CRITICAL THINKING

We live in an age of information. Computers, e-mail, the Internet, CD-ROMs, instant news, and fax machines bring us information more quickly than ever before. A simple search of the Internet will provide huge amounts of information. Some of the information has been subjected to scrutiny and is quite valid, some is well-informed opinion, some is naive misinformation, and some is even designed to mislead. How do we critically evaluate the information we get?

Critical thinking involves a set of skills that helps us to evaluate information, arguments, and opinions in a systematic and thoughtful way. Critical thinking also can help us better understand our own opinions as well as the points of view of others. It can help us evaluate the quality of evidence, recognize bias, characterize the assumptions behind arguments, identify the implications of decisions, and avoid jumping to conclusions.

CHARACTERISTICS OF CRITICAL THINKING

Critical thinking involves skills that allow us to sort information in a meaningful way and discard invalid or useless information while recognizing that which is valuable. Some key components of critical thinking are:

Recognize the Importance of Context

All information is based on certain assumptions. It is important to recognize what those assumptions are. Critical thinking involves looking closely at an argument or opinion by identifying the historical, social, political, economic, and scientific context in which the argument is being made. It is also important to understand the kinds of bias contained in the argument and the level of knowledge the presenter has.

Consider Alternative Views

A critical thinker must be able to understand and evaluate different points of view. Often these points of view may be quite varied. It is important to keep an open mind and to look at all the information objectively and try to see the value in alternative points of view. Often people miss obvious solutions to problems because they focus on a certain avenue of thinking and unconsciously dismiss valid alternative solutions.

Expect and Accept Mistakes

Good critical thinking is exploratory and speculative, tempered by honesty and a recognition that we may be wrong. It takes courage to develop an argument, engage in debate with others, and admit that your thinking contains errors or illogical components. By the same token, be willing to point out what you perceive to be shortcomings in the arguments of others. It is always best to do this with good grace and good humor.

Have Clear Goals

When analyzing an argument or information, keep your goals clearly in mind. It is often easy to get sidetracked. A clear goal will allow you to quickly sort information into that which is pertinent and that which may be interesting but not germane to the particular issue you are exploring.

Evaluate the Validity of Evidence

Information comes in many forms and has differing degrees of validity. When evaluating information, it is important to understand that not all the information from a source may be of equal quality. Often content about a topic is a mix of solid information interspersed with less certain speculations or assumptions. Apply a strong critical attitude to each separate piece of information. Often what appears to be a minor, insignificant error or misunderstanding can cause an entire argument to unravel.

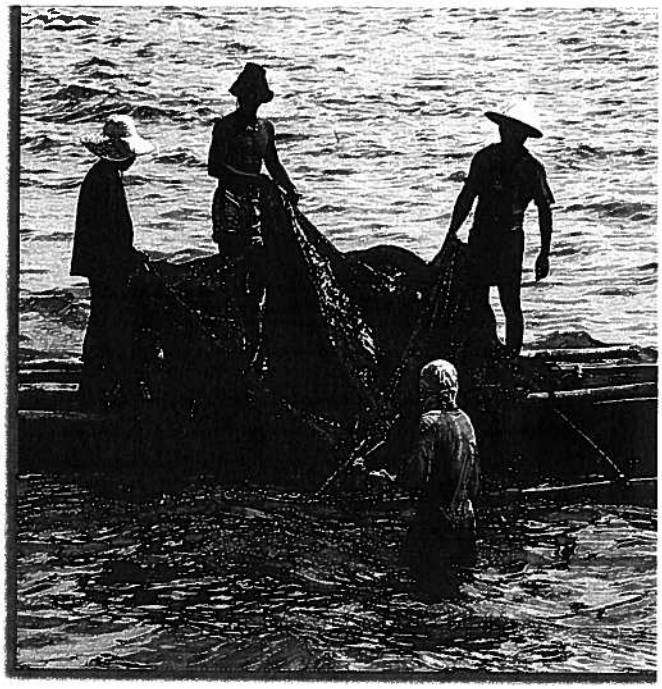
Critical Thinking Requires Practice

As with most skills, you become better if you practice. At the end of each chapter in the text, there is a series of questions that allow you to practice critical thinking skills. Some of these questions are straightforward and simply ask you to recall information from the chapter. Others ask you to apply the information from the chapter to other similar contexts. Still others ask you to develop arguments that require you to superimpose the knowledge you have gained from the chapter on quite different social, economic, or political contexts from your own.

Practice, practice, practice.

CHAPTER 1

ENVIRONMENTAL INTERRELATIONSHIPS



Environmental science is the study of interrelationships between humans and the natural world. These fishermen are interacting with the aquatic environment of fish and if they are successful they will influence the population of fish in this part of the ocean.

CHAPTER OUTLINE

The Nature of Environmental Science
- Interrelatedness Is a Core Concept
- An Ecosystem Approach
- Political and Economic Issues
- The Global Nature of Environmental Concerns

Regional Environmental Concerns
- The Wilderness North
- The Agricultural Middle
- The Dry West
- The Forested West
- The Great Lakes and Industrial Northeast
- The Diverse South

ISSUES & ANALYSIS
Government Regulation and Personal Property 12

CAMPUS SUSTAINABILITY INITIATIVE
The Association for the Advancement of Sustainability in Higher Education 12

GOING GREEN
Individual Decisions Matter 7

WATER CONNECTIONS
Social and Biological Interactions in the Management of Keoladeo National Park, India 4

OBJECTIVES

After reading this chapter, you should be able to:

- Understand why environmental problems are complex and interrelated.
- Realize that environmental problems involve social, ethical, political, and economic issues, not just scientific issues.
- Understand that acceptable solutions to environmental problems often are not easy to achieve.
- Understand that all organisms have an impact on their surroundings.
- Understand what is meant by an ecosystem approach to environmental problem solving.
- Recognize that different geographic regions have somewhat different environmental problems, but the process for resolving them is often the same and involves compromise.

A Global Perspective on "Sustainable Development of the Mekong River Delta" can be found on the book's website at www.mhhe.com/enger12e along with other interesting readings.

THE NATURE OF ENVIRONMENTAL SCIENCE

Environmental science is an interdisciplinary field that includes both scientific and social aspects of human impact on the world. The word *environment* is usually understood to mean the surrounding conditions that affect organisms. In a broader definition, **environment** is everything that affects an organism during its lifetime. In turn, all organisms including people affect many components in their environment. **Science** is an approach to studying the natural world that involves formulating hypotheses and then testing them to see if the hypotheses are supported or refuted. However, because humans are organized into complex societies, environmental science also must deal with politics, social organization, economics, ethics, and philosophy. Thus, environmental science is a mixture of the traditional science, individual and societal values, economic factors, and political awareness that are important to solving environmental problems. (See figure 1.1.)

Although environmental science as a field of study is evolving, it is rooted in the early history of civilization. Many ancient cultures expressed a reverence for the plants, animals, and geographic features that provided them with food, water, and transportation. These features are still appreciated by many modern people. Although the following quote from Henry David Thoreau (1817–62) is over a century old, it is consistent with current environmental philosophy:

> I wish to speak a word for Nature, for absolute freedom and wildness, as contrasted with a freedom and culture merely civil . . . to regard man as an inhabitant, or a part and parcel of Nature, rather than a member of society.

The current interest in the state of the environment began with philosophers like Thoreau and scientists like Rachel Carson and received emphasis from the organization of the first Earth Day on April 22, 1970. Subsequent Earth Days reaffirmed this commitment. As a result of this continuing interest in the state of the world and how people both affect it and are affected by it, environmental science is now a standard course or program at many colleges. It is also included in the curriculum of high schools. Most of the concepts covered by environmental science courses had previously been taught in ecology, conservation, biology, or geography courses. Environmental science incorporates the scientific aspects of these courses with input from the social sciences, such as economics, sociology, and political science, creating a new interdisciplinary field.

