CHAPTER 2

Population

Field Note Basic Infrastructure

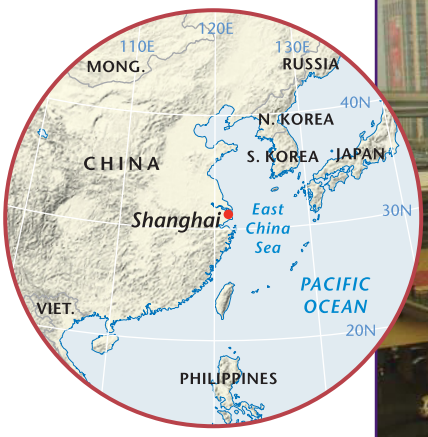


Figure 2.1
Shanghai, China. © Erin H. Fouberg.

The words wafted in the air as my colleague and I took a minute to process them. We were in Shanghai, China, visiting with a Chinese student who had spent a semester at our small college in a town of 26,000 in rural South Dakota. My colleague had asked the student what he missed most about our small town of Aberdeen. He replied without hesitating, "Basic infrastructure."

I thought about brand-new subway lines in Shanghai and Beijing, new airports throughout China, and high-speed trains being built to connect China's cities. I visualized the miles of gleaming new concrete we had driven on that afternoon on the ring highway on the outskirts of Shanghai (Fig. 2.1) and the empty fields where houses or other buildings had been leveled to make room for new high-density housing, more concrete, and more infrastructure. Shanghai's metro system only

dates to 1995. Shanghai now has the longest metro system on Earth—a system capable of transporting 5 million people a day. I thought about the lack of public transportation in my small town. I remembered that in 2010, China committed to spend an additional $1 trillion on urban infrastructure by 2015. I considered the words United States President Barack Obama used as he described, enviously, the infrastructure in China, "their ports, their train systems their airports are all vastly superior to us now."

I looked at the student and said, "Basic infrastructure? But you have better subway lines, high-speed railroads, roads, and airports than we do in the States." "Yes," he said, "But I don't have hot water."

A 2010 report in *Foreign Policy* agreed, "China's biggest urban challenge may be water; already, it has little to spare. Some 70 percent of water use today traces back to agriculture, but demand from urban consumers and commercial enterprise is on the rise. Even if the sheer amount of water isn't the problem, location will be; the country will need to spend more than $120 billion on water systems in the coming years to transport, store, and manage supplies." A graduate student in Beijing reiterated the water problem in China's cities. Her dormitory houses about 1000 students, but they all must walk out of the building to a central facility to shower, and she reported that they are only allowed to shower between 2 and 4 PM or between 9 and 11 PM.

China's population of 1.34 billion people has been migrating to cities in droves since economic reforms began in 1978. In 2011, the population of the world hit 7 billion people, with rising populations in China and India accounting for 40 percent of the population growth. China has undergone incredibly rapid expansion in its mining and manufacturing sectors, resulting in economic growth rates that are often at 10 percent a year. But rapid economic growth took its toll on water quality in China, which exacerbates water shortages in the country.

Providing services for 1.34 billion people is no small feat. Even though demographers now predict China's population will stabilize at 1.4 billion by 2025 and begin to decline after that, shifts in the composition of China's population will continue to challenge the provision of basic infrastructure to the country's people.

Southern, coastal China has a moist climate, much like the southeastern United States, but the climate in northern China is drier. With only 7% of the world's fresh water supply, China has an uphill battle in providing water resources to 1.34 billion people. This challenge is exacerbated by the fact that southern China has 80% of the country's water (*Foreign Policy*, 2011). To remedy the imbalance, China is now building a $60 billion canal system called the South-North Water Transfer Project that will include three different routes to divert water from the Yangtze River in southern China to the cities in the north (Fig. 2.2).

In this chapter, we examine the distribution of the world's population at several scales in order to understand where people live and why they live where they do. We also look into the continued growth of global population, noting that growth rates vary quite widely across our planet. Even as population growth in the wealthier core slows down to near (or below!) zero, it continues in the less wealthy periphery, in some countries at rates far above the global average. No such discussion would be complete without consideration of the health conditions prevailing across the world: health, well-being, and population growth tend to be closely related. And we will study the role of governments in their efforts to control the process.

Figure 2.2
Yixian, China. This canal is part of the South-North Water Transfer Project. The $60 billion project will divert water from southern China to northern China along three different routes.

Key Questions For Chapter 2

1. Where in the world do people live and why?
2. Why do populations rise or fall in particular places?
3. Why does population composition matter?
4. How does the geography of health influence population dynamics?
5. How do governments affect population change?

WHERE IN THE WORLD DO PEOPLE LIVE AND WHY?

When geographers study population, they focus on the variability of demographic features and factors across space. *Demography* is the study of population in general perspective, and population geographers work in tandem with demographers, seeking answers to the problems posed by these variations. The concept of scale is crucial in this research because such variability occurs from region to region, country to country, and within individual countries themselves.

Demographers report the **population density** of a country as a measure of total population relative to land size (Fig. 2.3). Population density assumes an even distribution of the population over the land. The United States, for example, with a territory of 3,717,796 square miles or 9,629,047 square kilometers (including the surfaces of lakes and ponds and coastal waters up to three nautical miles from shore) had a population of 308.2 million in 2010. This yields an average population density for the United States of just over 82 per square mile (32 per sq km). This density figure is also known as the country's **arithmetic population density**, and in a very general way it emphasizes the contrasts between the United States and such countries as Bangladesh (2741 per sq mi or 1058 per sq km), the Netherlands (1046 per sq mile or 404 per sq km), and Japan (875 per sq mile or 338 per sq km).

Field Note

"An overpass across one of Yangon's busy streets provides a good perspective on the press of humanity in lowland Southeast Asia. Whether in urban areas or on small back roads in the countryside, people are everywhere—young and old, fit and infirm. When population densities are high in areas of poverty and unsophisticated infrastructure, vulnerabilities to natural hazards can be particularly great. This became stunningly evident in 2008 when a tropical cyclone devastated a significant swath of the Irrawaddy Delta south of Yangon, killing some 100,000 people and leaving millions homeless."

Figure 2.3
Yangon, Mayanmar (Burma).

No country has an evenly distributed population, and arithmetic population figures do not reflect the emptiness of most of Alaska and the sparseness of population in much of the West. In other cases, it is actually quite misleading. Egypt, with a population of 78.1 million in 2010, has a seemingly moderate arithmetic population density of 78 per square kilometer (201 per sq mi). Egypt's territory of 1,000,445 square kilometers (386,660 sq mi) however, is mostly desert, and the vast majority of the population is crowded into the valley and delta of the Nile River. An estimated 98 percent of all Egyptians live on just 3 percent of the country's land, so, the arithmetic population density figure is meaningless in this case (Fig. 2.4 top, bottom).

Physiologic Population Density

A superior index of population density relates the total population of a country or region to the area of *arable* (farmable) land it contains. This is called the **physiologic population density**, defined as the number of people per unit area of agriculturally productive land. Take again the case of Egypt. Although millions of people live in its great cities (Cairo and Alexandria) and smaller urban centers, the irrigated farmland is densely peopled as well. When we measure the entire population of Egypt relative to the arable land in the country, the resulting physiologic density figure for

Field Note

"The contrasting character of the Egyptian landscape could not be more striking. Along the Nile River, the landscape is one of green fields, scattered trees, and modest houses, as along this stretch of the river's west bank near Luxor (Fig. 2.4 top). But anytime I wander away from the river, brown, wind-sculpted sand dominates the scene as far as the eye can see (Fig. 2.4 bottom). Where people live and what they do is not just a product of culture; it is shaped by the physical environment as well."

Figure 2.4 top
Luxor, Egypt. © Alexander B. Murphy.

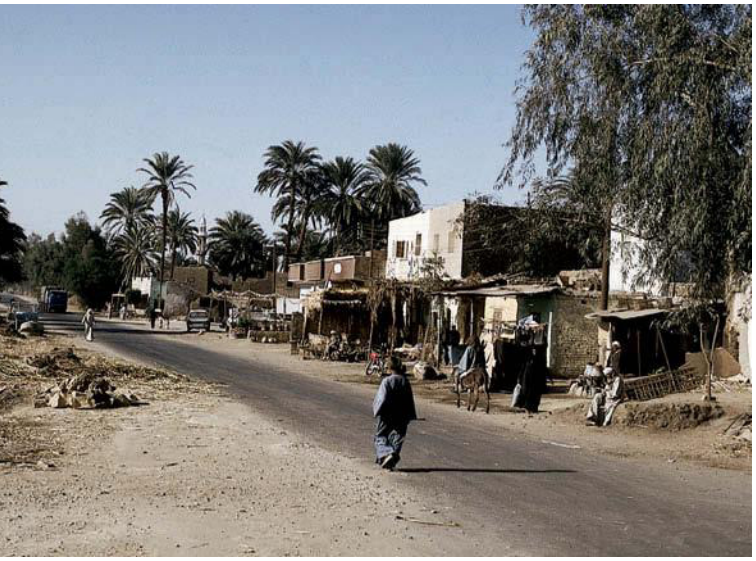


Figure 2.4 bottom
Luxor, Egypt. © Alexander B. Murphy.

Egypt in the year 2010 is 2599 per square kilometer (5717 per sq mi). This number is far more reflective of Egypt's population pressure, and it continues to rise rapidly despite Egypt's efforts to expand its irrigated farmlands.

Appendix B (at the end of this book) provides complete data on both arithmetic and physiologic population densities, and some of the data stand out markedly. Mountainous Switzerland's physiologic density is 10 times as high as its arithmetic density because only 1 out of every 10 acres in Switzerland is arable. Ukraine's population is 45,600,000 and its arithmetic density (population per sq km) is 76. Ukraine has vast farmlands which make its physiologic density 128 people per sq km of arable land. When comparing arithmetic density and physiologic density, the total number of people stays the same, and the only number that changes in calculating each is the amount of land. The difference in arithmetic density and physiologic density for a single country reveals the proportion of arable land to all land. In the case of Ukraine, the physiologic density is 1.68 times as high as the arithmetic density because 1 out of every 1.68 acres of land in Ukraine is arable.

In Appendix B, the countries and territories of Middle America and the Caribbean stand out as having high physiologic densities compared to the moderate physiologic densities for South America. India's physiolog density is the lowest in South Asia despite its huge population. Both China and India have populations well over 1 billion, but according to the physiologic density, India has much more arable land per person than China.

Population Distribution

People are not distributed evenly across the world or within a country. One-third of the world's population lives in China and India. Yet, each country has large expanses of land (the Himalayas in India and a vast interior desert in China) where people are absent or sparsely distributed. In addition to studying population densities, geographers study **population distributions**—descriptions of locations on the Earth's surface where individuals or groups (depending on the scale) live. Geographers often represent population distributions on **dot maps**, in which one dot represents a certain number of a population. At the local scale, a dot map of population can show each individual farm in a sparsely populated rural area. At the global scale, the data are much more generalized. In the following section of this chapter, we study world population distribution and density.

World Population Distribution and Density

From the beginning of humanity, people have been unevenly distributed over the land. Today, contrasts between crowded countrysides and bustling cities on the one hand and empty reaches on the other hand have only intensified. Historically, people tended to congregate in places where they could grow food—making for a high correlation between arable land and population density. Cities began in agricultural areas, and for most of history, people lived closest to the most agriculturally productive areas. In recent history, advances in agricultural technology and in transportation of agricultural goods have begun to change this pattern.

At the global scale, where one dot on a map represents 100,000 people, three major clusters of population jump out (Fig. 2.5). Each of the three largest population clusters is on the Eurasian (Europe and Asia combined) landmass. The fourth largest is in North America.

East Asia

Although the distribution map (Fig. 2.5) requires no color contrasts, Figure 2.6 depicts population density through shading: the darker the color, the larger the number of people per unit area. The most extensive area of dark shading lies in East Asia, primarily in China but also in Korea and Japan. Almost one-quarter of the world's population is concentrated here—over 1.34 billion people in China alone.

In addition to high population density in China's large cities, ribbons of high population density extend into the interior along the Yangtze and Yellow River valleys. Farmers along China's major river valleys produce crops of wheat and rice to feed not only themselves but also the population of major Chinese cities such as Shanghai and Beijing.

South Asia

The second major population concentration also lies in Asia and is similar in many ways to that of East Asia. At the heart of this cluster of more than 1.5 billion people lies India. The concentration extends into Pakistan and Bangladesh and onto the island of Sri Lanka. Here, people again cluster in major cities, on the coasts, and along rivers, such as the Ganges and Indus. The South Asia population cluster is growing more rapidly than the others as a result of China's declining total fertility rate (TFR). Demographers predict that by 2030, 1 out of 6 people in the world will live in India.

Two physical geography barriers create the boundaries of the South Asia population cluster: the Himalaya Mountains to the north and the mountains west of the Indus River Valley in Pakistan. This is a confined region with a rapidly growing population. As in East Asia, the overwhelming majority of the people here are farmers, but in South Asia the pressure on the land is even greater. In Bangladesh, over 152 million people, almost all of them farmers, are crowded into an area about the size of Iowa. Over large parts of Bangladesh the rural population density is between 3000 and 5000 people per square mile. By comparison, in 2010 the population of Iowa was just about 3 million people, and the rural population density was 53 people per square mile.

Europe

An axis of dense population extends from Ireland and the United Kingdom into Russia and includes large parts of Germany, Poland, Ukraine, and Belarus. It also includes the Netherlands and Belgium, parts of France, and northern Italy. This European cluster contains over 715 million inhabitants, less than half the population of the South Asia cluster. A comparison of the population and physical maps indicates that in Europe terrain and environment are not as closely related to population distribution as they are in East and South Asia. For example, note the lengthy extension in Figure 2.5, which protrudes far into Russia. Unlike the Asian extensions, which reflect fertile river valleys, the European extension reflects the orientation of Europe's coal fields. If you look closely at the physical map, you will note that comparatively dense population occurs even in mountainous, rugged country, such as the boundary zone between Poland and its neighbors to the south. A much greater correspondence exists between coastal and river lowlands and high population density in Asia than in Europe generally.

Another contrast can be seen in the number of Europeans who live in cities and towns. The European population cluster includes numerous cities and towns, many of which developed as a result of the Industrial Revolution. In Germany, 88 percent of the people live in urban places; in the United Kingdom, 89 percent; and in France, 74 percent. With so many people concentrated in the cities, the rural countryside is more open and sparsely populated than in East and South Asia (where only about 40 percent of the people reside in cities and towns).

The three major population concentrations we have discussed—East Asia, South Asia, and Europe—account for over 4 billion of the total world population of 7 billion people. Nowhere else on the globe is there a population cluster even half as great as any of these. The populations of South America and Africa combined barely exceed the population of India alone.

North America

North America has one quite densely populated region, stretching along the urban areas of the East Coast, from

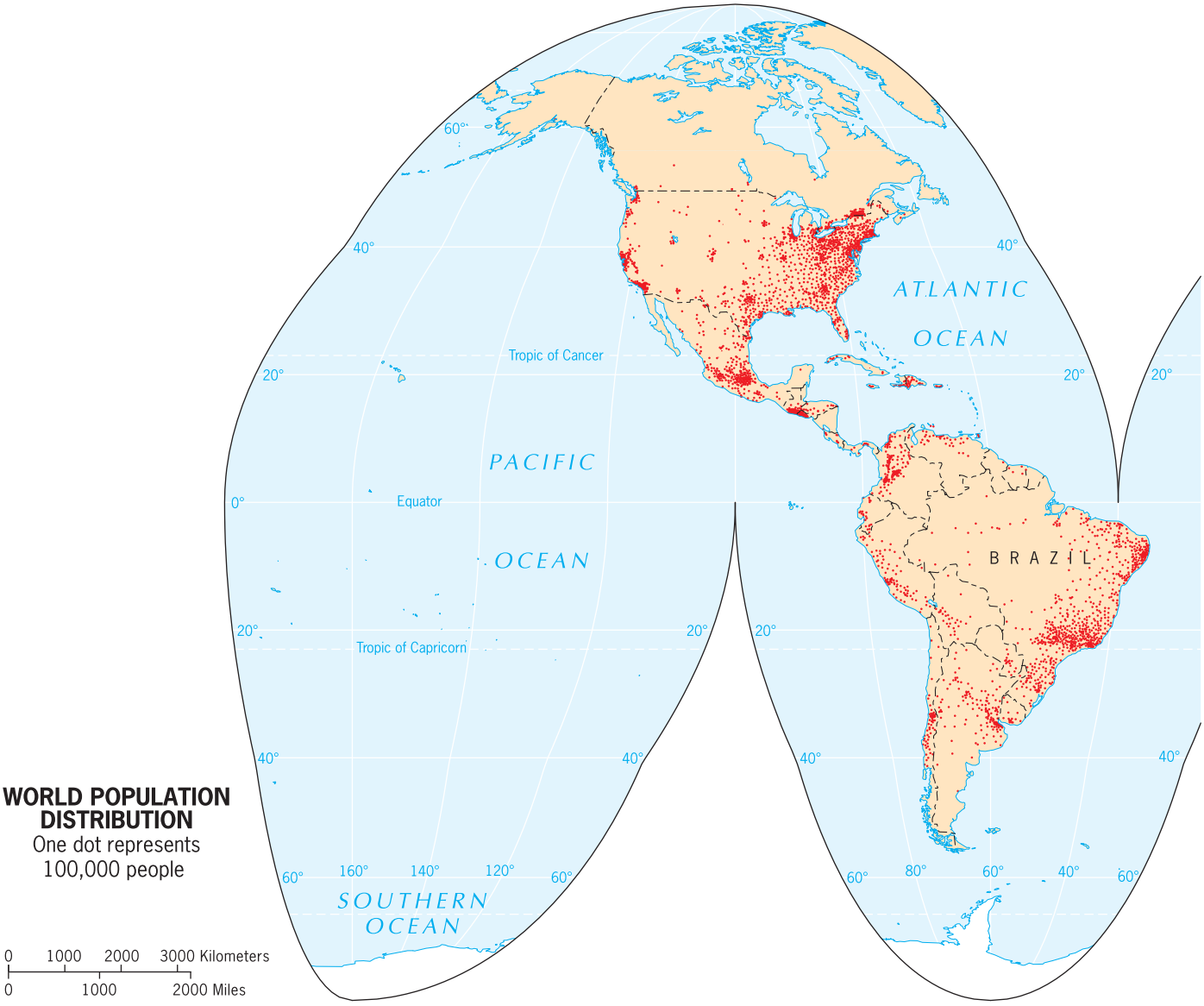
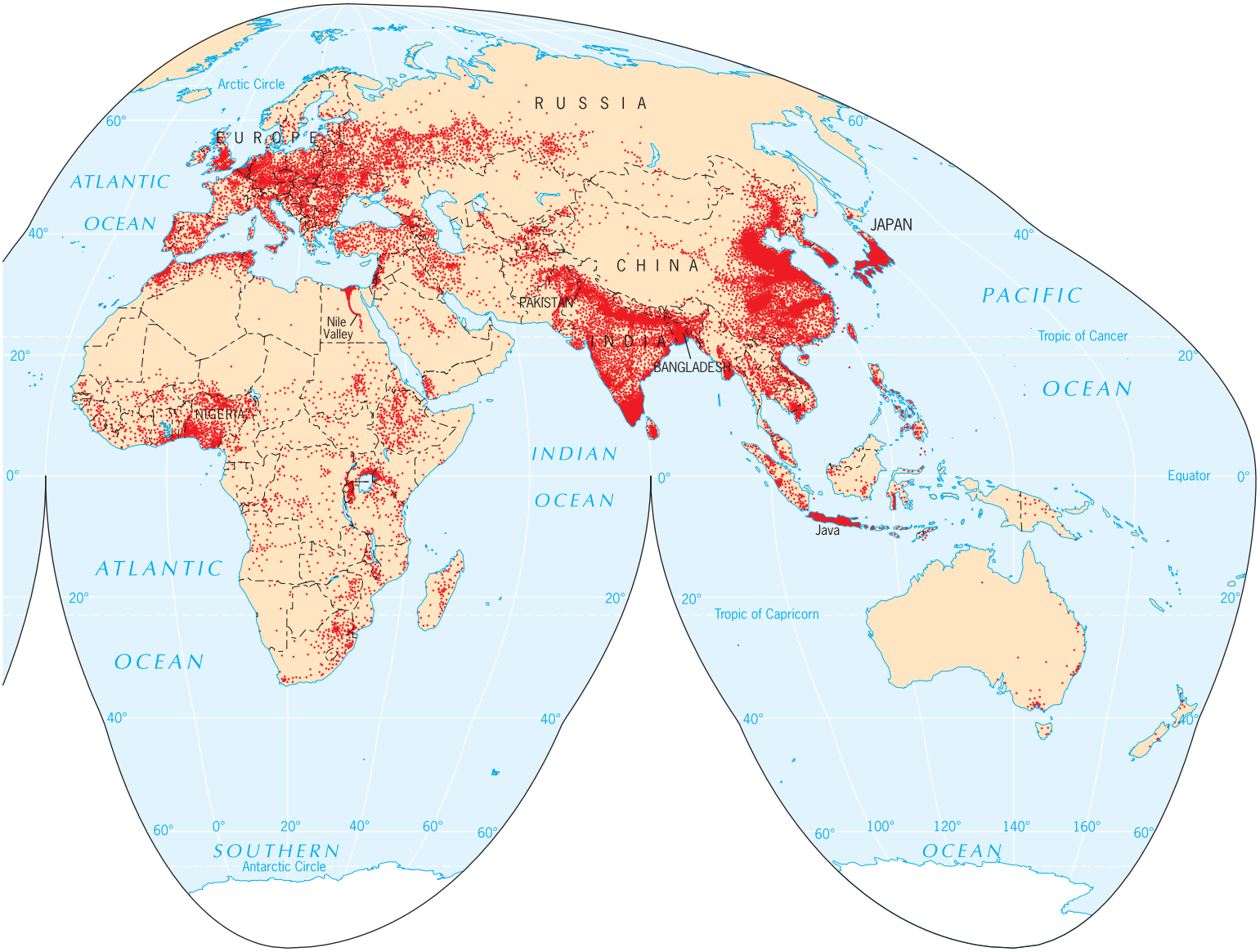


Figure 2.5
World Population Distribution. © H. J. de Blij, P. O. Muller, and John Wiley & Sons, Inc.

