



HUMANS AND SUSTAINABILITY: AN OVERVIEW

Chapter 1

Environmental Problems, Their Causes, and Sustainability



“It’s A Small World After All”

Outline

Living more sustainably

- A. Environmental science studies how the earth works, our interaction with the earth, and the methods/procedures we use to deal with environmental problems.
- B. Environment considers everything that affects a living organism.
- C. Ecology studies relationships between living organisms and their environment.
- D. Environmentalism is a social movement dedicated to protecting life support systems for all species.
- E. A path toward sustainability includes five subthemes that are address throughout the text:
 - 1. Natural capital—the natural resources and natural services that keep us and other species alive and support our economies.
 - 2. Natural capital degradation—occurs when human activities use renewable resources faster than they can be replenished.
 - 3. Solutions—are sought to degradation of natural resources.
 - 4. Trade-offs—or compromises are made to resolve conflicts.
 - 5. Individuals matter—to search for solutions to environmental problems.
- F. Life and economies depend on solar capital (energy from the sun) and natural capital (earth’s resources and ecological services).
- G. Man must protect our solar and natural capital and live off the resources they provide.
 - 1. For an environmentally sustainable society we must not compromise the needs of future generations.
 - 2. One view is that man must live sustainably by eliminating waste; discontinue our depletion and degrading of resources.
 - 3. A different view is that man can overcome these problems with ingenuity, economic growth, and technology.

Population Growth, Economic Growth, and Economic Development

- A. Human population growth continues to be more rapid than the earth can support—about 220,000 people per day.
- B. Economic growth provides people with the goods and services needed.
 - 1. Gross domestic product (GDP) is the market value for goods and services produced both within the country.
 - 2. Standard of living is the GDP divided by total population at midyear.
- C. Economic Development is improving living standards through growth. Most developed countries have high industrialization and high per capita income. Developing countries have moderate to low income; they represent about 97% of projected increase in world population.
 - 1. Economic developments reflect good and bad economic news.
 - a. Poverty produces harmful environmental effects.
 - b. Soil, water and forests are depleted.
 - c. Pollution levels are high.
 - d. Infant mortality rate is 8 times higher than in developed countries.
 - e. Wages are very low with poor working conditions as the norm.
 - 2. Developed countries enjoy higher a standard of living.
 - a. Longer life expectancy
 - b. Decrease in infant mortality
 - c. Food production is greater than food needs
 - d. Decreased air and water pollution
 - e. Decrease in poverty overall
 - 3. Environmentally sustainable development rewards sustainable activities and discourages harmful activities.
 - a. Doubling time is the time it takes to double the world’s population or economic growth, is calculated using the rule of 70: $70/\text{percentage growth rate} = \text{doubling time in years}$.

HUMANS AND SUSTAINABILITY: AN OVERVIEW
Chapter 1
Environmental Problems, Their Causes, and Sustainability

“It’s A Small World After All”

Resources

- A resource is anything obtained from the environment to meet our needs and wants.
- A. Natural capital/natural resources are those in the environment or those obtained from the environment: food, water, air, shelter petroleum, etc.
 - B. Material resources we get from the environment are classified as perpetual, renewable, or nonrenewable.
 - 1. A perpetual resource is renewed continuously, like solar energy.
 - 2. Renewable resources must not be used up faster than they can be replaced, like grasslands, fresh water and air, fertile soil, etc.
 - 3. Sustainable yield is the highest rate of use on an indefinite scale without degradation or depletion.
 - 4. Environmental degradation occurs when use of resources exceeds rate of replacement.
 - C. The Tragedy of the Commons describes the overuse or degradation of freely available resources such as ocean pollution, abuse of national parks, air pollution, etc. No one individual owns these free-access resources.
 - 1. Regulating access to these resources is one possible way to protect them.
 - 2. Use these resources below the estimated sustainable yields by reducing population.
 - 3. Converting the free-access resources to private ownership is another possible means to protect them.
 - a. Private owners may not actually protect the resources.
 - b. Global resources such as oceans, air, and migratory birds can’t be divided up and made private property.
 - c. Access to the resources is eliminated/reduced for many people.
 - 4. Governments have laws and treaties that regulate access to commonly owned resources.
 - D. What is our ecological footprint, our impact on the environment?
 - 1. The per capita ecological footprint is the biologically productive land and water needed to supply renewable resources and absorb waste for each individual.
 - 2. Humanity’s ecological footprint exceeds by about 39% the earth’s ecological capacity (or biocapacity) to replenish its renewable resources and absorb the resulting waste products and pollution.
 - 3. If China and India were to consume resources and emit pollution and waste at the same rate as the United States currently does, they would require two planet earths.
 - E. What are Nonrenewable Resources?
 - 1. Nonrenewable resources are those that exist in fixed quantity or stock in the earth’s crust. The resource is economically depleted when it costs too much to obtain what is left.
 - 2. These resources include energy resources (oil, coal, natural gas), metallic mineral resources (copper, iron, aluminum, etc.), and nonmetallic minerals like salt, clay, sand, and phosphates.
 - 3. There are solutions for an economically depleted resource.
 - a. Try to find more of the resource.
 - b. Recycle the resource and buy products made from recycled material, or reuse the resource in the same form.
 - c. Waste less.
 - d. Use less.
 - e. Try to develop a substitute for the resource.
 - f. Wait millions of years for more to be produced

