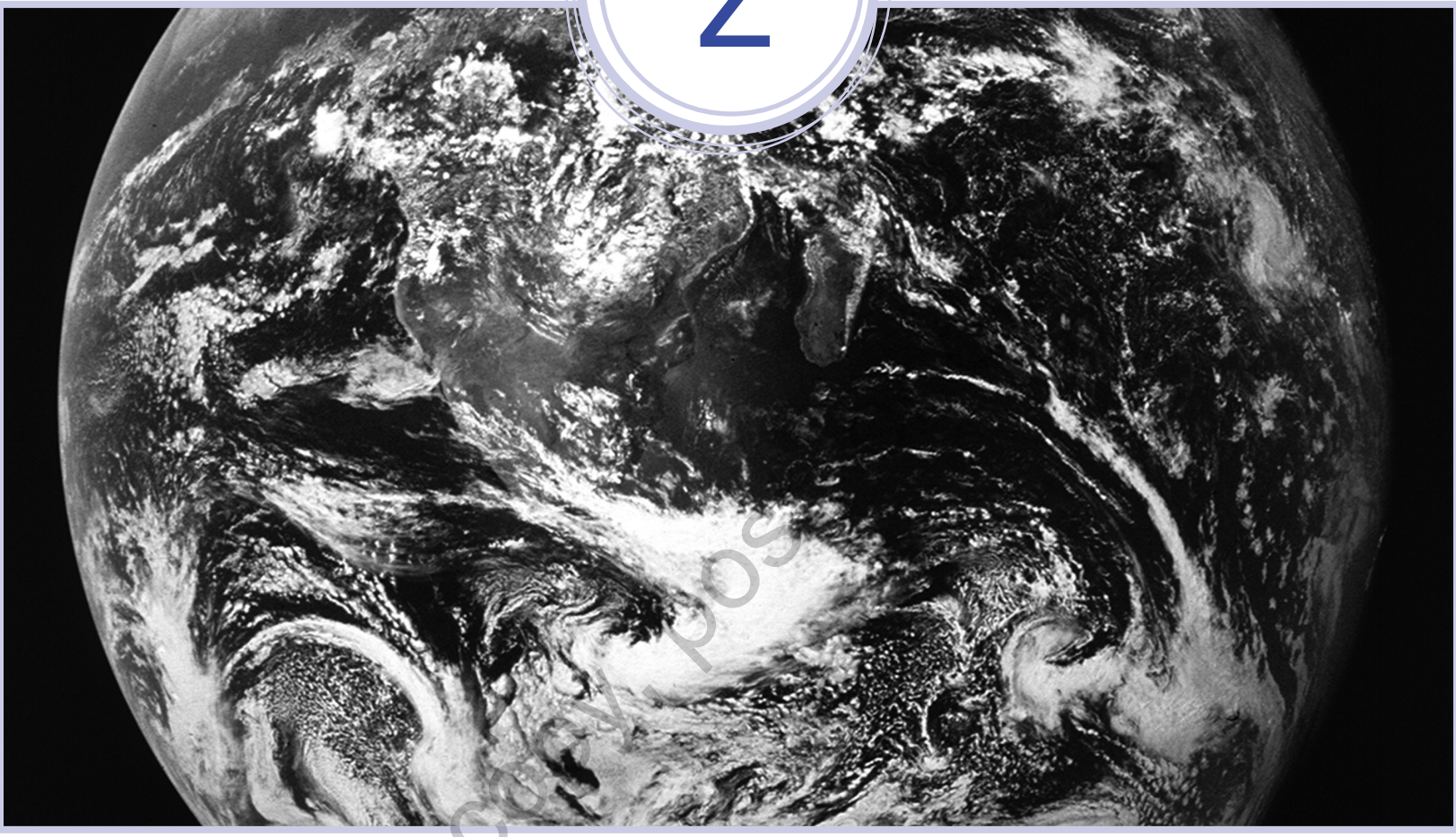
2



Point of Departure

Planet Earth

This familiar National Aeronautics and Space Administration (NASA) image is the most requested photo of the earth, depicting it as a watery blue marble floating alone in a sea of space. Viewed this way, it is easy to see how important stewardship of our global commons is for our mutual well-being. In this chapter, we will explore a variety of other ways of looking at and understanding the earth—the starting point for our journey.

NASA and the National Space Science Data Center.

Learning Objectives

After studying this chapter, you will be able to do the following:

- Define the field of geography and explain its key units of analysis and measurement
- Understand the key challenges facing our physical world
- Analyze sources and trends in population growth
- Explain the sources of food insecurity
- Distinguish alternative sources of energy and how each affects environmental security
- Evaluate the impact human beings are having on the sustainability of the planet
- Review key global initiatives designed to address climate change
- Reflect on ways personal behaviors can be adjusted to promote sustainability

Everyone has responsibility for the earth as a common resource, and we all must work together to maintain it. It is a shared resource that represents a **global commons**, a natural asset that is available to all. Clean air, a healthy environment, and access to the oceans and outer space all fall into this category. But sharing this global commons requires that all people use it in a responsible way to protect not only their individual interests but those of future generations. Noted economist Jeffrey Sachs, director of Columbia University's Center for Sustainable Development from 2002–2016, suggests that our ability to manage our interconnectedness to the planet is perhaps the most significant challenge of the twenty-first century.[1]

global commons a natural asset of the earth that is available to all

Ecologist Garrett Hardin captured the tension between individual interests and shared resources in his famous essay, "The Tragedy of the Commons," first published in 1968.[2] Hardin posed a hypothetical scene in which a village of herdsmen shares a common pasture for grazing their sheep. If each herdsman adds a sheep, he alone will benefit from future sales, but the costs of grazing for that sheep will be shared by all. An individual herdsman will add sheep because he does not feel the negative effects by himself. The benefits to him are great, but everyone shares the negative impacts. The incentive, then, would be for each herdsman to increase his personal flock. The ultimate result, however, would be overgrazing of the commons until there is nothing left and, hence, the tragedy of the commons. Hardin concludes with the sobering warning that the freedom of individuals to pursue their own interests without considering the impact of their choices on others could bring ruin to all.[3]

The tragedy of the commons helps us appreciate the challenge of sustainable development. The term *sustainable development* can be traced back to the World Commission on Environment and Development, better known as the Bruntland Commission, convened by the UN General Assembly in 1983 to address growing concerns about the deterioration of the environment stemming from economic and social development.[4] The commission's 1987 report, *Our Common Future*, would provide what has become the most widely used definition of **sustainable development**: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[5]

sustainable development "development that meets the needs of the present without compromising the ability of future generations to meet their own needs," as defined by the World Commission on Environment and Development

This chapter explores our connection to the earth as the starting point of our journey toward understanding the borders that have shaped our world. First, the study of **geography** will be introduced as a way to appreciate the expanse of our planet and how it is represented through maps. This will give us a sense of the patterns of human settlement—why we have come to live in certain places but not in others and why some areas flourish while others do not. Some of the critical issues that impact the health of our environment will then be examined: population growth, food production, energy, and climate change. Finally, we will explore some ways that you might enhance the physical sustainability of our habitat for future generations.

geography the study of the earth and its characteristics

Getting Our Heads around the Earth: Geography as a Field of Study

Viewed from space, the earth appears as a physical mass marked by oceans, mountains, deserts, rivers, forests, and fields. From this perspective, it appears static, when in fact it is not. Over the course of time, the borders that have differentiated this mass have been changed by natural events, from continental drift thousands of years ago to more recent hurricanes, wildfires, earthquakes, tsunamis, droughts, and floods. The earth's physical attributes, such as where arable land, mineral riches, or waterways are located, have to a large extent determined where people have settled. The fundamental challenge of geography has been that there is no one place where any of us can stand on the planet in order to observe the whole thing at once. It is also nearly impossible for any one person to conceive of all the ways in which people are connected to one another and to the planet. Our image of what the earth looks like has changed radically over time and has been profoundly shaped by technological developments.

Scholarly attempts to understand the physical world date back to the earliest philosophers. For starters, we owe the word *geography* to Greek scholar Eratosthenes, who was born around 275 BCE. Eratosthenes was interested in writing and learning about the earth, and the term he coined for this activity came from the Greek language—*geo*, meaning earth, and *graphos*, meaning description.[6] His greatest accomplishment in this regard was the first scientific calculation of the circumference of the earth based on his observations of the sun.

One of the earliest investigators whose impressions had lasting effects was Claudius Ptolemy. Born sometime late in the first century CE, Ptolemy was of Greek origin but lived in Alexandria, Egypt. Two of the major texts he produced, *Geography* and *Almagest*, were efforts to map the world in a system of degrees that measured distances from the equator.[7] Relying on limited knowledge, Ptolemy created a map that introduced the concepts of latitude and longitude (see Figure 2.1). While his calculations were off and much of the world was not known to him at the time, his contribution to measurement was significant and enduring.

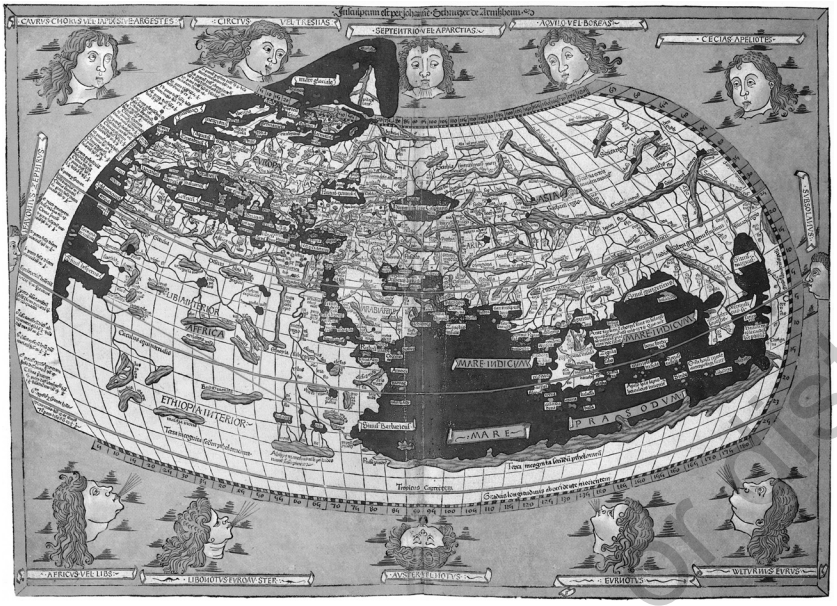
The modern discipline of geography developed much later in the mid-1800s. Alexander von Humboldt (1769–1859) was a German naturalist who is often called the "father of modern geography" for his contributions to an understanding of the dynamics of the physical world and the interface of humans with their environment.[8] His great work, *Cosmos*, included some of the first systematic observations about climate and its link to geography. Juxtaposing a review of ancient writings about the natural universe with the technologies emerging during his time, von Humboldt sought a scientific way to understand the earth.

