

Population and Natural Resources



Conceptual Framework:

How does population growth affect the availability of resources?

Authors:

Kristen Conway-Gomez (California State University-Pomona, USA)

Karen Barton (University of Northern Colorado, USA)

Min Wang and Dongying Wei (Beijing Normal University, China)

Matt Hamilton (Association of American Geographers, USA)

Marta Kingsland (Colegio de Todos los Santos, Argentina)

Learning Objectives

By completing this conceptual framework, you will be able to:

1. Distinguish different theoretical approaches to the study of population and natural resources.
2. Analyze the competing interests faced by human population growth and land availability and uses in different contexts.
3. Compare the environmental impacts of human population growth in different countries.
4. Gain awareness of different international perspectives and approaches to natural resource management.

Introduction

In the year 1900, there were approximately 1.6 billion people living on Earth. One hundred years later, the world population totaled just over 6 billion people. In 2011, the world total is likely to reach 7 billion, on its way to a projected 9 billion before 2050 (Figure 1). The increase in the size of the human population in the last half-century is unprecedented. But that increase did not occur evenly in different places, nor were the consequences of this growth the same in every place. And in the 21st century, some places are concerned more about population decline than growth.

This module examines the growth, decline, and movement of human populations over time and space, and how this affects the availability of resources such as food and water. Demography is the study of the characteristics of human populations, including fertility, mortality, and health. Geographers use demographic data to analyze the spatial variations in demographic characteristics and trends, linking these to their social consequences, seeking explanations for differences and solutions for inequalities. For example, geographers ask questions such as: Why do population growth rates vary from place to place? How does population growth affect the availability of resources at local, national, and global

scales? How can countries achieve sustainable use of environmental resources? Is population control necessary to raise the quality of life in poorer countries? Are wealthy countries consuming a disproportionate share of the world's resources, thereby depriving people living in the more populous developing regions? These are just some of the issues you will consider in this module.

By completing this module, you will learn geographical techniques for measuring and comparing population change in different places. The module covers a wide variety of population theories and topics, including movement, urbanism, and resources, and how experiences in one country can be quite different from the experiences of people in other countries.

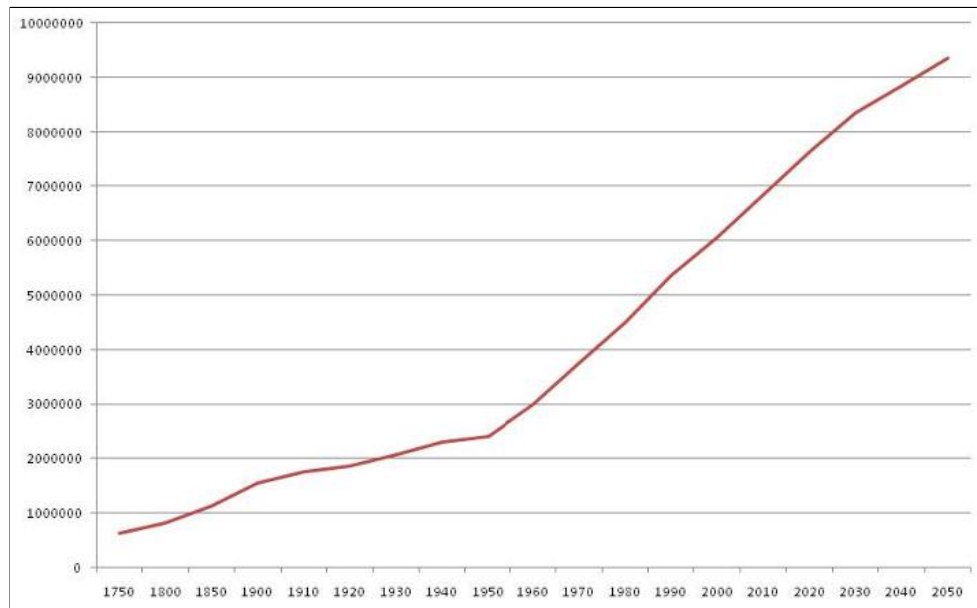


Figure 1. Increase in World Population since 1750 (projected to 2050) (in thousands)

Data sources: United Nations (1999) and US Census Bureau (2008)

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Images courtesy of the GeoCube project.

