Conserving Life

section 9 Biodiversity

LE 5.1a Animals and plants have a great variety of body plans and internal structures that contribute to their ability to maintain a balanced condition.

7.2d Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Also covered: LE 3.1b, 3.2b, 5.1b, 7.1a, 7.1b, 7.2c

Before You Read

On the lines below, explain what happened to the dinosaurs. Tell why you think it happened.

Read to Learn

The Variety of Life

When you walk through a forest, you see different kinds of trees, shrubs, and animals. Hundreds of species live in the forest. When you walk through a wheat field, you see wheat plants, insects, and weeds. Only a few species live in the wheat field. The forest has a higher biodiversity than the wheat field. Biodiversity refers to the variety of life in an ecosystem.

How is biodiversity measured?

The common measure of biodiversity is the number of species that live in an area. For example, a coral reef can be home to thousands of species including corals, fish, algae, sponges, crabs, and worms. The biodiversity of a coral reef is greater than that of the shallow waters around it.

Scientists once thought that the biodiversity of dark, deep-sea waters was low. Deep-sea exploration has helped scientists discover that species biodiversity is great.

What explains differences in biodiversity?

Biodiversity tends to increase the closer you move toward the equator, where temperatures tend to be warmer. Ecosystems that have the highest biodiversity are usually located in warm, moist climates. The tropical regions of the world are home to two-thirds of Earth's land species.
**Why is biodiversity important?**

Biodiversity is important for many reasons. It provides people with food, medicines, building products, and fiber for clothing. Every species on Earth plays a certain role in the cycling of matter. As a result of biodiversity, soils are richer, pollutants break down, and climates are stable.

**Why do humans need biodiversity?**

Eating a variety of foods is a good way for people to stay healthy. Hundreds of species help feed the human population all around the world.

Biodiversity can help improve food crops. Crossbreeding food crops with wild species helps develop plant strains that are resistant to many diseases. In the 1970s, American farmers began using a new strain of crossbred corn that resists fungal disease.

Most medicines used today originally came from wild plants. Scientists are still discovering new species. The next plant species discovered could be the cure for cancer.

Biodiversity strengthens an ecosystem. For example, if a disease infects a grapevine in a vineyard, it can easily move from one plant to the next because vines grow close together. Soon, the whole vineyard can become infected with the disease. Farmers may plant one row of grapevines and the next row of another crop. By alternating rows, farmers may help prevent a disease from spreading.

**Why is stability important to biodiversity?**

If one type of plant in a forest disappears, the forest still exists. Imagine that a forest had only one plant species, one herbivore species that ate the plant, and one carnivore species that ate the herbivore. What would happen if the plant species died out? Biodiversity helps keep the stability of an ecosystem.

**What changes biodiversity?**

About 100 years ago, passenger pigeons flew across North America. Today, however, the passenger pigeon is extinct. An **extinct species** is a species that was once present on Earth but has died out. 😐

Extinction is a normal part of nature. Fossil records show that many species have become extinct since life appeared on Earth. Species can become extinct because of competition from other species. They can become extinct because of changes in the environment.
Mass Extinction  A mass extinction happens when a disaster causes many species to die out. One occurred on Earth about 65 million years ago. That extinction, shown on the graph below, occurred in the Mesozoic Era. It wiped out almost two-thirds of all species living on Earth at that time, including dinosaurs.

This extinction might have happened because a huge meteorite crashed into Earth’s surface. The impact may have caused dust to block sunlight from reaching Earth’s surface leading to climate changes that many species could not survive. After a mass extinction, new species eventually appear. After the dinosaurs disappeared, many new species of mammals appeared on Earth.

![Mass Extinctions in Earth's History](image)

**What causes species to die out?**

Humans did not have anything to do with the dinosaurs becoming extinct. Today, however, human activities probably contribute to the extinction of many species. The rate of extinctions appears to be rising. About 40 species of plants and animals in the United States became extinct between 1980 and 2000. Hundreds of tropical species became extinct during that same period of time. As the human population increases, more species could be lost.

