

Protecting Biodiversity

? **Guiding Question:** How can we protect and preserve biodiversity?

Knowledge and Skills

- Explain legal actions nations can take to protect biodiversity.
- Explain the goal of Species Survival Plans.
- Describe three strategies for managing whole ecosystems and habitats.

Reading Strategy and Vocabulary

✓ Reading Strategy Before you read, set up a T-chart. Label the left column “Ways to Protect Biodiversity” and the right column “Details.” As you read, fill in both columns. You may choose to use the blue headings to fill in the left column.

Vocabulary Endangered Species Act (ESA), captive breeding, Species Survival Plan (SSP), biodiversity hotspot, endemic



7.3 LESSON PLAN PREVIEW

Differentiated Instruction Struggling students organize and compare legal efforts to protect biodiversity.

Real World Students discuss whether cloning can save endangered species.

Inquiry Students research and create a poster on one of Earth's biodiversity hotspots.

7.3 RESOURCES

In Your Neighborhood Activity, *Endangered Species* • Bellringer Video, *Belize's Safe Haven for Animals* • Real Data Online • Real Data Math Worksheet • Lesson 7.3 Worksheets • Lesson 7.3 Assessment • Chapter 7 Overview Presentation

FOCUS Watch the ABC News video *Belize's Safe Haven for Animals*, which describes one woman's efforts to protect animals in Belize. Use the video to launch a discussion about actions that can help protect biodiversity.

TODAY, MORE AND MORE SCIENTISTS and citizens see a need to do something about the loss of biodiversity. In his 1994 autobiography, *Naturalist*, E. O. Wilson writes: “When the [20th] century began, people still thought of the planet as infinite in its bounty. The highest mountains were still unclimbed, the ocean depths never visited, and vast wildernesses stretched across the equatorial continents.” But, since then, extinction rates have increased, and what was once seemingly endless wilderness is now threatened. So, Wilson writes, “Troubled by what we have wrought, we have begun to turn in our role from local conqueror to global steward.” Is Wilson right? Are we changing roles from conqueror to steward? And are we doing enough to protect remaining biodiversity?

Legal Efforts

🔑 Nations can pass laws and sign international treaties that protect biodiversity.

Biodiversity can be protected by law. In the United States, the major law that protects biodiversity is the **Endangered Species Act (ESA)**. Passed in 1973, the ESA has three major parts. First, it forbids the government and private citizens from harming listed endangered and threatened species or their habitats. Harmful actions could be direct, such as cutting down protected tree species, or indirect, like funding such a project. Second, the ESA forbids trade in products made from species that are on the list. Finally, it requires the U.S. Fish and Wildlife Service to maintain the official list of endangered and threatened organisms, and to develop recovery plans for each protected species. The goal of the law is to prevent extinctions by protecting at-risk species from natural or artificial threats, such as pollution, predation, disease, and habitat destruction. The hope is that with protection, declining populations can stabilize and eventually recover.



Reading Checkpoint

What does the Endangered Species Act do for protected species?



(a) Peregrine Falcon

FIGURE 12 Protection Under Law (a) The peregrine falcon (*Falco peregrinus*) owes its recovery to careful management under the ESA. (b) ESA protection for the northern spotted owl (*Strix occidentalis caurina*) caused some controversy in the Pacific Northwest when loggers lost their jobs.



(b) Spotted Owl

Benefits and Costs of the ESA The ESA has had a number of notable successes. For example, the peregrine falcon (Figure 12a), brown pelican, bald eagle, and other birds affected by the pesticide DDT are no longer listed as endangered. Other species, such as the red-cockaded woodpecker, are still endangered, but have stopped declining thanks to careful management under the ESA. In fact, roughly 40 percent of once-declining populations in the United States are now stable.

Polls repeatedly show that most Americans support the idea of protecting endangered species. However, some feel that species preservation under the ESA comes at too high a price. In the 1990s, part of the species recovery plan for the northern spotted owl (Figure 12b) in the Pacific Northwest, for example, protected large areas of old-growth forest. During the decline in timber harvesting that followed, many loggers lost their jobs. In addition, some landowners worry that use of their private land could be restricted if threatened or endangered species are found on it. Supporters, however, point out that parts of the ESA promote cooperation and trade-offs with landowners and developers.

International Cooperation At the international level, the United Nations has facilitated several treaties to protect biodiversity. A treaty is an agreement under international law. When nations ratify a treaty, they promise to uphold the laws that are described. One important biodiversity treaty is the 1975 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES protects endangered species by banning the international transport of their body parts. When enforced by the 175 member nations, CITES can protect tigers and other rare species whose body parts are traded internationally.

