**Chapter 6 – Humans in the Biosphere**

**Section 1 – A Changing Landscape**

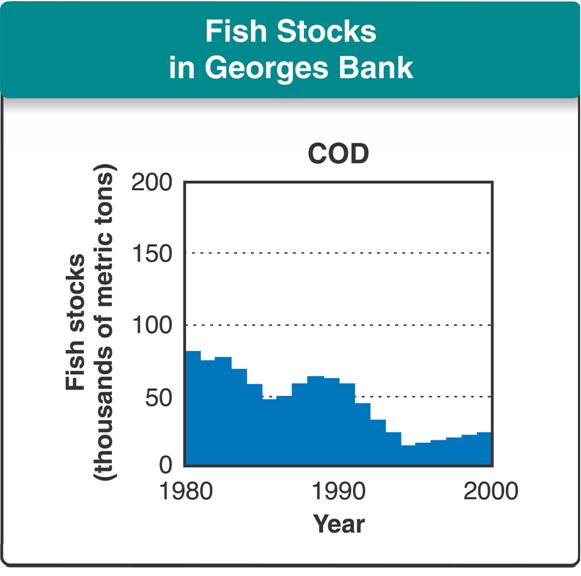
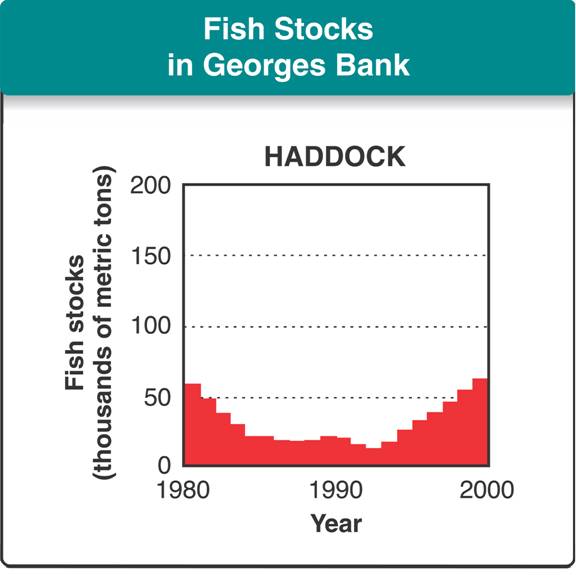
* Earth as an Island
  + All organisms on Earth share a limited \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ base and depend on it for their long-term survival.
  + To protect these resources, we need to understand how humans interact with the biosphere.
* What types of human activities can affect the biosphere?
* Human Activities
  + From the ecosystems in which they live, humans obtain such necessities as clean \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and recycled nutrients.
  + Ecologists refer to such necessities as “ecosystem goods and services” because they have value to individuals and societies.
* Some human activities that affect the biosphere include:
  + **hunting and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **agriculture**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **urban development**
* Hunting and Gathering
  + For most of history, humans obtained \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by hunting and gathering.
  + Today, groups of people in scattered parts of the world still follow the hunter-gatherer way of life.
* Agriculture
  + **Agriculture** is the practice of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. It includes the production of crops and the raising of livestock.
  + Agriculture provides human societies with a dependable supply of food that can be produced in large quantity and stored for later use.
* From Traditional to Modern Agriculture
  + In the 1800s and 1900s, advances in science and technology set the stage for a remarkable change in agriculture.
    - Large-scale irrigation turned \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ into fertile farmlands.
    - New machinery helped farmers increase yields.
    - New varieties of crops produced higher yields.
    - Chemical \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ boosted plant growth.
    - Pesticides controlled crop-damaging \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + New crops were often grown using a practice called **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_,** in which large fields are planted with a single variety of crop year after year.
* The Green Revolution
  + The green revolution was an effort in the mid-twentieth century to increase global \_\_\_\_\_\_\_\_\_\_\_\_\_ production through modern plant breeding and agricultural techniques.
  + Over the last 50 years, the green revolution has helped world food production double.
* Challenges for the Future
  + While increasing world food supplies, modern agriculture has created ecological challenges. For example:
    - Monoculture leads to problems with insect pests and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - Finding enough \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for irrigation is difficult.
* Industrial Growth and Urban Development
  + Human society and its impact on the biosphere were transformed by the Industrial Revolution, which added machines and factories to civilization.
  + The energy to power machinery comes mostly from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fuels—coal, oil, and natural gas.
  + Industrial growth and urban development affect both the local and global environment.
  + Discarded industrial waste pollutes air, water, and soil.
  + Dense human communities also produce waste.
  + Suburban growth consumes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and stresses native plants and animals.