**What are endangered species?**

To prevent species from becoming extinct, it is important to know which species could soon disappear. A species in danger of becoming extinct is an endangered species.
Human Impact The Florida panther is the most endangered species in the world. This species originally lived in all parts of Florida, as far west as Louisiana, and as far north as Tennessee. Now they are only found in a small part of southwest Florida, as shown on the map below. Human actions have led to the decline in the Florida panther population. Much of their habitat has been lost as cities have expanded to fill the land. Pollutants have entered their food chain and diseases have greatly reduced their numbers. Now, only a small breeding population exists in national and state parks.

Present Range of the Florida Panther

What are threatened species?
Species that are likely to become endangered in the near future are threatened species. The Godfrey’s butterwort is a species of carnivorous plant. It can be found near the Gulf coast between Tallahassee and Panama City. The plant already had a limited range. Now, the pine grown for logging has blocked the sunlight from these plants. This has reduced their population even more.

What causes habitat loss?
When people change an ecosystem, such as replacing a forest with a parking lot, the habitats of many species that lived in the forest may become smaller or disappear. Biodiversity can be reduced if many species lose their habitats.

The loss of habitat is a major reason why many species become endangered, threatened, or extinct. For example, the Key Largo cotton mouse lived on all the northern Florida Keys. The keys have become popular tourist destinations. The increase in buildings and people has led to a decrease in habitat available for the Key Largo cotton mouse.
Protecting Habitats The Key Largo cotton mouse has become a threatened species because of habitat loss. At first, scientists tried to introduce the Key Largo cotton mouse to a new habitat in the Keys. This effort did not succeed. A new strategy limits building in North Key Largo's forests.

How can a divided habitat reduce biodiversity?
Biodiversity can be reduced when a habitat is divided by roads, cities, or farms. Small areas of habitat usually have less biodiversity than large areas of habitat. Divided habitats are a problem for large animals that need large hunting territories. If their habitats are divided, the animals are forced to move somewhere else.

Small habitat areas make it difficult for species to recover from a disaster. If a fire destroys a small part of a forest, the salamanders living in that part are destroyed. After new trees have grown in that part of the forest, salamanders from the part of the forest that was not damaged move in to replace those that had died. However, if a fire destroys a grove of trees surrounded by paved parking lots, salamanders might never return. No salamanders live nearby to move into the area.

How can introduced species affect ecosystems?
An introduced species is a species that moves into an ecosystem as a result of human actions. These species usually have no predators or competitors in the new area, so the population of this species grows quickly. Introduced species can crowd out native species. Native species are the original organisms in an ecosystem.

In the early 1900s, much of southern Florida was swampland. People wanted to drain the swamps and build on the land. They brought the melaleuca tree from Australia to “dry up” the swamps. The trees quickly took over. Native species died, and animals that ate those native species lost their food source. The trees have reduced biodiversity in southern Florida.

Pollution
Pollution of land, water, or air also affects biodiversity. Soil that is contaminated with chemicals or other pollutants can harm plants or limit their growth. Plants provide habitats for many species. Any change in plant growth can limit biodiversity.
What causes water pollution?
Pollutants that contaminate the water harm organisms that live in the water. These pollutants come from factories, ships, or runoff from lawns and farms. The pollutants can kill aquatic plants, fish, insects, and the organisms they depend on for food.

What causes air pollution?
A form of water pollution known as acid rain is caused by air pollution. Acid rain forms when sulfur dioxide and nitrogen oxide released by industries and automobiles combine with water vapor in the air. Acid rain damages trees. It washes away calcium and other nutrients from the soil, making the soil less fertile. Acid rain also harms fish and other organisms that live in lakes and streams. Acid rain makes the water too acidic for many species of fish.

Air pollution from factories, power plants, and automobiles can harm tissues of many organisms. Air pollution can damage the leaves or needles of some trees. This can weaken the trees and make them less able to survive diseases or environmental disasters such as drought or flooding.

What is global warming?
Carbon dioxide (CO₂) is released into the air when wood, coal, gas, or any other fuel is burned. Humans burn large amounts of fuel. This contributes to an increase in the percentage of CO₂ in the atmosphere. An increase in CO₂ may raise Earth’s average temperature. This rise in temperature, called global warming, can lead to changes in climate that could affect biodiversity.

