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Roots of the Modern Sustainability Movement

In the summer of 2019, Iceland held a funeral for Okjukull, a glacier that melted as a result of global climate change. The entire country is losing ice at a rate of 11 billion tonnes (1 tonne is equivalent to 2204 pounds) a year. A plaque at the site of the ancient glacier states, "OK is the first Icelandic glacier to lose its status as a glacier. In the next 200 years all our glaciers are expected to follow the same path. This monument is to acknowledge that we know what is happening and what needs to be done. Only you know if we did it." (Figure 1.1).

But what action has been taken in the world to try to solve the climate change problem? How did we get to the point that human population is knowingly changing the world's climate? What historical developments have gotten us to this point? While there have always been waves of dramatic climate change over the history of our planet, what specific actions have caused the dramatic changes we have seen over the last 100 years?

Climate change isn't the only problem we face. It is but one of many issues in sustainability that prompt us to take a deeper look at our interaction with the environment. As you will see as you progress through this book, we face many problems. However, we have developed many solutions and there is reason to hope that we can make the appropriate changes to make our world more sustainable in the future.

The purpose of this chapter is to review the development of the modern sustainability movement from its roots in the nineteenth century to the development of international efforts to improve our world's environment. However, prior to getting us to this point, it is worthwhile to define the meaning of sustainability.

Meaning of Sustainability

Sustainability can be succinctly defined as doing what we can now to preserve the environment for future generations. However, in practice the word has a much deeper meaning. There are three components of sustainability: environment, equity, and economy. The environment is an obvious part of sustainability in that we are striving to preserve and protect the environment. Equity focuses on ensuring that fairness in environmental decision-making are front and center as we move forward in the future. And the economy component of sustainability focuses on the reality that we need to ensure that livelihoods are protected and enhanced as we strive to protect the environment for future generations.

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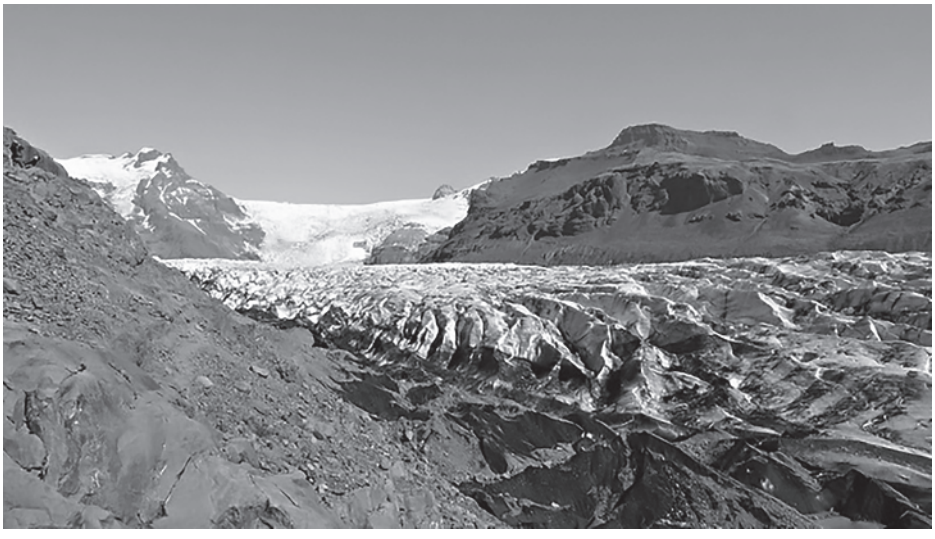

Figure 1.1 If global climate change is not stopped, Iceland may lose its glaciers (Photo by Peter de Rueter).

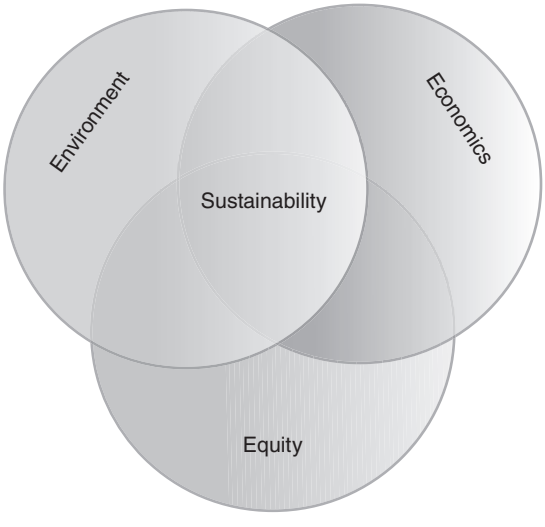

Figure 1.2 The three "E"s of sustainability: Environment, Economics, and Equity. Sustainability is achieved when the three are taken into consideration.

These three components: environment, equity, and economy, are often called the three pillars or three e's of sustainability. All three should be part of any decision making to ensure sustainable development for the future (Figure 1.2).

When businesses and green entrepreneurs think about sustainability, they use similar terms, but call them the triple bottom line: people, planet, and profits. For a business to be sustainable in the modern world, the profits are not the only consideration that must be taken. The impacts of actions on people and the planet are part of the mix. Businesses that embrace the tenets of modern sustainability are often considered green businesses.

Figure 1.3 This is the largest green roof in the United States. It covers the Rouge Factory that manufactures the Ford F-150, one of the least fuel-efficient personal vehicles on the market. Is this greenwashing or a real attempt at corporate sustainability?

Some businesses and other organizations try to embrace the popular environmental practices of our day and promote their efforts as green but in reality follow unsustainable practices. Such discordant behavior is called greenwashing (Figure 1.3).

In our modern world, it is difficult to avoid impacting the planet in some way. The study of sustainability teaches us how we as individuals, organizations, or societies can lessen our impacts so that we can leave our planet in better shape for the future.

As we will see in the next section, while the development of sustainability emerges out of the broad environmental movement of the nineteenth and twentieth centuries, it is deeply informed by the development of global economic and environmental agreements that caused deep concerns in the 1980's.

Nineteenth Century Environmentalism

It could be argued that prior to the western enlightenment and industrial revolution, most people in the world had an intimate relationship with nature. This was due, in part, to necessity. Most of us were farmers or found some way to feed ourselves off of the land and the bounty of nature. At the time, the earth had a larger spiritual role in humanity. The cycles of the moon and stars were more dominant in the non-electrified night sky and the life/death/rebirth annual patterns of nature provided metaphors for daily experiential existence in all of the major religions of the world. Such intimacy exists today in some corners

of our continents where the impacts of our modern age are light. Yet, for most of us, the seventeenth century enlightenment put our societies on a path of environmental decline and destruction while at the same time providing amazing technological advances and allowing the creation of the middle class.

The growth in technology during the industrial revolution (lasting roughly from the middle of the eighteenth century to the middle of the nineteenth century) transformed the world in tremendous ways. Urbanization increased and cities grew. At the same time, migration to industrial centers expanded and new markets throughout the world were sought. Europe and North America expanded their spheres of influence.

In the midst of this, many around the world started to question the value of the industrial revolution. Life was grim in many cities and the world started to see mass destruction of natural resources and the decline of air and water quality.