Interrelatedness Is a Core Concept

A central factor that makes the study of environmental science so interesting/frustrating/challenging is the high degree of interrelatedness among seemingly unrelated factors. Many naturalists and philosophers have thought about this over the years. The naturalist John Muir captured this interrelatedness theme in the following quote:

Tug on anything at all and you'll find it connected to everything else in the universe.

Charles Darwin exemplified this same kind of thinking when he proposed that the production of seeds in red clover plants in fields in England was directly related to the number of cats in the area. His logic was as follows: Villagers keep cats, cats hunt and kill meadow mice, bumblebees build their nests in the ground, meadow

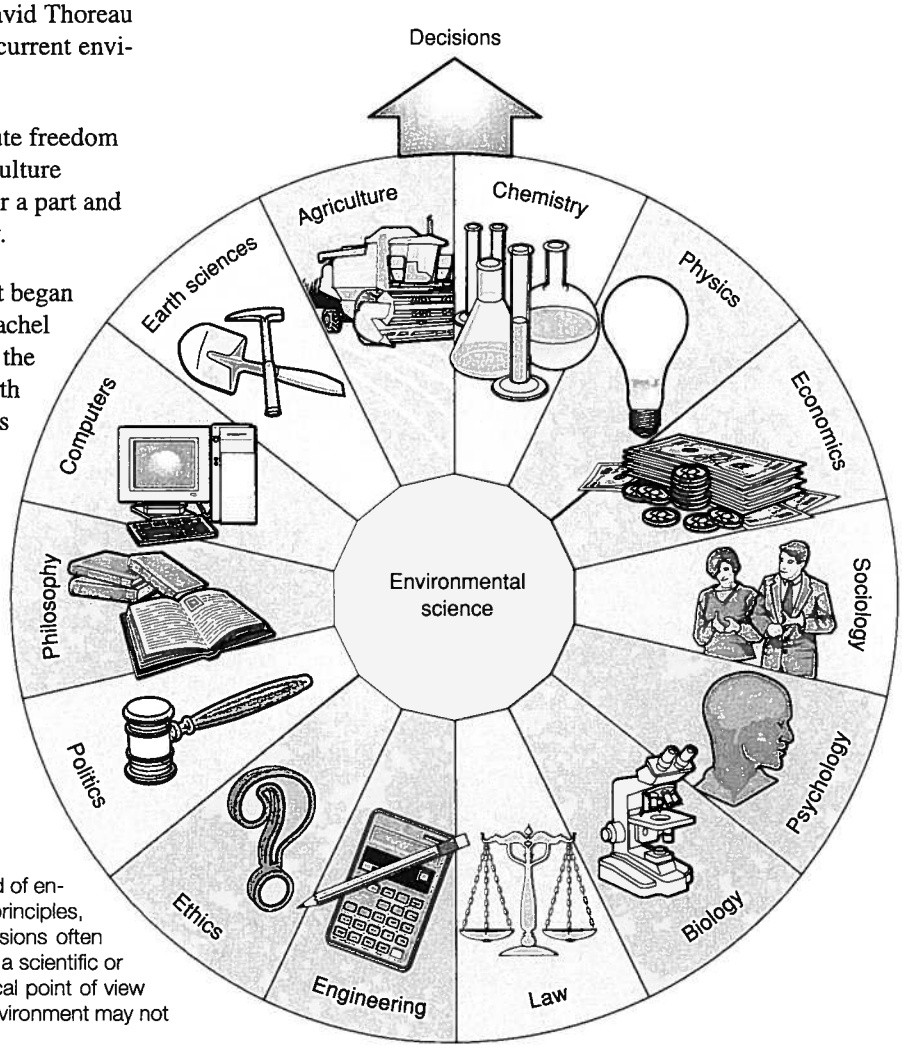


FIGURE 1.1 Environmental Science The field of environmental science involves an understanding of scientific principles, economic influences, and political action. Environmental decisions often involve compromise. A decision that may be supportable from a scientific or economic point of view may not be supportable from a political point of view without modification. Often political decisions relating to the environment may not be supported by economic analysis.

mice eat the honeycomb and larvae of bumblebees, and bumblebees have long tongues that allow them to pollinate clover, which other bees have difficulty doing. Therefore, since cats eat mice, more bumblebees survive to pollinate clover plants. While this may seem to be a fanciful story, let's look at a concrete example that illustrates how seemingly distinct things may actually be interconnected.

The reintroduction of wolves to Yellowstone National Park has resulted in many changes to the Yellowstone ecosystem. The initial introduction of 31 wolves in 1995 and 1996 has resulted in a current population of about 320 wolves. Several changes to the Yellowstone ecosystem can be directly attributed to the alterations brought about by wolves.

Wolves kill and eat elk. This has resulted in a significant reduction in the size of the elk herd from about 19,000 prior to wolf reintroduction to about 11,000 now. The presence of wolves also has modified the behavior of elk. Because they must be more vigilant and move about more because of the predatory behavior of wolves, elk spend less time feeding on willow, cottonwood, and aspen. Both the change in behavior and the reduced size of the elk herd have allowed the regeneration of stands of willow and aspen. This has in turn resulted in increased numbers of beavers that use these trees for food. The dams built by beavers tend to slow the flow of water and increase the recharge of groundwater. Furthermore, the stands of willow along the banks of streams cool the water and improve fish habitat. The stands of willow also provide needed habitat for some songbirds.

Wolves directly compete with coyotes and kill them if they have the opportunity. Thus, since the reintroduction of wolves the coyote population has fallen to half its previous level. There is evidence that the populations of the prey of coyotes—voles, mice, and other rodents—have increased. The increased availability of this food source has resulted in an increase in the number of foxes, hawks, and owls.

Thus, it is fair to say that the reintroduction of the wolf has changed how water flows through the landscape, and has led to increased populations of many organisms—willow, aspen, beaver, songbirds, foxes, certain rodent, hawks, and owls; and to the decline in the population of other organisms—coyote and elk (figure 1.2). Truly this is a story that illustrates the point made by Muir—*Tug on anything at all and you'll find it connected to everything else in the universe.*

It is important to understand that the reintroduction of wolves to Yellowstone was not purely a scientific undertaking. Many biologists and environmentalists argued that it was important to restore the wolf to its former habitat for biological reasons. Others looked at the issue in terms of ethics and felt that humans had an ethical obligation to restore wolves to their former habitat. While park managers could easily see the problems created by a lack of wolves and a huge elk population, they could not simply make the decision to bring back the wolf. A long history of controlling animals that could prey on livestock had to be overcome. Ranchers strongly opposed the reintroduction of wolves and saw this as an economic issue. If wolves left the park and killed their livestock, they would lose money. The farm lobby in Congress is very strong and fought long and hard to prevent the reintroduction. After a lengthy period of hearings and many compromises—including a fund to pay ranchers for cattle killed by wolves—the U.S. Fish and Wildlife Service was authorized to proceed with the reintroductions. Thus, the interconnectedness theme associated with the reintroduction of wolves to Yellowstone also applies to social, economic, and political realms of human activity.

An Ecosystem Approach

Environmental science involves an understanding that the natural world is organized into interrelated units called ecosystems. An **ecosystem** is a region in which the organisms and the physical environment form an interacting unit. Within an ecosystem there is a complex network of interrelationships. For example, weather affects plants, plants use minerals in the soil and are food for animals, animals spread plant seeds, plants secure the soil, and plants evaporate water, which affects weather.

