

More than 1.1 billion people live in India,
more than one-quarter of them in
object poverty.

CHAPTER 7 Human Populations

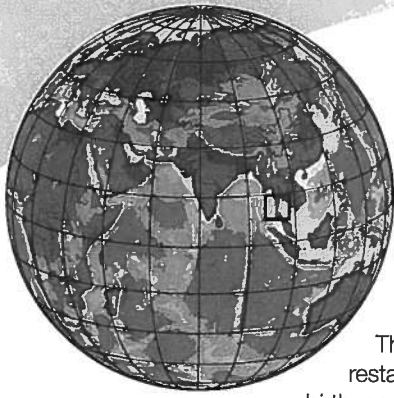
Live simply so that others may simply live.

—Mahatma Gandhi—

LEARNING OUTCOMES

After studying this chapter, you should be able to:

- 7.1 Trace the history of human population growth.
- 7.2 Summarize different perspectives on population growth.
- 7.3 Analyze some of the factors that determine population growth.
- 7.4 Explain how ideal family size is culturally and economically dependent.
- 7.5 Describe how a demographic transition can lead to stable population size.
- 7.6 Relate how family planning gives us choices.
- 7.7 Reflect on what kind of future we are creating.



Case Study Family Planning in Thailand: A Success Story

Down a narrow lane off Bangkok's busy Sukhumvit Road, is a most unusual café. Called Cabbages and Condoms, it's not only highly rated for its spicy Thai food, but it's also the only restaurant in the world dedicated to birth control. In an adjoining gift shop,

baskets of condoms stand next to decorative handicrafts of the northern hill tribes. Piles of T-shirts carry messages, such as, "A condom a day keeps the doctor away," and "Our food is guaranteed not to cause pregnancy." Both businesses are run by the Population and Community Development Association (PDA), Thailand's largest and most influential nongovernmental organization.

The PDA was founded in 1974 by Mechai Viravaidya, a genial and fun-loving former Thai Minister of Health, who is a genius at public relations and human motivation (fig. 7.1). While traveling around Thailand in the early 1970s, Mechai recognized that rapid population growth—particularly in poor rural areas—was an obstacle to community development. Rather than lecture people about their behavior, Mechai decided to use humor to promote family planning. PDA workers handed out condoms at theaters and traffic jams, anywhere a crowd gathered. They challenged governmental officials to condom balloon-blowing contests, and taught youngsters Mechai's condom song: "Too Many Children Make You Poor." The PDA even pays farmers to paint birth control ads on the sides of their water buffalo.

This campaign has been extremely successful at making birth control and family planning, which once had been taboo topics in polite society, into something familiar and unembarrassing. Although condoms—now commonly called "mechais" in Thailand—are the trademark of PDA, other contraceptives, such as pills, spermicidal foam, and IUDs, are promoted as well. Thailand was one of the first countries to allow the use of the injectable contraceptive DMPA, and remains a major user. Free non-scalpel vasectomies are available on the king's birthday. Sterilization has become the most widely used form of contraception in the

country. The campaign to encourage condom use has also been helpful in combating AIDS.

In 1974, when PDA started, Thailand's growth rate was 3.2 percent per year. In just fifteen years, contraceptive use among married couples increased from 15 to 70 percent, and the growth rate had dropped to 1.6 percent, one of the most dramatic birth rate declines ever recorded. Now Thailand's growth rate is 0.7 percent, or nearly the same as the United States. The fertility rate (or average number of children per woman) decreased from 7 in 1974 to 1.7 in 2006. The PDA is credited with the fact that Thailand's population is 20 million less than it would have been if it had followed its former trajectory.

In addition to Mechai's creative genius and flair for showmanship, there are several reasons for this success story. Thai people love humor and are more egalitarian than most developing countries. Thai spouses share in decisions regarding children, family life, and contraception. The government recognizes the need for family planning and is willing to work with volunteer organizations, such as the PDA. And Buddhism, the religion of 95 percent of Thais, promotes family planning.

The PDA hasn't limited itself to family planning and condom distribution. It has expanded into a variety of economic development projects. Microlending provides money for a couple of pigs, or a bicycle, or a small supply of goods to sell at the market. Thousands of water-storage jars and cement rainwater-catchment basins have been distributed. Larger scale community development grants include road building, rural electrification, and irrigation projects. Mechai believes that human development and economic security are keys to successful population programs.

This case study introduces several important themes of this chapter. What might be the effects

of exponential growth in human populations? How might we manage fertility and population growth? And what are the links between poverty, birth rates, and our common environment? Keep in mind, as you read this chapter, that resource limits aren't simply a matter of total number of people on the planet, they also depend on consumption levels and the types of technology used to produce the things we use.



FIGURE 7.1 Mechai Viravaidya (right) is joined by Peter Piot, Executive Director of UNAIDS, in passing out free condoms on family planning and AIDS awareness day in Bangkok.

7.1 POPULATION GROWTH

Every second, on average, four or five children are born, somewhere on the earth. In that same second, two other people die. This difference between births and deaths means a net gain of roughly 2.3 more humans per second in the world's population. In mid-2007 the total world population stood at roughly 6.6 billion people and was growing at 1.17 percent per year. This means we are now adding nearly 79 million more people per year, and if this rate persists, our global population will double in about 58 years. Humans are now probably the most numerous vertebrate species on the earth. We also are more widely distributed and manifestly have a greater global environmental impact than any other species. For the families to whom these children are born, this may well be a joyous and long-awaited event (fig. 7.2). But is a continuing increase in humans good for the planet in the long run?

Many people worry that overpopulation will cause—or perhaps already is causing—resource depletion and environmental degradation that threaten the ecological life-support systems on which we all depend. These fears often lead to demands for immediate, worldwide birth control programs to reduce fertility rates and to eventually stabilize or even shrink the total number of humans.

Others believe that human ingenuity, technology, and enterprise can extend the world carrying capacity and allow us to overcome any problems we encounter. From this perspective, more people may be beneficial rather than disastrous. A larger population means a larger workforce, more geniuses, more ideas about what to do. Along with every new mouth comes a pair of hands. Proponents of this worldview—many of whom happen to be economists—argue that continued economic and technological growth can both feed the world's billions and enrich everyone enough to end the population explosion voluntarily. Not so, counter many ecologists. Growth is the problem; we must stop both population and economic growth.

Yet another perspective on this subject derives from social justice concerns. In this worldview, there are sufficient resources for everyone. Current shortages are only signs of greed, waste, and oppression. The root cause of environmental degradation, in this view, is inequitable distribution of wealth and power rather than population size. Fostering democracy, empowering women and minorities, and improving the standard of living of the world's poorest people are what are really needed. A narrow focus on population growth only fosters racism and an attitude that blames the poor for their problems while ignoring the deeper social and economic forces at work.

Whether human populations will continue to grow at present rates and what that growth would imply for environmental quality and human life are among the most central and pressing questions in environmental science. In this chapter, we will look at some causes of population growth as well as how populations are measured and described. Family planning and birth control are essential for stabilizing populations. The number of children a couple decides to have and the methods they use to regulate fertility, however, are strongly influenced by culture, religion,



FIGURE 7.2 A Mayan family in Guatemala with four of their six living children. Decisions on how many children to have are influenced by many factors, including culture, religion, need for old age security for parents, immediate family finances, household help, child survival rates, and power relationships within the family. Having many children may not be the best interest of society at large, but may be the only rational choice for individual families.

politics, and economics, as well as basic biological and medical considerations. We will examine how some of these factors influence human demographics.

Human populations grew slowly until relatively recently

For most of our history, humans have not been very numerous compared to other species. Studies of hunting and gathering societies suggest that the total world population was probably only a few million people before the invention of agriculture and the domestication of animals around 10,000 years ago. The large and more secure food supply made available by the agricultural revolution allowed the human population to grow, reaching perhaps 50 million people by 5000 B.C. For thousands of years, the number of humans increased very slowly. Archaeological evidence and historical descriptions suggest that only about 300 million people were living at the time of Christ (table 7.1).

Until the Middle Ages, human populations were held in check by diseases, famines, and wars that made life short and uncertain for most people (fig. 7.3). Furthermore, there is evidence that many early societies regulated their population size through cultural taboos and practices such as abstinence and infanticide. Among the most destructive of natural population controls were bubonic plagues (or Black Death) that periodically swept across Europe between 1348 and 1650. During the worst plague years (between 1348 and 1350), it is estimated that at least one-third of the European population perished. Notice, however, that this didn't retard population growth for very long. In 1650, at the end of the last great plague, there were about 600 million people in the world.

TABLE 7.1

World Population Growth and Doubling Times

Date	Population	Doubling Time
5000 B.C.	50 million	?
800 B.C.	100 million	4,200 years
200 B.C.	200 million	600 years
A.D. 1200	400 million	1,400 years
A.D. 1700	800 million	500 years
A.D. 1900	1,600 million	200 years
A.D. 1965	3,200 million	65 years
A.D. 2005	6,400 million	40 years
A.D. 2050 (estimate)	8,920 million	140 years

Source: United Nations Population Division.

As you can see in figure 7.3, human populations began to increase rapidly after A.D. 1600. Many factors contributed to this rapid growth. Increased sailing and navigating skills stimulated commerce and communication between nations. Agricultural developments, better sources of power, and better health care and hygiene also played a role. We are now in an exponential or J curve pattern of growth.

It took all of human history to reach 1 billion people in 1804, but little more than 150 years to reach 3 billion in 1960. To go from 5 to 6 billion took only 12 years. Another way to look at population growth is that the number of humans tripled during the twentieth

century. Will it do so again in the twenty-first century? If it does, will we overshoot the carrying capacity of our environment and experience a catastrophic dieback similar to those described in chapter 6? As you will see later in this chapter, there is evidence that population growth already is slowing, but whether we will reach equilibrium soon enough and at a size that can be sustained over the long term remains a difficult but important question.

7.2 PERSPECTIVES ON POPULATION GROWTH

As with many topics in environmental science, people have widely differing opinions about population and resources. Some believe that population growth is the ultimate cause of poverty and environmental degradation. Others argue that poverty, environmental degradation, and overpopulation are all merely symptoms of deeper social and political factors. The worldview we choose to believe will profoundly affect our approach to population issues. In this section, we will examine some of the major figures and their arguments in this debate.

Does environment or culture control human populations?

Since the time of the Industrial Revolution, when the world population began growing rapidly, individuals have argued about the causes and consequences of population growth. In 1798 Thomas Malthus (1766–1834) wrote *An Essay on the Principle of Population*, changing the way European leaders thought about population growth. Malthus marshaled evidence to show that populations

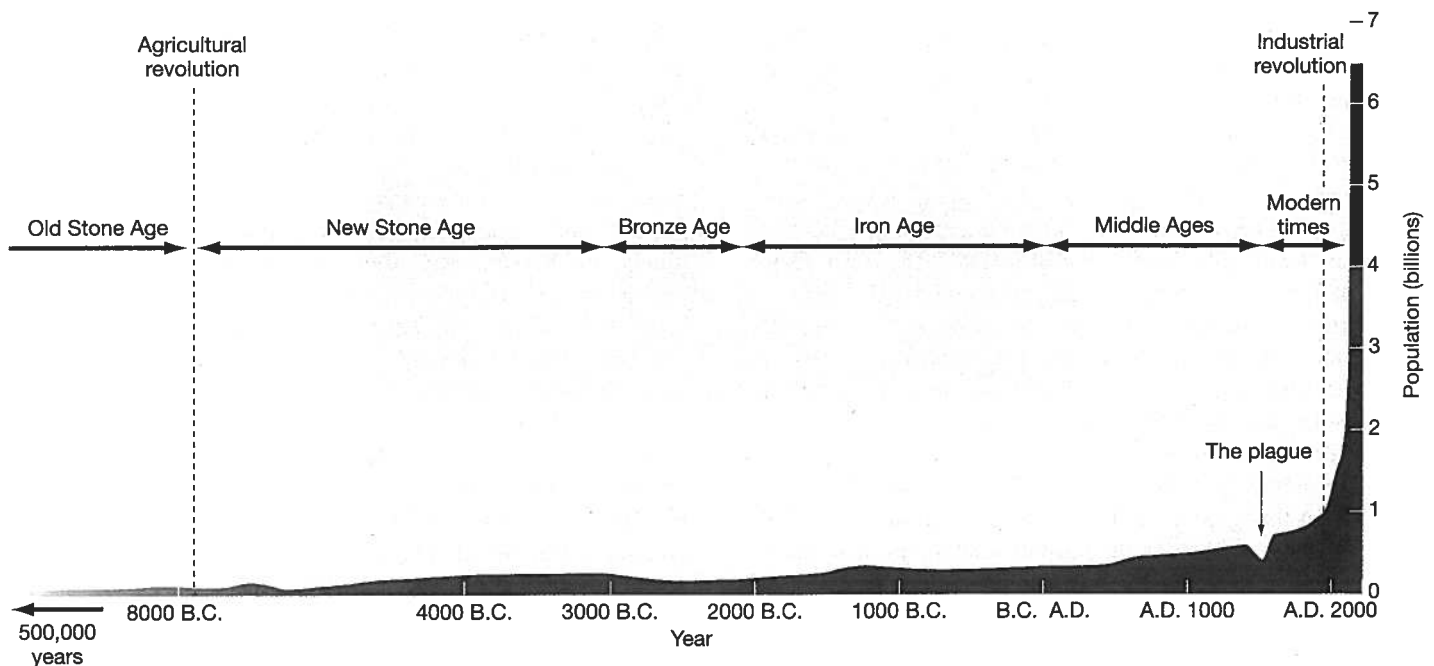


FIGURE 7.3 Human population levels through history. Since about A.D. 1000, our population curve has assumed a J shape. Are we on the upward slope of a population overshoot? Will we be able to adjust our population growth to an S curve? Or can we just continue the present trend indefinitely?