**Section 2 – Renewable and Nonrenewable Resources (Part 1)**

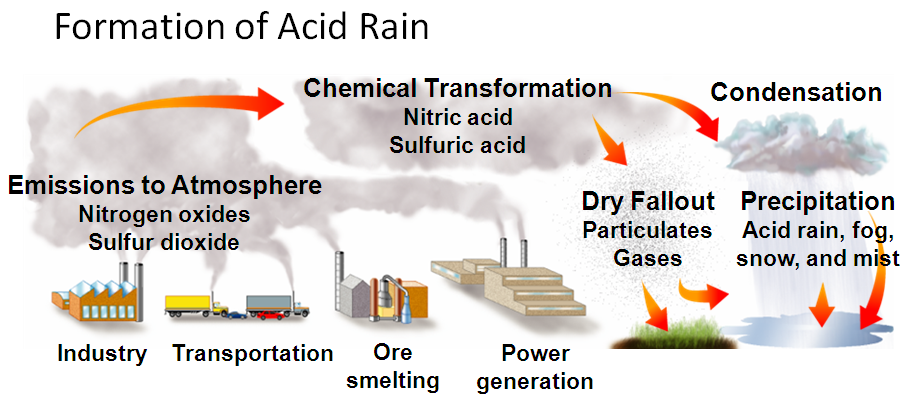
* Classifying Resources
  + Environmental goods and services may be classified as either renewable or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* **Renewable resources** can regenerate if they are ­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or can be replenished by biochemical cycles if they are nonliving.
  + A tree is an example of a renewable resource because a new tree can be planted in place of an old tree that dies or is \_\_\_\_\_\_\_\_\_\_\_\_ down.
* A **nonrenewable resource** is one that cannot be replenished by natural processes.
  + Fossil fuels such as coal, oil, and natural gas are nonrenewable resources. Once these fuels are depleted, they are gone \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* What effects do human activities have on natural resources?
  + Human activities can affect the quality and supply of renewable resources such as land, forests, fisheries, air, and fresh \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Sustainable Development
  + **Sustainable development** is a way of using natural resources without depleting them, and of providing for human needs without causing long-term environmental harm.
* Land Resources
  + Land provides space for \_\_\_\_\_\_\_\_\_\_\_\_\_\_ communities and raw materials for industry. Land also includes the soils in which crops are grown.
    - If managed properly, soil is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ resource.
  + Food crops grow best in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ soil—a mixture of sand, clay, rock particles, and humus (material from decayed organisms).
  + **Soil erosion** is the wearing away of surface soil by water and wind.
    - Plowing the land removes the roots that hold the soil in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and therefore increases the rate of soil erosion.
  + **Desertification** is the process by which productive areas are turned into \_\_\_\_\_\_\_\_\_\_\_\_.
    - Desertification is caused by a combination of farming, overgrazing, and drought.
  + A variety of sustainable-development practices can prevent problems such as soil erosion and desertification.
  + Sustainable-development practices include:
    - contour plowing—fields are plowed across the slope of the land to reduce erosion
    - leaving stems and roots of the previous year's crop in place to help hold the soil
    - planting a field with \_\_\_\_\_\_\_\_\_\_ rather than leaving it unprotected from erosion
* Forest Resources
  + Earth’s forests are an important resource for the products they provide and for the ecological functions they perform.
  + Forests:
    - provide wood for products and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - remove carbon dioxide and produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - store nutrients.
    - provide habitats and food for organisms.
    - moderate climate.
    - limit soil \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
    - protect freshwater supplies.
  + Whether a forest can be considered a renewable resource depends partly on the type of forest.
  + Temperate forests of the Northeast are renewable because they have been logged and have grown back naturally.
  + Old-growth forests, such as those in Alaska and the Pacific Northwest, are nonrenewable because it takes \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to produce them.
* Deforestation
  + Loss of forests, or deforestation, has several effects:
  + Erosion can wash away nutrients in the topsoil.
  + Grazing or plowing can permanently change local soils and microclimates, which prevents the regrowth of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Forest Management
  + Mature trees can be harvested selectively to promote the growth of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ trees and preserve the forest ecosystem.
  + Tree geneticists are breeding new, faster-growing trees that produce high-quality wood.

