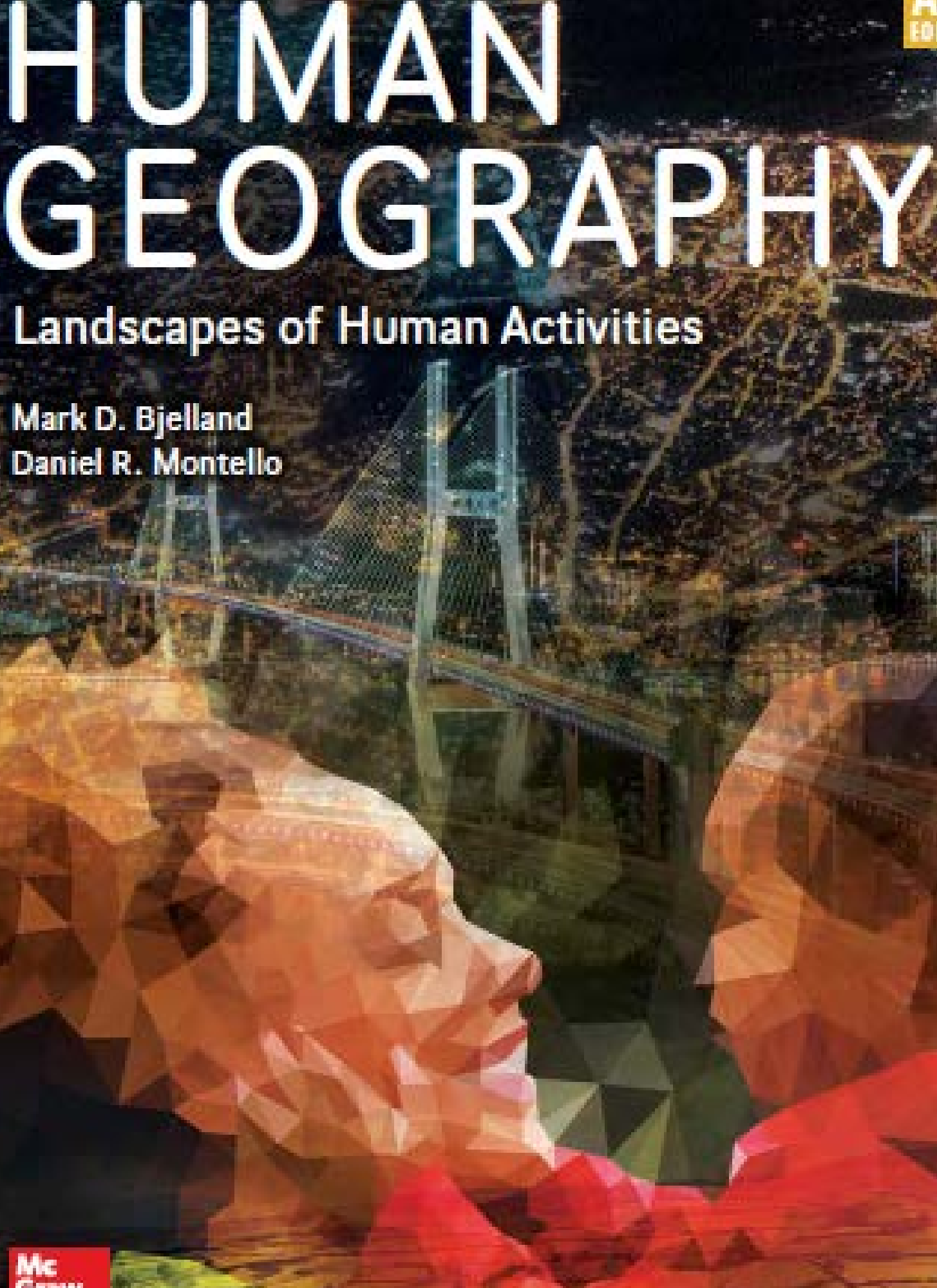
HUMAN GEOGRAPHY

Landscapes of Human Activities

Mark D. Bjelland
Daniel R. Montello



AP® EDITION

13th Edition

HUMAN GEOGRAPHY

Landscapes of Human Activities

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HUMAN GEOGRAPHY: LANDSCAPES OF HUMAN ACTIVITIES, THIRTEENTH EDITION

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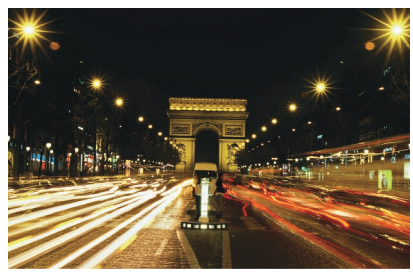

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Preface

This first AP adaptation of the best-selling college text, now in its thirteenth edition, retains the well-received organization and structure of the earlier college editions and includes comprehensive AP content and coverage that fully aligns to the AP course framework. The program seeks to introduce its users to the scope and excitement of geography and its relevance to their daily lives and roles as informed citizens. We recognize that for many students, human geography may be their first or only work in geography and this, their first or only textbook in the discipline. For these students particularly, we seek to convey the richness and breadth of human geography and to give insight into the nature and intellectual challenges of the field of geography itself. Our goals are to be inclusive in content, current in data, and relevant in interpretations. These goals are elusive. Because of the time lapse between world events and the publication of a book, events inevitably outpace analysis. We therefore depend on a continuing partnership with classroom teachers to incorporate and interpret current events and emerging geographic patterns.

Organization

The text offers flexibility for use as the core curriculum for a one- or two-semester AP course. The emphasis is on key concepts and theories in human geography, which can then be applied to understanding patterns of human activities and current events. Chapter 1 sets the stage by briefly introducing students to the scope, methods, and background basics of geography as a discipline and to the tools—especially maps—that all geographers employ. It is supplemented by Appendix A, which gives a more detailed treatment of map projections than is appropriate in a general introductory chapter. Both are designed to be helpful, with content supportive of, not essential to, the later chapters of the text.

The arrangement of those chapters reflects our own sense of logic and teaching experiences. Chapters 2 through 4 introduce major themes and fundamental concepts in human geography. Chapter 2 examines the basis of culture, culture change, and cultural regionalism. Chapter 3 offers a comprehensive review of concepts of spatial interaction and spatial behavior. Chapter 4 considers population structures, patterns, and change. Chapters 5 through 7 discuss the foundations for different social and cultural identities: language and religion (Chapter 5), ethnicity (Chapter 6), and folk and popular culture (Chapter 7). Chapter 7 also examines the landscape expressions of different cultures. Chapters 8, 9, and 10 focus on economic geography, beginning with activities connected to the Earth and natural resources (Chapter 8), then exploring the changing geographies of manufacturing and service industries (Chapter 9), and concluding with an examination of inequality and issues in economic development (Chapter 10). Chapter 11 examines the organization of urban systems and urban space, while Chapter 12 explores the political organization of territory. Chapter 13 draws together in sharper focus selected aspects of the human impact on the environment, demonstrating the relevance of human geographic concepts and patterns to matters of current national and global environmental concern.

Among those concepts is the centrality of gender issues that underlie all facets of human geographic inquiry. Because they are so pervasive and significant, we felt it unwise to relegate their consideration to a single separate chapter, thus artificially isolating women and women's concerns from all the topics of human geography for which gender distinctions and interests are relevant. Instead, we have incorporated significant gender/female issues within the several chapters where those issues apply—either within the running text of the chapter or, very often, highlighted in boxed discussions.

We hope by means of this structure to convey to students the logical integration that we recognize in the broad field of human geography. We realize that our sense of organization and continuity is not necessarily that of teachers using this text and have designed each chapter to be reasonably self-contained, able to be assigned in any sequence that satisfies the arrangement preferred by the teacher.

New to This AP Edition

We are pleased to introduce the first AP edition of *Human Geography: Landscapes of Human Activity*. Although the text's established framework from prior college editions has been retained in this thirteenth edition, each chapter has been revised to improve readability, fully cover the AP Human Geography course framework, and every chapter contains at least brief text additions or modifications to reflect current data. All chapters contain new or revised illustrations, maps, photos, as well as AP correlations, AP key terms highlighted at point of use, end-of-chapter AP test practice, and AP-focused review.

