Human Population Growth: Lessons from Demography

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On October 12, 1999, humanity reached a major milestone when the number of living people hit 6 billion. It took only 12 years to add a billion people, and by the time the 21st century dawned, people were adding 75 million every year. Feeding these millions has always been a major challenge to human ingenuity. Throughout history, times of abundant food have followed lean years according to changes in the environment. Agriculture, the application of science to food production, has tried to even out these uncertainties. Yet even now famines persist: The dramatic food shortages in North Korea during the late 1990s probably caused the deaths of 10% of its people (two million deaths), making it one of the worst such episodes in the 20th century.

Images of famine fill television screens and news magazines. Less obvious are the multitudes, estimated at about one person in seven, who are chronically underfed. But it could be much worse. The last half of the 20th century saw spectacular gains in food production capacity, which have allowed it to (just) keep up with the population growth. Now, with our increasing knowledge not only about the biology of food production, but also about the need to sustain our environment for the future, we have the potential for both feeding those who will join us over the next decades and of improving the nutritional situation for many of the world's poorest people.

1.1 The world population's rapid growth of the past 50 years is slowing.

Whereas various ancestors of humans existed over two million years ago, modern *Homo sapiens* probably emerged only in the past 50,000 years (see Chapter 13). At first the population increased slowly. Two thousand years ago the population reached 300 million, and now it stands at 6 billion, a 20-fold increase. Since then the human population has increased

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CHAPTER

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20-fold (**Figure 1.1**). Why this sudden increase? Populations grow when their rate of increase (because of births and, for a particular region, immigration) is greater than their rate of decrease (caused by deaths and emigration). For humans as a whole, the ancient way of life of hunting game and gathering plant foods probably also entailed both high birth rates and death rates. This resulted in a very slow overall growth rate.

Then, about 10,000 years ago, agriculture gradually replaced hunting and gathering. With the more reliable food supply and more settled existence, birth rates rose and death

Figure 1.1 There are more than six billion people in the world today. Shown here is a large crowd at the fish market in Chikomey, Ghana. The population growth rate of Africa is still 2.5% per year and has remained unchanged for 30 years. The growth rate in Asia has declined to 1.5% per year. High growth rates are sustained by high birth rates, and educating these young people is a major challenge and key to slowing down population growth. Photo by P. Cenini, FAO.

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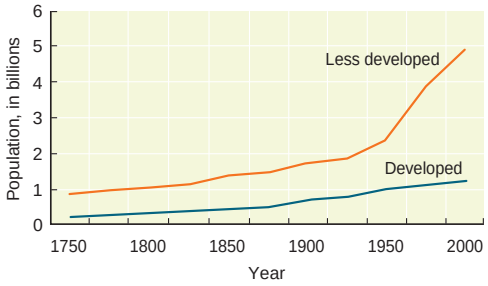

Figure 1.2 World population growth. The global population grew slowly until 1750, followed by an acceleration that continued through the 20th century. *Source:* Data from the United Nations Population Fund.

rates fell. This led to an increase in population, from 5 million to about 300 million by A.D. 1. For the next 1,800 years, high birth rates accompanied deaths from infectious diseases, famines, and wars. But the population did not "explode" until the past 200 years (**Figure 1.2**). This explosion in large part stemmed from the rise of modern science and technology, which reduced the death rate:

- Food production became more dependable. Improved transportation gave people access to food.
- Rising incomes allowed more people to afford the available food.
- Improved housing and public hygiene reduced the incidence of infectious diseases carried by rats, insects, water, and so on.
- Medical advances, such as the identification of disease agents (such as bacteria) and rational treatments (such as antibiotics), resulted in the control of previously lethal diseases.

In Europe and North America, these changes occurred over several centuries, so death rates there declined slowly. During the 19th century, Europe doubled its population; in North America, immigration from Europe and Africa fueled a 12-fold increase. When the 19th century began, about 25% of all people lived in the developed regions of the world (Europe, North America, and Japan) and 75% lived in what we now call the *developing countries*. By 1900, 33% lived in the developed countries and 66% in the less developed regions of the world (**Figure 1.3**).

In the first half of the 20th century, the events of the previous one accelerated. Improvements continued in agriculture, medicine (infant mortality—the death rate under 1 year of age—plummeted from 1 in 5 births to 1 in 20), and economics. In the United States, life expectancy at birth rose from 47 years in 1900 to 68 by 1950. With this dramatic reduction in the death rate, you might expect that the overall population growth rate would increase even faster than in the previous century. Instead, it gradually slowed down. The reason was a marked decrease in the number of children each woman had. Whereas in 1900 a typical U.S. woman had 5 children, by mid-century this number had fallen to 2.8.

Less developed regions of the world were not experiencing these types of changes. Indeed, change and lifestyle improvements have historically been slower in some regions of the world than in others. This has often led to explanations based on racial and cultural

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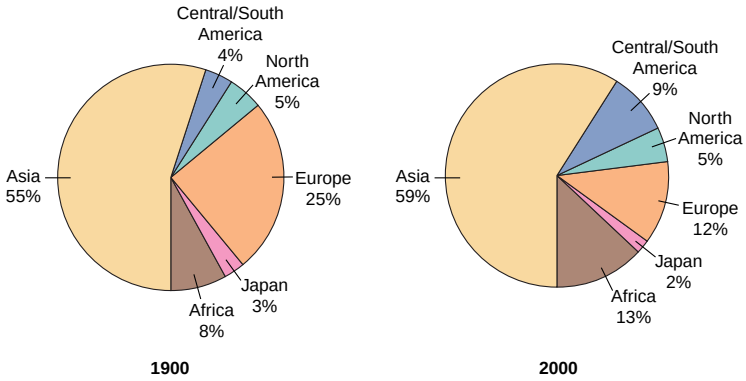

Figure 1.3 Distribution of the world's people, 1900 and 2000. During the past century, rapid population growth in the less developed regions resulted in their having the greatest share of the world population. This will continue in the current century. *Source:* Data from the United Nations.

superiority. But perhaps those in the currently developed regions were just lucky. The biologist Jared Diamond has shown that early hunter-gatherers in the Middle East had access to the right mix of plants and animals that they could tame from the wild. Few such organisms existed in any other region. Moreover, the invention of agriculture could spread quickly, because the climate is similar with respect to rainfall and temperature in, say, Spain and the Middle East, and there are no major geographic barriers to cultural exchange. In contrast, central and southern Africa have radically different climates, so a crop growing in one region will not grow in the other. Agriculture allowed the Eurasian population to grow and specialize, giving these people a "head start" in economic and cultural development, and they quickly widened their advantage.