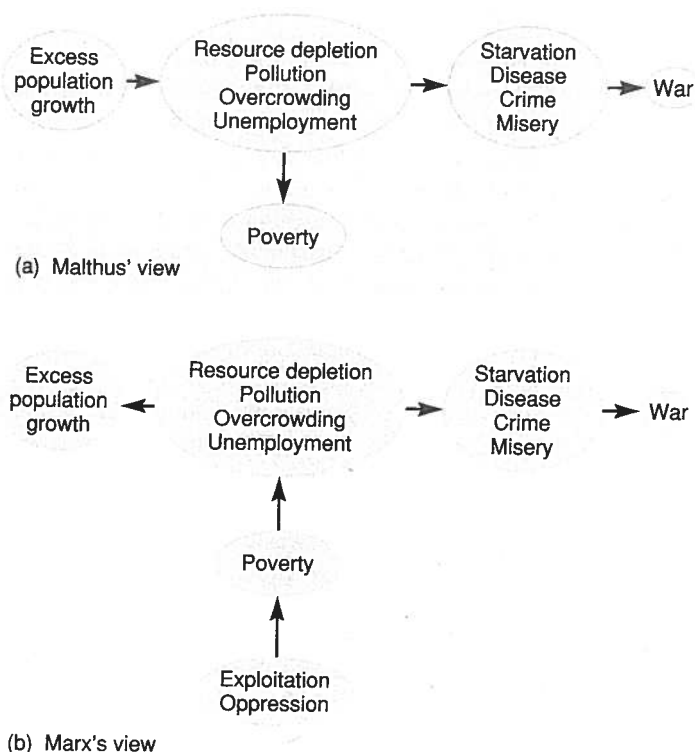


FIGURE 7.4 (a) Thomas Malthus argued that excess population growth is the ultimate cause of many other social and environmental problems. (b) Karl Marx argued that oppression and exploitation are the real causes of poverty and environmental degradation. Population growth in this view is a symptom or result of other problems, not the source.

tended to increase at an exponential, or compound, rate while food production either remained stable or increased only slowly. Eventually human populations would outstrip their food supply and collapse into starvation, crime, and misery (fig. 7.4a). He converted most economists of the day from believing that high fertility increased gross domestic output to believing that per capita output actually fell with rapidly rising population.

In Malthusian terms, growing human populations stop growing when disease or famine kills many, or when constraining social conditions compel others to reduce their birth rates—late marriage, insufficient resources, celibacy, and “moral restraint.” Several decades later, the economist Karl Marx (1818–1883) presented an opposing view, that population growth resulted from poverty, resource depletion, pollution, and other social ills. Slowing population growth, said Marx, required that people be treated justly, and that exploitation and oppression be eliminated from social arrangements (fig. 7.4b).

Both Marx and Malthus developed their theories about human population growth when understanding of the world, technology, and society were much different than they are today. But these different views of human population growth still inform competing approaches to family planning today. On the one hand, some believe that we are approaching, or may have surpassed, the earth’s carrying

capacity. Joel Cohen, a mathematical biologist at Rockefeller University, reviewed published estimates of the maximum human population size the planet can sustain. The estimates, spanning 300 years of thinking, converged on a median value of 10–12 billion. We are more than 6.5 billion strong today, and growing, an alarming prospect for some. Cornell University entomologist David Pimental, for example, has said: “By 2100, if current trends continue, twelve billion miserable humans will suffer a difficult life on Earth.” In this view, birth control should be our top priority. On the other hand, many scholars agree with Marx that improved social conditions and educational levels can stabilize populations. In this perspective, the earth is bountiful in its resource base, but poverty and high birth rates result from oppressive social relationships that unevenly distribute wealth and resources. Consequently, this position believes, technological development, education, and just social conditions are the means of achieving population control. Mohandas Gandhi stated it succinctly: “There is enough for everyone’s need, but not enough for anyone’s greed.”

Technology can increase carrying capacity for humans

Optimists argue that Malthus was wrong in his predictions of famine and disaster 200 years ago because he failed to account for scientific and technical progress. In fact, food supplies have increased faster than population growth since Malthus’ time. For example, according to the UN FAO Statistics Division, each person on the planet averaged 2,435 calories of food per day in 1970, while in 2000 the caloric intake reached 2,807 calories. Even poorer, developing countries saw a rise, from an average of 2,135 calories per day in 1970 to 2,679 in 2000. In that same period the world population went from 3.7 to more than 6 billion people. Certainly terrible famines have stricken different locations in the past 200 years, but they were caused more by political and economics than by lack of resources or population size. Whether the world can continue to feed its growing population remains to be seen, but technological advances have vastly increased human carrying capacity so far.

The burst of world population growth that began 200 years ago was stimulated by scientific and industrial revolutions. Progress in agricultural productivity, engineering, information technology, commerce, medicine, sanitation, and other achievements of modern life have made it possible to support thousands of times as many people per unit area as was possible 10,000 years ago. Economist Stephen Moore of the Cato Institute in Washington D.C., regards this achievement as “a real tribute to human ingenuity and our ability to innovate.” There is no reason, he argues, to think that our ability to find technological solutions to our problems will diminish in the future.

Much of our growth and rising standard of living in the past 200 years, however, has been based on easily acquired natural resources, especially cheap, abundant fossil fuels (see chapter 19). Whether rising prices of fossil fuels will constrain that production and result in a crisis in food production and distribution, or in some other critical factor in human society, concerns many people.

However, technology can be a double-edged sword. Our environmental effects aren't just a matter of sheer population size; they also depend on what kinds of resources we use and how we use them. This concept is summarized as the **I = PAT** formula. It says that our environmental impacts (I) are the product of our population size (P) times affluence (A) and the technology (T) used to produce the goods and services we consume. A single American living an affluent lifestyle that depends on high levels of energy and material consumption, and that produces excessive amounts of pollution, probably has a greater environmental impact than a whole village of Asian or African farmers. Ideally, Americans will begin to use nonpolluting, renewable energy and material sources. Better yet, Americans will extend the benefits of environmentally friendly technology to those villages of Asians and Africans so everyone can enjoy the benefits of a better standard of living without degrading their environment.

Population growth could bring benefits

Think of the gigantic economic engine that China is becoming as it continues to industrialize and its population becomes more affluent. More people mean larger markets, more workers, and efficiencies of scale in mass production of goods. Moreover, adding people boosts human ingenuity and intelligence that will create new resources by finding new materials and discovering new ways of doing things. Economist Julian Simon (1932–1998), a champion of this rosy view of human history, believed that people are the “ultimate resource” and that no evidence suggests that pollution, crime, unemployment, crowding, the loss of species, or any other resource limitations will worsen with population growth. In a famous bet in 1980, Simon challenged Paul Ehrlich, author of *The Population Bomb*, to pick five commodities that would become more expensive by the end of the decade. Ehrlich chose metals that actually became cheaper, and he lost the bet. Leaders of many developing countries share this outlook and insist that, instead of being obsessed with population growth, we should focus on the inordinate consumption of the world's resources by people in richer countries.

Think About It

What larger worldviews are reflected in this population debate? What positions do you believe neo-Malthusians and neo-Marxists might take on questions of human rights, resource abundance, or human perfectability? Where do you stand on these issues?

7.3 MANY FACTORS DETERMINE POPULATION GROWTH

Demography is derived from the Greek words *demos* (people) and *graphos* (to write or to measure). It encompasses vital statistics about people, such as births, deaths, and where they live, as well as total population size. In this section, we will survey ways human populations are measured and described, and discuss demographic factors that contribute to population growth.

How many of us are there?

The estimate of 6.55 billion people in the world in 2006 quoted earlier in this chapter is only an educated guess. Even in this age of information technology and communication, counting the number of people in the world is like shooting at a moving target. People continue to be born and die. Furthermore, some countries have never even taken a census, and those that have been done may not be accurate. Governments may overstate or understate their populations to make their countries appear larger and more important or smaller and more stable than they really are. Individuals, especially if they are homeless, refugees, or illegal aliens, may not want to be counted or identified.

We really live in two very different demographic worlds. One is old, rich, and relatively stable. The other is young, poor, and growing rapidly. Most people in Asia, Africa, and Latin America inhabit the latter demographic world. These countries represent 80 percent of the world population but more than 90 percent of all projected growth (fig. 7.5).

The highest population growth rates occur in a few “hot spots,” such as sub-Saharan Africa and the Middle East, where economics, politics, religion, and civil unrest keep birth rates high and contraceptive use low. In Niger, Yemen, and Palestine, for example, annual population growth is above 3.2 percent. Less than 10 percent of all couples use any form of birth control, women average more than seven children each, and nearly half the population is less than 15 years old. The world's highest current growth rate is in the United Arab Emirates, where births plus immigration are producing an annual increase of 6.8 percent (the highest immigration rate in the world is responsible for 80 percent of that growth). This means that the UAE is doubling its population size approximately every decade. Obviously, a small country with limited resources (except oil) and almost no fresh water or agriculture, can't sustain that high growth rate indefinitely.

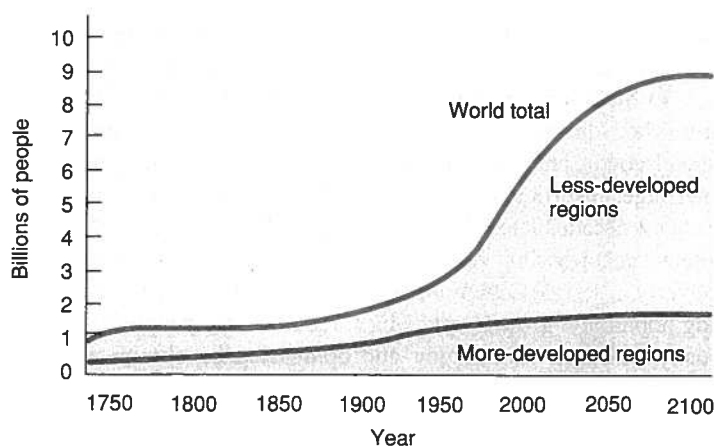


FIGURE 7.5 Estimated human population growth, 1750–2100, in less-developed and more-developed regions. Almost all growth projected for the twenty-first century is in the less-developed countries.

Source: UN Population Division, 2005.

