

CHAPTER 1 UNDERSTANDING OUR ENVIRONMENT

Chapter Overview

This chapter provides an overview of the study of environmental science. Students will explore the history of conservation and different attitudes towards nature. The material describes major environmental issues, and stresses the importance of sustainable development.

Topics and Key Concepts

Earth Systems and Resources

- Define the study of environmental science and the term environment.

Land and Water Use

- Describe some major environmental dilemmas and issues that shape our current environmental agenda.
- Examine the connection between poverty and freshwater availability, food insecurity, infectious disease, and quality of life indicators.
- Compare environmental justice, environmental racism, and toxic colonialism.
- Paraphrase the “Tragedy of the Commons” and identify key “commons” on Earth.

The Living World

- Discuss the history of conservation in the United States.
- Define the term sustainable development and discuss some of its requirements.
- Outline the various ecosystem services provided by Earth’s natural systems.

Themes:

1. Science is a process.
 - Science is a method of learning about the world.
 - Science is constantly changes the way we understand the world.
2. Energy conversions underlie all ecological processes.
 - Energy cannot be created; it must come from somewhere.
 - As energy flows through systems, at each step more of it becomes unusable.
3. The Earth itself is one interconnected system.
 - Natural systems change over time and space.
 - Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.

- Humans have had an impact on the environment for millions of years.
 - Technology and population growth have enabled humans to increase both the development of solutions.
5. Environmental problems have a cultural and social impact
 - Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
 6. Humans' survival depends on developing practices that will achieve sustainable systems.
 - A suitable combination of conservation and development is required.
 - Management of resources is essential.

Key Terms

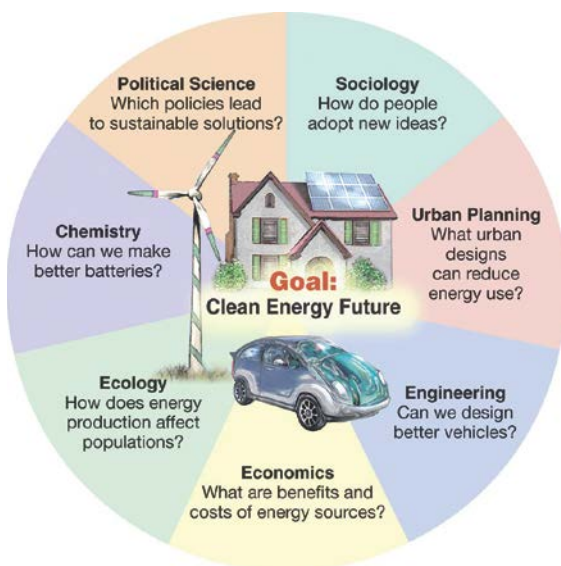
biocentric	global	quality-of-life
preservation	environmentalism	indicators
ecological footprint	inherent value	stewardship
ecosystem services	instrumental value	sustainable
environment	Millennium	development
environmental justice	Development	throughput
environmental racism	Goals	toxic colonialism
environmental science	moral extensionism	tragedy of the
environmentalism	moral value	commons
ethics		utilitarian conservation

Pacing Guide

Allow 2 to 3 days for this chapter. You will cover the topics in more depth throughout the course. Right now, you are giving students a greater awareness of what the study of environmental science involves.

Approach and Tips

This chapter sets the tone for the entire year in terms of why students have chosen to take an environmental science class. Every student will have his/her own reasons for being enrolled, along with his/her own biases regarding the environment and our utilization of Earth's resources. Students come to class looking for answers to questions they don't even realize they have (at this point in the course). Your job is to provide an awareness of the interrelationships between the living and nonliving, in order to make them informed citizens of the future. Use **Figure 1.2** (p. 10) to discuss how different types of knowledge help find solutions to environmental issues.



Briefly discuss the meaning of the study of environmental science. Make sure students understand that it is interdisciplinary in nature. Have students define the term *environment*. Challenge students to give examples of current environmental issues, and make a list on the board. They should include the following on their list: climate change, water pollution, air pollution, habitat destruction, human population, hunger, deforestation, loss of biodiversity, poverty, and food production.

As historical background, all AP students should know the first national park in the United States was Yellowstone. Stress the contributions of Theodore Roosevelt, Gifford Pinchot, John Muir, and Aldo Leopold to environmental conservation. Emphasize that the environmental movement gained ground when the effects of pollution on the environment became evident. Earth Day was established in 1970. Students will need to know the relative timing of various environmental challenges or accidents, as legislation often followed shortly thereafter.

Students must be able to describe the issues listed in question 1. Use specific examples of each, and ask students to provide some examples as well. With regard to climate change, which some students may doubt, provide data that supports climate change.

Students should understand that eliminating poverty and protecting the environment are linked in several ways. Use **Figure 1.16** (p. 21) in the textbook to discuss the inequitable distribution of resources.