Today, the discipline of geography is generally divided into two branches: physical geography and human geography. **Physical geography** focuses on the study of the earth and its resources. **Human geography** refers to how humans interface with the physical environment and how political, economic, social, and cultural factors influence these connections.

physical geography the study of the earth and its resources

human geography the study of how humans interface with the physical environment and how political, economic, social, and cultural factors influence these connections

FIGURE 2.1 ● Ptolemy's Map of the World



Source: Lord Nicolas the German (Donnus Nicholas Germanus), cartographer Johann the Blockcutter of Armsheim (Johannes Schnitzer or Johannes de Armssheim), engraver Ptolemy Jacobus Angelus, translator, Public domain, via Wikimedia Commons.

The study of maps, or **cartography**, unravels how these physical and human borders are depicted. Maps can show **topography**—any of the earth's physical features, including mountains, rivers, lakes, and streams, and their relationships to one another in terms of location and elevation. They can also portray political borders, which are frequently influenced by topography but fundamentally drawn by people to serve political interests. Many modern states, for example, are the artificial constructs of former colonial powers that do not necessarily recognize the historical patterns and natural relationships of a given area's inhabitants. Another type of map can show economic distinctions, such as the location of resources and trade routes. Social and cultural divisions can also be uncovered by noting how ethnic and cultural identities interface with political and economic borders. Even cooperation across borders can be mapped in terms of regional and international organizations.

cartography the depiction of physical and human-made borders

topography the depiction of the earth's physical features and their relationships to one another in terms of location and elevation

Modern technologies have changed the field of geography and how mapping occurs. Geographic information systems (GIS) combine the power of computers with satellite imagery to produce new ways of understanding spatial relationships and include new tools such as Google Earth and the global positioning system (GPS). These technologies are able to utilize different kinds of information about geography, from physical dimensions to human interventions, to track changes in the environment.[9] As a result, they offer a far more comprehensive picture than what had been available previously. This is particularly useful in understanding some of the critical challenges we face. For example, the National Snow and Ice Data Center has used Google Earth to track changes in the polar ice cap over time.[10] Countries are also using GIS technology for more strategic purposes that include pinpointing the location of military installations, potential improvised explosive devices (IEDs), or even the whereabouts of suspected terrorists.

These technological innovations have made us more sensitive to the finite nature of the planet on which we live. This capacity has enabled us to become more aware of the hazards that can affect everyone, regardless of where they are located. The earth is not an unlimited resource, and our charge must be to extract and utilize the resources we need to sustain our lives while not inflicting undue harm that might threaten future generations. The historical record suggests that we have not done a particularly good job to this point.

With its interdisciplinary perspective and approach, international studies can help us appreciate why we may have difficulty interfacing appropriately with our environment. Dealing with such issues as population management or climate change is not simply a matter of negotiating physical space or utilizing the tools at our disposal. Political considerations may constrain efforts to devise solutions, as they have in the case of finding suitable living arrangements for waves of refugees from Syria and elsewhere. When it comes to implementing policies to protect rain forests or limit unhealthy emissions, financial considerations can undermine the effort. As we have seen in parts of Africa and elsewhere, moreover, social and cultural traditions might frame resistance to vaccination programs designed to eradicate deadly diseases that know no borders. Our relationship with planet earth is a complicated one. The following sections address some of the challenges of managing resources and how they have been handled.

IN THEIR OWN WORDS
ALEXANDER VON HUMBOLDT

Although expressing himself in a way that may be unfamiliar, Alexander von Humboldt conveys a message that is as relevant today as it was in the nineteenth century—the need to systematically explore both the potential and limits of the planet.

> *There dwells an irresistible charm, venerated by all antiquity, in the contemplation of mathematical truths—in the everlasting revelations of time and space, as they reveal themselves in tones, numbers, and lines. The improvement of an intellectual instrument of research—analysis—has powerfully accelerated the reciprocal fructification of ideas, which is no less important than the rich abundance of their creations. It has opened to the physical contemplation of the universe new spheres of immeasurable extent in the terrestrial and celestial regions of space, revealed both in the periodic fluctuations of the ocean and in the varying perturbations of the planets.*[11]

As you move through the chapter, what are some of the new methodologies and recent scientific insights that might help us gain a greater understanding of the strategies to better sustain life on the planet?

Where We Live

As a starting point, it is important to understand that where people settle is not always a choice made freely. The borders that shape where we live are human-made. People can be uprooted by conflict and forced to flee their homes. They often have few, if any, options as to where they resettle and under what terms and circumstances. The result is they may end up having to live in inhospitable environments. In 2020, there were an estimated 79.5 million displaced people in the world. This figure has risen steadily over the years, with children accounting for more than half the total. Conflicts across Africa in countries such as the Democratic Republic of the Congo (DRC), Somalia, South Sudan, and the Middle East

(stemming from the wars in Syria and Yemen) are responsible for a considerable share of recent movements. While 33.8 million are refugees relocating across national boundaries, an even greater number—45.7 million—are displaced within their own countries.[12]

Those escaping violence may be forced to seek temporary shelter in large refugee tent cities that are established with direct assistance from humanitarian agencies. It is not uncommon for these camps to continue for years as the hatreds and political maneuverings producing these conflicts do not dissipate easily. This is certainly the case with the Dadaab camps in Kenya, the oldest of which were created in 1991 to house refugees from Somalia. For years the world's largest refugee complex, they have been administered by the United Nations.[13] Conditions are harsh and residents are susceptible to natural dangers, ranging from wild animals attacking small children who have invaded their environment to flooding from the annual rains. The temperatures in this area can soar well above 100 degrees Fahrenheit, but the camps may offer the only hope for shelter, food, and water. Kenya's government has grown weary of the camps, arguing that they are a drain on resources and cultivate extremist ideologies. Previous efforts to close them have been blocked, but pressure remains to do so. This would have dire consequences for those who would face repatriation to their homeland and a very uncertain future.[14]

The Kutupalong refugee camp is the largest in the world today. It is one of numerous facilities surrounding the town of Cox's Bazaar in Bangladesh, estimated to house more than 900,000 Rohingya refugees from Myanmar. The Rohingya are a Muslim minority that have endured discrimination and persecution in their homeland for many years. One of the ironies is that the leader of Myanmar who failed to stem the violence was Aung San Suu Kyi, long regarded as a champion of human rights who was awarded the Nobel Peace Prize in 1991. She was ousted the country's military in early 2021. The Rohingya have endured harsh conditions in exile, compounded by additional displacements stemming from seasonal monsoon rains. Despite efforts by the United Nations and private humanitarian agencies to extend health care and humanitarian assistance, it has proven difficult to provide sufficient care and the crisis persists.[15]

Economic pressures can also lead people to relocate. Sometimes, the best option is to migrate to places within their home countries where they can find work but where human habitation is not particularly sustainable over time. These areas are often along borders, where factories have been built and shantytowns are constructed with homes built from cardboard and any other materials that can be found. Overcrowding, coupled with the absence of electricity, running water, and adequate sewage and waste, make for a difficult existence. Many of the communities hosting the manufacturing facilities or *maquiladoras* across the U.S. border, in Mexico, exemplify these conditions.

AP Photo/Marco Ugarte, File

Mexican authorities face off against a caravan crossing into Mexico from Guatemala.

Living and working in this type of situation can further deepen and aggravate social and cultural divisions. While those who move to more central cities for work frequently have rising expectations about their futures, they may easily find themselves relegated to marginal status. The success that was so eagerly anticipated often goes unrealized. This is why many look beyond their borders in the search for a better life. The considerable uptick in migration from the

impoverished Northern Triangle of Central America (El Salvador, Guatemala, and Honduras) to the United States speaks directly to the significance of this economic imperative. More than half of the Salvadorans surveyed who joined the well-publicized and highly contentious 2018 "caravan" to the United States, for example, cited economic opportunity as their primary motive for participating.[16]

Finally, it is important to note that settlement patterns may be significantly influenced or altered by environmental considerations. The Internal Displacement Monitoring Centre of the Norwegian Refugee Council estimates that between 2008 and 2018 a total of 265.3 million people were displaced as a result of disasters. In 2018 alone, 17.2 million relocated, with 16.1 million of these seeking shelter from weather-related events. This figure exceeded the 10.8 million people fleeing conflict during the year. Disasters are not restricted to any particular area, but their burdens often fall disproportionally on those in the poorest regions, where management capabilities are more limited. More than 70 percent of the displacements stemming from disasters in 2018, for example, were in South Asia, East Asia, and the Pacific.[17] Resettlement is further complicated by the fact that environmental refugees are not generally covered under international provisions designed to assist displaced people. They may have a particularly difficult time finding safe haven in places where the political backlash against migration has gained traction.[18]

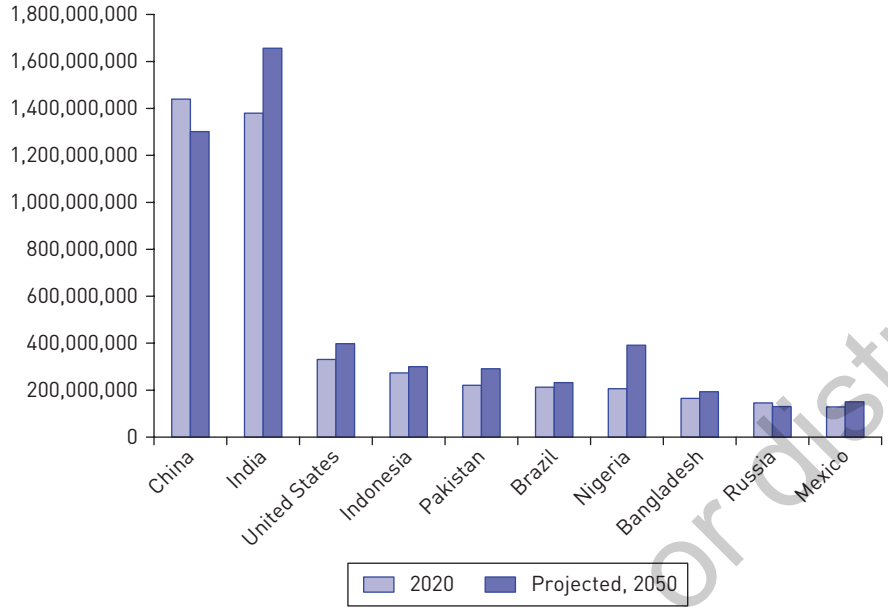
Population Management

One of the underlying factors perpetuating uneven development has been the rapid growth of the world's population. As more and more people come to inhabit the planet, protecting and managing shared resources becomes even more problematic. Burgeoning populations are consuming natural resources at unprecedented rates. Whether intentional or not, the actions of this growing population have significantly impacted our environment, from the destruction of natural habitats and extinction of animal and plant life to the pollution of the atmosphere.