The thirteenth edition contains many new and updated topics, including the following:

New Maps

Many existing maps have been updated for the thirteenth edition of *Human Geography.* In addition, new maps introduced in this edition include:

- A new choropleth map of the religiously unaffiliated in the United States
- A new map of metropolitan regions specializing in the information economy
- Satellite maps of urban growth in Las Vegas, Nevada
- Renewable freshwater resources per capita by country

New Boxes

Many of the boxed elements in the text have been updated, and the following new boxes have been introduced:

- "The Burning Man Festival of Art and Music: Subcultural Landscape in the Great Basin Desert" in Chapter 2
- "Health Geography," in Chapter 2
- AP "Geography and Citizenship: Changing Toponyms," in Chapter 5
- "Religious Attire in Secular Spaces," in Chapter 5
- AP "Geography and Citizenship: Monuments, Memorials, and Civic Spaces," in Chapter 7
- "Sustainable Development Goals," in Chapter 10
- AP "Geography and Citizenship: Gerrymandering in the United States," in Chapter 12

New/Revised Topics

New and revised topics in this book include the following:

- Updated population data and forecasts throughout
- New comparison of the components of projected population change in the developed and developing regions of the world
- Updated information on legal and undocumented immigration into the United States and proposals for construction of a wall along the Mexico border
- New material on China's and India's population policies and prospects
- An updated discussion of successful efforts to slow the spread of HIV in sub-Saharan Africa
- New population pyramid graphs for Nigeria, New Zealand, Japan, and East St. Louis, Ilinois
- New material on the 2014–2015 Ebola outbreak in West Africa
- Updated data for ethnic groups in the United States from the American Community Survey
- Updated material on refugee movements, immigration policy debates, and independence movements
- A new opening vignette for Chapter 7 on China's exuberant urban landscapes
- New material on the New Urbanism movement in urban planning
- New discussion of quaternary economic activities
- New material on the use of genetically modified crops in agriculture
- Updated information on the success of the United Nations, Millennium Development Goals (MDGs) and new Sustainable Development Goals (SDGs) for 2030
- A new presentation of Borchert's transportation epochs
- New material on Mackinder's heartland theory of geopolitics
- New discussion of the U.K. vote to withdraw from the European Union
- New set of four trend graphs for key indicators of global climate change
- The latest information on global climate change drawn from the 5th Assessment Report issued by the Intergovernmental Panel on Climate Change

AP Geography and Citizenship


AP Geography and Citizenship

International Population Policies

Thinking Geographically

Geography and Citizenship features introduce a topic of current national or international interest. Each feature includes the perspective of both sides of the issue, and then concludes with a set of questions designed to induce thought and discussion of the topic using human geographic insights. Questions require students to practice their writing skills—informal writing, research papers, and the role of argument—as described in the AP Course Framework.

AP Learning Objectives

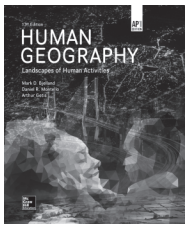
Learning Objectives from the AP Course Framework that are covered in the chapter content are listed in each chapter opener.

AP Key Words

Key Words from the AP Course Framework are highlighted in the narrative and identified in the list of Key Words at the end of each chapter. AP Key Words are also defined on the Glossary at the end of the book.

AP Test Practice

Practice questions covering core content and in the same format as the AP Human Geography Exam—multiple choice and free response questions—are provided at the end of each chapter.



AP Teacher Manual

Our new AP Teacher Manual gives teachers the tools to help students navigate the AP Human Geography course and succeed on the AP exam. The content supports and deepens understanding of the content covered in the Student Edition. The Teacher Manual, available in print and digital format, provides:

- Pacing Guides
- Sample Syllabus
- AP Key Words
- AP Discussion and Activities focused on core concepts
- Answers and rubrics for the new end-of-chapter AP Test Practice questions in the Student Edition

The Art of Human Geography

Most of the world maps use a Robinson projection, which permits some exaggeration of size in the high latitudes in order to improve the shapes of landmasses. Size and shape are most accurate in the temperature and tropical zones. The color palette for the maps was specifically chosen to accommodate most colorblind readers.

Acknowledgments

It is with great pleasure that we again acknowledge our debts of gratitude to both departmental colleagues—at Calvin University; at University of California–Santa Barbara; and at San Diego State University—and all others who have given generously of their time and knowledge in response to our requests. Special thanks go to undergraduate students Seth Haase and Hannah Fertich who assisted with map production. Other colleagues have been identified in earlier editions, and although their names are not repeated here, they know of our continuing appreciation.

We specifically, however, wish to recognize with gratitude the advice, suggestions, corrections, and general assistance in matters of content and emphasis provided by Johnathan Bascom, *Calvin University* and Dr. Susan Cassels, *University of California–Santa Barbara,* for this edition.

We appreciate their invaluable help, as well as that of the many other previous reviewers recognized in earlier editions of this book. No one, except the authors, of course, is responsible for final decisions on content, or for errors of fact or interpretation that the reader may detect.

A final note of thanks is reserved for the publisher's "book team" members separately named on the copyright page. It is a privilege to emphasize here their professional competence, unflagging interest, and always courteous helpfulness:

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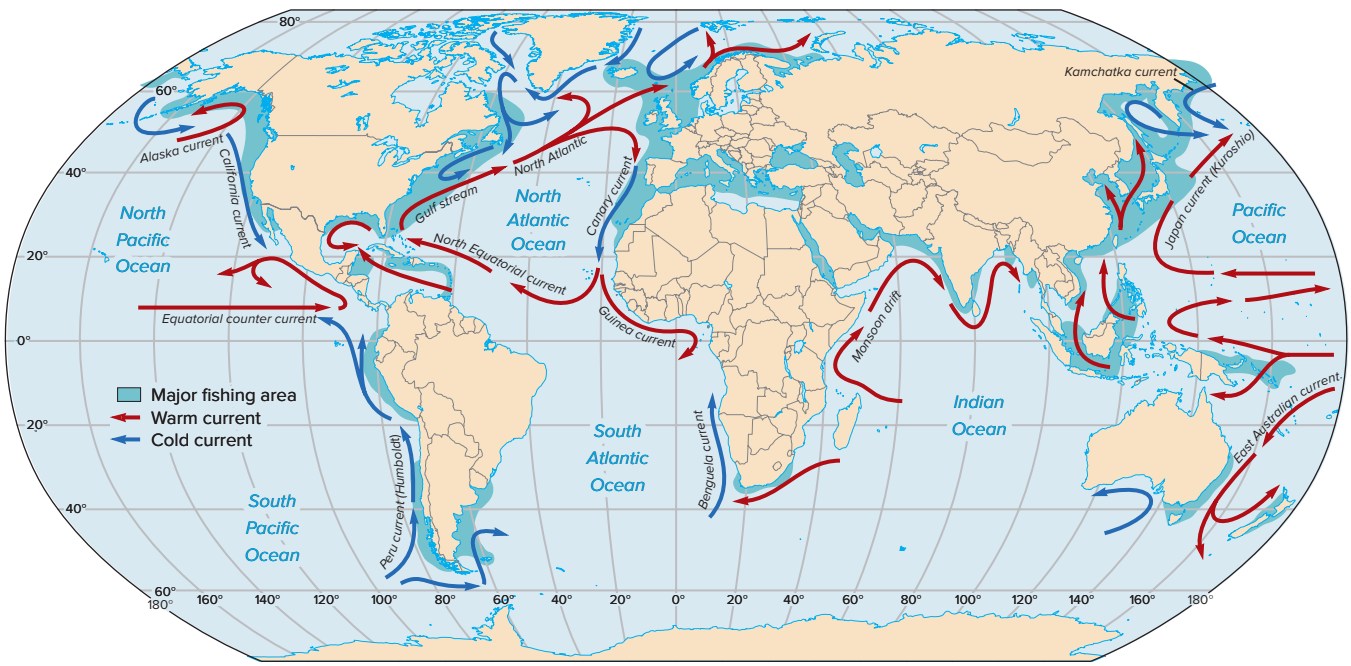

Meet the Authors

Mark D. Bjelland

Mark Bjelland received his B.S. and M.S. degrees from the University of Minnesota and University of Washington, respectively. He worked for six years as a consultant on transportation systems in Minneapolis–Saint Paul, water management in Washington State, environmental clean-ups on First Nations reservations in British Columbia, Canada, and major urban redevelopments in Vancouver, British Columbia. Intrigued by the geographical questions he encountered in his work, he earned a Ph.D. in geography from the University of Minnesota. He wrote his dissertation comparing deindustrialization, environmental justice, and brownfields redevelopment in the United States and Canada. He is professor of geography at Calvin University, where he has taught for 6 years, after 15 years at Gustavus Adolphus College. He has been a visiting scholar in the geography department at the University of British Columbia, received a Fulbright Foundation German Studies award to study urban planning in post-reunification Germany, and was awarded a U.S.-U.K. Fulbright Scholar Award to spend a year at Cardiff University in Wales researching the redevelopment of derelict industrial land and the creation of eco-communities. He loves to take geography students into the field, and in addition to local field trips to farms, small towns, and cities, he has led field courses to the Pacific Northwest, Hawai'i, and Europe. His research interests include urban and economic geography, environmental justice, urban sustainability, and religious diversity. His interests have been reflected in book chapters and articles published in *The Professional Geographer, The Geographical Review, The Encyclopedia of Geography, Research Journal of the Water Pollution Control Federation, Urban Geography,* and elsewhere. He is a co-author of McGraw-Hill's *Introduction to Geography*.

Daniel R. Montello

Daniel R. Montello received his B.A. degree from the Johns Hopkins University and his M.A. and Ph.D. degrees in environmental psychology from Arizona State University. He was also a postdoctoral fellow at the University of Minnesota and a visiting professor at North Dakota State University. He is currently professor of geography and affiliated professor of psychology at the University of California–Santa Barbara (UCSB), where he has been on the faculty since 1992. Dan teaches graduate and undergraduate courses in human geography, behavioral geography, cognitive science, statistics, research methods, cognitive issues in cartography and GIS, and environmental perception and cognition. His research is in the areas of spatial, environmental, and geographic perception, cognition, affect, and behavior. Specific research topics he and his colleagues have investigated include how people navigate in built and natural environments, how people find and lose their way, how children and adults develop an understanding of space and place (including how they acquire and use distance and direction knowledge), how people perceive and reason with maps and other visualizations, how people express their experience of place and space in language, how individuals and groups of people are similar and different in spatial thinking, how spatial relations interrelate with social relations, how people and information systems conceptualize geographic reality, and how human psychology relates to aspects of Earth science (including climate science and geology). Dan has co-authored or edited six books, including 2006's *An Introduction to Scientific Research Methods in Geography* by SAGE Publications, with Paul C. Sutton, and 2018's *Handbook of Behavioral and Cognitive Geography* by Edward Elgar Publishing. He and his co-authors have also published around 10 articles and book chapters. Dan is currently co-editor of the academic journal *Spatial Cognition and Computation* and sits on the editorial boards of *Environment and Behavior* and the *Journal of Environmental Psychology*. He has served as a reviewer for several funding agencies around the world and more than 50 academic journals in the fields of geography, cartography, geographic information science, psychology, education, cognitive science, computer science, anthropology, communication, economics, and planning. He is a member of the Association of American Geographers, the Psychonomic Society, and the Sigma Xi Scientific Honor Society.