What is ozone depletion?
The ozone layer is the part of the atmosphere that is made up of ozone gas. It is about 15 km to 30 km above Earth’s surface. The ozone layer protects life on Earth by preventing damaging amounts of the Sun’s ultraviolet (UV) radiation from reaching Earth’s surface.

The ozone layer is becoming thinner. This thinning is called ozone depletion. The thinning ozone layer allows more of the UV radiation that can harm organisms to reach Earth’s surface. Increased amounts of UV radiation can lead to more cases of skin cancer in humans.
After You Read

Mini Glossary

**acid rain**: results when sulfur dioxide and nitrogen oxide released by industries and automobiles combine with water vapor in the air

**biodiversity**: the variety of life in an ecosystem

**endangered species**: species that is in danger of becoming extinct

**extinct species**: species that was once present on Earth but has died out

**introduced species**: species that moves into an ecosystem as a result of human actions

**native species**: the original organisms in an ecosystem

**ozone depletion**: the thinning of the ozone layer

**threatened species**: species that is likely to become endangered in the near future

1. Review the terms and their definitions in the Mini Glossary. Write a sentence that explains the difference between introduced species and native species.

2. Complete this diagram by listing three things that reduce biodiversity.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Biodiversity is reduced.</td>
</tr>
</tbody>
</table>

3. How did highlighting the main idea and circling supporting details help you remember what you read about biodiversity?

ScienceOnline Visit glencoe.com to access your textbook, interactive games, and projects to help you learn more about biodiversity.

End of Section
Conserving Life

section 9 Conservation Biology

LE 7.2d Since the Industrial Revolution, human activities have resulted in major pollution of air, water, and soil. Pollution has cumulative ecological effects such as acid rain, global warming, or ozone depletion. The survival of living things on our planet depends on the conservation and protection of Earth’s resources.

Also covered: LE 3.2b, 7.1b, 7.1e, 7.2c

What You’ll Learn

- the goals of conservation biology
- ways to prevent the extinction of species
- how an endangered species can be reintroduced into its original habitat

● Before You Read

On the lines below, tell why you think zoos exist.

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● Read to Learn

Protecting Biodiversity

The study of methods for protecting biodiversity is called conservation biology. Conservation biologists develop strategies to stop the continuing loss of members of a species. Their strategies are based on the principles of ecology. Because human activities have much to do with this loss, the strategies have to consider the needs of the human population. However, because the needs of humans and other species are often different, it is difficult to make conservation plans to satisfy all needs.

Conservation Biology at Work

Most conservation plans have two goals. One goal is to protect the species from harm. The other goal is to protect the species’ habitats.

How can laws protect a species?

Laws can be passed to protect both the species and its habitat. One such law is the U.S. Endangered Species Act of 1973. This law makes it illegal to harm, collect, harass, or disturb the habitat of any species on the endangered or threatened species lists. The law also prevents the U.S. government from spending money on projects that might harm these species or their habitats.
**Enforcement**  The U.S. Endangered Species Act is enforced by the United States Fish and Wildlife Service. The Florida Department of Environmental Protection enforces the law in Florida. The Act has helped several species come back from near extinction.

**What is CITES?**
The United States works with other countries to protect endangered or threatened species. In 1975, The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was set up. One of its goals is to protect certain species by controlling international trade in these species or any part of the species, such as elephant ivory tusks. Under this agreement about 5,000 animal species and 25,000 plant species are protected.

**How are habitats being protected?**
A species that is protected by law cannot survive unless its habitat also is protected. Conservation biology works to protect habitats. One way is to set up nature preserves. Nature preserves include national parks and protected wildlife areas.

**Protecting the Florida Everglades**  For many years, a group of conservationists worked hard to find ways to protect the Florida Everglades. In 1947, President Harry S Truman dedicated the Everglades National Park. It was the first national park set aside for biological reasons. Without national parks and wildlife areas, some animals would be closer to extinction. Visitors to the Everglades National Park can view a mix of tropical and temperate species. Its rare mix of freshwater and saltwater habitats are now protected by law.