Pollution

- Pollutants are chemicals at high enough levels in the environment to harm people or other living organisms.
- A. Where Do Pollutants Come From, and What Are Their Harmful Effects?
 - 1. Pollutants may enter the environment naturally (i.e. volcanic eruptions) or through human activities such as burning coal; it tends to occur in or near urban and industrial areas.
 - 2. Point sources of pollutants are single, identifiable sources; such as automobiles or industrial plants. These are easier to identify and control.
 - 3. Non-point sources are dispersed, such as pesticides in air and water run-off; these are difficult

HUMANS AND SUSTAINABILITY: AN OVERVIEW
Chapter 1
Environmental Problems, Their Causes, and Sustainability

“It’s A Small World After All”

- to identify.
- a. Pesticides sprayed into the air may be carried from their source.
- b. Fertilizer runoff enters streams away from the source.
- 4. Three unwanted effects of pollutants are:
 - a. They can disrupt or degrade life-support systems of any organism.
 - b. They damage human health, wildlife, and property
 - c. They can produce nuisances in noise, smells, tastes, and sights.
- B. Solutions: What Can We Do About Pollution?
 - 1. We use two basic approaches to deal with pollution.
 - a. Pollution prevention/input pollution control reduces or eliminates production of pollutants.
 - b. Pollution cleanup/output pollution control cleans up or dilutes pollutants after they have been produced.
 - c. Problems with pollution clean up include
 - 1) Temporary bandage without long term pollution control technology, like the catalytic converter
 - 2) Pollutant is removed but causes pollution in another place: burning garbage/ burying it
 - 3) Expensive to reduce pollution to an acceptable level. Prevention is less expensive in the long run.

Environmental Problems: Causes and Connections

- A. Five major causes of environmental problems are:
 - 1. Population growth
 - 2. Wasteful Resource use
 - 3. Poverty
 - a. Focus is on survival at the expense of forests, soil, grasslands and wildlife.
 - b. Live in areas with a greater risk of natural disasters occurring
 - c. Generally work in unsafe and unhealthy conditions for low wages.
 - d. Reduced life expectancy.
 - e. No government-sponsored health plans, or retirement plans.
 - f. Die from preventable causes (malnutrition, normally nonfatal infectious diseases, lack of clean drinking water, and respiratory problems.
 - 4. Poor environmental accounting
 - 5. Ecological ignorance
- B. Affluence is the addiction to over-consumption of material goods.
 - 1. Symptoms: high debt level, declining health, increased stress, more bankruptcies
 - 2. Solutions: admit the problem, shop less, avoid malls and other shopping addictions
 - 3. Toynbee’s law of progressive simplification: transfer energy & attention to the nonmaterial side of life
- C. Affluence of developed countries can lead to environmental improvements.
 - 1. Money is available for technological improvements
 - 2. Since 1970 air and water are cleaner than previously
 - 3. Money was spent on environmental improvements
- D. Environmental Quality is affected by interactions between population size, resource consumption, and technology
 - 1. Environmental impact (I) depends on the number of people (P), average resource use/person (the Affluence), and the beneficial and harmful effects of technologies (T) used to provide/consume each unit of resource
 - 2. Developing countries have large populations that result in degradation of renewable resources
 - 3. Developed countries have high per capita consumption (U.S. use 30-100 times more than other countries)
 - 4. Some forms of technology are environmentally harmful, others are environmentally beneficial