Some ecosystems have easily recognized boundaries. Examples are lakes, islands, floodplains, watersheds separated by mountains, and many others. Large ecosystems always include smaller ones. A large watershed, for example, may include a number of lakes, rivers, streams, and a variety of terrestrial ecosystems. A forest ecosystem

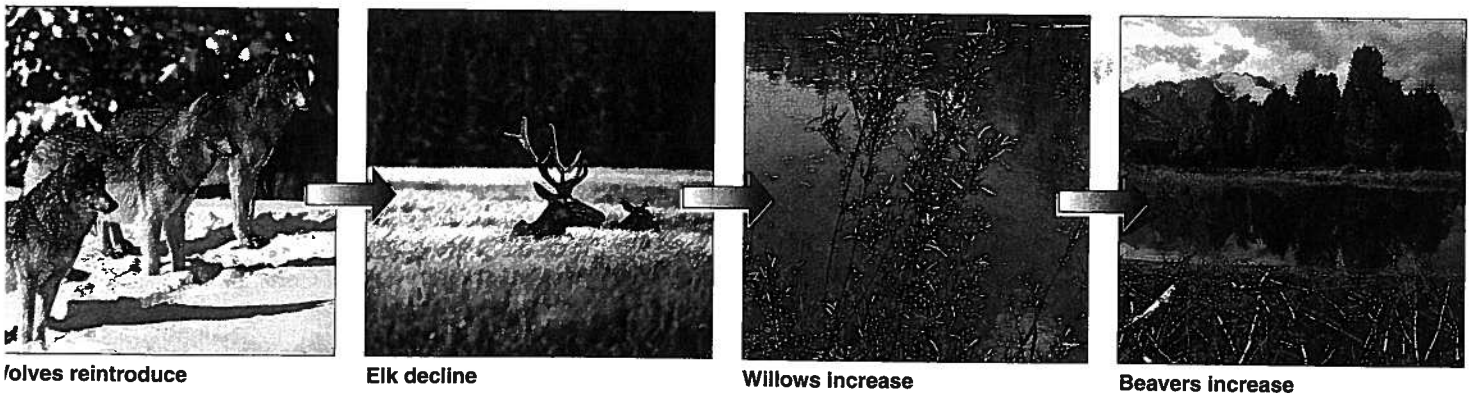


FIGURE 1.2 Wolf Reintroduction Reveals Interrelatedness The reintroduction of wolves to Yellowstone National Park initiated changes that rippled through the Yellowstone ecosystem. As wolves increased, elk and coyote populations decreased. Decreases in these populations resulted in increases in the populations of willow and aspen trees, beaver, foxes, and songbirds.

Water Connections

Social and Biological Interactions in the Management of Keoladeo National Park, India

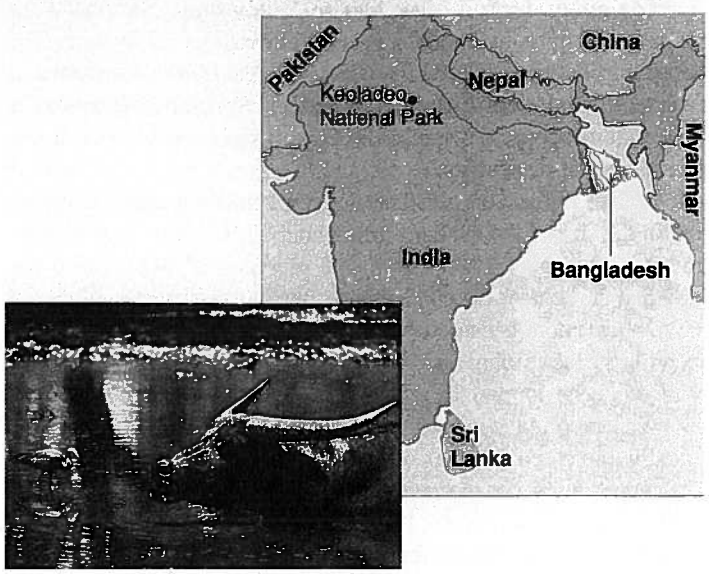
Keoladeo National Park is a small (2873 hectares; 7096 acres) artificial wetland system located near Bharatpur on the Ganges plain in India. The wetland was created in 1750 by local royalty to attract migratory birds for hunting. Today, over 350 bird species, including the endangered Siberian crane, inhabit the park seasonally. In 1982, Keoladeo was declared a national park and was designated as a World Heritage Site by the UNESCO in 1985.

Its designation as a park resulted in several changes to the way in which the land was used. Local villagers were prohibited from using the land to graze their cattle and water buffalo, and they could no longer harvest plants to use as food for their animals and for other purposes. It turned out that the traditional uses of the land were important for maintaining habitat suitable for the Siberian crane.

Water buffalo, certain aquatic plants, and the Siberian crane coexisted in a three-way relationship. The buffalo grazed on the aquatic vegetation, which kept it short and maintained open water areas. These conditions made it possible for the cranes to dig up rhizomes and tubers of the aquatic plants for food. In 1983, however, the India Wildlife Protection Act prohibited the grazing of buffalo in the park. As a result, the weeds grew to their full height and in solid masses that created a physical barrier that prevented the cranes from accessing their main food source, which led to a dramatic decrease in the numbers of cranes in the park.

The Wildlife Protection Act was formulated and implemented without consultation with local scientists or local communities. A decade-long study, costing nearly US$ 1 million indicated that grazing buffalo were key to controlling the growth of grasses and water weeds and that control of these plants was needed to support the Siberian crane and other bird populations. Local communities and scientists already knew this.

In recent years, drought and competition with farmers for irrigation water have resulted in many of the ponds drying up. Many of the migratory birds that visited the site have not been doing so because of the lack of water. The lack of appropriate water management has caused UNESCO to threaten to remove the World Heritage Site designation. The Indian government responded by constructing a canal to supply water that will maintain adequate water levels during periods of drought. Although the canal has brought additional water, it is not enough to solve the problem of drought. Therefore, ways to provide additional water are being considered.



Water buffalo

may cover hundreds of square kilometers and include swampy areas, openings, and streams as subsystems within it. Often the boundaries between ecosystems are indistinct, as in the transition from grassland to desert. Grassland gradually becomes desert, depending on the historical pattern of rainfall in an area. Thus, defining an ecosystem boundary is often a matter of practical convenience.

However, an ecosystem approach is important to dealing with environmental problems. The task of an environmental scientist is to recognize and understand the natural interactions that take place and to integrate these with the uses humans must make of the natural world.

Political and Economic Issues

Most social and political decisions are made with respect to political jurisdictions, but environmental problems do not necessarily coincide with these artificial political boundaries. For example, air pollution may involve several local units of government, several states or provinces, and even different nations. Air pollution generated in China affects air quality in western coastal states in the United States and in British Columbia, Canada. On a more local level, the air pollution generated in Juarez, Mexico, causes problems in the neighboring city of El Paso, Texas. But the issue is more than air quality and human health. Lower wage rates and less strict environmental laws have influenced some U.S. industries to move to Mexico for economic advantages. Mexico and many other developing nations are struggling to improve their environmental image and need the money generated by foreign investment to improve the conditions and the environment in which their people live.

The issue of declining salmon stocks in the Pacific Northwest of the United States and British Columbia, Canada, illustrates the political and economic friction associated with a resource that crosses political boundaries. From the U.S. perspective alone there are five federal cabinet-level departments, two federal agencies, and five federal laws, and numerous tribal treaties that affect decisions about the use of this resource. Furthermore, commercial fishers from several states and provinces are economically

affected by any decisions made concerning the harvesting of these fish. (See figure 1.3.) They are politically active and try to influence the laws and rulings of state, provincial, and national governments.

The freshwater resources of the Great Lakes are a shared resource of eight U.S. states and the Canadian provinces of Ontario and Quebec. Problems associated with the use of this resource are regulated by the International Joint Commission. The International Joint Commission was established in 1909, when the Boundary Waters Treaty was signed between the United States and Canada. The treaty was established in part to provide that the "boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property of the other." The commission has been instrumental in identifying areas of concern and encouraging the cleanup of polluted sites that affect the quality of the Great Lakes and other boundary waters. In general, the two national governments and the state and provincial governments have listened to the commission's advice and have responded by initiating cleanup activities and regulating the export of water from the region.