To put this growth in perspective, in just one minute, taking births and deaths into account, the population of the world expands by 150 people, with a growth rate of 2.5 per second.[19] This growth is uneven, as the more significant increases often occur in those regions or countries that are least able to provide for the added numbers. By 2050, it is estimated that world population will reach 9.9 billion. The fastest rates are expected across Africa, where population will likely double. This will account for around 58 percent of the total increase in the number of people inhabiting the planet between now and then.[20] Figure 2.2 shows the most populous countries in 2020 and their projected growth by 2050. In 2020, the top ten countries accounted for 57.7 percent of total world population; it is estimated they will account for 53.8 percent in 2050.

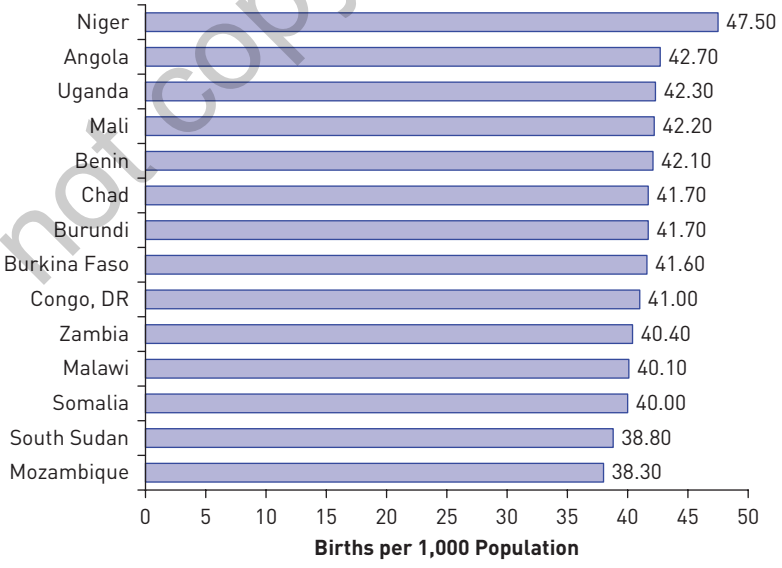
What are the factors that affect these disparities? There are several that can be examined. One of the most frequently cited is education. For example, in the largest, least educated, and most populous Indian state of Uttar Pradesh, the total fertility rate (TFR) is 2.74 children per woman. The rate for India as a whole is 2.18, down from 2.68 a decade ago.[21] The proportion of women using birth control is considerably less than the national average and is lowest among those with little or no education who often have the most difficulty feeding and sustaining their families. While the overall growth rate for India has slowed, population continues to expand annually at the rate of 1.17 percent, and the country is poised to surpass China in the coming years.[22] Cultural values also continue to push births in many areas, as the desire for a boy is great, family planning practices may be discouraged on religious grounds, and rural parents are still influenced by the need for large families to support them. Figure 2.3 suggests where the greatest growth in population is occurring—primarily in sub-Saharan Africa, as discussed later in the chapter—by measuring crude birth rate, which is the most commonly used indicator in determining population growth.

FIGURE 2.2 ● The World's Most Populous Countries



Sources: Data are from internetworldstats.com, with data from US Census Bureau, www.internetworldstats.com/stats8.htm.

FIGURE 2.3 ● Countries with Leading Population Growth Rates, 2020



Source: *CIA World Factbook*, https://www.cia.gov/library/publications/the-world-factbook/fields/345.html.

MUNIR UZ ZAMAN/AFP via Getty Images

Rohingya refugees at a water distribution site in the Bangladesh Kutupalong refugee camp in October 2020.

China has taken an interesting path in addressing this issue through its policy of one child per family. Up until recently, only those families living in rural areas were allowed to have more children to support their agricultural needs. There was considerable criticism of this policy by human rights activists because of the limits on individual choice, as well as its unintended consequences. Female babies were abandoned or even killed by Chinese parents who, like those in India, wanted a boy. This prioritization resulted in a disproportionate number of males, which has both practical and political consequences. Many young Chinese men have difficulty finding wives, are underemployed, and often feel alienated from society. As a result, they are seen by the government as a potential source of political opposition. In response to these tensions, the policy was amended in December 2013 to allow a second child if one of the parents was an only child. The previous exception to the policy applied only if both parents were single children. In 2016, the government went even further by extending the right to bear two children to every married couple, provided they are granted the required permit. The sluggish rise in China's birthrate prompted another review in 2018 and may result in the elimination of further—or perhaps even all—restrictions before too long.[23]

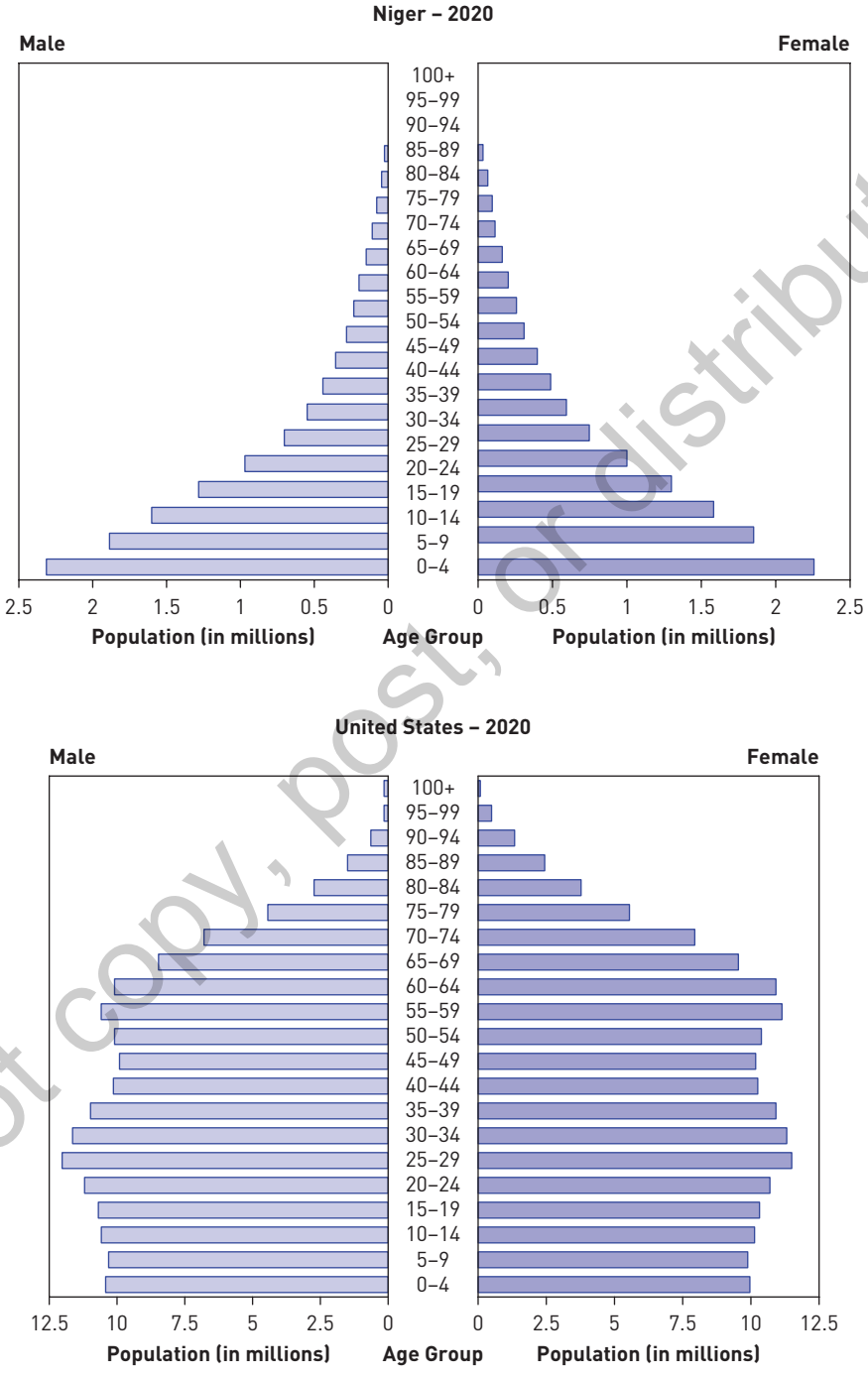
These trends have additional implications. In China, families traditionally cared for their aging parents. Now there is a shortage of care providers due to an aging population and the strict controls on reproduction. The number of Chinese people over age sixty-five is expected to reach 330 million by 2050, and the provisions for their care simply do not exist.[24] In contrast, many developing countries find themselves coping with a population that is very young (see Figure 2.4). The median age in Afghanistan is 19, and in Niger it is just 15.5, the world's lowest; in contrast, it is 37.7 in China and 38.2 in the United States.[25] Younger populations in conflict-prone or economically disadvantaged areas are a potential source of significant political change, especially as they gain access to technologies that facilitate communication and social networking. Although their efforts came up short in many instances, the youth who spearheaded uprisings across the Middle East in the spring of 2011 provided a model for political mobilization that is likely to spread in the years ahead.

Managing population—both nationally and globally—is often complicated by the need to balance multiple and sometimes competing objectives. The "Pro/Con" debate regarding the alleged impacts of population growth addresses this dilemma.

FIGURE 2.4 ● Population Distribution by Country, Age, and Gender

(Continued)

FIGURE 2.4 ● (Continued)



Source: *CIA World Factbook*, "Population Pyramids," https://www.cia.gov/library/publications/the-world-factbook.

PRO/CON

IS POPULATION GROWTH A MAJOR CONCERN?

Pro

Roger-Mark de Souza

President and CEO, Sister Cities International. Written for *CQ Researcher*, June 2018

Population is a powerful variable. Some believe that a larger population conveys status, power and wealth. Yet, the relationship between population and a country's priorities, such as general well-being and economic vitality, is not a simple linear equation.

Scratch the surface and you discover a complex system of interrelationships. Rapid population growth tends to affect local resource scarcity first (e.g., deforestation, water and land use, fisheries depletion), while consumption drives many other types of environmental issues, such as pollution.

It is also important to remember that in parts of the world that are still growing rapidly, people are generally more reliant on their local natural resources than are people elsewhere. These resources may be easily depleted with a growing population.

Ultimately, however, it's not just about population and numbers, it's about the power of allowing people to choose how many children they would like. History has shown that when women are given the opportunity and means to control their fertility, they tend to have fewer children.