Population Growth

Later in this Conceptual Framework, you will explore major population theories of the 19th and 20th centuries and apply those theories to a set of specific historical circumstances (famine in Ethiopia). To provide context for this discussion, we turn first to a discussion of *why* population rates have "exploded" in recent history. We then look at a model that explains how and why population dynamics change in response to increased economic development.

Three "revolutions" in technology - the agricultural (approximately 6,000 BCE until 1,800 CE), industrial (beginning in the late-18th century), and "green" (beginning in the mid-20th century) - have affected population numbers and their interactions with natural resources (Figure 2). Notice, however, that the pace of world population growth dramatically increased following the Industrial Revolution, peaking in the years after World War II. From the mid-20th century, the world population began to increase at unprecedented rates, a phenomenon known as the "population explosion".

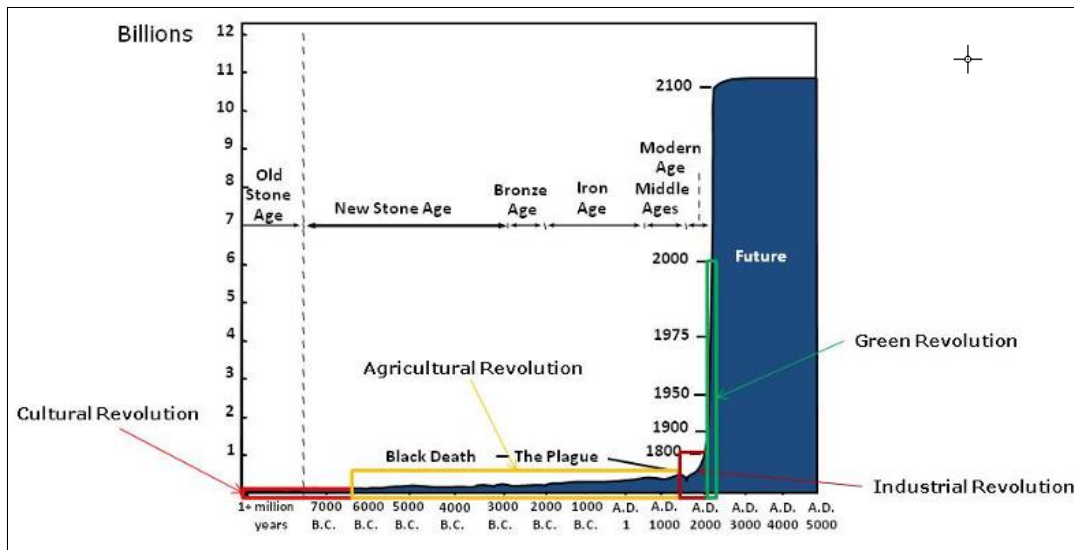


Figure 2. Impacts of Technological Revolutions on World Population Growth

Data sources: Population Reference Bureau (2003) and United Nations Population Division (1998)

The Green Revolution generated new techniques of crop production, including increased use of chemical fertilizers and the application of genetic engineering to crop research, making it possible to increase food production by dramatic rates. During the 20th century large tracts of land, for example in the United States, were dedicated to the cultivation of grains with increased production and improved quantity and quality. The same thing happened in countries like Argentina and Brazil from the beginning of the 20th century. Rice production in East and southeast Asia increased at rates over even the peak rates of population growth experiences in the 1960s and 1970s. New technologies were also introduced to more effectively distribute food among people. Furthermore, natural resources were found in much of the world and new agricultural technologies were developed. As you will see, this ability to produce more food challenged the "Malthusian" theory that limitations of agricultural production would lead to catastrophe if population growth went unchecked.

Even though yields of certain crops in certain countries increased, a high percentage of the world's population today still lacks sufficient food. The main problem behind the numbers suffering from hunger lies in the distribution of food. The current world population is increasing by nearly 80 million people per year. Hunger remains an issue for hundreds of millions of people in the world's least-developed countries.

Pause and Reflect 1:

Investigate socioeconomic data for the "Least Developed Countries" in the current World Population Data Sheet (at the PRB's website).
Where are these countries?

What explains their socioeconomic status?

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Measuring Population Change

Measuring population change is necessary to determine the impact of human activity on the Earth's surface. Population change can be described using words, statistics, and graphics. Two common statistical measures of population change are the Crude Birthrate (CBR) and the Crude Death Rate (CDR). CBR and CDR are usually expressed as the number of births or deaths per 1000 people in a given population, which allows geographers to compare population dynamics in countries with different population sizes. The number of births and deaths per year in a country can be used to calculate the Rate of Natural Increase (RNI), which describes the percentage annual growth of a population.