By the dawn of the 20th century, most humans still lived with high death rates accompanied by high birth rates, just as they had for centuries and as people in the rich countries had previously. Large families (6.2 children per woman) were the rule, and infant mortality rates remained high, as did deaths of older people from infectious diseases. In 1950, a baby born in India had a life expectancy of 39 years.

In the developed world, the last half of the 20th century continued the trends of the previous 50 years. Fertility (the number of children per female of reproductive age) continued to decline, so that by the end of the millennium mothers in most of Europe, North America, and Japan were each bearing fewer than two children. Currently, in these areas two typical parents do not bear enough children to replace themselves, resulting in absolute population decline, excluding immigration. At the same time, death rates have continued to fall, although not as dramatically as in the first half of the 1900s. Improved hygiene, vaccines, and antibiotics were three positive measures that gave quick results; tackling the diseases of old age such as cancer and heart disease is more difficult.

Meanwhile, in the less developed regions of Asia, Africa, and Latin America (**Table 1.1**) many countries rapidly adopted these same three "simple" measures to increase life expectancy. Death rates plummeted. Coupled with high fertility, the overall population growth rates rose and the term population explosion became commonplace. By the 1980s,

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Table 1.1 Comparison of developed and less developed regions

Indicator	Developed	Less Developed	World
Population (millions), 2002	1,193	4,944	6,137
Annual percent growth	0.1	1.6	1.3
Life expectancy, years	75	64	67
People per room	0.7	2.4	1.9
Mortality under 5, per 100 births	0.8	6.1	5.6
GNP per person, US$	20,520	3,300	6,650
Grain production, millions of tons	810	1,259	2,069
Farmland/person, hectares	1.5	0.6	0.7

the proportion of humanity living in the more developed regions was 20%, down from 35% a century earlier.

But then, as the century ended, signs appeared that women in the developing regions were starting to have fewer children, as in the developed regions in the first half of the century. This drop was not uniform across all countries (no such trend is): In China fertility dropped, whereas in central Africa it did not. But as the new millennium began, the population growth rate in the developing regions was slowing significantly. The explosion was over.

Most population experts expect the trends of the 20th century to continue into the 21st and beyond. The UN Population Division makes projections of world population trends every two years. The latest version (2000) predicts that

- Fertility will continue to decline, especially in the less developed regions, to reach replacement level (a little over two children per woman) in 2050 (see **Figure 1.4**).
- Life expectancy will continue to improve (see **Figure 1.5**), most clearly in the less developed regions, as hygiene and living standards improve. However, HIV infection may affect these predictions (see later discussion).

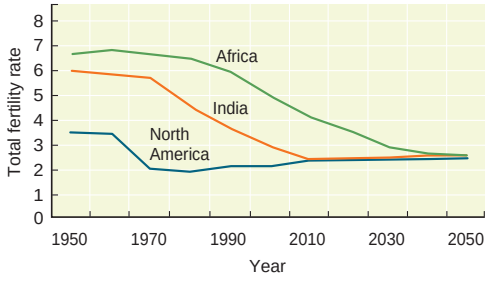

Figure 1.4 Declines in fertility. The total fertility rate is the average number of children a woman has as she passes through her childbearing years. Fertility fell in the developed regions after the "baby boom" following World War II. Fertility in the less developed regions has been falling since the 1980s and is predicted to keep falling during this century. *Source:* Data from the Population Division of the United Nations Department of Economic and Social Affairs.

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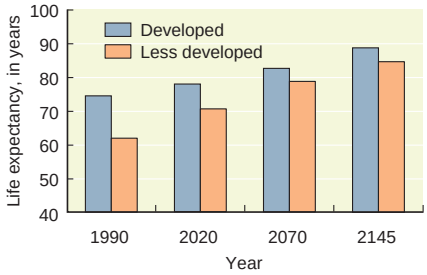

Figure 1.5 Life expectancies from birth. As sanitation and health care improved, life expectancy rose, first in the developed regions and then in the less developed. Over the next century this gap will nearly close. *Source:* Data from the United Nations.

- Overall world population will continue to grow because so many young people are entering reproductive age. But it will grow more slowly and will finally level off at 10.5 billion people by 2150 (**Figure 1.6**).

These projections differ dramatically from those made 20 or even 10 years ago. It is hard to predict scientific discoveries (or emerging infectious diseases); it is easier to foresee what these changes could do if applied to society as a whole. Scientists could predict the eradication of smallpox by the proper application of vaccine and the principles of public health, and this prediction was fulfilled. Put more broadly, changes in death rates can be explained and projected, barring the unforeseen. But how can you explain declining birth rates?

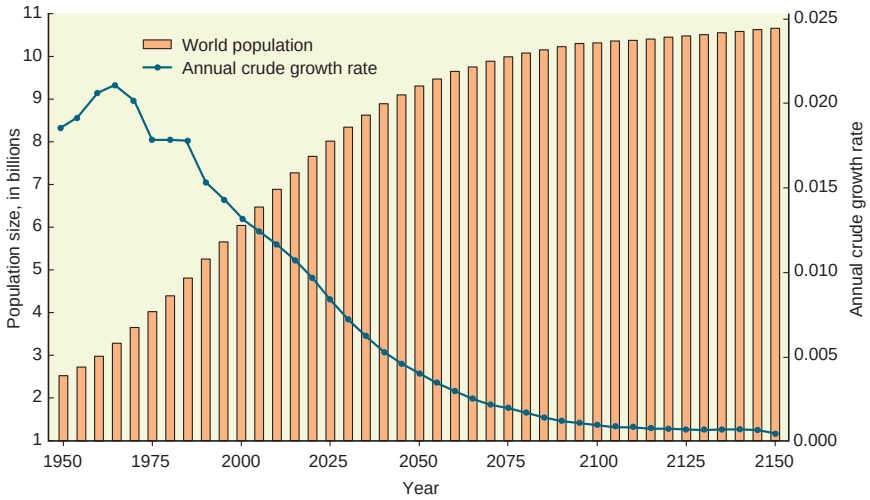

Figure 1.6 Projections of world population and annual growth rate. This is the median projection from the United Nations as of 2000. To calculate the doubling time for a population, divide the annual growth rate (such as 0.010) into 0.7 (in this case, the doubling time would be 70 years). Obviously, the smaller the growth rate, the longer the doubling time. *Source:* Data from the United Nations.

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1.2 Different theories of population growth seek to explain why growth rates change.