Washington, D.C. in the south to Boston, Massachusetts in the north. On Figure 2.5, the cities in this region agglomerate into one large urban area that includes Washington, D.C., Baltimore, Philadelphia, New York City, and Boston. Urban geographers use the term **megalopolis** to refer to such huge urban agglomerations. The cities of megalopolis account for more than 20 percent of the U.S. population.

Look at the global-scale map in Figure 2.6 and notice that the dense population concentration of megalopolis is stretched west into the nearby Canadian cities of Toronto, Ottawa, Montreal, and Quebec City. Adding these Canadian cities to the population of megalopolis creates a population cluster that is about one quarter the size of Europe's population cluster. If you have lived or traveled in megalopolis, you can think about traffic and comprehend what dense population means. However, recognize that the total population of megalopolis is 2.8 percent of the East Asian population cluster and that the 5,309 people per square mile density of New York City does not rival the density in world cities such as Mumbai, India, with a population density of



76,820 per square mile or Jakarta, Indonesia, with a population density of 27,137 per square mile.

Reliability of Population Data

When the United States planned and conducted its 2010 population **census**, the government ran advertisements on television and sent mailings encouraging every person in the country to be counted. State and city governments also recognized the importance of having their citizens counted in order to gain more federal dollars in per capita outlays because much federal government funding depends on population data. If the population of a disadvantaged group is undercounted, it translates into a loss of dollars for city governments that rely on federal government funding to pay for social services to disadvantaged groups. In addition to governments that provide services, advocates for disadvantaged groups encourage people to fill out their census forms: they are concerned that the people already in disadvantaged groups suffer when they are undercounted in the census. Being undercounted also translates into less government representation, for the

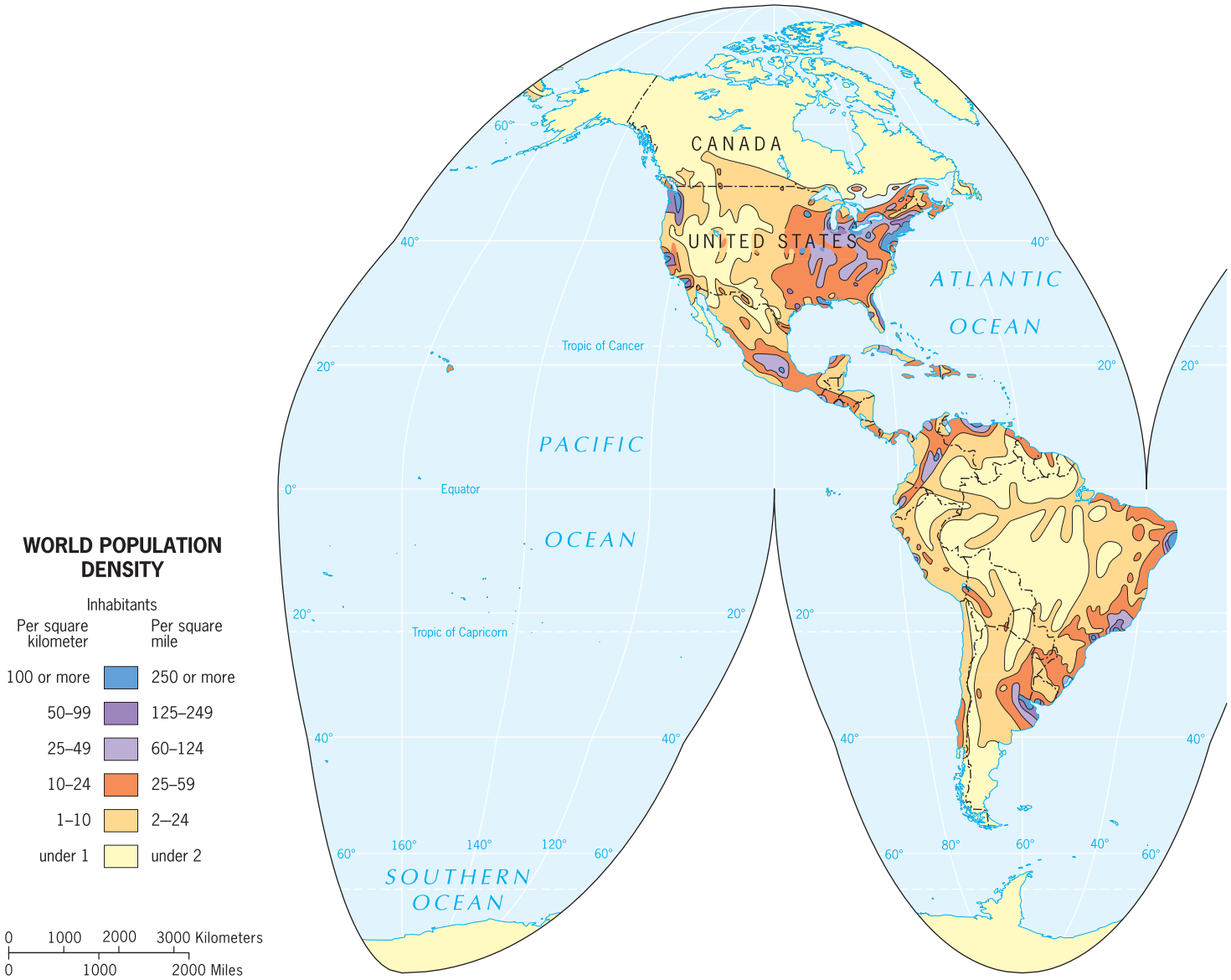


Figure 2.6
World Population Density. © H. J. de Blij, P. O. Muller, and John Wiley & Sons, Inc.

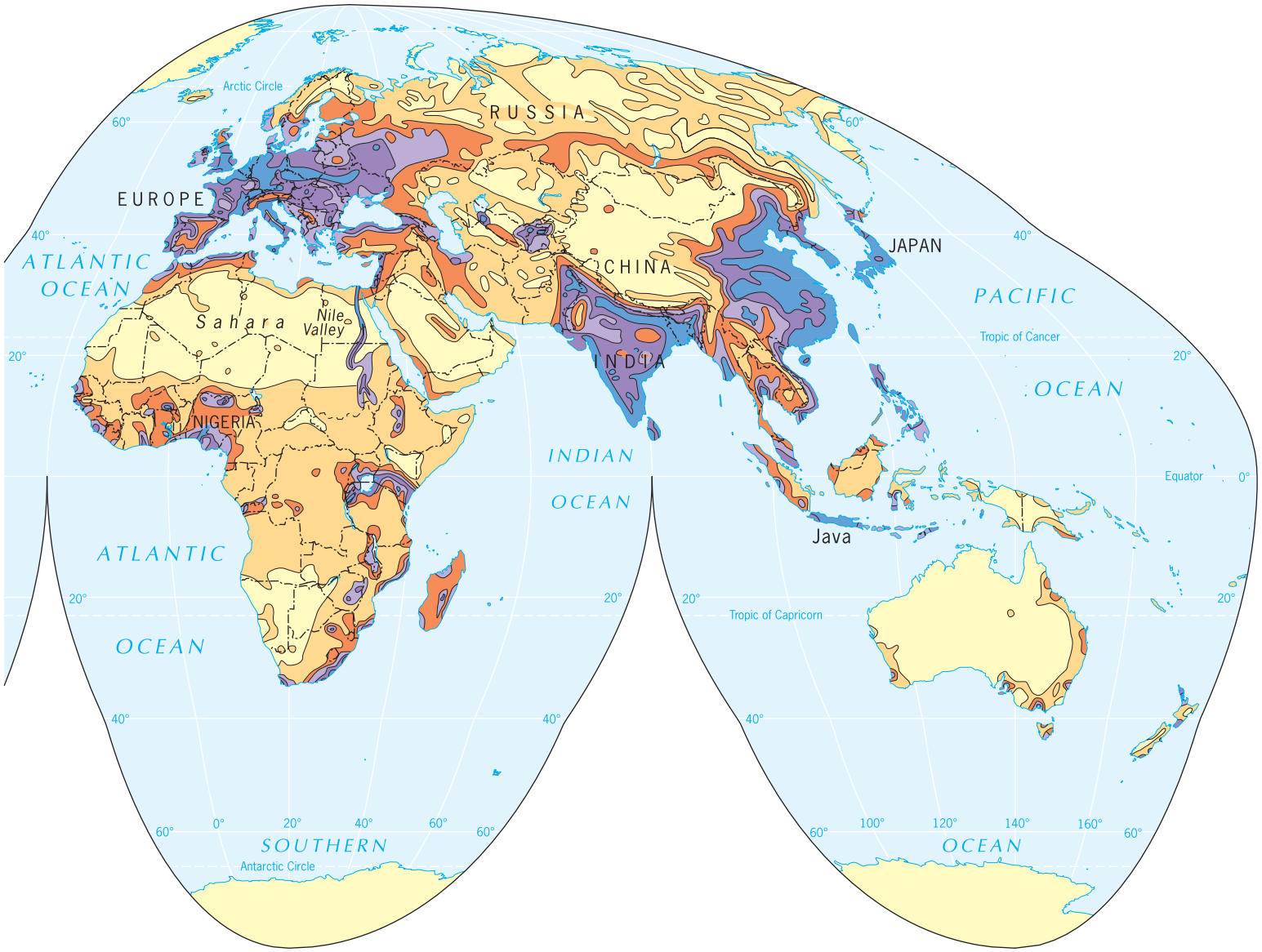
number of congressional seats allotted to each state is based on the census counts.

Advocacy groups urged the census in 2000 and again in 2010 to sample the population and derive population statistics from the samples. They argued that this would more accurately represent the true number of people in the United States. The United States Census Bureau continued to conduct its census as it always has, trying to count each individual in its borders.

If a prosperous country such as the United States has problems conducting an accurate census, imagine the difficulties that must be overcome in less well-off countries. The cost, organization, and reporting of a census go beyond what many countries can afford or handle.

Several agencies collect data on world population. The United Nations records official statistics that national governments assemble and report. The World Bank and the Population Reference Bureau also gather and generate data and report on the population of the world and of individual countries.

If you compare the population data reported by each of these sources, you will find inconsistencies in the data. Data on population, growth rates, food availability, health conditions, and incomes are often informed estimates rather than actual counts.



thinking geographically

As we discussed in the field note at the beginning of this chapter, the populations of China and India account for 40 percent of the world currently, and India is predicted to outpace China's population in the 2030s. How will Figure 2.5 look different 50 years from now? If you were updating this textbook in 50 years, where would the largest population clusters in the world be?

WHY DO POPULATIONS RISE OR FALL IN PARTICULAR PLACES?

In the late 1960s, alarms sounded throughout the world with the publication of Paul Ehrlich's *The Population Bomb*. Ehrlich and others warned that the world's population was increasing too quickly—and was outpacing our food production! We can trace alarms over the burgeoning world population back to 1798, when British economist Thomas Malthus published *An Essay on the Principles of Population*. In this work Malthus warned that

the world's population was increasing faster than the food supplies needed to sustain it. His reasoning was that food supplies grew *linearly*, adding acreage and crops incrementally by year, whereas population grew *exponentially*, compounding on the year before. From 1803 to 1826, Malthus issued revised editions of his essay and responded vigorously to a barrage of criticism.

The predictions Malthus made assumed food production is confined spatially, that what people can eat within a country depends on what is grown in the country. We now know his assumption does not hold true; countries are not closed systems. Malthus did not foresee how globalization would aid the exchange of agricultural goods across the world. Mercantilism, colonialism, and capitalism brought interaction among the Americas, Europe, Africa, Asia, and the Pacific. Through global interaction, new agricultural methods developed, and commodities and livestock diffused across oceans. In the 1700s, farmers in Ireland grew dependent on a South American crop that was well suited for its rocky soils, the potato. Today, wealthier countries that lack arable land, such as Norway, can import the majority of its foodstuffs, circumventing the limitations of their

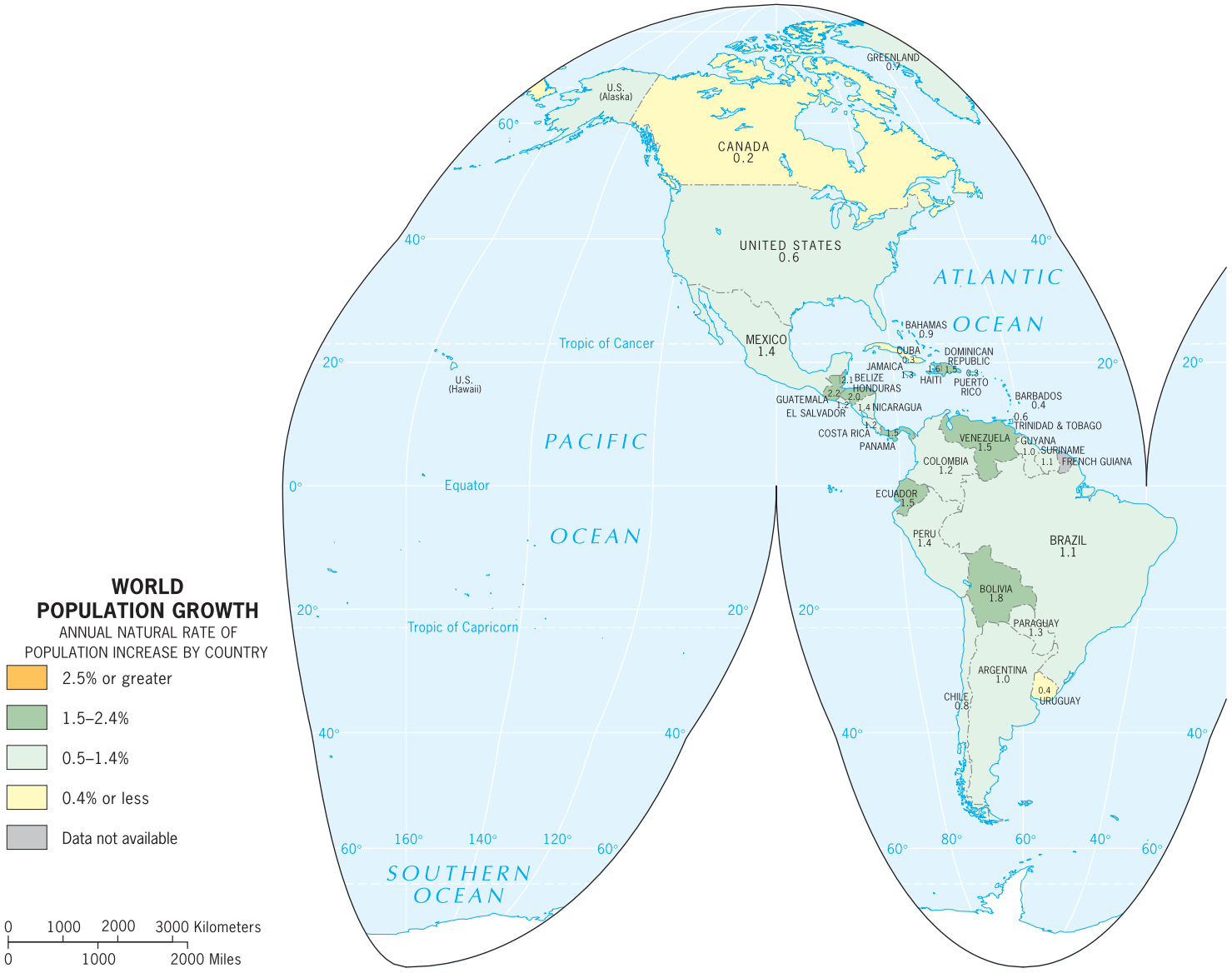


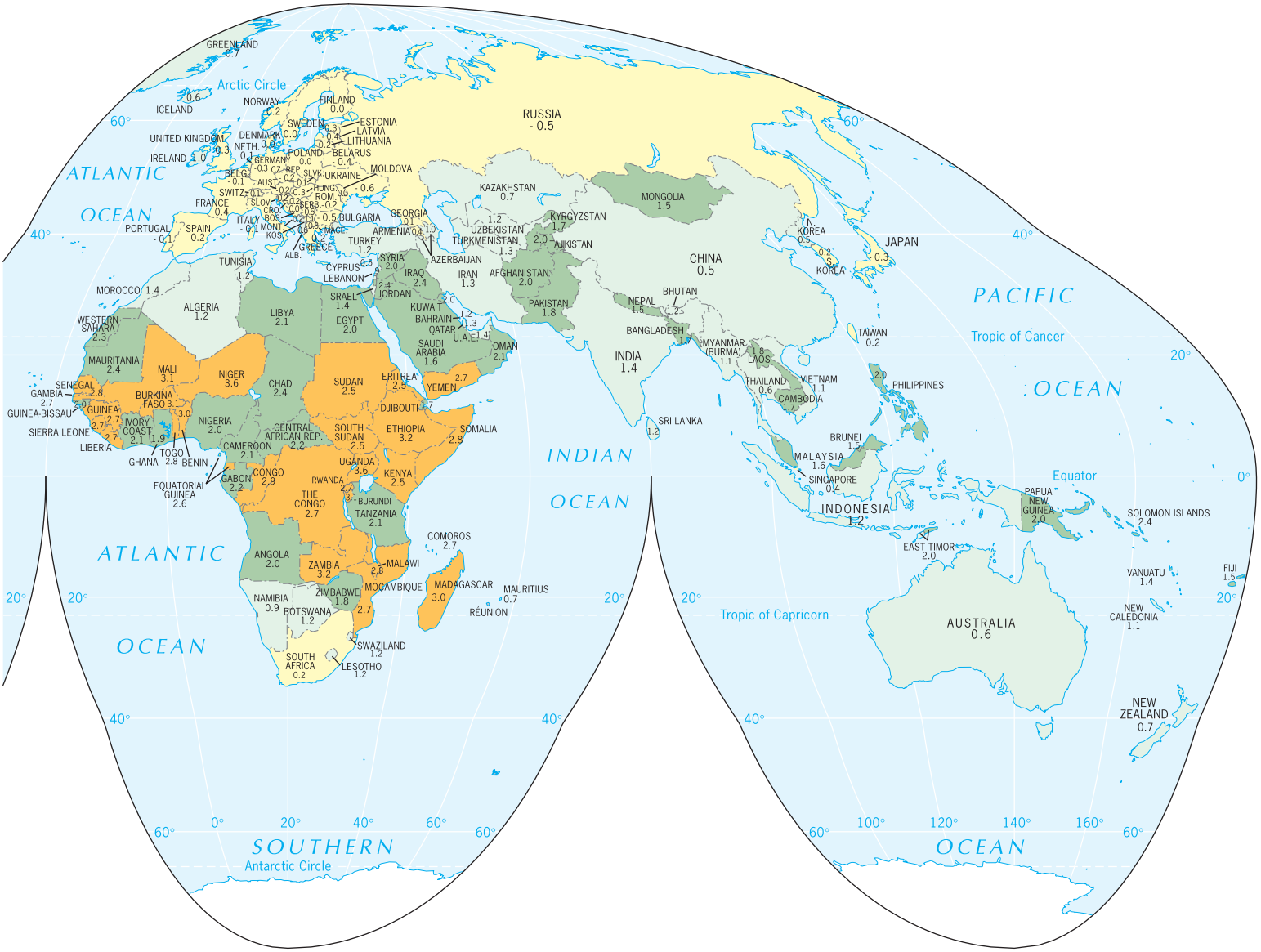
Figure 2.7

World Population Growth, 2010. Annual natural rate of population increase by country. *Data from*: United States Census Bureau, International Data Base, 2011.

lands. Each of these examples demonstrates that food production is not confined spatially, as Malthus assumed.