TABLE 7.2

The World's Largest Countries

2006		2050*	
Country	Population (millions)	Country	Population (millions)
China	1,311	India	1,628
India	1,122	China	1,437
United States	299	United States	420
Indonesia	225	Nigeria	299
Brazil	187	Pakistan	295
Pakistan	166	Indonesia	285
Bangladesh	147	Brazil	260
Russia	142	Bangladesh	231
Nigeria	135	Dem. Rep. of Congo	183
Japan	128	Ethiopia	145

*Estimate.

Source: Population Reference Bureau, 2006.

Some countries in the developing world have experienced amazing growth rates and are expected to reach extraordinary population sizes by the middle of the twenty-first century. Table 7.2 shows the ten largest countries in the world, arranged by their estimated size in 2006 and projected size in 2050. Note that, while China was the most populous country throughout the twentieth century, India is expected to pass China in the twenty-first century. Nigeria, which had only 33 million residents in 1950, is forecast to have nearly 300 million in 2050. Ethiopia, with about 18 million people 50 years ago, is likely to grow nearly eight-fold over a century. In many of these countries, rapid population growth is a serious problem. Bangladesh, about the size of Iowa, is already overcrowded at 147 million people. Another 84 million people by 2050 will only add to current problems.

The other demographic world is made up of the richer countries of North America, western Europe, Japan, Australia, and New Zealand. This world is wealthy, old, and mostly shrinking. Italy, Germany, Hungary, and Japan, for example, all have negative growth rates. The average age in these countries is now 40, and life expectancy of their residents is expected to exceed 90 by 2050. With many couples choosing to have either one or no children, the populations of these countries are expected to decline significantly over the next century. Japan, which has 128 million residents now, is expected to shrink to about 100 million by 2050. Europe, which now makes up about 12 percent of the world population, will constitute less than 7 percent in 50 years, if current trends continue. Even the United States and Canada would have nearly stable populations if immigration were stopped.

It isn't only wealthy countries that have declining populations. Russia, for instance, is now declining by nearly 1 million people per year as death rates have soared and birth rates have

plummeted. A collapsing economy, hyperinflation, crime, ruption, and despair have demoralized the population. Hor pollution levels left from the Soviet era, coupled with poor nutrition and health care, have resulted in high levels of ger abnormalities, infertility, and infant mortality. Abortions twice as common as live births, and the average number of children per woman is now 1.3, one of the lowest in the world. Death rates, especially among adult men, have risen dramatically. Male life expectancy dropped from 68 years in 1990 to 59 years in 2006. Russia, which is the world's largest country geographically, is expected to decline from 142 million people in 2006 to less than 100 million in 2050. It will then have a smaller population than Vietnam, Egypt, or Uganda. Other former Soviet states are experiencing similar declines. Estonia, Bulgaria, Georgia, and Ukraine, for example, now have negative growth rates and are expected to lose about 40 percent of their population in the next 50 years.

The situation is even worse in many African countries, where AIDS and other communicable diseases are killing people at a terrible rate. In Zimbabwe, Botswana, Zambia, and Namibia, for example, up to 39 percent of the adult population have AIDS or are HIV positive. Health officials predict that more than two thirds of the 15-year-olds now living in Botswana will die of AIDS before age 50. Without AIDS, the average life expectancy is estimated to be 69.7 years. Now, with AIDS, Botswana's life expectancy has dropped to only 31.6 years. The populations of many African countries are now falling because of this terrible disease (fig. 7.6). Altogether, Africa's population is expected to be nearly 200 million lower in 2050 than it would have been without AIDS.

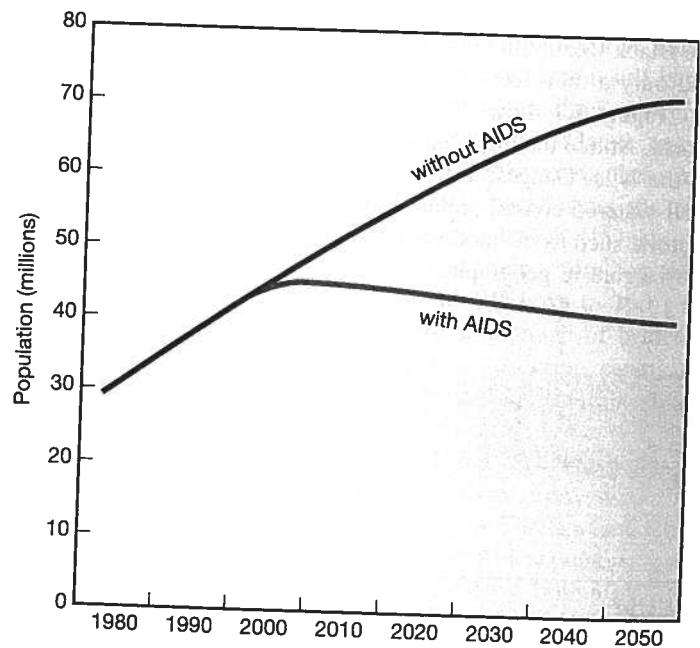


FIGURE 7.6 Projected population of south Africa with and without AIDS.

Data source: UN Population Division, 2006.

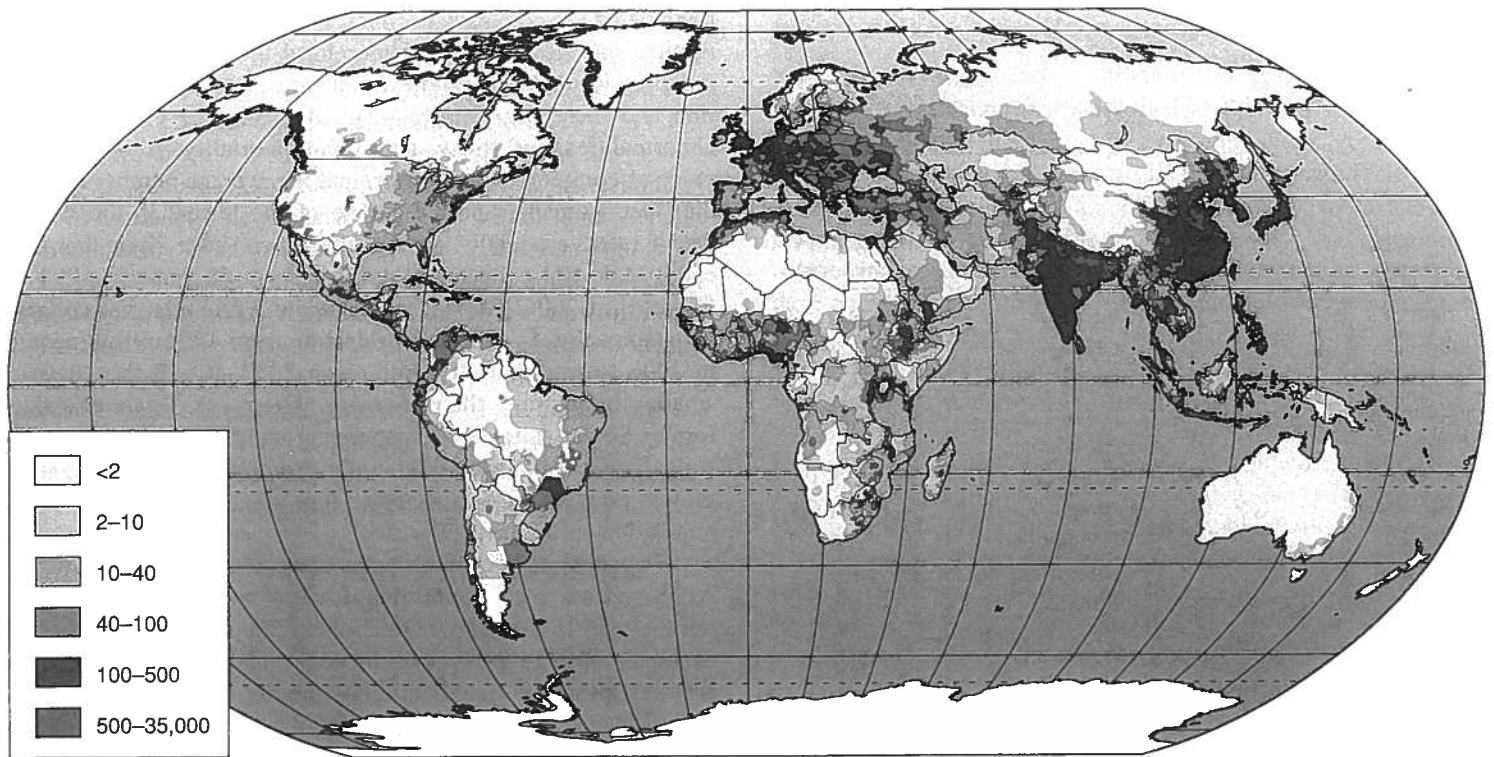


FIGURE 7.7 Population density in persons per square kilometer.
Source: World Bank, 2000.

AIDS is now spreading in Asia. Because of the large population there, Asia is expected to pass Africa in 2020 in total number of deaths. Although a terrible human tragedy, this probably won't affect total world population very much. Remember that the Black Death killed many people in the fourteenth century but had only a transitory effect on demography.

Figure 7.7 shows human population distribution around the world. Notice the high densities supported by fertile river valleys of the Nile, Ganges, Yellow, Yangtze, and Rhine Rivers and the well-watered coastal plains of India, China, and Europe. Historic factors, such as technology diffusion and geopolitical power, also play a role in geographic distribution.

Fertility measures the number of children born to each woman

As we pointed out in chapter 6, fecundity is the physical ability to reproduce, while fertility describes the actual production of offspring. Those without children may be fecund but not fertile. The most accessible demographic statistic of fertility is usually the **crude birth rate**, the number of births in a year per thousand persons. It is statistically "crude" in the sense that it is not adjusted for population characteristics such as the number of women in reproductive age. Table 7.3 shows birth rates more-developed and less-developed countries in 2006.

TABLE 7.3

Birth and Death Rates in 2006

	Population (Millions)	Births per 1,000	Deaths per 1,000	Total Fertility Rate	Natural Increase (Percent)
World	6,555	21	9	2.7	1.2
More-Developed Regions	1,216	11	10	1.6	0.1
Less-Developed Regions	5,339	23	8	2.9	1.5

Source: Population Reference Bureau, 2006.

The **total fertility rate** is the number of children born to an average woman in a population during her entire reproductive life. Upper-class women in seventeenth- and eighteenth-century England, whose babies were given to wet nurses immediately after birth and who were expected to produce as many children as possible, often had 25 or 30 pregnancies. The highest recorded total fertility rates for working-class people is among some Anabaptist agricultural groups in North America who have averaged up to 12 children per woman. In most tribal or traditional societies, food shortages, health problems, and cultural practices limit total fertility to about six or seven children per woman even without modern methods of birth control.

Zero population growth (ZPG) occurs when births plus immigration in a population just equal deaths plus emigration. It takes several generations of replacement level fertility (where people just replace themselves) to reach ZPG. Where infant mortality rates are high, the replacement level may be five or more children per couple. In the more highly developed countries, however, this rate is usually about 2.1 children per couple because some people are infertile, have children who do not survive, or choose not to have children.

Fertility rates have declined dramatically in every region of the world except Africa over the past 50 years (fig. 7.8). Only a few decades ago, total fertility rates above 6 were common in many countries. The average family in Mexico in 1975, for instance, had 7 children. By 2006, however, the average Mexican woman had only 2.4 children. According to the World Health Organization, 61 out of the world's 190 countries are now at or below a replacement rate of 2.1 children per couple, and by 2050, all but a few of the least-developed countries are expected to have reached that milestone. The greatest fertility reduction has been in Southeast Asia, where rates have fallen by more than half. Most

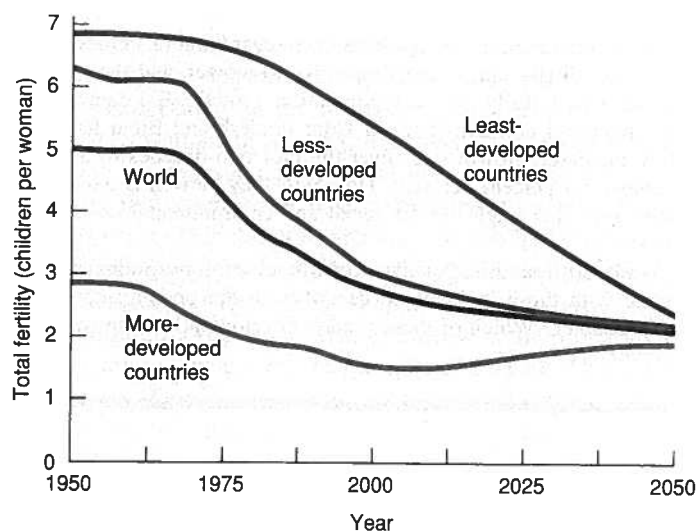


FIGURE 7.8 Average total fertility rates for less-developed countries fell by more than half over the past 50 years. Much of this dramatic change was due to China's one-child policy. Progress has been slower in the least-developed countries, but by 2050, they should be approaching the replacement rate of 2.1 children per woman of reproductive age.