In North America, this critique emerged within the romantic and transcendental movements, particularly in the writing of Henry David Thoreau, author of *Walden* (published in 1854). The romantic and transcendental movements of the nineteenth century idealized nature. Adherents believed that nature helped to transcend the meaning of an ordinary life.

The art of the era is exemplified by the Hudson River school of art that showed humans as observers of grand scenes in nature (this effect was later utilized by Ansel Adams' extraordinary images of the American west in the middle twentieth century). Many of the romantic images of the time were of the northeastern United States or Canada.

This approach to art certainly grew out of other traditions of landscape art found throughout the world, but it uniquely influenced North American thinkers by elevating nature in glorious ways. Nature was depicted as wholly good and as a path to greater enlightenment.

It is this enlightenment that Thoreau sought when he decided to move to a cabin on the property of noted romantic poet, Ralph Waldo Emerson on the edge of Concord, Massachusetts, from his comfortable house in town. He lived simply and contemplated the meaning of life, largely away from distractions of others.

His romantic view of the simple life is one that has been replicated by others for millennia—whether the hermit or the sage of the mountain. There is something innately human about seeking solace in nature. Thoreau, however, placed this experience squarely in the consciousness of the times by writing eloquently about it.

His work certainly influenced many others. John Muir, a Scottish born American naturalist, was perhaps the person who most put Thoreau's writings into practice.

Muir was only eleven when his family moved from Europe to a farm in Wisconsin. He entered the University of Wisconsin when he was in his early 20's and quickly became exposed to the writing of Thoreau. While he never graduated, he took a number of courses in a variety of scientific areas including geology, botany, and chemistry.

His strong religious background and his experience in the beautiful landscape of south-central Wisconsin certainly provided ample opportunity for him to see the hand of God in the works of nature. But as a young man, he set out and saw the world.

Muir completed a number of well-documented travels including a walk to the Gulf Coast of the United States in 1867 and a trip to California in 1868 where he was one of the first western explorers of the Sierra Nevada mountain region—including areas around Yosemite. It was there that he met Ralph Waldo Emerson, the leader of the romantic and transcendental movement. At the time, Emerson was rather elderly and in a slow decline of health. But each had a strong impact on each other.

With time, Muir became known for his own writing and essays documenting the wonders of the west and the beauty of nature found there. He strongly advocated for the preservation of Yosemite in order to preserve its unique natural beauty. His recommendations were followed when Yosemite became a national park in 1890.

The first US national park was Yellowstone and was established by Ulysses S. Grant in 1871, and Canada's first national park (Banff) was established in 1885. Several other nations developed national parks in the same era after the establishment of Yellowstone.

However, it is Yosemite that holds the greatest significance in the history of the sustainability movement, because it is here that we see the development of Muir's ideas about the importance of nature in our life and in providing solace for mankind. He helped to found the influential Sierra Club in 1892, which still works to preserve natural, lands and promote responsible use of the earth's resources.

Pinchot, Roosevelt, and Muir

Muir strongly believed in the total preservation of national parks. He did not believe that the activities of man should interrupt the peace of nature. In 1891, a different type of public land was established—the National Forest. They were established with the intention of providing opportunity for economic development of the resources on public lands (Figure 1.4).

The establishment of this type of public land challenged Muir's preservationist tendencies. The rapid expansion of the west through railroad and shipping lanes brought new settlers and new challenges. Most of the land was public and great economic good could

Figure 1.4 Forested lands like this one in northern Wisconsin provide a sense of peace and tranquillity. However, they can also be seen as holding resources that could be developed.

be obtained from it. There was great demand for timber, for ranching land, and for mining. The establishment of the National Forests allowed the use of the land while maintaining some type of public control.

Gifford Pinchot most articulated this approach to public lands. He became the first head of the US National Forest Service and greatly influenced the future direction of land management on public lands. His family was in the timber business and he knew the impact of poor forest practices on the environment. He decided to learn all he could about how best to protect the land for long-term forest yields. He also developed a strong belief that there should be a national policy around forest management in order to preserve them.

Yet, Pinchot also believed that forests should be utilized to extract the greatest good from them. He developed a conservation ethic that focused on producing the greatest yield possible from the land with as minimal disruption as possible. He is often seen as the father of the *conservation* movement that advocates the wise use of land in order to allow economic gain while preserving it for future generations.

Pinchot and Muir knew each other, but fell out when Pinchot promoted grazing on public lands in 1897. Muir believed that grazing severely damaged land for generations and created unsustainable conditions in forests.

Perhaps the most influential person to embody Muir's and Pinchot's visions was the American President (1901–1909), Theodore "Teddy" Roosevelt (Figure 1.5). An avid outdoorsman, Roosevelt loved being outside in nature and believed that the US should have a distinct conservation policy that protected wild lands. In this respect, he was influenced by John Muir. He had read Muir's writings and even travelled to California to meet with him in 1903. He believed strongly in setting aside public land in perpetuity for the enjoyment of future generations.

At the same time, Roosevelt was influenced by the work of Pinchot. He appointed him to the job as chief of the National Forest service in 1905 and they were friends. In the efforts of Roosevelt we see the realization of the two great visionaries for American public lands: Muir the preservationist and Pinchot the conservationist. Roosevelt found a way to expand both ideals through his conservation efforts.

Aldo Leopold and the Land Ethic

The work of Roosevelt, Muir, and Pinchot were early efforts that provided a framework for managing public space. Yet, there was little understanding about how to manage vast properties effectively. In the early twentieth century, schools of forestry were established and efforts were made to educate a new type of professional forester that was not only interested in seeking timber yields, but also in protecting forests for their intrinsic value.

The most influential of these new foresters was Aldo Leopold. Originally from Wisconsin, he graduated from the Yale School of forestry (one of its first graduates) in 1909 and started his career in land management in the southwestern United States. He developed the first management plan for the Grand Canyon. He eventually became the nation's first Professor of Game Management at the University of Wisconsin in 1933.

Figure 1.5 Teddy Roosevelt was one of the major leaders of the modern conservation movement. This is a statue of him near his home in Oyster Bay, New York.

While in Wisconsin, he purchased a piece of land that was highly impacted by poor agricultural practices in order to try to return it to natural conditions. Part experiment, and part labor of love, this effort provided a fundamental framework for his groundbreaking writing in *A Sand County Almanac,* which was published in 1949 after his death.

This book advocated the development of a land ethic based on ecosystems. Leopold understood that preservation or conservation efforts were somehow flawed. They were not informed by how nature actually worked. Leopold understood through his work in the southwest and Wisconsin that nature was highly impacted by man intentionally or unintentionally. He saw ecosystems, living organisms, and their environment, as the foundation for truly understanding nature and how it should be managed.

In his land ethic, he saw that land should not just be set aside or managed for economic gain as advocated by preservationist or conservationists. Instead, human society needed to understand the components of nature—things such as water, soil, air, and organisms—in order to fully grasp how it worked. If one truly wanted to preserve nature, an ethical system must be developed around the components of the ecosystem. The soil, individual plants, the air, etc. were as important as the land itself.