Population is also about possibility. Countries with large youth populations will face increasing demands for education, health care and employment. If these countries are able to meet the demands of their youth, they might reap what's called the "demographic dividend" as they leverage these young populations to increase economic productivity.

Without these investments, some countries may be more vulnerable to instability. Researchers have found that 80 percent of all new civil conflicts from 1970 to 2007 occurred in countries with youthful age structures (where 60 percent of the population is under age 30). Meeting unmet demand for family planning in countries with high numbers of young people could therefore help indirectly reduce the potential for conflict.

Con

Anne Hendrixson

Director, Population and Development Program, Hampshire College. Written for *CQ Researcher*, June 2018

The population picture today is very different from even fifty years ago. Since the 1960s, birth rates have declined more quickly than anticipated, and while the overall global population is still growing, it is growing at a slower rate.

Differences in birth rates among countries have contributed to a youthful Global South and an aging North. These age dynamics mean that most population growth will be in Africa, while countries including Japan, Italy and Germany will likely experience population declines because of aging. Over time, all countries will experience aging populations, where the majority of people are over sixty. Current age dynamics mean that population will have varied impacts in different places.

Now, as ever, it is important to put population in perspective. This means challenging the notion that growth is the primary issue in population studies and policy. Population growth has historically been positioned as the key driver of global problems such as poverty, environmental degradation, hunger and even war. This mindset too often over-determines the role of the number of people and detracts from a serious conversation about the complex interplay of political, economic and social factors that propel problems. Population numbers do not predetermine how people affect the world around them or automatically worsen problems.

Consider the relationship of people to the environment: Attributing environmental degradation to population growth assumes each person has an equal and negative "footprint." Not so. The rich have a greater impact than the poor, toxic industries generate more than their share of carbon emissions and unregulated development contributes to degradation. Dominant patterns of production, consumption and distribution are unsustainable, regardless of the number of people.

(Continued)

(Continued)

Population dynamics is mostly about plausibility. Demography is by no means destiny. However, fragile and impoverished states have very little resilience to adapt to the pressures created by young age structures and urbanizing populations. Context matters, and with tremendous complexity within social, economic, political and environmental factors, there is no single formula to guarantee successful economic development or conflict prevention.

Ultimately, responses require coordinated interventions from a variety of sectors. What is clear, however, is that when states pay attention to demographic variables and combine them with the empowerment of women, they increase their chances for sustained development and the well-being of their populace.

A focus on population growth has gender implications for policy. A primary response to population growth is curtailing fertility, specifically women's, as the point of intervention. This makes women responsible for family planning and too often sidelines men's role. It pits women's sexual and reproductive health decisions against larger and sometimes conflicting agendas, often to the detriment of comprehensive care.

Population is an important issue. Nuanced analyses of population trends are needed to create policies that support the environment and people of all ages. This is particularly true in the context of climate change, which disproportionately affects those least responsible for greenhouse gas emissions, while potentially deepening existing economic and other inequalities.

Source: S. Straight, "Global Population Pressures," *CQ Researcher* 28 (2018): 537–560. http://library.cqpress.com/.

Document ID: cqresrre2018062206

Document URL: http://library.cqpress.com.prox.lib.ncsu.edu/cqresearcher/cqresrre2018062206

Where Do You Stand?

1. Do governments have a legitimate right to impose population control policies to address food, energy, or other resource constraints?
2. Is it appropriate for the United States or any other country to attach family planning requirements to their food assistance programs?

Food and Hunger

carrying capacity the earth's ability to meet the needs of its population

Can the planet adequately provide for this growing population? Human efforts to sustain ourselves and to develop and progress have strained the earth's **carrying capacity**. In other words, our needs have placed considerable strain on the world's ecosystems, thereby threatening the global commons and suggesting the possibility of a potential tragedy, as envisioned by Hardin.

First and foremost, it is important to recognize that people require access to sufficient amounts of food and clean water to ensure their survival. This is our most basic physiological need, as noted by psychologist Abraham Maslow. While Maslow identified five levels of human needs (to be discussed more thoroughly in Chapter 11), the first is the most basic. Only once this is satisfied, can people move up the pyramid to address safety, belonging, esteem, and ultimately self-actualization.[26] Providing for the world's expanding population while protecting the environment is no easy task.

The idea that population growth would severely strain available resources is not new. Thomas Malthus (1766–1834), an English economist with an interest in demographics, wrote of this possibility in "An Essay on the Principle of Population," first published anonymously in 1798 and later revised and updated. Malthus speculated that the rate of

growth of the world's population would outstrip the production of food.[27] This notion is referred to as the **Malthusian dilemma**. More recent interpretations have suggested that, in today's terms, a population of more than 9 billion people in 2050 could well outstrip the supply of accessible food.[28] There is simply not enough arable land to meet that need, according to Columbia University's Earth Institute, and even the best efforts may not offset the devastation caused by **deforestation** to allow for enhanced agricultural production.

Malthusian dilemma the conflict inherent in the idea that the growth of the world's population increases geometrically, whereas the production of food can increase only arithmetically

deforestation the destruction of forest areas due to human actions or environmental factors

Appropriate use of available land is critical, but the production of food is also impacted by geographic changes taking place, both natural and human-made. Natural disasters—from forest fires to drought—that destroy crops and render lands unviable are just one impediment. Environmental degradation through the overuse of arable land and fertilizers also has a negative effect. The challenges are not limited to production. The availability of sufficient food can also be undermined by war due to the disruption of supply and distribution lines. Together, these elements play a considerable role in influencing both the price and safety of our food. A closer look sheds light on these concerns.

Despite Malthus's forecast, food production has increased over time, but the ability to feed a growing population has been weakened by other factors. The use of pesticides and chemicals designed to increase crop yields over the short term, for example, can have longer-term adverse effects on the soil that lasts for generations. The environmental danger is often most severe in developing areas where regulations may be limited and the need for food is acute. The UN Food and Agriculture Organization (FAO) reports that following years of relatively steady progress in reducing hunger, the number of undernourished people has been inching upward since 2015. Current figures suggest that there are still more than 820 million hungry people in the world, with more than 812 million of these living in the Global South. India (194.4 million) and China (122.4 million) have the largest overall numbers, while East and sub-Saharan Africa are most impacted proportionally, with 30.9 and 22.5 percent of their respective populations underfed.[29]

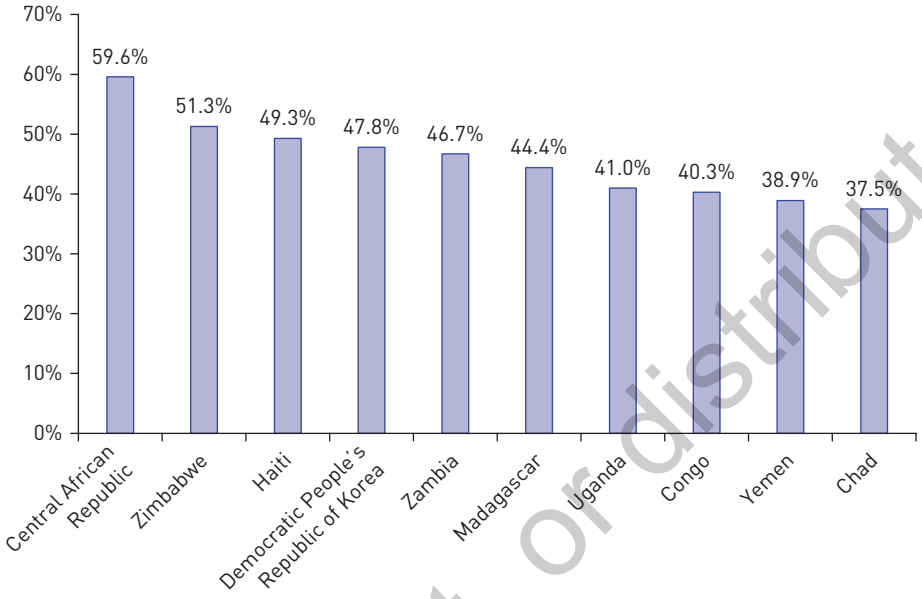
While these figures are staggering, even more disconcerting is the fact that more than 113 million people experience acute hunger requiring immediate assistance. Once again, Africa is the most severely impacted, owing largely to pervasive conflict (33 million), economic bottlenecks (10.2 million), and an array of climate-related shocks (23 million) that produce erratic rain patterns, flooding, droughts, and extreme temperatures.[30]

Across much of Africa, food produced locally is often exported to earn money and environmental conditions and political uncertainties often hinder distribution networks for supplies that remain available. For example, a succession of unfavorable rainy seasons has left 2.2 million people in need of emergency food assistance in Somalia, already reeling from a prolonged period of war. Civil conflict in the DRC continues to strain its food system, already burdened by the presence of large numbers of refugees and displaced persons as well as an outbreak of the Ebola virus. Meanwhile, an extended drought in Ethiopia affecting livestock and crop production has left more than 8 million people in desperate need of food assistance.[31]

Hunger is not simply about having enough food; it is also about the lack of access to food that provides adequate nutrition. The FAO, which monitors global food issues, refers to this condition as **food insecurity** and defines it as "a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life."[32] Children are the most vulnerable. More than 3 million children die each year from chronic undernourishment—dietary energy consumption that is continuously below the minimum requirement for a healthy lifestyle. Countless others are impacted by insufficient vitamin and mineral intake, which stunts their weight, height, and cognitive development.[33] Figure 2.5 identifies the countries with the greatest percentage of their populations suffering from undernourishment.

food insecurity the lack of secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life

FIGURE 2.5 ● The World's Most Undernourished Populations (by Percentage), 2016–2018

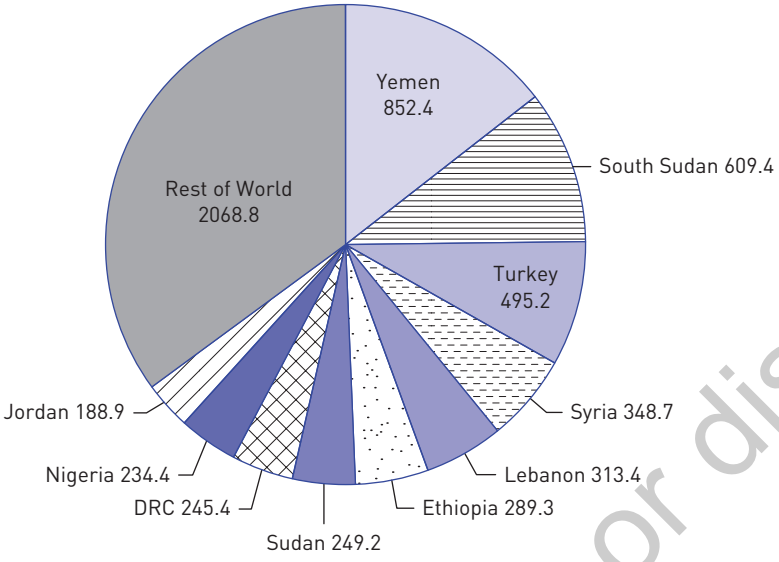


Source: Food and Agriculture Organization of the United Nations, *The State of Food Security and Nutrition in the World 2019 [Rome: Food and Agriculture Organization of the United Nations, 2019]*, annex 1, Table A1.1, http://www.fao.org/3/ca5162en/ca5162en.pdf.