FIGURE 7.9 China's one-child-per-family policy, promoted in this billboard, has been remarkably successful in reducing birth rates. It may, however, have created a generation of "little emperors," since parents and grandparents focus all their attention on an only child.

of this decrease has occurred in just the past few decades and contrary to what many demographers expected, some of the poorest countries in the world have been remarkably successful in lowering growth rates. As the opening case study for this chapter shows, Thailand reduced its total fertility rate from 7.0 in 1979 to 1.7 (lower than that in the United States) in 2006.

China's one-child-per-family policy decreased the fertility rate from 6 in 1970 to 1.8 in 1990 and 1.6 in 2006 (fig. 7.9). This policy, however, has sometimes resulted in abortions, forced sterilizations, and even infanticide. Another adverse result is that the only children (especially boys) allowed to families may grow up to be spoiled "little emperors" who have an inflated impression of their own importance. (fig. 7.9) Furthermore, there may not be enough workers to maintain the army, sustain the economy, or support retirees when their parents reach old age.

China reports that 119 boys are now being born for every 100 girls. Normal ratios would be about 105 boys to 100 girls. If this imbalance persists, there will be a shortage of brides in another generation. The government is considering easing the one-child policy. Macao, with a total average fertility rate of only 0.9, now has the lowest birth rate in the world.

Although the world as a whole still has an average fertility rate of 2.7, growth rates are now lower than at any time since World War II. If fertility declines like those in Thailand and China were to occur everywhere in the world, global population could begin to decline by 2050, and might be below 6 billion by 2150. Most of Eastern Europe now has fertility levels of 1.2 children per woman. Interestingly, Spain and Italy, although predominantly Roman Catholic, have similar fertility rates. Several Indian states have reached zero population growth, but their means of doing so have been very different (What Do You Think? p. 140).



What Do You Think?

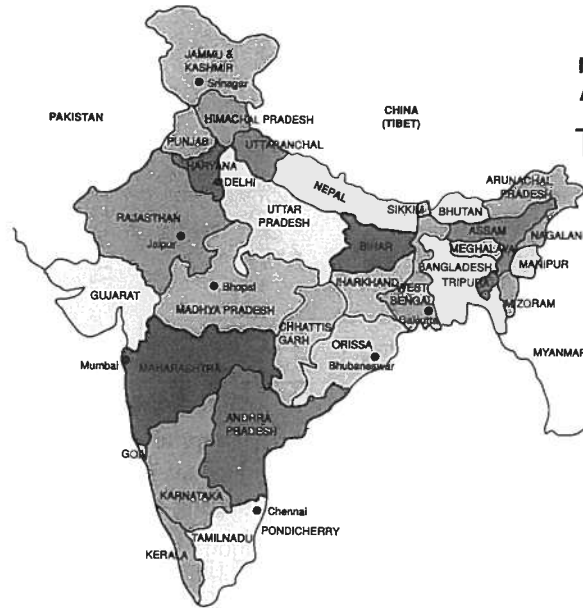
How to Reduce Population Growth?

Every year, India adds more people to the world's population than any other country. In 2006, having added more than 185 million residents in the previous decade, India had more than 1.1 billion people. By 2050, if current growth rates persist, India will have increased its population by more than 50 percent over current levels, and will have around 1.63 billion residents, making it the most populous country in the world. How will the country, which already has more than a quarter of its population living in abject poverty, feed, house, educate, and employ all those being added each year? And what's the best way to slow this rapid growth? The fierce debate now taking place about how to control India's population has ramifications for the rest of the world as well.

Currently, fewer than half of all Indian women use any form of birth control. How can this percentage be raised? On one side of this issue are those who believe that the best way to reduce the number of children born is poverty eradication and progress for women. Drawing on social justice principles established at the 1994 UN Conference on Population and Development in Cairo, some argue that responsible economic development, a broad-based social welfare system, education and empowerment of women, and high-quality health care—including family planning services—are essential components of population control. Without progress in these areas, they believe, efforts to provide contraceptives or encourage sterilization are futile.

On the other side of this debate are those who contend that, while social progress is an admirable goal, India doesn't have the time or resources to wait for an indirect approach to population control. The government must push aggressively, they argue, to reduce births now or the population will be so huge and its use of resources so great that only mass starvation, class war, crime, and disease will be able to bring it down to a manageable size.

Unable to reach a consensus on population policy, the Indian government decided in 2000 to let each state approach the problem in its own way. Some states have chosen to focus on social justice, while others have adopted more direct, interventionist policies.



Indian states have taken very different approaches to family planning and human development.

The model for the social justice approach is the southern state of Kerala, which achieved population stabilization in the mid-1980s, the first Indian state to do so. Although still one of the poorest places in the world, economically, Kerala's fertility rate is comparable to that of many industrialized nations, including the United States. Both women and men have a nearly 100 percent literacy rate and share affordable and accessible health care, family planning, and educational opportunities; therefore, women have only the number of children they want, usually two. The Kerala experience suggests that increased wealth isn't a prerequisite for zero population growth.

Taking a far different path to birth reduction is the nearby state of Andhra Pradesh, which reached a stable growth rate in 2001. Boasting the most dramatic fertility decline of any large Indian state, Andhra Pradesh has focused on targeted, strongly enforced sterilization programs. The poor are encouraged—some would say, compelled—to be sterilized after having only one or two children. The incentives include cash payments. You might receive 500 rupees—equivalent to (U.S.) \$11 or a month's wages for an illiterate farm worker—if you agree to have "the operation." In addition, participants are eligible for better housing, land, wells, and subsidized loans.

The pressure to be sterilized is overwhelmingly directed at women, for whom the procedure is major abdominal surgery. Sterilizations often are done by animal husbandry staff and carried out in government sterilization camps. This practice raises troubling memories of the 1970s for many people, when then-Prime Minister Indira Gandhi suspended democracy and instituted a program of forced sterilization of poor people. There were reports at the time of people being rounded up like livestock and castrated or neutered against their will.

While many feminists and academics regard Andhra Pradesh's policies as appallingly intrusive and coercive to women and the poor, the state has successfully reduced population growth. By contrast, the hugely populous northern states of Uttar Pradesh and Bihar have seen slightly increased growth rates over the past two decades to a current rate above 2.5 percent per year. How will they slow this exponential growth, and what might be the social and environmental costs of not doing so?

What do you think? How do birth control programs in India compare with those in Thailand describes in the opening case study for this chapter? Which of these models for population control would you favor?

Mortality is the other half of the population equation

A traveler to a foreign country once asked a local resident, "What's the death rate around here?" "Oh, the same as anywhere," was the reply, "about one per person." In demographics, however, **crude death rates** (or crude mortality rates) are

expressed in terms of the number of deaths per thousand persons in any given year. Countries in Africa where health care and sanitation are limited may have mortality rates of 20 or more per 1,000 people. Wealthier countries generally have mortality rates around 10 per 1,000. The number of deaths in a population is sensitive to the age structure of the population. Rapidly growing, developing countries such as Libya or Costa Rica have lower

crude death rates (4 per 1,000) than do the more-developed, slowly growing countries, such as Denmark (12 per 1,000). This is because there are proportionately more youths and fewer elderly people in a rapidly growing country than in a more slowly growing one.

Crude death rate subtracted from crude birth rate gives the **natural increase** of a population. We distinguish natural increase from the **total growth rate**, which includes immigration and emigration, as well as births and deaths. Both of these growth rates are usually expressed as a percent (number per hundred people) rather than per thousand. A useful rule of thumb is that if you divide 70 by the annual percentage growth, you will get the approximate doubling time in years. Niger, for example, which is growing 3.4 percent per year, is doubling its population every 20 years. The United States, which has a natural increase rate of 0.6 percent per year, would double, without immigration, in 116.7 years. Belgium and Sweden, with natural increase rates of 0.1 percent, are doubling in about 700 years. Ukraine, on the other hand, with a growth rate of -0.8 percent, will lose about 40 percent of its population in the next 50 years. The world growth rate is now 1.2 percent, which means that the population will double in about 58 years if this rate persists.

Life span and life expectancy describe our potential longevity

Life span is the oldest age to which a species is known to survive. Although there are many claims in ancient literature of kings living a millennium or more, the oldest age that can be certified by written records was that of Jeanne Louise Calment of Arles, France, who was 122 years old at her death in 1997. The aging process is still a medical mystery, but it appears that cells in our bodies have a limited ability to repair damage and produce new components. At some point they simply wear out, and we fall victim to disease, degeneration, accidents, or senility.

Life expectancy is the average age that a newborn infant can expect to attain in any given society. It is another way of expressing the average age at death. For most of human history, we believe that average life expectancy in most societies has been about 30 years. This doesn't mean that no one lived past age 40, but rather that so many deaths at earlier ages (mostly early childhood) balanced out those who managed to live longer.

Declining mortality, not rising fertility, is the primary cause of most population growth in the past 300 years. Crude death rates began falling in western Europe during the late 1700s. Most of this advance in survivorship came long before the advent of modern medicine and is due primarily to better food and better sanitation.

The twentieth century has seen a global transformation in human health unmatched in history. This revolution can be seen in the dramatic increases in life expectancy in most places. Worldwide, the average life expectancy has risen from about 30 to 65 years over the past century (see fig. 6.5). Table 7.4 shows gains in some selected countries. Globally, the number of people

TABLE 7.4
Life Expectancy at Birth for Selected Countries in 1900 and 2006

Country	1900		2006	
	Males	Females	Males	Females
India	23	23	62	63
Japan	42	44	79	86
Russia	31	33	59	72
Sweden	57	60	78	83
United States	46	48	75	80

Source: Population Reference Bureau, 2006.

over 60 years old is expected to triple, increasing from 600 million today to nearly 2 billion in 2050. The oldest old (60 years) is projected to grow five-fold to about 400 million that same period.

The greatest progress in life expectancy has been in developing countries. Take the case of Nicaragua, for example. In 19 the average Nicaraguan man could expect to live only 29 years while the average woman would reach just 33 years. By 2006, although Nicaragua had an annual per capita income of about (U.S.)\$3,600, the average life expectancy for both men and women had more than doubled and was close to that of countries with ten times its income level. Longer lives were due primarily to better nutrition, improved sanitation, clean water, and education rather than miracle drugs or high-tech medicine. While the gains were not as great for the already industrialized countries, residents of the United States, Italy, and Japan, for example, now live about half-again as long as they did at the beginning of the twentieth century.

As figure 7.10 shows, there is a good correlation between annual income and life expectancy up to about (U.S.) \$4,000 per person. Beyond that level—which is generally enough for adequate food, shelter, and sanitation for most people—life expectancies level out at about 75 years for men and 85 for women.

Large discrepancies in how benefits of modernization and social investment are distributed within countries are revealed in differential longevity of various groups. The greatest life expectancy reported anywhere in the United States is for Asian American women in New Jersey, who live to an average age of 91. By contrast, Native American men on Pine Ridge Indian Reservation in neighboring South Dakota, live, on average, only to age 48. Only a few countries in Africa have a lower life expectancy. The Pine Ridge Reservation is the poorest area in America with an unemployment rate near 75 percent and high rates of poverty, alcoholism, drug use, and cultural alienation. Similarly, African-American men in Washington, D.C., live, on average, only 57.9 years, or less than men in Lesotho or Swaziland.