Malthus assumed the growth of food production was linear, but food production has grown exponentially as the acreage under cultivation expands, mechanization of agricultural production diffuses, improved strains of seed are developed, and more fertilizers are used. In the twenty-first century, bioengineering continues to bring new hybrids, genetically modified organisms, and countless herbicides and pesticides that enabled exponential growth in food production.

Nonetheless, Malthus's ideas continue to attract followers. Neo-Malthusian scholars continue to share Malthus's concerns, even if they do not agree with every detail of his argument, and continue to be alarmed at the continuing rise in the world's population. Neo-Malthusians point out that human suffering is now occurring on a scale unimagined even by Malthus. Although many demographers predict the world population will stabilize later in the twenty-first century, neo-Malthusians argue that overpopulation is a real problem that must be addressed now.



Population Growth at World, Regional, National, and Local Scales

Analysis of population growth and change requires attention to scale. In this section, we examine population growth at different scales, but we must be mindful that what happens at one scale can be affected by what is happening at other scales and in other places at the same time.

Keeping in mind that population change in one place can be affected rapidly by what is going on in a neighboring country or at the regional scale, one can gain some insights by looking at population change within the confined territory of a country (or other administrative unit, such as a province or city). To calculate the natural increase in a country's population, simply subtract deaths from births. This is a simple statistic to calculate and comprehend. However, calculating the natural increase misses two other key components in a country's population: immigration, which along with births adds to the total population, and emigration (outmigration), which along with deaths, subtracts from the total population. Using these four components, we can calculate demographic change within a territory.

When we mapped population growth in Figure 2.7, we did not take into account emigration and immigration. Other maps and tables of population growth you see may consider emigration and immigration. Statistics for each population trait can be calculated globally, by region, by country, or even by smaller locale. When studying population data across scales and across the world, we must constantly remind ourselves of exactly what is being calculated and for where. Otherwise, many of the statistics we read will seemingly be contradictory.

Population Growth at the Regional and National Scales

The world map of population growth rates (Fig. 2.7), displayed by country, confirms the wide range of natural increases in different geographic regions. These variations have existed as long as records have been kept: countries and regions go through stages of expansion and decline at varying times. In the mid-twentieth century, the population of the former Soviet Union was growing vigorously. Thirty years ago, India's population was growing at nearly 3.0 percent, more than most African countries; then India's growth rate fell below that of Subsaharan Africa. Today, Africa's rate of natural increase still is higher than India's (2.4 percent to 1.3 percent), but now Subsaharan Africa faces the impact of the AIDS epidemic, which is killing millions, orphaning children, reducing life expectancies, and curtailing growth rates.

The map also reveals continuing high growth rates in Muslim countries of North Africa and Southwest Asia. Saudi Arabia has one of the highest growth rates in the world, but some smaller countries in this region are increasing even faster. For some time during the second half of the twentieth century, countries in this region saw their growth rates increase even as those in most of the rest of the world were declining. But more recently several of the fast-growing populations, for example, those of Iran and Morocco, have shown significant declines. Demographers point to the correlation between high growth rates and the low standing of women: where cultural traditions restrict educational and professional opportunities for women, and men dominate as a matter of custom, rates of natural increase tend to be high.

South Asia is the most important geographic region in the population growth rate picture. The region includes the country that appears destined to overtake China as the world's most populous: India. Only one country in this region has a growth rate lower than the world average: Sri Lanka. But Sri Lanka's total population is only 20.8 million, whereas the fast-growing countries, Pakistan and Bangladesh, have a combined population exceeding 333 million. India, as the map shows, is still growing well above the world average. The situation in East Asia, the world's most populous region, is different. China's official rate of natural growth has fallen well below 1.0 percent (0.5 in 2010), and Japan's population is no longer growing. Southeast Asia's natural growth rates remain higher, but this region's total population is much lower than either East or South Asia; key countries, such as Indonesia, Thailand, and Vietnam, have declining growth rates.

South America is experiencing significant reductions in natural population growth rates, where those rates were alarmingly high just a generation ago. The region as a whole is still growing at 1.4 percent, but Brazil's population, for example, has declined from 2.9 percent in the mid-1960s to 1.4 percent today. And the populations of Argentina, Chile, and Uruguay are growing at rates well below the world average.

As Figure 2.7 shows, the slowest growing countries—including those with declining rates of natural population increase—lie in the economically wealthier areas of the world extending from the United States and Canada across Europe and Japan. In the Southern Hemisphere, Australia, New Zealand, and Uruguay are in this category. Wealth is not the only reason for negative population growth rates. Russia's population is declining because of social dislocation in the wake of the collapse of the Soviet Union: deteriorating health conditions, high rates of alcoholism and drug use, and economic problems combine to shorten life expectancies

(especially among males) and to lower birth rates. In recent years, Russia's economy has improved, but its birth rate has remained low. Similar problems afflict Ukraine and Kazakhstan, two of Russia's neighbors, which also show slow or negative growth.

Between 1900 and 2000, the world population rose from 1.6 billion people to 6.1 billion, and in 2011, the world population reached 7 billion. The growth in world population is not a result of women having more children. Instead, the last century of population growth stems largely from longer life expectancies. In 1900, global life expectancy was 30 years, and by 2000, it was 65 years. Demographers now predict world population will stabilize at around 10 billion people by 2100.

Predictions of a stabilized global population are based on a combination of longer life expectancies coupled with lower fertility rates. Demographers measure whether a population can replace its deaths with births by looking at **total fertility rates** (TFRs). To reach replacement levels—to keep a population stable over time without immigration—the women of childbearing age in a country need a TFR of 2.1. The TFR reports the average number of children born to a woman of childbearing age. In 2000, more than 60 countries, containing 45 percent of the world's population, had fallen below replacement level (Fig. 2.8).

Demographers at the United Nations predict the TFR of the combined world will fall to 2.1 by 2030. The world TFR combines regions including Europe, where fertility levels are low (Fig. 2.9), and regions including Africa, where fertility levels are high. Predicting population growth is difficult because so much depends on the decisions made by women of childbearing age. Demographers and population geographers agree that two major trends are happening now that will influence how much the world population continues to grow. First is the aging population of Europe, China, and Japan, and second is the declining fertility rate in many developing countries including Brazil and Iran.

Both the aging population of developed countries and the declining fertility rates in developing countries lead to predictions that the global population will continue to grow but at a lower rate. The United Nations reports the proportion of older to younger people in a country with the **aging index**, which is the number of people age 65 and older per 100 children ages 0–14. The aging index reveals an older Europe with 263 older people for every 100 children and a younger Africa with 37 older people for every 100 children.

Why are women having fewer children? In wealthier countries, more women are choosing to stay in school, work on careers, and marry later, delaying childbirth. The impact of the aging population of Europe can be seen in the number of elderly people each person in the working-age population supports through taxes.

An aging population requires substantial social adjustments. Older people retire and eventually suffer health problems, so they need pensions and medical care. The younger workers in the population must work in order to provide the tax revenues that enable the state to pay for these services. As the proportion of older people in a country increases, the proportion of younger people decreases. Thus, fewer young workers are providing tax revenues to support programs providing services for more retired people. To change the age distribution of an aging country and provide more taxpayers, the only answer is immigration: influxes of younger workers to do the work locals are unable or unwilling to do.

What will happen when a country resists immigration despite an aging population? Over the next half-century, Japan will be an interesting case study. Japan's population is no longer growing, and projections indicate the Japanese population will decline as it ages. The population fell from a peak of 127.84 million in 2004 to 127.51 million in 2009. Japan predicts its population will fall below 100 million to 95.15 million by 2050. Japan was a closed society for hundreds of years, and even today, the Japanese government discourages immigration and encourages homogeneity of the population. More than 98 percent of the country's population is Japanese, according to government statistics. In August 1999, the British newspaper *The Guardian* reported that the Japanese government's efforts to maintain the homogeneity of the population are often "lauded domestically as a reason for the country's low crime rate" and strong industrial economy.

In developing countries, a combination of government and nongovernment organizational programs encourage women to have fewer children. Some women are also choosing to have fewer children because of economic and social uncertainty in the developing world. Today, TFRs are falling almost everywhere on Earth, in large part because of family planning. In some countries fertility rates are declining dramatically. Kenya's TFR is now down to 4.6; China's fell from 6.1 to 1.75 in just 35 years, and in 2010 dropped to 1.5. Once the government of Iran began to allow family planning, the TFR fell from 6.8 in 1980 to 1.8 in 2010.

There was a time when a low TFR seemed to be a desirable national objective, something that all governments would surely want. However, long-term economic implications and demographic projections gave many governments pause. Countries need a young, vigorous, working-age population in order to work and pay taxes to support the long-term needs of an aging population. When governments saw their population growth rates decline sharply, many took countermeasures. China softened its One-Child Only policy, Sweden, Russia, and other European countries provided financial

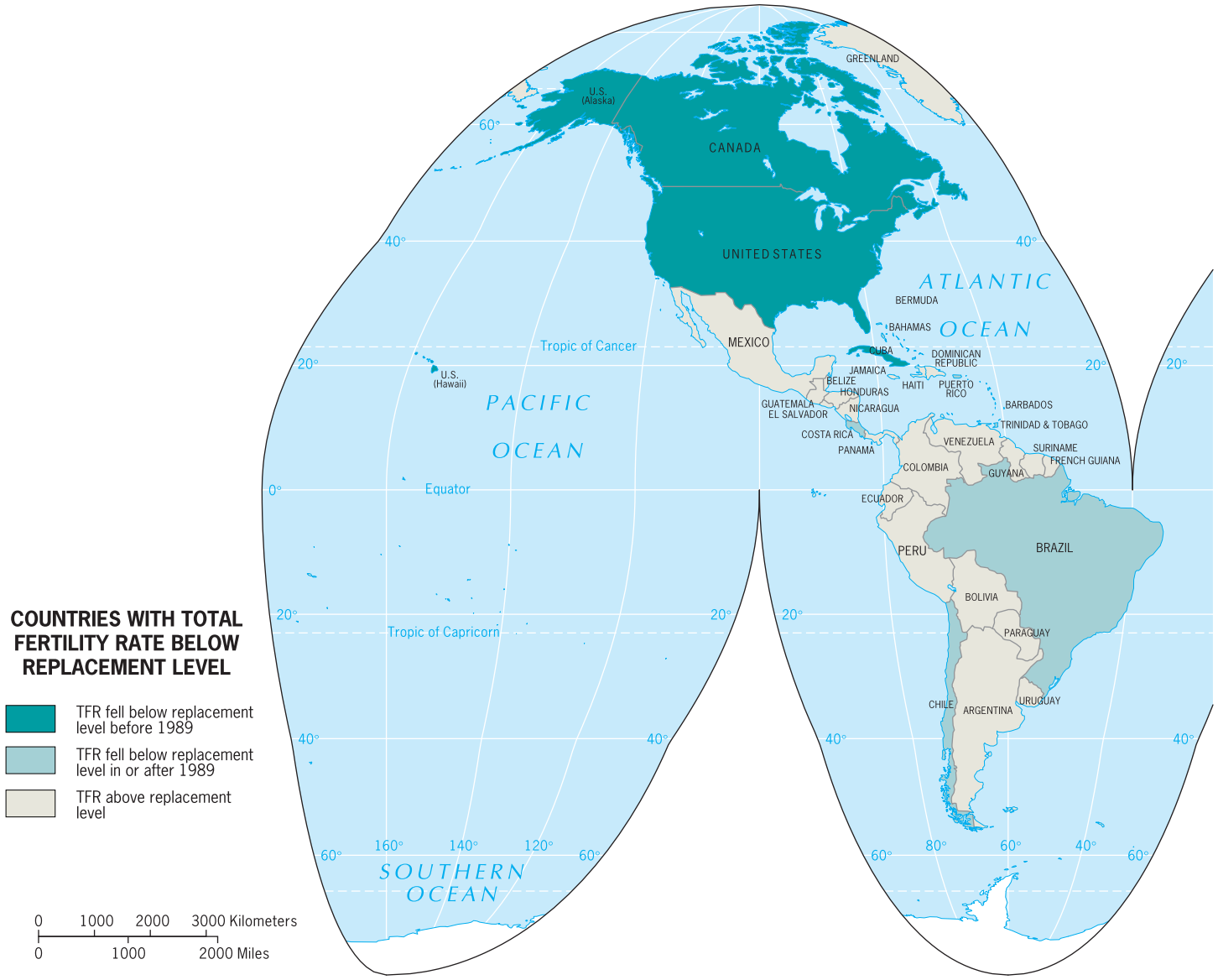
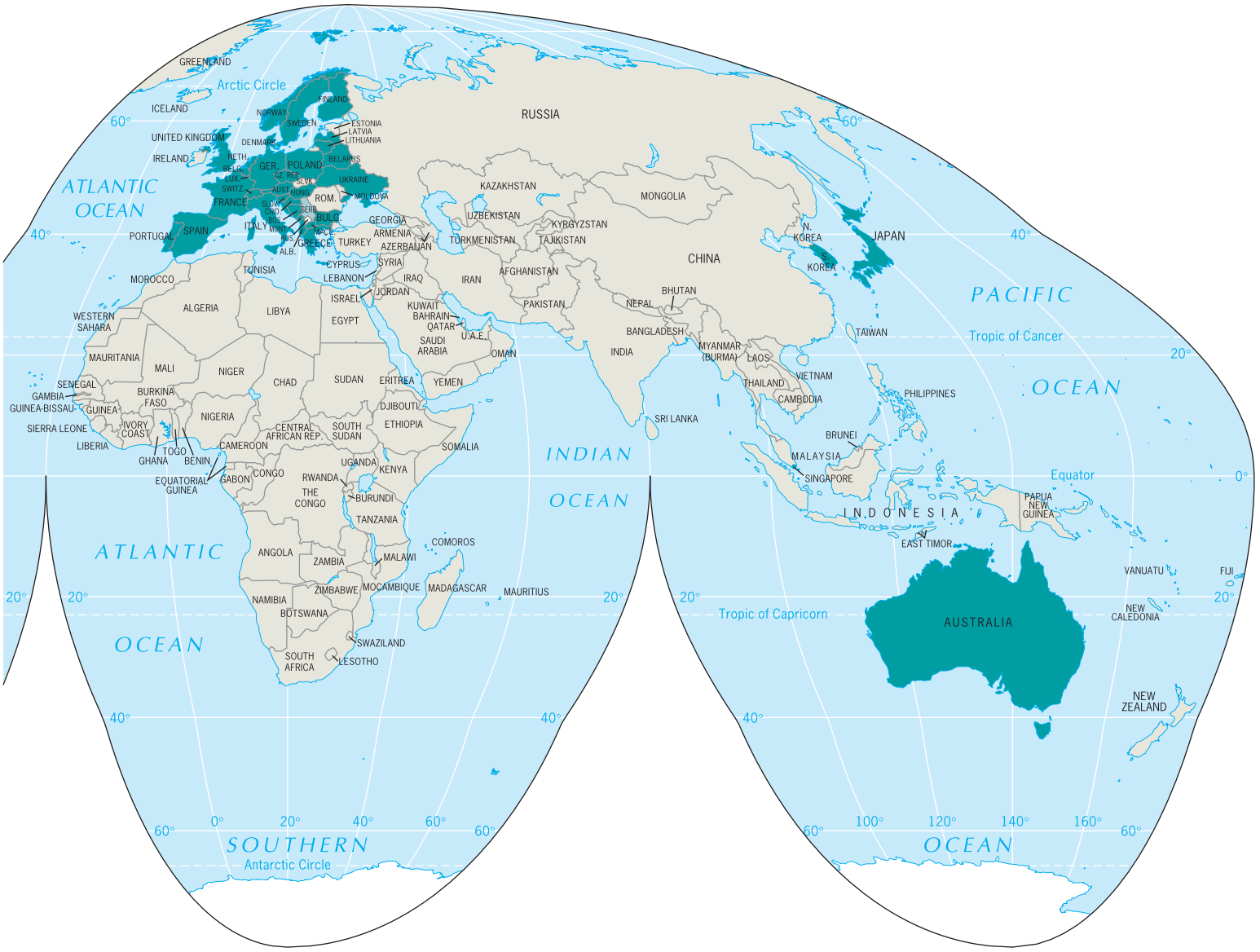


Figure 2.8
Year That Total Fertility Rate Among Women Fell Below Replacement Levels. *Data from*: World Bank, World Development Indicators, 2011.

incentives like long maternity leaves and state-paid daycare to prospective mothers, and even the Japanese found themselves in a national debate over family size and immigration. Still, such programs and debates have so far had limited success in encouraging sustained population growth.

How can the worldwide population continue to increase when so many countries are experiencing low TFRs and population decline? Despite declining population growth rates and even negative growth rates (growth rates below 0.0) in a number of the world's countries, the global population continues to rise. The worldwide TFR was 2.6 in 2007, above the replacement level of 2.1. Although the population bomb Ehrlich warned of is no longer ticking at the same rapid pace, the worldwide population continues to grow. The low TFRs



and low population growth rates enumerated in this chapter are dwarfed by continued additions to the population in countries where growth rates are still relatively high, such as India, Indonesia, Bangladesh, Pakistan, and Nigeria.

One way to easily grasp the growth rate in world population is to compare the population's rate of growth to its **doubling time**. Every rate of growth has a doubling time; for example, if you invest $100 at 10 percent, compounded annually (exponentially), it would take about seven years to double to $200, and then another seven years to become $400, and then another seven years to become $800. When the growth rate is 10 percent, therefore, the doubling time is around seven years.

Two thousand years ago, the world's population was an estimated 250 million. More than 16 centuries passed before this total had doubled to 500 million, the estimated

Field Note

"My mind was on wine. I was in Bordeaux, France, walking down the street to the Bordeaux Wines Museum (Musée des Vins de Bordeaux) with a friend from the city. Having just flown from Dakar, Senegal, after spending several weeks in Subsaharan Africa, I found my current surroundings strikingly different. Observing the buildings and the people around me, I noticed that after having been among so many young children in Subsaharan Africa, the majority of the inhabitants I encountered in Bordeaux were adults. I turned to my friend and asked, 'Where are all the children?' He looked around, pointed, and replied, 'There goes one now!' In Bordeaux, in Paris, in all of France and the rest of Europe, there are fewer children and populations are aging (Fig. 2.9)."

Figure 2.9
Bordeaux, France. © H. J. de Blij.

population in 1650. Just 170 years later, in 1820 (when Malthus was still writing), the population had doubled again, to 1 billion (Fig. 2.10). And barely more than a century after this, in 1930, it reached 2 billion. The doubling time was down to 100 years and dropping fast; the **population explosion** was in full gear. Only 45 years elapsed during the next doubling, to 4 billion (1975). During the mid-1980s, when the rate declined to 1.8 percent, the doubling slowed to 39 years. Today, world population is doubling in 54 years, and the continuing slowdown in the estimated doubling rate is one of the bright spots in the problematic demographic picture.

For demographers and population geographers who study global population growth today, the concept of doubling time is losing much of its punch. With populations falling in many places, fears of global population doubling quickly are definitely subsiding. Many indicators, such as the slowing of the doubling time, suggest that the worst may be over, that the explosive population growth of the twentieth century will be followed by a marked and accelerating slowdown during the twenty-first century. The global growth rate is now down to 1.4 percent, perhaps slightly lower. But today the world's population is 7 billion, yielding an increase in world population that still exceeds 80 million annually at this growth rate.