For example, suppose a country has a total population of 250 million people, with four million births and one million deaths over a year-long period. The Rate of Natural Increase for this country would be calculated as follows:

$$\text{Birthrate per 1000 population} = (\text{Births per year} / \text{Total population}) * 1000 = (4,000,000 / 250,000,000) * 1000 = 0.016 * 1000 = 16$$

$$\text{Death Rate per 1000 population} = (\text{Deaths per year} / \text{Total population}) * 1000 = (1,000,000 / 250,000,000) * 1000 = 0.004 * 1000 = 4$$

To convert these into the RNI, you subtract the CDR from the CBR and multiply by 10 (necessary to convert the data from a per 1000 basis to a per 100, or percentage, basis).

$$\text{Rate of Natural Increase} = (\text{Birthrate} - \text{Death Rate}) * 10 = (16 - 4) * 10 = 1.2\%$$

Given a RNI of 1.2%, we can predict that the population of this country will grow by 3,000,000 people in one year ($250,000,000 \times 1.2\% = 3,000,000$).

As you might imagine, comparing population trends and patterns using only statistics would be very difficult. Fortunately, there are ways to visualize statistical data to reveal meaningful geographic information. Geographers use maps to display, analyze, and compare demographic data like CBR, CDR, and RNI in different places. In the next activity, you will be asked to create choropleth maps to interpret population change in Bolivia, a country in South America. The activity will also illustrate some of the possible effects of population growth on the environment.

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Spatial Thinking Activity: Mapping Population Data

View the following interactive presentation on choropleth mapping, which illustrates how to create maps from tables of population data. To start the activity, simply click the screen. You can advance through the presentation by clicking anywhere on the screen, or by moving your pointer to the left side to navigate a table of contents.

After viewing the presentation, download this 4-page file: Population in Bolivia. These are worksheets from *Activities and Readings in the Geography of the World* (ARGWorld). Complete the worksheets and answer these questions:

- (1) Examine the map of Bolivia. In what part of Bolivia is population growth the slowest? The fastest?
- (2) What reasons can you give for these patterns?
- (3) Does the map support the hypothesis that population growth is causing deforestation in some parts of Bolivia? Why or why not?
- (4) What are the advantages of a spatial analysis of population data? What limitations do you observe?

The Shockwave plugin for your browser is required to view the activity. The plugin can be downloaded at no cost from <http://www.adobe.com/products/shockwaveplayer/>. Note: On the table of contents, ignore the buttons for Related Units and Exit to Main Menu. Once the plugin is installed, you may have to click to choose to allow active content or follow the browser directions to activate the active content.

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The Demographic Transition Model

The Demographic Transition Model (DTM) is a popular method for analyzing the evolution of the world population (Figure 3). It shows the expected changes in birth and death rates over an unspecified timeframe. The DTM is based on the historical experience of Europe, as birth and death rates declined, beginning in the case of those nations in the late-18th and early-19th centuries. The only variables that are forecast by this model are birth and death rates, but many scientists believe that economic development is the major factor causing the birth and death rates to fluctuate. They argue that with economic development, people gain better access to birth control; public health and sanitation improves; women become more independent; and food and basic necessities become more plentiful. These improvements, in turn, increase life expectancy and eventually prompt women to have fewer children.

What evidence is there to support the theory that economic development leads to a decline in death and birth rates? Some population geographers point to the population histories of Western European countries as examples, where populations that once grew rapidly experienced a gradual decline and stabilization of birth and death rates as a result of improved food supplies, public health, and technology. Historically, population changes in Western Europe corresponded to the four stages described on the next page.

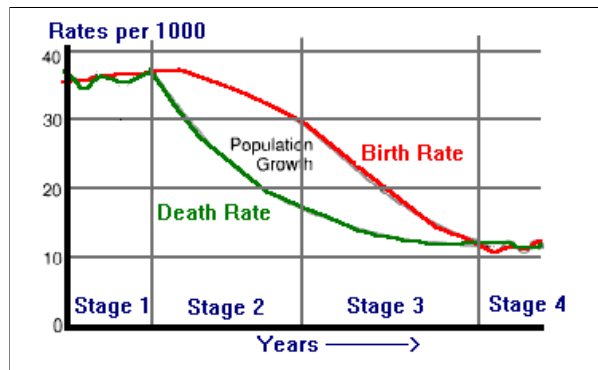


Figure 3. The Demographic Transition Model

Source: InternetGeography (www.learnontheinternet.co.uk)

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Explaining the Demographic Transition Model

Here are the characteristics associated with each stage of the classic four-stage DTM. In parentheses, the approximate dates of the onset of each stage are shown as they occurred in Europe, but there was much variation even across that region, so these dates are approximate.