In 1992, leaders of many nations met in Rio de Janeiro, Brazil, and agreed to the Convention on Biological Diversity, sometimes called the biodiversity treaty. The treaty has three goals: to conserve biodiversity, to use biodiversity in a sustainable manner, and to ensure the fair distribution of biodiversity's benefits. The treaty has already had many accomplishments. It has helped increase global markets for "shade-grown" coffee and other crops grown without removing forests, for example. As of 2009, close to 200 nations have joined the Convention on Biological Diversity. The United States has signed the treaty, but has not ratified it, meaning that the treaty is not yet enforced by U.S. law.

BIG QUESTION

Why is it important to protect biodiversity?

Explanation Have students work in teams to form opinions on the importance of international cooperation in the protection of biodiversity. Have each team write a statement summarizing their opinion, and have team members verbally support and justify their team's opinion using information from the chapter.

ANSWERS

Reading Checkpoint The ESA forbids people and governments from harming listed species, and selling anything made from listed species. It also requires the U.S. Fish and Wildlife Service to maintain the list and come up with recovery plans for each protected species.

Make A Difference Answers will vary.



MAKE A DIFFERENCE

Do you think the United States should ratify the biodiversity treaty? Write a letter to your state or federal legislator explaining why you think it is or is not important that the United States enforce the regulations of the treaty.

Single-Species Approaches

 Species Survival Plans manage, protect, and reintroduce threatened and endangered species.

Conservation biologists use field data, lab data, theory, and experiments to study the effects of people on other organisms. In protecting biodiversity, conservation programs can target specific, single species, or can try to protect whole habitats and ecosystems. Captive breeding and cloning are examples of single-species approaches.

ANSWERS

Real Data

1. By about 400%
2. About 500
3. They are offspring of the captive tamarins that were reintroduced.
4. Answers will vary.

Reading Checkpoint An endemic species is one that is found only in one particular place.

Captive Breeding Programs In the effort to save threatened and endangered species, zoos and botanical gardens have become centers for captive breeding.

Captive breeding is the process of breeding and raising organisms in controlled conditions. In modern zoos and aquariums, captive breeding is part of an overall program to protect the species called a **Species Survival Plan (SSP)**.



Golden Lion Tamarin

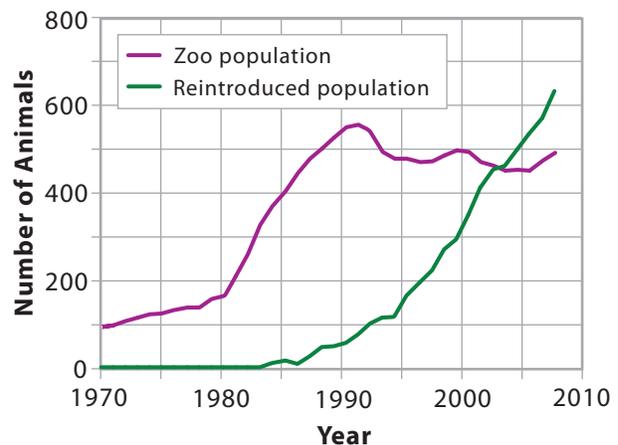
Real Data

Golden Lion Tamarin

Species Survival Plans, or SSPs, are efforts to protect and manage captive populations of specific organisms. These plans are coordinated by zoos and aquariums with the ultimate goal of reintroducing healthy individuals to the wild. Since the early 1980s, Dr. Jonathan Ballou at the Smithsonian Institution's National Zoo in Washington, D.C., has been tracking and managing the captive population of golden lion tamarins around the world. Some of his data are shown at right.

1. **Calculate** By approximately what percent has the zoo population of tamarins in this SSP increased since 1970?
2. **Analyze Data** Reintroduction typically begins once a captive population has reached a certain "target size." Based on the graph, what is the approximate target captive population size for the golden lion tamarin?
3. **Infer** According to Dr. Ballou's data, 153 golden lion tamarins have been reintroduced to the wild from captivity. However, according to the graph, the reintroduced population includes about 650 individuals. Where did the other 497 tamarins come from?

Recovery and Reintroduction of the Golden Lion Tamarin



Source: J. D. Ballou and J. Mickelberg, *International Studbook for Golden Lion Tamarins* (Washington, D.C.: National Zoological Park, Smithsonian Institution, 2007). B. Holst et al., *Lion Tamarin Population and Habitat Viability Assessment Workshop 2005, Final Report* (Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group, 2006).

4. **Form an Opinion** Do you think it is ever okay to remove animals from the wild and bring them into captivity? Why or why not?