Better Living Through Chemistry, The Great Smog of 1952, and Rachel Carson

While the large debates over the wise use of public lands moved forward and evolved into Leopold's land ethic, American private land was utilized to advance a new technological revolution centered on chemistry. The world began to see that we were in a new chemical age at the end of World War II, brought about in part by the dropping of atomic bombs over Hiroshima and Nagasaki. The building blocks of nature were discovered and could be transformed in new, exciting, and sometimes deadly ways.

We started to understand the potential of using chemical building blocks for creating new chemicals and products. While there was some concern over the use and management of these emerging products, the world saw the advances as miracles in areas such as fertilizers, pest control, plastics, and fuels. The chemical age saw the transformation of peoples' lives in unimaginable ways (Figure 1.6).

While there was still concern about nuclear war, there was also space exploration, the interstate highway system, and suburban development. The post-war world was a very different place from the pre-war dreariness. We had a sense that we could do anything.

Yet, we started to see that there were impacts from our use of chemicals on the landscape. We saw new forms of pollution, destruction of ecosystems, and new health concerns emerge. One of the first important visible impacts of this new age was the Great Smog of 1952 in London.

This event occurred during a windless period in early December. The stagnant air allowed the buildup of coal smoke that permeated not only the streets of London, but homes and businesses as well. At least 4000 died from the event and tens of thousands became ill. The smog caused great concern among the public about the impacts of air pollution and efforts were made to develop rules to control coal smoke. Eventually, the Parliament of the United Kingdom passed the Clean Air Act of 1956.

While not the first air pollution act in Europe, it was the most important one in that it was the first to develop effective mechanisms for improving public health through the

Figure 1.6 The 1950s and 1960s saw the world change in unimaginable ways. This was my family's dining room in that era. How is your dining room different? How does this change the chemistry around us?

Figure 1.7 Birds and bird eggs were a major theme of Rachel Carson's book. Today, many songbirds have made a recovery, but others are still under threat due to environmental challenges.

development of non-coal fuels and via the regulation of the actions of individual households. The UK's Clean Air Act set the stage for the regulation of a variety of pollutants by national governments around the world.

While the Great Smog was an important event in the development of air pollution controls, the person who is most credited with nudging the world into the understanding of broader pollution issues is Rachel Carson, noted author of the book *Silent Spring*.

Rachel Carson was a nature writer who was connected with some of the leading government and university researchers in the 1950's and early 1960's. Through their work, she learned that there was growing concern in the scientific community about the dangers of unregulated chemical usage to human health and the broader environment. The chemical industry at the time largely acted with impunity and was able to release emissions and create products regardless of their broader impact.

The title of the book, *Silent Spring*, references concerns over the fact that some of the pesticides in use at the time were causing the death of large numbers of birds, thereby causing a silent spring (Figure 1.7). The impact of Carson's writing was significant to the development of the world's understanding that industrialization had distinct costs associated with it. The very existence of nature was impacted by our ability to create new commercial chemicals out of atomic building blocks.

Around the world, people started to question the use of these new organic and inorganic chemicals and investigate their impacts. For example, the investigation of illnesses near a mercury mine in Minamata, Japan led to the discovery of an uncommon illness named for the city, Minamata disease. Water that contained mercury emitted from industrial wastewater systems entered local ecosystems, most importantly the local bay. The mercury accumulated in fish and shellfish that were major sources of food for the local population.

And Minamata was only one of hundreds of cases that were discovered. There were many examples of the environmental impacts of mines and factories on the environment and public health. In addition, there was growing concern over the use of the widespread application

of pesticides and fertilizers. Plus, the expansion of the widespread use of coal-burning power plants and individual automobiles in the suburban age began to be felt.

Citizens all over the world started to demand action by their governments to create new laws to protect themselves and their environments from the dangers of environmental pollution. An age of new environmental activism was born.

Environmental Activism of the 1960s and 1970s and the Development of Environmental Policy

New activism emerged in the 1960s as a direct result of widespread environmental contamination and devastation. People began to see the impact of industrialization in their local communities. There was widespread pollution of waterways, soil, and air. In addition, the development of packaging, fast food, and the mobile family caused widespread littering along roadways. The everyday experience of most people was vastly different from that dreamed of by the transcendentalists. Nature was no longer inspirational for most. It was a problem.

Several important works were published that influenced that way we think about the environment and sustainability today. Ralph Nader, long an advocate for the environment and consumer protection published *Unsafe at Any Speed* (1965) about the reluctance of the automobile industry to develop safety measures in cars—things like safety belts that we take for granted today.

The year 1968 was a time of change for much of the world. It also saw the publication of three seminal pieces of writing: *The Population Bomb* by Paul Ehrlich, *Desert Solitaire* by Edward Abbey, and the essay, *The Tragedy of the Commons* by Garret Hardin. Ehrlich's book highlighted concerns of global overpopulation and the impact of large populations on the Earth's environment. While the Earth has been able to accommodate significant population growth since the publication of *The Population Bomb*, concerns remain as to the overall impact of increasing populations on the planet. In similar fashion, Hardin's essay brought to light via metaphor the impacts of economic self-interest on shared resources. It is impossible for us to get everything we want without causing some degree of environmental stress in shared places. This problem is exacerbated when populations increase and resources are stressed. In contrast to the previous two works that focus on population growth and the depletion of resources, Edward Abbey's book brings forward some of the ideas espoused by Thoreau, Muir, and Leopold.

Edward Abbey was a writer and a seasonal park ranger influenced by the American west where he spent most of his adult life. He wrote a number of books including *Desert Solitaire* (1968). This book is a loving tribute to the American West and a memoir reminiscent of the transcendental writers. However, it is also highly critical of the park system and the promotion of tourism within the parks.

His later work, *The Monkey Wrench Gang* (1975) became influential to the philosophy of Earth First! which was founded in 1979 to promote a radical environmental agenda that advocated that there was no compromise in the defense of the environment. Some of their members have been accused of "monkey wrenching", or sabotage, to harm equipment, like bulldozers, that could be used to destroy a natural landscape. They were also accused of

Figure 1.8 How much growth is enough? These developments in Caracas, Venezuela create challenges for infrastructure and also for environmental management.

spiking trees by hammering metal stakes into trunks that could cause breakage of a chainsaw and harm to the operator.

In 1971, Barry Commoner published the book *The Closing Circle* which focused on framing an economy that was less harmful to the environment than traditional open capitalism which he saw as the cause of many environmental problems. He also did not believe that overpopulation was the major problem causing environmental degradation (in contrast to Paul Ehrlich's *Population Bomb* thesis). Instead, he believed that the issues were inherent in the way that people lived within modern capitalistic societies focused on consumption.

Shortly after the release of Commoner's book, the Club of Rome published a book by several authors called *The Limits to Growth* (1972) which returned the conversation to issues of population growth and the impacts of growth on the environment (Figure 1.8). The book, using revolutionary computer models, predicted that the earth's population was running out of resources and that many of the contemporary economic practices were highly unsustainable over the long-term.

