

# Chapter 6

# Humans in the Biosphere

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# Essential Question

**How have human activities shaped local and global ecology?**



**What is the relationship between  
resource use and sustainable  
development?**



# Humans in the Biosphere

Humans affect regional and global environments through agriculture, development, and industry in ways that have an impact on the quality of Earth's natural resources, including soil, water, and the atmosphere.



# Agriculture

- **Agriculture:** refers to the practice of farming
- **Monoculture:** a farming strategy in which large fields are cleared to plant a single highly productive crop, year after year.
  - Enables efficient sowing, tending, and harvesting of crops using machines
- **Green revolution:** the development of highly productive crop strains and the use of modern agricultural techniques to increase yields of food crops
  - Has provided many people with better nutrition



# 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
  - Example: the use of insects to control unwanted pests instead of insecticide



# Renewable and nonrenewable resources

- Environmental goods and services can be classified as either
  - a) renewable or b) non-renewable
- **A Renewable resource** can regenerate if they are alive or can be replenished by biochemical cycles if they are nonliving.
  - Example: A tree, wind energy
- **A nonrenewable resource** is one that cannot be replenished by natural processes.
  - example: Coal, oil



# Question and Answer

**What is the relationship between resource use and sustainable development?**





**Why is soil and water important  
and how do we protect it?**



# Soil Resources

- Healthy soil supports both agriculture and forestry
  - The mineral and nutrient-rich portion of soil is called **topsoil**
    - Good topsoil absorbs and retains moisture yet allows it to drain.
    - Good topsoil is produced by long-term interactions between soil and plants growing in it. It can take centuries to form.
    - Topsoil can be a renewable resource if managed properly, but it can be damaged or lost if mismanaged
    - Soil erosion and loss can be minimized through careful management of agriculture and forestry.



- **Desertification:** lower land productivity caused by over farming, over-grazing, seasonal drought, and climate change
- **Deforestation:** the destruction or loss of forests
  - Can result in severe erosion, loss of topsoil, and loss of biodiversity.



# Freshwater Resources

- Humans depend on fresh water and freshwater ecosystems for goods and services, including drinking water, industry, transportation, energy, and waste disposal.
- **Pollutant:** harmful material that can enter the biosphere through the land, air, or water.
  - Example: oil spills
  - The primary sources of water pollution are industrial and agricultural chemicals, residential sewage, and nonpoint sources.



# Biological Magnification

- **Biological magnification:** increasing concentration of a harmful substance in organisms at higher trophic levels in a food chain or food web.
  - This occurs because it cannot be broken down or eliminated from the body of the organism. Instead the pollutant collects in the body tissues of the organism.
  - Examples: Mercury, DDT, or a PCB
    - DDT is a pesticide that increased in concentration in organisms high on the food chain. This is because the compound cannot be broken down in organisms.

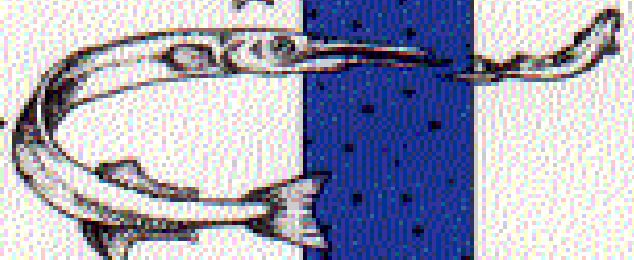


13.8 ppm



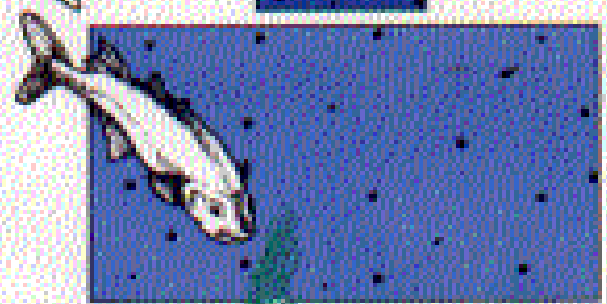
Tertiary consumers

2.07 ppm



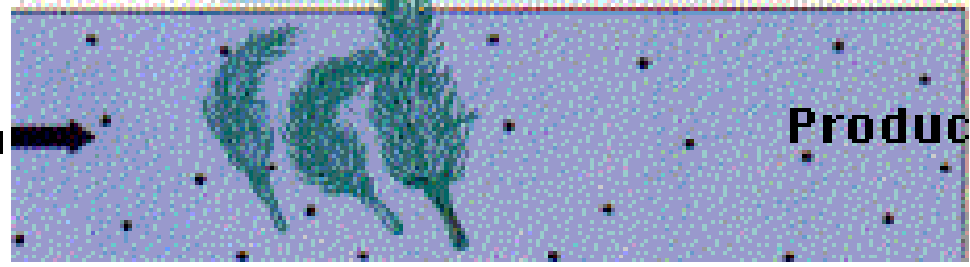
Secondary consumers

0.23 ppm



Primary consumers

0.04 ppm



Producers

The numbers are representative values of the concentration in the tissues of **DDT** and its derivatives (in parts per million, ppm)

# Atmospheric Resources

- Common forms of air pollution include smog, acid rain, greenhouse gases, and particulates.
  - **Smog:** a mixture of chemicals that occurs as a grey-brown haze in the atmosphere
    - Primarily due to automobile exhaust



# Acid Rain

- The burning of fossil fuels release nitrogen and sulfur compounds into the atmosphere
- When they combine with water vapor it forms nitric and sulfuric acids that fall as acid rain.
  - Acid rain can kill plants by damaging their leaves and change the pH of soils and aquatic ecosystems





# Acid Rain Formation



# Question and Answer

**Why is soil and water important  
and how do we protect it?**



**What are the most significant threats to biodiversity?**



# Biodiversity

- **Biodiversity:** 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:** The number of different species in the biosphere, or in a particular area
- **Genetic diversity:** sum total of all the different forms of genetic information carried by all organisms living on Earth today
- **Invasive species:** organisms that have migrated to places where they are not native



- Human activity can reduce biodiversity by altering habitats, hunting species to extinction, introducing toxic compounds into food webs, contributing to climate change, and introducing foreign invasive species to new environments
  - **Extinction:** occurs when a species disappears from all or part of its range
  - **Endangered species:** a species whose population size is declining in a way that places it in danger of extinction



# Conserving Biodiversity

- To conserve biodiversity, we must protect individual species, preserve habitats and ecosystems, and make certain that human neighbors of protected areas benefit from participating in conservation efforts.
  - **Ecological hot spot** is a place where significant numbers of species and habitats are in immediate danger of extinction.



# Question and Answer

**What are the most significant threats to biodiversity?**



**How can ecology guide us  
toward a sustainable future?**





# Meeting Ecological Challenges

- **Ecological footprint** describes the total area of functioning land and water ecosystems needed both to provide the resources an individual or population uses and to absorb and make harmless the wastes that individual or population generates.
  - Takes into account the need to provide resources such as energy, food, water, shelter, and to absorb such wastes as greenhouse gases and sewage
  - Ecologists use footprint calculations to estimate the biosphere's carrying capacity for humans
  - According to data, the average American has an ecological footprint over four times larger than the global average



# Ecology in Action

- By: (1) recognizing a problem in the environment, (2) researching that problem to determine its cause, and then (3) using scientific understanding to change our behavior, we can have a positive impact on the environment
- Some issues include, but are not limited to: the disappearing ozone, overfishing, and climate change



# Question and Answer

**How can ecology guide us  
toward a sustainable future?**



# Essential Question

**How have human activities shaped local and global ecology?**