**Section2 – Renewable and Nonrenewable Resources (Part 2)**

* Fishery Resources
  + Fishes and other animals that live in water are a valuable source of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Overfishing
    - Overfishing, or harvesting fish faster than they can be replaced by reproduction, has greatly reduced the amount of fish in parts of the world’s oceans.
    - Until recently, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ seemed to be a renewable resource, but overfishing has limited that resource.
* Sustainable Development
  + The U.S. National Marine Fisheries Service has issued guidelines that specify how many fish, and of what size, can be caught in various parts of the oceans.
  + The regulations have helped fish populations \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



* Aquaculture
  + The raising of aquatic animals for human \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is called **aquaculture**, is also helping to sustain fish resources.
* Air Resources
  + The condition of the air affects people’s health.
  + **\_\_\_\_\_\_\_\_** is a mixture of chemicals that occurs as a gray-brown haze in the atmosphere.
  + Smog is:
    - due to automobile exhausts and industrial emissions.
    - considered a pollutant because it threatens people’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + A **pollutant** is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ material that can enter the biosphere through the land, air, or water.
    - The burning of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fuels can release pollutants that cause smog and other problems in the atmosphere.
  + Strict automobile emissions standards and clean-air regulations have improved air quality in many cities, but air pollution is still a problem.
  + Many combustion processes release nitrogen and sulfur compounds into the atmosphere.
  + These compounds combine with water vapor to form **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rain**.



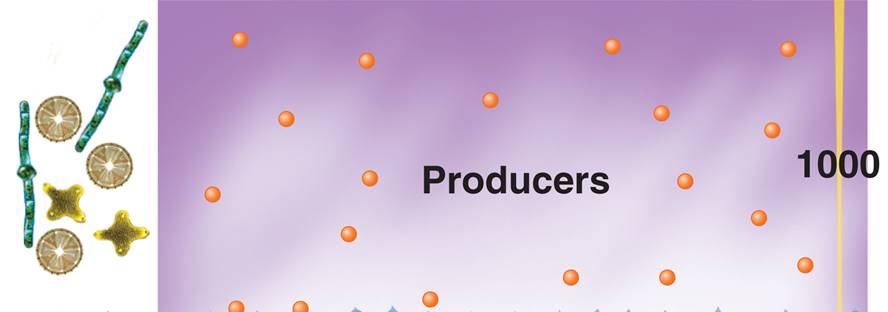
* Acid rain kills plants by damaging their leaves and changing the chemistry of soils and standing-water ecosystems.
* Acid rain may dissolve and releases \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ elements, such as mercury, from the soil, freeing the elements to enter other portions of the biosphere.
* Freshwater Resources
  + Americans use billions of liters of fresh water daily for everything from drinking and washing to watering crops and making steel.
  + Although water is a renewable resource, the total supply of fresh water is limited and is threatened by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Sources of pollution include:
    - improperly discarded chemicals that enter streams and rivers.
    - wastes discarded on land that seep through soil and enter underground water supplies.
    - domestic sewage containing compounds that encourage growth of algae and bacteria.
    - sewage containing microorganisms that spread \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Sustainable Use of Water
  + One way to ensure the sustainable use of water is to protect the natural systems involved in the water \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that help purify water.
  + These include:
    - wetlands
    - forests
    - other vegetation
  + Also, by conserving water in:
    - home
    - industry
    - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Section 3 – Biodiversity (Part 1)**