Stage 1: Both birth and death rates are high and population grows slowly, if at all (Europe between pre-history and about 1650).

Stage 2: Birthrates remain high, but death rates fall sharply as a result of improved nutrition, medicine, health care, and sanitation. Population begins to grow rapidly (began in Europe slowly after 1650, then more rapidly after the Industrial Revolution spread in the early 19th century).

Stage 3: Birthrates begin to drop rapidly, death rates continue to drop, but more slowly. Economic and social gains, combined with lower infant mortality, reduce the desire for large families (in Europe, birthrates in some nations began to fall in the 19th century and spread across the region by the early 20th century).

Stage 4: Both birth and death rates are in balance, but at a much lower rate; population growth is minimal if at all (Europe since the 1970s).

The theory of demographic transition assumes that a country will move from a pre-industrial (agricultural) economic base to an urban, industrial one, with a corresponding decrease in family size and population growth. The slowing of population growth theoretically results from better standards of living, improvements in health care, education (especially for women), sanitation, and other public services. Although this four-stage pattern has been repeated in other places besides Europe, there are local variations, sometimes significant, as the trajectory of development is everywhere different and by no means inexorable. For example, many of today's least-developed countries still retain the high birth rates characteristic of Stage 2. Also, parts of Europe, Russia and Japan may be entering a new, fifth stage, where birth rates are below death rates, and the population ages and begins to decline.

Pause and Reflect 2:

Before continuing, think about the following questions and discuss them with your classmates:

1. The demographic transition theory assumes that birth and death rates begin to fall as nations develop their economies. Do you think economic development is enough to stabilize a country's population? Why or why not?
2. What has the demographic experience been in your country? Does it fit the demographic transition model? Why or why not?

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Resource-based Theories of Population

Human population growth does not occur at the same rate everywhere. In fact, some countries are experiencing population declines. Most European and North American countries, for example, have already experienced a substantial decline in fertility rates; they completed their **demographic transition** from high rates to low rates of fertility and mortality by the middle of the 20th century. Many developing countries, in contrast, are now at an intermediate stage of low mortality as a result of improvements to public health, but still have high fertility rates; consequently, their population growth is rapid.

It is remarkable that, despite many new developments over the past 50 years, one fact looks very much the same: populations are growing most rapidly where such growth can be afforded the least — where pollution, resource shortages, and environmental damage create additional stresses on the ability of governments to meet the basic food, clothing, and shelter needs of their populations.

The relationship between human population growth and the availability of **natural resources** has occupied the minds of many thinkers since at least the 18th century. However, it was Thomas Robert Malthus who for the first time gave a systematic analysis of population and resources, followed by Karl Marx, who had a radically different perspective than Malthus. These two theories will be discussed in the next several pages.

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Malthusian Theory of Population

Thomas Robert Malthus was the first economist to propose a systematic theory of population. He articulated his views regarding population in his famous book, *Essay on the Principle of Population* (1798), for which he collected empirical data to support his thesis. Malthus had the second edition of his book published in 1803, in which he modified some of his views from the first edition, but essentially his original thesis did not change.

In *Essay on the Principle of Population*, Malthus proposes the principle that human populations grow exponentially (i.e., doubling with each cycle) while food production grows at an arithmetic rate (i.e. by the repeated addition of a uniform increment in each uniform interval of time). Thus, while food output was likely to increase in a series of twenty-five year intervals in the arithmetic progression 1, 2, 3, 4, 5, 6, 7, 8, 9, and so on, population was capable of increasing in the geometric progression 1, 2, 4, 8, 16, 32, 64, 128, 256, and so forth. This scenario of arithmetic food growth with simultaneous geometric human population growth predicted a future when humans would have no resources to survive on. To avoid such a catastrophe, Malthus urged controls on population growth. (See [here](#) for graphs depicting this relationship.)