The consciousness of the times returned to considering the implications of economic activity within the E.F. Schumacher's important book, *Small is Beautiful: Economics as if People Mattered* (1973). The idea of expansive economic growth and consumption, coupled with the idea that bigger was better was highly critiqued in this work. The question of enoughness is raised. When do we have enough stuff to be happy? Does it take more and more stuff? The implications of wanting more are significant on the environment. Schumacher argues that there are limits to the capacity of the planet to absorb the pollution and provide resources for rampant economic growth. Instead, we should focus on the smallness of what we need and on limiting impacts of economic development.

In 1979, James Lovelock published *Gaia: A New Look at Life on Earth* that claimed that the earth could be seen as a living organism. What happens in one part of the planet will impact

other parts in sometimes unpredictable ways. Lovelock helps us view the Earth in more holistic ways. He clearly outlines how the different systems of the earth, such as energy or nutrient cycling interact with each other. Thus, damage done to the planet by humans will likely have unexpected impacts that may end up harming humans in the long term.

The 1960s and 1970s also saw the founding of several key organizations including the World Wildlife Fund, that promotes wildlife conservation, the Environmental Defense Fund, which strives to preserve ecosystems, Greenpeace, an independent group which focuses on direct action to confront environmental problems, and Friends of the Earth, an international environmental advocacy group which protects the environment within social, environmental, political, and human rights contexts; Friends of the Everglades; Worldwatch Institute that examines worldwide data to develop environmentally sustainable solutions; The Land Institute which focuses on sustainable agriculture; and Earth First! that focuses on interventions to protect nature.

The decades also saw the development of key environmental advocates that had important voices within the emerging pop culture of the time that was rife with environmentalism and the overall environmental sentiment brought about by the Age of Aquarius and the widespread hippie movement. While many such individuals could be discussed, three will be highlighted: Lady Bird Johnson, Jacques Cousteau, and Pete Seeger.

Lady Bird Johnson was the wife of US President Lyndon Johnson who served in office after the assassination of President John F. Kennedy. Johnson is considered by many to be the architect of the Federal response to the Civil Rights Movement of the 1960s and was a strong advocate for equality. His wife was very supportive of his efforts. However, she also became very concerned over the state of litter and the environment in the nation. The US interstate highway system was relatively new and many areas were becoming covered with trash. Americans did not have an ethical way to manage garbage along roadways. She took highway beautification on as a major cause in a way similar to how Michelle Obama, the wife of Barack Obama, took on food and health as a platform.

The Highway Beautification Act, sometimes called Lady Bird's Bill, was passed in 1965 and provided rules for billboards, fencing, and the type of development that could be promoted adjacent to roadways. She also sought to plant native flowing plants along roads to improve the overall experience for drivers and passengers. If you see a patch of flowers blooming on a trash-free and billboard-free US interstate, you have Lady Bird Johnson to thank. There is no doubt that her efforts helped to educate a generation of Americans on the importance of trash removal and the aesthetic role of nature in our everyday life. Her celebrity status as the wife of the most powerful man in the US gave her a platform to promote a practical environmentalism that continues to this day.

Jacques Cousteau is another celebrity of the era. He was a French explorer and filmmaker who advocated marine conservation. He became active in the modern environmental movement when the French government planned to dump radioactive waste into the ocean. He was a very vocal critic of such practices. However, he is best known for a series of films that he made that had critical acclaim. He won the Palme D'Or at the Cannes film festival in 1956 for his first film, a documentary, *Silent World*. After that he created a number of films until his death in the 1997.

His films documenting the underwater world were a sensation in the 1960s. They provided a fresh look at a landscape that had been looked at as largely unknown. The seas were

convenient dumping grounds because the impact of our waste was largely unknowable. No longer. With Cousteau's work, the seas were seen as amazingly diverse and connected with the broader surface ecology. He became a worldwide celebrity and strongly advocated for marine protection.

There are many American musicians and artists who became active on environmental issues in the 1960s and 1970s. It was a period of activism with actors like Robert Redford lending their celebrity clout to causes. Many songwriters and singers were particularly effective. Some were noted for their regional celebration of places such as John Denver's *Rocky Mountain High*. Others provided important public support for environmentalists advocating for change in local or national policy. The individual who best represents this group of musician activists is the folk singer Pete Seeger.

Seeger was involved with folk music throughout his very long career. He was born in 1919 and died in 2013. He was very involved with labor and civil rights music and protest prior to the Vietnam War. During the war, his music became much more political and edgy, particularly as the Civil Rights movement became much more vital and violent.

Like many artists of the era, he also became involved with environmental causes, most notably the clean-up and preservation of the Hudson River. His music inspired many of the times to get involved in society and seek to change it for the better. The improvements of the Hudson River ecosystem are the result, in part, of Seeger's effort.

The Growth of Environmental Laws in the 1960s and 1970s

In response to public pressure, a slew of new laws emerged during throughout the 1960s and 1970s. In the US alone, hundreds of federal, state, and local laws emerged that strove to protect the environment. Important federal rules include: The Clean Air Act (1963); The National Emissions Standards Act (1965); The Solid Waste Disposal Act (1965); The National Environmental Policy Act (1969); The Formation of the Environmental Protection Agency (EPA-1970); The Formation of the National Oceanic and Atmospheric Administration (NOAA-1970); The Williams-Steiger Occupational Safety and Health Act (creating OSHA-1970); The Lead-Based Point Poisoning Prevention Act (1970); The Marine Protection, Research, and Sanctuaries Act of 1972 (1972); The Endangered Species Act (1973); The Safe Drinking Water Act (1974); The Hazardous materials Transportation Act 1975); The Resource Conservation and Recovery Act (RCRA-1976); The Toxic Substances Control Act (1976); and The Surface Mining Control and reclamation Act (1977). Some of these will be discussed in upcoming chapters.

Environmental rule making continued after the 1970's, but this two-decade period is as important to the environmental policy movement as the 1770s and 1780s were to the growth of democracy in North America and Europe.

Each of these federal laws provided new protections for different areas of the environment. They are among the most significant suite of environmental laws passed by any federal government in the world. While new rules have been created since these laws were passed in the 1960s and 1970s, this time period was the most important era for the development of public policy focused on protection of the environment. Many governments around

the world followed the lead of the US federal government by instating rules to protect local, state, and national environments and resources.

The First Earth Day

In the midst of this tumultuous time, there were many events that tried to capture the public's focus on the environment. The most important of these was Earth Day, first held in April of 1970. To many, the event signaled the start of the modern environmental movement.

Earth Day was the brainchild of several individuals, but is often credited to Wisconsin Senator Gaylord Nelson. He was disturbed by pollution problems around the United States and decided to develop a "teach-in" to educate people about the environment.

Since the first Earth Day in 1970, it has been celebrated every year on April 22. The movement has grown from a US event to a broader international event with coordinated activities, themes, and special events each year.

The focus of Earth Day, however, is always on education. Over the years, the themes have changed and new issues have emerged. But, the success of Earth Day is due largely to the flexible nature of the event with its broad focus on educational themes and public ceremonies and entertainment. The spring season, with its elements of rebirth and the signal of hope provide fitting seasonal background to Earth Day events.