Why not simply send food to those in need? This is where political and economic considerations often intervene. There are many efforts to provide food aid, coordinated by both governmental and nongovernmental entities. Internationally, the UN World Food Programme (WFP) is a key actor in emergency food aid response. The WFP was awarded the Nobel Peace Prize in 2020 for its work to combat hunger. While aid is welcomed, it is frequently hard to get to the people who need it most. One of the greatest inhibitors is conflict. The safe transportation and distribution of food can be impeded by the lines of battle or even the logistics of navigating vastly overcrowded refugee camps. This situation is particularly problematic in sub-Saharan Africa. War in central Africa has resulted in large numbers of displaced people from the Central African Republic (CAR), estimated to be more than 600,000. In the DRC, the figures are even higher, with an estimated 4.5 million people affected by food insecurity across the country. In South Sudan, nearly 7 million people (60 percent of the country's population) are lacking sufficient food due to the continuing effects of ongoing conflict. Other areas are affected as well. In Yemen, a proxy war between Saudi Arabia and Iran has produced a humanitarian crisis of significant proportions while leaving an estimated 20 million of the country's 28 million people hungry.[34]

The magnitude of the food crisis is reflected in the vast numbers of people in dire need of assistance. In 2018 alone, the WFP serviced 86.7 million people in eighty-three countries, 70 percent of whom were facing critical circumstances. While natural conditions such as drought or floods leave many in harm's way, it is not

FIGURE 2.6 ● WFP Direct Expenditures—Leading Recipients ($ Millions), 2018



Source: World Food Programme, *Annual Performance Report for 2018*, Annex VII-B. pp. 149–153. https://docs.wfp.org/api/documents/WFP-0000104617/download/.

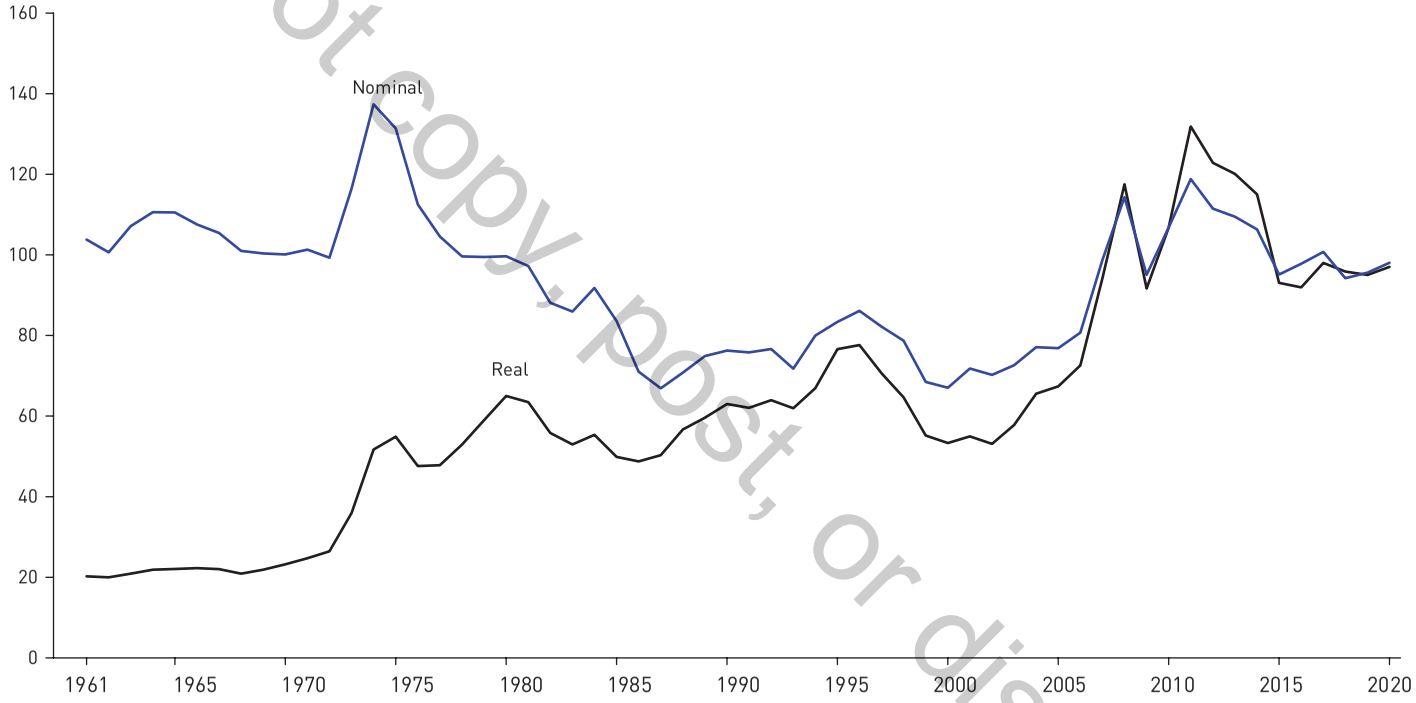
surprising that the problem is often most acute in countries either experiencing serious political turmoil directly or accommodating refugees fleeing neighboring areas. Figure 2.6 identifies the leading recipients of WFP assistance in 2018. Five major donors contributed almost 74 percent of the funding for this work (the United States, the European Commission, Germany, the United Kingdom, and Saudi Arabia).[35]

AP Photo/Petros Giannakouris

A Greek coast boat leads a dingy with migrants and refugees during a rescue operation in September 2019.

Cost is also an issue limiting the supply of food to those in need. Food is a primary commodity, and commodity prices can vary widely. While prices spiked in 2008 due to the global financial crisis and again to even higher levels in 2011, they began to come down in 2014 and have generally continued to moderate.[36] Food prices are difficult to project, however, given the number of factors that can influence the availability of most commodities. In addition to growing demand and natural conditions that might limit production, political volatility, an unanticipated pandemic, or even an uptick in investor speculation to manipulate markets can push prices upward. Figure 2.7 documents recent trends in food prices.

FIGURE 2.7 ● The Shifting Cost of Food



Source: Food and Agriculture Organization of the United Nations, "World Food Situation: FAO Food Price Index," http://www.fao.org/worldfoodsituation/foodpricesindex/en.

Note: The FAO Food Price Index is a measure of the monthly change in international prices of a basket of food commodities. It consists of the average of five commodity group price indexes (representing fifty-five quotations), weighted with the average export shares of each of the groups for 2002 to 2004.

Food insecurity affects certain groups of people more profoundly than others, but it is a truly global challenge that crosses borders and reflects both the opportunities and limits of collective action. On the one hand, we see public and private international organizations intervening proactively in response to conflicts and natural disasters that disrupt production and distribution systems and leave millions in desperate need of food each year. These efforts do not always succeed, however, as the magnitude of crises in such places as Syria, Myanmar, and Sudan can easily overwhelm these efforts.

Meanwhile, planting new fields in the Amazon and other places to offset the loss of cropland from drought and other climate-related conditions present their own problems. In Australia, for example, more than 27 million acres burned in 2019 and 2020—killing twenty-nine people, destroying more than 2500 homes, and resulting in the loss of an estimated 1.25 billion animals. The unprecedented number of fires across the Amazon rain forest in 2019, moreover, threatened to undermine its vital role in pulling greenhouse gases out of the atmosphere. They also served as a stark reminder of the difficulties of reconciling national and global interests, even when it comes to matters impacting directly on life on the planet. Economic and political considerations drove the Brazilian government headed by Jair Bolsonaro to tolerate slash-and-burn farming practices and to open the rainforest more broadly to commercial exploration despite considerable outside pressure to reverse these policies.[37]

Energy Security

Beyond the struggle for food, the earth is also being compromised by lifestyle and consumption choices. The use of energy offers an important example of the challenge. One of the key components of sustainable development is that it does no harm to future generations. The global demand for coal, oil, and other nonrenewable sources of energy taxes the environment and calls attention to the fragile nature of the world's ecosystem.

Persistent demands for economic development exacerbate the need for energy. The world has relied extensively on oil for its industrial development, but the oil supply is finite. One alternative has been nuclear energy. Once popular in the United States, Japan, and parts of Europe as a source of cleaner and more efficient energy, safety have been a persistent concern. An accident at the Three Mile Island nuclear plant in Pennsylvania in 1979 and the far more serious malfunction in Ukraine at the Chernobyl facility in 1986, which affected the health of thousands of inhabitants and rendered a significant amount of surrounding land unusable and uninhabitable due to contamination, dampened support. The meltdown of reactors in Japan resulting from a 2011 tsunami appeared to be an important watershed. Not long after the Japanese tragedy, Germany curtailed its program and announced it would phase out nuclear energy production by 2022. A number of other countries also began to review their policies. After years of waning enthusiasm, however, the United States has reversed course to some degree. The 2018 Nuclear Energy Innovation Capabilities Act aims to revitalize the nuclear industry by supporting existing plants and developing advanced reactors to jump-start the industry. Advocates note that these reactors would generate zero-emission electricity and would lessen reliance on coal and natural gas.[38]

Energy disasters are not limited to the nuclear arena and can affect both air and water supplies as well. The harvesting of natural resources for energy has had its own set of challenges and disasters. A gas plant leak in Bhopal, India, in 1984 killed 3,800 people and sickened several thousand.[39] The explosion on the BP *Deepwater Horizon* oil rig in the Gulf of Mexico in 2010 gained considerable notoriety, killing eleven workers and spilling roughly 5 million barrels of oil into the water. Perhaps even more significant over the longer term is the lesser known Taylor Energy oil spill triggered by Hurricane Ivan in 2004.

It went virtually undetected until discovered by monitors assessing the *Deepwater Horizon* tragedy and has continued to impact the Gulf. An estimated 4 million gallons had spilled into the waters by the end of 2017 and the leak is still not fully under control. Taylor Energy repaired only a fraction of the damaged wells, proceeding instead to cease drilling and liquidate its assets to escape accountability. This case points to the potential dangers that lie ahead as interest in expanding offshore drilling in the United States and elsewhere has resurfaced.[40]

The Human Factor: Contributing to the Problem?

Through our efforts to sustain ourselves and to provide for our basic needs, we have both purposefully and inadvertently contributed to the degradation of our environment. In addition to global warming and climate change, the depletion of our rain forests, the desertification of arable land, the pollution of our water supply, and the compromising of our air quality are among the more significant impacts. A closer look illustrates the impacts of our activities.