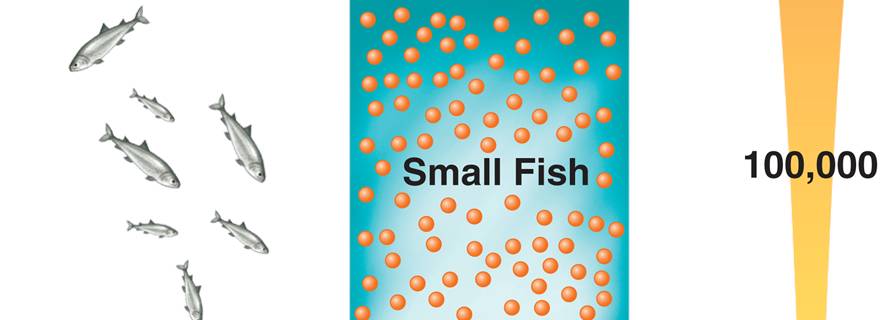
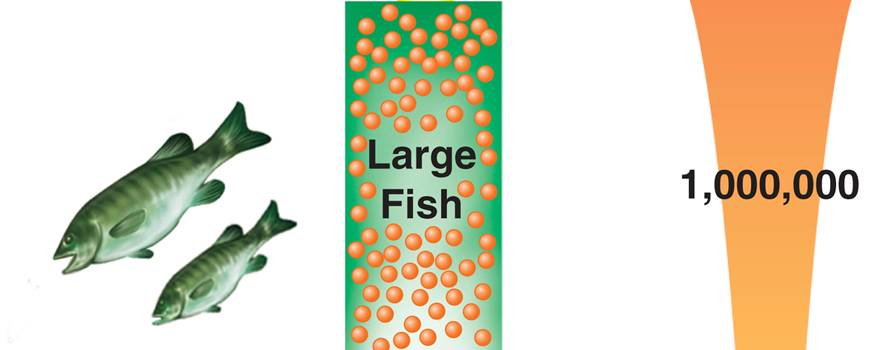
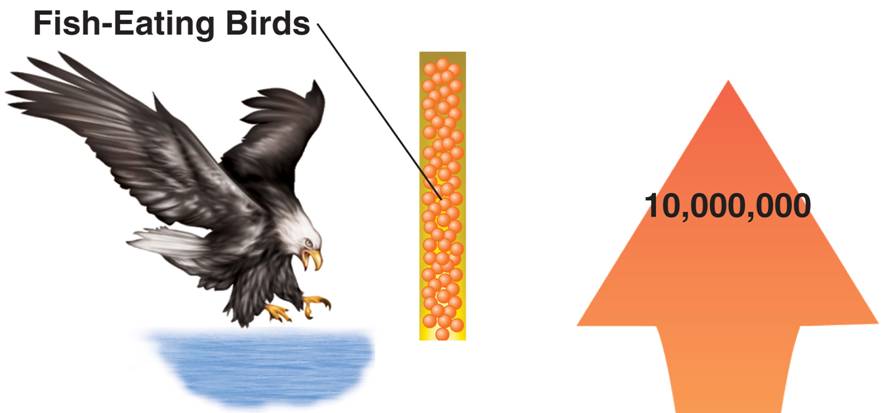
* The Value of Biodiversity
  + Biological diversity, or **biodiversity**, is the sum total of the genetically based variety of all organisms in the biosphere.
  + **Ecosystem diversity** includes the variety of habitats, communities, and ecological processes in the living world.
  + **Species diversity** is the number of different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the biosphere.
  + **Genetic diversity** is the sum total of all the different forms of genetic information carried by all organisms living on Earth today.
* Why is biodiversity important?
  + Biodiversity is one of Earth's greatest natural \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Species of many kinds have provided us with foods, industrial products, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—including painkillers, antibiotics, heart drugs, antidepressants, and anticancer drugs.
* What are the current threats to biodiversity?
* Threats to Biodiversity
* Human activity can reduce biodiversity by:
  + **altering habitats**
  + **hunting species to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **introducing toxic compounds into food \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **introducing foreign species to new environments**
  + **Extinction** occurs when a species \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 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 **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species**.
  + As the population of an endangered species declines, the species loses genetic diversity.
* Habitat Alteration
  + When land is developed, natural habitats may be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + Development often splits ecosystems into pieces, a process called **habitat fragmentation**.
  + The smaller a species’ habitat is, the more vulnerable the species is to further disturbance.
* Demand for Wildlife Products
  + Throughout history, humans have pushed some animal species to extinction by hunting them for food or other products.
  + Today, in the U.S., endangered species are protected from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + The Convention on International Trade in Endangered Species, CITES, bans international trade in products derived from endangered species.
* Pollution
  + Many forms of pollution can threaten biodiversity.
  + One of the most serious problems occurs when toxic compounds accumulate in the tissues of organisms.
  + DDT, one of the first \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is a good example of this.
  + For a long time DDT was considered harmless, and it drained into rivers and streams in low concentrations.
  + However, DDT has two hazardous properties:
  + It is **nonbiodegradable**, which means that it cannot be broken \_\_\_\_\_\_\_\_\_ by organisms.
  + Once DDT is picked up by organisms, it cannot be eliminated from their \_\_\_\_\_\_\_\_\_\_\_\_.