International Concerns

The 1960s and 1970s was a time of significant global conflict. Several important events included the Vietnam War, the Arab–Israeli Conflicts, The Arab Oil Embargo, Coups in Africa and Latin America, and the Iran Hostage Crisis. At the same time, the United Nations emerged as an important body that could assist international cooperation and promote peace.

Increasing population led to higher death tolls from natural disasters. For example, a tropical cyclone in Bangladesh killed 300 000 in 1970—a shocking number of fatalities. In addition, there were cases of drought induced starvation or thirst, often a result of poor rural development throughout many parts of the world.

Some of these problems, including conflict, death from natural disasters, and poor development, were seen within the context of the environment—and the environmental issues were often beyond the capability of a single nation to manage. Thus, the United Nations was seen as an organization that could facilitate not only interventions in environmental crises, but also promote international agreements to ensure the protection and preservation of the environment.

The UN and other organizations were able to craft some key agreements. Some of them are discussed below.

Ramsar Convention on Wetlands in 1971—this UN treaty focuses on maintaining the ecology of wetlands and promoting sustainable uses of them.

Establishment of the UN Protectorate of the Environment in 1972—the mission of this group is "To provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations." The protectorate essentially manages most of the environmental initiatives of the United Nations.

Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration) 1972—the first agreement to recognize the right to an "environment of a quality that permits a life of dignity and well-being…"

Convention for the Protection of World Cultural and Natural Heritage 1972—this agreement established protections for both important cultural and natural sites around the world, thereby elevating historic sites into the previous efforts on the preservation of wilderness.

Establishment of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)—this 1973 voluntary agreement was organized by the World Conservation Union. There are now 183 signatories to the agreement.

Each of these early agreements helped the world recognize that efforts could be made to establish important links between the developed world and the developing world in order to improve conditions for all. The agreements also helped to establish the general notion that what happens to one group of people has implications for the rest of the world's population. We started to understand that the actions of one person, organization, business, or government could unknowingly make a positive or negative impact on the lives of others around the planet.

Ozone and the World Comes Together

Within this context, alarm bells started to ring within the scientific community about problems associated with ozone depletion in the upper atmosphere. Ozone, or O3, is a chemical that occurs naturally within the atmosphere. It can form from atmospheric pollution in the lower atmosphere to cause significant respiratory stress on high-smog days in urban settings. However, in the upper atmosphere, ozone shields us from ultraviolet radiation coming from the sun.

In the 1970s scientists started to recognize that a group of chemicals called chlorofluorocarbons were destroying the ozone within the stratosphere. There was significant concern about the damage that the unfiltered ultraviolet radiation would do to ecosystems—particularly humans. Excess radiation is known to cause skin cancer. The locations of the thinnest parts of the ozonosphere were found to be at the polls. A number of maps were created to outline the extent of the "ozone holes" year by year. Yet, there was very little policy advocated for the removal of CFCs from use.

Although CFCs are damaging to the upper layers of the atmosphere, they are very useful chemicals. They are effective in refrigerant systems, are excellent propellants in aerosol sprays, and work well as solvents. So, there was significant resistance to ban or reduce these very effective chemicals in everyday life.

However, as the impact of CFCs increased in the 1970s and 1980s, and the ozone holes over the poles grew, something had to be done. Two important events occurred in the mid

1980s to try to address these issues. The first was the Vienna Convention for the Protection of the Ozone Layer (1985) and the second was the Montreal Protocol on Substances that deplete the Ozone Layer (1987). The first is an international agreement to protect the ozonosphere and the second is a legally binding international agreement to reduce ozone-depleting chemicals.

The advent of the Montreal Protocol in 1987 is extremely significant. For the first time, the world realized that it needed to act together to reduce the impact of harmful pollution produced by most nations of the world. One nation could not act unilaterally to solve the problem. Instead, agreements about reductions needed to be reached that all nations could agree on to try to solve the dangerous problems of ozone depletion.

Fortunately, the agreement worked and the chemicals associated with ozone destruction in the upper atmosphere are declining for the most part. The successful development of the Montreal Protocol demonstrated to the world that international agreements could be forged to solve real environmental problems. Unfortunately, ozone was but one major problem confronting the world in the 1980s.

Globalization and the Brundtland Report

The term globalization is used to describe the process by which exchanges between countries lead to a sameness of culture or attitudes, often through an integration of economic or transportation systems. Globalization has been taking place for centuries. For example, when the Romans expanded their empire and "Romanized" their conquered territories, they brought with them to the new lands their architecture, arts, language, and other forms of culture. That is why there are Roman roads in England and Roman theaters in North Africa. But, globalization is a two-way street. Christianity, which had its birth in western Asia, found a willing home in Rome within a short time. Plus, there were extensive biological and cultural exchanges that occurred during the Columbian Exchange in the 1500s between the Americas and the "Old World" of Europe, Africa, and Asia.

Certainly we can find many examples of globalization within the history of our culture. But, the modern form of globalization started to accelerate in the 1980s.

Prior to this time, there certainly was international trade, communications, and cultural exchanges. However, with the advent of modern transportation systems, open trade agreements, and telecommunications and computing, the world changed. Resources could be moved around quickly. Factories could locate in areas of cheap labor, and decisions made in financial capitals like Tokyo, Paris, Cairo, or New York could impact rural areas in Brazil, Yemen, Gabon, or Myanmar.

Plus, it became clear that globalization connects us in unexpected ways. We immediately saw the devastation of environmental disasters like the chemical leak in Bhopal India that killed thousands in 1984, the Chernobyl nuclear plant devastation in 1986, and the 1988 forest fires of in Yellowstone that burned almost 800 000 acres. Each of these environmental events, while not impacting everyone across the world, were felt emotionally by everyone at the time due to the magnitude of the impact—particularly since many of them were caused by worldwide trends of globalization.

In our modern era, globalization is something we take for granted. Many of us buy products in our local stores that were manufactured in far distant places. We have very little connection to the means of production. Many of us live in consumer societies separate from the impacts of factories, shipping, or resource extraction. Goods are routinely shipped around the world in expanding networks of global trade.

Even our food is shipped all over the world. We can buy fruits and vegetables that are out of season in our area from areas of the world where they are in season. We live in amazing times.

In the 1980s the process of globalization was a relatively new trend. While there certainly were international trade and global connections, there was not the current expansive trade we see today.

As globalization started to expand, many started to become concerned about the impacts of globalization on the environment and the world's cultures. The concern framed itself within broad discussion around sustainable development due to the vast evidence for the deterioration of environmental and social conditions in the wake of globalization. In addition, there were clear winners and losers as a result of this economic global change and economic disparities were becoming more evident.

Since its creation, the United Nations has been concerned about these issues. However, in the late 1970s and the early 1980s there was evidence that conditions were deteriorating and many felt it was important to try to address the problem.

Thus, the United Nations in 1983 established the World Commission on Environment and Development. The group was chaired by Gro Harlem Brundtland, the former Prime Minister of Norway. The group was charged with finding ways to develop strategies for global sustainable development. Their groundbreaking work, the *Report of the World Commission on Environment and Development: Our Common Future*, often called the Brundtland Report, became a key document outlining the future of international sustainable development.

