ESM116:

Introduction to environmental Science

Environmental Science

- study of how humans interact with the environment
- The environment includes all conditions that surround living organisms:
    - Climate
    - Air and water quality
    - Soil and landforms
    - Presence of other living organisms

- major goal is to understand and solve environmental problems

  - how we use natural resources

  - how our actions alter the environment

- major fields of study that contribute to environmental science:

  -biology

  -earth science

  -physics

  -chemistry

  -social science

  -Ecology

Ecology

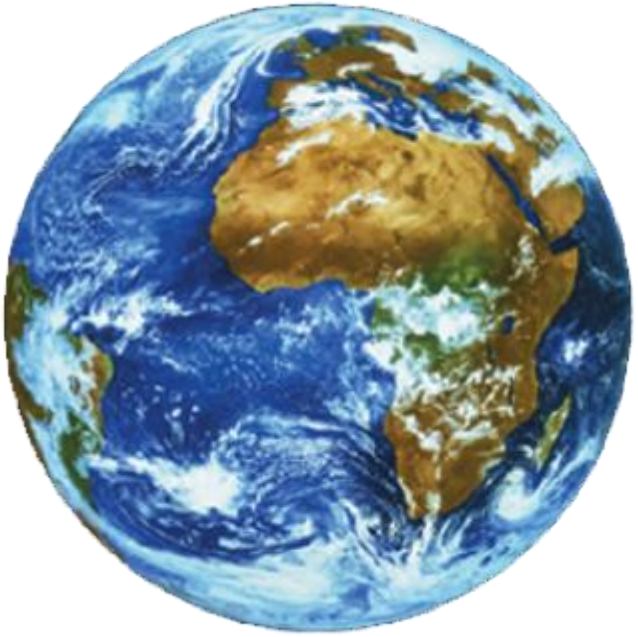
- study of how living things interact with each other and their nonliving environment

Basic History of Humans and the Environment

- **Hunter-Gatherers (10,000 B.C.)**
  - Obtained food by collecting plants and hunting wild animals.
  - No organized agriculture or animal raising.
  - Effects on the environment were limited.
    - Hunting of some animal species.
    - Picked up and spread plants/seeds to new areas.

- **Agricultural Revolution (6000-7000 B.C.)**
  - Humans first developed the process of breeding, growing, and harvesting plants for food as well as animal domestication.
  - Effects on the environment:
    - Human population grew more quickly
    - Natural habitats (grasslands, forests) replaced by farmland and villages.
    - New breeds of animals and plants were created.

- **Industrial Revolution (1800s)**
  - Shift in the source of energy to fossil fuels
  - Effects on the environment:
    - More efficient farming
    - Faster human population growth
    - Increased burning of fossil fuels.
    - Introduced synthetic plastics, fertilizers, pesticides.
    - Higher amounts of pollution.



- The Earth is a closed system.
  - The only thing that enters or leaves the earth in large quantities is heat.
  - Resources are limited, but population continues to increase.
  - Waste produced do not go away.

Major Environmental Problems

- Resource Depletion
  - Resources can be renewable (e.g water) or nonrenewable (e.g petroleum).
  - The supply of nonrenewable resources like fossil fuels and minerals will eventually run out.
  - The supply of renewable resources is often used so quickly that it cannot be replenished.

Major Environmental Problems

- Pollution
  - Undesired change in air, water, or soil quality that affects the health of living things.
  - Biodegradable pollution will break down naturally over time.
  - Non-degradable pollution does not break down.

Major Environmental Problems

- Loss of Biodiversity
  - Biodiversity is the number of different species present in an ecosystem.
  - Extinction, or the complete loss of a species, is a natural event that can be accelerated by human actions.

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?
  - Which needs should be given the highest priority in our decision making?
- Different types of ethics have emerged in human culture in modern history.

Environmental Ethics…

- Main historical stages of environmental ethics.
  - Anthropocentric
  - Pragmatic Resource Conservation
  - Moral and Aesthetic Nature Preservation

Environmental Ethics…

- **Anthropocentrism** literally means “human-centered”.
  - This set of ethics protects and promotes 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.

