

Water Pollution

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Water Pollution: Types, Effects, and Sources

- What is water pollution?
- Major types of pollutants, sources and effects

Major Categories of Water Pollutants

■ Infectious Agents

- Bacteria, Viruses, Protozoa, Parasitic Worms
- Source: Human and animal waste

■ Oxygen-Demanding Waste

- Organic debris & waste + aerobic bacteria
- Source: Sewage, feedlots, paper-mills, food processing

■ Inorganic Chemicals

- Acids, Metals, Salts
- Sources: Surface runoff, Industrial effluent, household cleansers

■ Radioactive Materials

- Iodine, radon, uranium, cesium, thorium
- Source: Coal & Nuclear Power plants, mining, weapons production, natural

■ Plant Nutrients

- Nitrates, Phosphates,
- Source: Sewage, manure, agricultural and landscaping runoff

■ Organic Chemicals

- Oil, Gasoline, Plastics, Pesticides, Solvents, detergents
- Sources: Industrial effluent, Household cleansers, runoff from farms and yards

■ Eroded Sediment

- Soil, Silt

■ Heat/Thermal Pollution

- Source: Power plants, Industrial

Pollution in Streams



1.Sewage

2.Industrial Effluent

3.Solid Waste

Lake Pollution

- Dilution less effective than with streams
- Stratification in lakes and relatively little flow hinder rapid dilution of pollutants
- Lakes more vulnerable to pollutants than streams
- Eutrophication: causes and effects
- Preventing or removing eutrophication

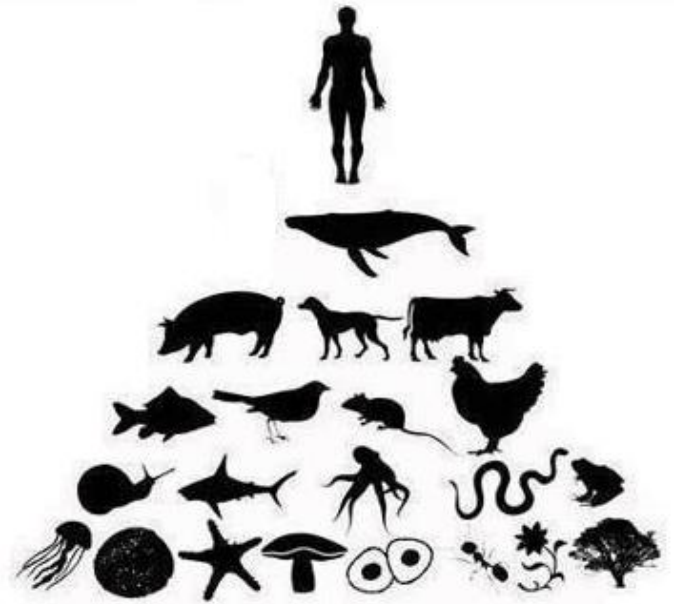
Groundwater Pollution: Causes and Persistence

- Sources of groundwater pollution
- Slow flowing: slow dilution and dispersion
- Consequences of lower dissolved oxygen
- Fewer bacteria to decompose wastes
- Cooler temperatures: slow down chemical reactions
- “Degradable” and nondegradable wastes in groundwater

Environmental Ethics

- Environmental ethics is the discipline that studies the moral relationship of human beings to the environment.
 - What is the value of the environment?
 - What moral responsibility do we have in dealing with the major environmental problems that result from our resource consumption?
 - Which needs should be given the highest priority in our decision making?
- Two main categories of ethics have emerged in human culture in modern history.

- Anthropocentrism literally means “human-centered”.
 - This set of ethics protects and promotes of human interests or well-being at the expense of all other factors.
 - Often places an emphasis on short-term benefits while disregarding long-term consequences.



- Ecocentrists believe that nature deserves to exist for its own sake regardless of degree of usefulness to humans.
 - The preservation of ecosystems or other living things takes priority over human needs.