The Brundtland Report was the first to provide a concise definition of sustainability within the context of sustainable development, "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition is commonly used today.

But, the Brundtland Report was not just important for providing one of the first important definitions of sustainability. It also changed the way we look at environmental issues. The report detailed that most environmental problems are not the result of just the action of one person or industry. Instead, most environmental issues are the result of an integrated set of actions and situations that lead to environmental decline. Key to this understanding is the recognition that problems with issues like population, food, species loss, energy, industry, urbanization, and human settlement are connected. We could no longer think of environmental issues as easy to solve by just regulating a pollutant or industry. These issues were cultural and social issues that required deeper understanding of the root of the problem.

The report also detailed the impacts of inequality to the environment. Between nations the beneficiaries of industrialization do not often feel the negative effects of industrialization. Even within cultures, differences in class, gender, education, or age can lead to differences of environmental experiences and harms.

The report also noted that there are distinct limits to growth due of industrialization due to lack of resources to support long-term growth. The report is linked here and should be perused to get a sense of the breadth of content: http://www.un-documents.net/wced-ocf.htm For example, the report discusses at great length the state of energy options across the world and challenges for the future. Similar types of summaries are made for food, population, endangered species, industrialization, and urbanization.

The report is often praised for clearly outlining the problems the world was facing in the 1980s. Yet, many have been disappointed with the lack of progress on many of the issues that were outlined.

The weakness of the report is within the recommendations section. It essentially suggests strengthening national laws, international agreements, and improving global institutions to manage the issues. Yet the report does not provide any specific measurable outcomes by which to measure success. As we will see, this emerges as a key initiative after the 1990s.

Although the Brundtland Report has been critiqued for not having enough clear solutions for the problems it identifies, it stands as one of the most important documents in the sustainability literature because (1) it clearly defines sustainable development, (2) it recognizes that environmental problems are linked with social issues such as governance, poverty, class, and gender; and (3) it highlights that there are limits to industrialization due to diminishing resources.

Globalization continues to be an issue of great concern within the environmental community for a number of reasons and the Brundtland Report only started the conversation. One of the leading voices providing concern about the impacts of globalization on society and the environment is Vandana Shiva. She is a leading critical voice in the anti-globalization movement—a movement that rejects the negative aspects of globalization while embracing the positive developments of international cooperation. She believes strongly in the importance of local, traditional practices, over unsustainable global enterprises.

Shiva has worked in a number of important areas. For example, she has been a critic of the impacts of genetically modified food production. Large agricultural corporations patent their seeds and make farmers dependent upon not only the seeds, but also the required maintenance and fertilizers recommended by the companies. This takes farming away from traditional practices and hurts the ability of farmers to save seeds for future generations. The winners in this practice are the western corporations and the losers are the local farmers who become dependent upon a globalized system of agriculture.

Deep Ecology

About the same time that globalization was emerging as an environmental issue, the philosophical movement known as deep ecology evolved near the end of the 1970s as somewhat of a critique of the bureaucratic response to environmental decline and the overall lack of progress toward environmental improvement. The movement was in some ways founded on the writings of Norwegian Arne Naess and was deeply informed by the works of Leopold, Carson, and Abbey. Many other contemporary authors promote deep ecology principles and it is still an important approach advocated by some in the environmental movement today.

The basic tenet of deep ecology is that the environment and nature as a whole has value regardless of its utility. It should therefore be protected not for its utility, but for its very right to exist. Man is seen not as a protector of nature, but as a problem for it. Thus, deep ecologists often advocate simple living, lowering of human population, and deeper connections with nature. Some have developed alternative communities such as Dancing Rabbit Ecovillage (see www.dancingrabbit.org).

In many ways, deep ecologists have strong connections with the historic Muir/Pinchot dialectic, clearly residing in the Muir camp. They have a discomfort with the idea of utilizing nature for the greatest good of mankind. Instead, they advocate preservation of nature and treading lightly upon it. As we will see, the deep ecology movement greatly influences the modern sustainability movement. However, many are critical of the view of sustainability as a field that promotes some of the traditional notions of conservation and nature as a source of economic development.

Deep ecology also greatly impacted the world of environmental activism. Earth First!, for example, believes in resorting to a variety of approaches to try to stop environmental decline. Deep ecologists garnered significant attention in the 1990s as they tried to stop deforestation of old growth forests. They conducted a number of protests and events to raise attention to the cutting down of old trees. Some resorted to climbing trees to live in them to prevent their felling. The most famous of these "tree sitters" is perhaps Julia Butterfly Hill. On December 10, 1997, she climbed an at-risk tree she later named Luna, and stayed in it for 738 days. She prevented the tree from destruction, and other trees in a 200-foot buffer, as part of her agreement to leave the tree. Hill's effort inspired a variety of non-violent activism around the environment throughout the globe.

While encouraged by the efforts of individuals like Julia Butterfly Hill, deep ecologists become frustrated with the general lack of measurable action on the environment and become frustrated with efforts to preferentially accommodate businesses or individuals over the environment.

Environmental Justice

While the deep ecologists were focused on the preservation of natural landscapes, a new group of activists and researchers began to raise concerns over the preservation of their communities and cultures (Figure 1.9).

The environmental community has traditionally been dominated by white men. As the movement evolved into the 1970s and 1980s there was growing criticism that environmentalists were willing to turn a blind eye toward the environmental issues in communities of color in favor of natural landscapes devoid of people. Several cases highlighted this criticism. Hazel Johnson, often considered the mother of the environmental justice movement, provides a point of departure for discussing one of the most famous of these cases.

Hazel Johnson was an activist on the South Side of Chicago. She became concerned with environmental issues after she started to notice that several people she knew became ill for no apparent reason in the early 1980s. She started to document cases of cancers and other sicknesses and became convinced that there were environmental reasons for the illnesses.

Figure 1.9 This image of street art in Brooklyn gives one a sense of the challenges associated with diversity and fairness in urban issues.

As she conducted her work, she found that her neighborhood had the highest rates of cancer in Chicago. She also learned that the community was surrounded by dozens of landfills and dozens of leaking underground storage tanks. She found that the drinking water for many in the community was contaminated with chemicals leaking from these underground sources.

Johnson's efforts, and those of others such as Robert Bullard (who will we read about Chapter 11) helped define environmental justice as one of the most important new areas to emerge in our era into the modern environmental movement. Eventually, President Clinton in 1994 signed an executive order to ensure environmental justice was taken into consideration in federal efforts. The law also directed the government to take action within minority and low-income communities to ensure that efforts were made to improve environmental conditions. Also, the EPA started the Office of Environmental Equity in 1992 (now the Office of Environmental Justice).

Since then, environmental justice has been applied rather broadly to encompass a variety of different types of regions and situations. For example, environmental justice can be a consideration when examining the impacts of consumer societies on the developing world or when examining the impacts of international conflict on communities. As we will see in Chapter 11, this new approach provides opportunities for community empowerment, renewal, and revitalization.