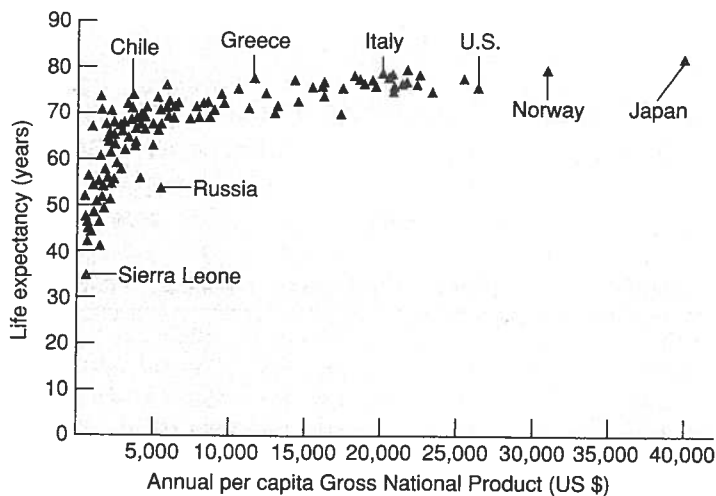


FIGURE 7.10 As incomes rise, so does life expectancy up to about (U.S.) \$4,000. Russia is an exception, with a life expectancy nearly 20 years less than that of Chile, even though their GNP is about the same.

Source: The World Bank, *World Development Indicators 1997*, the World Bank, Washington, D.C., 1997.

Some demographers believe that life expectancy is approaching a plateau, while others predict that advances in biology and medicine might make it possible to live 150 years or more. If our average age at death approaches 100 years, as some expect, society will be profoundly affected. In 1970 the median age in the United States was 30. By 2100 the median age could be over 60.

If workers continue to retire at 65, half of the population could be unemployed, and retirees might be facing 35 or 40 years of retirement. We may need to find new ways to structure and finance our lives.

Living longer has demographic implications

A population that is growing rapidly by natural increase has more young people than does a stationary population. One way to show these differences is to graph age classes in a histogram as shown in figure 7.11. In Niger, which is growing at a rate of 3.4 percent per year, 49 percent of the population is in the prereproductive category (below age 15). Even if total fertility rates were to fall abruptly, the total number of births, and population size, would continue to grow for some years as these young people enter reproductive age. This phenomenon is called population momentum.

By contrast, a country with a stable population, like Sweden, has nearly the same number in each age cohort. A population that has recently entered a lower growth rate pattern, such as Singapore, has a bulge in the age classes for the last high-birth-rate generation. Notice that there are more females than males in the older age group in Sweden because of differences in longevity between the sexes.

Both rapidly growing countries and slowly growing countries can have a problem with their **dependency ratio**, or the number of nonworking compared to working individuals in a population. In Mexico, for example, each working person supports

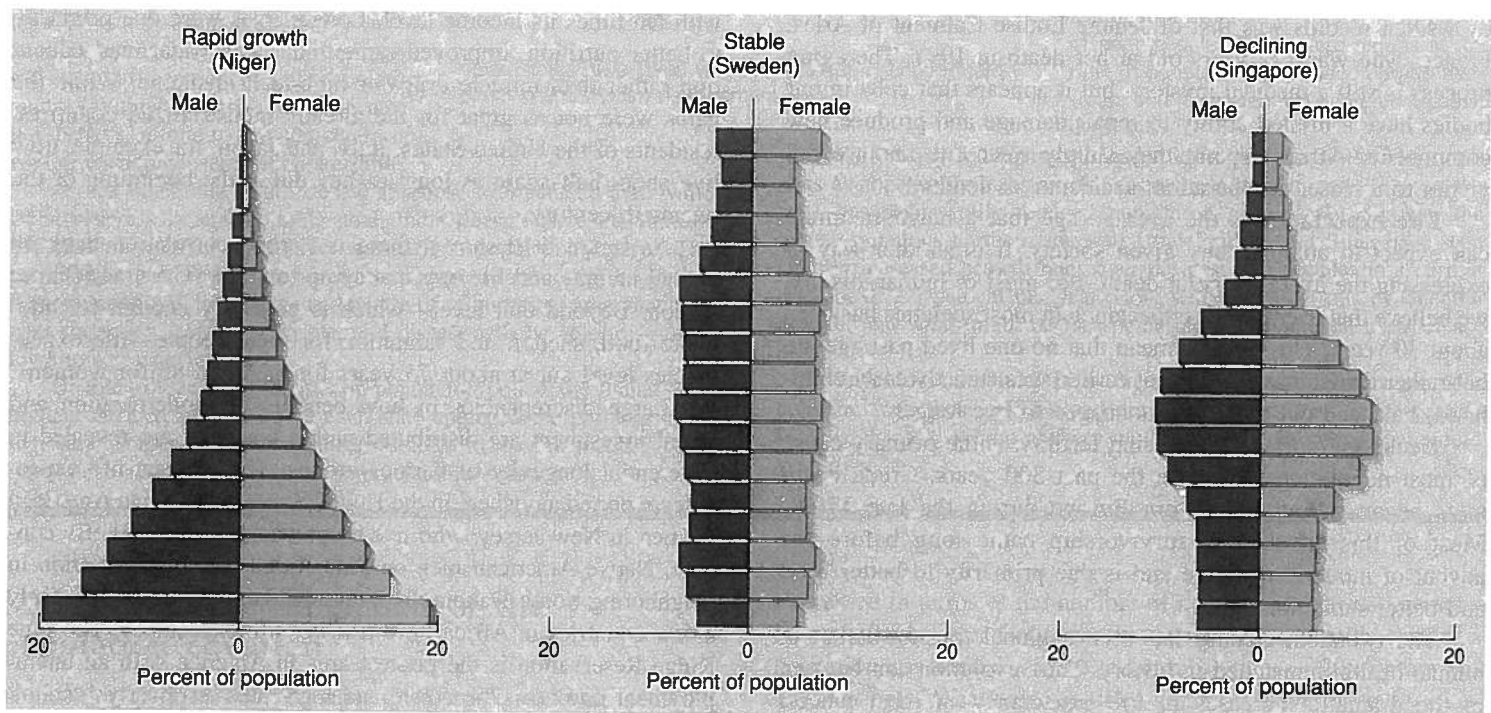


FIGURE 7.11 Age structure graphs for rapidly growing, stable, and declining populations.

Source: U.S. Census Bureau, 2006.

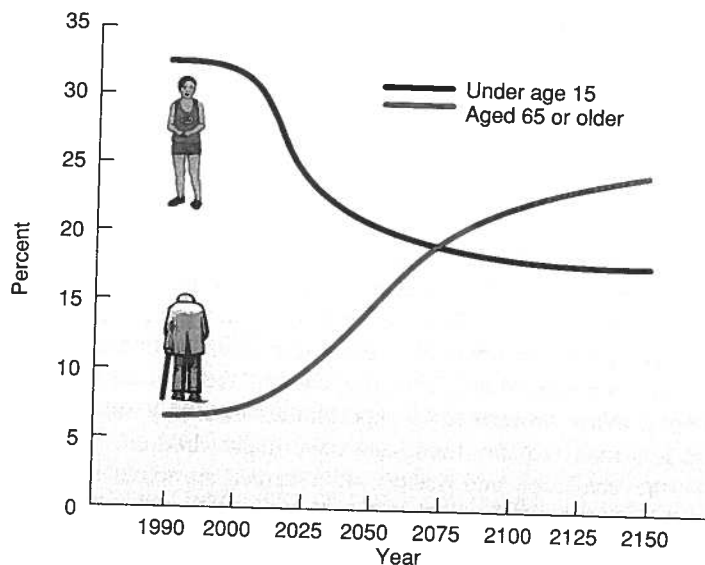


FIGURE 7.12 By the mid-twenty-first century, children under age 15 will make up a smaller percentage of world population, while people over age 65 will contribute a larger and larger share of the population.

a high number of children. In the United States, by contrast, a declining working population is now supporting an ever larger number of retired persons and there are dire predictions that the social security system will soon be bankrupt. This changing age structure and shifting dependency ratio are occurring worldwide (fig. 7.12). By 2050 the UN predicts there will be two older persons for every child in the world. Many countries are rethinking their population policies and beginning to offer incentives for marriage and child-rearing.

Emigration and immigration are important demographic factors

Humans are highly mobile, so emigration and immigration play a larger role in human population dynamics than they do in those of many species. Currently, about 800,000 people immigrate legally to the United States each year, but many more enter illegally. Western Europe receives about 1 million applications each year for asylum from economic chaos and wars in former socialist states and the Middle East. The United Nations High Commission on Refugees reported that in 2006 there were 20.8 million refugees who had left their countries for political or economic reasons, while about 25 million more were displaced persons in their own countries, and 175 million migrants had left their homes to look for work, greater freedom, or better opportunities.

The more-developed regions are expected to gain about 2 million immigrants per year for the next 50 years. Without migration, the population of the wealthiest countries would already be declining and would be more than 126 million less than the current 1.2 billion by 2050. In 2006, nearly 42 million

U.S. residents (14.5 percent of the total population) classified themselves as Hispanic or Latino. They now constitute the largest U.S. minority.

Immigration is a controversial issue in many countries. "Guest workers" often perform heavy, dangerous, or disagreeable work that citizens are unwilling to do. Many migrants and workers are of a different racial or ethnic background than the majority in their new home. They generally are paid low wages and given substandard housing, poor working conditions, and few rights. Local residents often complain, however, that immigrants take away jobs, overload social services, and ignore established rules of behavior or social values. Anti-immigrant groups are springing up in many rich countries.

Some nations encourage, or even force, internal mass migrations as part of a geopolitical demographic policy. In the 1970s, Indonesia embarked on an ambitious "transmigration" plan to move 65 million people from the overcrowded islands of Java and Bali to relatively unpopulated regions of Sumatra, Borneo, and New Guinea. Attempts to turn rainforest into farmland had disastrous environmental and social effects, however, and the plan was greatly scaled back. China has announced a plan to move up to 100 million people to a sparsely populated region along the Amur River in Heilongjiang. By some estimates, more than 250 million internal migrants in China have moved from rural areas to the cities to look for work.

7.4 IDEAL FAMILY SIZE IS CULTURALLY AND ECONOMICALLY DEPENDENT

A number of social and economic pressures affect decisions about family size, which in turn affects the population at large. In this section we will examine both positive and negative pressures on reproduction.

Many factors increase our desire for children

Factors that increase people's desires to have babies are called **pronatalist pressures**. Raising a family may be the most enjoyable and rewarding part of many people's lives. Children can be a source of pleasure, pride, and comfort. They may be the only source of support for elderly parents in countries without a social security system. Where infant mortality rates are high, couples may need to have many children to be sure that at least a few will survive to take care of them when they are old. Where there is little opportunity for upward mobility, children give status in society, express parental creativity, and provide a sense of continuity and accomplishment otherwise missing from life. Often children are valuable to the family not only for future income but even more as a source of current income and help with household chores. In much of the developing world, children as young as 6 years old tend domestic animals and younger siblings, fetch water, gather firewood, and help grow crops or sell things in the

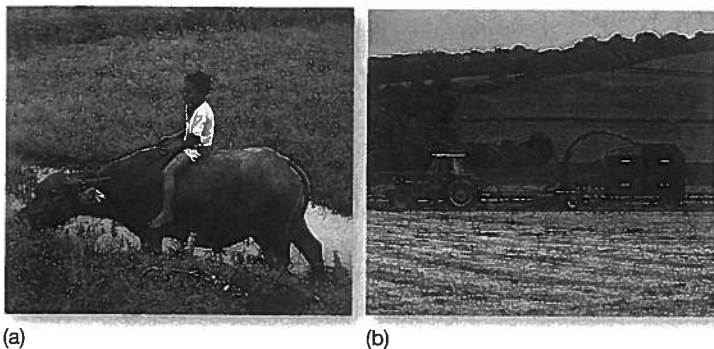


FIGURE 7.13 In rural areas with little mechanized agriculture (a) children are needed to tend livestock, care for younger children, and help parents with household chores. Where agriculture is mechanized (b) rural families view children just as urban families do—helpful, but not critical to survival. This affects the decision about how many children to have.

marketplace (fig. 7.13) Parental desire for children rather than an unmet need for contraceptives may be the most important factor in population growth in many cases.