Demography—the study of human populations—seeks to explain changes in population growth rates. These explanations often depend on the ideological leanings of the social scientists involved. The publication, in 1798, of political economist Thomas Malthus's *An Essay on the Principle of Population* started the population debate. After the French Revolution, some people optimistically predicted that living conditions for poor farmers would improve now that aristocrats no longer held sway over rural peasants. Malthus disagreed. He noted that the human population has the capacity to expand geometrically (1—2—4—8—16—), and (he believed) food production could increase only linearly (1—2—3—4—5—). As a result, he predicted, population growth would soon outpace food production; wars and famines would check population.

Malthus based his projections of food production on what he called the "qualities of the land" in England at the time. Even with what he called "great encouragements to agriculture," he felt there was little hope that farming could keep up with the growing population. He used his numeric scenario as a polemic device, perhaps overdramatizing to make his point.

Malthus reasoned as follows: Seven million people lived in England in 1800. If this population grew geometrically and needed X amount of food, a generation later (1825) 14 million people would need $2X$ food; because food production increased linearly, the $2X$ food would in fact be available. But look at the next generation: By 1850, 28 million people would be needing $4X$ food, but only $3X$ food would be available. So one quarter of the population would not have enough food. This food deficit would deepen as time went on. Malthus believed population increase promoted poverty, and he felt the solution was to postpone marriage (reduce the birth rate) and improve public health (reduce the death rate).

A basic tenet of Malthus's theory has been discredited: People now know food production can increase geometrically and can keep up with—and even rise faster than—population growth. Many of his dire predictions of the results from population increases have not been fulfilled. Yet his theory still finds strong support among neo-Malthusians, who agree with his general proposal that population increase tends to result in poverty.

The neo-Malthusians believe rapid population growth is a major threat to world economy, the environment, and political stability. They have extended Malthus's arguments in two ways:

- *Ecological Malthusians* stress that population growth undermines the natural resource base. Thus the growing population causes deforestation, soil erosion, water and air pollution, and other forms of environmental degradation, which in turn exacerbates poverty. And poverty may lead to further population growth.
- *Productionist Malthusians* stress that more people need more jobs and services from the government. This pressure severely strains government budgets to provide adequate education, housing, and health care, preventing economic growth. Poverty results.

Neo-Malthusians sometimes represent their views with the equation

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

where I = impact, P = population, A = affluence, and T = technology. Some argue that A or T is most important, but most contend that P is the most important component.

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In contrast to this somewhat pessimistic view, non-Malthusians argue that population growth does not cause poverty and hunger. Instead, a common set of social causes links population growth to poverty and hunger: the lack of jobs, education, health care, and social stability. Thus population control cannot eradicate poverty unless people also deal with the fundamental causes of rising population. These include economic dependency, maldistribution of land, and unemployment. Some history supports the non-Malthusian viewpoint: In general, where incomes rise, population growth rates fall.

Some non-Malthusians, mostly economists such as the late Julian Simon, turn Malthus's argument on its head: They feel that, far from being the cause of human misery, population growth is a good thing, because humans are the "ultimate resource." As population grows, problems—and more importantly, solutions—are created. In terms of the equation, increasing *P* improves *T*, which improves *I*. In their argument, the need for more food stimulates better use of available resources through agricultural science, depletion of a resource through overuse stimulates the search for alternatives, and so on. In a famous exchange, Simon challenged a leading neo-Malthusian, Paul Ehrlich, to prove that five mineral resources in short supply in 1980 would become even more scarce during the late 20th century because of rising population, driving prices up. Simon proposed that human ingenuity would find either more of the resources or a substitute, and that the prices would fall. He won the bet. (The metals Ehrlich chose were copper, chrome, nickel, tin, and tungsten. All declined in price. For example, better methods of extracting nickel were found; more fiber-optic cables replaced copper wires; and so on.)

Given the slowdown in growth rate, dire neo-Malthusian predictions of population projections seem less urgent these days. In addition, data from demographic studies support the non-Malthusians. Observations by Kingsley Davis and other demographers show that industrialization and rising incomes play a major role in reducing population growth rates. This happened first in many countries in Europe, later in some regions of the developing world, and is projected for the rest of the developing regions over the next few decades. This change is called the *demographic transition*, and it has typically occurred in four stages (**Figure 1.7**):

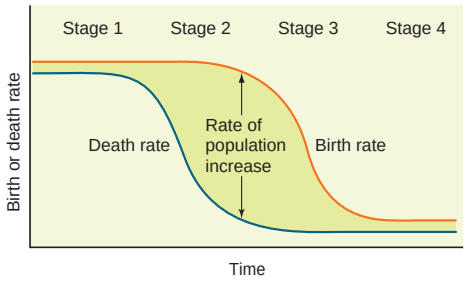

Figure 1.7 The demographic transition model. In stage 1, the birth rate and death rate are high, and the rate of population increase is small. In stage 2, better health care and sanitation reduce the death rate, but the birth rate stays the same, resulting in rapid population increase. In stage 3, the birth rate falls, and in stage 4 the rate of population increase is low. The population has stabilized once again, but at a much higher level than before. *Source:* Data from T. W. Merrick (1989), World population in transition, *Population Bulletin* 41.

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Stage 1. Both birth rate and death rate are high, essentially canceling each other out so that the growth rate is low. Poor parents have many children because they provide cheap farm labor and care for the parents in their old age. Also, social factors such as religion and proof of male virility and female fertility can encourage couples to have many children.

Stage 2. Improvements in living conditions and health care reduce the incidence of disease and death. These advances are readily accepted by society. But social mores are slow to change, so the birth rate remains high, whereas the death rate drops and the overall growth rate increases.

Stage 3. As living conditions and education improve, the birth rate declines to near the level of the death rate. The population growth rate slows.

Stage 4. The birth rate and death rate are once again near each other, but now at a much lower level than in stage 1. The population growth rate returns to its previous low level.

Country after country has gone through these four phases. Most notably, fertility has declined as the well-being of the population improved. In Europe and North America, this happened in the 19th and early 20th centuries. In the developing world, it is happening now (**Figure 1.8**). How fast these stages occur depends on many factors, including culture, economic development, and political considerations.