Measuring Sustainability

One of the ways in which we have looked to address the failures of the past is by developing measurable sustainability goals for the future and assessing success after a period of time via an outcomes assessment process. Thus, it is not enough to set goals, one has to develop procedures to achieve goals, measure the success toward reaching the goals, and evaluate how to improve practices to achieve unmet goals. This approach toward measuring sustainability is an outcomes-based approach that is the cornerstone of the modern environmental movement. It is no longer enough to do small things toward the environment in a feel-good way. One has to measure the outcomes in order to assess whether or not one is truly achieving appropriate goals.

Measurement of goals allows comparisons year to year, from place to place, or from organization to organization. This comparison allows "benchmarking" of outcomes to assess success and best practices. Two states, for example, could compare efforts to reduce greenhouse gas pollution. The state that is most successful could serve as an example to the other state in order to find pathways toward positive outcomes.

This idea of sustainability measurement has been around for a long time. For example, many have tried to lower pollution levels for decades prior to the modern push for sustainability measurement. However, the comprehensive approach toward measuring sustainability indicators expanded greatly in the late 1990s and into the present era. We will discuss sustainability measurement in great detail in Chapter 3, but it is worth reviewing briefly here.

One of the first important international sustainability indicators is the UN Millennium Goals, which evolved out of the 2000 United Nations Millennium Summit. All of the nations of the world signed up to the goals of the summit, which arguably can be traced to the Brundtland Report. The intent of the summit was to achieve the goals by 2015. The major eight goals are:

1. Eradicating extreme poverty and hunger
2. Achieving universal primary education
3. Promoting gender equality and empowering women
4. Reducing child mortality rates
5. Improving maternal health
6. Combating HIV/AIDS, malaria, and other diseases
7. Ensuring environmental sustainability
8. Developing a global partnership for development

Each of these goals has set targets and a timeline for meeting them. For example, Goal 7, Ensure environmental sustainability, has four sub-goals with distinct measurable outcomes:

7A. Integrate the principles of sustainable development into country policies and programs; reverse loss of environmental resources

7B. Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss
- Proportion of land area covered by forest
- CO^2 emissions, total, per capita and per $1 Gross Domestic Product
- Consumption of ozone-depleting substances
- Proportion of fish stocks within safe biological limits
- Proportion of total water resources used
- Proportion of terrestrial and marine areas protected
- Proportion of species threatened with extinction

7C. Halve, by 2015, the proportion of the population without suitable access to safe drinking water and basic sanitation
- Proportion of population with sustainable access to an improved water source, urban and rural
- Proportion of urban population with access to improved sanitation

7D. By 2020, to have achieved a significant improvement in the lives of at least 100 million slum-dwellers
- Proportion of urban population living in slums

Each of the sub-goals of Goal 7, ensure environmental sustainability, has distinct measurable outcomes associated with it. No longer was it enough to say that species would be protected or that countries would do all they could to provide safe drinking water to their populations. Now, the world was expecting real significant outcomes to improve the lives of humans and a stronger protection of the environment.

Since the development of the Millennium Development Goals, the United Nations approved the Sustainable Development Goals. They will be discussed in more detail in Chapter 3. But it is important to note that there are a number of other measurable goals that have been developed to assist with sustainability management. The LEED green building rating system provides another example of the types of outcomes-based approaches that have emerged in recent years.

LEED stands for leadership in energy and environmental design. The LEED green building rating system was developed by the US Green Building Council in the late 1990s as a way to rate the "greenness" of buildings based on a variety of measurable criteria.

LEED is a point-based system that allows buildings to be rated as silver, gold or platinum based on performance in a number of areas. Plus, LEED certification can be done on new construction, existing buildings, commercial interiors, building cores, retail buildings, schools, homes, and neighborhoods.

In new construction, for example, points can be earned for site selection, development density, brownfield development, transportation infrastructure, habitat protection, storm water design, light pollution reduction, water use reduction, landscaping choices, wastewater management, energy systems, waste management, materials reuse, and indoor air quality. While not a comprehensive list, the previous list demonstrates the complexity of green building certification.

Green buildings are becoming more common and there are thousands of them that have been certified since certification started in the late 1990s. Some notable LEED buildings include the Empire State Building (green renovation) and Target Field in Minneapolis (home of the Minnesota Twins).

As we will see, this type of green certification and outcomes-based sustainability measurement is very common and a source of many jobs for students interested in sustainability careers.

Some have critiqued the sustainability benchmarking movement as too simplistic. For example, the LEED rating system provides excellent ways to measure the green technology used in a building, but does not evaluate how a building is to be used. In other words, you could build a giant mansion with all kinds of green bells and whistles. You could have it run totally on solar energy and utilize composting toilets in all 13 bathrooms. However, if the mansion were for you and your small family, it would not nearly be as green as living within a small conventional apartment.

Thus, it is important to evaluate the nature of the green rating system to examine the values behind it. The US Green Building Association is clearly most concerned about advancing green technologies in order to improve the overall impact of the building on the planet. For the most part, they do not concern themselves with the use of the building after it is built.

Some rating systems may also hide the complexities of an issue. Take for instance the push for the use of recycled paper. Imagine that you are a paper company that utilizes pulp from paper derived from sustainably managed forests in Canada. Your paper mills are fueled by hydroelectric power which is considered a green source of energy. In some rating systems, this would be considered a non-sustainable paper product because the paper does not have recycled content.

The issue can become more complex. Imagine you are a paper purchaser near the paper company noted above. If your firm decides to purchase only recycled paper, this requires you to import paper from a recycling mill that may be hundreds of miles away from the local source. By the measure of many sustainability indicators this would be the appropriate decision. However, when taking a number of variables into consideration, such as carbon footprints, transportation emissions, and community impacts, the decision to follow a sustainability measurement scheme becomes rather complex.

Thus, while sustainability benchmarking systems seem very basic at first glance, they are actually rather complex systems. It is important to understand the purpose of the scheme and understand the implications of choosing to rely on a benchmarking system in any organization. We will discuss this in more detail in Chapter 3.

The Climate Change Challenge

At the start of this chapter, I noted that Iceland held a funeral for the loss of its first glacier. All around us there is evidence for climate change. For many, climate change is the key sustainability problem. There is no doubt that climate change is linked to many of the topical issues covered in the upcoming chapters. It is anticipated that without rapid action on reducing greenhouse gases the world will see many more problems.

Hurricane Sandy was a superstorm that devastated the coast of the Mid-Atlantic region of the United States in October of 2012. It hit the most populated coastal region of the US near the New York Metropolitan area. Striking at night with deadly force, many were surprised by the strength of the storm and its far-reaching impacts.

In Manhattan, one of the five boroughs of New York City, flooding occurred in many areas including the famous neighborhoods of the Lower East Side, Chinatown, and The Battery. Subway tunnels flooded and residents were without power for days. In Staten Island and Queens, other boroughs of the city, a storm surge destroyed entire neighborhoods and caused dozens of deaths.

Was this storm caused by global climate change? In just two years, the New York region was hit by two sizable hurricanes. This has not happened in the history of the city which more typically experiences a sizable storm every half century or so.