Arthur Getis

Arthur Getis received his B.S. and M.S. degrees from Pennsylvania State University and his Ph.D. from the University of Washington. He is the co-author of several geography textbooks, as well as two books dealing with map pattern analysis. He has also published widely in the areas of urban geography, spatial analysis, and geographical information systems. He is coeditor of *Journal of Geographical Systems* and for many years served on the editorial boards of *Geographical Analysis* and *Papers in Regional Science.* He has held administrative appointments at Rutgers University, the University of Illinois, and San Diego State University (SDSU) and currently holds the Birch Chair of Geographical Studies at SDSU. In 2002 he received the Association of American Geographers Distinguished Scholarship Award. Professor Getis is a member of many professional organizations and has served as an officer in, among others, the Western Regional Science Association and the University Consortium for Geographic Information Science.

Pamela Wolfe

Pamela Wolfe has been a teacher at Yeshiva of Greater Washington in Silver Spring, Maryland, since 1980. She is now History Department Head and Head of the Humanities Division. She has taught French, English, Math, and Earth Science over the years but now teaches AP European History, AP Human Geography, AP U.S. Government, and AP U.S. History. She does consulting work for the College Board, running workshops in AP European History and AP Human Geography. During the summer, Pam teaches week-long AP Summer Institutes for teachers in both subjects at Manhattan College, Goucher College, Rutgers University, and others institutions. She served as an AP Reader for European History for 15 years and was on the AP Test Development Committee, which writes the AP European History exams. She has written an online learning program for Human Geography students and worked on a textbook, study guide, and test bank for European History classes. Her latest projects were study guides for Human Geography and European History and this new AP Human Geography textbook.

In Memory Of

Jerome D. Fellmann (1926–2010) was the lead author for the first ten editions of this book. He earned his B.S., M.S., and Ph.D. degrees at the University of Chicago and spent over 50 years teaching geography at the University of Illinois at Urbana–Champaign. His research specializations were in urban geography and economic geography, Russia, and geographic education. His contributions to undergraduate education are honored by the annual Fellmann prize, given to top graduating geography and GIS students at the University of Illinois.

Judith M. Getis (1938–2010) contributed to the early editions of this book. She did her undergraduate studies at Radcliffe College (Harvard University) and the University of Michigan and completed her M.A. in geography at Michigan State University. She taught cartography at Rutgers University and developed educational materials for Educational Testing Services. She was a co-investigator on the National Science Foundation's original High School Geography Project. In addition to this book, she co-authored *Introduction to Geography; Environments, Peoples, and Inequalities; The United States and Canada;* and *You Can Make a Difference*.

Personalized, Adaptive, and Dynamic **Digital Resources**

Human Geography **is enriched with resources including diagnostic assessment, skill and unit reviews, and writing exemplars with feedback that provide students with an opportunity to contextualize and apply their understanding.**

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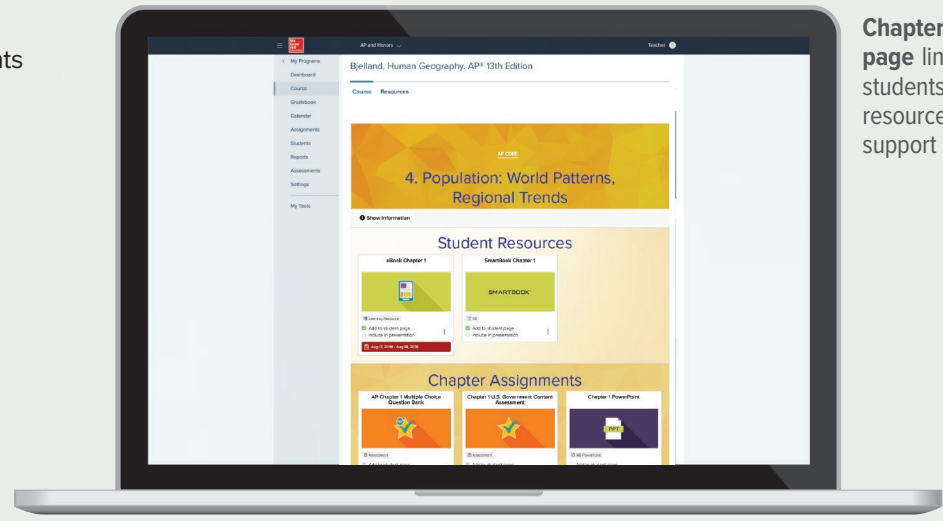

Chapter landing page links students to resources that support success.

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SMARTBOOK® is the online adaptive study tool. The interactive features engage students and personalize the learning experience with self-guided tools that:

- assess a student's proficiency and knowledge,
- track which topics have been mastered,
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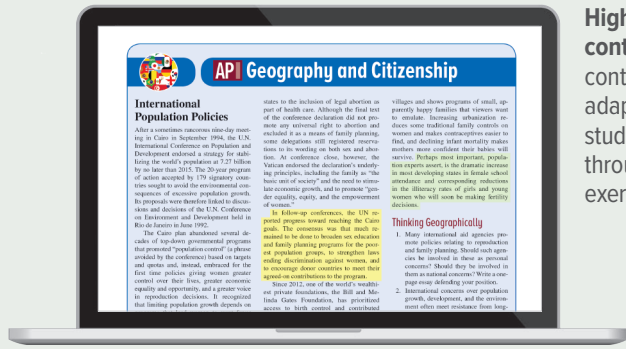

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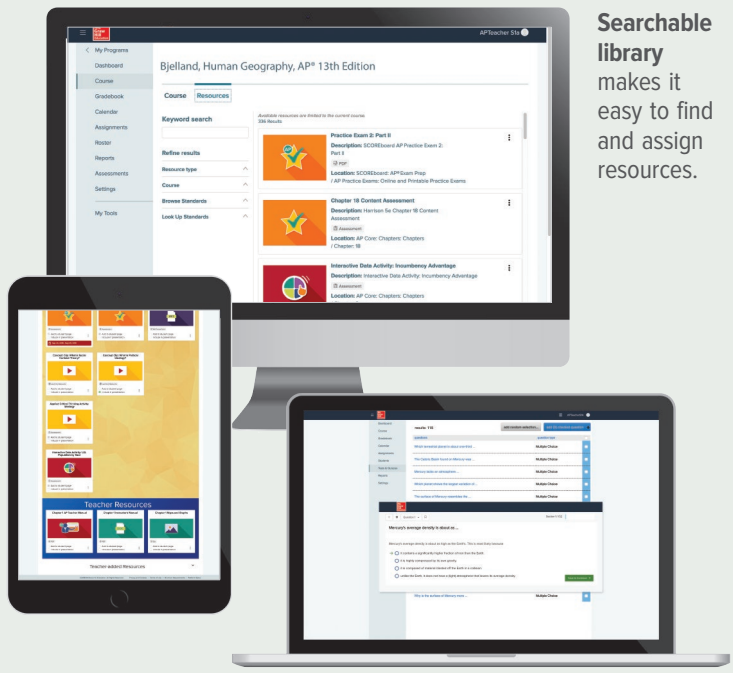

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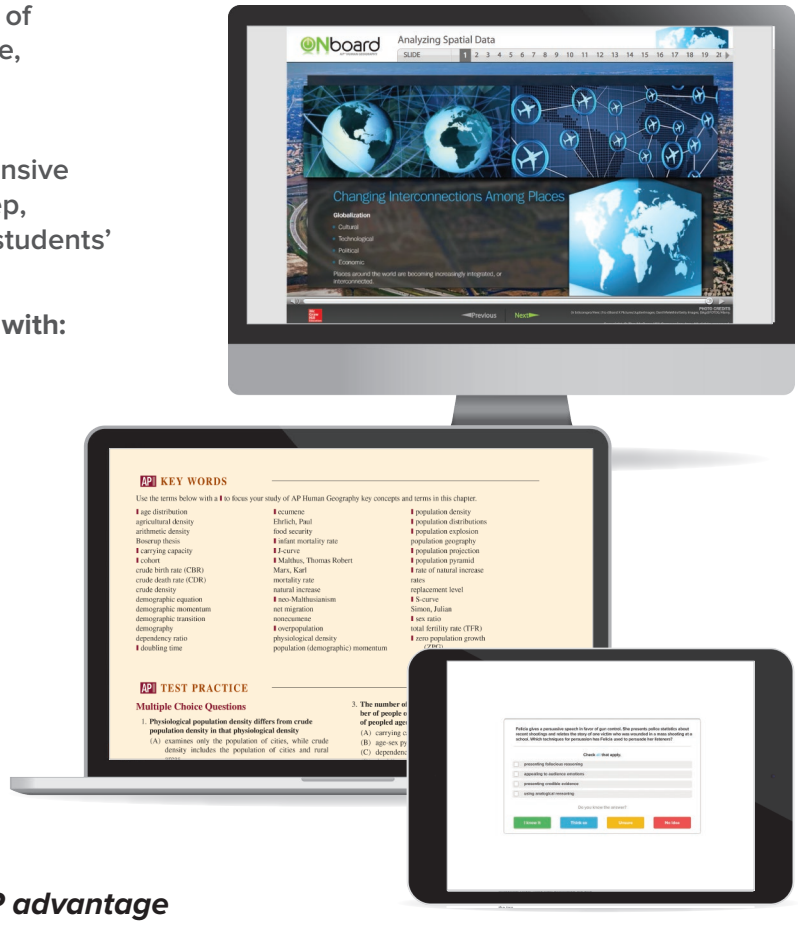