HUMANS AND SUSTAINABILITY: AN OVERVIEW

Chapter 1

Environmental Problems, Their Causes, and Sustainability

“It’s A Small World After All”

- A. Since humans were hunter-gatherers, three major cultural transformations have increased the human impact on earth.
 - 1. The agricultural revolution which began 10,000 to 12,000 years ago allowed people to settle and raise crops and domesticate animals.
 - 2. The industrial-medial revolution, which began about 275 years ago, led to a shift from rural villages and animal-powered agriculture to an urban society using fossil fuels for manufacturing material items, agriculture, and transportation
 - 3. The information-globalization revolution began about 50 years ago and uses new technologies for gaining access to more information on a global scale.
- B. Until about 12,000 years ago, humans were mostly hunter-gatherers.
- C. Three major cultural changes have impacted the environment
 - 1. The agricultural revolution allowed people to settle in villages, raise crops, and domesticate animals.
 - 2. The industrial-medical revolution began an urban society which introduced both a higher standard of living and increased environmental degradation.
 - 3. The information-globalization revolution introduced new technologies
- D. The environmental history of the environment can be divided into 4 eras:
 - 1. The tribal era, consisting of tribal people.
 - 2. The frontier era began when European colonists began settling North America, and the environment was viewed as resources for humans.
 - 3. The early conservation era marked the beginning of environmental awareness.
 - 4. The current era emphasizes environmental awareness.

Sustainability and Environmental Worldviews

- A. Environmental news centers on improvements in quality of life and protecting the environment. But, there are many serious problems not addressed and/or ignored.
- B. If degradation of the environment is not halted, sustainable development is not possible.
 - 1. Technological optimists’ group tells us not to worry.
 - 2. Environmental pessimists see the problem as hopeless.
- C. Environmental worldviews and ethics determine the way people view the seriousness of environmental problems.
 - 1. Your environmental worldview is your assumptions and values about the world and your role.
 - a. The planetary management worldview holds that nature exists to meet our needs.
 - b. The stewardship worldview holds that we manage the earth, but we have an ethical responsibility to be stewards of the earth
 - c. The environmental worldview holds that we are connected to nature and that nature exists for all species equally.
 - 2. There are four major components of earth’s natural sustainability
 - a. Reliance on solar energy
 - b. Reserve biodiversity
 - c. Population control
 - d. Nutrient recycling
 - 3. To sustain natural capital we must build social capital by working together to find and implement solutions.
 - 4. To live more sustainably, we must focus on:
 - a. Pollution and waste prevention
 - b. habitat protection
 - c. environmental restoration
 - d. Less wasteful resource use
 - e. Population stabilization
 - f. Protecting natural capital

HUMANS AND SUSTAINABILITY: AN OVERVIEW
Chapter 1
Environmental Problems, Their Causes, and Sustainability

“It’s A Small World After All”

Summary

1. All life depends on energy from the sun, solar capital, and the resources and ecological services of the earth, natural capital, to survive. An environmentally sustainable society provides for the current needs of its people without undermining the ability of future generations to do the same.
2. The world’s population is growing about 1.2% per year, which adds about 77 million people per year. Economic growth increases a country’s capacity to provide goods and services to its people. Economic development uses economic growth to improve standards of living. Globalization is a process of increasingly interconnecting people through social, economic, and environmental global changes.
3. The earth’s main resources are perpetual resources like solar energy, renewable resources like forests and fresh water, and nonrenewable resources like oil and gas. The resources can be depleted or degraded by overuse, by waste, by pollution, by man’s increasing ‘ecological footprint’.
4. The principle types of pollution are air, water, soil and food pollutants. We can prevent pollution or clean up pollution. Prevention is far preferable because cleaning up pollution often causes additional pollutants in another part of the environment.
5. The basic causes of today’s environmental problems are population growth, wasteful use of resources, the tragedy of the commons, poverty, poor environment accounting and ecological ignorance. They are interconnected because of political and economic practices that are not equitable for various populations, in resource consumption and in technological applications.
6. The world’s current course is not sustainable. Environmental sustainable development encourages environmentally beneficial forms of economic growth and discourages environmentally harmful growth.