After the storm, the Mayor of the City, Michael Bloomberg stated, "Our climate is changing. And while the increase in extreme weather we have experienced in New York City and around the world may or may not be the result of it, the risk that it may be—given the devastation it is wreaking—should be enough to compel all elected leaders to take immediate action."

This book is a textbook, but it is also a call to action. As you learn more about sustainability, think about how you can make a difference to make the world a better place for future generations.

The Road Ahead

The remainder of the book is divided into a total of 13 chapters. Each provides a distinct view of a major theme of sustainability. Along the way, I will introduce you to different experts on sustainability who are making a difference in research, community activism, economic development, or environmental protection. Prior to outlining the book, I think you should know a little bit about me, your author.

I am originally from a small village in southeastern Wisconsin called Waterford (Figure 1.10). This location is right in the middle of North American and in the region of the United States sometimes called the Upper Midwest. By car, my family could get to Chicago in about an hour and a half or to Milwaukee in about an hour. However, we did not travel to these places very much. Instead, we spent much of our free time in the woods of northern Wisconsin near the border of the Upper Peninsula of Michigan where we had a cabin. We would spend weekends and vacations in the woods and on the water. While we had all the comforts of a modern middle-class family, we were certainly more outdoorsy than most.

After graduating from high school I attended the University of Wisconsin at Oshkosh where I majored in Geology. I fell in love with mineralogy and with geologic fieldwork, especially after taking a field school that took me all over northwestern Canada in the Yukon, British Columbia, and Alberta. I wanted to become a mining geologist. I went on for my masters in geology at the University of Wisconsin at Milwaukee where my thesis was on the glacial geology of a portion of western Wisconsin near the Mississippi River. During this time, I worked for a mineral exploration company looking for particular minerals in stream sediment. The idea was to try to find trace minerals associated with gemstones in order to try to find deposits of rare gem minerals.

While conducting this work in rural areas throughout the Midwest, I realized that the surface of the earth was much more altered than most geologists thought it was. The world

Figure 1.10 Your author hiking on our family property in northern Wisconsin in 1968. How did your upbringing impact the way you think about the environment?

was not the simple layers of geology modified by earth forces. The planet was changed by the forces of its human population. Since my epiphany, scientists have caught on to my observations and now call the current geologic age the Anthropocene.

As I reflected on the implications of my discovery, I realized that there was scant information about the role of humans on altering the earth's surface. I was aware of the work of people like Leopold and Carson, but there were few conducting systematic work on the alteration of the surface of the earth. Eventually, I decided to make that the major theme of the rest of my career. I have worked at two major universities, the University of South Florida, and my current home, Hofstra University, to conduct this work.

In order to make that happen, I decided to work with noted soil scientist, Robert Eidt. He developed the term, anthrosol—a soil that is modified by the actions of man. I completed my dissertation on the distribution of lead pollution in soils in the late 1980s.

Over the last three decades, I continued to work on soil and sediment pollution issues. I've studied lead pollution in soils in Florida and I also studied the distribution and magnitude of pollution in street sweeping sediment, storm water, and street debris. I have published a number of pieces on these topics.

In recent years, I have become more and more concerned with problems associated with greenhouse gas pollution and global climate change. I was educated on some of the policy issues when I took a summer course at the Vermont Law School with Patrick Parenteau.

Since then, I've written widely on greenhouse gas policy and a variety of other sustainability issues.

Of course, my work has also stayed close to my roots in the geosciences. I deeply love nature and the field of geology. I continue to conduct research on natural systems and have published works on caves and sinkholes.

I also love to garden and spend time in nature. I have a blog that you can visit called *On the Brink* that includes my informal writing on the environment (http://bobbrinkmann.blogspot.com). I've travelled to all continents but Australia and Antarctica and have been to all of the US states except Oregon. I love to take walks in nature and love parks. Whenever I travel, I try to visit as many parks as I can to get a sense for the landscape and to better understand how different regions of the world organize their public lands.

As a gardener, I am also interested in food. We have greatly transformed our agricultural system in my lifetime and I am interested how this impacts us not only from a health perspective, but also from an ethical standpoint. Most of us have very different relationships with the plants and animals that provide us food than our parents and grandparent had.

During my lifetime the world has changed greatly. In some ways, it has changed for the better. In others, it has changed for the worse. Readers of this book will likely have the same experiences. We have serious energy and water issues, populations continue to expand, and global climate change is likely to vex us for decades.

My purpose in writing this book is to provide an organizational framework for understanding these and other issues within the new field of sustainability. I've had the opportunity to work as a researcher as the field developed and I think my approach to the discipline is a suitable starting off point for someone interested in learning about sustainability. In this book, you'll find that my approach is systematic in that the organization of the text takes us from one theme to another and build upon each other. However, I try to bring in real-world applications of the content and introduce you to people who are at the cutting edge of the sustainability field. I have also provided a series of interesting Weblinks within each chapter that can take you in new directions and that provide real-world information about the work of others in the field.

Organization

This book is divided into four parts, each with three or more chapters. Part 1 focuses on the roots of sustainability. In this section, we will explore the historic background of the field (as we have done in this chapter), provide a basic understanding of earth systems, and review ways that sustainability is measured. Part 2 examines sustainability and natural resources. There are chapters on energy, greenhouse gas management and climate change, water, and food and agriculture. Part 3 brings us toward the understanding of sustainability and communities with information on green building, transportation, waste, and environmental justice. Finally, the book concludes with Part 4 with sections on planning, sustainable development, green economies, business sustainability, and sustainability at colleges and university.

I hope that you enjoy this book. If you have any suggestions for improvement, please do not hesitate to contact me at Robert.brinkmann@hofstra.edu

When I tell people that I teach and write in the sustainability field, their first question, after a bemused look is to ask me, "what's that?!" Some of the sustainability majors in my department have told me that their friends do not fully understand the major or the discipline and that they have a hard time explaining the major to their parents. Here are some of the majors in the environmental sustainability field and roughly what they study.

Environmental Science. An environmental science major takes courses on the major earth systems sciences such as ecosystems (biology), water and other resources (geology, meteorology, hydrology, and geography), environmental chemistry, and environmental engineering. Students in this field often take a number of supporting science and math courses. Students taking an environmental science degree typically earn a bachelor of science (BS) degree.

Environmental Policy. Environmental policy majors focus their studies on a range of issues related to the development and management of environmental policies. They take a number of liberal arts and applied courses in areas that may include government and policy, planning, sociology, economics, and business. Students that earn an environmental policy degree usually obtain a bachelor of the arts.

Environmental Studies. An environmental studies major usually looks at environmental issues within the humanities. They will take courses in literature, philosophy, and art. Students that earn this degree often receive a bachelor of science.

Sustainability Studies. A sustainability major often links science and policy in order to find ways to improve overall environmental, social, or economic sustainability. Due to the diversity of the field, sustainability curricula vary widely. However, sustainability tends to be much more applied than any of the previously mentioned degrees in that the focus of the degree is solving real-world problems via achieving measurable improvements.

There are many other types of environmental degrees that are offered throughout the world including environmental management, environmental planning, environmental economics, environmental geology, and urban ecology. Each offers differing perspectives on the field of the environment.

What environmental courses and degrees are offered at your university or school?