Environmental Ethics…

Pragmatic Resource Conservation

- Conservationists believe the environment should be used in a planned way to benefit everyone.
- The correct policy will create the greatest good for the greatest number, for the longest time.

Environmental Ethics…

Moral and Aesthetic Nature Preservation

- Preservationists believe that nature deserves to exist for its own sake regardless of degree of usefulness to humans.

The silent spring

- Rachel Carson wrote a book entitled *Silent Spring* about the effects of pesticides on birds.
  - Awakened the public to threats of pollution and toxic chemicals to humans as well as other species.

Global Environmentalism

- Increased travel and communication enables people to know about daily events in places unknown in previous generations.
  - Issues and problems are explored on a global scale instead of a local one.

Tragedy of the Commons

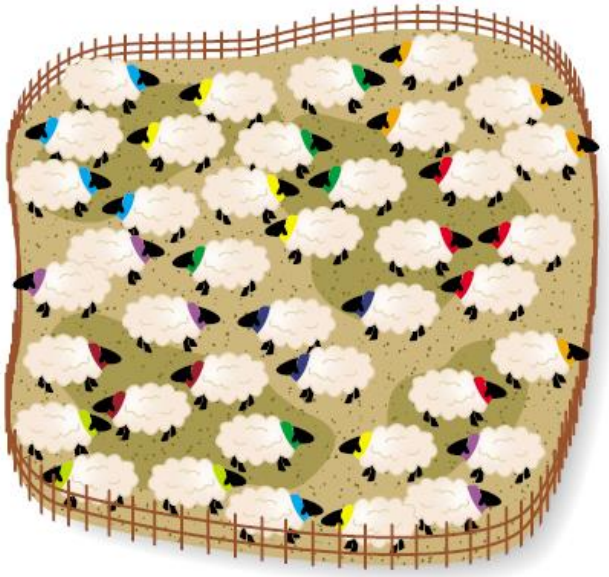
- An ecologist named **Garrett Hardin** wrote an essay describing the source of environmental problems as a conflict:
  - Short-term interests of individuals

    versus…

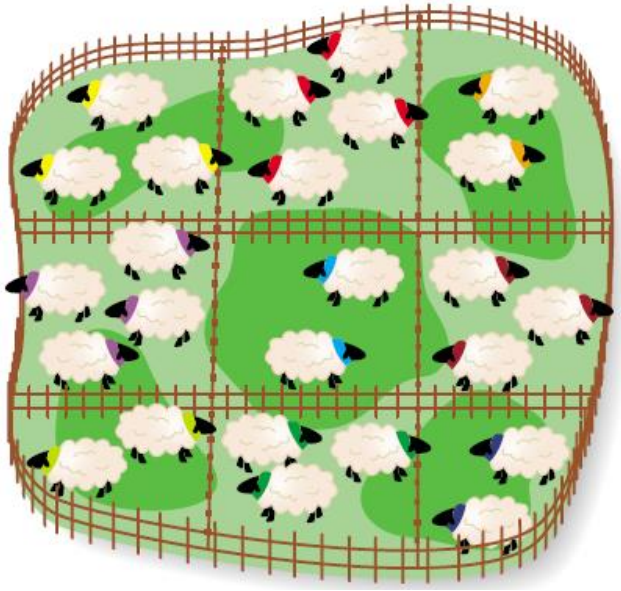
    Long-term interests of civilization and the Earth itself

Tragedy of the Commons

- Suppose each villager owns a small herd of sheep.
- And 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 an entire village.
  - Likely outcome: Villagers obtain as many sheep as possible, to graze in the commons.