As a result of falling TFRs in both the developing and developed world, demographers no longer caution about doubling time. With women having fewer children, many demographers are predicting the world may reach **zero population growth** in the next 50 years. In

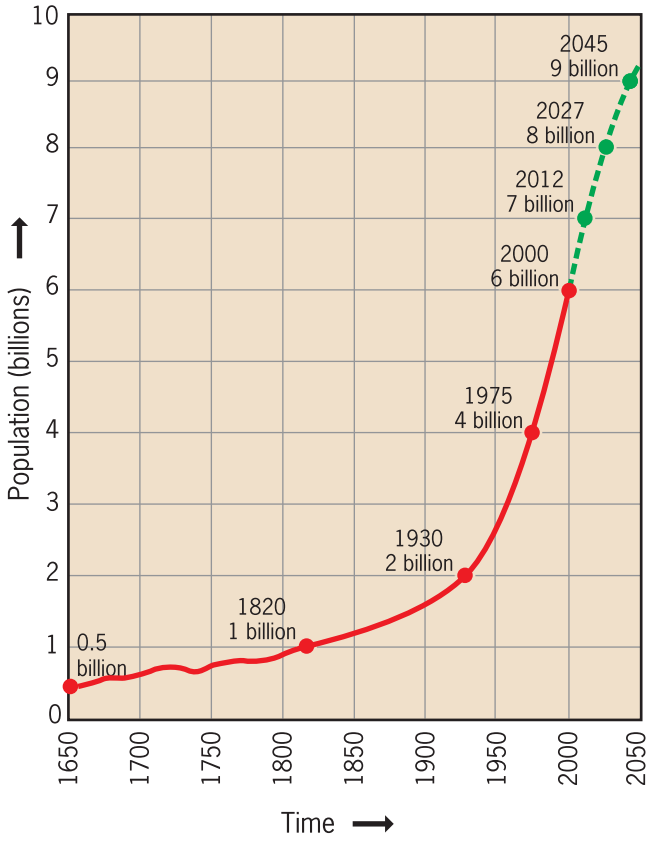


Figure 2.10

Population Growth, 1650 to 2050. The dashed line indicates one estimate of global population growth for the next 50 years. *Data from*: United States Census Bureau, International Data Base, 2011.

fact, current predictions point to zero population growth globally by the end of the century, with population rising to 9.3 billion by 2050 and then leveling off around 10 billion people.

No single factor can explain the variations shown in Figure 2.7. Economic prosperity as well as social dislocation reduce natural population growth rates. Economic well-being, associated with urbanization, higher levels of education, later marriage, family planning, and other factors, lowers population growth. In the table presented in Appendix B, compare the indices for natural population increase and the percentage of the population that is urbanized. In general, the higher the population's level of urbanization, the lower its natural increase. Cultural traditions also influence rates of population growth, Religion, for example, has a powerful impact on family planning and thus on growth rates, not only in Islamic countries but also in traditional Christian societies (note the Roman Catholic Philippines' growth rate) and in Hindu-dominated communities (such as India).

Population Growth within Countries

The information provided in Figure 2.7 is based on countrywide statistics. Significant demographic variations also occur *within* countries. Political geographers call countries states. State governments partition their countries into administrative units called States (United States), provinces (Canada), departments (France) or the like. In India, for example, States in the north record population growth rates far above the national average (Fig. 2.11). But other States, in the west and southwest region, have populations that are growing much more slowly. Women in southern India have higher female literacy, greater land ownership rates, better access to health care, and more access to birth control methods. All of these factors keep the growth rates lower in the south than the north of India.

In the 1950s, India became the first country in the world to institute a population planning program, before the fear of worldwide overpopulation and a global population bomb spread. In the 1960s, when census numbers revealed the extreme growth rates in the north, the Indian government instituted a national population planning program, encouraging States to join.

Despite the federal effort, rapid population growth continues, especially in the northern and eastern States. India is a federation of 28 States and 7 union territories, and the individual States differ greatly both culturally and politically. Social problems arose in some of the States where governments pursued the population planning campaign vigorously. During the 1970s, the Indian government began a policy of forced sterilization of any man with three or more children. The State of Maharashtra sterilized 3.7 million people before public opposition led to rioting, and the government abandoned the program (Fig. 2.12). Other States also engaged in compulsory sterilization programs, with heavy social and political costs—eventually, 22.5 million people were sterilized.

The horrors of the forced sterilization program of the 1970s are haunting India again. In 2004, three districts in the State of Uttar Pradesh (India's most populous State with over 170 million people) instituted a policy of exchanging gun licenses for sterilization. The policy allowed for a shotgun license in exchange for the sterilization of two people and a revolver license in exchange for the sterilization of five people. Abuse began almost immediately, with wealthy landowners sterilizing their laborers in exchange for gun licenses. Before the "guns for sterilization" policy, districts in Uttar Pradesh encouraged sterilization by providing access to housing and extra food for people who agreed to be sterilized.

Today, most Indian State governments are using advertising and persuasion—not guns for sterilization—to encourage families to have fewer children. Posters urging

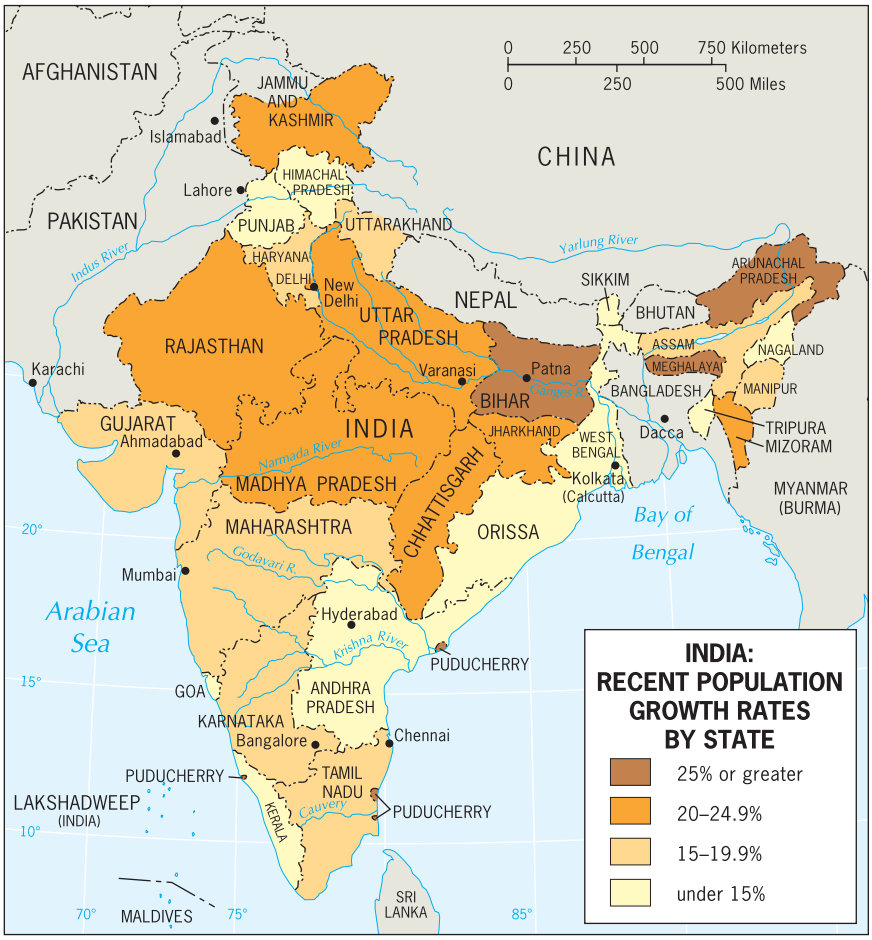


Figure 2.11
Population Growth Rates in India, 2001–2011. *Data from*: India Census Bureau, 2011.

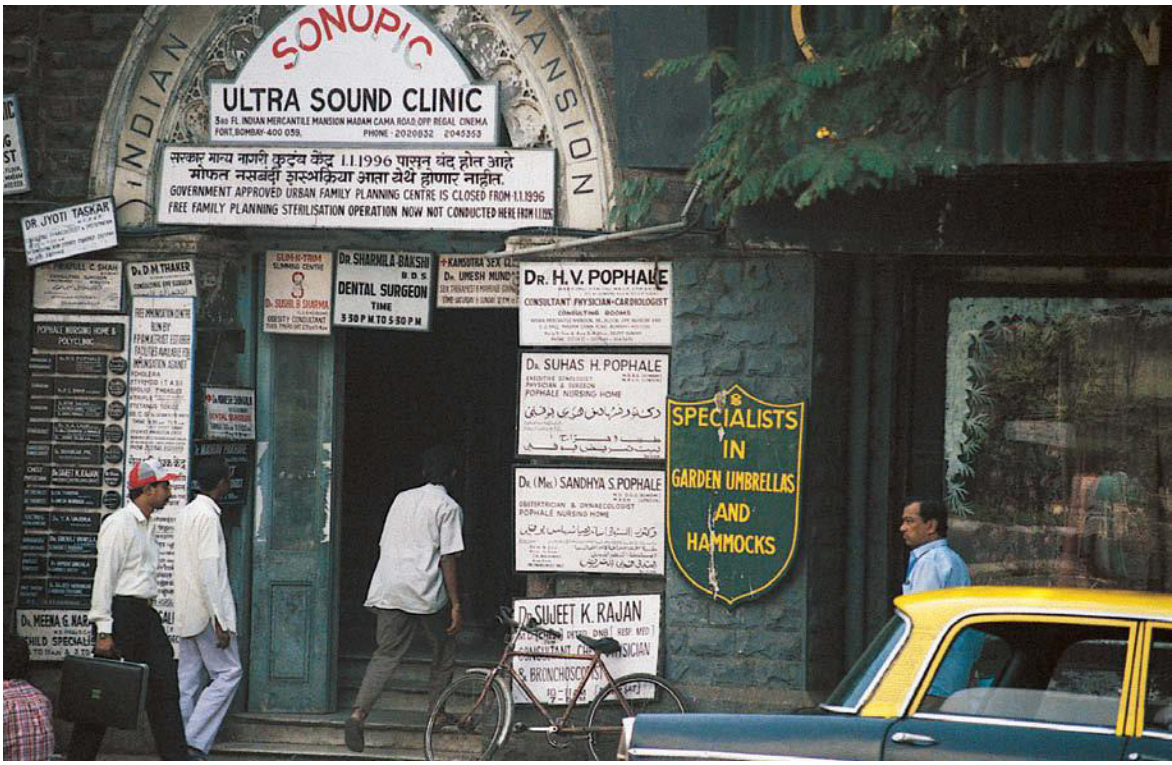


Figure 2.12
Maharashtra, India. Above the entrance to a suite of medical offices is a sign announcing that the "free family planning sterilization operation" closed in 1996. © H. J. de Blij.

people to have small families are everywhere, and the government supports a network of family planning clinics even in the remotest villages. The southern States continue to report the lowest growth rates, correlating with higher wealth and higher education levels and literacy rates of females in these States. The eastern and northern States, the poorer regions of India, continue to report the highest growth rates.

Our world map of growth rates is a global overview, a mere introduction to the complexities of the geography of population. The example of India demonstrates that what we see at the scale of a world map does not give us the complete story of what is happening within each country or region of the world. Both India and China have over 1 billion people, but as a result of the higher growth rates in India (1.64) and declining growth rates in China (.5), demographers predict India will become the most populated country in the world in 2030.

The Demographic Transition

The high population growth rates now occurring in many poorer countries are not necessarily permanent. In Europe, population growth changed several times in the last three centuries. Demographers used data on baptisms and funerals from churches in Great Britain to study changes in birth and death rates of the population. They expected the rate of **natural increase** of the population—the difference between the number of births and the number of deaths—to vary over different periods of time. Demographers calculated the **crude birth rate** (CBR), the number of live births per year per thousand people in the population (Fig. 2.13), and the **crude death rate** (CDR), the number of deaths per year per thousand people (Fig. 2.14).

The church data revealed that before the Industrial Revolution began in Great Britain in the 1750s, the country experienced high birth rates and high death rates, with small differences between the two. The result was low population growth. After industrialization began, the death rates in Great Britain began to fall as a result of better and more stable access to food and improved access to increasingly effective medicines. With a rapidly falling death rate and a birth rate that remained high, Britain's population explosion took place. From the late 1800s through two world wars in the 1900s, death rates continued to fall and birth rates began to fall, but stayed higher than death rates, resulting in continued population growth but at a slower rate. Finally, in recent history, both the birth rate and death rate in Great Britain declined to low levels, resulting in slow or stabilized population growth.

Demographers call the shift in population growth the **demographic transition**. The transition is typically modeled as shown in Figure 2.15. The model is based on the kind of shift that Britain experienced, but other places either have gone through a similar shift or are in the process of doing so. The initial low-growth phase, which in all places endured for most of human history, is marked by high birth rates and equally high death rates. In this phase, epidemics and plagues keep the death rates high among all sectors of the population—in some cases so high that they exceed birth rates. For Great Britain and the rest of Europe, death rates exceeded birth rates during the bubonic plague (the Black Death) of the 1300s, which hit in waves beginning in Crimea on the Black Sea, diffusing through trade to Sicily and other Mediterranean islands, and moving through contagious diffusion and the travel of rats (which hosted the vector, the flea, that spread the plague) north from the Mediterranean.

Once the plague hit a region, it was likely to return within a few years time, creating another wave of human suffering. Estimates of plague deaths vary between one-quarter and one-half of the population, with the highest death rates recorded in the West (where trade among regions was the greatest) and the lowest in the East (where cooler climates and less connected populations delayed diffusion). Across Europe, many cities and towns were left decimated. Historians estimate the population of Great Britain fell from nearly 4 million when the plague began to just over 2 million when it ended.

Famines also limited population growth. A famine in Europe just prior to the plague likely facilitated the diffusion of the disease by weakening the people. Records of famines in India and China during the eighteenth and nineteenth centuries document millions of people perishing. At other times, destructive wars largely wiped out population gains. Charts of world population growth show an increase in the world's population from 250 million people 2000 years ago to 500 million people in 1650 and 1 billion people in 1820. However, the lines connecting these points in time should not trend steadily upward. Rather, they turn up and down frequently, reflecting the impacts of disease, crop failures, and wars.

The beginning of the Industrial Revolution ushered in a period of accelerating population growth in Europe. Before workers could move from farms to factories, a revolution in agriculture had to occur. The eighteenth century marked the Second Agricultural Revolution, so named because the first occurred thousands of years earlier (see Chapter 11). During the Second Agricultural Revolution, farmers improved seed selection, practiced new methods of crop rotation, selectively bred livestock to increase production and quality, employed new technology such as the seed drill, expanded storage capacities, and consolidated landholdings for greater efficiencies. With more efficient farming methods, the number of people needed in farming decreased and the food supply increased, thereby supporting a higher population overall.

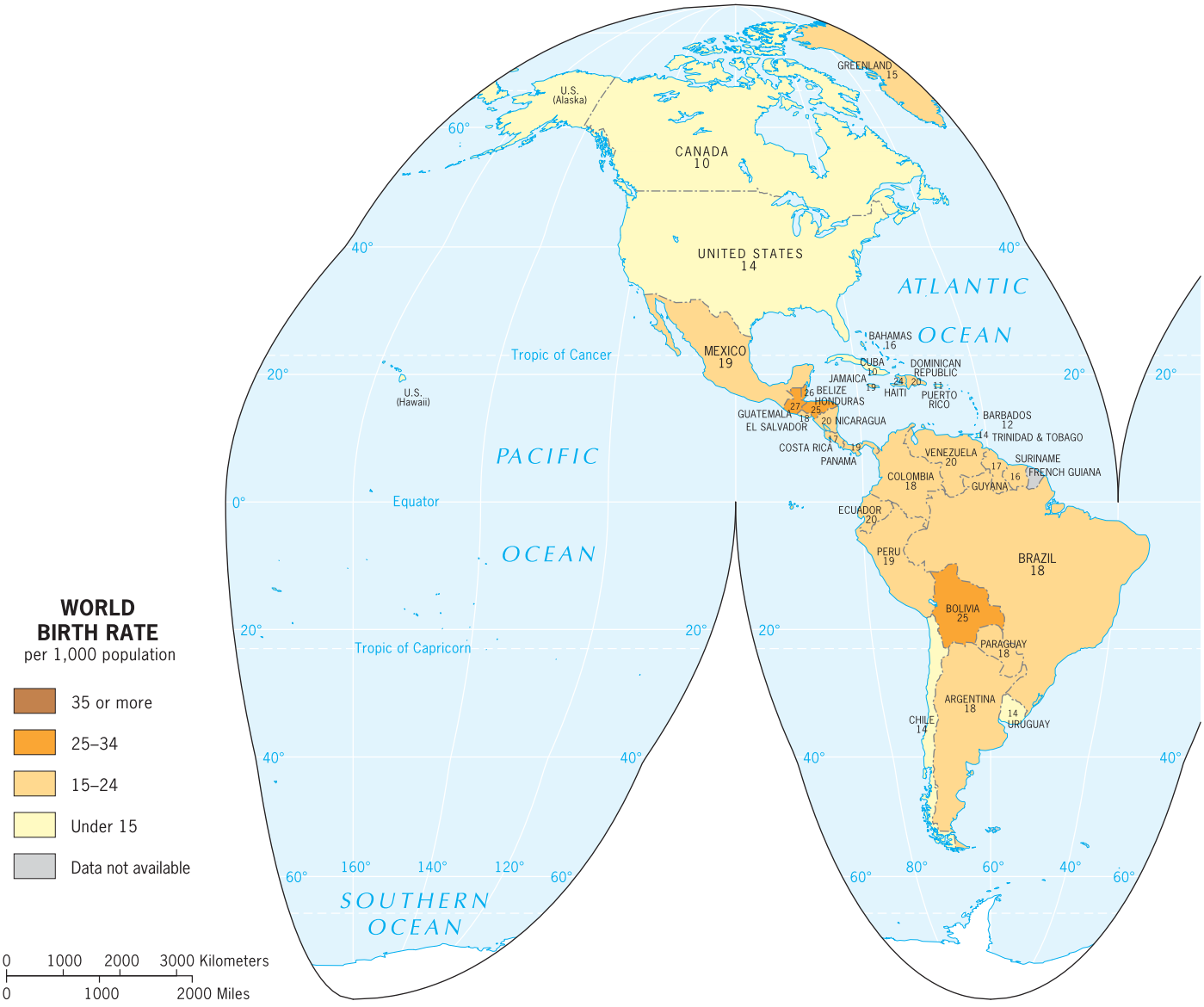
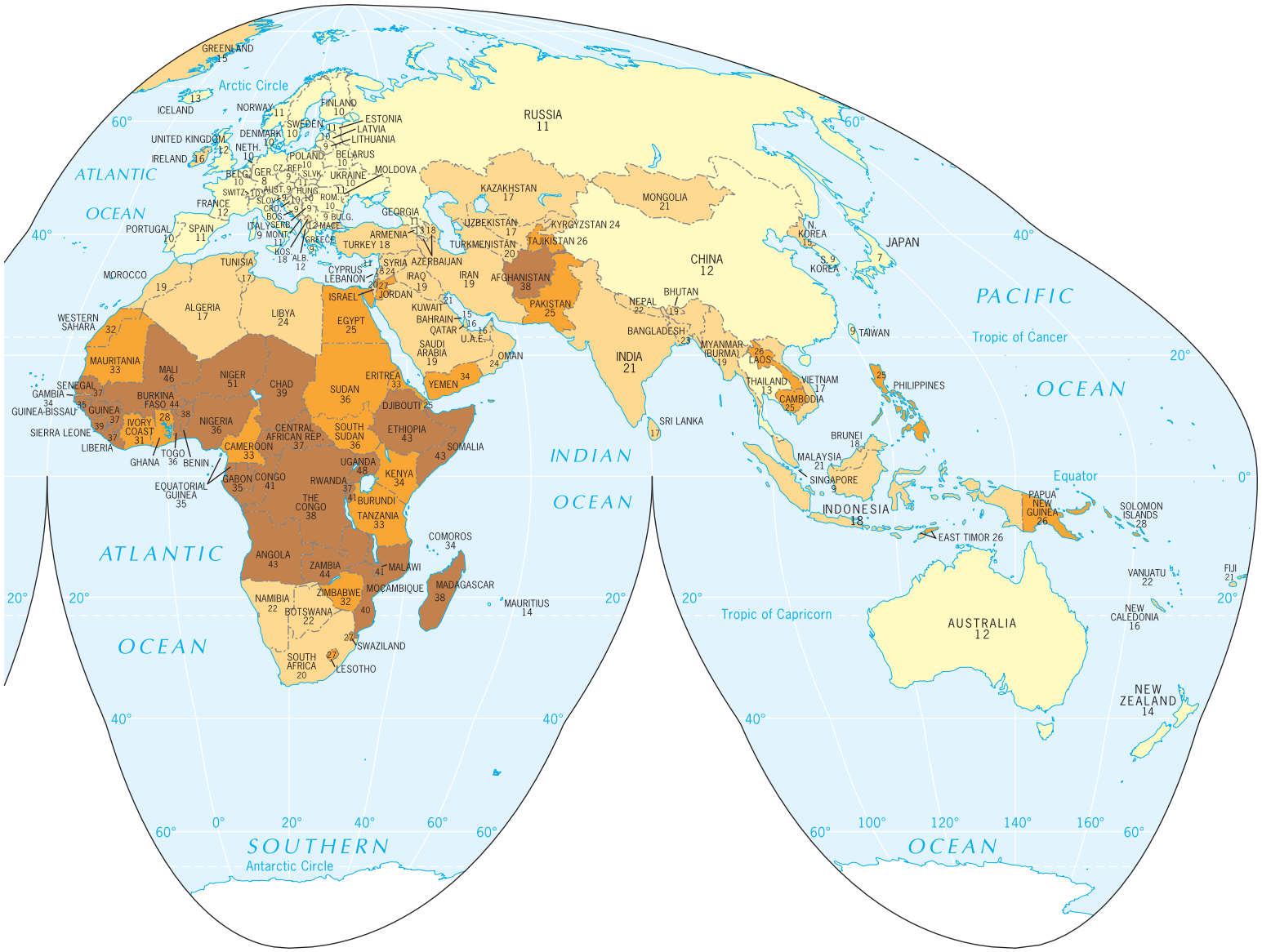


Figure 2.13

Crude Birth Rate. Number of Births in a year per 1000 People. *Data from:* United States Census Bureau, International Data Base, 2011.