On the basis of a hypothetical world population of one billion in the early nineteenth century and an adequate means of subsistence at that time, Malthus suggested that there was a potential for a population increase to 256 billion within 200 years but that the means of subsistence were only capable of being increased enough for nine billion to be fed at the level prevailing at the beginning of the period. He therefore considered that the population increase should be kept down to the level at which it could be supported by the operation of various checks on population growth, which he categorized as "preventive" and "positive" checks.

The chief preventive check envisaged by Malthus was that of "moral restraint", which was seen as a deliberate decision by men to refrain "from pursuing the dictate of nature in an early attachment to one woman", i.e. to marry later in life than had been usual and only at a stage when fully capable of supporting a family. This, it was anticipated, would give rise to smaller families and probably to fewer families, but Malthus was strongly opposed to birth control within marriage and did not suggest that parents should try to restrict the number of children born to them after their marriage. Malthus was clearly aware that problems might arise from the postponement of marriage to a later date, such as an increase in the number of illegitimate births, but considered that these problems were likely to be less serious than those caused by a continuation of rapid population increase.

He saw positive checks to population growth as being any causes that contributed to the shortening of human lifespans. He included in this category poor living and working conditions which might give rise to low resistance to disease, as well as more obvious factors such as disease itself, war, and famine. Some of the conclusions that can be drawn from Malthus's ideas thus have obvious political connotations and this partly accounts for the interest in his writings and possibly also the misrepresentation of some of his ideas by authors such as Cobbett, the famous early English radical. Some later writers modified his ideas, suggesting, for example, strong government action to ensure later marriages. Others did not accept the view that birth control should be forbidden after marriage, and one group in particular, called the Malthusian League, strongly argued the case for birth control, though this was contrary to the principles of conduct which Malthus himself advocated.

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Karl Marx's Theory of Population

Karl Marx (1818-1883) is regarded as the Father of Communism. He did not separately propose any theory of population, but his surplus population theory has been deduced from his theory of communism. Marx opposed and criticized the Malthusian theory of population.

According to Marx, population increase must be interpreted in the context of the capitalistic economic system. A capitalist gives to labor as wage a small share of labor's productivity, and the capitalist himself takes the lion's share. The capitalist introduces more and more machinery and thus increases the surplus value of labor's productivity, which is pocketed by the capitalist. The surplus is the difference between labor's productivity and the wage level. A worker is paid less than the value of his productivity. When machinery is introduced, unemployment increases and, consequently, a reserve army of labor is created. Under these situations, the wage level goes down further, the poor parents cannot properly rear their children and a large part of the population becomes virtually surplus. Poverty, hunger and other social ills are the result of socially unjust practices associated with capitalism.

Population growth, according to Marx, is therefore not related to the alleged ignorance or moral inferiority of the poor, but is a consequence of the capitalist economic system. Marx points out that landlordism, unfavorable and high man-land ratio, uncertainty regarding land tenure system and

the like are responsible for low food production in a country. Only in places where the production of food is not adequate does population growth become a problem.

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Paul Ehrlich: Neo-Malthusian

As global populations rose spectacularly in the 20th century, theoretical debates over the extent and causes of the population problem expanded. Thomas Malthus and Karl Marx had set the initial stage for the world population debate, but other population theorists - including Paul Ehrlich, Julian Simon, Garrett Hardin, and Barry Commoner - would carry the ongoing discussion in the second half of the 20th century.

In 1968, as world population hovered above 3 billion, Paul Ehrlich authored the book *The Population Bomb*, a widely read publication that sold several million copies in the United States alone. Ehrlich, a biologist, maintained that the rate of population growth was outstripping agricultural growth and the capacity for renewal of Earth's resources. Given current rates of natural increase, Ehrlich predicted "certain" demographic disaster in response to eventual food shortages and disease. In the opening to his book, he wrote: "The battle to feed all of humanity is over" and later stated that, "In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs" (Ehrlich 1968). Ehrlich argued that industrialized regions such as North America and Europe would be required to undertake "mild" food rationing as starvation spread across the developing worlds of Asia, Latin America, and Africa. In a worst case scenario, he predicted that the lack of food security in the developing world would set into motion several geopolitical crises that could result in thermonuclear war. At its core, Ehrlich's population theory contained three major elements: a rapid rate of change, a limit of some sort, and delays in perceiving the limit.