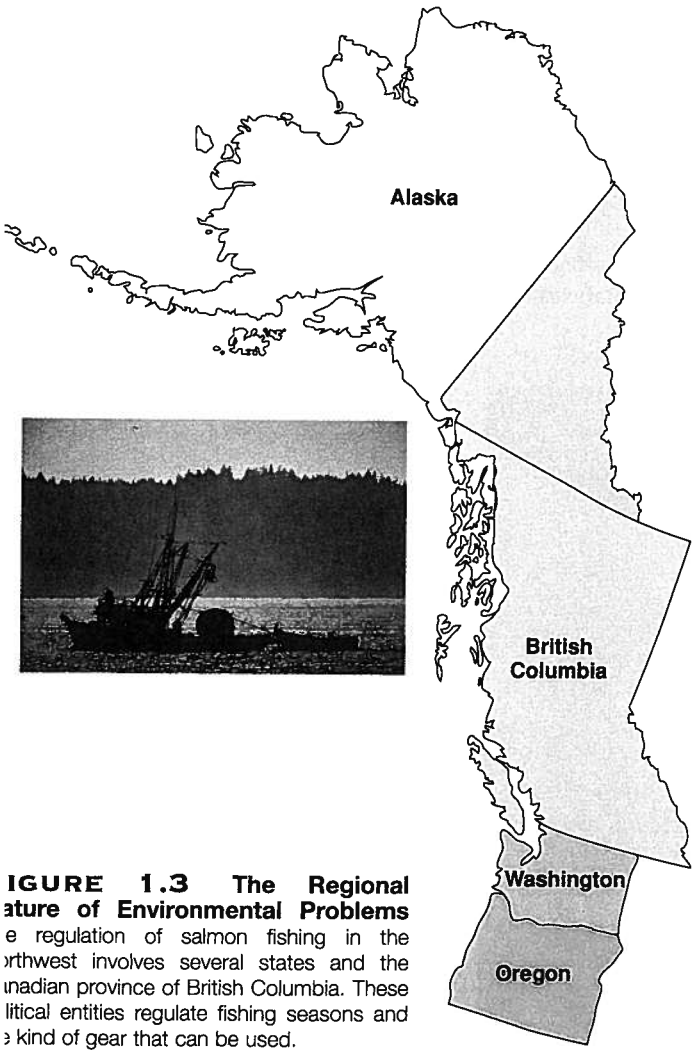


FIGURE 1.3 The Regional Nature of Environmental Problems The regulation of salmon fishing in the Northwest involves several states and the Canadian province of British Columbia. These political entities regulate fishing seasons and the kind of gear that can be used.

The Global Nature of Environmental Concerns

As the human population has increased, the natural ecosystems of the Earth have been stressed. Recognition of this has led to international activities to address concerns about the Earth's natural systems and how humans are affecting them.

The Earth Summit

The first worldwide meeting of heads of state that was directed to a concern for the environment took place at the Earth Summit, formally known as the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. One of the key outcomes of the conference was a series of policy statements on sustainable development that were identified as Agenda 21.

More than 178 governments at the 1992 conference adopted three documents related to sustainable development: Agenda 21, the Rio Declaration on Environment and Development, and the Statement of Principles for the Sustainable Management of Forests. The United Nations Commission on Sustainable Development was created in 1993 to monitor and report on implementation of the agreements. Follow-up conferences were held in 1997 and 2002 to assess progress.

Climate Change

In 1997, representatives from 125 nations met in Kyoto, Japan, for the Third Conference of the United Nations Framework Convention on Climate Change. This conference, commonly referred to as the Kyoto Conference on Climate Change, resulted in commitments from the participating nations to reduce their overall emissions of six greenhouse gases (linked to global warming) by at least 5 percent below 1990 levels and to do so between the years 2008 and 2012. The Kyoto Protocol, as the agreement was called, was viewed by many as one of the most important steps to date in environmental protection and international diplomacy. It is clear that many countries will not meet their goals, but are making progress toward their goals.

The Millennium Ecosystem Assessment

In 2005, the Millennium Ecosystem Assessment was completed. It was initiated by the United Nations and included input from over 1360 experts from around the world. It looked at the services provided by ecosystems and evaluated the status of each service. Four broad areas of ecosystem services were identified: supporting services, provisioning services, regulating services, and cultural services. Supporting services include such ecosystem functions as: photosynthesis, soil formation, nutrient cycling, and

water cycling. Provisioning services include resources provided by ecosystems such as: food, fiber, genetic resources, natural medicines, and freshwater. Regulating services include ecosystem activities that affect air quality, water flow, erosion control, water purification, climate control, disease regulation, pest regulation, pollination, and natural hazards. Cultural services include spiritual, religious, and aesthetic values, and the use of the natural world for recreation.

In general the report is quite negative. As the human population has grown we are putting pressure on the natural ecosystems of the world, and most are being negatively affected. Food production is one bright spot. Production of crops, livestock, and fish from aquaculture have increased. However, this is at the expense of the loss of soil from erosion, the conversion of natural ecosystems to managed agricultural systems, and overconsumption of water resources.

REGIONAL ENVIRONMENTAL CONCERNS

To illustrate the interrelated nature of environmental issues, we will look at several regions of North America and highlight some of the key features and issues of each. (See figure 1.4.) For example, protecting endangered species is a concern in many parts of the world. In the Pacific Northwest, an endangered species known as the northern spotted owl depends on undisturbed mature forests for its survival. Development and logging may conflict with the survival of the owl. In most metropolitan areas, the problem of endangered species is purely historical, since the construction of cities has destroyed the previously existing ecosystem. Here we present a number of regional vignettes to illustrate the complexity and interrelatedness of environmental issues. Each region has specific environmental issues that capture the attention of the people who live there.

THE WILDERNESS NORTH

Much of Alaska and Northern Canada can be characterized as **wilderness**—areas with minimal human influence. Much of this land is owned by governments, not by individuals, so governmen policies have a large effect on what happens in these regions These areas have important economic values in their trees, animals, scenery, and other natural resources. Exploitation of the region's natural resources involves significant trade-offs. Usually a portion of the natural world is altered permanently, but the area altered is so small that many people consider it insignificant Because of the severe climate, northern wilderness areas tend to be very sensitive to insults and take a long time to repair damage done by unwise exploitation. Mining, oil exploration, development of hydroelectric projects, and harvesting of timber all require roads and other human artifacts. These activities also alter the culture of native people by introducing new technologies and generating economic benefits.

In the past, many short-term political and economic decisions failed to look at long-term environmental implications. Today, however, people are concerned about these remaining wilderness areas Politicians are more willing to look at the scientific and recreationa values of wilderness as well as the economic value of exploitation.

Native people, who consider much of this region to be their land, have become increasingly sophisticated in negotiating with state, provincial, and federal governments to protect rights they feel they were granted in treaties. They are sensitive to changes in land use or government policy that would force changes in their traditional way of life.

