**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.