**What is the purpose of wildlife corridors?**
Some large-animal species, such as the Florida panther, need large amounts of land to survive. However, it is not always possible to create large nature preserves. One way to solve this land problem is to link smaller parks together with wildlife corridors.

Wildlife corridors are part of a strategy for saving the endangered Florida panther. A male panther needs a territory of at least 712 km². This area is larger than many of the protected panther habitats. Wildlife corridors allow panthers to move from one preserve to another without crossing roads or entering areas where humans live.
How are habitats being restored?
Habitats that have been harmed by human activities can be restored. **Habitat restoration** is the process of taking action to bring a damaged habitat back to a healthy condition. Project Greenshores, shown below, began in 2001 as a habitat restoration effort. Its goal is to return an oyster reef and salt marsh to the Pensacola Bay ecosystem. Workers placed 20,000 tons of recycled concrete and limestone rock in the salt marsh off the coast. The materials formed a man-made reef, which protects aquatic plants from the waves and gives oysters a habitat. The reef also provides a place for bird and marine wildlife.

Project Greenshores is managed by the Florida Department of Environmental Protection. Students and volunteers have been important to the success of the project.

![Project Greenshores](image)

What is the purpose of wildlife management?
Wildlife parks and preserves do not automatically protect species living there from harm. People are needed to manage the areas. For example, in South Africa, guards patrol wildlife parks to prevent poachers from killing elephants for their ivory tusks. Some wildlife preserves do not allow visitors other than biologists who are studying the area.

Wildlife managers and hunters often work together to protect certain animal species. People usually are not allowed to hunt or fish in a park unless they buy a license. The sale of licenses provides money for taking care of the wildlife area. It also helps prevent overhunting. Licenses usually limit the number of animals a hunter is allowed. Hunting rules also can help prevent a population from becoming too large for an area.
How can keeping animals in captivity preserve biodiversity?

Sometimes endangered or threatened animals are placed in zoos. Often these animals are no longer found in the wild. A **captive population** is a population of organisms that is cared for by humans. Often, with human care, the numbers of the species increase.

Keeping endangered or threatened animals in captivity can help preserve biodiversity. However, it is not an ideal solution. Providing food, space, and care can be expensive. Sometimes captive animals lose their wild behaviors. If that happens, these animals might not survive if they are returned to their habitats.

**What is the purpose of reintroduction programs?**

Sometimes members of captive populations can be put back into the wild to help restore biodiversity. **Reintroduction programs** return captive organisms to an area where the species once lived. Once reintroduced, researchers may observe the animals from a distance. These programs can be successful only if the reasons that caused the species to become endangered are removed. Plants also can be reintroduced into their original habitats. Often this is done by replanting seedlings in the original habitats.

**How are seed banks used?**

Seed banks store the seeds of many endangered plants species. There are seed banks throughout the world. If a species becomes extinct in the wild, the stored seeds can be planted to reintroduce the plants to their original habitats.

**Why are some species relocated?**

Reintroduction programs do not always involve captive populations. The most successful reintroduction programs happen when wild organisms are moved to a suitable new habitat. The brown pelican relocation is an example of this.

The pelican was once common along the Gulf of Mexico. In the mid-1900s, a pesticide known as DDT ended up in the food that pelicans ate. Because of DDT, the pelican's eggshells became so thin that they broke before the chicks could hatch. Soon, pelicans disappeared from Louisiana and most of Texas. In 1971, pelicans were reintroduced to the area. By the year 2000, more than 7,000 brown pelicans lived in Louisiana and Texas. The United States banned the use of DDT in 1972.
**After You Read**

**Mini Glossary**

- **captive population:** a population of organisms that is cared for by humans
- **conservation biology:** the study of methods for protecting biodiversity
- **habitat restoration:** the process of taking action to bring a damaged habitat back to a healthy condition
- **reintroduction program:** a program that returns captive organisms to an area where the species once lived

1. Review the terms and their definitions in the Mini Glossary. Using two of the terms, write a sentence explaining what is being done to protect biodiversity.

2. Use the web diagram below to identify different strategies used to protect biodiversity.

![Diagram](image_url)