Consider the example of Sweden, which has completed the transition. During the 18th and 19th centuries, the largely rural population had many children for the labor and social security reasons noted earlier. The death rate fluctuated because of periodic epidemics. As infectious diseases came under control in the late 19th and early 20th centuries, the death rate declined steadily. In the meantime, industrialization—coupled with more efficient farming—drew more and more people to the burgeoning cities. Children, once an economic asset, now contributed less to family income (extended education and child labor laws added to the time before children became productive). In addition, city hous-

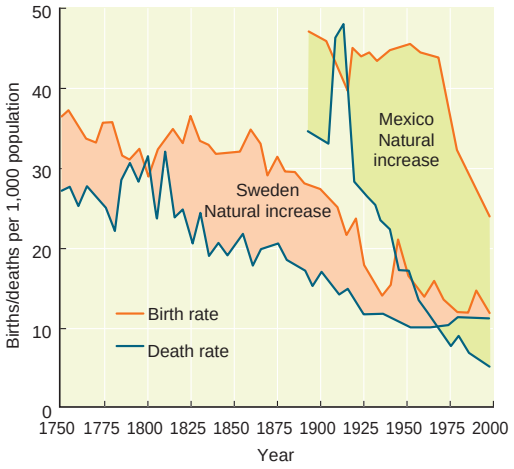

Figure 1.8 Demographic transitions in Sweden and Mexico. Although there were fluctuations, especially in death rates, as public health measures were gradually imposed, the general patterns in these two countries resemble each other and the theoretical pattern in Figure 1.7. The transition happened much faster in Mexico than in Sweden. *Source:* Population Reference Bureau.

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ing was in short supply. Couples married later and relied on birth control to limit children. So fertility declined.

Consider the demographic history of Mexico, a country now in the middle of the transition. As in Sweden of 1750, in the early 20th century the birth and death rates in Mexico were both high. (Death rates spiked around 1925, during the Mexican Revolution.) But both parameters, and the growth rate of Mexico's population, began at a much higher level than Sweden's, so when the transition began in Mexico, it proceeded much faster. The rapid drop in death rates during the first half of the 20th century led to very rapid population growth; twice as many Mexicans were alive in 1950 as in 1930, and by the 1970s the population was growing by 3% a year. The population is still growing, but much more slowly now that economic development, land redistribution, and education have taken hold. Many families in Mexico now also have only two children.

All over the developing world, fertility rates are declining, which is a major cause for optimistic projections about the leveling off of the human population in the next 50 years. The varied reasons for these fertility declines include economic, social, political, and religious factors. In addition, fertility is inversely related to education. Societal changes in developing countries include the following improvements:

- Secondary school enrollments increased from 45% in 1990 to 58% in 2000.
- Adult literacy was 70% in 2000.
- Half of the women are using some form of contraception.
- Changes in economic systems and increased world trade have made more jobs available in cities.
- Infant mortality rates have declined significantly, ensuring the survival of more children.

A concerted effort by the government can alter fertility rates. A classic recent case is the Republic of Korea (South Korea; see **Table 1.2**). In 1960, Korea was a village society with high birth and death rates and a life expectancy of about 50 years (stage 1). By 1990, both birth and death rates had fallen precipitously and life expectancy had risen (stage 4). In the meantime, a rapid demographic transition took place. Two factors, both planned by the government, led to this transition. First, the population became urbanized, because jobs, many in high technology, were created to attract foreign investment. Second, the government gave high priority to birth control education and contraceptive use. The ethnic homogeneity of the Korean population and their high literacy rate were important factors aiding this effort.

Table 1.2 The demographic transition in Korea: 1965–1990

	1965	1990
Total fertility rate	4.8	1.6
Infant mortality rate/1,000	75	24
Life expectancy (years)	55	73
Urban population (%)	28	75
GNP per person (US$)	130	4,500
Contraceptive use (%)	22	80

Source: Data from O. Kim and P. van den Oever (1992), Demographic transition and patterns of natural resource use in Korea, *Ambio* 21:56–62.

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1.3 HIV infection is slowing population growth in Africa.

Population projections assume certain predictions about public health, development, and fertility. They cannot predict the unforeseen, such as wars, weather-induced famines, and new diseases. Although wars always seem to be in the world and people cannot do much about the weather except to have food "insurance," until recently most were confident humanity had the tools to defeat major diseases, especially those that afflict the young. AIDS has proven that confidence wrong.

In 2001 alone, 3 million people died of AIDS and 5 million more became infected with HIV. By 2002 the total number of infected people was 40 million. Although in the developed countries medicine has made some progress and has extended the lives of people with AIDS in the developed countries, these treatments are expensive and out of reach for 95% of the HIV-infected people who live in less developed regions of Africa and Asia. For these people, HIV infection is tantamount to a death sentence.

AIDS affects people of all ages, but in terms of population projections its effects are most dramatic for the young. Half of all the newly infected in 2001 took hold on people under 25. The vast majority of women with AIDS who get pregnant pass the virus to their offspring during pregnancy (rarely), delivery, or through breast milk. The mothers die, leaving their children orphaned. There are already 12 million such AIDS orphans, most of them infected with HIV.

The numbers are staggering for a disease that was unknown just 25 years ago. In sub-Saharan Africa, where nearly 70% of the global HIV/AIDS cases are found, 1 person in 30 is infected with HIV (**Figure 1.9**). In contrast to developed countries, where the infection

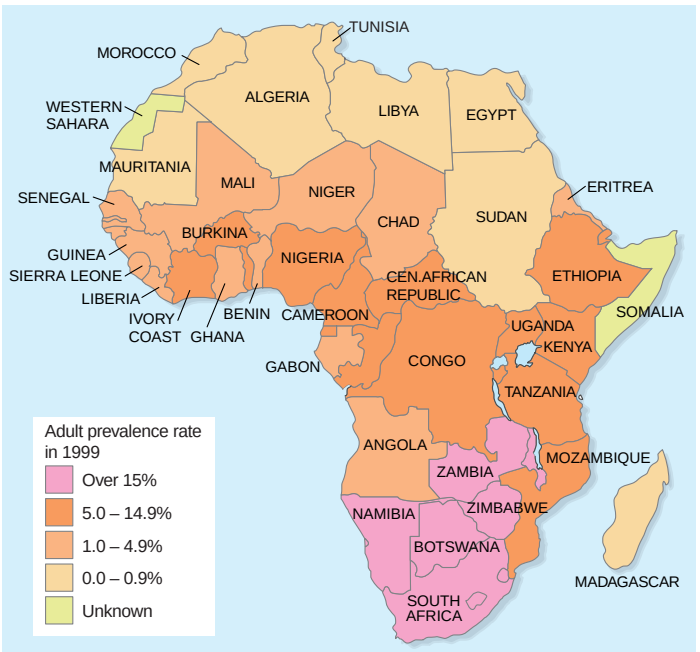

Figure 1.9 The distribution of HIV and AIDS cases in Africa. Obtaining affordable drugs for infected people and stopping transmission of the virus are major challenges facing poor African countries that lack health care delivery systems. *Source:* United Nations World Health Organization.