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- Interactive, engaging pedagogy tied to the text
- Powerful reporting tools and customizable content

3 SCOREboard

AP Test Prep

- Personalized, diagnostic AP content review
- Three complete, auto-graded AP practice exams
- Builds mastery and confidence for AP Exam success

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CHAPTER 4

POPULATION:

World Patterns, Regional Trends

The Djemaa el-Fna open-air market in the old quarter of Marrakesh, Morocco, is among the liveliest of markets in North Africa.
©Goodshoot/Getty Images

AP Learning Objectives

- Identify the factors that influence the distribution of human populations at different scales.
- Define methods geographers use to calculate population density.
- Explain the differences between and the impact of methods used to calculate population density.
- Explain how population distribution and density affect society and the environment.
- Describe elements of population composition used by geographers.
- Explain ways that geographers depict and analyze population composition.
- Explain factors that account for contemporary and historical trends in population growth and decline.
- Explain theories of population growth and decline.
- Explain the intent and effects of various population and immigration policies on population size and composition.
- Explain how the changing role of females has demographic consequences in different parts of the world.
- Explain the causes and consequences of an aging population.

"Zero, possibly even negative [population] growth" was the 1972 slogan proposed by the prime minister of Singapore, an island country in Southeast Asia. His nation's population, which stood at 1 million at the end of World War II (1945), had doubled by the mid-1960s. To avoid the overpopulation he foresaw, the government decreed "Boy or girl, two is enough" and refused maternity leaves and access to health insurance for third or subsequent births. Abortion and sterilization were legalized, and children born fourth or later in a family were to be discriminated against in school admissions policy. In response, by the mid-1980s birth rates had fallen to below the level necessary to replace the population, and abortions were terminating more than one-third of all pregnancies.

"At least two. Better three. Four if you can afford it" was the national slogan proposed by that same prime minister in 1986, reflecting fears that the earlier campaign had gone too far. Gone was concern that overpopulation would doom the country to perpetual poverty. Instead, Prime Minister Lee Kuan Yew was moved to worry that population limitation would deprive Singapore of economic growth potential and the youthful, educated workforce needed to support its aging population. His 1990 national budget provided for sizable long-term tax rebates for second children born to mothers younger than 28. Not certain that financial inducements alone would suffice to increase population, the Singapore government annually renewed its offer to take 100,000 Hong Kong Chinese who might choose to leave when China took over that territory in 1997. By 2018, Singapore was among the richest countries in the world. It also had one of the lowest fertility rates in the world. Population decline was avoided, however, by carefully increasing immigration rates to make up for the lack of births.

The policy reversals in Singapore reflect an inflexible fact of population: the structure of the present controls the content of the future. The size, characteristics, growth trends, and migrations of today's populations help shape the well-being of peoples yet unborn. The numbers, age, and sex distribution of people; patterns and trends in their fertility and mortality; and their density of settlement and rate of growth both affect and are affected by the social, political, and economic organization of a society. Through population analysis, we can understand the relationship between population and resources, evaluate national and international population policies, and make reasoned forecasts of what the future may bring.

Population geography provides the background concepts and theories to understand and forecast the size, composition, and distribution of the human population. It differs from **demography,** the statistical study of human population, in its concern with *spatial* analysis—location, density, pattern, and relationship to the physical environment. Regional natural resources, standard of living, food supply, and conditions of health and well-being are basic to geography's population concerns. In addition, they are fundamental expressions of the human–environmental relationships that are one of the core themes of human geography.

4.1 Population Growth

Sometime in 2017, a human birth raised the Earth's population to 7.5 billion people. In 1999, the count reached 6 billion. In 2017, the world was adding an additional 83 million people annually, or some 230,000 per day. By contrast, it took from the beginning of human history to about the year 1800 to reach 1 billion, and another 130 years to add the second billion. However, the annual rate of population increase has slowed from a peak value of 2.1 percent in 1962 to 1.1 percent in 2017. Even with the slowing rate of population growth, the United Nations in 2017 projected that the world would likely be home to 9.8 billion inhabitants in 2050. Projections of world population contain uncertainty that increases as they extend further into the future. The U.N. projections for the year 2100 range from 9.5 to 13.3 billion, with a best projection of 11.2 billion. U.N. projections for 2300 range from 2.3 to 36 billion.

All demographic forecasts agree, however, that essentially all of any future growth will occur in countries now considered *developing* (**Figure 4.1**), with especially rapid growth in the 47 least-developed states. The world's 10 most populous countries are mostly found in the developing regions of the world, and that trend will become even more pronounced by 2050 (**Table 4.1**). We will return to these projections and to the difficulties and disagreements inherent in making them later in this chapter.

Just what is implied by numbers in the millions and billions? With what can we compare the 2017 population of Trinidad and Tobago in the Caribbean (about 1.4 million) or of China (about 1.4 billion)? It is difficult to appreciate a number as vast as 1 million or 1 billion, and the great distinction between them. Here is an example offered by the Population Reference Bureau to help visualize the immensity of these numbers.

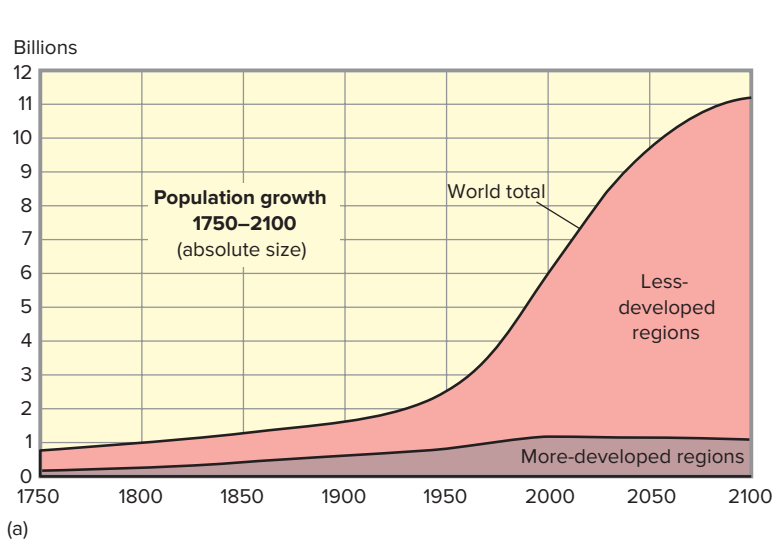
- A 2.5-centimeter (1-inch) stack of U.S. paper currency contains 233 bills. If you had a *million* dollars in thousand-dollar bills, the stack would be 11 centimeters (4.3 inches) high. If you had a *billion* dollars in thousand-dollar bills, your pile of money would reach 109 meters (358 feet)—about the length of a football field.

Table 4.1

World's Most Populous Countries, 2017 and 2050

2017		2050	
Country	**Population (millions)**	**Country**	**Population (millions)**
China	1,387	India	1,676
India	1,353	China	1,343
United States	325	Nigeria	411
Indonesia	264	United States	397
Brazil	208	Indonesia	322
Pakistan	199	Pakistan	311
Nigeria	191	Brazil	231
Bangladesh	165	Congo Dem. Rep.	216
Russia	147	Bangladesh	202
Mexico	129	Ethiopia	191

Source: *Population Reference Bureau, 2017.*



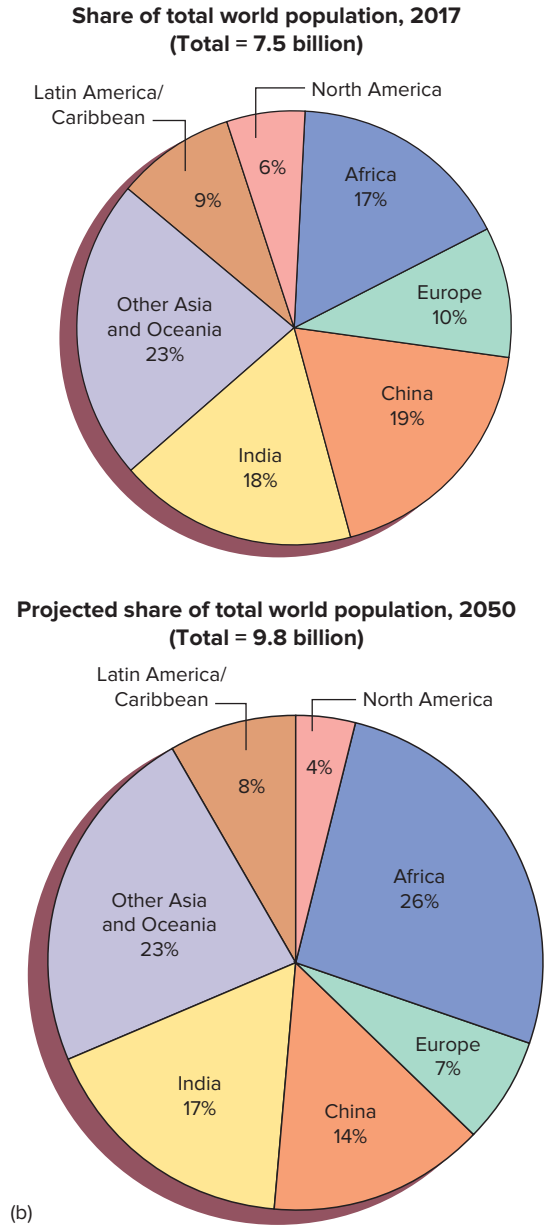


Figure 4.1 World population numbers and projections. (*a*) World population began explosive expansion after World War II ended in 1945. Numbers in more developed regions will remain stable or decline during this century due to low fertility rates. However, higher immigration and higher fertility among immigrants are projected to increase the U.S. population by more than 20 percent between 2017 and 2050, and large-volume immigration into Europe could alter its projected population decline. Between 2000 and 2100, nearly all population growth is projected to take place in 58 high-fertility countries. The high-fertility countries are all classified as *less developed*, and 39 are located in Africa, 9 in Asia, 6 in Oceania, and 4 in Latin America/Caribbean. (*b*) Africa is forecast to grow faster than the other world regions, increasing its share of the world's population substantially. China and Europe will decline slightly in total population and see a decline in their share of world population.