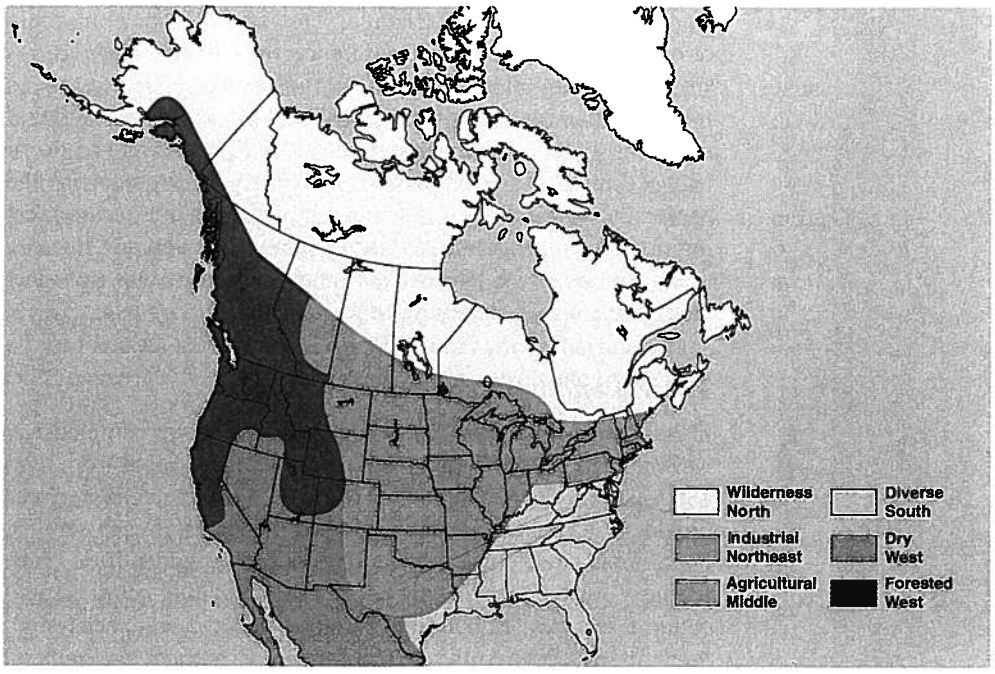


FIGURE 1.4 Regions of North America Because of natural features o the land and the uses people make of the land, different regions of North America face different kinds of environmental issues. In each region, people face a large number of specific issues, but certain kinds of issues are more important in some regions than others.

Going Green

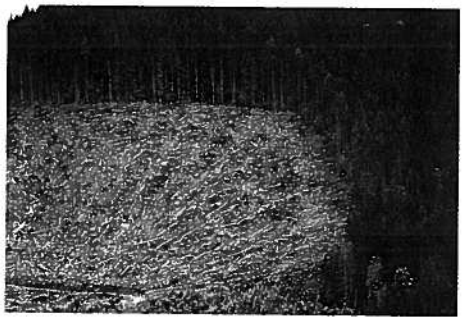
Individual Decisions Matter

There is a growing awareness that sustainability needs to be a core value if future generations are to inherit an Earth worth having. Those who support green initiatives are motivated in many different ways. Some are motivated by ethical or moral beliefs that they should live lightly on the land." Some are motivated by the economic realities of rising energy costs or the costs associated with correcting environmental mistakes. Some simply want to be seen as having green values.

Regardless of their motivation, people around the world are making green decisions. Organizers of conferences and concerts are buying carbon credits to offset the impact of their events. Companies have discovered that consumers seek green products. Governments have passed laws that encourage their citizens to live more sustainably. Ultimately, however, green initiatives depend on individuals making everyday decisions. How many pairs of shoes do I really need? Do I really need the latest electronic gadget? Should I buy products that are produced locally? In the final analysis, most daily decisions have an environmental impact and you have a role to play.

To call attention to these bits of good news, several features in this book will highlight green initiatives. Each chapter will have a "Going Green" feature that highlights a particular green initiative. In addition, specific college campuses will be showcased for their particular green initiatives. Finally, you will be asked to consider changes that you can make that collectively can help lead to a sustainable society.

Walrus harvesting



A clear-cut forest

Grizzly bear fishing for salmon

FIGURE 1.5 The Wilderness North Protection of wilderness is a major issue in this region. The major points of conflict involve the government role in managing these lands and wildlife, the protection of the rights and beliefs of native people, and the desire of many to exploit the mineral and other resources of the region.

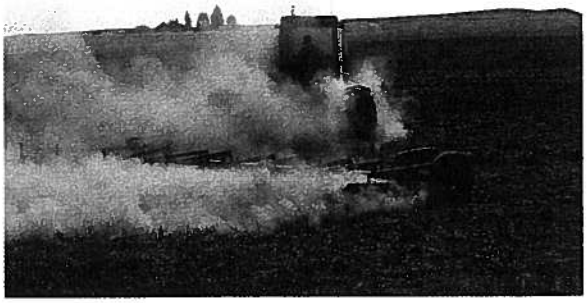
Concerned citizens, business interests, and environmental activists have become increasingly sophisticated in influencing decisions made by government. The process of compromise is often difficult and does not always ensure wise decisions, but most governments now realize they must listen to the concerns of their citizens and balance economic benefits with social and cultural benefits. (See figure 1.5.)

The Agricultural Middle

The middle of the North American continent is dominated by intensive agriculture. This means that the original, natural ecosystems have been replaced by managed agricultural enterprise. It is important to understand that this area was at one time wilderness. Today, you would need to search very hard to find regions of true wilderness in Iowa, Indiana, or southern Manitoba. Some special areas have been set aside to preserve fragments of the original natural plant and animal associations, but most of the land has been converted to agriculture wherever practical.

The economic value generated by this use of a rich soil resource is tremendous, and most of the land is privately owned. Governments cannot easily control what happens on these privately held lands. But governments indirectly encourage certain activities through departments of agriculture that encourage agricultural research, grant special subsidies to farmers in the form of guaranteed prices for their products and other special payments, and develop markets for products.

One of the major, nonpoint pollution sources (pollution that does not have an easily identified point of origin) is agriculture. Air pollution in the form of dust is an inevitable result of tilling the land. Soil erosion occurs when soil is exposed to wind and moving water and leads to siltation of rivers, impoundments, and lakes. Fertilizers and other agricultural chemicals blow or are washed from the areas where they are applied. Nutrients washed from the land enter rivers and lakes where they encourage the growth of algae,



Dust

Erosion

Food production

Pesticide use

FIGURE 1.6 The Agricultural Middle The rich soil resource of this region has been converted to managed agricultural activity. The use of pesticides and fertilizer and exposure of the land to erosion cause concern about pollution of surface and groundwater. Most farmers still maintain that these practices are essential in modern agriculture and that they can be used safely and with minimal pollution.

lowering water quality. The use of pesticides causes concern about human exposure, effects on wildlife that are accidentally exposed, and residues in foods produced.

Since many communities in this region rely on groundwater for drinking water, the use of fertilizers and pesticides, and their potential for entering the groundwater as a result of unwise or irresponsible use, is a consumer issue. In addition, many farmers use groundwater for irrigation, which lowers the water table and leaves less groundwater for other purposes.

In an effort to stay in business and preserve their way of life, farmers must use modern technology. Careful use of these tools can reduce their impact; irresponsible use causes increased erosion, water pollution, and risk to humans. (See figure 1.6.)

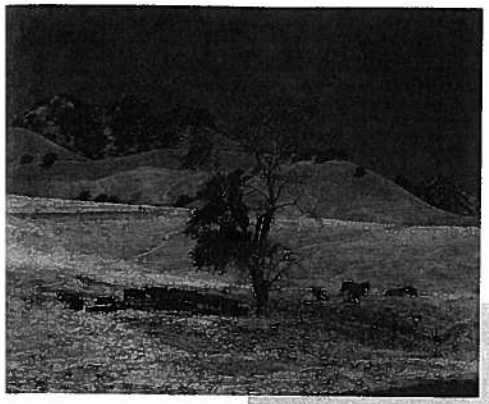
The Dry West

Where rainfall is inadequate to support agriculture, ranching and raising livestock are possible. This is true in much of the drier portions of western North America. Because much of the land is of low economic value, most is still the property of the federal government, which encourages its use by providing water for livestock and irrigation at minimal cost, offering low-cost grazing rights, and encouraging mining and other development.