While some criticized Ehrlich's work as simply a repetition of Malthus's 19th century argument, Ehrlich's most vocal opponent, economist Julian Simon, was skeptical of the more central tenets of the population bomb, particularly the definition of limits. In the 1970s, Julian Simon published two central pieces that served to galvanize the population debate: *The Economics of Population Growth* (1977) followed by *The Ultimate Resource* (1981). Simon argued that the relationship between population growth and economic growth was not as simple as Ehrlich believed, and that the extent to which population pressure impacted resources was overstated. The crux of Simon's argument centered on his belief that Ehrlich's limit on the availability of resources was misdirected. Simon instead argued that it was not possible to have too many people, for the only limit in determining the scarcity of resources was human imagination. People, the economist suggested, were the ultimate resource. According to Simon, ingenious, resourceful humans had the capacity to invent crops with higher yields, or to construct inexpensive, safe housing for growing populations. Simon's other contention was that current views on population and resource issues failed to take the long view, and that frequently too short a time frame was considered when examining demographic problems.

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The Simon-Ehrlich Wager

In 1980, Julian Simon and Paul Ehrlich engaged in a very public debate that underscored their disparate standpoints on population and resource scarcity. Known as the Simon-Ehrlich wager, Simon invited Ehrlich and his colleagues to select and purchase five non-government controlled resources worth a total of \$1000 whose value would be measured over time. Agreeing to the wager, Ehrlich's team selected chromium, copper, nickel, tin and tungsten as the commodities and then chose 1990 as the payoff date. If the price of the resource bundle rose, this implied that the resource had become scarcer and Simon therefore would be forced to pay the difference. If the price of the bundle had dropped, this would signify greater abundance, and Simon would receive the monetary difference.

Between 1980 and 1990, the world's population grew by more than 800 million, the largest increase in one decade, causing many to believe that the value of the bundle would rise due to population pressure and corresponding resource scarcity. Yet in September 1990, the inflation adjusted price of all five metals had fallen, forcing Ehrlich to mail Simon a check for \$576 to settle the wager. Wired Magazine eventually dubbed Simon a "doomslayer" for his stance against those who argued that an ecological Armageddon was around the corner. (For more discussion about the Simon-Ehrlich wager, see here.)

In contrast, while Ehrlich was often criticized as a "doomsdayer" theorist, he is credited for developing a simple equation that examines population's relationship to environmental impact. Known as the IPAT equation, Ehrlich argued that environmental impacts (I) are the result of three variables: population (P); affluence (A); and technology (T), as follows:

$$I = P \times A \times T$$

Not surprisingly, Ehrlich implicated population size as the main driver behind environmental problems, disagreeing with environmentalists such as Barry Commoner, who believed inappropriate technologies and consumption to be the prime causes of degradation. Nevertheless, in developing IPAT, Ehrlich put in place a new framework for population debates that looked beyond numbers to include human impact. Measuring the variables, however, can be challenging, particularly the technology variable.

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Garrett Hardin and Lifeboat Ethics

Ehrlich and Simon were not the only theorists of the 1970s to debate the extent and causes of the population problem, nor were they the last to discuss the merits of possible solutions. Biologist Garrett Hardin, known primarily for his research on common property resources, published "Life Boat Ethics" in 1974, a manuscript in which he outlined the case for and against aiding poor, populous nations. Using a lifeboat as a metaphor for the position of rich, industrialized countries, Hardin questioned the ethics of whether "swimmers" surrounding the lifeboat should be taken aboard (or given aid) in light of the vessel's limited carrying capacity.

To explain the metaphor, Hardin pointed to proposals to create a World Food Bank, an international cache of food reserves to which "nations would contribute according to their abilities and from which they would draw according to their needs" (Hardin 1974). Hardin questioned whether we should appeal to our humanitarian impulses and provide aid or whether we'd be better served caring for those individuals already positioned in the boat.

Hardin concluded that the World Food Bank is essentially a commons in disguise where the less "provident" will be able to "multiply" and tax the planet's resources at the expense of other nations that had planned for potential famine and disease through appropriate policies (Hardin 1974: 39). Hardin argued that ultimately, this disparity would bring eventual ruin upon all those who share in the commons. In the short run, Hardin concluded, a World Food Bank would diminish the need for food but in the long run would increase it without limit given rapid rates of population growth in developing nations.