Approximately 31 percent of the earth's surface is covered by forest, with only five countries accounting for more than 54 percent of the total (Russia, Brazil, Canada, the United States, and China). Roughly 18.7 million acres of forest are lost each year, the equivalent of twenty-seven football fields every minute. In addition to the ecological consequences, this trend has important economic implications. Worldwide, more than 54 million jobs are tied either directly or indirectly to this sector.[41] Population growth has contributed significantly to this loss of trees, as the clearing of forests provides opportunities for cultivating crops and grazing animals. The practices of commercial logging companies seeking to capitalize on the worldwide demand for timber have also added to this devastation. The consequences are significant not only for the land but also the wildlife that resides there.

Trees play a critical role in maintaining the balance of the ecosystem by storing carbon. Their removal releases carbon, thereby contributing to global warming and climate change. While the rate of deforestation appears to be slowing, it is still considered by the FAO to be alarmingly high, with a net loss of approximately 4.7 million hectares per year between 2010 and 2020 and the most significant damage occurring in tropical areas. Table 2.1 offers a snapshot of the world's forests, whose health will impact directly on our ability to meet future water, climate, biodiversity, and energy needs.[42]

desertification the degradation of land in arid, semi-arid, and dry sub-humid areas resulting from variations in the climate and human activities

A related consequence of our activities is **desertification**. This refers to the degradation of land in arid, semi-arid, and dry sub-humid areas resulting from variations in the climate and human activities.[43] It is estimated that around 75 percent of the world's land is already affected, with an area equivalent to half the size of the European Union's 1.6 million acres damaged annually. More than a hundred countries have been touched, and 2 billion people are now living on land that is especially vulnerable—concentrated heavily across some of the poorest areas of Africa and Asia. Given the scope of the problem, restoration efforts such as the UN's Great Green Wall Initiative in Africa are only making a modest difference.[44] Desertification is hindering food production, increasing downstream flooding, and reducing water quality. It is responsible for the displacement of some 700 million people due to the scarcity of land-based resources.[45]

Similar problems exist for water—arguably the most critical resource for human survival. Estimates suggest that globally, 844 million (or one in nine) people lack access to safe water supplies and nearly one million people die each year from water, sanitation, and hygiene-related illnesses. Sadly, a child dies every two minutes from one of these diseases.[46] The presence of toxic pollutants in the water supply has contributed

TABLE 2.1 ● The World's Forest Areas, 2020

	Forest Area (Mill. Hectares)	Percentage of World Total	Net Annual Forest Change 2000–2010 (Mill. Hectares)	Net Annual Forest Change 2010–2020 (Mill. Hectares)
Africa	637	15.7	–3.4	–3.9
Asia	623	15.3	2.4	1.2
Europe	1,017	25.1	1.2	0.3
North and Central America	753	18.6	0.2	–0.1
Oceania	185	4.6	–0.2	0.4
South America	844	20.8	–5.2	–2.6
Total World	4,059	100.0	–5.2	–4.7

Source: Food and Agriculture Organization of the United Nations, *Global Forest Resources Assessment 2020* (2020). http://www.fao.org/3/ca9825en/CA9825EN.pdf.

significantly to this crisis. The use of bodies of water as waste disposal sites and the runoffs from chemicals and fertilizers used for industrial and agricultural purposes have been particularly problematic. Purposeful efforts to redirect the flow of water periodically add to the drama. This prompted a dispute between Ethiopia and Egypt in 2013, for example, when Ethiopia moved to divert a part of the Nile River to construct a hydroelectric dam. While the parties ultimately agreed to ensure that the project did not adversely affect countries downstream, the controversy has endured, and the competition for water remains highly politicized.[47]

Across an already volatile Middle East, access to water has become a source of additional tension. In Iraq, for example, the lack of sufficient rainfall and neighboring Turkey's construction of dams on the Euphrates River to support development have impacted agricultural output. Jordan, one the world's most water-deprived countries, has struggled greatly to secure adequate supplies. This has strained the water-sharing arrangement governing the so-called Island of Peace, a small pocket of lush terrain along its border with Israel, which once served as a symbol of cooperation between the two countries.[48] Some have suggested that future conflict in the region may be as much about water as it will be about competing claims to the land.

Xinhua/Alamy Stock Photo

Firefighters rescue residents trapped by a flood in Fujian Province, China, in July 2019.

UNDERSTANDING CROSS-BORDER CONFLICT

HOW CAN INTERNATIONAL STUDIES HELP?

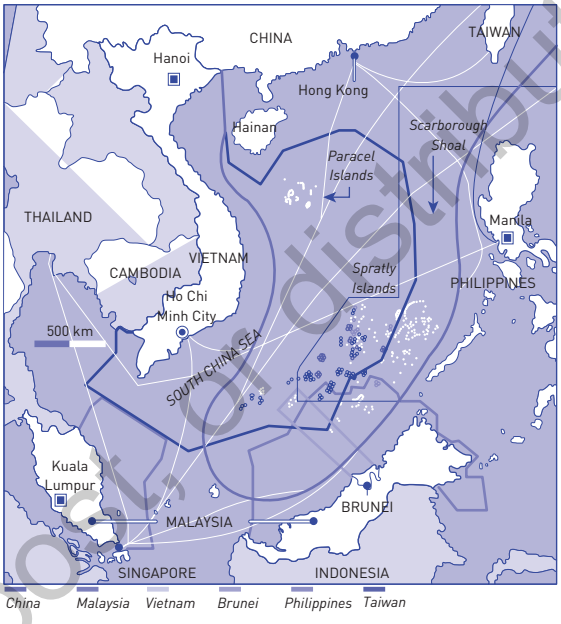
The South China Sea

The South China Sea is one of the most contentious waterways in the world today. The disputes, which revolve around a number of critical issues and involve an array of pivotal actors, suggest how physical attributes can assume considerable economic and political importance. The sea is estimated to carry approximately $3.4 trillion in annual trade and is believed to contain the equivalent of around 11 billion barrels of oil and 190 trillion cubic feet of natural gas. For the United States and China, it also represents an important geostrategic test of wills with respect to power and influence across the Asia Pacific.

Map 2.1 offers a glimpse into the complexity of the challenge. In close proximity to numerous countries, there are competing claims to sovereign control of the South China Sea and the right to access and free passage. China has been particularly assertive in this regard. It has actually added 3,200 acres of land since 2013 to bolster its alleged historical entitlements, including the creation of new islands in the Spratly Island group by adding sand to existing reefs and the construction of ports and military installations. For China, these are considered legitimate steps to protect its security and consistent with its interpretation of prevailing international norms and standards.

Vietnam, the Philippines, Taiwan, Malaysia, and Brunei have all put forward their own competing claims. Tensions spiked in July 2016, when an arbitration panel under the auspices of the UN Convention on the Laws of the Sea ruled in favor of the Philippines in one of its territorial disputes with China. The proceedings were boycotted by China, which indicated it would not be bound by the ruling. For its part, the United States has become increasingly entangled in the drama, periodically sending military ships and planes into the area under the guise of ensuring freedom of navigation and to constrain China. This presents its own dangers, as there were eighteen unsafe incidents reported in the area between 2016 and 2018 involving United States and Chinese ships and aircraft. An international crisis was narrowly avoided in September 2018 when a Chinese warship and an American destroyer almost collided while jockeying for position. These types of encounters are likely to become even more frequent as both countries move to enhance their military force capabilities and reinforce their presence in the region.

MAP 2.1 ● The South China Sea



Source: NordNordWest, CC BY-SA 3.0 DE, https://creativecommons.org/licenses/by-sa/3.0/de/deed.en, via Wikimedia Commons.

This is more than a localized set of skirmishes. The significance of the South China Sea extends well beyond the immediate vicinity. With its considerable resources and strategic location, the sea is a source of significant financial leverage and provides a means to promote and extend political security. Given the concerns of both China and the United States, the disputes can also influence the future direction of this most important relationship. With much at stake, a failure to reach some sort of accommodation could prove highly destabilizing for many years to come.

What is the role of crossing borders in resolving this issue? How can the cross-disciplinary focus of international studies help?

Questions

- What role does geography play in adding to the intensity of this conflict?

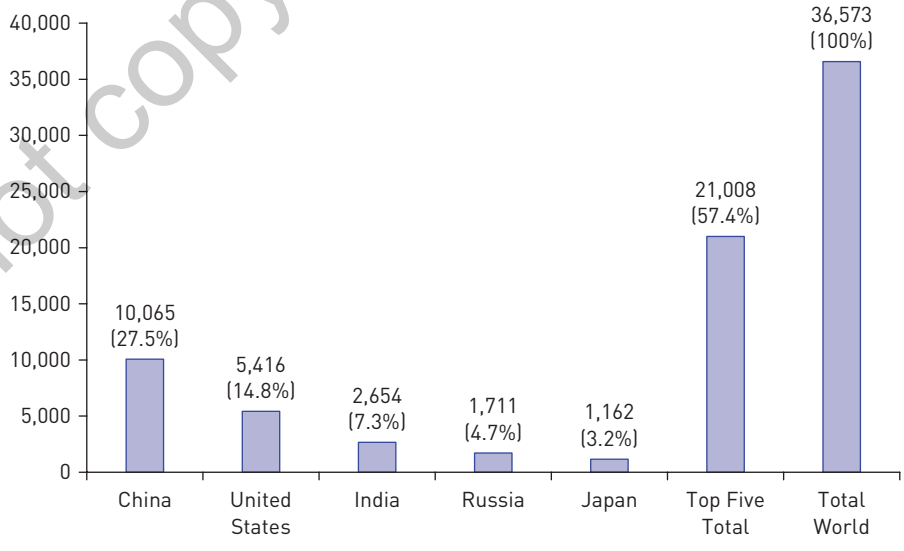
- What are the political motives behind the actions of the countries involved in this dispute?
- What are the economic stakes for each of the countries engaged?
- Do social and cultural factors come into play?
- Can the international community play a constructive role in mediating the tensions?

Sources: Howard W. French, "What's Behind Beijing's Drive to Control the South China Sea?" *Guardian*, July 28, 2015, https://www.theguardian.com/world/2015/jul/28/whats-behind-beijings-drive-control-south-china-sea-hainan; "Understanding China's Position on the South China Sea Dispute," *ISDP*, June 2016, http://isdp.eu/publication/understanding-chinas-position-south-china-sea-disputes; Jane Perlez and Steven Lee Myers, "U.S. and China Are Playing 'Game of Chicken' in South China Sea," *The New York Times*, November 8, 2018, https://www.nytimes.com/2018/11/08/world/asia/south-china-sea-risks.html; Council on Foreign Relations, "Territorial Disputes in the South China Sea," *Global Conflict Tracker*, updated August 28, 2019, https://www.cfr.org/interactive/global-conflict-tracker/conflict/territorial-disputes-south-china-sea.