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first spread among homosexual males and intravenous drug abusers, in less developed regions more women than men are infected with HIV. The reasons for this are not clear, but the female–male ratio is 13 to 10. There are many possible reasons for this ratio of infection; most are strain-specific differences. Also, exposure to HIV does not necessarily result in infection with HIV.

Because AIDS kills, its effects on population growth are profound. In 1990, life expectancy for a baby born in southern Africa had risen from 44 years to 60 years. AIDS threatens to wipe out this gain. By 2005, a newborn will have a life expectancy of only 45. One way to look at a population is to graph its age structure; that is, how many people are in each age group. Less developed countries with high birth rates and poor longevity have far more younger than old people, so the graph is shaped like a pyramid. This preponderance of young people of reproductive age signals a population momentum, so that even if fertility falls, merely replacing all these young people will keep the population rising. For some countries, AIDS is turning the pyramid graph into a chimney shape (**Figure 1.10**), with far fewer young people.

It appears now (2002) that African countries will receive cheaper drugs to fight AIDS, but poverty and lack of infrastructure in many regions will make it difficult to distribute and administer those drugs. In the absence of affordable treatment or a vaccine, the only way to slow this epidemic, which threatens populations all over the world—and which therefore becomes the responsibility of or concern for all populations— is to reduce the transmission of the virus from one person to another. The developing world has had several notable successes. In 1994, 13% of the Ugandan population was HIV positive. Political leadership by President Museveni (unlike Museveni, some leaders are reluctant to openly discuss AIDS), community programs, and the participation of religious leaders in disease control reduced the spread of HIV by one third. At the same time, Thailand obtained similar results.

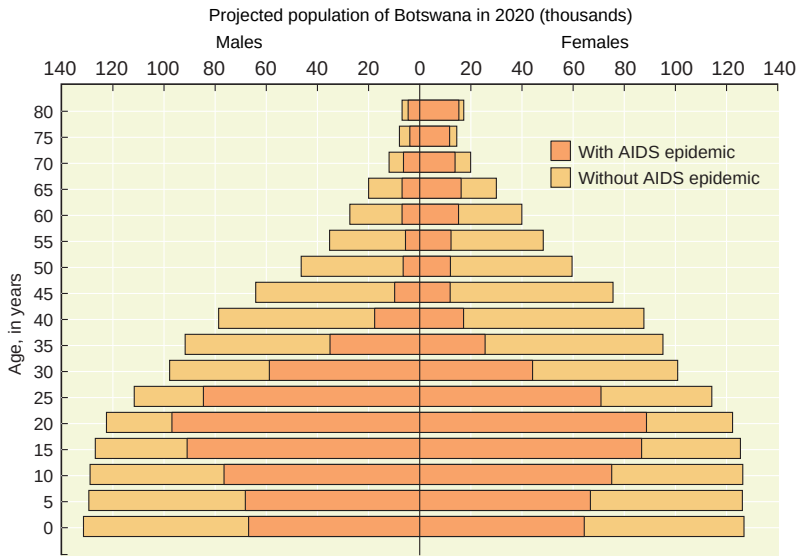

Figure 1.10 The effect of AIDS on the predicted age structure of the Botswana population, 2020. By killing so many young people, AIDS may turn the "population pyramid" into a "population chimney." *Source:* Data from UNAIDS.

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The risk of exposure to HIV through sexual intercourse or birth is strongly related to poverty. Migrant workers, truck drivers, commercial sex workers, and children of infected mothers all have high rates of infection. Moreover, intravenous drug use is more common among poor people, and the virus can travel from one person to another by contaminated needles. Finally, AIDS, like many other issues in population growth, is an issue of gender.

1.4 Improvements in the status of women are essential for reducing HIV infection, population growth, and poverty.

Gender encompasses the economic, social, and cultural aspects of being male or female. In all societies, being a man or woman is not just a matter of sex, or the biological ability to produce eggs or sperm. There are particular social expectations about how the sexes should act, above and beyond biological differences. These roles range from clothing to work to relations with the opposite sex. They are not universal; for example, in much of the developing world, women are the farmers. But women's role in marketing the crops they harvest varies: In sub-Saharan Africa women play a major role, whereas in South Asia they do not. And where they do not market their crops, or where they do not control the finances, they benefit much less.

The roles of men and women must be taken into account in discussing population because different roles demand different approaches. Also, in all societies women have lower status than do men. Women usually have less education, less ownership of land, and less power to enter into or leave a marriage. Yet they often put in more working hours than men, most of them unpaid.

Take the case of HIV transmission, an increasingly important determinant of population growth in Africa. Within a stable relationship, the woman typically is not in control. She may obey the social dictum of monogamy, but her husband/lover often does not. The woman lacks the means or social authority to force her partner to engage in safe sexual practices.

During the 1990s, two major conferences dealt with issues of gender and population and development. Both the Cairo Conference on Population (1994) and the Beijing Conference on Women (1995) stressed the need for progress in four areas:

- Increase investments in the education of girls.
- Meet the needs of adolescent girls by encouraging the postponement of the first pregnancy and enhancing the status of women.
- Promote greater male responsibility in parenthood, reducing the disproportionate role of women in the home.
- Provide opportunities for women outside of childbearing and child rearing.

Besides satisfying the need for social justice, will these changes help reduce population growth? Many data show that the answer is yes.

The more educated a woman is, the more likely she is to have access to and use birth control methods. The last half of the 20th century saw a "reproductive revolution." The developments of the birth control pill, intrauterine device (IUD), simple sterilization methods, and implanted contraceptives made family planning easier than ever before. By 2000, half of all women of childbearing age were using some form of birth control, up from 10% a half-century earlier (**Figure 1.11**). There are differences among countries—in Mexico 65% use birth control, whereas in Mali only 7% do—but the trend is clearly up.

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Figure 1.11 The reproductive revolution. A community health worker shows women in a Bangladeshi village how to use a condom. A major factor in the fertility decline has been the availability of and instruction in contraceptives use. *Source:* Ron Giling/Lineair/Peter Arnold, Inc.

Women's education is a powerful factor in reducing fertility. For example, in Togo, West Africa, a 1998 survey revealed that women who finished high school had an average of 2.7 children, whereas those with no education had 6.5. One reason is that educated women stay in school longer (and away from childbearing) and have more options. The net result is that they tend to postpone their first child until well into their 20s (**Figure 1.12**). Progress in educating girls has been steady for the past 20 years, although they still lag behind boys, typically being forced to drop out of school to work or get married. In 1980, 42% of boys and 28% of girls of school age in developing countries were enrolled in secondary school. By 2000, these numbers had increased to 55% and 45%, respectively.