**Biodiversity (Part 2)**

* When DDT enters food webs, it undergoes biological magnfication.
  + In **biological magnification**, concentrations of a harmful substance increase in organisms at higher trophic levels in a food chain or food \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + In 1962, biologist Rachel Carson wrote *Silent Spring,* which alerted people to the dangers of biological magnification.



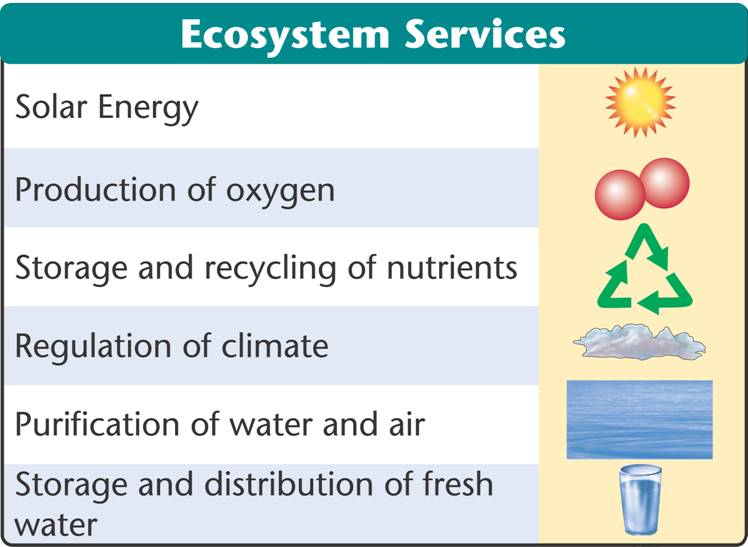


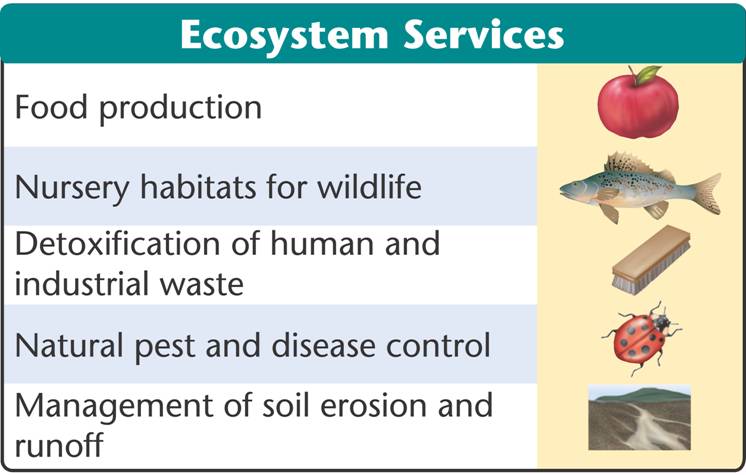


* The widespread use of DDT threatened populations of many animals—especially fish-eating birds like the bald \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—with extinction.
* By the early 1970s, DDT was banned in the U.S. and in most other industrialized countries; as a result, affected bird populations have recovered.
* Introduced Species
  + Another threat to biodiversity comes from plants and animals that humans transport around the world either accidentally or intentionally.
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ species** are introduced species that reproduce rapidly because their new habitat lacks the predators that would control their population.
  + Hundreds of invasive species—including zebra mussels in the Great Lakes and the leafy spurge across the Northern Great Plains—are already causing ecological problems in the United States.
* Conserving Biodiversity
  + Conservation is the wise management of natural resources, including the preservation of habitats and wildlife.
* Strategies for Conservation
  + Many conservation efforts are aimed at managing individual species to keep them from becoming \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* What is the goal of conservation biology?
  + 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.
* Conservation Challenges
  + Protecting resources for the future can require people to change the way they earn their living today.
  + Conservation regulations must be informed by solid research and must try to maximize benefits while minimizing economic costs.

**Section 4 – Charting a Course for the Future**

* What are two types of global change of concern to biologists?
* Researchers are gathering data to monitor and evaluate the effects of human activities on important systems in the biosphere. Two of these systems are:
  + the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ layer high in the atmosphere
  + the global climate system
* Ozone Depletion
  + Between 20 and 50 kilometers above Earth's surface, the atmosphere contains a relatively high concentration of ozone gas. This layer of the atmosphere is called the **ozone \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.
  + The ozone layer absorbs a good deal of harmful ultraviolet, or \_\_\_\_\_\_\_\_\_\_\_, radiation from sunlight before it reaches Earth's surface.
* Exposure to UV can:
  + cause \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + damage \_\_\_\_\_\_\_\_\_\_\_\_\_
  + decrease organisms' resistance to disease
  + damage plant leaf tissue and phytoplankton in the oceans
* Early Evidence
  + In the 1970s, scientists discovered a hole in the ozone layer over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