The concept of sustainable development is a fundamental idea central to the study of environmental science. To ensure our survival, we must not use resources faster than nature can replenish them. As we work toward sustainable development, we need to preserve and respect the cultures of indigenous peoples, and we need to distribute resources equitably for all people.

Common Mistakes and Misconceptions

The one major misconception in this chapter has to do with global climate change. Many students think that this does not exist, or that it is merely a cyclical event that occurs every so often. Address this skepticism by presenting climate change as supported by scientific evidence, and remind students that science itself is neither good nor bad, but simply a source of data for humans to analyze and use to better society.

Students also commonly mix up developed and developing nations. They will need to provide specific examples of each on the AP Exam.

Activities

An Introductory Environmental Lesson Activity

A good introductory activity, before discussing environmental issues, is to view the movie *The Lorax*. It helps prompt discussion and gives students insights into the nature of the class. Obtain a copy of *The Lorax* by Dr. Seuss from the library or online. Read/view this in class, and have students answer the questions on the worksheet at the end of the chapter.

What in the World? Activity

Present to students several pictures representing environmental issues. Have each student describe what is happening in the picture and where this might be occurring. If possible, have one picture for each student. Include pictures of deforestation, air pollution, oil spills, overpopulation, overfishing, water pollution,

and any other environmental issue. This helps students get involved, because as we all know the impact a picture can have compared to reading text.

Charting Environmental Events

Use an online timeline resource to generate an environmental timeline from the mid-1850s to the present. This timeline should list significant environmental events. Have students add to this timeline throughout the year as new subjects are discussed in class.

Questions for Review

1. What is environmental science?
Environmental science is the systematic study of our environment and our proper place in it. A relatively new field, environmental science is highly interdisciplinary, integrating physical sciences, natural sciences, social sciences, and humanities in a broad, holistic study of the world around us.
2. How does an ecological footprint change with location?
The developed and industrialized nations will have a larger ecological footprints due to the fact that they are resource-intensive. In contrast, the developing countries will have relatively small footprints, because people in these countries are using renewable resources for cooking and heating and are usually subsistence farmers.
3. What are the two guiding principles of sustainable development?
The two principles are that we must not use resources faster than nature can replenish them, and that we must distribute resources evenly to all people.
4. How is inherent value different from instrumental value?
Inherent value refers to something having an intrinsic right to exist, whereas instrumental value is being of value or having use to someone who matters.
5. Who was Rachel Carson, and why was she important for the environmental awareness movement?
Rachel Carson's most significant contribution to the environmental movement was her book Silent Spring. This book warned of the effects of pesticide use, in particular DDT, to our environment.

Practice Questions

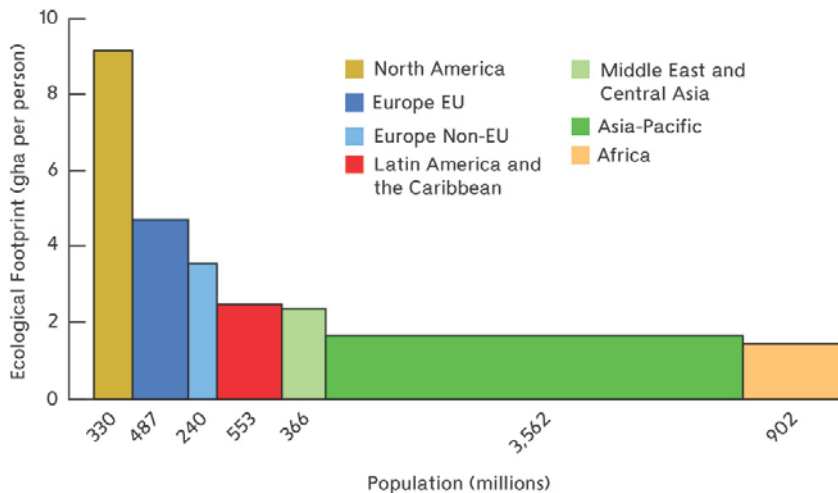
Multiple Choice:

Directions for questions 1–5: The lettered choices below correspond to the descriptions given in questions 1–5. Select the one lettered choice that best fits each statement. Each choice may be used once, more than once, or not at all.

- (A) utilitarian conservation
- (B) biocentric preservation
- (C) land ethic
- (D) *Silent Spring*
- (E) inherent value

1. Rachel Carson's book
2. Aldo Leopold's philosophy
3. intrinsic right to exist
4. Gifford Pinchot's philosophy
5. John Muir's philosophy
6. The characteristics of Environmental Science include
 - I. It is mission-oriented.
 - II. It is interdisciplinary.
 - III. It integrates natural science with social science.
 - (A) I only
 - (B) II only
 - (C) I and II only
 - (D) II and III only
 - (E) I, II, and III
7. Which of the following is **NOT** a current environmental issue?
 - (A) overpopulation
 - (B) food production
 - (C) nonsustainability of Easter Island
 - (D) climate change
 - (E) deforestation

Use the figure below to answer questions 8–10.