Sources: (a) Estimates from Population Reference Bureau and United Nations Population Fund; (b) Based on United Nations and U.S. Bureau of the Census data and projections.

The implications of the present numbers and the potential increases in population are of vital current social, political, and ecological concern. Population numbers were much smaller some 12,000 years ago when continental glaciers began their retreat, people spread to formerly unoccupied portions of the globe, and human experimentation with food sources initiated the Agricultural Revolution. The 5 or 10 million people who then constituted all of humanity obviously had considerable potential to expand their numbers. In retrospect, we see that the natural resource base of the Earth had a population-supporting capacity far in excess of the pressures exerted on it by early hunting and gathering groups.

Some observers maintain that despite a large and growing world population, the adaptive and exploitive ingenuity of humans will generate solutions to resource shortages. To them, population growth means more pressure for innovations and a larger pool of human talent to generate those innovations. Others, however, frightened by the resource demands of a growing world population that had already expanded fourfold—from 1.6 billion to 6.1 billion—in the century from 1900 to 2000, compare the Earth to a lifeboat or spaceship with an ever-increasing number of passengers. They point to recurring problems of malnutrition and starvation (though these are realistically more a matter of failures of distribution than of inability to produce enough food worldwide). They cite global climate change, air and water pollution, the loss of forest and farmland, rising prices of many minerals and fossil fuels, and other evidences of strains on world resources as signs that the world population has reached the Earth's physical capacity.

On a worldwide basis, populations grow only one way: The number of births in a given period exceeds the number of deaths. Ignoring for the moment regional population changes resulting from migration, we can conclude that humans have been highly successful in overcoming natural controls on their numerical

growth. In contrast, current estimates of slowing population growth and eventual stability clearly indicate that humans by their individual and collective decisions may effectively limit growth and control global population numbers. The implications of these observations will become clearer after we define some terms important in the study of population and explore their significance.

4.2 Some Population Definitions

Demographers employ a wide range of measures of population composition and trends, though all their calculations start with a count of events: of individuals in the population, of births, deaths, marriages, and so on. Demographers convert those counts to *rates* to make them more meaningful and useful in population analysis.

Rates simply record the frequency of occurrence of an event during a given time frame for a designated population—for example, the marriage rate as the number of marriages performed per 1,000 population in the United States last year. Demographers also place populations into *cohort* groups as they calculate birth rates, death rates, and so on. A **cohort** is a population group unified by a specified temporal characteristic—the age cohort of 0–4 years, perhaps, or the college class of 2025 (**Figure 4.2**). Basic values and rates useful in the analysis of world population and population trends have been reprinted with the permission of the Population Reference Bureau as Appendix B to this book. Comparing values in Appendix B and studying the choropleth maps in this chapter will help illustrate the discussion that follows.

Birth Rates

The **crude birth rate (CBR),** often referred to simply as the *birth rate,* is the annual number of live births per 1,000 population. It is "crude" because it relates births to total population without regard to the age or sex composition of that population.

Figure 4.2 Whatever their differences may be by race, sex, or ethnicity, these babies will forever be clustered demographically into a single birth cohort.

©Diane Macdonald/Stockbyte/Getty Images

A country with a population of 2 million and with 40,000 births a year would have a crude birth rate of 20 per 1,000.

$$\frac{40{,}000}{2{,}000{,}000} = \frac{20}{1{,}000} = 20 \text{ per thousand}$$

The birth rate of a country is, of course, strongly influenced by the age and sex structure of its population, the customs and family size expectations of its inhabitants, and its population policies. Because these conditions vary widely, recorded national birth rates vary—as of 2017, from a high of 48 in Niger in sub-Saharan Africa to 8 per 1,000 in Hong Kong, Japan, and South Korea in Asia and Greece, Italy, Monaco, Portugal, and San Marino in Europe. Birth rates of 30 or above per 1,000 are considered *high* and are found in sub-Saharan Africa, Afghanistan, Egypt, Iraq, the Palestinian Territory, Timor-Leste, and Yemen. In these countries, poverty is widespread and a high proportion of the female population is young. In many of them, birth rates may be significantly higher than official records indicate.

Birth rates of less than 18 per 1,000 are reckoned *low* and are characteristic of industrialized, urbanized regions. Overall, the Caribbean, East Asia, Europe, North America, Oceania, and South America have low birth rates. In recent years, low birth rates have been observed in an increasing number of developing states. Some of these, such as China (see "China's Way—and Others"), have adopted effective government-led population programs. In others, changed cultural norms have reduced desired family size. *Transitional* birth rates (between 18 and 30 per 1,000) characterize developing and newly industrializing regions such as Central America, Central Asia, South Asia, Western Asia, Southern Africa, and Northern Africa.

As the recent population histories of Singapore and China indicate, birth rates are subject to change. The transition to low birth rates in more developed countries is usually ascribed to industrialization, urbanization, and, in recent years, aging populations. While restrictive family planning policies in China rapidly reduced the birth rate from more than 33 per 1,000 in 1970 to 18 per 1,000 in 1986, industrializing Japan experienced a comparable 15-point decline in the decade 1948–1958 with little governmental intervention. Indeed, the stage of economic development appears closely related to variations in birth rates among countries, although rigorous testing of this relationship proves it to be imperfect (**Figure 4.3**). As a group, the more developed states of the world showed a crude birth rate of 11 per 1,000 in 2017; less-developed countries (excluding China) registered about 24 per 1,000 (down from 35 in 1990).

Technological developments such as the birth control pill have played a major role in declining birth rates. However, the sociological and ideological subsystems of culture are also important. Religious and political beliefs can also influence birth rates. In a number of different religions, more devout individuals tend to have more children. The convictions of many Roman Catholics and Muslims that their religion forbids the use of artificial birth control techniques often led to high birth rates among believers. However, predominantly Catholic Italy has one of the world's lowest birth rates. Islam itself does not prohibit contraception, and birth rates vary widely across Muslim countries. Regional variations in projected percentage contributions to world population growth are summarized in **Figure 4.4**.

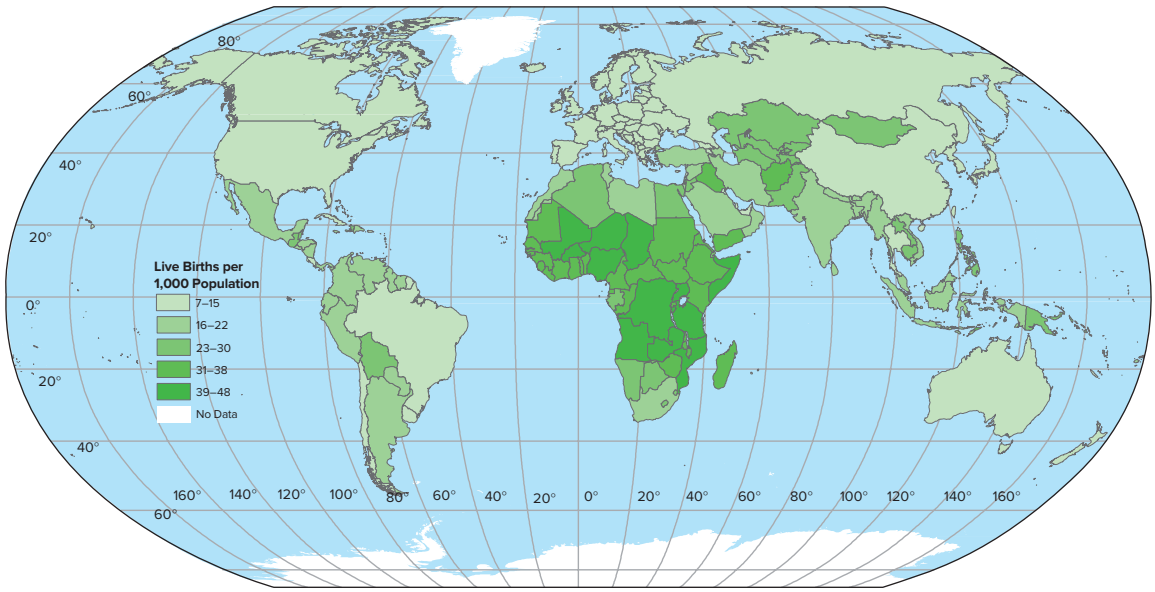


Figure 4.3 Crude birth rate, 2017. Africa stands out for its significantly higher birth rates. The map suggests a degree of precision that is misleading in the absence of reliable, universal registration of births. The pattern shown serves, however, as a generally useful summary of comparative reproduction patterns.