  + After it was first discovered, the ozone hole grew larger.
  + Since the ban, the level of CFCs in the atmosphere has decreased, indicating that the ban will have positive, long-term effects on the global environment.
  + Current data predict that the ozone holes should shrink and disappear within \_\_\_ years.
* Global Climate Change
  + All life on Earth depends on climate conditions such as temperature and rainfall.
  + Many ecologists are concerned about strong evidence that climate is changing.
  + Since the late 19th century, average temperatures have \_\_\_\_\_\_\_\_\_\_\_\_\_\_ about 0.6 Celsius degrees.
  + Data indicate that since 1980, average temperatures have risen between 0.2 and 0.3 Celsius degrees.
  + The term used to describe the increase in the average temperature of the biosphere is **global \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
  + One sign of global warming is melting polar ice.
* Evidence of Global Warming
  + The geological record shows that Earth’s climate has changed repeatedly during its history.
  + Researchers must determine whether the current warming trend is part of a larger, natural cycle of climate change, or whether it is caused by \_\_\_\_\_\_\_\_\_\_\_\_\_ activity.
  + A widely accepted hypothesis is that current warming is related, in part, to human activities that add carbon dioxide and other greenhouse gases to the atmosphere.
  + The burning of fossil fuels, along with the cutting and burning of forests, adds carbon \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to the atmosphere faster than the carbon cycle removes it.
  + Data show that concentrations of carbon dioxide in the atmosphere have been rising for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years.
  + As a result, the atmosphere’s natural greenhouse effect is intensified, causing the atmosphere to retain more heat.
* Possible Effects of Global Warming
  + Most recent computer models suggest that average global surface temperatures will increase by 1 to 2 Celsius degrees by the year 2050.
  + Sea levels may rise enough to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ coastal areas, affecting coastal ecosystems as well as human communities.
  + Parts of North America may experience more droughts during the summer growing season.
  + New organisms may be able to live in places where they once could not.
  + Other organisms may become threatened or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in areas where they once thrived.
* The Value of a Healthy Biosphere
  + Ecosystems provide many goods and services, such as water purification and waste recycling.
  + Ecosystems are also a reservoir of organisms that may one day provide humans with new \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and new crops.





* People can make wise choices in the use and conservation of resources.
  + Avoid using more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than necessary.
  + Plant trees to replace those that have been cut down.
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and reuse trash and other wastes.
  + Safely remove hazardous materials.