Women usually marry at a younger age than do men. In the United States, average ages at marriage are 24 and 26 for women and men, respectively. However, in Niger the ages are 16 and 24, and in Bangladesh they are 18 and 26. This gap reinforces social customs

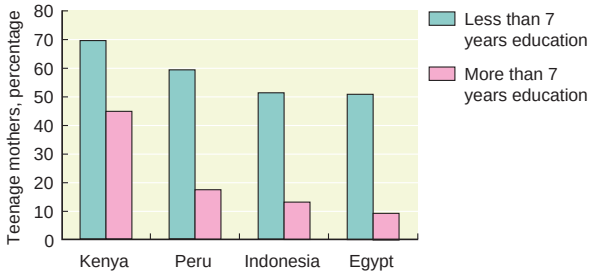

Figure 1.12 Mothers' education and teenage childbearing, 1995. The more education a woman has, the less likely she is to have a child while a teenager. Such births in less developed countries are often high risk for both the mother and child. In addition, women with more education have fewer children overall. *Source:* United Nations Population Fund.

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of female subjugation in marriage. Reproductive choices are almost all made by the husband, and they usually tend toward having more children. As gender inequality lessens, it is possible that joint reproductive decisions will become the norm. Equality in making these decisions tends to result in smaller families.

1.5 Migration within and between countries is an important population issue.

Population growth is largely determined by birth and death rates, but for any given region or country migration can also play an important role. Two types of migration are

- From country to country (generally called *immigration* and *emigration*)
- From place to place within a country (often between urban and rural areas)

Moving is difficult for most people, and they do it only when benefits in income and social opportunities outweigh costs. In 2000, about 145 million people were living outside their native lands, and the number is increasing by 2 to 4 million every year. This is only 2% of the whole human population, yet the influence of migration on a region's population can be significant.

Historically, there have been times of great migrations among different areas of the world. Europeans colonized the Americas in the 17th and 18th centuries, and continued to come until the flow slowed in the second half of the 20th century. These were economic migrants. They brought millions of African slaves and other indentured servants who were essential in developing the New World. There are also sociopolitical migrants. When India became independent in 1947, millions of Moslems left the new country to form their own Islamic country, Pakistan, and millions of Hindus traveled from Pakistan in the opposite direction.

About half of all international migrations are between less developed countries. These people generally live on borders that are relatively poorly patrolled, or belong to ethnic groups present in both countries. Colonial powers originally drew many international borders without regard to ethnic group distribution.

Migrations from the less developed countries to the developed ones have more impact, because they usually involve great distances and cultural differences. Over the past decade, the major movements have been

- From South and Central America and Asia to North America. These movements account for 75% of U.S. immigration. The United States receives over a million legal and illegal immigrants per year, more than any other country.
- From North Africa and the Middle East to Europe. Many of these people have settled in England and France.
- From southern and eastern Europe to western Europe. This has occurred since the breakup of the Soviet empire. The most striking example is Germany, which has absorbed millions of immigrants from the former East Germany as well as from other republics.

The impact of these immigrants is most evident in their numbers compared to the low rate of natural increase (birth rate minus death rate) in the receiving countries. During the 1990s, immigration caused half of the population growth in the developed regions. The net emigration from the less developed countries hardly affects their population numbers because of the high growth rate. As more immigrants from different ethnic groups enter the developed countries, the ethnic compositions of the receiver countries

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change. Caucasians, who were by far the majority in California in 1960, will soon be a minority in the state.

All countries have laws regarding immigration, and many migrants enter their new home country under these laws. But because such laws usually limit the number of immigrants in some way, others try to enter illegally. These clandestine migrations, usually economic but sometimes sociopolitical, range from rickety African boats washing up on the shores of the Calabrian coast of Italy, to families crossing the desert from Mexico to the southwestern United States.

South Africa is a relatively wealthy country adjacent to much poorer countries. Every year, several hundred thousand economic migrants cross the poorly fenced border from Mozambique into South Africa. Many of these people are not Mozambican at all but come from more distant African countries. With a long border and no ocean or desert to cross, South Africa presents an attractive target for a destitute person seeking opportunities.

The reactions of the native South Africans to the newcomers in their midst vary. Politicians have blamed illegal immigrants for South Africa's soaring crime rate, for taking jobs away from natives, and for the high rate of HIV infection. The evidence for these claims is scant. Many employers rely on the illegal immigrants. Mining and agriculture employers, in particular, find them more willing to work harder than some natives, and highly skilled. Some citizens refer to the illegals derisively as *makwerewere,* meaning "those who jabber like grasshoppers." These three threads—blaming immigrants for social problems, accepting them because of their desperate willingness to work, and disliking foreigners—have intertwined in many countries.

Migrations forced by war or civil strife have been common throughout history, and the current era is no exception. Although their numbers are relatively small, refugees (people involuntarily living in another country who cannot return to their home) evoke strong sympathies (**Figure 1.13**). In 2000 there were about 12 million, with Palestinians

Figure 1.13 Refugees from the Rwandan civil war in Zaire. Wars always result in acute food shortages among civilian populations, in spite of international efforts to deliver food aid. *Source:* Courtesy of the United Nations High Command for Refugees. Photo by L. Taylor.

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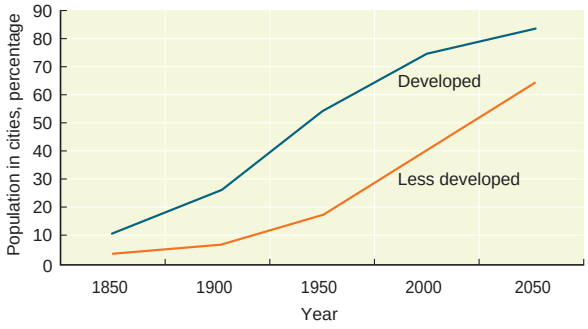

Figure 1.14 Trends for urbanization. The urban population in the world has grown three times faster than the rural population. Although the growth in developed regions is leveling off, more and more people in developing regions are migrating to cities, this trend is projected to continue in this century. *Source:* Data from the United Nations.

and Afghanis accounting for the largest fraction. The ultimate aim of any refugee is to return home. In recent years, mostly with UN assistance, about a million people have done so annually.