Source: Data from Population Reference Bureau, 2017.

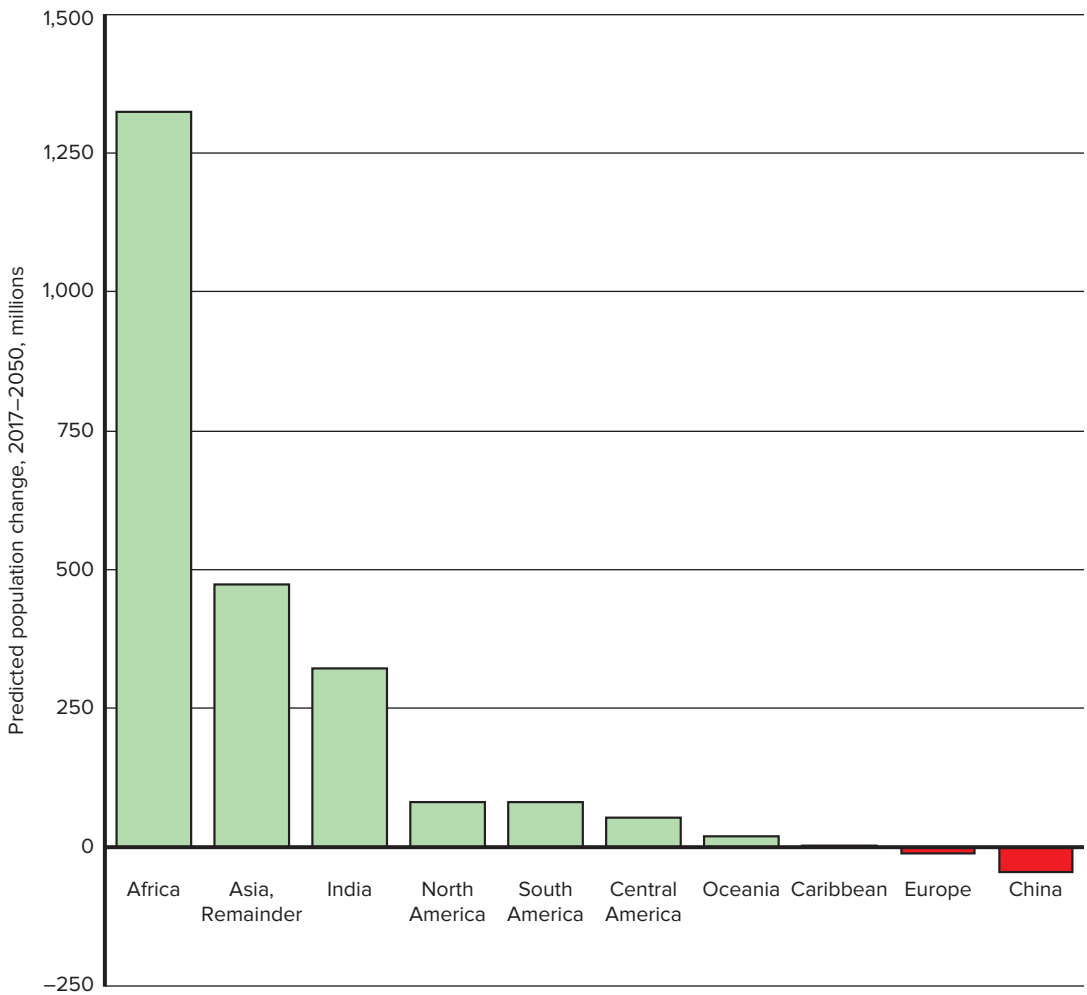


Figure 4.4 Projected contributions to world population growth by region, 2017 to 2050. Africa is projected to contribute more than half of the world's population growth in the period 2017 to 2050. India will surpass China as the world's most populous country as it continues to grow. Meanwhile, between 2017 and 2050, China's population will level off and begin a modest decline.

Source: Calculated from Population Reference Bureau, 2017.

China's Way—and Others

An ever larger population is "a good thing," Chairman Mao announced in 1965 when China's birth rate was 37 per 1,000 and population totaled 717 million. At Mao's death in 1976, numbers reached 852 million, though the birth rate then had dropped to 25. During the 1970s, China introduced a well-publicized campaign advocating the "two-child family" and providing services, including abortions, supporting that program. It was a bold attempt to create a more prosperous and powerful China while avoiding the ecological problems forecast by neo-Malthusians. In response, China's birth rate dropped to 19.5 per 1,000 by the late 1970s.

"One couple, one child" became the slogan of a more stringent population control drive launched in 1979, backed by both incentives and penalties to assure its success in China's tightly controlled society. Late marriages were encouraged; free contraceptives, cash awards, abortions, and sterilizations were provided. Penalties, including steep fines, were levied for second births. At the campaign's height in 1983, the government ordered the sterilization of either husband or wife for couples with more than one child. Infanticide—particularly the abandonment or murder of female babies—was a reported means both of conforming to a one-child limit and of increasing the chances that the one child would be male.

The one-child policy was relaxed in 1984 to permit two-child limits in rural areas where the majority of the Chinese population still resided. In contrast, newly prosperous urbanites have voluntarily reduced their fertility to well below replacement levels, with childless couples increasingly common.

Nationally, the one-child policy was so successful that when it was officially ended in 2015, an estimated 400 million births had been averted. Indeed, demographers and government officials express serious concerns that population aging and decline, not growth, are the next problems to be confronted. Projections suggest that by 2027, because of lowered fertility rates, China's population numbers will actually start falling. The country is already beginning to face a pressing social problem: a declining proportion of working-age persons and an absence of an adequate welfare network to care for a rapidly growing number of senior citizens.

China and India are the two most populous countries in the world, home to more than one-third of the global population. Back in 1950, both countries had total fertility rates of about 6 children per woman. China had 560 million residents, compared to 370 million in India. But India is predicted to surpass China by 2025 to become the most populous country on Earth. China and India's different approaches to population policy offer a contrast with great global significance. India was one of the first countries to implement a national family planning program. It has long subsidized birth control devices, legalized abortion in 1972, and has performed more surgical sterilizations than any other country. In the mid-1970s during the Indian emergency, Indira Ghandi's government implemented draconian population control measures including mass sterilization camps and even forced sterilizations. Reactions to abuses during the Indian emergency led to a rejection of coercive population policies. Instead, India relies on education and advertising campaigns. The success of the programs has been limited and India's population continues to grow while China's plateaus.

Concerned with their own increasing numbers, many developing countries have introduced their own programs of family planning, stressing access to contraception and sterilization. International agencies have encouraged these programs, buoyed by such success as the 21 percent fall in fertility rates in Bangladesh from 1970 to 1990 as the proportion of married women using contraceptives rose from 3 percent to 40 percent under intensive family planning encouragement.

With some convincing evidence, improved women's education has been proposed as a surer way to reduce births than either encouraged contraception or China's coercive efforts. Studies from individual countries indicate that 1 year of female schooling can reduce the fertility rate by between 5 percent and 10 percent.

Figure 4A Chinese Family planning poster on advertising billboard.
©Alasdair Drysdale

Fertility Rates

Crude birth rates display such regional variability because of differences in age and sex composition and/or disparities in births among those of reproductive-age. The rate is "crude" because its denominator contains persons who have no chance at all of giving birth—males, young girls, and older women. For example, we would expect a very low crude birth rate in a community with a high percentage of elderly. The **total fertility rate (TFR)** is a more refined and thus more accurate measure for showing the