While some have criticized the lifeboat ethics stance as harsh or callous, Hardin actually supported those humanitarian projects that stressed technology and advice rather than those that supplied food or cash. In drafting his solutions to the population problem, Hardin invoked the Chinese Proverb: "Give a man a fish and he will eat for a day; teach him how to fish and he will eat for the rest of his days". While Hardin criticized foreign aid that "frequently inspires mistrust rather than gratitude on the part of the recipient nation", he supported Rockefeller and Ford Foundation agricultural development projects that funded local, community-based solutions to poverty (Hardin 1974: 40).

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Barry Commoner and Poverty

In 1980, biologist Barry Commoner entered the population debate with his chapter entitled "Poverty Breeds Overpopulation". A strong critic of Hardin's lifeboat ethics, Commoner questioned how passengers in the lifeboat and swimmers in the ocean assumed their relative positions in the first place. Tracing the roots of the problem to the colonial period, Commoner argues that initially, colonialism served to improve conditions and develop resources within colonies through the construction of roads, communication, and medical services. However, over time the resultant wealth in the developing world was siphoned away to developed nations in what Commoner calls a process of "demographic parasitism" (Commoner 1980: 4). More simply, the gap between the rich and poor nations grew as the rich fed the poor with their own resources. Commoner suggests that this process of international exploitation had the added effect of rapid population growth in former colonies. In other words, without financial resources available to improve living conditions, people in developing countries relied more heavily upon increased birth rates as a form of social security. Commoner summarized: "The poor countries have high birthrates because they are extremely poor, and they are extremely poor because other countries are extremely rich" (Commoner 1980: 4).

Commoner therefore concluded that the birth rate is not only affected by biological factors such as fertility and contraception but by social factors, such as quality of life. If the standard of living continues to increase, Commoner argued, population rates eventually level off in a self-regulating process. Commoner's solution to the population problem was to increase GDP per capita as a way to motivate voluntary reduction of fertility. He argued that the developed world has a duty to restore the imbalance in wealth between the developed and developing worlds by returning wealth to impoverished nations and abolishing poverty.

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Geographic Context: Ethiopian Famine and Live Aid

The 20th century population debate was made real when a drought of record proportions struck Ethiopia (primarily Tigray and northern Wollo) in 1984 and 1985, eventually impacting nearby Eritrea as well. The environmental damage wrought by drought was exacerbated by Ethiopia's civil war and the misallocation of government resources. Nearly 8 million people were affected by the drought, and over 1 million died as a result of starvation and disease.

The international media's portrayal of the tragedy brought global condemnation to Ethiopia's handling of the crisis. Young children with distended bellies, victims of protein deficiencies such as Kwashiorkor, were captured in photographs and their illnesses portrayed on television. These images served to mobilize large-scale fundraising efforts for the east African famine. Most notably, in 1985, British musician Bob Geldof organized the musical relief effort, "Live Aid", encouraging Western nations to raise money and participate in relief efforts in East Africa. The Live Aid concert raised US\$ 100 million, and was viewed globally, with 400 million people tuning in to see the program.

Figure 4. News Report about Live Aid (1985)

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The Causes of Famine?

The Ethiopian crisis stimulated interesting questions about the demographic causes and consequences of the famine and how best to address the tragedy through policy. The tragedy enables students of geography to apply population theories to a particular place and time and to better understand the real world implications of policy recommendations.

Would the task of sending Western aid in the form of money and food to Ethiopia sink the lifeboat portrayed in Hardin's metaphor? Or, following Barry Commoner's view, might Ethiopian relief efforts be more accurately viewed as "the return of resources" to a formerly wealthy nation made poor through colonialism? (Ethiopia, at the height of the Kingdom of Axum, boasted a mix of urban architecture, extensive trade networks, and mineral extraction, while in 1984 its GDP per capita was \$283).

With a total fertility rate of 6.7 in 1984, the Ehrlich camp might identify Ethiopia's large population as the major culprit behind the crisis (US Census Bureau, International Database). Left uncontrolled, population pressure ultimately increased stress on the nation's environmental resources; exacerbated by drought, these factors caused a crisis of Malthusian proportions. Viewed from Julian Simon's standpoint, however, the Ethiopian people were not the problem but the solution. What sorts of technologies might Ethiopians employ to increase crop yields and prevent future famines?

