Chapter 1

Introduction:
The Environment at Risk

Learning Objectives
By the end of this chapter the reader will be able to:
• Describe how environmental health problems influence our lives
• Describe the potential impacts of population growth upon the environment
• State a definition of the term environmental health
• List at least five major events in the history of environmental health
• Identify current issues in the environmental health field
• Describe employment opportunities in the environmental health field

Healthy People 2010
• Maintaining environmental quality is a pressing task for the 21st century.
Healthy People 2010

- Goal Number 8, Environmental Health: “Promote health for all through a healthy environment.”
- Goal Number 8 Objectives include:
  - Outdoor Air Quality
  - Water Quality
  - Toxics and Wastes
  - Healthy Homes & Healthy Communities
  - Infrastructure and Surveillance
  - Global Environmental Health

Environmental Health Threats

- Trash that fouls our beaches
- Hazardous wastes (including radioactive wastes) leaching from disposal sites
- Continuing episodes of air pollution in some areas
- Exposures to toxic chemicals
- Destruction of the land through deforestation
Population and Environment: The Three P’s

• Pollution
• Population
• Poverty

Principal Determinants of Health Worldwide

Pollution

• Combustion of fossil fuels (e.g., petroleum and coal) that disperse greenhouse gases into atmosphere may cause
  ✓ Global warming
  ✓ Change in distribution of insect vectors

Population

• What is a population?
  o The total number of inhabitants constituting a particular race, class, or group in a specified area
• Overpopulation in developing nations is leading to the human population exceeding the carrying capacity of the planet.
  o World population of 10-12 billion during 21st century?
  o Related to urban crowding
Infectious disease epidemics: A consequence of crowding?

• Avian influenza A (H5N1) virus: outbreaks on poultry farms in Asia
  - Health officials were concerned that the virus might mutate, enabling human-to-human transmission and a resulting pandemic.
• Swine flu (H1N1 influenza): spread through North America to other parts of the globe.
  - The WHO declared a pandemic.

Poverty

• Linked to population growth
• One of the well-recognized determinants of adverse health outcomes

Significance of the Environment for Human Health

• Exposure to potentially hazardous agents accounts for many of the forms of environmentally associated morbidity and mortality.
• Examples of hazardous agents are:
  o Microbes
  o Toxic chemicals and metals
  o Pesticides
  o Ionizing radiation
Scope of Environmental Health Problems

- Environmental factors are thought to contribute significantly to many forms of chronic disease such as cancer, including cervical cancer, prostate cancer, and breast cancer.

Environmental Risk Transition

- Changes in environmental risks that happen as a consequence of economic development in the less developed regions of the world.

- Before transition occurs, poor quality of:
  - Food
  - Air
  - Water

- After transition, a new set of environmental problems take hold. Examples include release of:
  - Acid rain precursors
  - Ozone-depleting chemicals
  - Greenhouse gases
Population Growth

- Increasing at an exponential rate
- Threatens to overwhelm available resources
- May cause periodic food scarcity and famine in some areas of the world.

Trends in Population Growth

- As of June 1999, 6 billion people inhabited our planet.
  - Interactive map
- U.S. 315 million
  - U.S. Population clock
- World 7 billion
  - World Population clock
  - World map
- From 1931 to 1974 (a 43-year interval), the earth’s population doubled and is projected to double again during approximately the same interval (1974 to 2018).
Population Density per Square Mile - 2007

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Land area (sq mi)</th>
<th>Density per sq mi</th>
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<td>Macau S.A.R.</td>
<td>453,125</td>
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<tr>
<td>Monaco</td>
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<td>Singapore</td>
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<td>Gaza Strip</td>
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<td>Iceland</td>
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<td>Spain</td>
<td>45,421,255</td>
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Sources: For further information and links to more data, visit http://www.infoplease.com/ipa/A0934666.html#ixzz2JaCwXlz1

Swine Flu (H1N1 2009 Virus)