Human activity has also damaged the atmosphere, perhaps irreparably. Air pollution from industrial output and the burning of fossil fuels, combined with the devastation of the rain forest, which naturally absorbs carbon emissions, has produced what is commonly referred to as the **greenhouse effect**. While the release of greenhouse gases—that is, gases that trap heat in the atmosphere[49]—occurs naturally, the amount of these gases in the atmosphere has expanded significantly due to the burning of fossil fuels. As a result, the average temperature of the earth has increased. National Oceanic and Atmospheric Administration data suggest that the five hottest years on record have all occurred since 2010.[50] While there are a number of contributing factors, *global warming* stems largely from the large-scale emissions of carbon dioxide and other greenhouse gases into the atmosphere. Figure 2.8 identifies the largest carbon dioxide emitters. Although

greenhouse effect the rise in the earth's temperature due to greenhouse gases that trap heat in the atmosphere

FIGURE 2.8 ● The World's Largest Carbon Dioxide Emitters, 2018 (Million Metric Tons)*



Source: Global Carbon Atlas, http://www.globalcarbonatlas.org/en/CO2-emissions (accessed June 16, 2020).

*Includes carbon dioxide emissions from consumption of petroleum, natural gas, and coal and from flaring of natural gas.

a worldwide problem with implications that extend beyond geographic borders, the bulk of emissions originate in a handful of countries. Only five (China, United States, India, Russia, Japan) are responsible for 57 percent of all releases, while the top fifteen countries account for 72 percent of the total.

The Global Response

There have been numerous international efforts to address these issues, beginning with the Earth Summit in 1992. Organized by the UN Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, this meeting was designed to generate support for a set of guiding principles and policies to slow down and perhaps someday eliminate pollution-generating activities. Subsequent meetings resulted in further agreements. The Kyoto Protocol that was adopted in 1997 and went into effect in 2005 incorporated specific guidelines to reduce greenhouse gases. While developed countries committed to lowering their annual carbon emissions, developing counties were exempted from the mandate, even as they were encouraged to engage. With few mechanisms available to ensure compliance, the results were limited at best, with the United States and China continuing to contribute heavily to the fouling of the atmosphere. In fact, worldwide emissions actually rose nearly 40 percent between 1990 and 2009.[51]

In June 2012, the UN Conference on Sustainable Development met for the Rio+20 Conference to mark the twentieth anniversary of the 1992 Earth Summit. Delegates renewed their broad commitment to a common vision but did not go very far in tackling the structural barriers impeding more directed action to protect the global commons. As the world's population increases and the burdens of maintaining the global economy mount, environmentally related pressures persist. For developing countries, the task is magnified by the lack of resources to effectively address these challenges—even if there is the political will to do so.

Of particular concern are the effects of climate change. Following four years of negotiations, the 21st Conference of the Parties to the UN Framework Convention on Climate Change (referred to as COP21) was held in Paris in late 2015 to hammer out a comprehensive plan. The Paris Agreement, as it came to be known, was significant. In addition to reaffirming the goal to limit the increase in global temperature to below 3.6 degrees Fahrenheit (2 degrees Celsius), signatories agreed to set national targets for reducing their greenhouse gas emissions. Although there would be no penalties for failing to reach those targets, the agreement contained provisions to enhance transparency and to encourage all countries to assume financial responsibility.[52]

In a major step forward, China and the United States affirmed their participation in 2016. These two countries alone generate close to 40 percent of total emissions.[53] In June 2017, however, President Donald Trump announced that the United States was withdrawing, arguing that the agreement placed a disproportionate burden on the country. While China and others reaffirmed their commitments, this step was a considerable blow that called into question the ability to meet the projected goals. The Biden administration brought the United States back into the fold during its first day in office, thereby restoring momentum moving forward toward COP26 scheduled for November 2021.

It is interesting to note that, despite the shifting political winds across the United States, a number of local communities have mobilized to implement environmentally friendly policies.[54] The Climate Mayor's Initiative has taken on new life, growing to more than four hundred municipalities representing seventy million people. Several thousand businesses, cities, and states have joined a coalition headed by former New York City mayor and 2020 presidential candidate Michael Bloomberg to curtail emissions. The overall impact of these

and other efforts remains somewhat limited, as the Trump administration countered by cutting back regulations and clean energy initiatives.[55]

In a related development, more than 170 countries moved forward in October 2016 in Kigali, Rwanda, to address hydrofluorocarbons (HFCs), chemical coolants used in refrigerators and air conditioners that add to greenhouse gases in the atmosphere. Building upon the Montreal Protocol, a 1987 agreement designed to phase out substances depleting the ozone layer, this pact was especially noteworthy for its legally binding nature and the inclusion of specific timetables and targets to replace HFCs with alternative coolants. Allowing for a more gradual implementation schedule, it took effect in January 2019 with some sixty-five countries but without the participation of the two largest producers and users of HFCs—China and the United States.[56]

Conclusion: What Can You Do?

Even if countries cannot reach agreement on how to attack these issues, the interconnected nature of the environment requires us to recognize the global consequences of our individual actions. The drive to encourage the use of alternative and renewable energy resources is a case in point. These renewable sources include solar technologies, wind harnessing for energy production, and geothermal energy generated from the heat of the earth. Progress has been slow and sporadic due to the cost involved and the reluctance of governments and energy consumers to absorb that cost. The good news is that conservation activities are beginning to make a difference. Examples include the use of appliances with Energy Star consumption ratings, hybrid automobiles that use both gas and electricity, and fluorescent and LED lightbulbs.

The efforts of Ashton Hayes, a small English village of around one thousand people outside Liverpool, are also instructive. Spurred by the initiative of a single citizen, residents have undertaken a series of individual and collective steps to cut greenhouse emissions. They have installed solar panels and glazed windows to insulate their homes, have used clotheslines instead of dryers, and have even agreed to cut the number of airplane flights they take. Looking to become England's first carbon-neutral community, Ashton Hayes has reduced its emissions by 40 percent since beginning the experiment in 2006. About 200 cities and towns from across the world have been in contact over the years to seek guidance, and a good number have adopted measures that have been used in Ashton Hayes.[57]

What can you do to promote the sustainability of our planet? With regard to energy, you might begin by calculating your **carbon footprint**—a measurement of the amount of greenhouse gases produced daily through the use of fossil fuels for electricity, heating and air conditioning, and transportation. There are carbon footprint calculators that ask about your use of natural resources to heat and cool your home, how you get around town, and even your food preferences to help you identify areas where you can reduce your impact on the global system.

carbon footprint
a measurement of the amount of greenhouse gases produced daily through the use of fossil fuels for electricity, heating and air conditioning, and transportation

Another way you can make a difference is to follow the three *R*s—*reduce, reuse*, and *recycle*. *Reduce* refers to the amount of waste you generate, particularly in terms of disposable goods that cannot be recycled. According to the U.S. Environmental Protection Agency (EPA), between 1960 and 2015, the amount of waste each person generated in the United States rose from 2.7 to nearly 4.5 pounds per day. In 2015 alone, Americans produced 262 million tons of trash, while recycling and composting at a rate of 34.7 percent. This was considerably higher than the recycled rate of a mere 6.4 percent in 1960.[58] Waste that is not biodegradable continues to be a problem, however, and one of the more significant culprits is packaged goods. The challenge of managing waste is even greater for less developed countries that do not have adequate processing systems in place. More and more, they find themselves buried in this waste, with no place to dispose it.

One area of great concern is electronic waste. A report of the World Economic Forum, in support of the United Nations E-waste Coalition, estimates that nearly 50 million tons of e-waste valued at $62.5 billion is generated each year, and this figure could rise to 120 million tons by 2050. To help better visualize the magnitude of the situation, current levels are the equivalent of 125,000 jumbo jets or 4,500 Eiffel Towers and would cover an area the size of Manhattan![59] China (7.2 million tons) and the United States (6.3 million tons) lead the way, followed by Japan, India, and Germany. On a per capita basis, the countries of the European Union are among the largest contributors.[60] Given the gold, silver, copper, and other metals contained in various electronic products, it is not surprising that up to 90 percent of this waste is illegally traded.[61]

With sales of electronic products rising across the developing world, there are additional concerns about increasing carbon emissions, the capacity of recycling facilities, and the hazards of e-waste disposal. As China has moved away from accepting waste, Thailand and other countries across Southeast Asia with limited environmental regulations have become important destinations.[62] In addition to the potential environmental effects, this could have severe health consequences. At one of the world's largest e-waste dumps in Accra, Ghana, workers suffer from skin diseases and respiratory illnesses due to excessive pollution levels.[63] While there have been important efforts to develop national recycling programs, the road is not always a smooth one. In India, for example, recycle and recovery projects in large urban centers such as Bangalore and Mumbai have struggled to gain acceptance as they seek to infuse state-of-the-art technologies and techniques that fit community needs.[64]

The second *R* emphasizes *reuse* as a way of reducing waste. The concept of reusable materials applies to salvaged goods from buildings that are torn down; these recycled goods are used to construct new buildings or reused in other ways. For example, the ReStore outlets in the United States and Canada run by the nonprofit organization Habitat for Humanity take donated home improvement goods and resell them; the proceeds support the construction of Habitat for Humanity homes in local communities.[65] Another example is playground safety surfaces that consist of rubber mulch made from recycled tires. There is a need for caution when utilizing these materials, however, due to evidence suggesting potential health hazards to soccer goalies and others frequently and directly exposed to them.[66]

The success of these programs depends on the third *R*—recycle. Recycling allows materials that are considered waste to be transformed into usable items. It can be as simple as putting a plastic water bottle or newspaper in a recycling bin or purchasing goods made from recycled materials. It can include sharing with others through charitable donations of usable goods or simply swapping clothes with friends.

How You Can Connect

You can reduce, reuse, and recycle by . . .