In sum, the theories of Malthus, Marx, Ehrlich, Simon, Hardin and Commoner enable us to apply *general* demographic principles to real world geographic problems such as the Ethiopian famine. Yet the African famine cannot be separated from the *particular* economic, social, cultural and environmental context of that region. Indeed, there are differences in the world that call for consideration. Not every location on earth is the same. Because of geographic differences – whether in economies, population growth, or natural resource availability – we can see different outcomes resulting from population changes and resulting interactions with natural resources. Geography therefore provides us with a lens for understanding the complex spatial dimensions of population issues.

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Sustainable Development, Population, and Geographic Scale

In 1987, just a few years after the Ethiopian famine, the Brundtland Report was released by the United Nations. Entitled "Our Common Future", the document lamented the degradation of environmental resources and outlined the effects that such deterioration would have on social and economic growth for world populations.

The Brundtland Report, named after the Commission's Chair, Gro Harlem Brundtland, then-Prime Minister of Norway, acknowledged that many environmental issues were global in scope and not necessarily limited to regions or locales:

"It is becoming increasingly clear that the sources and causes of pollution are far more diffuse, complex, and interrelated - and the effects of pollution more widespread, cumulative, and chronic - than hitherto believed. Pollution problems that were once local are now regional or even global in scale. Contamination of soils, ground-water, and people by agrochemicals is widening and chemical pollution has spread to every corner of the planet." (Brundtland 1987: Chapter 8: Resolution 18)

In recognition of the increased scale of resource problems, the document issued a call for sustainable development (Brundtland 1987: Chapter 2: Part IV). Population pressure, food security, industry and energy – problems inherent to the developed or developing world – were all identified as equally critical challenges to sustainable development. In other words, Africa's rapid population growth rates caused concern for the environment, but so, too, did the demands of energy hungry nations in the West. In conclusion, the Commission argued that regional, national and international institutions and non-governmental organizations had the capacity to create policies at various scales that would affect environmental change worldwide.

Indeed, the importance of acknowledging the concept of geographic scale in understanding population and resource issues had become apparent in the Brundtland Report. Local and global scales have inevitably become linked in this age of globalization. Sustainable development policies, if they are to be effective, need to recognize these important spatial connections. Poverty in southern Africa may drive people to have more children (local scale), but economic markets (global scale) that make African nations dependent upon single commodity exports exacerbate poverty. Geographers such as Bernard Nietschmann (1997) and his research, based mainly in Nicaragua, have long recognized the important role that geographic scale plays in interpreting population and resource problems.

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Conclusion

In this conceptual framework, you learned how population change could be measured using geographic tools and data. You also considered different theories held by scientists (Malthus, Marx, Ehrlich, Simon, Hardin and Commoner) about the causes of population growth and its effects on the Earth's environment using the Ethiopian famine to provide geographic context.

Although food production in different world regions has generally increased at similar rates, there has been much more variability in the rate of population growth from place to place. In countries where populations are growing rapidly, there is some concern that this growth threatens the local availability of resources. Indeed, some scientists warn that the Earth has a carrying capacity that limits the number of people that the environment can support. But not all scientists share this view. Whereas some point out that the environmental "doomsday" scenarios that were predicted many decades ago have failed to materialize, others believe the world's poor are the victims of a global economy that distributes power and resources unequally.

In the case studies for this module, you will learn more about the economic, political, and environmental dimensions of population growth and its impact on natural resources in different countries. You will see how important it is to understand the specific local contexts of these relationships. For a preview of the case studies, continue to the next page.

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Case Studies

The *Population and Natural Resources* module currently offers four geographical case studies built on the ideas and theories presented in this conceptual framework. They provide examples of environmental, political, and social issues related to population change and economic development.

1. Case study: *How can food be produced sustainably to feed growing populations?* Focusing on Argentina, this case study examines how increases in soybean production have resulted in varied environmental and social impacts.

2. Case study: *How does urban development affect the quality and quantity of natural resources?* This case study examines the impact of urban growth on the availability of agricultural land in the United States.

3. Case study: *What are the challenges of meeting the resource needs of very large populations?* In this case study, set in China, you will analyze the challenges posed by a large population for ensuring safe and adequate access to water resources.

4. Case study: *Was population growth responsible for rapid deforestation in the Central Highlands of Vietnam?* In the Vietnam case study, the causes and consequences of the conversion of forests to coffee plantations is analyzed.

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