Objectives

1. Define *exponential growth*. Describe the connection between exponential growth and environmental problems.
2. Distinguish between *solar capital* and *natural capital*. Evaluate the significance of these forms of capital in the development of human societies.
3. Distinguish between living on principal and living on interest. Analyze which of these behaviors humans are currently illustrating. Evaluate the possibility of continuing to live in our current style.
4. Define *globalization*. What factors affect globalization? Summarize the advantages and disadvantages of globalization.
5. Distinguish between developed countries and developing countries. Describe changes in the wealth gap between these groups of countries.
6. Distinguish between the following terms: *physically depleted* and *economically depleted resources*; *nonrenewable*, *renewable*, and *potentially renewable resources*; *reuse* and *recycle*. Draw a depletion curve. Explain how recycling and reuse affect depletion time.
7. Define *sustainable yield*. Describe the relationship between sustainable yield and environmental degradation. Describe the tragedy of the commons. Summarize how most environmentalists alleviate this type of tragedy.

HUMANS AND SUSTAINABILITY: AN OVERVIEW

Chapter 1

Environmental Problems, Their Causes, and Sustainability

“It’s A Small World After All”

8. Distinguish between the following terms: *point source of pollution* and *nonpoint source of pollution*; *persistent*, *nonpersistent*, and *nondegradable pollutants*. Distinguish between *pollution prevention* and *pollution cleanup*. Evaluate the effectiveness of these two approaches in decreasing pollution.
9. Summarize underlying causes of environmental problems. Describe a simple model of relationships among population, resource use, technology, environmental degradation, and pollution. Evaluate which model is most useful to you. Assess which model would be most useful in explaining these relationships to young children and which more closely resembles reality.
10. Understand the cultural changes that have increased the human impact on the natural environment.
11. Summarize strategies humans can use to work closely with the earth.

Key Terms (**Terms are listed in the same font style as they appear in the text.**)

affluenza (p. 19) <i>agricultural revolution</i> (p. 20) <i>biodiversity</i> (p. 6) common-property (p. 112) developed countries (p. 10) developing countries (p. 10) environment (p. 7) <i>environmental career</i> (p. 8) environmental degradation (p. 12) environmental ethics (p. 22) <i>environmental pessimists</i> (p. 22) environmental science (p. 7) environmental wisdom worldview (p. 23) environmental worldview (p. 22) environmentalism (p. 8) environmentally sustainable economic development (p. 10) environmentally sustainable society (p. 9) exponential growth (p. 6) free access resources (p. 12) frontier environmental worldview (p. 21) globalization (p. 10) gross domestic product (GDP) (p. 10) <i>industrial-medicalrevolution</i> (p. 20) <i>information-globalization revolution</i> (p. 20) input pollution control (p. 16) <i>law of progressive simplification</i> (p. 19) <i>living sustainably</i> (p. 9) <i>malnutrition</i> (p. 18) <i>metallic mineral resources</i> (p. 14) natural capital (p. 8) stewardship worldview (p. 23) sustainability (durability) (p.8) sustainable yield (p. 12) solar capital (p. 8)	<i>early conservation era</i> (p. 21) ecological footprint (p. 13) ecology (p. 7) economic development (p. 10) economic growth (p. 9) <i>energy resources</i> (p. 14) sound science (p. 9) <i>social sciences</i> (p. 7) <i>species</i> (p.6) <i>stewards</i> (p. 23) <i>technological optimists</i> (p. 22) tragedy of the commons (p. 12) <i>natural sciences</i> (p. 7) <i>natural sustainability</i> (p. 23) <i>nonmetallic mineral resources</i> (p. 14) nonpoint sources (p. 15) nonrenewable resources (p. 14) output pollution control (p. 16) <i>overconsume</i> (p. 18) per capita ecological footprint (p. 13) per capita GDP (p. 10) perpetual resource (p. 12) planetary management worldview (p. 22) point sources (p. 15) pollution (p. 14) pollution cleanup (p. 16) pollution prevention (p. 16) poverty (p. 18) recycling (p. 14) renewable resource (p. 12) <i>research frontier</i> (p. 8) resource (p. 10) reuse (p. 14) social capital (p. 25) <i>underconsume</i> (p. 18)
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