In the 1800s, as the Industrial Revolution diffused through continental Europe, other advances also helped lower death rates. Sanitation facilities made towns and cities safer from epidemics, and modern medical practices diffused. Disease prevention through vaccination introduced a new era in public health. The combined improvements in food supply and medical practice resulted in a drastic reduction in death rates. Before 1750 death rates in Europe probably averaged 35 per 1000 (birth rates averaged under 40), but by 1850 the death rate was down to about 16 per 1000.

Birth rates fell at a slower rate, leading to a population explosion. The increase in the rate of population growth in Europe spurred waves of migration. Millions of people left the squalid, crowded industrial cities (and farms as well) to emigrate to other parts of the world. They were not the first to make this journey. Adventurers, explorers, merchants, and colonists had gone before them. In a major wave of colonization from 1500 through the 1700s, European migrants decimated native populations through conquest, slavery, and the introduction of diseases against which the local people had no natural immunity.



When a second wave of European colonization began in Africa and Asia during the late 1800s, the Europeans brought with them their newfound methods of sanitation and medical techniques, and these had the opposite effect. By the mid-1900s, declining death rates in Africa, India, and South America brought rapid population increases to these regions. At this point, new alarms and cautions of worldwide overpopulation rang.

Although the global alarms continued to ring, they subsided for populations in Europe and North America when population growth rates began to decline in the first half of the 1900s. The cause was a significant decline in birth rates. Populations continued to grow, but at a much slower rate. Many countries in Latin America and Asia experienced falling birth rates later in the twentieth century, which helped slow the global population growth rate.

Why have birth rates declined? Throughout the 1900s, lower birth rates arrived first in countries with greater urbanization, wealth, and medical advances. As more and more people moved to cities, both the economics and the culture of large families changed. Instead of

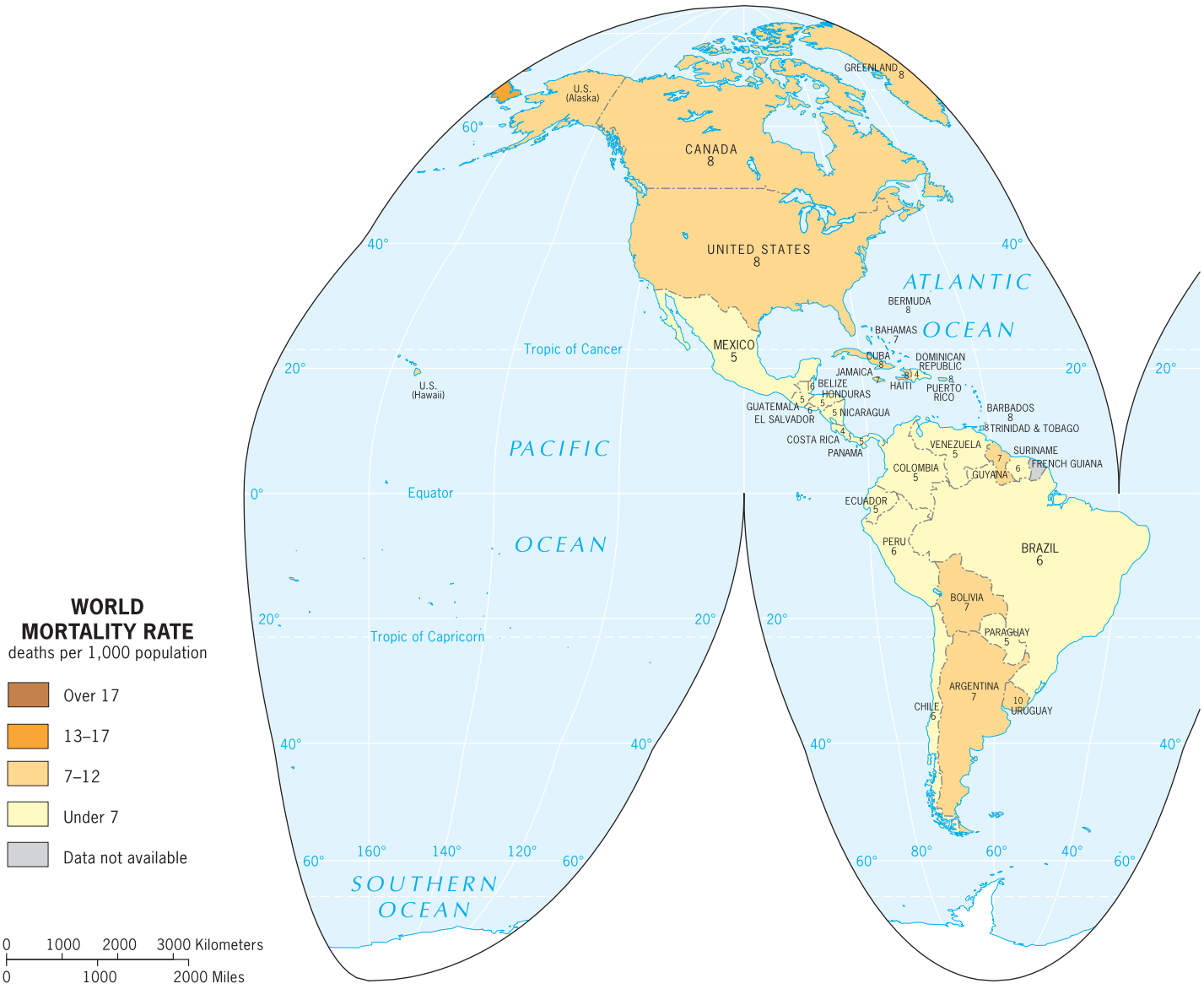
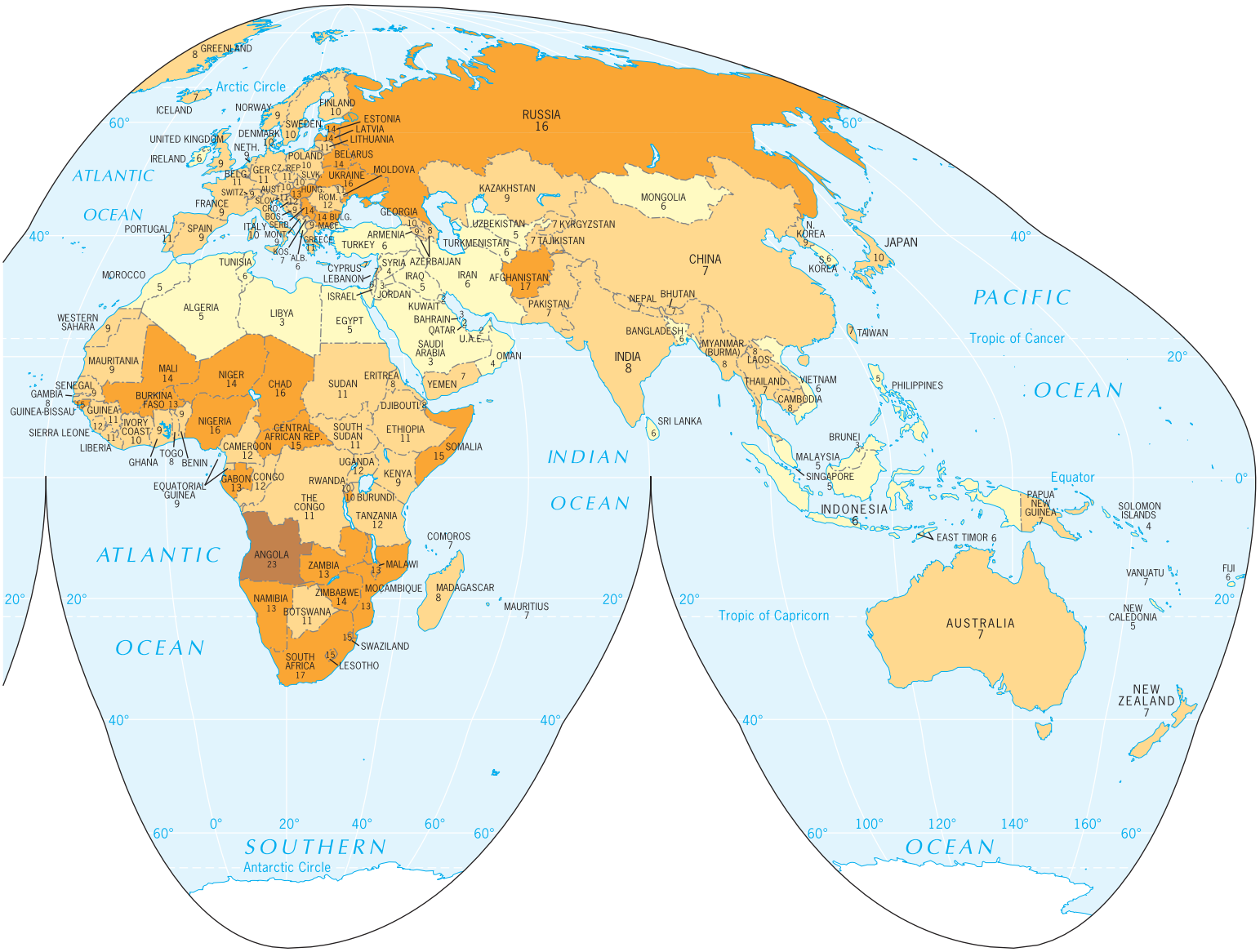


Figure 2.14

Crude Death Rate: Number of Deaths in a Year per 1000 People. *Data from*: United States Census Bureau, International Data Base, 2011.

lending a hand on the family farm, children in urban areas were often seen as a drain on the family finances. At the same time, new opportunities—especially for women—were not always compatible with large families. Hence, many women delayed marriage and childbearing. Medical advances lowered infant and child mortality rates, lessening the sense that multiple children were necessary to sustain a family. In recent history, the diffusion of contraceptives, the accessibility to abortions, and conscious decisions by many women to have fewer or no children or to start having children at a later age have all lowered birth rates within a country.

In some parts of the world, countries are now experiencing exceptionally low TFRs. Low birth rates along with low death rates put the countries in a position of negligible, or even negative, population growth. Birth rates are lowest in the countries where women are the most educated and most involved in the labor force.



Future Population Growth

It may be unwise to assume that the demographic cycles of all countries will follow the sequence that occurred in industrializing Europe or to believe that the still-significant population growth currently taking place in Bangladesh, Mexico, and numerous other countries will simply subside. Nonetheless, many agencies monitoring global population suggest that the populations of most (if not all) countries will stop growing at some time during the twenty-first century, reaching a so-called **stationary population level** (SPL). This would mean that the world's population would stabilize and that the major problems to be faced would involve the aged rather than the young.

Such predictions require frequent revision, however, and anticipated dates for population stabilization are often moved back. Only a few years ago, the United Nations predicted world population would stabilize at

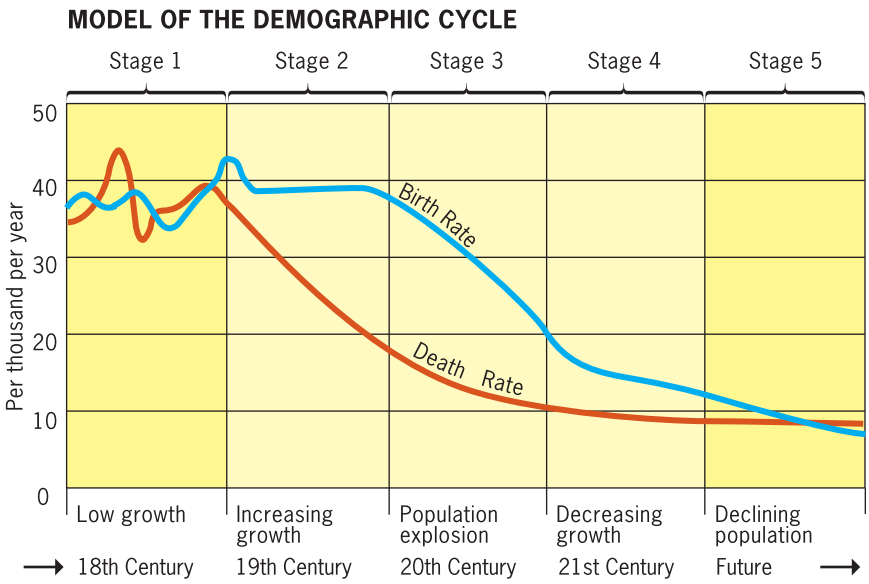


Figure 2.15
The Demographic Transition Model. Five stages of the demographic transition.

10 billion in 200 years. The United Nations changed its predictions based on lower fertility rates in many countries. All agencies reporting population predictions have to revise their predictions periodically. In the late 1980s, for example, the World Bank predicted that the United States would reach SPL in 2035 with 276 million inhabitants. Brazil's population would stabilize at 353 million in 2070, Mexico's at 254 million in 2075, and China's at 1.4 billion in 2090. India, destined to become the world's most populous country, would reach SPL at 1.6 billion in 2150.

Today these figures are unrealistic. China's population passed the 1.2 billion mark in 1994, and India's reached 1 billion in 1998. If we were to project an optimistic decline in growth rates for both countries, China's population would "stabilize" at 1.4 billion in 2025 and India's at 1.7 billion in 2060, according to a 2011 United Nations report. But population increase is a cyclical phenomenon, and overall declines mask lags and spurts as well as regional disparities.

Examine Appendix B at the end of the book. Study the growth rate column. Which countries have the highest growth rates? Determine what stage of the demographic transition these countries are in, and hypothesize what may lead them to the next stage.

WHY DOES POPULATION COMPOSITION MATTER?

Maps showing the regional distribution and density of populations tell us about the number of people in countries or regions, but they cannot reveal two other aspects of those populations: the number of men and women and their ages. These aspects of population, the **population composition**, are important because a populous country where half the population is very young has quite different problems than a populous country where a large proportion of the population is elderly. When geographers study populations, therefore, they are concerned not only with spatial distribution and growth rates but also with population composition.

The composition is the structure of a population in terms of age, sex, and other properties such as marital status and education. Age and sex are key indicators of population composition, and demographers and geographers use **population pyramids** to represent these traits visually.

The population pyramid displays the percentages of each age group in the total population (normally five-year increments) by a horizontal bar whose length represents its share. Males in the group are to the left of the center line, females to the right.

A population pyramid can instantly convey the demographic situation in a country. In poorer countries, where birth and death rates generally remain high, the pyramid looks like an evergreen tree, with wide branches at the base and short ones near the top

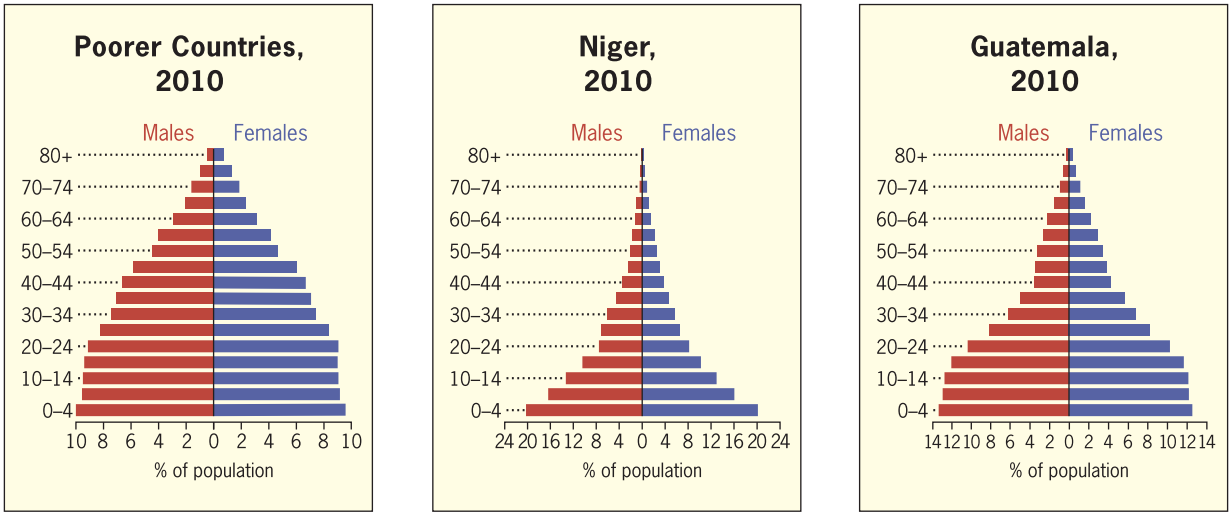


Figure 2.16

Age–Sex Population Pyramids for Countries with High Population Growth Rates. Countries with high total fertility rates, high infant mortality rates and low life expectancies will have population pyramids with wide bases and narrow tops. *Data from*: United Nations, World Population Prospects: The 2010 Revision.

(Fig. 2.16). The youngest age groups have the largest share of the population; in the composite pyramid shown here, the three groups up to age 14 account for more than 30 percent of the population. Older people, in the three highest age groups, represent only about 4 percent of the total. Slight variations of this pyramidal shape mark the population structure of such countries as Pakistan, Yemen, Guatemala, The Congo, and Laos. From age group 15 to 19 upward, each group is smaller than the one below it.

In countries with economic wealth, pyramid shapes change. Families become smaller, children fewer. A composite population pyramid for wealthier countries looks like a slightly lopsided vase, with the largest components of the population not at the bottom but in the middle. The middle-age bulge is moving upward, reflecting the aging of the population (Fig. 2.17) and the declining TFR. Countries with low TFR and high wealth, such as Italy, France, and Sweden, fit into this pyramid model.

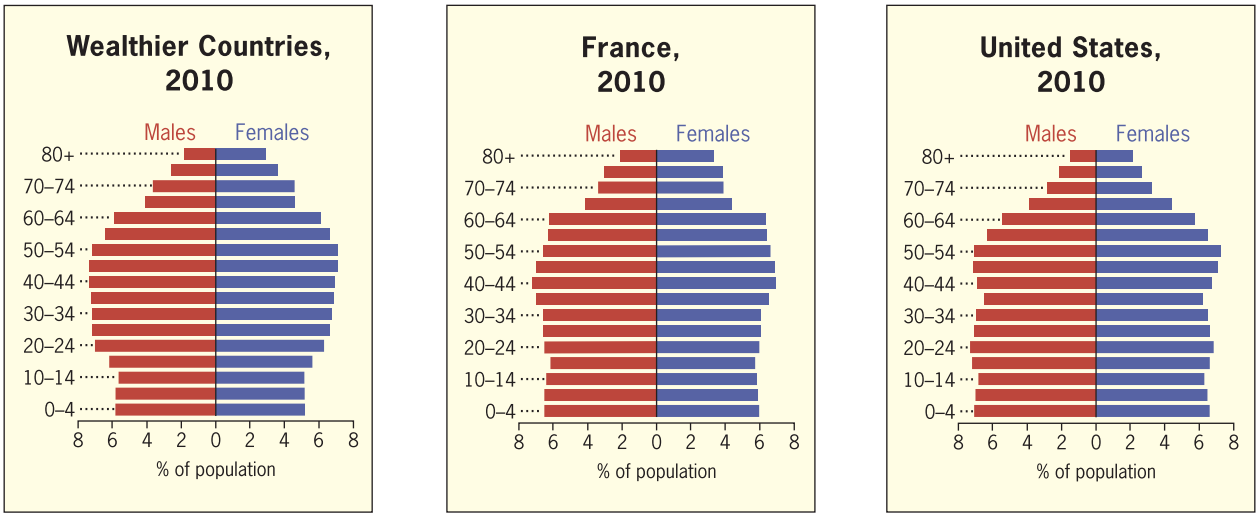


Figure 2.17

Age–Sex Population Pyramids for Countries with Low Population Growth Rates. Countries with lower total fertility rates and longer life expectancies have population pyramids shaped more uniformly throughout. *Data from*: United Nations, World Population Prospects: The 2010 Revision.