8. Which area of the world has the largest eco-footprint?
 - (A) North America
 - (B) Asia-Pacific
 - (C) Europe (EU)
 - (D) Europe (non-EU)
 - (E) Africa

9. Identify the region with the largest population and the smallest footprint.
 - (A) Africa
 - (B) Europe
 - (C) Latin America and the Caribbean
 - (D) Asia-Pacific
 - (E) North America

10. The areas of the world with the smallest footprint have these characteristics.
 - (A) Many people live in poverty, and the countries are developed.
 - (B) Many people live in poverty, and the countries are developing.
 - (C) Many people are wealthy, and technology can solve any problem.
 - (D) Many people are wealthy, and the countries are developed.
 - (E) Many people live in poverty, and the countries have large GDPs.

Free-Response Question:

Directions: Answer all parts of the following question. Where explanation or discussion is required, support your answers with relevant information and/or specific examples. When a calculation is required, be sure to show how you arrived at your answer.

1. Throughout history, several waves of environmental thought have been evident.
 - (a) Describe John Muir's environmental philosophy and Gifford Pinchot's environmental philosophy.
 - (b) Rachel Carson has been called the mother of environmentalism.
 - (i) Identify her claim to fame.
 - (ii) What environmental problem did she bring to the forefront of society?
 - (iii) Identify one other individual who had a profound effect on the environmental movement.
 - (iv) For the individual you identified in part (iii), describe his/her contribution to the environmental movement.
 - (c) Some argue that sustainable development is the only path for planet Earth.
 - (i) Define *sustainable development*.
 - (ii) What role does poverty play in sustainable development?
 - (iii) Do you think sustainable development will work?

Answers to Practice Questions

Multiple Choice:

1. D
2. C
3. E
4. A
5. B
6. E
7. C
8. A
9. D
10. B

Free-Response Question:

This question is based on 10 points.

1. (a) 2 points total. 1 point for each philosophy given. John Muir's philosophy was biocentric preservation, which stated that nature deserves to exist for its own rights. Gifford Pinchot's philosophy was utilitarian conservation, which stated that forests should be used for resources for a long time.

(b) (i) 1 point for identifying *Silent Spring*

(ii) 1 point for indicating that her book warned of toxic pollutants, in particular, pesticides poisoning the birds and the environment

(iii) 1 point for identifying another individual. Some individuals are: Barry Commoner, Aldo Leopold, Theodore Roosevelt, and David Brower.

(iv) 1 point for describing their contributions. Barry Commoner was an activist scientist who spoke out against hazards. Aldo Leopold's land ethic inspired the treatment of land with love and respect. Theodore Roosevelt established framework for national parks, wildlife refuges. David Brower introduced techniques of modern environmentalism, which included litigation.

- (c) (i) 1 point for defining sustainable development as using resources but not depleting them faster than they can be created.
- (ii) 2 points for describing the role of poverty. 1 point for indicating that people who live in poverty overuse resources, and 1 point for indicating that eliminating poverty goes hand in hand with sustainable development
- (iii) 1 point for a yes or no answer with supporting detail. No, because there are too many people to live at the same level of economic prosperity of the developed countries. In other words, there are not enough resources. Yes, because you can eliminate poverty and allow for an equitable distribution of resources.

Answers to questions in the Student Edition:

Case Study AP Document-Based Question (page 10)

- (A) 119,000,000 homes.
- (B) Low carbon energy uses considerably less fossil fuel energy than conventional energy sources like coal, oil, and natural gas. Low carbon energy sources includes nuclear energy and renewable energy sources such as solar, wind, hydropower, geothermal, biomass, and ocean energy. It is important for sustainable development because without low carbon energy sources, greenhouse gases will continue to rise. In order to bring them down, fossil fuel energy must be replaced by a large amount of low carbon energy sources.
- (C) Answers will vary but should include generating less waste and disposing of it in a proper manner so that the overflow does not get to Kibera. Another should be to improve their water and sewage treatment so once again Kibera does not get the overflow from the wealthy neighborhoods. From an energy perspective, they could support the use of low carbon energy sources by using them themselves and supporting policy initiatives to build additional affordable multi-unit housing options in Kibera that are powered by low carbon energy sources. Other answers may include maintaining an effective police force so crime from the wealthy neighborhood doesn't cross over into Kibera, creating schools and promoting education with extra resources.