Society also has a need to replace members who die or become incapacitated. This need often is codified in cultural or religious values that encourage bearing and raising children. In some societies, families with few or no children are looked upon with pity or contempt. The idea of deliberately controlling fertility may be shocking, even taboo. Women who are pregnant or have small children are given special status and protection. Boys frequently are more valued than girls because they carry on the family name and are expected to support their parents in old age. Couples may have more children than they really want in an attempt to produce a son.

Male pride often is linked to having as many children as possible. In Niger and Cameroon, for example, men, on average, want 12.6 and 11.2 children, respectively. Women in these countries consider the ideal family size to be only about one-half that desired by their husbands. Even though a woman might desire

fewer children, however, she may have few choices and little control over her own fertility. In many societies, a woman has no status outside of her role as wife and mother. Without children, she has no source of support.

Other factors discourage reproduction

In more highly developed countries, many pressures tend to reduce fertility. Higher education and personal freedom for women often result in decisions to limit childbearing. The desire to have children is offset by a desire for other goods and activities that compete with childbearing and childbearing for time and money. When women have opportunities to earn a salary, they are less likely to stay home and have many children. Not only are the challenge and variety of a career attractive to many women, but the money that they can earn outside the home becomes an important part of the family budget. Thus, education and socioeconomic status are usually inversely related to fertility in richer countries. In developing countries, however, fertility is likely to increase as educational levels and socioeconomic status rise. With higher income, families are better able to afford the children they want; more money means that women are likely to be healthier, and therefore better able to conceive and carry a child to term.

In less-developed countries where feeding and clothing children can be a minimal expense, adding one more child to a family usually doesn't cost much. By contrast, raising a child in the United States can cost hundreds of thousands of dollars by the time the child is through school and is independent. Under these circumstances, parents are more likely to choose to have one or two children on whom they can concentrate their time, energy, and financial resources.

Figure 7.14 shows U.S. birth rates between 1910 and 2000. As you can see, birth rates have fallen and risen in a complex pattern. The period between 1910 and 1930 was a time of industrialization and urbanization. Women were getting more education

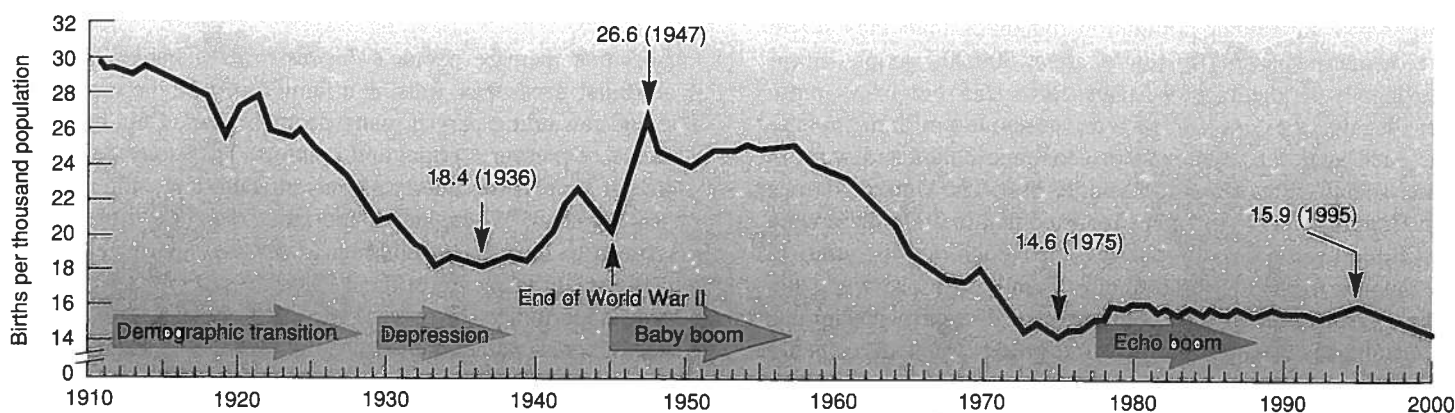


FIGURE 7.14 Birth rates in the United States, 1910–2000. The falling birth rate from 1910 to 1929 represents a demographic transition from an agricultural to an industrial society. The baby boom following World War II lasted from 1945 to 1965. A much smaller “echo boom” occurred around 1980 when the baby boomers started to reproduce.

Source: Data from Population Reference Bureau and U.S. Bureau of the Census.

than ever before and entering the workforce. The Great Depression in the 1930s made it economically difficult for families to have children, and birth rates were low. The birth rate increased at the beginning of World War II (as it often does in wartime). For reasons that are unclear, a higher percentage of boys are usually born during war years.

At the end of the war, there was a “baby boom” as couples were reunited and new families started. This high birth rate persisted through the times of prosperity and optimism of the 1950s, but began to fall in the 1960s. Part of this decline was caused by the small number of babies born in the 1930s. This meant fewer young adults to give birth in the 1960s. Part was due to changed perceptions of the ideal family size. Whereas in the 1950s women typically wanted four children or more, in the 1970s the norm dropped to one or two (or no) children. A small “echo boom” occurred in the 1980s as people born in the 1960s began to have babies, but changing economics and attitudes seem to have permanently altered our view of ideal family size in the United States.

Think About It

How many children (if any) do you want to have? Is this number different from that of your parents or grandparents? Why or why not?

Could we have a birth dearth?

Most European countries now have birth rates below replacement rates, and Italy, Russia, Austria, Germany, Greece, and Spain are experiencing negative rates of natural population increase. Asia, Japan, Singapore, and Taiwan are also facing a “child shock” as fertility rates have fallen well below the replacement level of 2.1 children per couple. There are concerns in all these countries about falling military strength (lack of soldiers), economic power (lack of workers), and declining social systems (not enough workers and taxpayers) if low birth rates persist or are not balanced by immigration. In a sense, the United States is fortunate to have a high influx of immigrants that provides youth and energy to its population.

Economist Ben Wattenberg warns that this “birth dearth” might seriously erode the powers of Western democracies in world affairs. He points out that Europe and North America accounted for 22 percent of the world’s population in 1950. By the 1980s, this number had fallen to 15 percent, and by the year 2030, Europe and North America probably will make up only 9 percent of the world’s population. Germany, Hungary, Denmark, and Russia now offer incentives to encourage women to bear children. Japan offers financial support to new parents, and Singapore provides a dating service to encourage marriages among the upper classes as a way of increasing population.

On the other hand, since Europeans and North Americans consume so many more resources per capita than most other people in the world, a reduction in the population of these countries will do more to spare the environment than would a reduction in population almost anywhere else.

One reason that birth rates have been falling in many industrialized countries may be that toxins and endocrine hormone disruptors in our environment interfere with sperm production. Sperm numbers and quality (fertilization ability) appear to have fallen about half over the past 50 years in a number of countries. Widespread chemicals, such as phthalates—common ingredient in plastics—that disrupt sperm production may be responsible for this decline. We’ll discuss this further in chapter 8.

7.5 A DEMOGRAPHIC TRANSITION CAN LEAD TO STABLE POPULATION SIZE

In 1945, demographer Frank Notestein pointed out that a typical pattern of falling death rates and birth rates due to improving conditions usually accompanies economic development. He called this pattern the **demographic transition** from high birth and death rates to lower birth and death rates. Figure 7.15 shows an idealized model of a demographic transition. This model is often used to explain connections between population growth and economic development.

Economic and social development influence birth and death rates

Stage I in figure 7.15 represents the conditions in a premodern society. Food shortages, malnutrition, lack of sanitation and medicine, accidents, and other hazards generally keep death rates high in such a society around 35 per 1,000 people. Birth rates are correspondingly high to keep population densities relatively constant. As economic development brings better jobs, medical care, sanitation, and a generally improved standard of living in Stage II, death rates often fall very rapidly. Birth rates may actually rise at first as more money and better nutrition allow people to have the children they always wanted. Eventually, in a mature industrial economy (Stage III), birth rates fall as people see that their children are more likely to survive and that the whole family benefits from concentrating more resources on fewer children. Note that population continues to grow rapidly during this stage because of population momentum (baby boomers reaching reproductive age). Depending on how long it takes to complete the transition, the population may go through one or more rounds of doubling before coming into balance again.

Stage IV in figure 7.15 represents conditions in developed countries, where the transition is complete and both birth and death rates are low, often, a third or less than those in the predevelopment era. The population comes into a new equilibrium in this phase, but at a much larger size than before. Most of the countries of northern and western Europe went through the demographic transition in the nineteenth or early twentieth century similar to the curves shown in this figure.

Many of the most rapidly growing countries in the world today, such as Kenya, Yemen, Libya, and Jordan, now are in the Stage II of this demographic transition. Their death rates have fallen

The Demographic Transition Model

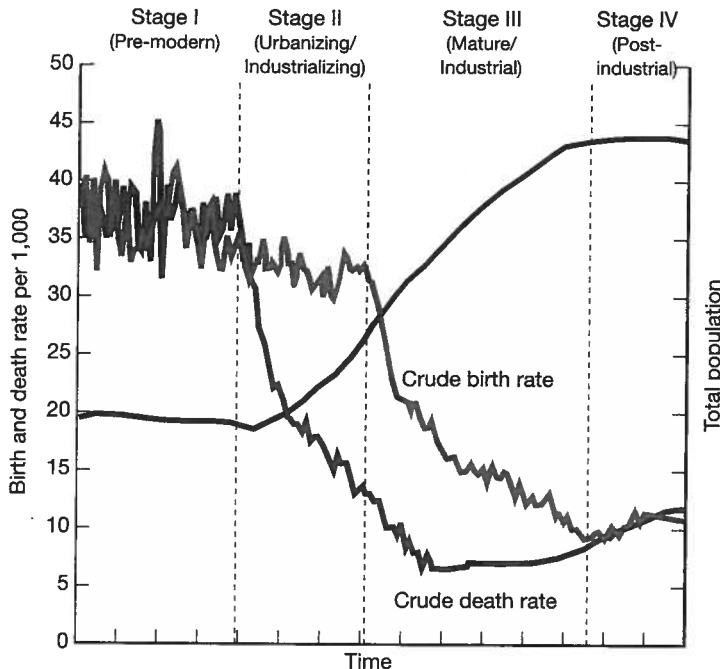


FIGURE 7.15 Theoretical birth, death, and population growth rates in a demographic transition accompanying economic and social development. In a predevelopment society, birth and death rates are both high, and total population remains relatively stable. During development, death rates tend to fall first, followed in a generation or two by falling birth rates. Total population grows rapidly until both birth and death rates stabilize in a fully developed society.

close to the rates of the fully developed countries, but birth rates have not fallen correspondingly. In fact, both their birth rates and total population are higher than those in most European countries when industrialization began 300 years ago. The large disparity between birth and death rates means that many developing countries now are growing at 3 to 4 percent per year. Such high growth rates in developing countries could boost total world population to 9 billion or more before the end of the twenty-first century. This raises what may be the two most important questions in this entire chapter: Why are birth rates not yet falling in these countries, and what can be done about it?

There are reasons to be optimistic about population

Four conditions are necessary for a demographic transition to occur: (1) improved standard of living, (2) increased confidence that children will survive to maturity, (3) improved social status of women, and (4) increased availability and use of birth control. As the example of Thailand in the opening case study for this chapter shows, these conditions can be met, even in relatively poor countries.

Some demographers claim that a demographic transition already is in progress in most developing nations. Problems in taking censuses and a normal lag between falling death and birth rates may hide this for a time, but the world population should stabilize sometime in the next century. Some evidence supports this view. As we mentioned earlier in this chapter, fertility rates have fallen dramatically nearly everywhere in the world over the past half century.

