Introduction

What is Environmental Science?

Science As A Way of Knowing

Scientists use science to search for testable evidence.

- world is knowable
- uniformitarianism - processes of the past were the same as they are now and as they will be in the future
- keep it simple
- change is inevitable
- new facts can disprove existing theories BUT science never provides absolute proof that a theory is right

Science As A Way of Knowing

Scientists don’t work in a vacuum. In fact many scientists often work on different aspects of a common “problem”.

For example, different teams of scientists are gathering huge amounts of data about Mars from vastly different areas of the planet.

Team A » Theory A      Team B » Theory B

Eventually through the use of the “scientific method” a “big picture” will emerge.

See more on Scientific Design and Reasoning in your text
Scientific Method

Used by scientists to follow a series of logical, orderly steps to formulate and test hypotheses.

- Make observations
- Formulate a hypothesis
- Test hypothesis
- Collect data
- Interpret data
- Draw conclusions

Statistics and Probability

Statistics: "on average"

Average January Snowfall

Statistics and Probability

Statistics: "on average"

Average Annual Rainfall
Statistics and Probability

Statistics: “on average”

Average Exam Grade

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<th>Score</th>
<th>Frequency</th>
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Statistics and Probability

Statistics: “on average”

Average Dose of Toxin Needed to Kill A Mouse

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<th>µg/kg</th>
<th>Frequency</th>
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Statistics and Probability

Probability: “what are the chances?”

Example in Book

Every time you flip a coin, the chance that it will be tails is 1 tail out of 2 choices (heads or tails) = 1/2 = 50%, similarly the chance of getting 2 tails in a row would be 1/2 x 1/2 = 1/4 = 25%.

Chances of getting 5 tails in a row would be:
1/2 x 1/2 x 1/2 x 1/2 x 1/2 = 1/32

As you start the 5th flip, what are chances of getting tails?
1/2

Out of 100 people, how many would be likely to flip 5 tails in a row?
# students x odds for 5 x 100 x 1/32 = 3
Statistics and Probability

**Probability: “What are the chances?”**

**Example**

If you are dealt 2 cards from a standard deck of 52 cards, what are the odds of being dealt "pocket rockets" (i.e. 2 Aces)?

1. First card dealt, chances of getting an ace are 4 Aces in 52 cards = 4/52
2. Second card dealt, chances of getting an ace are 3 Aces in deck out of 51 cards = 3/51
3. Therefore, chances of being dealt 2 Aces is 4/52 x 3/51 = 0.004 x 4 in 1000 = 1 in 250

Science vs. “Junk” Science

**Baloney Detection Kit - Carl Sagan**

<table>
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<th>Table 1.2 in Text</th>
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<tbody>
<tr>
<td>1. How reliable are the sources of this claim? Is there reason to believe that they might have an agenda to pursue?</td>
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<td>2. Have the claims been verified by other sources? What data are presented in support of this opinion?</td>
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<td>3. What position does the majority of the scientific community hold in this issue?</td>
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<td>4. How does this claim fit with what we know about how the world works? Is it reasonable or contradictory?</td>
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<td>5. Are the arguments balanced and logical? Have proponents considered alternative points of view?</td>
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<td>6. What do you know about the sources of funding for a particular position? Are they financed by partisan groups?</td>
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<td>7. Where was evidence for competing theories published? Has it undergone impartial peer review?</td>
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Thinking About Thinking

**Useful Ways of Thinking**

- **Analytical Thinking**: What parts make this problem?
- **Logical Thinking**: Can orderly reasoning help?
- **Critical Thinking**: How could I do this differently?
- **Reflective Thinking**: What did it all mean?
**History of Environmentalism**

**Four Distinct Stages**

1. Pragmatic resource conservation
   - Marsh, Roosevelt, Pinchot - utilitarian conservation - "resources used for the greatest good, the greatest number, and the longest time"

2. Nature preservation
   - Muir - biocentric preservation - "nature exists for its own sake regardless of its usefulness to us"

3. Concern about health and ecological damage
   - England: coal burning Czarcan - Silent Spring - chemical toxins, etc.

4. Global environmental citizenship

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**State of the World**

**Causes of Environmental Degradation**

1. Human population growth - 1.4% per year
2. Food shortages / famines - soil erosion, nutrient depletion
3. Food security / distribution
4. Water deficits / contamination
5. Energy Production and Use - Fossil, Nuclear, Alternative
6. Global Climate Change / Ozone Depletion
7. Destruction of Habitat - tropical forests, coral reefs, wetlands
8. Toxic air and water pollutants
9. Solid and hazardous waste - NIMBY, NIMTOO