Use the Math (page 16)

Cropland coverage changed by 1.67% $((1.2-0.45)/0.45)$ from 1961-2008. This is greater than the change in fishing grounds $((1.5-0.7)/0.7 = 1.14\%)$. Grazing land makes up 17% $((1.3/7.75*100)$ of the total footprint in 2008.

Use the Math (page 18)

An estimated 16,500 ($5\text{million} \times 0.06 \times (55/1000)$) infant deaths are predicted in a least-developed country and 1,500 ($5\text{million} \times 0.06 \times (5/1000)$) infant deaths are predicted in a most-developed country. There is a 23.1% ($55/1000 \times 4.2$) chance a family in a least-developed country will experience the loss of an infant, and a 0.9% ($5/1000 \times 1.8$) chance that a family in a most-developed country will experience the loss of an infant.

Use the Math (page 22)

Answers may vary slightly but should be near the following: China, India, and the United States experienced an approximate 433% ($((80-15)/15)$), 333% ($((16-2)/2)$), and 18% ($((20-17)/17)$) increase, respectively, from 1980 to 2015. Around 207 quadrillion Btus are expected to be consumed by the world in 2035.

AP Connections Review Answers (pages 30-32)**Multiple-Choice**

1. d. Utilitarians, as their name implies, look at nature as providing useful things.
2. b. Low income is the quality of life indicator characterized by the poorest nations. The quality of life indicators found in the poorest nations include high infant mortality rates, low income, high numbers of children, inadequate nutrition, and low availability of medical care.
3. e. This kind of development is the antithesis of “sustainable” growth because it is very disruptive to both the environment and to people.
4. a. Toxic colonialism is the release of toxins in undeveloped countries because they do not have the means to fight the injustice.
5. c. habitat destruction can endanger species. All of the other choices help protect species.
6. c. measuring your ecological footprint is useful to understanding your impact vs. what the planet is capable of supporting.
7. c. The world population is expected to reach 8-10 billion by 2050.
8. b. The economic benefits to poor or disadvantaged communities often leads them to accept environmental hazards into their community.
9. e. This kind of development is the antithesis of “sustainable” growth because it is very disruptive to both the environment and to people.
10. c.

Data Analysis and Free-Response Questions

1a About 2.64 million gha $(9+1+1.5+0.1+0.3+0.1)*2.2$

1b Cropland makes up 14% $(1/(5+1+0.1+0.8+0.1+0.1)*100)$ of the ecological footprint of the average U.S. person.

1c A person in Bangladesh has an ecological footprint of 1gha. A person in Australia has one just under 7gha, or 600% higher than someone in Bangladesh $((7-1)/1*100)$.

2a Answers will vary, but should make connections between sustainability resulting in a lower ecological footprint.

2b Answers will vary, but should include strategies consistent with sustainable practices – reduced energy use, low carbon energy sources, changes in lifestyle.

An Introductory Environmental Lesson Activity

Student: _____

1. What is the Lorax? What is his role in the book?
2. From chapter 1 in the textbook, we learned that Roosevelt and Pinchot's policies, called **utilitarian conservation**, state that forests should be saved "not because they are beautiful or because they shelter wild creatures of the wilderness, but only to provide homes and jobs for people." With this in mind, compare and contrast the Once-ler's way of business to Roosevelt and Pinchot's idea of forestry.
3. John Muir, a geologist, author, and first president of the Sierra Club, opposed Pinchot's ideas. His outlook, **biocentric preservation**, emphasizes the fundamental right of other organisms to exist and to pursue their own interests. Which character in the book has similar views to Muir, and why are these views so controversial today?
4. Rachel Carson, considered by many to be the mother of environmentalism, added a new set of concerns to the environmental agenda. She awakened the public to the threats of pollution and toxic chemicals. Discuss the different toxins that were produced in the production of the thneed.
5. Though the Once-ler polluted the area where he lived, environmentalists have now concluded that the new concern for our planet should be one of **global environmentalism**, because we are all interconnected, and events that occur on the other side of the globe have profound and immediate effects on our lives. List three things that could have global effects in the production of the thneed.
6. Many environmental problems are interconnected and can have compounding effects. After reading *The Lorax*, look at the list below and discuss the implications of how any two or more of the items can cause a worsened environmental effect.

energy consumption	waste disposal
human population explosion	deforestation
loss of biodiversity	water pollution
soil erosion	global warming
food shortages	political unrest

7. How would the thneed factory be different in a developing country versus a developed one? Discuss issues such as raw material use, waste disposal, energy consumption, and workers' rights.
8. In the last part of the book, the Lorax uses the word *unless*. What does that mean, and how can you, as an average citizen, make a difference in the environment?
9. Many economists argue that the solution to the Lorax's dilemma is found in properly defined property rights. What does this mean, and how would this solve the problem?
10. Do some research in the library or online. Who might be an example of a modern-day "lorax"?