Some countries have had remarkable success in population control. In Thailand, Indonesia, Colombia, and Iran, for instance, total fertility dropped by more than half in 20 years. Morocco, Dominican Republic, Jamaica, Peru, and Mexico all have seen fertility rates fall between 30 percent and 40 percent in a single generation. The following factors could contribute to stabilizing populations:

- Growing prosperity and social reforms that accompany development reduce the need and desire for large families in most countries.
- Technology is available to bring advances to the developing world much more rapidly than was the case a century ago, and the rate of technology transfer is much faster than it was when Europe and North America were developing.
- Less-developed countries have historic patterns to follow. They can benefit from our mistakes and chart a course to stability more quickly than they might otherwise do.
- Modern communications (especially television) have caused a revolution of rising expectations that act as a stimulus to spur change and development.

Many people remain pessimistic about population growth

Economist Lester Brown takes a more pessimistic view. He warns that many of the poorer countries of the world appear to be caught in a “demographic trap” that prevents them from escaping from the middle phase of the demographic transition. Their populations are now growing so rapidly that human demands exceed the sustainable yield of local forests, grasslands, croplands, or water resources. The resulting resource shortages, environmental deterioration, economic decline, and political instability may prevent these countries from ever completing modernization. Their populations may continue to grow until catastrophe intervenes.

Many people argue that the only way to break out of the demographic trap is to immediately and drastically reduce population growth by whatever means are necessary. They argue strongly for birth control education and bold national policies to encourage lower birth rates. Some agree with Malthus that helping the poor will simply increase their reproductive success and further threaten the resources on which we all depend. Author Garret Hardin described this view as lifeboat ethics. “Each rich nation,” he said, “amounts to a lifeboat full of comparatively rich people. The poor of the world are in other much more crowded

lifeboats. Continuously, so to speak, the poor fall out of their lifeboats and swim for a while, hoping to be admitted to a rich lifeboat, or in some other way to benefit from the goodies on board. . . . We cannot risk the safety of all the passengers by helping others in need. What happens if you share space in a lifeboat? The boat is swamped and everyone drowns. Complete justice, complete catastrophe.”

Social justice is an important consideration

A third view is that **social justice** (a fair share of social benefits for everyone) is the real key to successful demographic transitions. The world has enough resources for everyone, but inequitable social and economic systems cause maldistributions of those resources. Hunger, poverty, violence, environmental degradation, and overpopulation are symptoms of a lack of social justice rather than a lack of resources. Although overpopulation exacerbates other problems, a narrow focus on this factor alone encourages racism and hatred of the poor. A solution for all these problems is to establish fair systems, not to blame the victims. Small nations and minorities often regard calls for population control as a form of genocide. Figure 7.16 expresses the opinion of many people in less-developed countries about the relationship between resources and population.

An important part of this view is that many of the rich countries are, or were, colonial powers, while the poor, rapidly growing countries were colonies. The wealth that paid for progress and security for developed countries was of course extracted from colonies, which now suffer from exhausted resources, exploding populations, and chaotic political systems. Some of the world's poorest countries such as India, Ethiopia, Mozambique, and Haiti had rich resources and adequate food supplies before they were impoverished by colonialism. Those of us who now enjoy abundance may need to help the poor countries not only as a matter of justice but because we share the same environment.

In addition to considering the rights of fellow humans, we should also consider those of other species. Rather than ask what is the maximum number of humans that the world can possibly support, perhaps we should think about the needs of other creatures. As we convert natural landscapes into agricultural and industrial areas, species are crowded out that may have just as much right to exist as we do. Perhaps we should seek the optimum number of people at which we can provide a fair and decent life for all humans while causing the minimum impact on nonhuman neighbors.

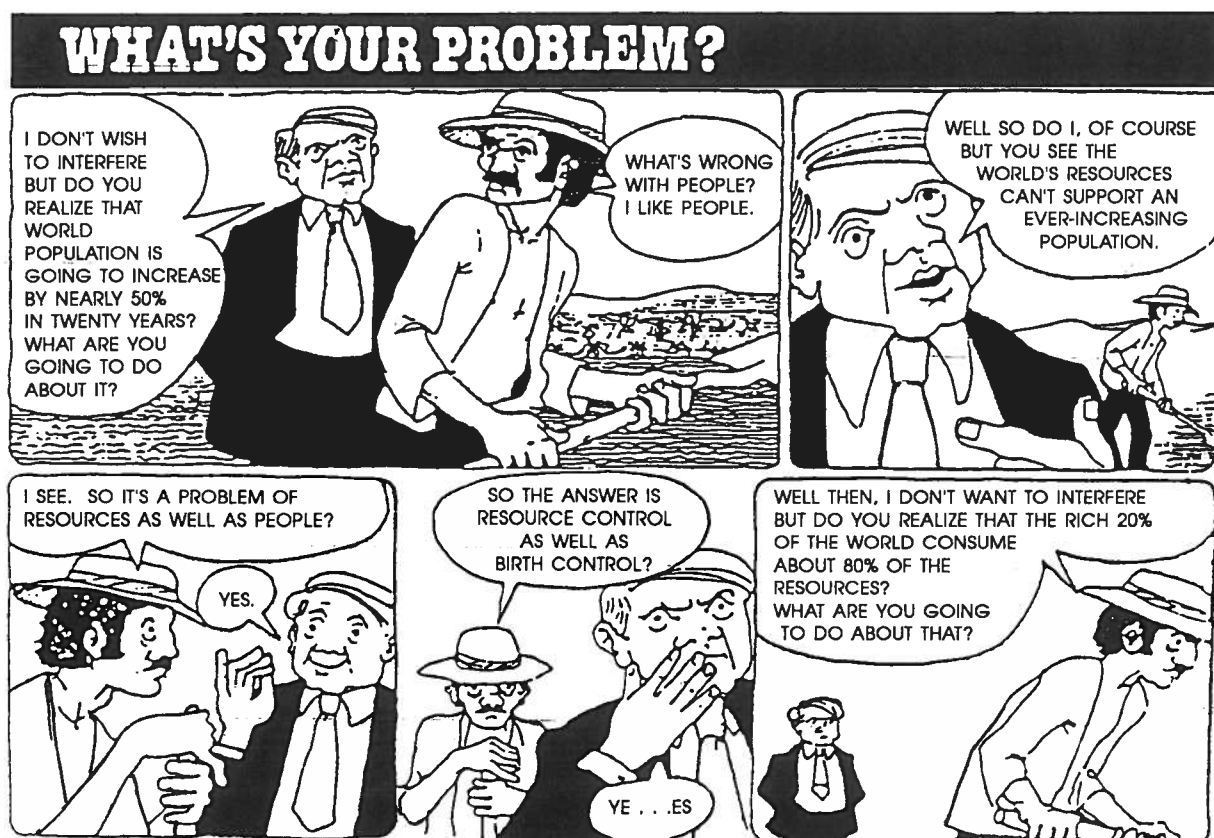


FIGURE 7.16 Controlling our population and resources—there may be more than one side to the issue.

Women's rights affect fertility

Opportunities for education and paying jobs are critical factors in fertility rates (fig. 7.17). Child survival also is crucial in stabilizing population. When Infant and child mortality rates are high, as they are in much of the developing world, parents tend to have high numbers of children to ensure that some will survive to adulthood. There has never been a sustained drop in birth rates that was not first preceded by a sustained drop in infant and child mortality. One of the most important distinctions in our demographically divided world is the high infant mortality rates in the less-developed countries. Better nutrition, improved health care, simple oral rehydration therapy, and immunization against infectious diseases (chapter 8) have brought about dramatic reductions in child mortality rates, which have been accompanied in most regions by falling birth rates. It has been estimated that saving 5 million children each year from easily preventable communicable diseases would avoid 20 or 30 million extra births.

Increasing family income does not always translate into better welfare for children since men in many cultures control most financial assets. Often the best way to improve child survival is to ensure the rights of mothers. Land reform, political rights, opportunities to earn an independent income, and improved health status of women often are better indicators of total fertility and family welfare than rising GNP.

7.6 FAMILY PLANNING GIVES US CHOICES

Family planning allows couples to determine the number and spacing of their children. It doesn't necessarily mean fewer children—people may use family planning to have the maximum number of children possible—but it does imply that the parents will control their reproductive lives and make rational, conscious decisions about how many children they will have and when those children will be born, rather than leaving it to chance. As the desire for smaller families becomes more common, birth control becomes an essential part of family planning in most cases. In this context, **birth control** usually means any method used to reduce births, including abstinence, delayed marriage, contraception, methods that prevent implantation of embryos, and induced abortions. As the opening case study in this chapter shows, there are many ways to encourage family planning.

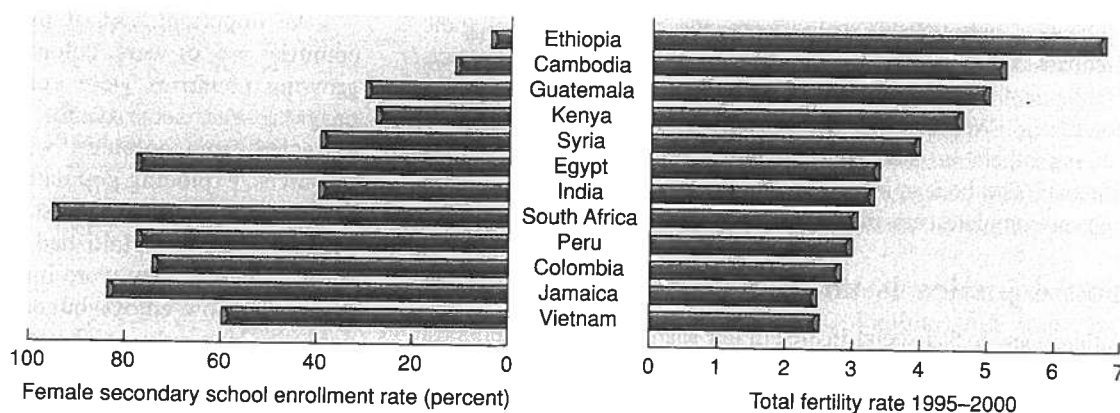


FIGURE 7.17 Total fertility declines as women's education increases.
Source: Worldwatch Institute, 2003.

Fertility control has existed throughout history

Evidence suggests that people in every culture and every historic period have used a variety of techniques to control population size. Studies of hunting and gathering people, such as the !Kung or San of the Kalahari Desert in southwest Africa, indicate that our early ancestors had stable population densities, not because they killed each other or starved to death regularly, but because they controlled fertility.

For instance, San women breast-feed children for three or four years. When calories are limited, lactation depletes body fat stores and suppresses ovulation. Coupled with taboos against intercourse while breast-feeding, this is an effective way of spacing children. Other ancient techniques to control population size include abstinence, folk medicines, abortion, and infanticide. We may find some or all of these techniques unpleasant or morally unacceptable, but we shouldn't assume that other people are too ignorant or too primitive to make decisions about fertility.

Today there are many options

Modern medicine gives us many more options for controlling fertility than were available to our ancestors. The major categories of birth control techniques include (1) avoidance of sex during fertile periods (for example, celibacy or the use of changes in body temperature or cervical mucus to judge when ovulation will occur), (2) mechanical barriers that prevent contact between sperm and egg (for example, condoms, spermicides, diaphragms, cervical caps, and vaginal sponges), (3) surgical methods that prevent release of sperm or egg (for example, tubal ligations in females and vasectomies in males), (4) hormone-like chemicals that prevent maturation or release of sperm or eggs or that prevent embryo implantation in the uterus (for example, estrogen plus progesterone, or progesterone alone, for females: gossypol for males), (5) physical barriers to implantation (for example, intrauterine devices), and (6) abortion.

TABLE 7.5

Some Birth Control Methods and Pregnancy Prevention Rates

Method	Number of Women in 100 Who Become Pregnant
Sterilization (male, female)	<1
IUD	<1
Oral contraceptive (the Pill)	1-2
Hormones (implant, patch, injection, etc.)	1-2
Male condom	11
Sponge and spermicide	14-28
Female condom (e.g., cervical cap)	15-23
Diaphragm together with spermicide	17
Abstinence during fertile periods	20
Morning-after-pill (e.g., Preven)	20
Spermicide alone	20-50
Actively seeking pregnancy	85

Source: U.S. Food and Drug Administration, *Birth Control Guide*, 2003 Revision.