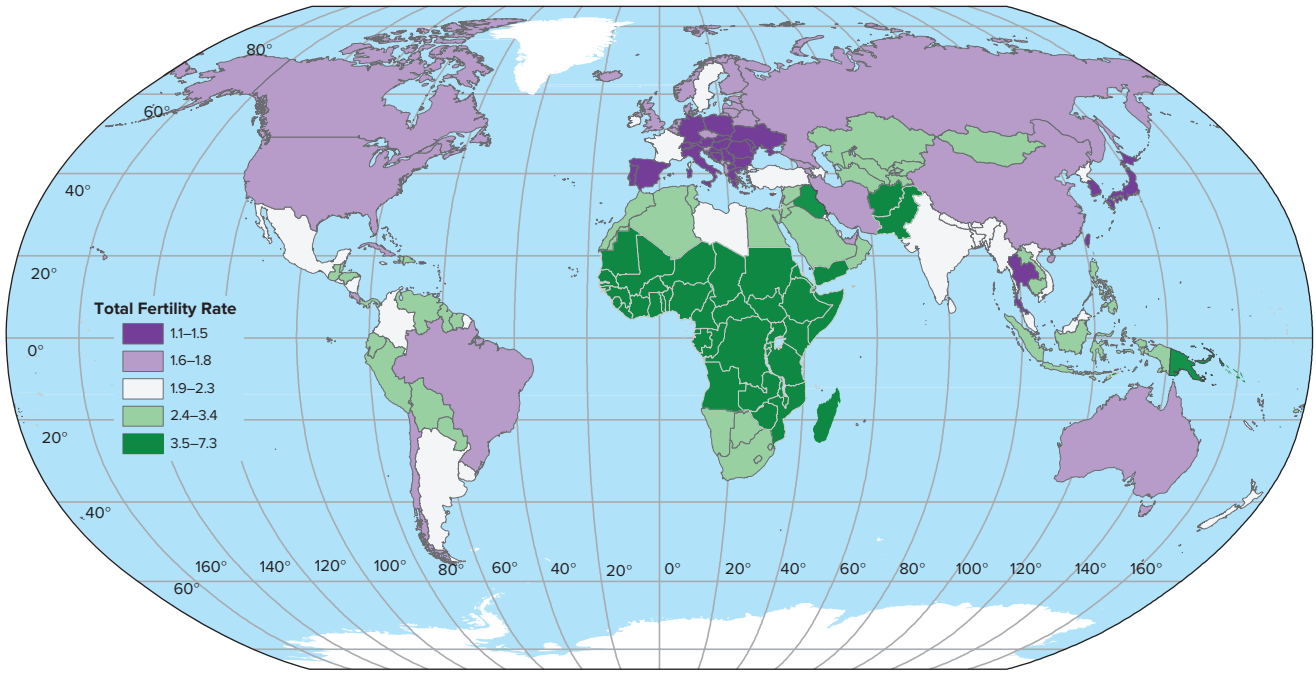


Figure 4.5 The total fertility rate (TFR) indicates the average number of children that would be born to each woman if, during her childbearing years, she bore children at the same rate as women of those ages actually did in a given year. Unlike the crude birth rate, the TFR is not affected by the age distribution of a population and thus is a more direct measure of fertility. Depending on mortality conditions, a TFR of 2.1 to 2.3 or more children per woman is considered the "replacement level," at which a population will eventually stabilize. Total fertility rates illustrate the demographic divide between the high fertility countries of sub-Saharan Africa and the low fertility countries of Europe and East Asia.

Source: Data from Population Reference Bureau, 2017.

rate and probability of reproduction among fertile females, the only segment of population capable of bearing children.

The TFR (**Figure 4.5**) tells us the average number of children that would be born to each woman if, during her childbearing years, she bore children at the current year's rate for women that age. Thus, a TFR of 3 means that the average woman in a population would be expected to have three births in her lifetime. The fertility rate is not affected by the share of women in their childbearing years and best summarizes the expected reproductive behavior of women. Thus, it is a more useful and more reliable figure for comparative and predictive purposes than the crude birth rate.

Although a TFR of 2.0 would seem sufficient exactly to replace present population (one baby to replace each parent), in reality replacement levels are reached only with TFRs of 2.1 to 2.3 or more. The fractions over 2.0 are required to compensate for mortalities that occur before women complete their childbearing years. The concept of *replacement level fertility* is useful here. It marks the level of fertility at which each successive generation of women produces exactly enough children to ensure that the same number of women survive to have offspring themselves. In general, then, the higher the level of mortality in a population, the higher the replacement level of fertility will be. For Mozambique early in the 21st century, the replacement level fertility was 3.4 children per woman.

On a worldwide basis, the TFR in 2017 was 2.5, down from 3.6 a quarter century earlier. The more developed countries recorded a 1.6 TFR in 2017. That decrease has been dwarfed by the rapid changes in reproductive behavior in much of the developing world. Since 1960, the average TFR in the less-developed world has fallen by half from the traditional 6.0 or more to 2.6 in 2017. That dramatic decline reflects the fact that women and men in developing countries are marrying later and having fewer children, following the pattern earlier set in the developed world. There has been, as well, a great increase in family planning and contraceptive use. In 2017, the United Nations reported that 85 percent of the global demand for family planning and contraceptives had been met.

The recent fertility declines in developing states have been more rapid and widespread than anyone expected. The TFRs for so many of them have dropped so dramatically since the early 1960s (**Figure 4.6**), that the fantastic world population projections issued then are now generally discounted and rejected. Indeed, in 2017, half of the global population lived in countries with fertility rates of 2.1 or less. China's decrease from a TFR of 5.9 births per woman in the period 1960–1965 to officially about 1.8 in 2017 and comparable drops in TFRs of Bangladesh, Brazil, Mozambique, and other states demonstrate that fertility reflects cultural values, not biological imperatives.

In fact, demographers have long assumed that recently observed developing country—and therefore global—fertility rate declines to the replacement level would continue and in the long run lead to stable population numbers. However, nothing in logic or history requires population stability at any level. Indeed, the experience of sub-replacement fertility in most developed countries suggests the real possibility of absolute decline.

World regional and national fertility rates reported in Appendix B and other sources are summaries that conceal significant variations between population groups. India's published TFR of 2.3 is a pooled number that hides the variation between a low value of 1.4 in the state of Goa and 3.4 in Bihar. The U.S. 2015 national average

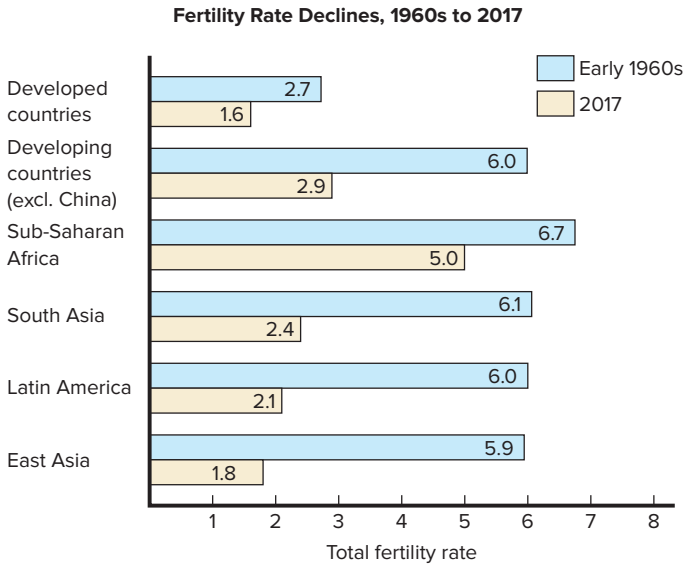


Figure 4.6 Differential fertility rate declines. Fertility has declined most rapidly in Latin America and Asia and much more slowly in sub-Saharan Africa. In 88 countries, the 2017 fertility rate was below the replacement level. The lowest fertility rates are found in Eastern and Southern Europe and in the more developed countries of Asia. The United States was long thought to be unique among developed states with its near-replacement fertility rates. However, it too has dropped below replacement levels with a 2017 TFR of 1.8.

Sources: Population Reference Bureau, 2017.

fertility rate of 1.8 does not reveal that the TFR for Hispanics was 2.1, compared to only 1.3 for American Indians and Alaska Natives.

Death Rates

The **crude death rate (CDR),** also called the **mortality rate,** is calculated in the same way as the CBR: the annual number of events per 1,000 population. In the past, a valid generalization was that the death rate, like the birth rate, varied with national levels of development. In the past, the highest rates (more than 20 per 1,000) were found in the less-developed countries of Africa, Asia, and Latin America; lowest rates (less than 10) were associated with developed states of Europe and North America. That correlation mostly disappeared as dramatic reductions in death rates occurred in developing countries in the years following World War II. Infant mortality rates and life expectancies improved as antibiotics, vaccinations, and pesticides were made available in almost all parts of the world and as increased attention was paid to sanitary facilities and safe water supplies.

Indeed, by 1994 death rates for less-developed countries as a group actually dropped below those for the more developed states and have remained lower since (**Figure 4.7**). Less improvement has been seen in reducing maternal mortality rates (see the feature "The Risks of Motherhood"). Like crude birth rates, death rates are affected by a population's age distribution. Countries with a high proportion of elderly people, such as Japan, have higher death rates than those with a high proportion of young people, such as Mexico, despite differences in living standards. The pronounced youthfulness of populations in developing countries, as much as