In North America, the Association of Zoos and Aquariums (AZA) currently oversees SSPs for more than 180 species. Captive breeding as part of an SSP is carefully managed to ensure the greatest possible genetic diversity. One goal of SSPs is for captive-bred organisms to be reintroduced into the wild. SSPs also involve education, outreach, and research.

One example of a successful SSP is the program to save the golden lion tamarin (*Leontopithecus rosalia*). Golden lion tamarins are primates native to the coastal forests of Brazil. By the early 1970s, habitat fragmentation had caused a dramatic population decline—only 200 or so were left in the wild. The SSP for golden lion tamarins started with just 91 individuals in 26 zoos. As of 2007, there were nearly 500 golden lion tamarins in 145 participating zoos worldwide. And best of all, more than 150 tamarins cared for in captivity have been reintroduced to the wild.

Cloning The newest idea for saving species from extinction is to make more individuals through cloning. In this technique, DNA from an endangered species is inserted into a cultured egg cell that has had its nucleus removed. The egg is then implanted into a closely related species that can act as a surrogate mother. Even if cloning can succeed from a technical standpoint, most biologists agree that cloning won't really help prevent biodiversity loss. Without ample habitat and protection in the wild, most scientists think having cloned animals in a zoo does little good.

Ecosystem and Habitat Approaches

 Strategies that manage whole ecosystems and habitats, such as the hotspot approach, conservation concessions, and wildlife corridors, protect many species at once.

Most laws, including the Endangered Species Act, do not specifically provide protection for whole habitats and ecosystems, only individual species. However, many conservation biologists recognize the need to move beyond single-species approaches.

Biodiversity Hotspots One effort oriented around geographic regions, rather than single species, is the mapping of biodiversity hotspots. A **biodiversity hotspot** is an area that both supports an especially high number of endemic species and is rapidly losing biodiversity. A species is **endemic** to an area if it is found nowhere else in the world. To qualify as a hotspot, a location must harbor at least 1500 endemic plant species, or 0.5% of the world total. In addition, a hotspot must have already lost 70% of its habitat as a result of human actions and be in danger of losing more. Hotspots are seen as areas critical to global biodiversity.



What is an endemic species?

