Chapter 22
How Humans Influence the Living World

Global Change:
pollution,
acid precipitation,
global warming, loss of biodiversity
Saving Our Environment
Pollution

global change= widespread effects on the worldwide ecosystem
<u>one of the most serious problems facing humanity's future</u>

Pollution takes many forms

A. air pollution is a major problem in the world's cities
- <u>New York and Boston:</u> gray-air cities: because of sulfur oxides from industrial pollution
- <u>Los Angeles</u>: brown-air cities: because pollutants in the air react with sunlight to form smog

B. water pollution
- despite improved methods of sewage treatment, lakes and rivers are becoming increasingly polluted with sewage
- fertilizers and insecticides also get washed from the land to the water

toxic chemicals, although no longer manufactured, still circulate in the ecosystem
- Ie: chloronated hydrocarbons, a class of compounds that includes DDT, have all been banned for normal use in the U
- break down slowly.
- accumulate in animal fat tissue
- become increasingly concentrated = biological magnification

Biological magnification of DDT

Acid Precipitation

- Acid rain: sulfur products of industry combine with water vapor in the air and return to earth as rain or snow (precipitation)
- acid precipitation destroys life
- at least 1.4 million acres of forests in the Northern Hemisphere have been adversely affected
- Tens of thousands of lakes in the northeastern US/ Canada are dying biologically as their pH levels fall below 5.0

Global Warming

Industrial society's burning of fossil fuels has released huge amnts of CO2

- chemical bonds in CO_2 transmit radiant energy from the sun but trap the longer wavelengths of infrared light (or heat)
- trapped heat → greenhouse effect
- other G-H gases: CFCs, nitrogen oxides, methanes, H20 vapor

The greenhouse effect
The earth's greenhouse effect is intensifying

global warming: ↑in the average global temps associated with ↑d CO_2 concentration in atmosphere

some possible effects:

- changes to rainfall patterns
- increases in agricultural yield but increased risks of drought
- Rising sea level: melting of ice in glaciers and the polar ice caps,
- Loss of Biodiversity
- Current rates of extinction are alarmingly high,

Biodiversity crisis
3 factors play a role in extinction

1. habitat loss: single most important cause

2. species overexploitation: species that are hunted or harvested by humans have historically been at risk of extinction

3. introduced species
the introduction of exotic species results in extinction because these species have no native predators to keep their populations in check

The Ozone Hole

- Life moved from water to land only after a protective shield of O3 was added by photosynthesis
- ozone shield protects the earth from harmful radiation
- starting in 1975, earth's ozone shield began to disintegrate, leaving a mysterious zone of lower-than-normal ozone concentration
- In 2000, the hole measured 28.4 million sq. km
  Covered an area in S. Chili exposing 120k people to high UV
- Chlorofluorocarbons (CFCs)
  - responsible for the breakdown of ozone
  - originally thought to be harmless,
  - used as coolants in refrigeration and cooling, gas in aerosol contains, and as the foaming agent in Styrofoam
  - CFCs catalyze conversion of O_3 (ozone) → O_2
  - the drop in worldwide ozone is now over 3%
  - ↑ as much as 20% in lethal melanoma skin cancers

Reducing Pollution

4 Ways to Approach This Problem:

1.reducing pollution

2.Alternative sources of energy

3.preserve non-renewable resources

4.curb population growth

Economists have now identified an "optimum" amount of pollution based on how much it costs to ê pollution versus

- the social and environmental costs of allowing pollution
- If pollution exceeds the optimum: social cost is too high
- if pollution is LESS than the optimum: economic cost is too high
- Is there an optimum amount of pollution?

2 approaches devised to ↓ pollution in US

- antipollution laws
  - stiff standards set for what can be released into the environment
- pollution taxes
  - assessed in order to balance the conflicting demands of environmental safety and economic growth

Preserving Nonreplaceable Resources

3 nonreplaceable resources being reduced at alarming rates in US

1. Topsoil: over ¼ of topsoil has been lost since 1950

2. Groundwater: in aquifers is being depleted or polluted

3. Biodiversity: loss of species creates instability in ecosystems and reduces productivity

Curbing Population Growth

- world pop reached 6.5 billion people in 2004 and will double in ~ 58 years
- our world cannot support this growth
- slowing population growth will help sustain the world's resources
- *but per capita consumption is also important*

Growth curve of the human population
Distribution of population growth

- Human population growth is not occurring uniformly over the planet
- the rate at which a population can be expected to grow in the future can be assessed graphically by means of a population pyramid

Population pyramids

The AIDS epidemic in Africa will have a huge impact on population sizes

- In sub-Saharan Africa, AIDS has reduced life expectancy at birth by 20 years

lessening the impact of our resource consumption

- ecological footprint

- the amount of productive land required to support an individual at the standard of living of a particular population through the course of his or her life

- the ecological footprint of an individual in the US is 10X greater than that of someone in India

Preserving Endangered Species

Once you understand why a particular species is endangered, it becomes possible to think of designing a recovery plan

- habitat restoration

- captive propagation

- sustaining genetic diversity

- preserving keystone species

- conservation of ecosystems

Recovery Plans

Cleaner Sources of Energy

- Tons of CO_2 is put into the atmosphere

- Every mile you drive = 1 pound of CO_2

- 2006: Americans reduced CO_2 put into the atmosphere

- But earth is still getting warmer

GOAL: reduce CO_2 emissions, sequester carbon

Reasons to find alternative energy

- pollution generated by burning coal, oil,
- the increasing scarcity of oil,
- and the potential contributions of CO_2 to global warming

Possibilities include

- nuclear power
- solar power
- wind power

Looking Closer at Ethanol

- A simple 2 carbon alcohol
- Rich in energy storing C-H bonds
- 1 gal ethanol = 80% of 1 gal gasoline
- If cars burn carbon recently produced via photosynthesis by living plants, then they are returning to the atmosphere what was recently extracted from it.
- NO net increase in CO2