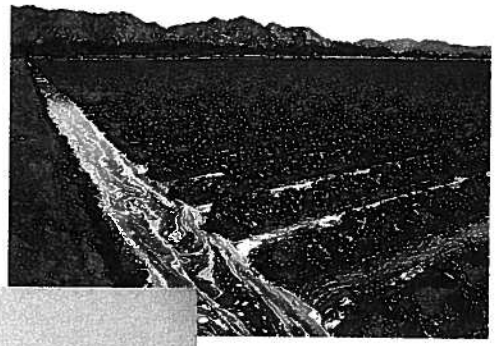
Many people believe that government agencies have seriously mismanaged these lands. They assert that the governmental agencies are controlled by special interest groups and powerful politicians sensitive to the demands of ranchers, that they subsidize ranchers by charging too little for grazing rights, and that they allow destructive overgrazing because of the economic desires c ranchers. Ranchers argue that they require access to governmen owned land, that they cannot afford significantly increased graz ing fees, and that changing government policies would destroy way of life that is important to the regional economy.

Water is an extremely valuable resource in this region. It i needed for municipal use and for agriculture. Many area particularly the river valleys, have fertile soils that can be use for intensive agriculture. Cash crops such as cotton, fruits, an vegetables can be grown if water is available for irrigatio Because water tends to evaporate from the soil rapidly, long-ter use of irrigated lands often results in the buildup of salts in th soil, thus reducing fertility. Irrigation water flowing from fields polluted by agricultural chemicals that make it unsuitable f other uses such as drinking. As cities in the region grow, an i creasing conflict arises between urban dwellers who need wat for drinking and other purposes, and ranchers and farmers wh need the water for livestock and agriculture. Increased deman for water will result in shortages, and decisions will have to b made about who will ultimately get the water and at what pric If the urban areas get the water they want, some farmers ar ranchers will go out of business. If the agricultural interests g the water, urban growth and development will have to be limite and expensive changes will have to be made to conserve dome tic water use.

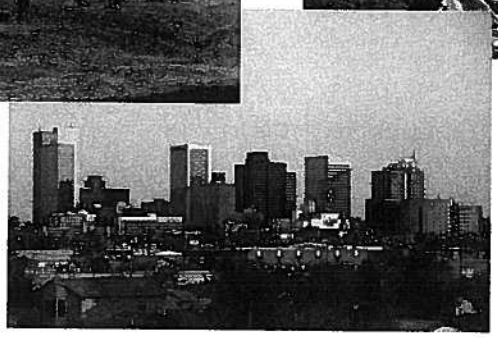
Because population density is low in most of this regio much of the land has a wilderness character. Increasingly, a co flict has developed between the economic management of t



Grazing



Irrigation



Urban areas

Grazing on federal land

FIGURE 1.7 The Dry West Water is a key issue in this region. Both city dwellers and rural ranchers and farmers need water, and conflict results when there is not enough water to satisfy the desires of all. In addition, much of the land in this region is owned by the federal government. This raises concerns about how the government manages the land and how government policy affects the people of the region.

ınd for livestock production and the desire on the part of many) preserve the "wilderness." Designating an area as wilderness ıeans that certain uses are no longer permitted. This offends inividuals and groups who have traditionally used the area for razing, hunting, and other pursuits. A long history of use and ɔuse of this land by overgrazing, modification to encourage lants valuable for livestock, and the introduction of grasses for vestock has significantly altered the region so that it cannot uly be called wilderness. The low population density does, ɔwever, provide a remoteness and natural character that many ;ek to preserve. (See figure 1.7.)

'HE FORESTED WEST

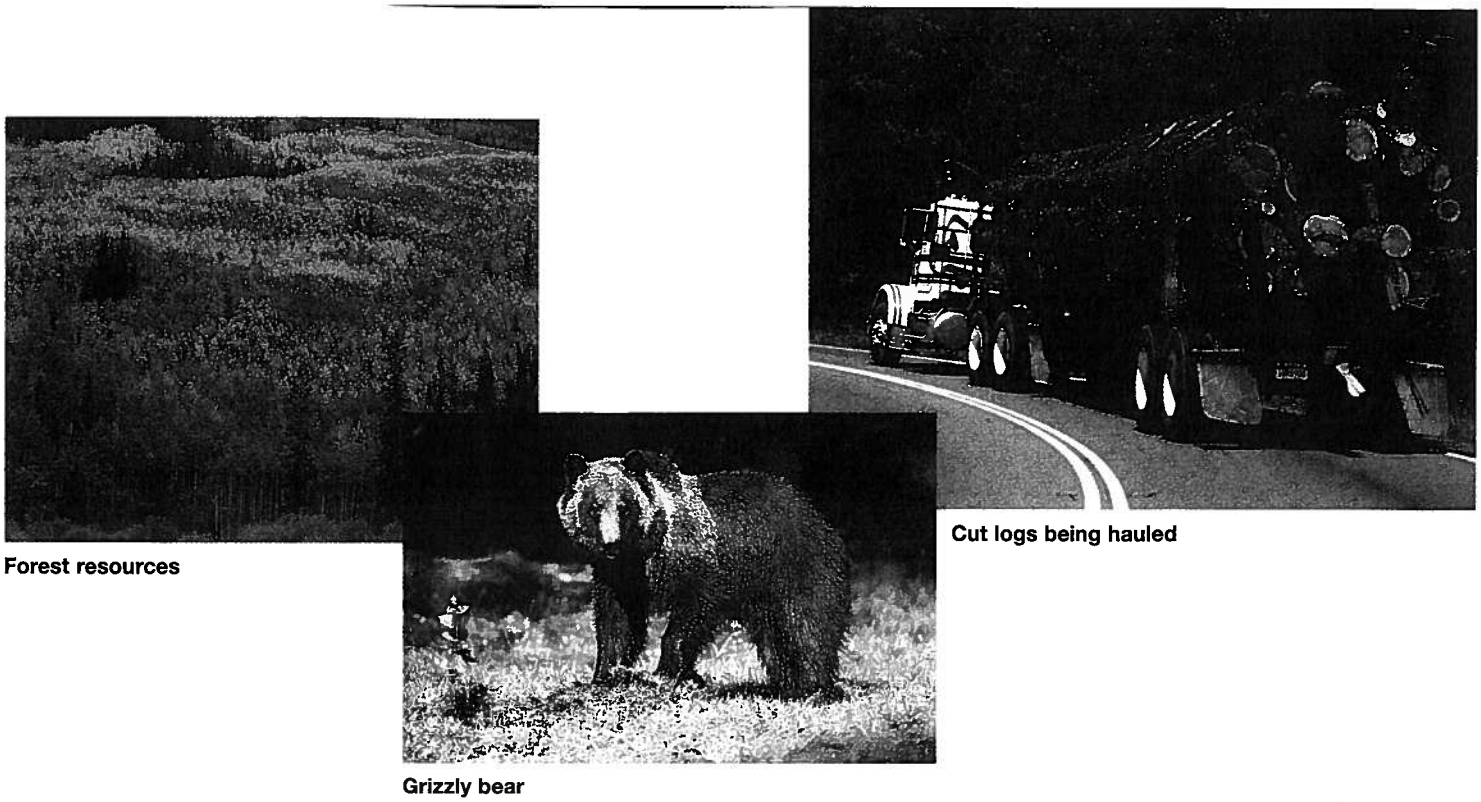
he coastal areas and mountain ranges of the western United ;ates and Canada receive sufficient rainfall to support extensive ɔniferous forests. Since most of these areas are not suitable for rmland, they have been maintained as forests with some grazing tivity in the more open forests. Governments and large commeral timber companies own large sections of these lands. ɔvernment forest managers (U.S. Forest Service, Bureau of ınd Management, Environment Canada, and various state and ovincial departments) historically have sold timbercutting rights a loss and are thought by many to be too interested in the proıction of forest products at the expense of other, less tangible lues. In 1993, the U.S. Forest Service was directed to stop low-cost timber sales.

This policy change has become a major issue in the old-growth rests of the Pacific Northwest, where timber interests maintain ıt they must have access to government-owned forests in order to remain in business. Many of these areas have significant wilderness, scenic, and recreational value. Environmental interests point out that it makes no sense to complain about the destruction of tropical rainforests in South America while North America makes plans to cut large areas of previously uncut, temperate rainforest. Are the intangible values of preserving an ancient forest ecosystem as important as the economic values provided by timber and jobs?