Most migrations take place within a country. In 1850, 11% of the people in the developed regions lived in cities. In the late 19th century, as agriculture became more efficient and industrialization offered the promise of urban jobs, people began to move en masse from rural areas to cities. Government policies hastened this transition by improving the infrastructure of roads, schools, and so on for the migrants. By 1900, cities held 26% of the population, and the percentage has since grown to its current 84% (**Figure 1.14**). As with the demographic transition, less developed regions have lagged behind in this rural-to-urban change, but they are catching up quickly.

In 1960, the three most densely populated urban areas in the world—London, Tokyo, and New York—were all in the developed regions. By 2000, Tokyo was joined by São Paulo, Brazil, and Mexico City. By 2015, demographers project, the three largest will be Tokyo, Lagos, Nigeria, and Mumbai (Bombay), India. In addition to these "megacities," the developing countries will have hundreds of new smaller cities each with fewer than a million residents.

What does urbanization mean for population growth? In general, people living in cities are better educated and have better health and life expectancy and higher incomes than their rural counterparts. As a result, urban fertility is lower. But as cities grow, so does the strain on the government to provide the basic services that are so necessary for demographic change.

1.6 Population policies are often inconsistent.

The reactions of the developed countries to the current wave of immigrants underline the changing nature of governmental population policies. These policies are actions designed to influence population growth, composition, or distribution. Basically, the immigration policy issues boil down to two questions: Should immigrants be welcomed in unlimited numbers, and should they have full rights as citizens? The United States has a long history of answering yes to both questions. In the 19th century, ships docking in New York harbor only needed to keep a log of who disembarked, so great was the need for settlers.

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Subject to numerical limitation

- Close family relationship with a U.S. citizen or legal permanent resident: 226,000 per year
- Possessing needed job skills: 140,000 per year

Not subject to numerical limitation

- Spouses, children, and parents of citizens
- Refugees and people claiming asylum
- Spouses and children of people given permanent residence in the amnesty of 1986
- Amerasians born in Vietnam
- Aliens from countries adversely affected by the 1965 immigration law, which reduced their numbers (e.g., Ireland)

Figure 1.15 U.S. immigration policy. The only consistent internal population policy that the United States has concerns immigration. Rather than being strictly demographic, the policy has economic, political, and humanitarian goals.

Soon the numbers were so high that government designed tests to screen out the feeble in mind and body. Concerns about the influence of immigrants not from western Europe on U.S. culture, coupled with mistaken ideas of racial superiority, led in the 1920s to restrictive quotas, based on race, for immigrants from different world regions. Today, policies are more attuned with economic goals, and the laws have been broadened to accept families of those already in the United States (**Figure 1.15**).

In recent years, increased immigration from developing countries, coupled with the low natural growth rate of the Caucasian U.S. population, have renewed concern among some Americans. Germany, France, and Italy are grappling with the same issues. Immigrants in many European countries do not have full political rights; they are welcomed as labor but not as citizens.

Within a country, internal population policies also vary and evolve over time. Except in cases of deliberate genocide, most countries enact public health measures that reduce the death rate. Some countries have policies that regulate birth rate. For example, in the 1970s China had 500 million citizens under age 21. The government correctly feared that even if these people reproduced at the replacement level (and the rate at that time was above this level), by 2000 the huge population would be greater than the economy could support. So the government mandated a strict one-child policy. Between 1980 and 2000, fertility and population growth fell rapidly. In these terms, the policy was successful. But many critics felt it violated individual human rights. When Indira Gandhi's administration in India tried something similar with forced male sterilization in 1975–1977, it was thrown out of office and a backlash against any population policy resulted that took decades to overcome.

The evolution of 20th-century external population policies, in which a government acts to influence others, is a fascinating story of politics and religion. At first the main question was, Is there a global population problem? Shortly after it was founded in 1945, the United Nations established a commission to gather data on populations of member states. As the evidence mounted, two camps emerged: The United States, United Kingdom, Sweden, and India felt there was a serious problem of population growth. An odd coalition of the Catholic Church (which opposes any form of artificial contraception) and communist countries (who felt that the "problem" was the result of capitalism and would disappear under communism) joined to oppose the very idea of a population problem. This coalition effectively blocked any efforts at helping developing countries curb their birth rates.

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By the 1970s, opposition by the communist states softened. A consensus emerged that there was indeed a population problem. This was a time of alarmist, apocalyptic books with titles such as *The Population Bomb* and *Famine: 1975!* Funders began to give modest assistance for population control, with the United States in the lead. But again two viewpoints emerged on how to proceed:

- *Incrementalists,* such as the United States and most Western developed countries, felt that individual countries must first curb population growth. Then they would be able to develop economically.
- *Redistributionists,* which included most developing countries, argued that the fastest way to improve their lot was to spread out the world's resources, which were (and are) concentrated in the rich countries. This economic development would reduce population growth.

The policies that resulted from this debate attempted to satisfy both sides but actually satisfied neither. Some redistribution of the world's wealth did occur beginning in the mid-1970s, but the recipients were a few oil-producing countries. Interestingly, as these countries got richer the results for population growth were mixed. Some countries reduced their growth rate; others, such as the Arab states, did not.

In 1984, the United Nations sponsored another population conference, at which delegates confronted an astonishing turnabout in U.S. policy. Under President Ronald Reagan, the United States, which had previously supported family planning programs, now opposed them. In fact, the U.S. delegation now took an almost redistributionist stance, favoring economic development before population control. The new approach was not quite redistributionist: Instead of favoring giving assets to the poor countries, the U.S. policy encouraged them to develop free-market economies on their own. Once the benefits of the free market stimulated economic well-being, the U.S. delegates predicted that fertility would decline. Three days after he took office in 1993, President Bill Clinton reversed this policy; the United States was once again a leader in global family planning efforts. However, when President George W. Bush took office in 2001, one of his first acts was to cut off U.S. aid to many family planning organizations.

Given these flip-flops on the international stage, it is not surprising that the United States does not have a consistent internal population policy. Over U.S. history, the government has tacitly encouraged fertility. But this approval is not as overt as in western Europe or in countries such as Canada, where the government gives parents an allowance for each child. Instead, in the United States the reward is indirect, as in the income tax deduction for children.

Some ecologists have pointed out that every child born in the United States uses far more global resources than a child anywhere else on Earth, and thus argue for limiting U.S. population growth. But there has been no policy to discourage fertility. However, the United States has always had an explicit immigration policy, as mentioned earlier.

What might a U.S. population policy entail? It could set goals for

- The ideal growth rate
- Birth rates and immigration policies to satisfy this growth rate
- Death rate targets, including childhood mortality, that vary in different parts of the country
- Distribution (and redistribution) of people around the country

Unfortunately, competing political, social, economic, and religious agendas make agreement on such a policy highly unlikely.

