Chapter 1
Sustainability of our planet
The environment

- Everything around you; both living and nonliving things

- Examples: air, water, sunlight, people, plants, animals
Environmental Science

- The study of how humans interact with the environment.

- Involves many subjects such as: engineering, biology, chemistry, earth science, economics, political science, ethics, moral judgments
Goals of Environmental Science

- There are 3 goals to studying environmental science.
- 1. Learn how life on Earth has survived and thrived.
- 2. Understand how humans interact with the environment.
- 3. Find ways to deal with environmental problems and live more sustainably.
What is sustainability?

• The ability of Earth’s natural systems that support life to adapt to the changing environmental conditions indefinitely.
Scientific factors to sustainability

• Why has life existed on the planet for about 3.8 billion years?
  1. Solar energy - photosynthesis
  2. Biodiversity – variety of species, genes, ecosystems on the planet to help with adapting to new environmental conditions
  3. Nutrient cycling – when an organism dies, it decays, nutrients go back into ground for another organism
Social factors to sustainability

• How have past decisions on environmental problems effected today’s society?

• 1. Economics – production and consumption of goods and services

• 2. Political science – government/politics and how it relates to the environment

• 3. Ethics – study of right and wrong
Natural Capital

- Natural resources and ecosystem services that keep humans and other species alive and support human economies

- Natural Capital = Natural Resources + Ecosystem Services
Natural Resources

- Biomass energy
- Solar
- Geothermal
- Renewable Resources
- Wind
- Non-Renewable Resources
- Natural Gas
- Coal
- Oil
Natural Resources

- Fall into three categories:
  - 1. Inexhaustible – sun, wind, water
  - 2. Renewable – forests, wildlife, clean air, fresh water
  - 3. Nonrenewable – fossil fuels, minerals
Ecosystem Services

- Natural services provided by healthy ecosystems that support life and human economies at no monetary cost

- Examples: forests help purify air and water, regulate climate, reduce soil erosion, provide habitats for species, nutrient cycling
Video

- video on ecosystem services
Degrading Natural Capital

- When humans use renewable resources faster than they can be replaced naturally
Resource Depletion

- Over fishing of ocean fish – our food source
Use of Resources

How do we as humans share common resources?

From fishing the oceans to using the water at Portage Lakes State Park, how do we make sure these common resources are not ruined?
Tragedy of the Commons

- Garrett Hardin called natural capital degradation (environmental degradation) the “tragedy of the commons”.

- The commons are shared resources like atmosphere, the ocean, or the fish in the ocean.
Tragedy of the Commons

- When people think what they take or pollute is too small of an amount to matter. But when everyone’s small amount adds up, the resource becomes polluted or unusable.
The Tragedy of the Commons

Imagine an open pasture shared by multiple cattle owners. Each owner increases their herd to maximize their benefit. With an unregulated resource this is "logical" since the benefit is enjoyed by the individual and the impacts are shared by all. This leads to the ultimate overgrazing of the pasture.

**Shared Resource**
- The Commons
  - 40 acres [16 hectares]
  - 1,320 ft² [400 m²]

**Sustainable Use**
- 20 Cows
  - Carrying Capacity

**Depleted Resource**
- 20+ Cows
  - Tipping Point

The Tragedy of the Commons applies to numerous environmental, economic and social phenomena and has particular relevance to greenhouse gas regulation related to global warming.

The "commons" dimensions and formulas are for illustrative purposes only.
Use of Resources

- Tragedy of the Commons:
  When no one owns the resource, no one takes responsibility for it. Then the resource is overused and becomes depleted.

[Links to Tragedy of the Commons part 1 and Tragedy of the Commons]
A Solution to Natural Capital Degradation

- A group or individual needs to take responsibility for it. We have park rangers paid by tax payers, volunteers to watch for violations, and we have laws to prevent depletion.
A Global Perspective

- In the world, there are two types of categories countries can be placed.

Developed – high average incomes
highly industrialized

Examples: United States, Canada, Japan, Australia
A Global Perspective

- The second category countries can be placed into is developing countries. Developing – less industrialized less average income

Examples: Haiti, Kenya
Global Perspective

- Developed nations use close to 75% of the resources used every year but only make up about 20% of the world’s population.

- What is your view on this statistic?
Ecological Footprint

- The amount of land and water needed to supply an individual or a population with resources.

- The size of the footprint is proportional to the amount of renewable resources consumed.
Ecological Footprint

How many planets we’d need if everyone lived like a resident of the following:

<table>
<thead>
<tr>
<th>Balanced Budget</th>
<th>Global Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>5 Planets</td>
</tr>
<tr>
<td>USA</td>
<td>3.4</td>
</tr>
<tr>
<td>Argentina</td>
<td>1.7</td>
</tr>
<tr>
<td>South Africa</td>
<td>1.5</td>
</tr>
<tr>
<td>China</td>
<td>1.0</td>
</tr>
<tr>
<td>India</td>
<td>0.4</td>
</tr>
<tr>
<td>World Average</td>
<td>1.4</td>
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</tbody>
</table>

When the footprint is larger than the biological capacity, a deficit is formed.

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Ecological Footprint

- This is a calculation of the amount of land and resources needed to support one person’s lifestyle from a particular country.

**ecological footprint**
Ecological footprints are not all equal

- The ecological footprints of countries vary greatly.
  - The U.S. footprint is much greater than the world’s average.
  - Developing countries have much smaller footprints than developed countries.
IPAT model

- Environmental impact of human activities ($I$) is based on:
  - 1. Population size ($P$)
  - 2. Affluence ($A$)
  - 3. Technologies ($T$) can be harmful or beneficial

$$I = P \times A \times T$$
Causes of environmental problems

- The human population is growing exponentially. This means the population is growing at a fixed rate per unit of time.

- It adds up fast!!!
Causes of environmental problems

- Affluence means you have the money to buy more resources.

- This leads to more production of products which can cause more air pollution, water pollution, and land degradation from mining more resources.
Affluence can be good too. It leads to:

- Better education
- More money for cutting edge technology
- Cleaner natural resources like water and air
- Food is abundant
- Diseases are reduced
Causes of environmental problems

- Poverty makes people desperate for survival, getting their basic needs, on a daily basis. These people don’t worry about the long-term environmental impacts of their survival choices.
Causes of environmental problems

- The price for goods and services do not include full-cost pricing. This includes the cost for the item as well as the harmful environmental and health cost of making the item.
Environmental Worldview

- This is your set of assumptions and values concerning the natural world and what you think your role in managing it should be.

Based on this definition, will everyone in the class have the same worldview?
Environmental Worldview

- Human-Centered Worldview – see the world as a support system for human life. We are in charge of nature and should manage/take care of Earth for humans.
Environmental Worldview

- Life-Centered Worldview – all species have value regardless of their potential or use to society. Humans have an ethical responsibility to protect all species from extinction through human activities.
Environmental Worldview

- Earth-Centered Worldview – humans are only one species on the planet and Earth’s natural capital exists for all species.
Take the worldview quiz

- http://www.allthetests.com/quiz19/quiz/1144365659/Environmental-Worldview
Environmentally sustainable society

- It protects natural capital and lives off its income. It gives future generations the ability to meet their resource needs.

- If we deplete our natural capital, we have an unsustainable lifestyle.
Global Goal

Our goal as humans is to achieve a sustainable world.
- High standards of living for all
- Habitats would be preserved
- Garbage would be turned into something useful
- Stop wasting natural resources
Sustainable World

• How can you contribute to a sustainable world in your own life? Give at least three specific examples.