HOW DOES THE GEOGRAPHY OF HEALTH INFLUENCE POPULATION DYNAMICS?

The condition of a country's population requires much more than simply knowing the total population or the growth rate. Also of significance is the welfare of the country's people across regions, ethnicities, or social classes. Among the most important influences on population dynamics are geographical differences in sanitation, the prevalence of diseases, and the availability of health care.

Infant Mortality

One of the leading measures of the condition of a country's population is the **infant mortality rate** (IMR). Infant mortality is recorded as a baby's death during the first year following its birth (unlike child mortality, which records death between ages 1 and 5). Infant mortality is normally given as the number of cases per thousand, that is, per thousand live births.

Infant and child mortality reflect the overall health of a society. High infant mortality has a variety of causes,

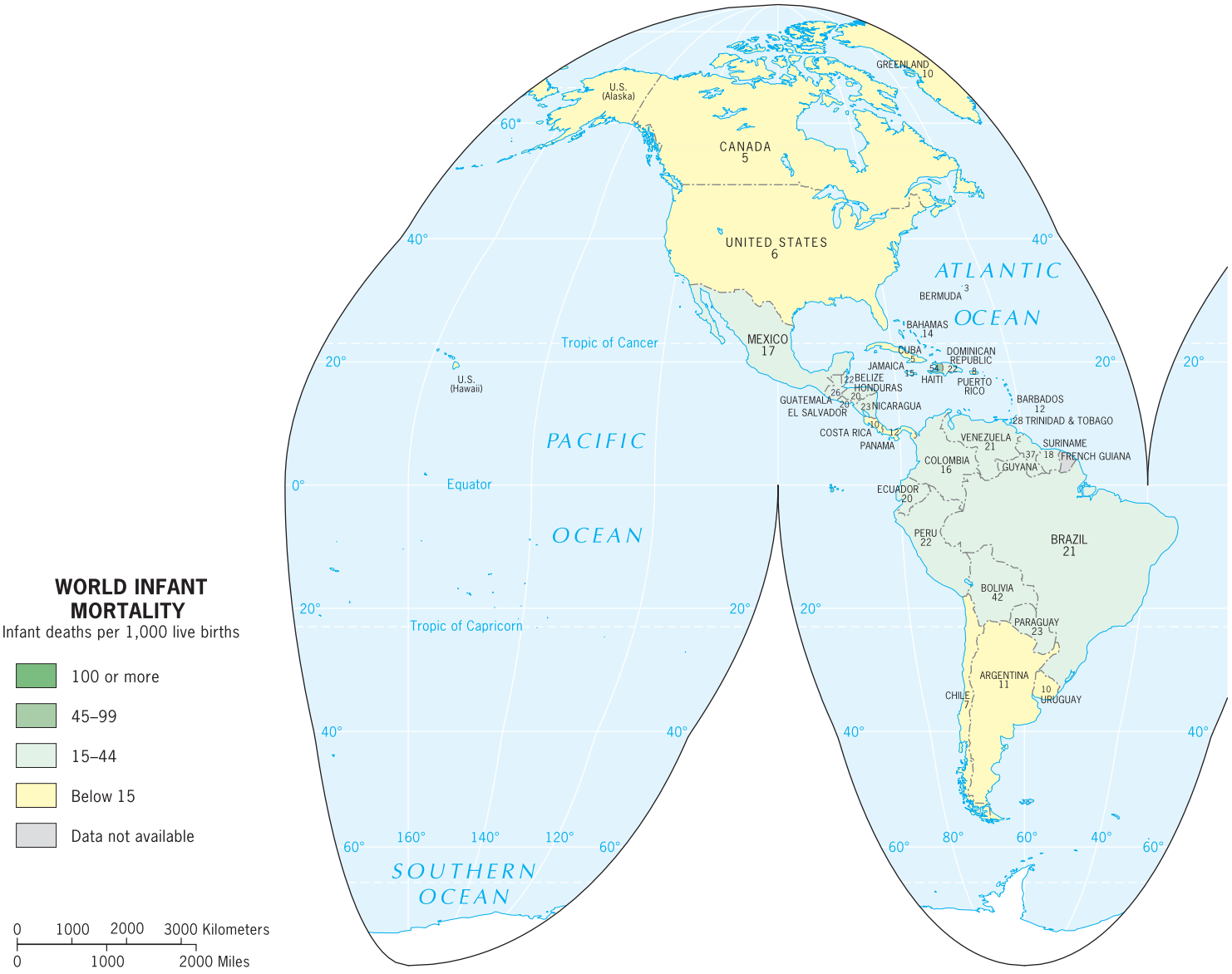
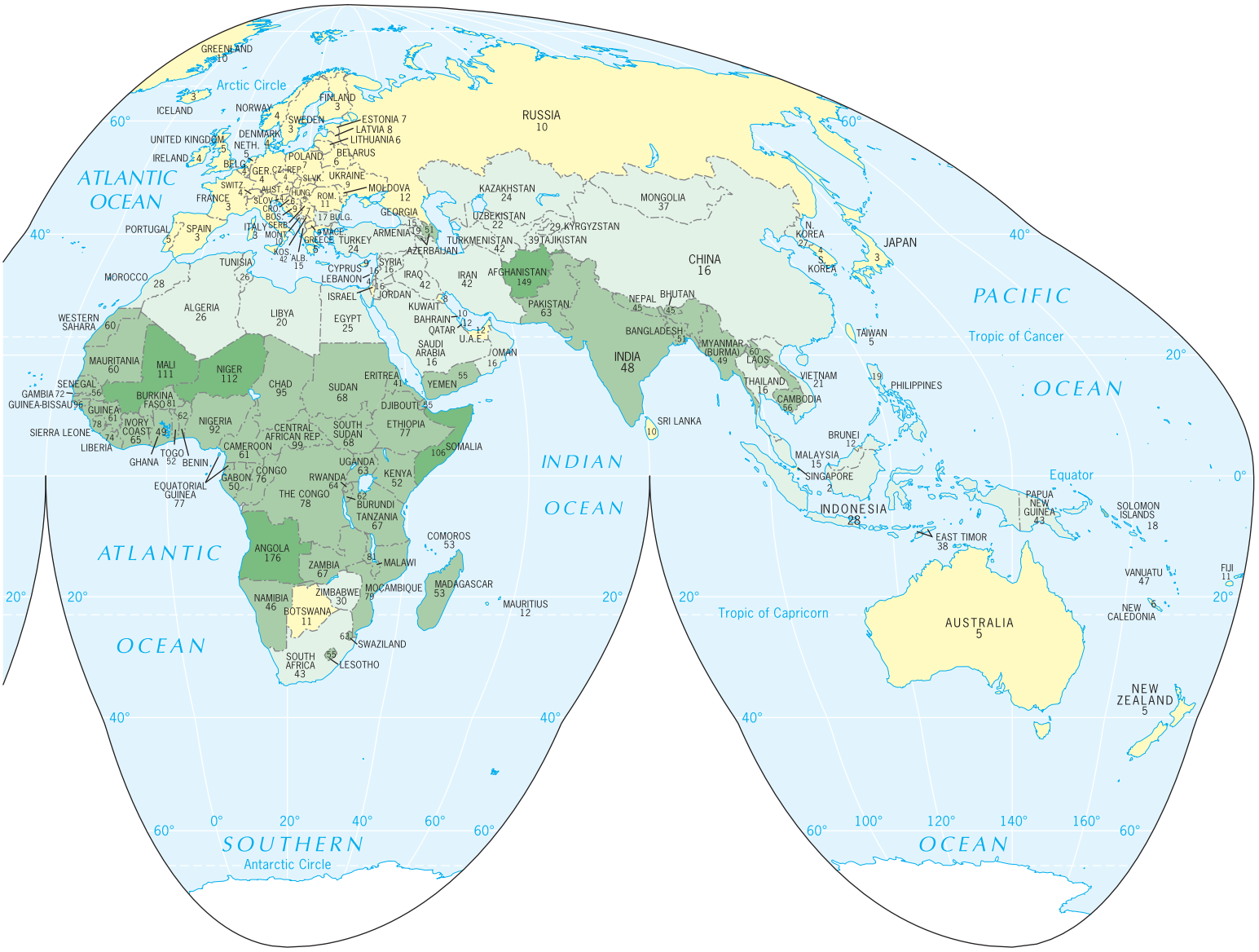


Figure 2.18
Infant Mortality Rate, 2011. *Data from:* CIA World Fact book, 2011 estimate.

the physical health of the mother being a key factor. In societies where most women bear a large number of babies, the women also tend to be inadequately nourished, exhausted from overwork, suffering from disease, and poorly educated. Often, infants die because they are improperly weaned. Demographers report that many children die because their parents do not know how to cope with the routine childhood problem of diarrhea. This condition, together with malnutrition, is the leading killer of children throughout the world. Poor sanitation is yet another threat to infants and children. Estimates are that more than one-fifth of the world's population lacks ready access to clean drinking water or hygienic human waste-disposal facilities.

The map showing the world distribution of infant mortality (Fig. 2.18) reveals high rates in many poorer countries. The map shows infant mortality patterns at five levels ranging from 100 or more per thousand (one death for every eight live births) to fewer than 15. Compare this map to that of overall crude death rate (CDR) in Figure 2.14, and the role of infant mortality in societies with high death rates is evident.

The lowest infant mortality rate among larger populations has long been reported by Japan, with 3.0 deaths per 1000 live births in a country of over 127 million people.



Some less populated countries show even lower IMRs. Singapore has over 4.5 million people and an incredibly low IMR of just under 3, and Sweden's nearly 9 million people record an IMR of 2.8.

In 2008, 22 countries still reported an IMR of 100 or more, and several had rates of 125 or higher—that is, one death or more among every eight newborns. Sierra Leone and Afghanistan had the highest IMR: 165. Dreadful as these figures are, they are a substantial improvement over the situation 20 years ago (although they are not much improved since 1997). Globally, infant mortality has been declining, even in the poverty-stricken regions of the world.

Each of these observations about infant mortality rates considers what is happening within an entire country. The IMR varies within countries and gives us a lens into variations in access to health care and health education within a country. A statistic typically varies by region, ethnicity, social class, or other criteria. The IMR of South Africa is 48 per 1000, an average of all the people within the country's borders. The IMR for South African whites is near the European average; for black Africans it is nearer the African average; and for the Coloured and Asian population sectors it lies between these two figures. The reported average for South Africa does not tell ethnic and class differences within South Africa.

In the United States, in 2004, the IMR for African Americans was 13.6, above the countrywide average of 6.8 and the IMR of 5.7 for non-Hispanic whites. The risk factors that lead to a high IMR afflict African Americans at a much higher rate than non-Hispanic whites in the United States. According to the Centers for Disease Control, 88.9 percent of non-Hispanic whites but only 76.5 percent of African Americans received prenatal care starting in the first trimester of their pregnancy. Lower education levels for African American women also contributed to the higher IMR. One risk factor that contributes to high IMR, smoking during pregnancy, was higher for non-Hispanic whites. The Centers for Disease Control found that 13.8 percent of non-Hispanic whites smoked cigarettes during pregnancy in 2004, and 8.4 percent of African American women smoked during pregnancy.

The IMR in the United States also varies by region, with the highest IMR in the South and the lowest in the Northeast (Fig. 2.19). Race, ethnicity, social

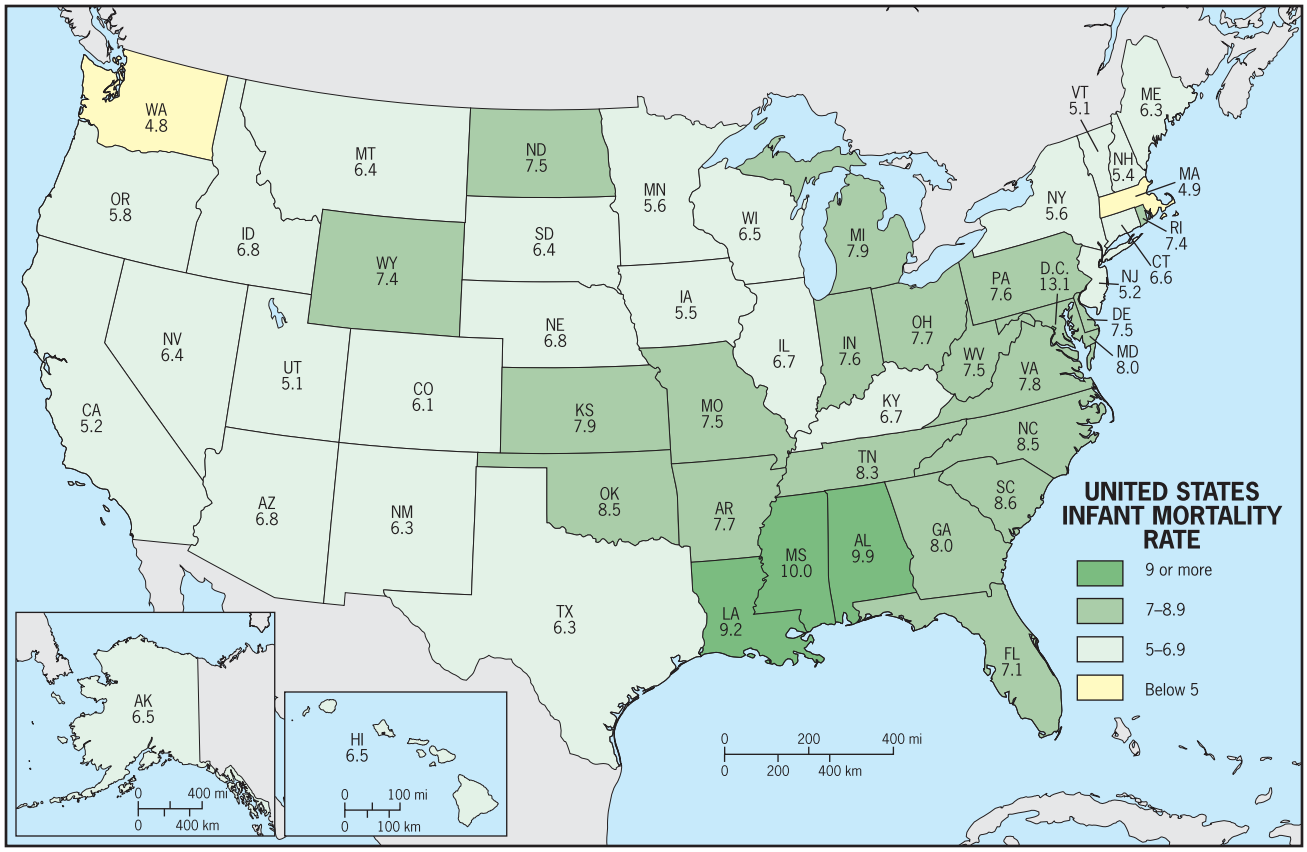


Figure 2.19

Infant Mortality Rate in the United States. Infant deaths per 1000 live births. *Data from*: Centers for Disease Control, National Vital Statistics Reports, 2007.

class, education levels, and access to health care also vary by region in the United States, and these correlations are found for many health problems from diabetes to heart disease.

According to the Office of Minority Health and Health Disparities at the Centers for Disease Control in the United States, "The leading causes of infant death include congenital abnormalities, pre-term/low birth weight, Sudden Infant Death Syndrome (SIDS), problems related to complications of pregnancy, and respiratory distress syndrome. SIDS deaths among American Indian and Alaska Natives is 2.3 times the rate for non-Hispanic white mothers."

Another measurement of the health of children early in life is the newborn death rate, a measurement of the number of children who die in the first month of life out of every 1000 live births. Surprisingly, the United States has the *second highest newborn death rate* in the world. The annual State of the World's Mothers report explains that the high newborn death rate in the United States and in other wealthy countries is typically from premature births and low-birth-rate babies. In the poorer countries of the world, diarrhea and infections cause half of newborn deaths.

Figure 2.20 maps the Mother's Index from the State of the World's Mothers report. The Mother's Index measures 10 barometers of well-being for mothers and children. Although the United States has a high newborn death rate, its position on the Mother's Index is high. The overwhelmingly low measurements for Subsaharan Africa on the Mother's Index confirms that poverty is a huge factor in the health of women and children. Specifically, 99 percent of newborn deaths and 98 percent of maternal deaths (deaths from giving birth) occur in the poorer countries of the world.

In the countries in the world experiencing violent conflict, the Mother's Index plunges, and the chances of newborn survival fall. Examine Figure 2.20 again and note the position of countries that have violent conflict or a recent history of conflict: Iraq, Afghanistan, Liberia, Sierra Leone, and Angola.

Child Mortality

Infants who survive their first year of life still do not have a long life expectancy in the poorer areas of the world. The **child mortality rate**, which records the deaths of children between the ages of 1 and 5, remains staggeringly high in much of Africa and Asia, notably in the protein-deficient tropical and subtropical zones. *Kwashiorkor* (also known as protein malnutrition), a malady resulting from a lack of protein early in life, afflicts millions of children; *marasmus*, a condition that results from inadequate protein and insufficient calories, causes the deaths of millions more. In some countries, more than one in five children still die between their first and fifth birthdays, a terrible record in the twenty-first century.

Life Expectancy

Another indicator of a society's well-being lies in the **life expectancy** of its members at birth, the number of years, on average, someone may expect to remain alive. Figure 2.21 shows the average life expectancies of populations by country and thus does not take into account gender differences. Women outlive men by about four years in Europe and East Asia, three years in Subsaharan Africa, six years in North America, and seven years in South America. In Russia today, the difference is approximately 12 years.

The map does reveal huge regional contrasts. At the start of the century, world average life expectancy was 68 for women and 64 for men. Not only are these levels exceeded in the wealthy countries of the Western world, but great progress has also been made in East Asia, where Japan's life expectancies are the highest in the world. With its low infant and child mortality rates and low fertility rates, Japan's life expectancy is predicted to rise to 106 by the year 2300. By contrast, tropical Subsaharan African countries have the lowest life expectancies. In Subsaharan Africa, the spread of AIDS over the past three decades has lowered life expectancies in some countries below 40, a level not seen for centuries.

Life expectancies can change in relatively short order. In the former Soviet Union, and especially in Russia, the life expectancies of males dropped quite precipitously following the collapse of communism, from 68 to 62 years. In 2010, the United Nations estimated the life expectancy for males in Russia was 63. A 2010 report in *Foreign Affairs* credited "poor diet, smoking, sedentary lifestyles" and alcoholism as the main reasons why men in Russia have lower life expectancies than women." In 2011, the United Nations estimated Russia's life expectancy for females was 75, twelve years longer than the life expectancy of Russian men.

Life expectancy figures do not mean everyone lives to a certain age. The figure is an average that takes account of the children who die young and the people who survive well beyond the average. The dramatically lower figures for the world's poorer countries primarily reflect high infant mortality. A person who has survived beyond childhood can survive well beyond the recorded life expectancy. The low life expectancy figures for the malnourished countries remind us again how hard hit children are in poorer parts of the world.