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1.7 Increases in population have been matched by increases in food supply, but hunger persists.

Ever since agriculture began, an increased ability to produce food has accompanied the rise in human population. The recent history of food production shows a steady increase most markedly in the less developed countries, where the major increases in population have occurred (**Figure 1.16**). How has this food production increase been achieved? What foods have been important in the increases? Historically, there have been two ways to increase food production:

- Increase the amount of land used to produce food
- Increase the amount of food produced per season on the land already being used for agriculture

The amount of arable land presently being cultivated is about 1.5 billion hectares (ha). Researchers have estimated that cultivated arable land increased by 432 million ha between 1860 and 1920, and again by 419 million ha between 1920 and 1978. Thus a considerable proportion of the increased food production since 1860 has been achieved by plowing more land. Since 1978, however, the amount of cultivated land has remained more or less steady. Because the world population has added 1.7 billion people since then, the amount of cultivated land per person has dropped by about 25%. Clearly, the productivity of this land must have improved significantly to keep pace with the growing population, or we would be facing starvation on a massive scale.

Of the approximately 300 types of plants cultivated in the world, 24 supply nearly all our food. More than 85% of the human diet comes from eight species of plants, and over half comes from just three cereal grains: maize, wheat, and rice. Although the area devoted to these plants has not risen much in the past 50 years, the production index (total food produced per land area) has risen considerably. These impressive yield increases have been most pronounced in the developed countries, which can afford the technologies to coax the most out of crops. Farmers in poor countries have also seen significant improvements, especially since the Green Revolution.

How did these increases in cultivated area, yield per hectare, and population affect the amount of food available per person? The food index (food produced per person) has risen

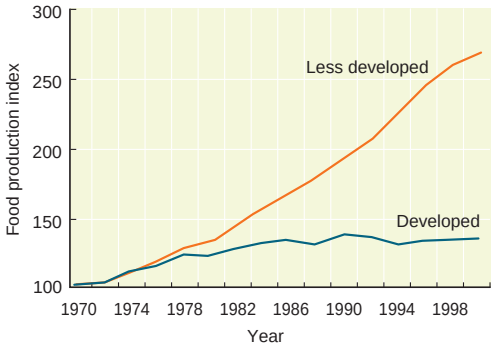

Figure 1.16 Overall food production in developing and developed countries. Notice that the developing countries, where most people live, have had more dramatic increases than the developed countries. However, the per person data look quite different. For purposes of illustration, production levels in 1970 are arbitrarily set at 100. *Source:* Data from United Nations Food and Agriculture Organization.

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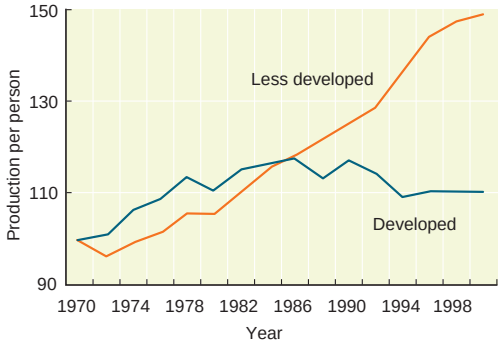

Figure 1.17 Food Index: Food production per person. The amount of food produced per person has remained the same in the developed regions for the past 25 years, whereas food production increases have outstripped the population rise in the developing regions. For purposes of illustration, production levels in 1970 are arbitrarily set at 100. *Source:* Data from U.S. Department of Agriculture.

somewhat, although not nearly as dramatically as overall food production (**Figure 1.17**), once again with the gains most pronounced in the less developed countries. In Chapter 2 we discuss the relationships among these food increases, changing agricultural practices and technologies, and agricultural R&D (research and development).

Calculations invariably show that an adequate amount of food is produced to meet the needs of the global population. Yet hunger persists. The United Nations estimates that almost 800 million people are chronically undernourished, two thirds of them living in Asia and the Pacific. Children are especially sensitive to undernutrition or malnutrition. Surveys conducted in developing regions ranging from Asia to Africa to Latin America during the 1990s indicated that 4 in 10 showed stunting (low height for age), 2 in 10 were underweight (low weight for age), and 1 in 10 showed wasting (low weight for height). This malnutrition bodes ill for these children as they grow up. In Chapter 4 we discuss the reasons why food insecurity persists in a world of apparent plenty.

CHAPTER SUMMARY

During the second half of the 20th century, the human population increased rapidly to 6 billion, with most of the expansion occurring in the less developed countries, especially in Asia. Recent projections show that world population growth will slow dramatically in the next 25 years and that the human population will stabilize, probably at 8 to 9 billion, sometime between 2050 and 2075. This stabilization will occur as women in developing countries decrease their total fertility rate and the populations pass through the demographic transition, which brings birth rates back in line with death rates. Improving the status of women in developing countries is one of the most important factors in reducing the birth rate and population growth. Migration within and between countries has also emerged as a major population issue that countries must address. Worldwide, record numbers of undocumented workers from poor countries are entering richer neighboring countries in search of jobs. Most countries do not have consistent population policies to deal with these migrations. In the past 50 years, increases in food production have matched and outstripped increases in population. The result has been a steady rise in the food availability per person. Nevertheless, food insecurity and malnutrition have not been eliminated and one person in seven does not have food security.

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Discussion Questions

1. What would be the best way for your country to reduce population growth in developing countries? Should your country be active in this arena, and why or why not?
2. Why does ethnic homogeneity in a developing country make it easier to slow the population growth rate, as happened in Korea?
3. How might regional traditions of a developing country hinder efforts at (a) reducing population growth and (b) improving the status of women?
4. What are possible reasons for higher rates of HIV infection in women than men in less developed regions of sub-Saharan Africa?
5. Compare and contrast neo-Malthusian and non-Malthusian schools of thought in the context of current undernutrition problems in Asia and Africa.
6. Immigration was very high in both the United States and western Europe during the 1990s. What factors caused these increases? How did these regions respond to immigration pressure?
7. Humanity currently produces enough food to give every person an adequate diet. What factors in your country cause an unequal distribution of food? How is the government of your country responding to this?
8. In the currently well-developed regions, the demographic transition occurred over many decades to centuries. Why is it occurring more rapidly in many less developed regions?
9. Thirty years ago, the human population was growing very rapidly with seemingly no end in sight. Now there is optimism that world population growth is slowing down and may level off during this century. List the major factors that led to this change.
10. Conduct a survey of your family and friends to determine what they know of human population and its growth. If they lack adequate knowledge (and most will), inform them of the facts. How can the public be better informed of these issues?

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