- Concern that a large proportion of the population might be susceptible to infection with the virus.
- Seasonal influenza vaccine H1N1 strain might not provide protection.
- During the summer and fall months of 2009, influenza activity peaked.
- Week ending October 24, 2009—49 of 50 states reported geographically widespread disease.
- Worldwide (as of 31 January 2010) more than 209 countries and overseas territories or communities reported laboratory confirmed cases of pandemic influenza H1N1 2009, including at least 15174 deaths.
Population Dynamics

- Refers to the ever-changing interrelationships among the set of variables that influence the demographic makeup of populations as well as the variables that influence the growth and decline of population sizes.
- Causes of population growth are attributed to:
  - Increases in fertility
  - Reductions in mortality
  - Migration

Fertility

- A measure of fertility is the **total fertility rate (TFR)**, which indicates how many births a woman would have by the end of her reproductive life.
- In the U.S., the fertility rate fluctuates from around 2.0 to 2.1 births per woman.
  - The natural population replacement rate is estimated to be 2.1.
- U.S., Canada, Japan, South Korea, Thailand, China, and many European countries are at or below the replacement rate for fertility.
- Many Asian, Latin American, and African countries have a fertility rate of 4.0 births per woman.

Mortality

- Declined markedly over time in both industrialized and less developed countries.
- The reduction has been accomplished through:
  - Public health improvements
  - Famine control
  - Increased availability of drugs and vaccines
Migration

• Migration has contributed to population growth in many areas of the world.
• In 2005, the three leading countries for receiving international immigrants were the United States, Russia, and Germany.
• Reasons for migration include:
  o Economic betterment
  o Escape from religious and political persecution
  o Relief from unstable conditions
• The U.S. Census estimates that by 2050 the U.S. population will grow by 100 million and one-third of that growth will be from migration.

Demographic Transition

• Refers to alterations over time in a population’s fertility, mortality, and make-up.
• Developed societies have progressed through three stages that have affected their age and sex distributions.

The Three Stages of Demographic Transition

Stage 1: Population mostly young, and fertility and mortality rates are high. Overall, the population remains small.

Stage 2: Mortality rates drop and fertility rates remain high. There is a rapid increase in population, particularly among the younger age groups.

Stage 3: Fertility rates drop and cause a more even distribution of the population according to age and sex.
Epidemiologic Transition

- Describes a shift in the pattern of morbidity and mortality from causes related primarily to infectious and communicable diseases to causes associated with chronic, degenerative diseases.

- Examples include:
  - Chronic, degenerative diseases including cardiovascular diseases, cancer, neuro-psychiatric conditions, and injuries
  - These conditions are becoming the major causes of disability and premature death in many nations.

Consequences of Population Increases

- Rapid growth of the population contributes to the deterioration of the environment through depletion of natural resources and increasing pollution.

- The effects of rapid growth of the world's population include:
  - Urbanization
  - Overtaxing carrying capacity
  - Food insecurity
  - Loss of biodiversity
Urbanization

- Worldwide, the proportion of urban residents has increased from about 5% in 1800 to 50% in 2000 and is expected to reach about 66% by 2030.

Megacities

- An urbanized area that has more than 10 million inhabitants
- As of 2010, there are 27 megacities in the world
  - Twelve of them are over 20 million

Factors that Lead to Urbanization

- Industrialization
- Food availability
- Employment opportunities
- Lifestyle considerations
- Escape from political conflict
Hazards of the Urban Environment

1. Biological pathogens or pollutants including pathogenic agents and their vectors (and reservoirs)
2. Chemical pollutants including those added to the environment by human activities (e.g., industrial wastes) and chemical agents present in the environment independent of human activities
3. Reduced availability, increased cost, and lowered quality of natural resources on which human health depends—e.g., food, water and fuel.
4. Physical hazards (e.g., high risk of flooding in houses and settlements built on floodplains or of mudslides or landslides for houses on slopes)