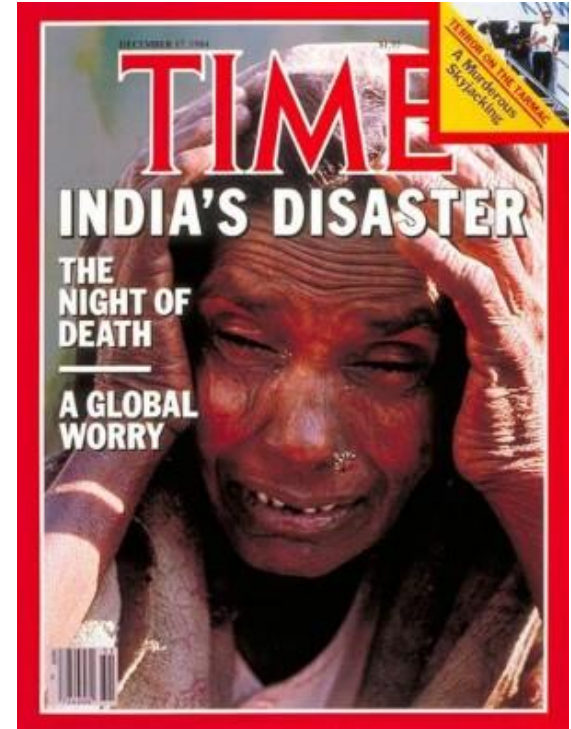
Modern Environmentalism

- In 1952, the Cuyahoga river in Ohio caught fire due to all the pollution that had accumulated in it.
- Rachel Carson published a book in 1962 entitled *Silent Spring* about the effects of pesticides on large predatory birds, particularly the bald eagle.
 - This began a public awakening to threats of pollution and toxic chemicals to humans as well as other species.
 - This movement is called Modern Environmentalism.



Case Study: Bhopal Pesticide Plant

- In December of 1984, a pesticide factory located near the town of Bhopal, India leaked a large amount of toxic chemicals into the air.
- The chemicals resulted in an immediate death toll of about 3,000 people, with 8,000 more dying of long-term health ailments.
 - A total of 558,125 injuries were reported to the Indian government.
 - A settlement of \$470 million was reached by Union Carbide and the Indian government.



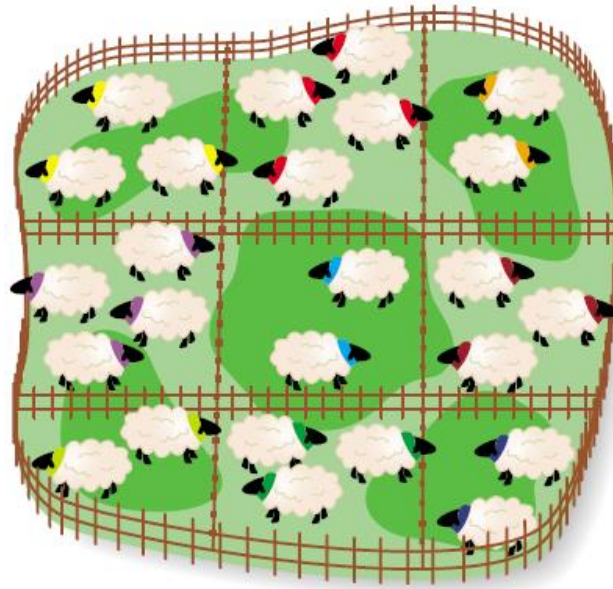
The Tragedy of the Commons

- A great deal of progress has been made since the birth of modern environmentalism, but many debates still rage on.
- An ecologist named Garrett Hardin wrote an essay called “*The Tragedy of the Commons*”, describing the source of environmental problems as a conflict:
 - Short-term interests of individuals
 - versus...
 - Long-term interests of civilization and the Earth itself

- A small village consists mostly of farmers that raise and sell sheep at a nearby city.
- The only place for the sheep to graze is a commons in the center of the village.
 - A commons is an area that belongs to no individual; it is shared by the entire society.
- Likely outcome: Villagers obtain as many sheep as possible, allow to graze in the commons.
 - Maximize short-term financial gain.



- What if the commons was instead divided into sections that was owned by each villager?
 - Because the land is owned, individuals are much more likely to plan and use it for the long-term.



- The *Tragedy of the Commons* describes the likeliness of a commons area being exploited for short-term economic gain.
- Modern examples include the atmosphere and oceans.



Economics and the Environment

- Economics has a huge influence in environmental decision-making.
- One of the most basic principles of economics is supply and demand.
 - The greater the demand for a limited resource, the higher the price.

The Goal: A Sustainable World

- Sustainability is when human needs are met so that the population can survive **indefinitely.**

- “Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”
 - Brundtland Commission, 1987



Reading Assignment:

What is the Polluter pays principle ?

What is the tragedy of the anticommons?

Thank you !