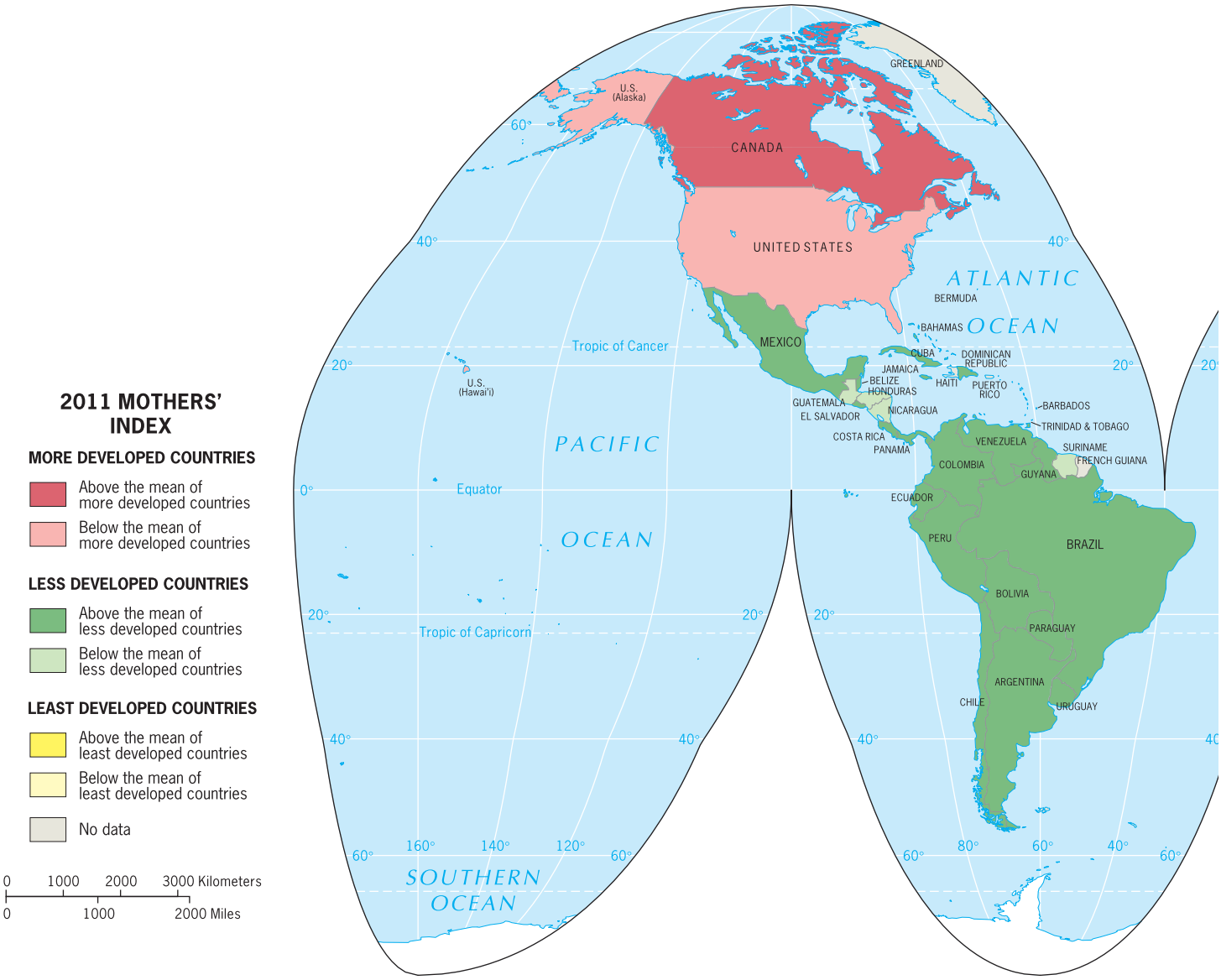


Figure 2.20

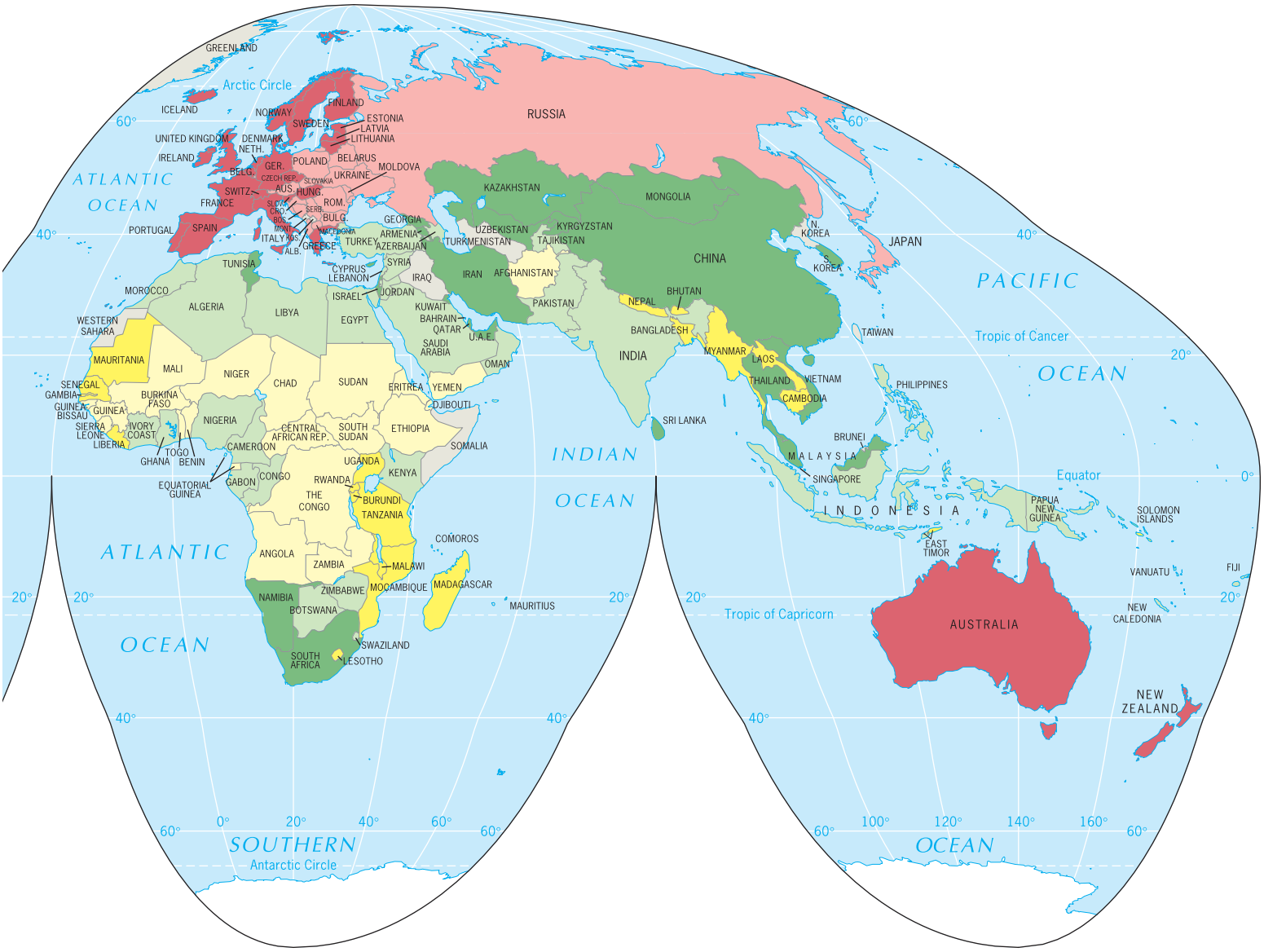
The Mothers' Index, 2011. Save the Children calculates the mothers' index annually, based on 13 indicators, to gauge the overall well-being of mothers and their children by country. *Data from*: Save the Children.

Influence on Health and Well-Being

Health and well-being are closely related to location and environment. People who live in Iceland (where mosquitoes are rare) do not need to worry about contracting malaria, unless they travel to parts of the tropics where malaria prevails. People who live in close proximity to animals, including livestock, run a greater risk of catching certain diseases than do people who live in cities. When an outbreak of a particular disease occurs (for example "bird flu" in East Asia), its source and diffusion are studied by specialists in medical geography.

Medical geographers study diseases, and they also use locational analysis to predict diffusion and prescribe prevention strategies. A medical geographer can answer questions such as: Where is the bird flu most likely to diffuse and under what time line if an outbreak occurs in New York City? If a country receives enough funding to build 25 clinics for people in rural areas, where should these clinics be located so as to allow a maximum of patients to be able to reach them?

Diseases can be grouped into categories to make it easier to understand the risks they pose. About 65 percent of all diseases are known as **infectious diseases**,



resulting from an invasion of parasites and their multiplication in the body. Malaria is an infectious disease. The remainder can be divided into the **chronic** or **degenerative diseases**, the maladies of longevity and old age such as heart disease, and the **genetic** or **inherited diseases** we can trace to our ancestry, that is, the chromosomes and genes that define our makeup. Sickle-cell anemia, hemophilia, and lactose intolerance are among these genetic diseases. These can be of special geographic interest because they tend to appear in certain areas and in particular populations, suggesting the need for special, local treatment.

Three geographic terms are used to describe the spatial extent of a disease. A disease is **endemic** when it prevails over a small area. A disease is epidemic when it spreads over a large region. A pandemic disease is global in scope.

Infectious Diseases

Infectious diseases continue to sicken and kill millions of people annually. Malaria, an old tropical disease, alone still takes more than a million lives annually and infects about 300 million people today. HIV/AIDS, an affliction

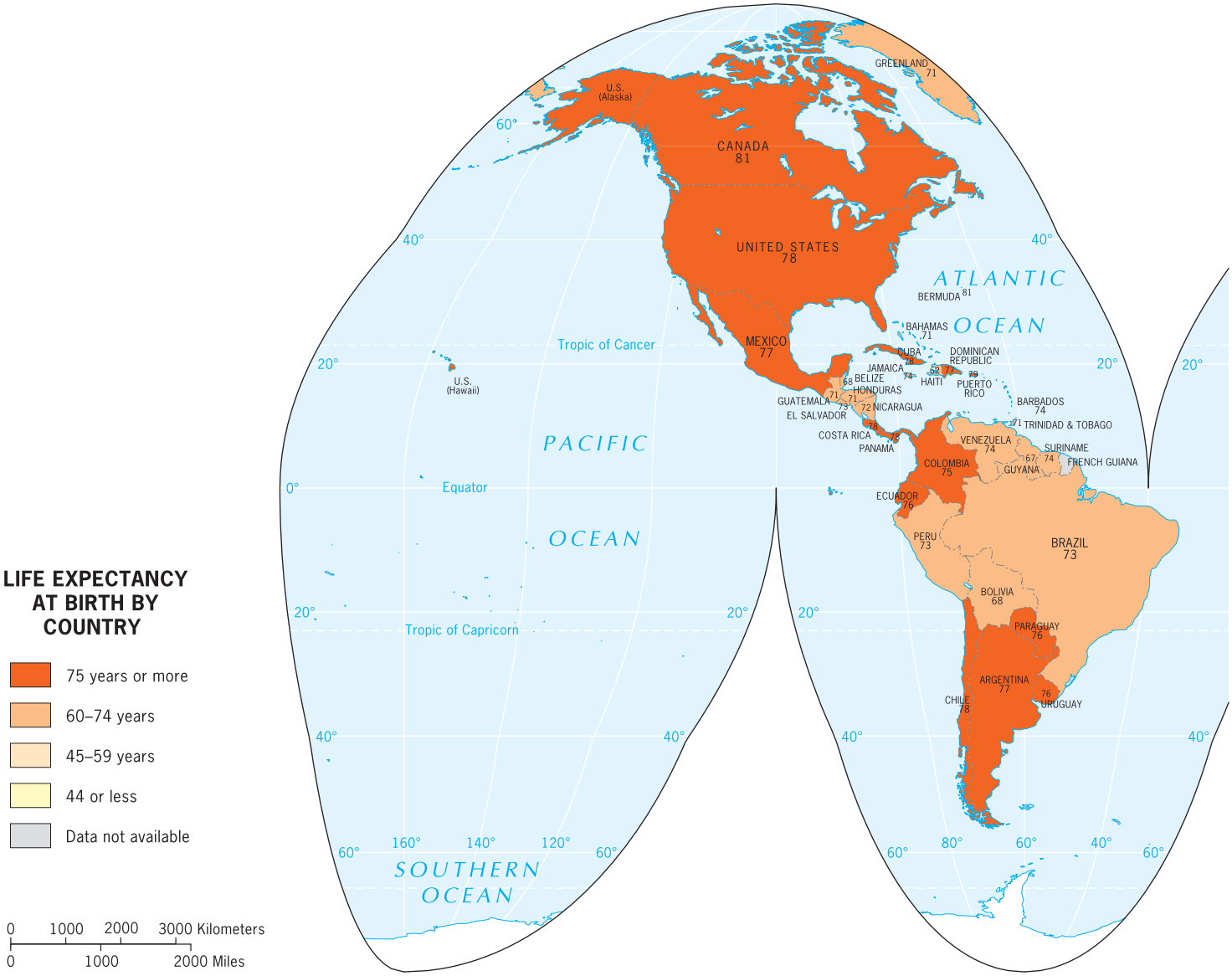


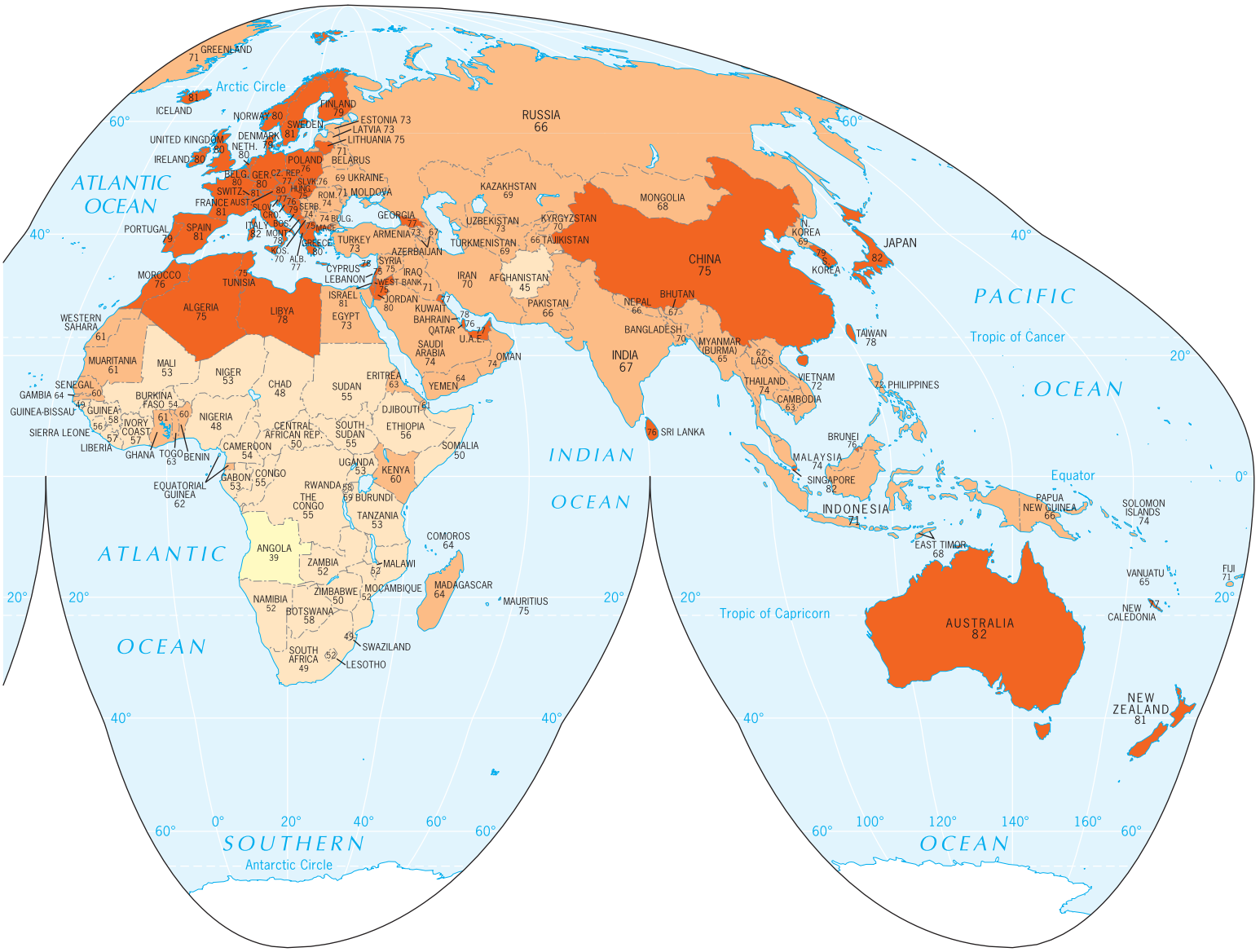
Figure 2.21
Life Expectancy at Birth in Years, 2011. *Data from*: US Census Bureau, International Database 2011

that erupted in Africa only about 30 years ago, has killed about 25 million people since that time. These two maladies illustrate two kinds of infectious disease: *vectored* and *nonvectored*.

A vectored infectious disease such as malaria is transmitted by a intermediary *vector*—in malaria's case a mosquito. What happens is that the mosquito stings an already-infected person or animal, called a *host*, and sucks up some blood carrying the parasites. These parasites then reproduce and multiply in the mosquito's body and reach its saliva. The next time that mosquito stings someone, some of the parasites are injected into that person's bloodstream. Now that person develops malaria as the parasites multiply in his or her body, and he or she is a host.

Mosquitoes are especially effective vectors of infectious diseases ranging from yellow fever (another historic illness) to dengue fever (a newer disease that is fast spreading—see Chapter 1). But mosquitoes are only one kind of vector. Fleas, flies, worms, snails, and other vectors transmit such terrible diseases as sleeping sickness, river blindness, guinea worm, elephantiasis, and numerous others. Tropical climates, where warm, moist conditions allow vectors to thrive, are the worst-afflicted areas of the world, but infectious diseases are a global phenomenon.

No disease in human history has taken more lives than malaria, and the battle against this scourge still is not won. On the day you read this, about 3000 people will die



from malaria, the great majority of them in Africa and most of them children. What these numbers do not tell you is that an estimated 3 to 5 million people live lives that are shortened and weakened by malaria infection. If you do not die from malaria as a youngster, you are likely to be incapacitated or struggle in exhaustion with chronically severe anemia throughout your life (see Chapter 10 for a longer discussion of malaria).

Nonvectored infectious diseases, such as influenza, are transmitted by direct contact between host and victim. A kiss, a handshake, or even the slightest brush can transmit influenza, a cold, or some other familiar malady. Even standing close to another person who exhales and spreads tiny moisture particles can transmit the disease to you. HIV/AIDS (discussed below) is a nonvectored infectious disease that is transmitted primarily through sexual contact and secondarily through needle sharing in intravenous drug use.

Chronic and Genetic Diseases

Chronic diseases (also called degenerative diseases) are the afflictions of middle and old age, reflecting higher life expectancies. Among the chronic diseases, heart disease, cancers, and strokes rank as the leading diseases in this category, but pneumonia, diabetes, and liver diseases also take their toll. In the United States 100 years ago, tuberculosis,

TABLE 2.1
Leading Causes of Death in the United States, 2010. *Data from*: Center for Disease Control, National Center for Health Statistics, 2010 and U.S. Census Statistical Abstract 2011.

Cause	Percent
1. Heart Disease	25%
2. Cancer	23%
3. Stroke	6%
4. Chronic Lower Respiratory Disease	5%
5. Accidents	5%
6. Diabetes	3%
7. Alzheimer's Disease	3%

pneumonia, diarrheal diseases, and heart diseases (in that order) were the chief killers. Today, heart disease and cancer head the list, with stroke (cerebral hemorrhage) next and accidents also high on the list (Table 2.1). In the early 1900s, tuberculosis and pneumonia caused 20 percent of all deaths; today, they cause fewer than 5 percent. The diarrheal diseases, which were so high on the old list, are now primarily children's maladies. Today, the diarrheal diseases are not even on the list of the 10 leading causes of death.

At the global scale, diseases of infancy have been largely defeated, and such infectious diseases as tuberculosis and pneumonia are less serious threats than they were. The battles against cancer and heart disease, however, are far from won. Recent decades have brought new lifestyles, new pressures, new consumption patterns, and exposure to new chemicals, and we do not know how these affect our health. In order to distribute adequate food supplies to populations in huge urban areas, we add various kinds of preservatives to foods without knowing exactly how they will affect our health in the long run. We substitute artificial flavoring for sugar and other calorie-rich substances, but some of those substitutes have been proven to be dangerous. Despite all the sugar substitutes, obesity plagues a significant percentage of the U.S. population, bringing with it heart disease and diabetes. Even the treatment of drinking water with chemicals is rather recent in the scheme of global population change, and we do not know its long-term effects. Future chronic diseases may come from practices we take for granted as normal now.

Genetic diseases are of particular interest to medical geographers because they are disorders that tend to be transferred from one generation to the next and display clustering that raises questions about environment and long-term adaptation. Prominent among these are metabolic diseases—the body's inability to process all elements of the diet—in which enzymes play a key role. If the body fails to produce enough (or any) of a particular enzyme, the result can be serious metabolic malfunction. For example, some people suffer from a malady called primary lactose intolerance. If you suffer from this disorder, you do not have an adequate supply of one (or a set) of enzymes that you need to break down the milk sugar lactose.

AIDS

Low life expectancies in some parts of the world are caused by the ravages of diseases such as **AIDS** (Acquired Immune Deficiency Syndrome)—a disease identified in Africa in the early 1980s. Undoubtedly, AIDS had taken hold in Africa years earlier, perhaps decades earlier. But its rapid diffusion worldwide began in the 1980s, creating one of the greatest health catastrophes of the past century. Nowhere has its impact been greater than in Africa itself.

Medical geographers estimate that in 1980 about 200,000 people were infected with HIV (Human Immunodeficiency Virus, which causes AIDS), all of them Africans. By 2007, the number worldwide exceeded 33.2 million according to the United Nations AIDS Program, with 68 percent (22.5 million) of all cases in Subsaharan Africa! The infection rate has been slowing, and some regions have experienced a downturn, but eastern Europe and Central Asia have recently seen a surge in HIV infection.

