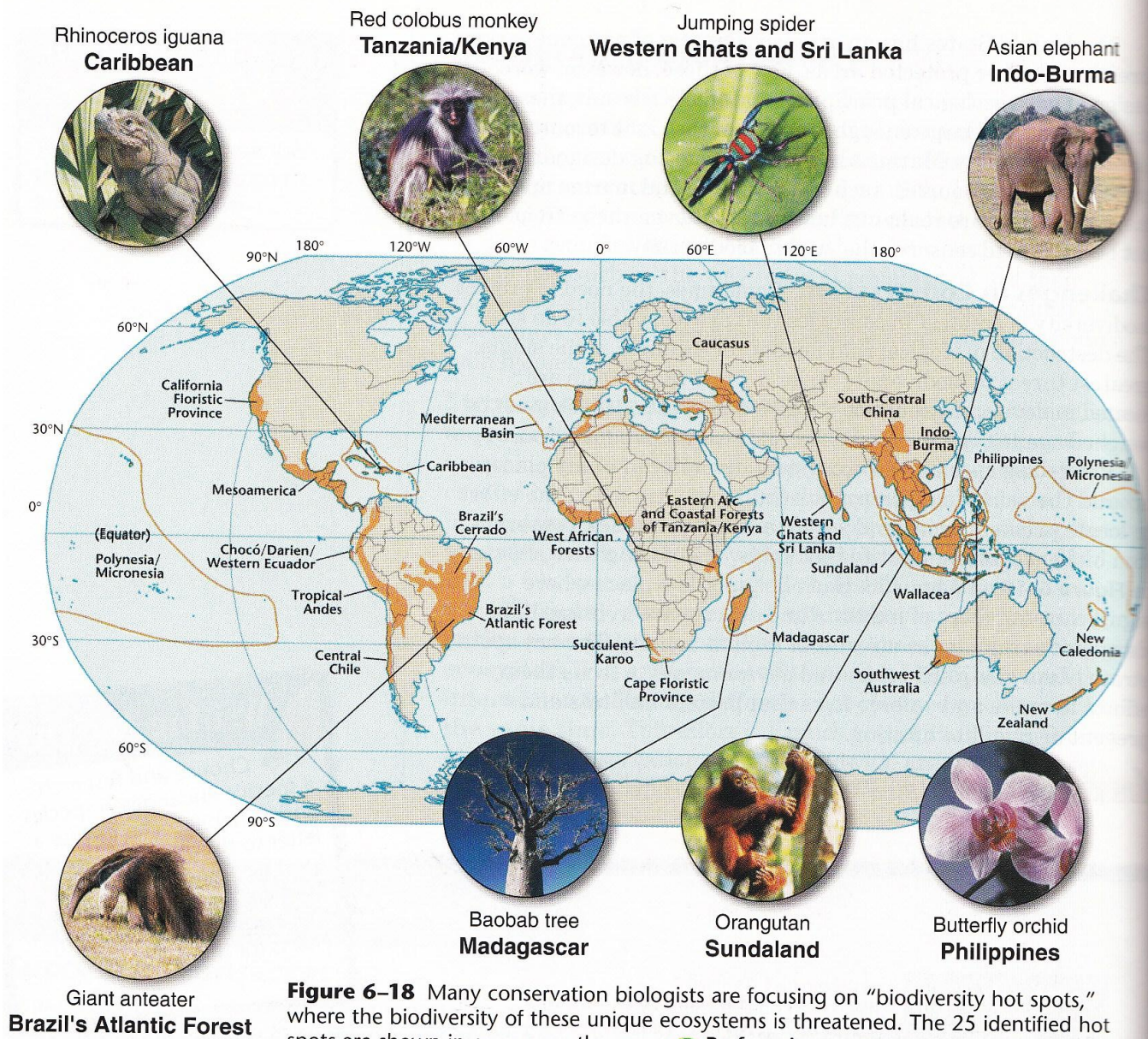
**CHECKPOINT** What do conservation biologists mean by a "hot spot"?

**Writing Activity**

Choose and research a specific endangered species and its habitat. Then, write a letter to the editor of your local newspaper stating the problem and offering one or more possible conservation efforts for that species.







**Figure 6-18** Many conservation biologists are focusing on “biodiversity hot spots,” where the biodiversity of these unique ecosystems is threatened. The 25 identified hot spots are shown in orange on the map. By focusing on protecting specific ecosystems, biologists hope to preserve global biodiversity.

## 6-3 Section Assessment

- Key Concept** Why is biodiversity worth preserving?
- Key Concept** List four different ways in which humans are decreasing biodiversity.
- Key Concept** What is the current focus of conservation biologists worldwide?
- Explain the relationship between habitat size and species diversity.

- Critical Thinking Predicting** What problems could result if an endangered species were introduced into a nonnative habitat?

**iTEXT Assessment** Use iText to review the important concepts in Section 6-3.

### MAKING CONNECTIONS

#### Exploring Biomes

Review biomes in Chapter 4. Then, choose one of the hot spots shown above. Find out about the biome in which these unique ecosystems and endangered species occur. Report on your findings and suggest specific actions that can be taken to preserve the biome's biodiversity.