Environmental organizations are concerned about the consequences logging would have on organisms that require mature, old-growth forests for their survival. Grizzly bear habitat in Alaska and British Columbia could be altered significantly by logging; the northern spotted owl has become a symbol of the conflict between logging and preservation in Oregon and Washington; and preservation of coastal redwood forests has become an issue in northern California. (See figure 1.8.)

THE GREAT LAKES AND INDUSTRIAL NORTHEAST

While much of the West and Central regions of North America are characterized by low population densities and small towns, major portions of the Great Lakes and Northeast are dominated by large metropolitan complexes that generate social and resource needs that are difficult to satisfy. Many of these older cities were formed around industrial centers that have declined, leaving behind poverty, environmental problems in abandoned industrial sites, and difficulties with solid waste disposal, air quality, and land-use priorities. Interspersed among the major metropolitan areas are small towns, farmland, and forests.



Forest resources

Cut logs being hauled

Grizzly bear

FIGURE 1.8 The Forested West The cutting of forested areas for timber production destroys the previous ecosystem. Some see the tree: as a valuable resource that provides jobs and building materials. Others see the forest ecosystem as a natural resource that should be preserved. In addi tion, government ownership of much of this land has generated considerable political debate about what the appropriate use of the land should be.

One of the major resources of the region is water transport. The Great Lakes and eastern seacoast are extremely important to commerce; ships can travel throughout the area by way of the St. Lawrence Seaway and the Great Lakes through a series of locks and canals that bypass natural barriers. Because of the importance of shipping in this region, harbors have been constructed and waterways have been deepened by dredging. The waterways are maintained at considerable government expense.

One of the greatest problems associated with the industrial uses of the Great Lakes and East Coast is the historic problem of the contamination of the water with toxic materials. In some cases, unthinking or unethical individuals dumped toxins directly into the water. In other cases, small, accidental spills or leaks over long periods of time have contaminated the sediments in harbors and bays. The cleanup of contaminated industrial sites and sediments in the adjacent water is a major economic and social cost.

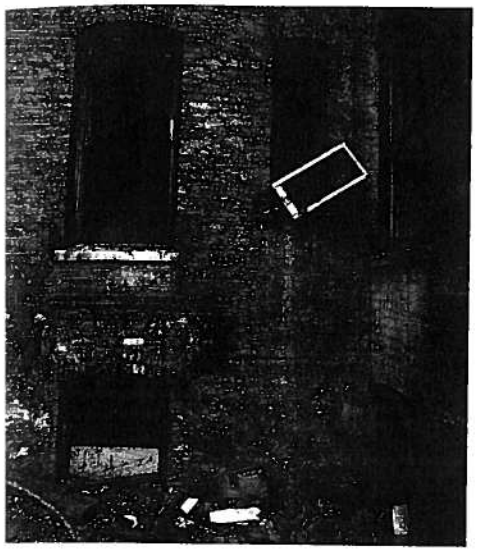
A major concern about these pollutants is that they bioaccumulate (see chapter 14) in the food chain. The concentrations of some chemicals in the fat tissue of top predators, such as lake trout and fish-eating birds, can be a million times higher than the concentration in the water. Because of this, government agencies have issued consumption advisories for some fish and shellfish in contaminated areas. Since many kinds of fish can swim great distances, advisories for the Great Lakes warn against eating certain fish taken anywhere within the lakes, not just from the site of contamination. Similarly, Chesapeake Bay has been subjected to years of thoughtless pollution, resulting in reduced fish and shellfish populations and advisories against consuming some organisms taken from the bay.

Water always generates considerable recreational value. Consequently, conflicts arise between those who want to use the water for industrial and shipping purposes and those who wish tc use it for recreation. Due to the fact that so much of the Nortl American population is concentrated in this region, the eco nomic value of recreational use is extremely high. Consume pressure is great to clean up contaminated sites and preven future pollution. Contaminated areas do not enhance tourism o quality of life.

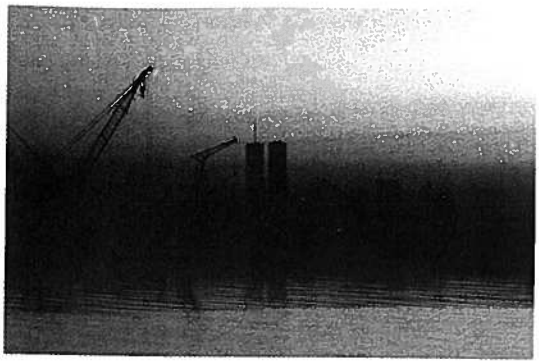
Most of these older, large cities had no plan to shape thei growth. As a result, open space for people is limited and urbai dwellers have few opportunities to interact with the natura world. Children who grow up in these cities often do not knov that milk comes from a cow—they have never seen, smelled, o touched a cow. Consequently, urban people have difficulty under standing the feeling rural people have for the land. These urbai dwellers may never have an opportunity to experience wilder ness. Their major environmental priorities are cleaning u contaminated sites, providing more parks and recreation facili ties, reducing air and water pollution, and improving transporta tion. (See figure 1.9.)

The Diverse South

In many ways, the South is a microcosm of all the regions previously discussed. The petrochemical industry dominates the economies o Texas and Louisiana, and forestry and agriculture are significan elements of the economy in other parts of the region. Major metro politan areas thrive, and much of the area is linked to the coast eithe directly or by the Mississippi River and its tributaries. The environ mental issues faced in the South are as diverse as those in the othe regions.



Inner-city decay in Chicago



New York harbor

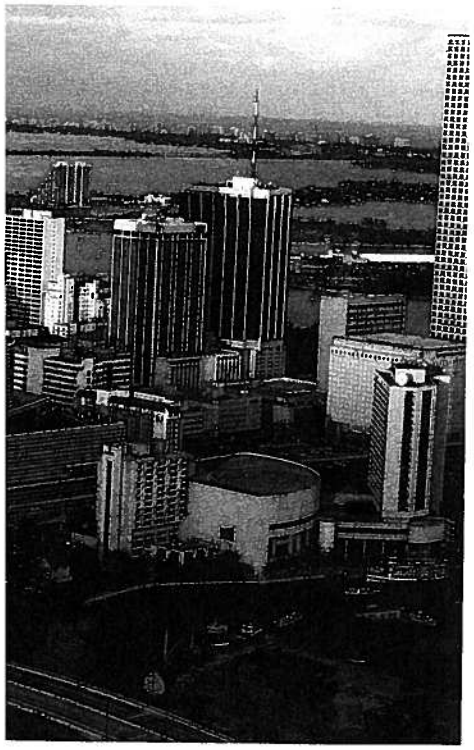
Chicago central city

FIGURE 1.9 The Great Lakes and the Industrial Northeast Industry, waterways, and population centers are defining elements of this region. The historically extensive use of the Great Lakes and coastal areas of the Northeast for industry, because of the ease of providing water transportation, has resulted in many older cities with poor land-use practices. Rebuilding cities, providing recreational opportunities for urban dwellers, and repairing previous environmental damage are important issues. The water resources of the region provide transportation, recreation, and industrial opportunities.

Some areas of the South (particularly Florida) have had extremely rapid population growth, which has led to groundwater problems, transportation problems, and concerns about regulating the rate of growth. Growth means money to developers and investors, but it requires municipal services, which are the responsibility of local governments. Too many people and too much development also threaten remaining natural ecosystems.

Poverty has been a problem in many areas of the South. This creates a climate that encourages state and local governments to accept industrial development at the expense of other values. Often, jobs are more important than the environmental consequences of the jobs; low-paying jobs are better than no jobs.