- Using reusable grocery and shopping bags
- Carrying a reusable water bottle
- Riding a bicycle or some other nonmotorized vehicle when feasible
- Taking public transportation or carpooling whenever possible
- Installing LED bulbs in your home
- Adjusting your thermostat to limit energy consumption

The complexity of the challenge is exemplified by waste picking, a dangerous practice especially common among the urban poor in the Global South that involves salvaging recyclable goods from trash piles. This is a way of life for as many as 15 million people, or 1 percent of city dwellers in developing countries.[67] In Brazil, for example, these pickers account for as much as 92 percent of aluminum and 80 percent of cardboard recycling.[68] Children are heavily engaged in this process and the ones most directly at risk. The country has taken some steps to improve health and safety conditions at these sites and has established cooperatives to promote alternative employment opportunities.[69]

The resources and interconnected ecosystems that support the planet are fragile. A recent study of the UN's Intergovernmental Panel on Climate Change (IPCC) speaks directly to the challenge ahead. By contributing directly to such extreme weather conditions as droughts and floods, climate change has limited the availability of land that would otherwise be available for cultivation. This is severely straining food production and distribution systems. Since poorer areas—especially in the Global South—are less equipped to handle these difficulties, people are migrating northward, only to find their entries blocked into countries increasingly reluctant or unwilling to admit them. Policies designed to provide more food may add to the dilemma. Draining wetlands to open more farmland, for example, releases carbon dioxide back into the atmosphere. Meanwhile, raising more cattle to expand the availability of meat poses its own challenge, as they are major producers of methane—a greenhouse gas.[70]

No matter how difficult the task, it is our responsibility to safeguard and sustain planet earth. Natural borders cannot contain the effects of human activities, even as they complicate efforts to generate strategies to redirect or counteract them. Individual initiatives are an important first step, but a more systematic and coordinated response is required. Some have suggested that technology is the key, as it links people around the globe and offers new ways to work together in addressing the issues before us. The role of technology is considered in the next chapter, which launches our trip across the other borders dividing the world today.

WHAT CAN YOU DO WITH INTERNATIONAL STUDIES?

Composting in India

By Rozita Singh, Head, Solutions Mapping, Accelerator Lab, UNDP India

In 2010, I watched a documentary called *Don't Rubbish It*. Little did I know that the nine-minute documentary would shape my "interest area"—solid waste management—and change the course of my professional journey. The documentary showcased a case study on composting featuring a Bangalore-based organization called *Daily Dump* (http://dailydump.org). The founder, Ms. Poonam Bir Kasturi, has designed a series of products suitable for household composting. I fell in love with the three-tier *khamba* model—it was a beautiful terra-cotta product especially designed for urban dwellers. Often, urban residents face space issues which hampers their ability to even attempt composting at home! The Daily Dump products can be kept anywhere (from open courtyards to tiny balconies), and what I liked most was that it made composting so much easier!

As urbanization increases, the problem of mounting garbage in the cities increases. With land fast becoming a scarce commodity, how long can we depend on landfills? The idea is to promote the habit of segregation at the source among the urban households in New Delhi, India. The technique is aerobic composting using terra-cotta pots

(Continued)

(Continued)

Personal photo by Rozita Singh

that convert organic kitchen waste into manure in a very simple way. The intended outcome is to sensitize urban residents to the problem of increased solid waste generation and show them a sustainable solution to the problem. Using the pots will decrease the pressure on existing landfills by offsetting the organic waste that currently constitutes roughly 60 to 70 percent of the total waste generated in an ideal household. My ultimate dream or mission is to convince the urban residents to adopt the practice of composting so that we handle our own waste responsibly.

As part of the British Council's Climate Champion Programme, I decided to make this my school project. It is part of the National Action Project (NAP), and I was selected to receive a grant. I became part of a group called Social Action Team under NAP, and along with my fellow climate champions from different cities, we took up waste management as our mission and started working on mini community projects. Upon graduation, this activity led me to a job as a Research Associate in the Centre for Research on Sustainable Urban Development and Transport Systems at The Energy and Resources Institute (TERI) in New Delhi, India, working on urban climate resilience issues. In 2016, my passion for working on urban challenges took me to Erasmus University, Rotterdam, where I went on to pursue my MSc in Urban Management and Development.

I believe in the power of the "one"—the individual. As an eco-lover and graduate of a master's program in sustainable development practice, I feel that I should emulate the teachings of sustainable living. Moreover, this project is the perfect example of the three *R*s (reuse, reduce, and recycle). Turning your waste into compost is good for the environment and good for your soul. It is also a logical step because it doesn't make sense for organic waste to be sent to the landfill! On average, an urban Indian household generates 0.5 kg (1.1 lb.) of waste each day. When this mixed waste ends up in the landfill, it produces methane, a greenhouse gas. Imagine how many emissions you can save by not sending this waste to the landfill, instead turning it into manure. Individual action has the power to translate to a larger communal action. Collectively the Daily Dump users offset around 42,068 kgs of organic waste daily from the landfill (Figures last updated in May 2018). Imagine if the first user would have thought—"What can one person possibly do or achieve?" This movement wouldn't have reached the same scale or impact.

During my thesis period at Erasmus, I researched the topic of "Circular economy," a step beyond recycling that looks at the material economy our world runs on. The principles outline the age-old belief that "waste has value" and by being regenerative by design, we can "close the loop" and achieve a towards zero waste state. My current journey at UNDP Accelerator Lab network in the "Decade of Action" (10 years left for achieving the outlined Sustainable Development Goals target) is all about scouting for such impactful innovations.

Know more about the fastest and largest learning network here: https://acceleratorlabs.undp.org/.

If you would like to learn more about the India Accelerator Lab, please visit our blog at: https://www.in.undp.org/content/india/en/home/blog/Stay_hungry_stay_foolish.html.

Key Concepts

carbon footprint 47
carrying capacity 36
cartography 27
deforestation 37
desertification 42
food insecurity 37
geography 26
global commons 25
greenhouse effect 45
human geography 26
Malthusian dilemma 37
physical geography 26
sustainable development 25
topography 27

To Learn More

Books and Other Print Media

Michael M. Andregg, *Seven Billion and Counting: The Crisis in Global Population Growth* (Minneapolis, MN: Twenty-First Century Books, 2014).

Michael Andregg looks at the capacity of the planet to sustain a population projected to reach 10 billion people before 2050.

Simon Dalby, Susan Horton, Rianne Mahon, and Diana Thomaz, *Achieving the Sustainable Development Goals: Global Governance Challenges* (New York, NY: Routledge, 2019).

The authors, who are experts in various aspects of global governance, discuss how to meet the challenges in reaching each of the Sustainable Development Goals.

Thomas L. Friedman, *Hot, Flat, and Crowded: Why We Need a Green Revolution—And How It Can Renew America* (New York, NY: Picador, 2009).

In this book, Thomas Friedman examines the global thirst for oil and its future environmental impact.

Jenny Goldie and Katharine Betts, eds., *Sustainable Futures: Linking Population, Resources and the Environment* (Collingwood, Australia: Csiro Publishing, 2014).

The authors discuss the challenges posed by continuing population growth to sustainability in Australia, particularly in how it relates to the depletion of natural resources.

Al Gore, *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It* (New York, NY: Rodale, 2006).

Former U.S. vice president Al Gore's famous book and documentary film of the same name trace the pattern of global warming and its consequences and were quite instrumental in heightening awareness of the challenges presented by climate change.

Naomi Klein, *This Changes Everything: Capitalism vs. The Climate* (New York, NY: Simon & Schuster, 2015).

Naomi Klein puts forward a forceful case for reducing greenhouse emissions, suggesting the need for innovative approaches that recognize how the market system has contributed to the severity of the climate crisis.

Elizabeth Kolbert, *Field Notes from a Catastrophe: Man, Nature, and Climate Change*, rev. ed. (New York, NY: Bloomsbury USA, 2015).

This update of Elizabeth Kolbert's 2006 classic on global warming puts forward a compelling case for addressing the many issues adding to the magnitude of the challenge.

Frances Moore Lappe and Joseph Collins, *World Hunger: 10 Myths* (New York, NY: Grove Press, 2015).

The authors identify some of the more common myths that distract us from addressing the underlying factors contributing to the persistence of hunger across the world today.

Nathaniel Rich, *Losing Earth: A Recent History* (New York, NY: Farrar, Strauss and Giroux, 2019).

In this book, Nathaniel Rich chronicles the early movement to raise awareness of climate change in the 1980s. It connects this to present policy discussions regarding this issue.

David Wallace-Wells, *The Uninhabitable Earth: Life After Warming* (New York, NY: Crown/Archetype, 2019).

This book, based on a best-selling article, warns about potential disasters that could result from global warming in the future.

Websites

GRID-Arendal, www.grida.no

Based in Norway, GRID-Arendal is a center that collaborates with UNEP to communicate information and data about the environment. It features excellent data and maps.

The Intergovernmental Panel on Climate Change, https://www.ipcc.ch

The IPCC is the official branch of the United Nations that assesses the effects of climate change in all parts of the world.

National Centers for Environmental Information, https://www.ncei.noaa.gov/

A massive archive of data dealing with all aspects of the global environment, including historical data showing how these aspects have changed over time.

Population Reference Bureau, www.prb.org

This organization provides information about population, health, and environmental issues around the world and seeks to influence policy on these matters.

Rise Against Hunger, www.riseagainsthunger.org

This international hunger relief organization provides food and other forms of aid to some of the world's most vulnerable.

Sustainable Development, https://www.sciencedirect.com/topics/earth-and-planetary-sciences/sustainable-development

A useful reference that defines "sustainable development" in terms of a balance of economy, environment, and community and discusses the goals necessary to achieve it.

World Atlas, www.worldatlas.com

This is a good, user-friendly site that includes a considerable number of maps and information regarding social, economic, and environmental conditions for countries across the world.

Videos

An Economic Case for Protecting the Planet (2018)

In this TED Talk, economist Naoko Ishii discusses economic practices that she believes should be changed in order to ensure the survival of the planet. Available at ted.com.

Before the Flood (2016)

In this documentary film, producer Leonardo DiCaprio explores climate change and numerous ways in which it might be addressed. An accompanying website includes considerable amount of background material: https://www.beforetheflood.com/explore.

Future Food (2013), http://www.bullfrogfilms.com/catalog/ffs.html

With the world's population expected to rise to 9 billion people by 2050, this six-part series looks to Peru, Kenya, India, Nigeria, China, and the United States as it examines how we might continue to feed ourselves in the twenty-first century.

How to Let Go of the World and Love All the Things Climate Can't Change (2016), http://www.bullfrogfilms.com/catalog/howto.html

This film travels to twelve countries on six continents to explore the realities and consequences of climate change.

An Inconvenient Truth (2006)

Former vice president Al Gore argues the case that we have reached a tipping point in climate change.

In Our Hands: Seeding Change (2017)

This documentary deals with a growing number of British farmers and food producers who work outside of the industrial food system. They seek to build an alternative food system that limits its damaging effects on the environment.

Let the Environment Guide Our Development (2013), http://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development

Johan Rockstrom is head of the Stockholm Resilience Centre (http://www.stockholmresilience.org), which focuses on cooperative approaches to sustainability. In this video, he talks about the special relationship people have with the earth and how it must be protected.

The Lorax (2011)

This animated feature is based on the book by Dr. Seuss (1972), which explores the impact of overconsumption, environmental degradation, and personal responsibility.

NASA and the National Space Science Data Center.