Chapter 1
Studying the State of Our Earth

Neuse River

- North Carolina, 1991
- In just a few days, a billion fish dead...
- Cause was a microscopic organism of the genus Pfiesteria.
- Emitted a toxin that was also causing illness in the researchers.
- Nausea, sores, vomiting, memory loss, confusion.

Why Concern??

- Recreation and fishing industries harmed.
  - $40 million loss in seafood sales in the Chesapeake region alone.
- Other researchers had trouble reproducing the findings of the NCSU team.
  - 16 years later (2007) other researchers finally confirmed the toxin stage of the life cycle.

So what’s the point?

- Human activities can have unintended impact on the environment.
- Environmental Science can be controversial because of conflict between science and economics.

Vocabulary

- Environment
- Environmental Science
  - Distinguish between biotic and abiotic
  - “soil” not non-living as book states
- System
  - Ecosystem
  - Environmentalism
  - Environmentalist
  - Environmental scientist
  - Environmental science
  - Environmental studies
**TABLE 1.3** Few key global environmental indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Impact (current)</th>
<th>Event (near future)</th>
<th>Overall impact on environmental quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological diversity</td>
<td>Large number of extinctions, extinction rates increasing</td>
<td>Extinctions still continue</td>
<td>Negative</td>
</tr>
<tr>
<td>Food production</td>
<td>Per capita production possibly decreasing</td>
<td>Population leveling off</td>
<td>May affect the number of people Earth can support</td>
</tr>
<tr>
<td>Average global surface temperature</td>
<td>Increasing</td>
<td>Probably will continue to increase at an alarming rate</td>
<td>Probably detrimental</td>
</tr>
<tr>
<td>Human population</td>
<td>Still increasing, but growth rate decreasing</td>
<td>Population leveling off</td>
<td>Probably detrimental</td>
</tr>
<tr>
<td>Resource depletion</td>
<td>Many resources are being depleted at rapid rate. But hunting, habitat alteration, etc.</td>
<td>Resource consumption rates on stay a factor</td>
<td>Increased use of most resources has negative effects</td>
</tr>
</tbody>
</table>

Table 1.3

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**What is Biodiversity?**

- Quantity and variety of life forms.
- 3 Levels: genetic, species, ecosystem.

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**Genetic Diversity**

- A measure of the genetic variation among individuals in a population.
- Populations with high genetic diversity are better able to respond to environmental change than populations with lower genetic diversity.

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**Species Diversity**

- The number of species in a region or in a particular type of habitat.
- Species - a group of organisms that is distinct from other groups in form, behavior, or biochemical properties. Individuals in a species can breed and produce fertile offspring.

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**Ecosystem Diversity**

- A measure of the diversity of ecosystems or habitats that exist in a particular region.

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**Background Extinction rate**

- The average number of species going extinct over a long period of time.
- Some scientists estimate more than 10,000 species are currently going extinct each year... this is 5000 times the background rate.
- Cause: habitat destruction and degradation.

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*Carrier pigeon*
Human Population

- The current human population is 6.8 billion...and growing!
- Over a million additional people is added to the Earth every 5 days.

Population Momentum

- Since 1960 the world population growth has slowed, but the actual population will continue to grow for at least 50-100 more years

Resource Depletion

- As the human population grows, the resources necessary for our survival become increasingly depleted.
- Some natural resources such as coal, oil and uranium are finite and cannot be renewed or reused.
- Other natural resources like aluminum or copper, also exist in finite amounts but can be recycled.

Resource Depletion

- Development improvement in human well-being through economic advancement. As economies develop, resource consumption also increases.

- Developed nations make up 20% of the population
- Use 60% of all the energy
- And drive 87% of the world's autos
The Scientific Method

- Observations and questions
- Hypothesis
- Collecting data
- Interpreting results
- Disseminating findings

Collecting Data

- Replication- repeating the measurement many times
- Sample size- the number of times the measurement is repeated.
- Accuracy- how close a measured value is to the actual or true value.
- Precision- how close to one another the repeated measurements are.
- Uncertainty- how much the measure differs from the true value.

Interpreting Results

- Once results have been obtained, analysis of the data begins. This process involves two types of reasoning, inductive and deductive.
- Inductive reasoning- the process of making general statements from specific facts or examples.
- Deductive reasoning- the process of applying a general statement to specific facts or situations.

Disseminating Findings

- Scientists present papers at conferences and publish the results of their investigations. This allows other scientists to repeat the original experiment and verify or challenge the results.

- Theory- a hypothesis that has been repeatedly tested and confirmed by multiple groups of researchers and is widely accepted.
- Natural law- When a theory has been tested multiple times and there are no known exceptions. Ex. Law of gravity and laws of thermodynamics.
- Environmentalism- social movement seeking to protect the environment through lobbying, activism, and education.

- Environmentalist- A person who participates in environmentalism.

- Environmental Scientist- Follows process of observation, hypothesis testing, and field and laboratory research.

### Environmental Science vs. Studies

<table>
<thead>
<tr>
<th>Science</th>
<th>Studies</th>
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</thead>
<tbody>
<tr>
<td>Chemistry</td>
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</tr>
<tr>
<td>Biology</td>
<td>Biology</td>
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<tr>
<td>Earth</td>
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<td></td>
<td>Policy</td>
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<td>Economics</td>
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<td>Literature</td>
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<td></td>
<td>Ethics</td>
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</table>

- Biotic- the living part of the Earth (animals, plants)

- Abiotic- the non-living part of the Earth (soil, air, water)

- Environmental studies- includes environmental science, the study of interactions among human systems and those found in nature along with other subjects such as environmental policy, economics, literature and ethics.