Hazards of the Urban Environment

5. Aspects of the built environment with negative consequences on physical or psychosocial health (e.g., overcrowding; inadequate protection against noise; inadequate provision of infrastructure, services, and common areas).
6. Natural resource degradation (e.g., of soil and water quality)
7. National/global environmental degradation with more indirect but long-term influences on human health

Carrying Capacity

• The population that an area will support without undergoing environmental deterioration
• The carrying capacity of an environment tends to limit population size.
• Food availability, reproductive behavior, and infectious diseases tend to keep animal populations in check.
Population Crashes

• If components of the human life support system are disrupted by overpopulation of the planet, the species Homo sapiens could suffer a population crash.

Environment

• Refers to “... the complex of physical, chemical, and biotic factors (as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.”

The Ecological Model

• Proposes that the determinants of health (environmental, biological, and behavioral) interact and are interlinked over the life course of individuals.

Figure 1-8
The ecological model of population health.
**Ecosystem**

- “An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit.”
  - Millennium Ecosystem Assessment, 2003

**Environmental Health**

- “…addresses all the physical, chemical, and biological factors external to the person, and all the related factors impacting behaviors.”
- Encompasses control of environmental factors
- Aims to prevent disease
  - Source: World Health Organization

**Historical Background**

Hippocrates

- Greek philosopher who lived between 460 and 370 BC, often referred to as “the father of medicine.” He emphasized the role of the environment as an influence on people’s health and health status in his work titled *On Airs, Waters, and Places* (ca. 400 BC).
- Proposed that environmental and climatic factors such as the weather, seasons, and prevailing winds; the quality of air, water, and food; and one’s geographic location were influential in causing changes in human health.
**Historical Background**

Environmental History Post-1800

- Classified into three eras
  - The first wave of environmental concern (19th century to mid-20th century)
  - The second wave of environmental awareness (mid-20th century to 1980s)
  - The third period of environmental concern (1980s to the present)

**Current Hot Topics**

<table>
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<tr>
<th>Table 1-3: Examples of Hot Topics in Environmental Health</th>
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<tr>
<td><strong>Air quality</strong></td>
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<tr>
<td>Conservation</td>
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<tr>
<td>Endangered species/Wildlife impacts</td>
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<td>Energy resources</td>
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<td>Environmental justice</td>
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<td>Environmental protection</td>
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<tr>
<td>Forests</td>
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<td>Global warming/Global climate change</td>
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<td>Greenhouse gases</td>
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<td>Hazardous wastes</td>
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<td>Source: Partial data from LouisSain, Environment issues. Copyright 2003, LouisSain, a division of Rand Everhot Inc. All rights reserved.</td>
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</table>
Careers in Environmental Health

• Industrial Hygienist:
  - Responsible for control of hazards that may affect workers as well as hazards that may impact the community.

• Toxicologist:
  - The field of environmental toxicology specializes in the effects of toxic chemicals upon the environment and living creatures such as human beings and wildlife. Occupational and industrial toxicologists investigate the effects of chemicals found in the workplace upon the health of workers.

Careers in Environmental Health

• Environmental Health Inspector:
  - Responsible for monitoring and enforcing government regulations for environmental quality.

• Occupational Health Physician/Occupational Health Nurse:
  - Involved with the prevention and treatment of occupationally related illnesses and injuries.
  - Investigate hazards in the work environment.
  - Develop procedures for abatement of hazards.
  - Conduct health education programs.

<table>
<thead>
<tr>
<th>TABLE 3-4</th>
<th>Policies Related to Environmental Health</th>
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<tr>
<td>Academic institutions</td>
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<td>Industrial</td>
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<td>Nuclear</td>
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<td>Chemical</td>
<td>Environmental impact assessments</td>
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<td>Engineering</td>
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Source: Adapted information from the 2013-2014 Health Report, Occupational Health Services, Department of Environmental Health and Safety, University of Washington, Seattle, WA. (2013).