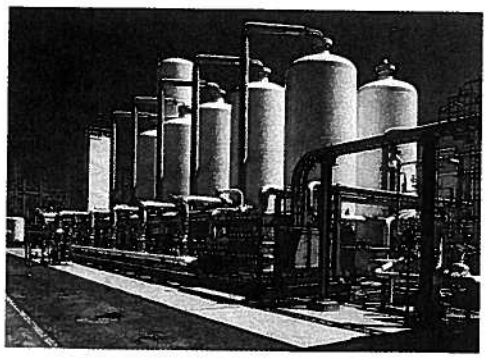
The use of the coastline is of major concern in many parts of the South. The coast is a desirable place to live, which may encourage unwise development on barrier islands and in areas that are subject to flooding during hurricanes and other severe weather events. In addition, industrial activity along the coast has resulted in the loss of wetlands. (See figure 1.10.)



ami metropolitan area

Everglades

FIGURE 1.10 The Diverse South Poverty has been a historically important problem in the region. Often the creation of jobs was considered more important than the environmental consequences of those jobs. The use of coastal areas for industry has resulted in pollution of coastal waters. The heavy use of the Mississippi River for transportation and industry has caused pollution problems. In addition, the desirable climate in the South has resulted in intense pressure to develop new housing for those who want to move to the region. Unwise development of housing on fragile coastal sites has resulted in damage to buildings by storms and the actions of the oceans. This causes intense debate on land use.



Petrochemical plant

CAMPUS SUSTAINABILITY INITIATIVE

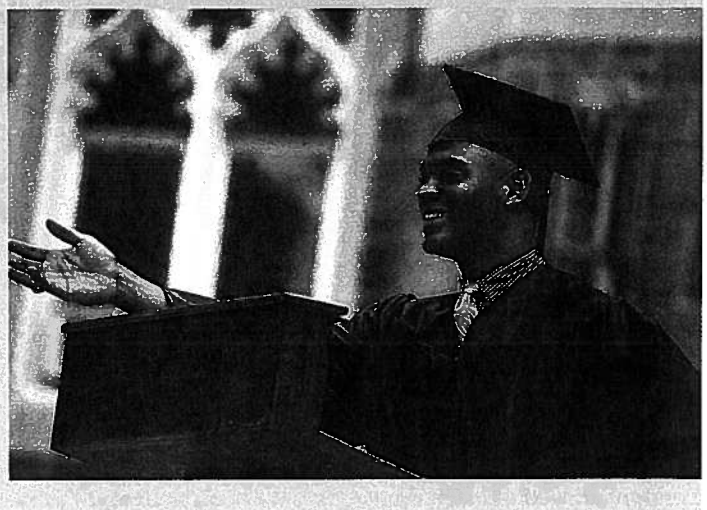
The Association for the Advancement of Sustainability in Higher Education

The Association for the Advancement of Sustainability in Higher Education (AASHE) was founded in 2006 as a membership organization of colleges and universities in the United States and Canada. There are currently about 500 member colleges and universities. AASHE's mission is to promote sustainability in all aspects of higher education. Its definition of sustainability includes human and ecological health, social justice, secure livelihoods, and a better world for all generations. A core concept of AASHE is that higher education must be a leader in preparing students and employees to understand the importance of sustainability and to work toward achieving it. Furthermore, campuses should showcase sustainability in their operations and curriculum.

To accomplish its goals, AASHE sponsors conferences and workshops to educate members. It also provides networking opportunities and an e-bulletin to facilitate the exchange of information about sustainable practices on campuses.

AASHE is currently developing a rating system that will allow educational institutions to assess their progress toward achieving sustainability. The Sustainability Tracking, Assessment, and Rating System (STARS) focuses on three major categories of activity: education and research, operations, and administration and finance.

In each chapter of this edition of *Environmental Science: A Study of Interrelationships,* we will highlight the efforts of one of the member colleges of AASHE to achieve sustainability. Is your college a member Go to the AASHE website and check its membership list.



ISSUES & ANALYSIS

Government Regulation and Personal Property

There are many ways in which government intrudes into your personal lives. Many kinds of environmental regulations require people to modify their behavior. However, one of the most controversial situations occurs when government infringes on personal property rights. The Endangered Species Act requires that people do no harm to threatened and endangered species. They may not be hunted or harvested and often special areas are established to assure their protection.

Many people have found after they have purchased a piece of land that it has endangered species as inhabitants. They are then faced with a situation in which they cannot use the land as they intended, and the land loses much of its value to them. Some argue that they should be allowed to use the land for their original purpose because they did n know it was habitat for an endangered species. Others argue that the have been deprived of a valuable good by the federal government and th the government should compensate them for their loss.

On the other hand, the people charged with enforcing the regulatio say that they are simply following the laws of the land and that tl landowner must obey.

The threatened California gnatcatcher is a small grey bird that inha its coastal sagebrush habitats. This photo shows the results of a compromi between developers and efforts to preserve the California gnatcatch Some land that was originally planned for development has been set asi as habitat for the gnatcatcher.

- Do you think landowners should be compensated for their loss by tl federal government?
- Should purchasers of land do better research about the land th want to buy?

Summary

Environmental science involves science, economics, ethics, and politics in arriving at solutions to environmental problems. Artificial political boundaries create difficulties in managing environmental problems because most environmental units, or ecosystems, do not coincide with political boundaries. Therefore, a regional approach to solving environmental problems, one that incorporates natural geographic units, is ideal. Furthermore, as the population of the world has grown and the exchange of people and goods between countries has increased, many environmental problems have become global in nature. Each region of the world has certain environmental issues that are of primary concern because of the mix of population, resource use patterns, and culture.

Thinking Green

1. Look for locally grown produce in the supermarket—less energy is used to transport locally grown products.
2. Join a local environmental organization.
3. Volunteer for your local Earth Day event in April.
4. Visit a natural area, nature center, or park typical of your region and learn to identify five plants.
5. Go to the website of the League of Conservation Voters, click on the Scorecard tab, and find out the "environmental score" of your senators and representative.

What's Your Take?

The governors of the Great Lakes states have signed an agreement that prohibits the export of water from the Great Lakes. They argue that the water is a valuable resource that is needed by the citizens of their states and that export would deprive the states' citizens of the resource. Regions of the country that are water poor argue that the water in the Great Lakes is a resource that should be shared by all citizens of the country. Develop an argument that supports or refutes the governors' stated policy.

Review Questions

1. Describe why finding solutions to environmental problems is so difficult. Do you think it has always been as complicated?
2. Describe what is meant by an ecosystem approach to environmental problem solving. Is this the right approach?
3. List two key environmental issues for each of the following regions: the wilderness North, the agricultural middle, the forested West, the dry West, the Great Lakes and industrial Northeast, and the South. How are the issues changing?
4. Define environment and ecosystem and provide examples of these terms from your region.
5. Describe how environmental conflicts are resolved.
6. Select a local environmental issue and write a short essay presenting all sides of the question. Is there a solution to this problem?

Critical Thinking Questions

1. Imagine you are a U.S. congressional representative from a western state and a new wilderness area is being proposed for your district. Who might contact you to influence your decision? What course of action would you take? Why?
2. How do you weigh in on the issue of jobs or the environment? What limits do you set on economic growth? Environmental protection?
3. Imagine you are an environmentalist in your area who is interested in local environmental issues. What kinds of issues might these be?
4. Imagine that you lived in the urban East and that you were an advocate of wilderness preservation. What disagreements might you have with residents of the wilderness North or the arid West? How would you justify your interest in wilderness preservation to these residents?
5. You are the superintendent of Yellowstone National Park and want to move to an ecosystem approach to managing the park. How might an ecosystem approach change the current park? How would you present your ideas to surrounding landowners?
6. Look at the issue of global warming from several different disciplinary perspectives—economics, climatology, sociology, political science, agronomy. What might be some questions that each discipline could contribute to our understanding of global warming?