AIDS is a debilitating disease that weakens the body and reduces its capacity to combat other infections. It is spread through bodily contact that involves the exchange of bodily fluids such as blood or semen. Sexual activity and shared needles can transmit it, but so can blood transfusions. Over a period of years, a person's immune system is impaired, weight loss and weakness set in, and other afflictions, such as cancer or pneumonia, may hasten an infected person's demise.

Over the past two decades, the AIDS pandemic has reached virtually all parts of the world, but its full dimensions are unknown. People infected by HIV do not immediately display visible symptoms of the disease; they can carry the virus for years without being aware of it, and during that period they can unwittingly transmit it to others. In its earliest stages a blood test is needed to confirm HIV's presence, but millions go untested. Add to this the social stigma many people attach to this malady, and it is evident that official statistics on AIDS lag behind the real numbers.

That is true not only in Africa but in other parts of the world as well; both India and China, for example, long denied that AIDS presents a serious health threat to their populations. Now China is reporting at least 650,000 infected, and the number in India may well exceed 5 million. Estimates of the number of cases in the United States surpass 1 million; in Middle and South

America, nearly 2 million are infected. Southeast Asia now has as many as 6 million cases.

Nowhere is AIDS having the impact that it has had on Subsaharan Africa, however. In 2006, some 24 percent of people aged 15 to 49 were infected in Botswana, 20 percent in Zimbabwe, almost 19 percent in South Africa, and 17 percent in Zambia. These are the official data; medical geographers estimate that 20 to 25 percent of the entire population of several tropical African countries is infected. The United Nations AIDS program reports that more than 1.6 million people died of AIDS in Subsaharan Africa in 2007 alone. Geographer Peter Gould, in his book *The Slow Plague* (1993), called Africa a "continent in catastrophe," and the demographic statistics support his viewpoint. Life expectancy in Botswana and Swaziland has declined to 34 (and is projected to fall farther), and in Zimbabwe it is 36. In a continent already ravaged by other diseases, AIDS is the leading cause of death.

AIDS is reshaping the population structure of the countries hardest hit by the disease. Demographers look at the projected population pyramids for countries with high rates of infection and no longer see population pyramids—they see population chimneys. The shape of the projected population pyramid is altered to look more like a chimney than a pyramid, reflecting the major impact AIDS plays on the younger population in the country and its future generations (Fig. 2.22). The United States Census Bureau projects that AIDS will cause higher rates of death among young women than young men. In countries with population chimneys, men will take younger and younger brides, thus increasing the rate of AIDS in younger females.

Geographers are engaging in fieldwork to understand the human toll of AIDS locally and within families. Geographer Elsbeth Robson studied the impact of AIDS in hard-hit Zimbabwe. She found that global processes such as the diffusion of AIDS and reductions in spending on health care (often mandated by structural adjustment programs) "shape young people's home lives and structure their wider experiences." In Subsaharan Africa, the number of children orphaned when parents die from AIDS is growing rapidly (Fig. 2.23). In 2004, UNICEF reported that in just two years, between 2001 and 2003, the number of global AIDS orphans (children who have lost a parent to AIDS) rose from 11.5 million to 15 million. Robson found that in addition to the rising number of AIDS orphans, many young children, especially girls, are taken out of school to serve as caregivers for their relatives with AIDS (Figure 2.24). Robson found in her interviews with young caregivers that "more children are becoming young carers as households struggle to cope with income and labor losses through illness and mortality."

There are few positives to report. The number of AIDS-related deaths is declining globally from a peak of 2.1 million in 2004 to 1.8 million in 2009. The greatest decline in AIDS-related deaths was in South Africa between 2004 and 2009, when AIDS-related deaths in Subsahran Africa diminished by 20 percent. The declining death rate from AIDS is due to increased access to anti-retro viral drugs (ARVs) that slow the progression of the disease), better health-care access for people living with HIV, and a decline in the number of new infections since the late 1990s.

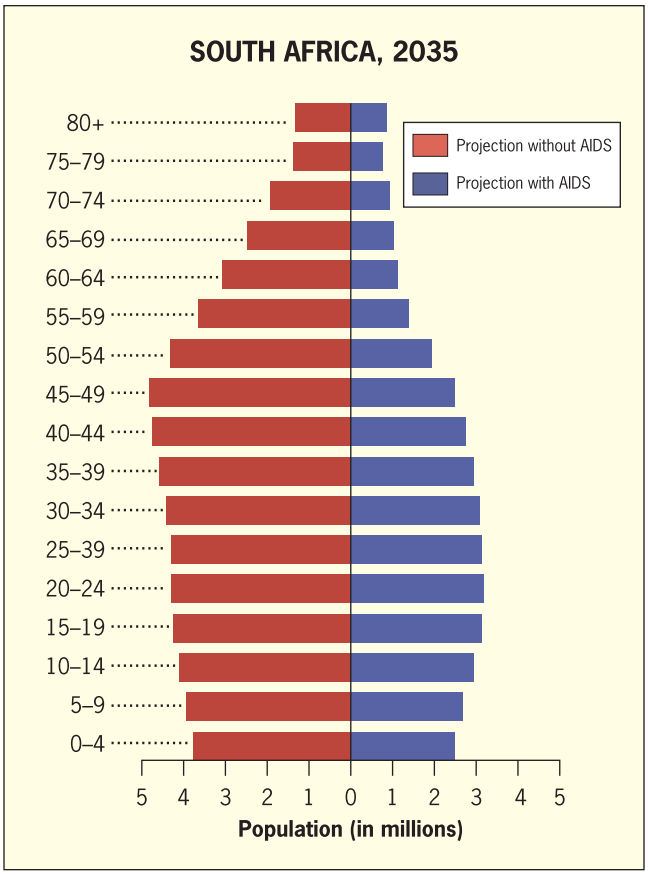


Figure 2.22
Effect of AIDS on the Population Pyramid for South Africa, Predicted 2035. Estimated population, male and female, with AIDS and without AIDS. *Data from*: United States Census Bureau, 2005.

Uganda, once Africa's worst afflicted country, has slowed the growth of AIDS through an intensive, government-sponsored campaign of propaganda and action—notably the distribution of condoms in even the remotest part of the country. Access to ARVs in Africa has increased markedly over the last decade. As a result of pressure from HIV/AIDS activists and governments, pharmaceutical companies have decreased prices of ARVs. Today, over 5 million people in developing countries are being treated with ARVs. Nonetheless, the impact of AIDS will be felt in African economies and in African demographics for generations to come. HIV/AIDS will constrain African economic development (see Chapter 10) and require world intervention to overcome.

Field Note

"The day was so beautiful and the children's faces so expressive I could hardly believe I was visiting an AIDS hospice village set up for children. The Sparrow Rainbow Village on the edges of Johannesburg, South Africa, is the product of an internationally funded effort to provide children with HIV/AIDS the opportunity to live in a clean, safe environment. Playing with the children brought home the fragility of human life and the extraordinary impacts of a modern plague that has spread relentlessly across significant parts of Subsaharan Africa."

Figure 2.23
Johannesburg, South Africa. © Alexander B. Murphy.

thinking geographically

Study Figure 2.19, the infant mortality rate (IMR) by state in the United States. Hypothesize why the IMR is low in some regions of the country and high in others. Shift scales in your mind, and take one state and choose one state to consider: how do you think IMR varies within this state? What other factors are involved at this scale and this level of generalization to explain the pattern of IMRs? Use the population Internet sites listed at the end of this chapter to determine whether your hypotheses are correct.

HOW DO GOVERNMENTS AFFECT POPULATION CHANGE?

Over the past century, many of the world's governments have instituted policies designed to influence the overall growth rate or ethnic ratios within the population. Certain policies directly affect the birth rate via laws ranging from subsidized abortions to forced sterilization. Others influence family size through taxation or subvention. These policies fall into three groups: expansive, eugenic, and restrictive.

The former Soviet Union and China under Mao Zedong led other communist societies in **expansive**

Guest Field Note

Marich Village, Kenya

This drawing was done by a Pokot boy in a remote primary school in northwestern Kenya. He agreed to take part in my fieldwork some years after I had started researching young carers in Subsaharan Africa. Since those early interviews in Zimbabwe I have been acutely aware of young carers' invisibility—you can't tell who is a young carer just by looking at them. Indeed, invisibility is a characteristic of many aspects of the social impacts of HIV/AIDS. This young person drew himself working in the fields and taking care of cattle. African young people help with farming and herding for many reasons, but for young caregivers, assisting their sick family members in this way is especially important.

Credit: Elsbeth Robson, Keele University

Figure 2.24

population policies, which encourage large families and raise the rate of natural increase. Ideological, anticapitalist motives drove those policies, since abandoned in China. Today, some countries are again pursuing expansive population policies—because their populations are aging and declining. The aging population in Europe has encouraged some countries to embark on policies to encourage (through tax incentives and other fiscal means) families to have more children.

Birth rates in Russia plummeted after the 1991 collapse of the Soviet Union. The TFR in Russia in 1980 was 2.04, and now it is only 1.34. Russian Prime Minister Vladimir Putin calls the demographic crisis Russia's greatest current problem. The Russian government offers cash subsidies of $10,000 to women who give birth to a second or third child.

In response to concerns over Russia's aging population, the government of Ulyanovsk Province has held a National Day of Conception each September 12 since 2005. In 2007, government and businesses in Ulyanovsk Province offered the afternoon off for people to participate in the National Day of Conception. The government planned to award a free car to the proud parents of one of the children born 9 months later, on June 12—the Russian National Day. On June 12, 2008 in the Ulyanovsk Province, 87 children were born, about 4 times the average daily birth rate in the province. Russia experienced an increase in TFR in the first half of 2008, but the ability to sustain a high TFR in the country will depend on many factors, including alleviating social problems, stabilizing incomes, and continued government support.

In the past, some governments engaged in **eugenic population policies**, which were designed to favor one racial or cultural sector of the population over others. Nazi Germany was a drastic example of eugenics, but other countries also have pursued eugenic strategies, though in more subtle ways. Until the time of the civil rights movement in the 1960s, some observers accused the United States of pursuing social policies tinged with eugenics that worked against the interests of African Americans. Some argue that Japan's nearly homogeneous culture is the result of deliberately eugenic social policies. Eugenic population policies can be practiced covertly through discriminatory taxation, biased allocation of resources, and other forms of racial favoritism.

Today many of the world's governments seek to reduce the rate of natural increase through various forms of **restrictive population policies**. These policies range from toleration of officially unapproved means of birth control to outright prohibition of large families.

Figure 2.25
Chengdu, China. A large billboard warning readers to follow China's one-child policy.

China's **one-child policy**, instituted after the end of the Maoist period in the 1970s, drastically reduced China's growth rate from one of the world's fastest to one of the world's slowest (Fig. 2.25). Under the one-child policy, families that had more than one child were penalized financially, and educational opportunities and housing privileges were kept from families who broke the one-child mandate.

Population growth rates in China fell quickly under the one-child policy. In the 1970s, China's growth rate was 3 percent; in the mid-1980s it was 1.2 percent; and, today, China's growth rate is 0.5 percent. The main goal of the one-child policy was achieved, but the policy also had several unintended consequences, including an increased abortion rate, an increase in female infanticide, and a high rate of orphaned girls (many of whom were adopted in the United States and Canada).

During the 1990s, under pressure to improve its human rights records and also with the realization that the population was quickly becoming gender (Fig. 2.26) and age imbalanced (Fig. 2.27), China relaxed its one-child policy. Several caveats allow families to have more

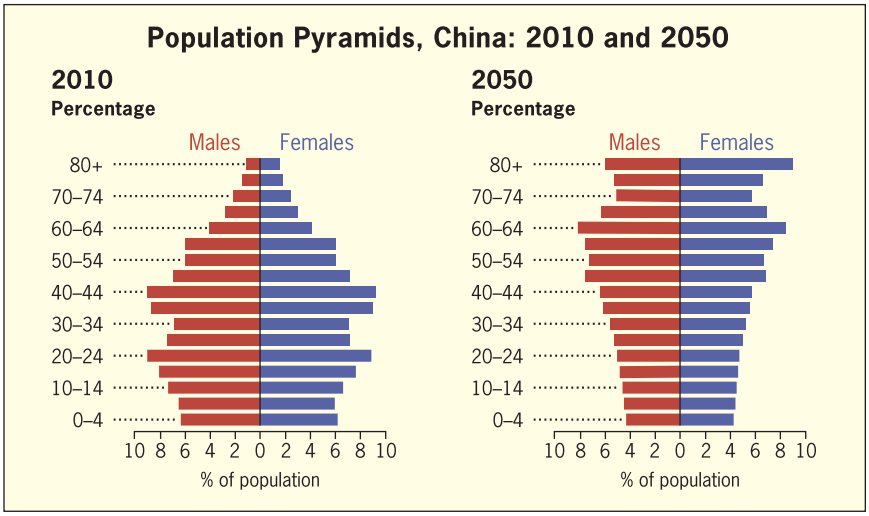


Figure 2.26
Population Pyramids, China: 2010 and 2050. *Data from:* Population Reference Bureau, 2010.

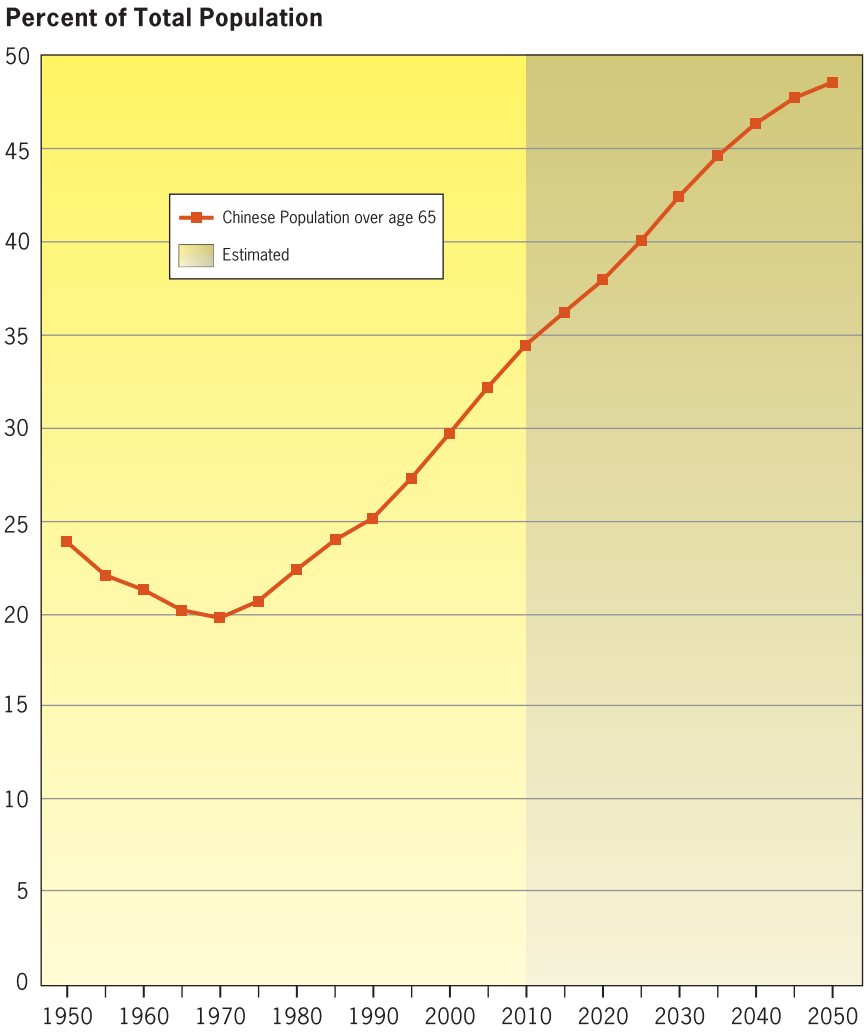


Figure 2.27
Percent of Population over Age 65 in China, 1950–2050. *Data from:* Population Reference Bureau, 2010.

than one child. For example, if you live in a rural area and your first child is a girl, you can have a second child, and if both parents of the child are only children, they can have a second child. With these changes, the National Bureau of Statistics of China now estimates that the population growth rate in China will climb again over the next 10 years.

Limitations

Population policies are not independent of circumstances that can influence growth and decline. In the 1980s, the government of Sweden adopted family-friendly policies designed to promote gender equality and boost fertility rates. The programs focused on alleviating much of the cost of having and raising children. In Sweden, couples who work and have small children receive cash payments, tax incentives, job leaves, and work flexibility that last up to eight years after the birth of a child. The policies led to a mini-birth-rate-boom by the early 1990s.

When the Swedish economy slowed shortly thereafter, however, so did the birth rate. The children born in 1991 made up a class of 130,000 students in the Swedish education system. But the children born three years later, in 1994, made up a class of only 75,000 students. The government had to build new classrooms for the temporary population boom, but then faced excess capacity when the boom subsided. Sweden's population policies have helped to produce a natural rate of increase that is a little higher than that in many other European countries, but these policies can achieve only so much. With a TFR still well below 2, the Swedish government continues to think about new ways to support families and promote birth rates. One imaginative, but not evidently successful, approach was suggested by a spokeswoman for the Christian Democrat Party, who urged Swedish television to show racier programming at night in hopes of returning the population to a higher birth rate!

Contradictions

Some areas of the world with low population growth rates (Fig. 2.9) are in the very heart of the Roman Catholic world. Roman Catholic doctrine opposes birth control and abortion. Adherence to this doctrine appears to be stronger in areas remote from the Vatican (headquarters of the Catholic Church). For example, the Philippines, thousands of miles from the Vatican, is Asia's only Roman Catholic country. The Church and the Philippine State agree on abortion, as the Philippine constitution prohibits abortion. However, on the issue of artificial contraceptives, which the still powerful Church opposes, the Philippine government disagrees with the Catholic Church. Instead, the Philippine government supports birth control in order to stem population growth.

Among Islamic countries, the geographic pattern is the opposite. Saudi Arabia, home to Mecca—the hearth of Islam—has one of the world's fastest population growth rates (2.7 percent). But in Indonesia, thousands of miles from Mecca and near the Philippines, the government began a nationwide family planning program in 1970. When fundamentalist Muslim leaders objected, the government used a combination of coercion and inducement to negate their influence. By 2000, Indonesia's family planning program had lowered the growth rate to 1.6 percent, and today it stands at 1.4 percent.

When studying government policies on population, one of the most important things to remember is unintended consequences. Choose one country in the world where women have little access to education and are disempowered. Consider the previous section of this chapter on age composition, and determine how restrictive population policies in this country would alter the population composition of the country.

Summary

In the late 1700s, Thomas Malthus sounded warning bells about the rapidly growing population in Great Britain. He feared a massive famine would soon "check" the growing population, bringing widespread suffering. Although the famine in Great Britain did not take place as he predicted, the rapidly growing worldwide population made many more follow Malthus's trajectory, issuing similar warnings about the population explosion over the last two centuries.

The growth rate of the world population has certainly slowed, but human suffering is not over yet. Dozens of countries still face high death rates and high birth rates. Even in countries where the death rate is low, slowed population growth is often a result of horrid sanitary and medical conditions that lead to high infant and child mortality, diseases such as AIDS that ravage the population and orphan the young, or famines that governments deny and that global organizations cannot ameliorate.

Population pyramids illustrate that as wealthier countries worry about supporting their aging populations, poorer countries have problems of their own. A high birth rate in a poor country does not necessarily mean overpopulation—some of the highest population densities in the world are found in wealthy countries. Even poor countries that have lowered their birth rates and their death rates are constantly negotiating what is morally acceptable to their people and their cultures.

Geography offers much to the study of population. Through geography we can see differences in population problems across space, how what happens at one scale affects what goes on at other scales, and how different cultures and countries approach population questions.

Geographic Concepts

population density
arithmetic population density
physiological population density
population distribution
dot map
megalopolis
census
total fertility rate (TFR)
aging index
doubling time
population explosion
zero population growth
natural increase
crude birth rate
crude death rate
demographic transition
stationary population level (SPL)
population composition
population pyramids
infant mortality rate
child mortality rate
life expectancy
infectious diseases
chronic or degenerative diseases
genetic or inherited diseases
endemic
AIDS
expansive population policies
eugenic population policies
restrictive population policies
one-child policy

Learn More Online

About China's South-North Water Transfer Project
http://news.bbc.co.uk/2/hi/programmes/from_our_own_correspondent/9132843.stm

About Population Growth in the World
www.prb.org
http://www.pbs.org/wgbh/nova/earth/global-population-growth.html

About the Composition of the Population of the United States
www.census.gov

About the Global AIDS Crisis
www.unaids.org/en/
www.npr.org/healthscience/aids2004/

About International Population Programs
www.unfpa.org

Watch It Online

About the Population Transition in Italy
www.learner.org/resources/series85.html#program_descriptions