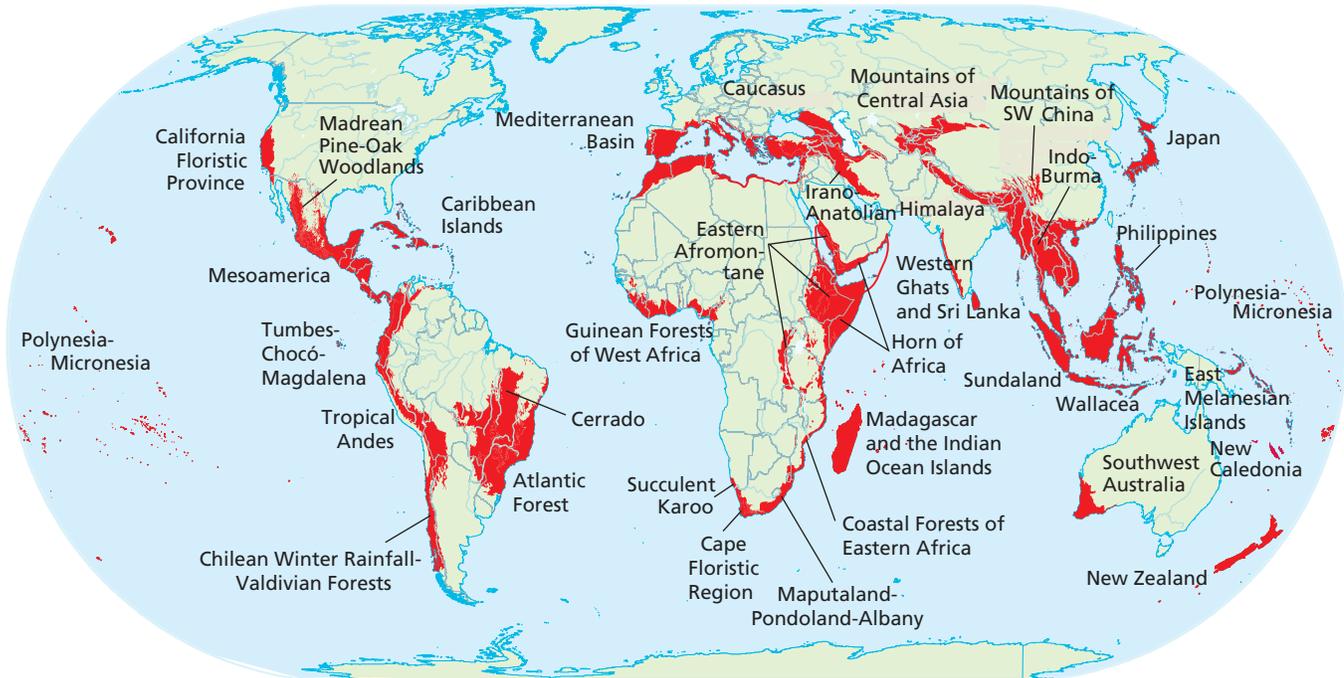


FIGURE 13 Endemic Species This enormous tree is a coastal redwood (*Sequoia sempervirens*), a species found only in a thin strip of land from central California to Oregon. It is one of the species endemic to the biodiversity hotspot known as the California Floristic Province.

FIGURE 14 Biodiversity

Hotspots Some areas of the world possess exceptionally high numbers of species found nowhere else. Many conservation biologists have supported prioritizing habitat preservation in these areas, called biodiversity hotspots. Shown in red are the 34 biodiversity hotspots mapped by Conservation International.

The nonprofit group Conservation International maintains a list of 34 biodiversity hotspots, shown in **Figure 14**. Together, these areas once covered 15.7% of the planet's land surface. Today, however, they cover only 2.3%. This small amount of land is the exclusive home for 50% of the world's plant species and 42% of all terrestrial vertebrate species. The hotspot concept helps conservation biologists focus on these areas, where the greatest number of unique species can be protected with the least amount of effort.



Adapted from *Hotspot map*, Conservation International, 2005.

Economic Approaches Many of today's conservation efforts attempt to protect not only land and wildlife, but the economic interests of the local people as well. Wisconsin-based Community Conservation, for example, has set up a number of community-based conservation projects in the small Central American nation of Belize. These projects not only protect wildlife, but also bring in money from researchers and ecotourists.

A more direct economic approach is the *debt-for-nature swap*. Here, a conservation organization raises money and offers to pay off a portion of a developing nation's international debt in exchange for a promise by the nation to set aside reserves, fund environmental education, and better manage protected areas.

A newer economic strategy that Conservation International has pioneered is called the *conservation concession*. Governments often sell concessions, or rights, to corporations allowing them to extract resources. A nation can, for example, earn money by selling the right to log its forests. Conservation International has started paying countries for the right to conserve its resources, not extract them. The South American nation of Suriname, which has extensive areas of untouched rain forest, entered into such an agreement. As a result, Suriname has made about \$15 million and logging in the rain forest has been significantly reduced.

ANSWERS

Reading Checkpoint Conservation groups pay nations to conserve resources, rather than extract and sell them.



Reading Checkpoint

How do conservation concessions work?



FIGURE 15 Safe Passage The southern cassowary (left) is a large flightless bird closely related to the emu and ostrich. Only 1200–1500 individuals remain in Australia. Conservation biologists hope that when completed, the corridor (right) will enable isolated cassowary populations to interbreed. Above, volunteers are planting trees that will form part of the corridor.



Wildlife Corridors Recall that population sizes often decline when habitat is fragmented. One way to increase fragment size is to establish *wildlife corridors* that connect habitat fragments. A major benefit of wildlife corridors is that they enable once-isolated populations of organisms to interbreed, thus increasing genetic diversity.

There are currently several corridor initiatives at work in Southeast Asia to help rejoin fragments of tiger habitat. The most ambitious is a proposal made in 2008, by the Wildlife Conservation Society and the Panthera Foundation. They hope to someday establish an 8000-km (5000-mi)-long corridor across eight southeast Asian countries. The Australian Rainforest Foundation is in the midst of a similar project called “Operation Big Bird.” The foundation is building a 250-km (150-mi)-long corridor of rainforest habitat for the endangered southern cassowary (*Casuaris casuaris*). With luck, the corridor will help the declining population of this unusual “big bird” to recover.

ANSWERS

Lesson 3 Assessment

1. **Benefits:** protects endangered species and prevents extinctions; **costs:** creates barriers to land development and can cost jobs
2. The captive population has increased and more than 150 golden lion tamarins have been reintroduced to the wild.
3. Each deals with protection of whole habitats and ecosystems.
4. Answers will vary.

LESSON 3 Assessment

1. **Explain** What are the major benefits and costs of the Endangered Species Act?
2. **Apply Concepts** In what ways has the golden lion tamarin SSP been successful?
3. **Compare** What do the hotspot mapping project, conservation concession programs, and wildlife corridors have in common?
4. **Explore the BIGQUESTION** What are some of the advantages to focusing on the conservation of a single species versus trying to conserve ecosystems or habitats? What might be some of the disadvantages? Which do you think is the better approach, or should we use both?