Not surprisingly, the most effective birth control methods are also the ones most commonly used (table 7.5). In the United States, the majority of women younger than 30 who eventually want to become pregnant use the Pill. Most women over 35, with their child-bearing years behind them, choose sterilization. Male condom use is more effective than the remaining techniques in the table, and increases in effectiveness when used with a spermicide. Only 2 to 6 women in a hundred become pregnant in a year using this combination method. Condoms have the added advantage of protecting partners against sexually transmitted diseases, including AIDS, if they are made of latex and used correctly. That may partly explain why their use in the United States went from 3.5 million users in 1980 to 8 million in 2000. Condoms are an ancient birth control method; the Egyptians used them some 3,000 years ago.

More than 100 new contraceptive methods are now being studied, and some appear to have great promise. Nearly all are biologically based (e.g., hormonal), rather than mechanical (e.g., condom, IUD). Recently, the U.S. Food and Drug Administration approved five new birth control products. Four of these use various methods to administer female hormones that prevent pregnancy. Other methods are years away from use, but take a new direction entirely. Vaccines for women are being developed that will prepare the immune system to reject the hormone chorionic gonadotropin, which maintains the uterine lining and allows egg implant, or that will cause an immune reaction against sperm. Injections for men are focused on reducing sperm production, and have proven effective in mice. Without a doubt, the contemporary couple has access to many more birth control options than their grandparents had.

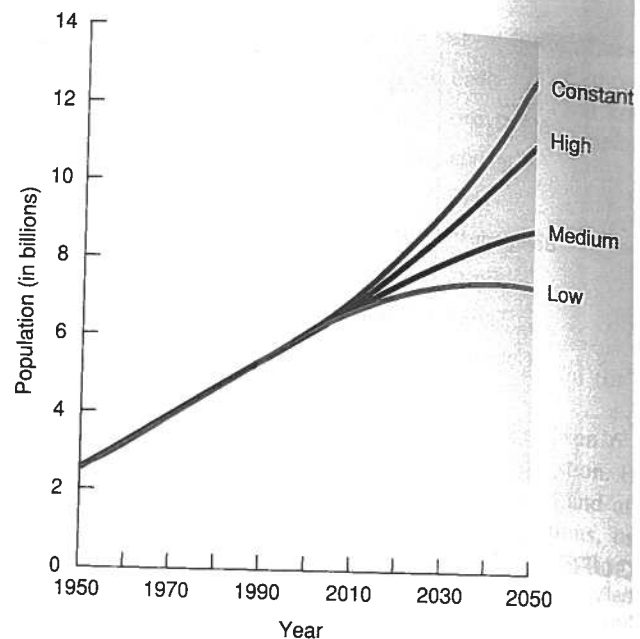


FIGURE 7.18 Population projections for different growth scenarios. Recent progress in family planning and economic development have led to significantly reduced estimates compared to a few years ago. The medium projection is 8.9 billion in 2050, compared to previous estimates of over 10 billion for that date.

Source: UN Population Division, 2004.

7.7 WHAT KIND OF FUTURE ARE WE CREATING?

How many people will be in the world a century from now? Most demographers believe that world population will stabilize some time during the next century. The total number of humans, when we reach that equilibrium, is likely to be somewhere around 8 billion people, depending on the success of family planning programs and the multitude of other factors affecting human populations. Figure 7.18 shows three scenarios projected by the UN Population Division in its 2004 revision. The optimistic (low) projection shows that world population might reach about 7 billion in 2050, and then fall back below 6 billion by 2150. The medium projection suggests that growth might continue to around 8.9 billion in 2050, and then stabilize. The most pessimistic projection assumes a constant rate of growth (no change from present) to 25 billion people by 2150.

Which of these scenarios will we follow? As you have seen in this chapter, population growth is a complex subject. To accomplish a stabilization or reduction of human populations will require substantial changes from business as usual.

An encouraging sign is that worldwide contraceptive use has increased sharply in recent years. About half of the world's married couples used some family planning techniques in 2000, compared to only 10 percent 30 years earlier, but another 100 million couples say they want, but do not have access to, family planning. Contraceptive use varies widely by region. More than

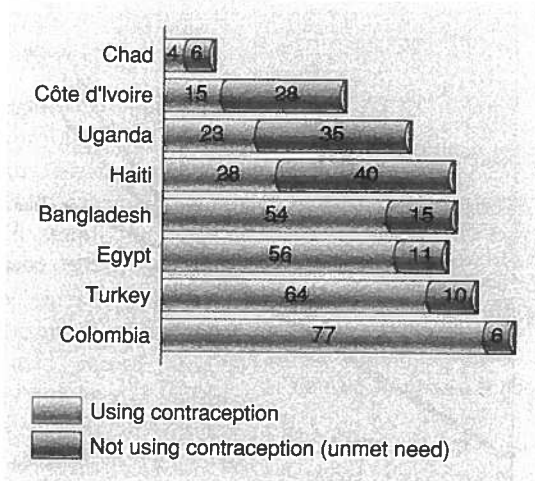


FIGURE 7.19 Unmet need for family planning in selected countries. Globally, more than 100 million women in developing countries would prefer to avoid pregnancy but do not have access to family planning.
Source: Population Reference Bureau, 2003.

70 percent of women in Latin America use some form of birth control, compared to 51 percent in Asia (excluding China), and only 21 percent in Africa.

Figure 7.19 shows the unmet need for family planning among married women in some representative countries. When people in developing countries are asked what they want most, men say they want better jobs, but the first choice for a vast majority of women is family planning assistance. In general, a 15 percent increase in contraceptive use equates to about one fewer birth per woman per lifetime. In Chad, for example, where only 4 percent of all women use contraceptives, the average fertility is 6.6 children per woman. In Columbia, by contrast, where 77 percent of the women who would prefer not to be pregnant use contraceptives, the average fertility is 2.6.

Religion and politics complicate family planning

In 1994, the United Nations convened a historic meeting in Cairo, Egypt, to discuss women's rights and population. The United States played a lead role in the International Conference on Population and Development (ICPD), which identified links between population growth, economic development, environmental degradation, and the social status of women and girls. To address these issues, 179 countries, including the United States, endorsed the goal of universally available reproductive health services, including family planning, by 2015.

Since 2000, however, the United States has refused to reaffirm the ICPD because it maintained that the document could be interpreted as promoting abortion—even though the ICPD clearly states, “In no case should abortion be promoted as a method of family planning.”

In particular, the United States has withheld funds from the United Nations Population Fund (UNFPA) due to claims that, by working in China, the fund tacitly supports the forced abortions reported to be part of that country's one-child policy. A fact-finding team sent to China in 2002 found “no evidence of UNFPA knowledge of or support for such measures,” but funding was still halted. Ms. Thoraya Obaid, executive director of the UNFPA, said her organization “does not, and never will condone or support coercive activities of any kind, anywhere.”

She also said, “The denial of these funds will, unfortunately, significantly affect millions of women and children worldwide for whom the life-saving services provided by the UNFPA will have to be discontinued.” She estimated that the funds withheld by the United States could have prevented 2 million unwanted pregnancies, 800,000 abortions, 4,700 maternal deaths, 60,000 cases of serious maternal illness, and more than 77,000 infant and child deaths.

Many Muslim countries encourage couples to have as many children as possible. Access to birth control is difficult or forbidden outright. Still, some Islamic governments recognize the need for family planning. Iran, for example, decided, in the 1990s, to promote smaller families. It succeeded in cutting birth rates by more than half in ten years.

The World Health Organization estimates that nearly 1 million conceptions occur daily around the world as a result of some 100 million sex acts. At least half of those conceptions are unplanned or unwanted. But there are still places where people desire large families (fig. 7.20).

Deep societal changes are often required to make family planning programs successful. Among the most important of these are (1) improved social, educational, and economic status

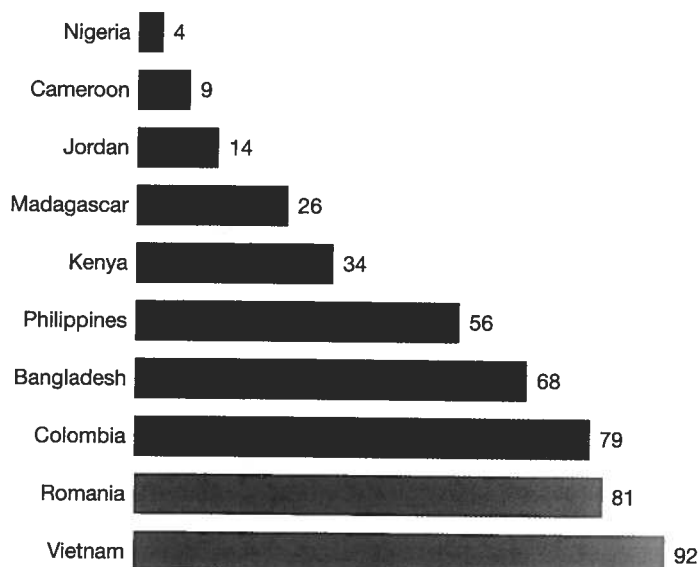


FIGURE 7.20 Percent of married reproductive-age women with two living children who do not want another child.

Data source: UN Population Division, 2006.

for women (birth control and women's rights are often interdependent); (2) improved status for children (fewer children are born as parents come to regard them as valued individuals rather than possessions); (3) acceptance of calculated choice as a valid element in life in general and in fertility in particular (belief that

we have no control over our lives discourages a sense of responsibility); (4) social security and political stability that give people the means and the confidence to plan for the future; (5) knowledge, availability, and use of effective and acceptable means: birth control.

CONCLUSION

A few decades ago, we were warned that a human population explosion was about to engulf the world. Exponential population growth was seen as a cause or corollary to nearly every important environmental problem. Some people still warn that the total number of humans might grow to 30 or 40 billion by the end of this century. Birth rates have fallen, however, almost everywhere, and most demographers now believe that we will reach an equilibrium around 9 billion people in about 2050. Some claim that if we promote equality, democracy, human development, and modern family planning techniques, population might even decline to below its current level of 6.5 billion in the next 50 years. How we should carry out family planning and birth control remains a controversial issue. Should we focus on political and economic reforms, and hope that a demographic transition will

naturally follow; or should we take more direct action (or action) to reduce births?

Whether our planet can support 9 billion—or even 6 billion—people on a long-term basis remains a vital question. If those people try to live at a level of material comfort and affluence now enjoyed by residents of the wealthiest nations, using the old, polluting, inefficient technology that we now employ, the answer is almost certain that even 6 billion people is too many in the long run. If we find more sustainable ways to live, however, it may be that 9 billion people could live happy, comfortable, productive lives. If we don't find new ways to live, we probably face a crisis no matter what happens to our population size. We'll discuss pollution problems, energy sources, and sustainability in subsequent chapters of this book.

REVIEWING LEARNING OUTCOMES

By now you should be able to explain the following points:

- 7.1 Trace the history of human population growth.
 - Human populations grew slowly until relatively recently.
- 7.2 Summarize different perspectives on population growth.
 - Does environment or culture control human populations?
 - Technology can increase carrying capacity for humans.
 - Population growth could bring benefits.
- 7.3 Analyze some of the factors that determine population growth.
 - How many of us are there?
 - Fertility measures the number of children born to each woman.
 - Mortality is the other half of the population equation.
 - Life span and life expectancy describe our potential longevity.
 - Living longer has demographic implications.
 - Emigration and immigration are important demographic factors.
- 7.4 Explain how ideal family size is culturally and economically dependent.
 - Many factors increase our desire for children.
 - Other factors discourage reproduction.
 - Could we have a birth dearth?
- 7.5 Describe how a demographic transition can lead to stable population size.
 - Economic and social development influence birth and death rates.
 - There are reasons to be optimistic about population.
 - Many people remain pessimistic about population growth.
 - Social justice is an important consideration.
 - Women's rights affect fertility.
- 7.6 Relate how family planning gives us choices.
 - Fertility control has existed throughout history.
 - Today there are many options.
- 7.7 Reflect on what kind of future we are creating.
 - Religion and politics complicate family planning.