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



Economics and the Environment

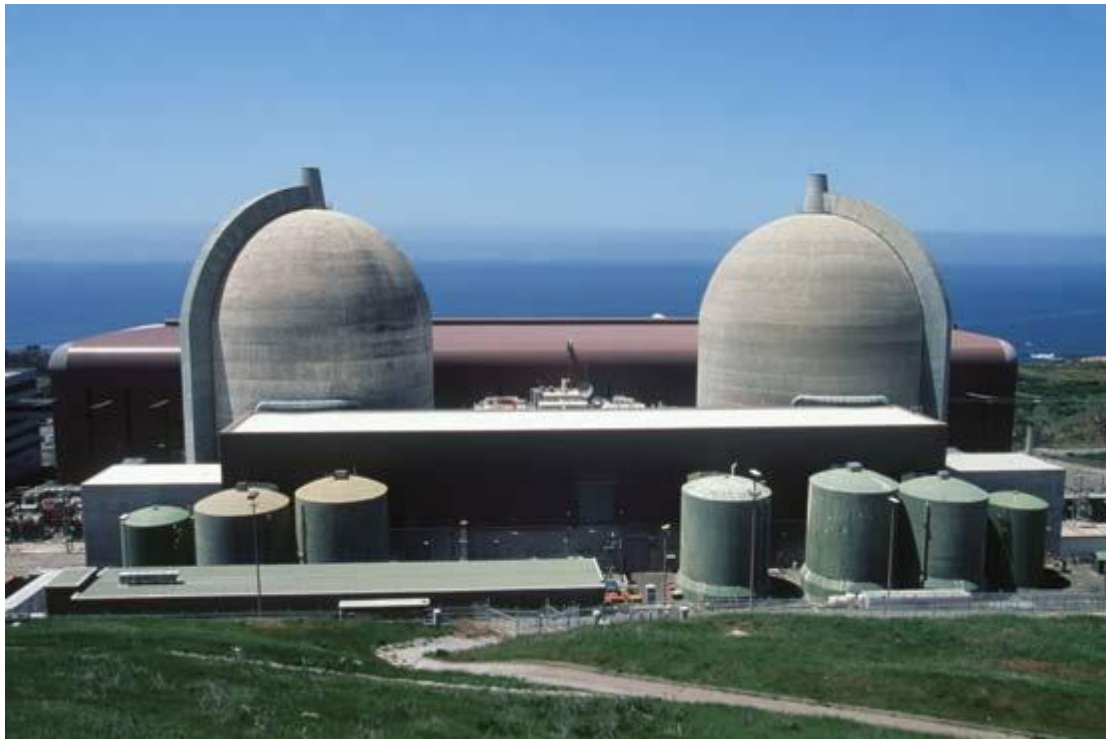
- Supply and Demand – The greater the demand for a limited resource, the higher the price.
  - Examples:
    - Increasing price of oil/gasoline

Economics and the Environment

- Cost/Benefit Analysis – Is the cost of doing something worth the price?
  - Ex: Pollution cleanup of Waukegan Harbor

Economics and the Environment

- Risk Analysis – The probability that something will cause injury or death.
  - Ex: Nuclear power



Bhopal and Dow Chemical

- 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.
  - No legal settlement was reached with Union Carbide, now owned by Dow Chemical.

- To properly compensate and treat all individuals affected by this disaster, Dow Chemical would have to pay several billion dollars in settlements.
- Dow Chemical has a yearly profit of over $2 billion, with total assets worth nearly $70 billion.

The Demographic Divide: Developed and Developing Nations

Developed and Developing Countries

- Environmental issues faced by different countries vary depending on their economic status.
- Developed – Higher incomes, longer life span, lower growth rate.
  - e.g: United States, Japan, France, U.K.

Developing and Developed Countries

- Developing countries – Have lower incomes, shorter life span, rapid population growth.
  - e.g: India, Afghanistan, most of sub-Saharan Africa

Population and Consumption

- Developing countries tend to have severe overpopulation. This leads to:
  - Deforestation
  - Bare soil
  - Native animals driven to extinction
  - Malnutrition, starvation, disease
- About 80% of the world's population falls in this category
  - Only use 25% of the world's resources

Population and Consumption

- Developed countries, while smaller in size and growth, consume resources at a greater rate.
- About 20% of the world's population uses 75% of its resources.

The Goal: A Sustainable World

- Sustainability
  - 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*