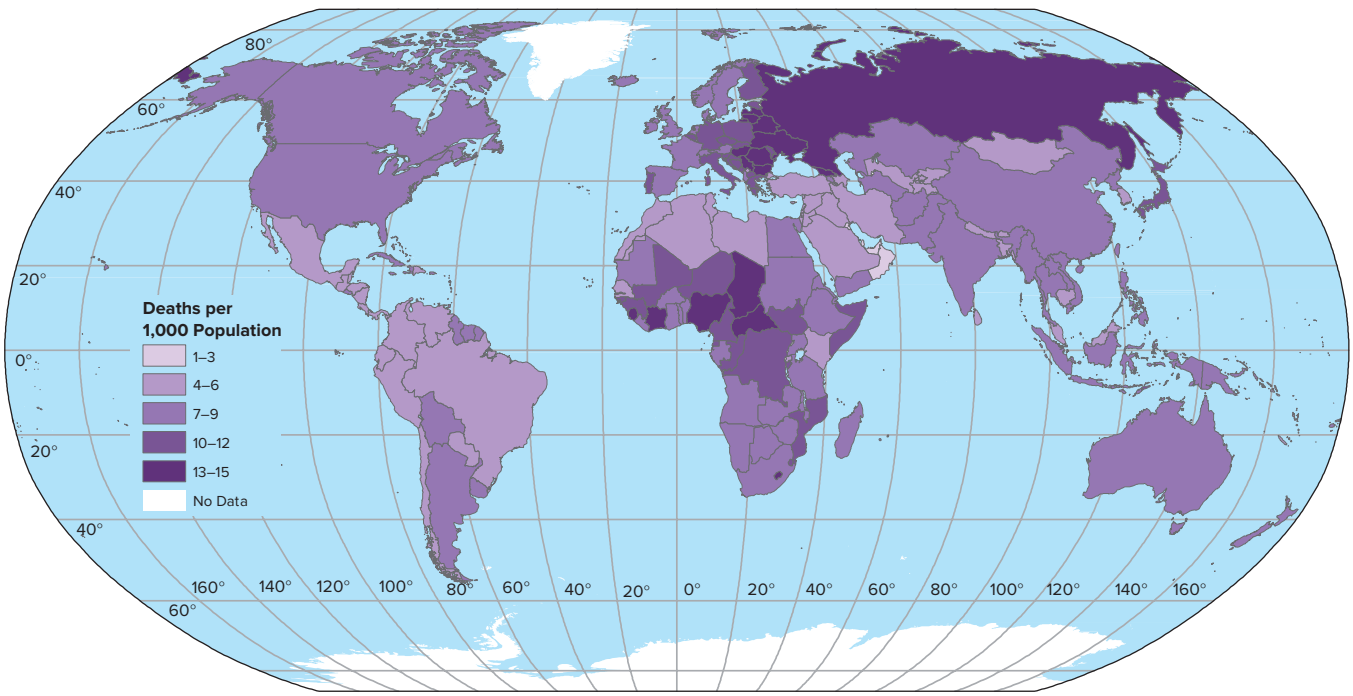


Figure 4.7 Crude death rates (CDRs) show less worldwide variability than do the birth rates displayed in Figure 4.3. The widespread availability of at least minimal health protection measures and a generally youthful population in the developing countries yield death rates frequently lower than those recorded in "old age" Europe. With its youthful population, Mexico has a lower death rate than the United States.

Source: Data from Population Reference Bureau, 2017.

The Risks of Motherhood

One of the most glaring global inequities is the maternal mortality ratio—maternal deaths per 100,000 live births. According to the World Health Organization (WHO), approximately 830 women die each day from preventable causes related to pregnancy and childbirth, leaving hundreds of thousands of children motherless.

As shown in the chart, the geography of maternal mortality is highly uneven; 99 percent of maternal deaths take place in less-developed states and two-thirds take place in sub-Saharan Africa. Pregnancy complications, childbirth, and unsafe abortions are the leading slayers of women of reproductive age throughout the developing world. According to 2015 data, the lifetime maternal mortality risk is 1 in 17 in Sierra Leone, versus 1 in 24,000 in Greece. Countries with extraordinarily high maternal death ratios are found in war-torn or politically unstable areas of Africa and Asia. In regions with high HIV prevalence, AIDS indirectly contributes to higher maternal death rates.

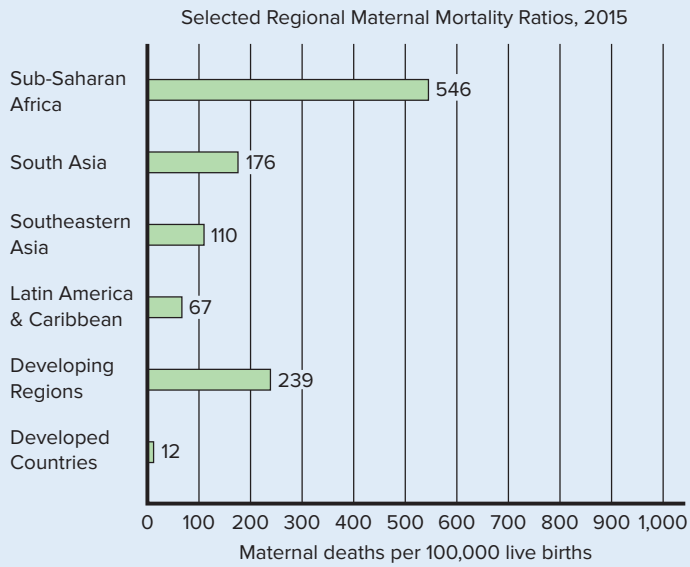


Figure 4B Maternal deaths per 100,000 live births by regions.

The vast majority of maternal deaths in the developing world are preventable. Most result from causes rooted in the social, cultural, and economic barriers confronting the world's poor: malnutrition, lack of access to prenatal health care, and unavailability of trained medical assistance, medications, or blood transfusions at birth. Education of women and girls is an important element in reducing maternal mortalities. Education empowers women to challenge practices that endanger their health.

Given the immense human suffering associated with preventable maternal deaths, the United Nations included improving maternal health among its eight Millennium Development Goals (MDGs). Specifically, the goal called for reducing the maternal mortality rate by three-quarters between 1990 and 2015. Substantial progress was made in all world regions with a 44 percent global drop in maternal deaths. The most dramatic improvements were in South Asia, which saw its rate drop from 590 to 176 deaths per 100,000 births. Meanwhile, sub-Saharan Africa lowered its rate from 870 to 546, yet still has the furthest to go. In 2016, the UN issued its Sustainable Development Goals calling for reducing maternal mortalities below 70 deaths per 100,000 live births by 2030.

Source: *Graph data from* Trends in Maternal Mortality: 1990 to 2015. *Geneva, Switzerland: WHO Press, 2015.*

improvements in sanitary and health conditions, is an important factor in the recently reduced mortality rates of those areas.

To overcome that lack of comparability, death rates can be calculated for specific age groups. The **infant mortality rate**, for example, is the ratio of deaths of infants aged 1 year or younger per 1,000 live births:

$$\frac{\text{deaths age 1 year or younger}}{\text{1,000 live births}}$$

Infant mortality rates are significant because it is at these ages that the greatest declines in mortality have occurred, largely as a result of better health services, clean water, and sanitation. The drop in infant mortality accounts for much of the decline in the overall death rate in the last few decades, for mortality during the first year of life is usually greater than in any other year.

Two centuries ago, it was not uncommon for 200–300 infants per 1,000 to die in their first year. Today, rates are in the single digits in developed countries and 32 for the world as a whole (**Figure 4.8**). Still, striking world regional and national variations remain. The highest infant mortality rates are in war-torn or politically unstable countries in Africa. For all of Africa, infant mortality rates are more than 50 per 1,000. In contrast, infant mortality rates in more developed countries are more uniformly in the 2–7 range. Infant mortality rates are not solely a matter of the economic status of a country. For example, the U.S. infant mortality rate exceeds that of many countries and even Cuba and Iran. Nor are rates uniform within a country. In the United States, African Americans have an infant mortality rate much higher than that of Asians, whites, or Hispanics.

Modern medicine and sanitation have increased **life expectancy** and altered age-old relationships between birth and death rates. In the early 1950s, only five countries, all in northern Europe, had life expectancies at birth of more than 70 years. By 2015, the average life expectancy at birth for the global population had risen to 71.4 years. The leading causes of death are now non-communicable diseases such as heart disease and stroke. The availability of

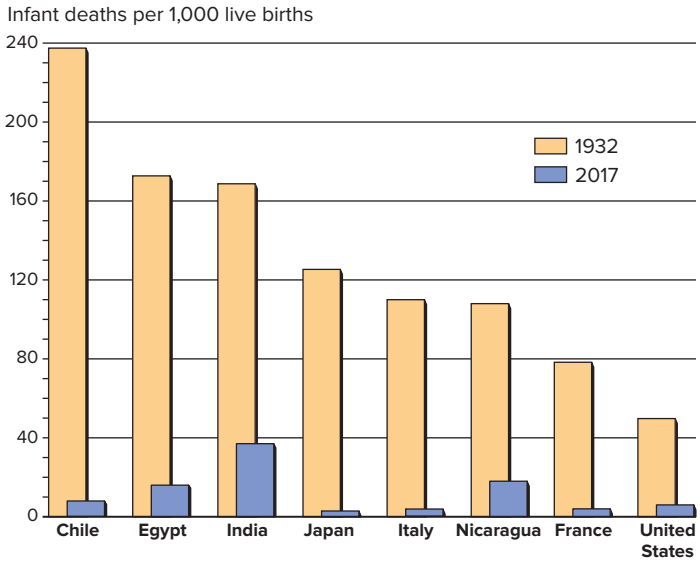


Figure 4.8 Infant mortality rates for selected countries. Dramatic declines in the rate have occurred in all countries. Nevertheless, the decreases have been proportionately greatest in the urbanized, industrialized countries, where sanitation, safe water, and quality health care are widely available.

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

clean water and sanitation varies regionally, and the least developed countries have least benefited from them. In low-income countries, leading causes of death also include communicable diseases such as malaria, tuberculosis, and water-borne diseases caused by a lack of sanitation, such as cholera, dysentery, and typhoid.

Starting in the 1950s, global life expectancies increased by about 3 years per decade. But in the 1990s, HIV/AIDS undermined global improvements in life expectancies. AIDS is the fifth most common cause of death in low-income countries and is forecast to surpass the Black Death of the 14th century—which caused an estimated 25 million deaths in Europe and 13 million in China—as history's worst-ever epidemic. According to a report by UNAIDS, AIDS-related illnesses had killed 35 million people by 2017. The United Nations estimated 37 million people were HIV positive in 2017. Some 70 percent of those infected live in sub-Saharan Africa, where HIV (originally a disease of monkeys) first established itself as a virulent human epidemic strain in the 1950s.

Southern and eastern Africa have the highest rates of HIV infection in the world. Four countries in southern Africa have adult HIV infection rates above 15 percent: Swaziland, Lesotho, Botswana, and South Africa. In southern and eastern Africa, HIV/AIDS has reduced life expectancies and slowed economic growth as parents and workers in the prime of life become ill and die prematurely. More than 10 million children in sub-Saharan Africa have lost one or both parents to HIV/AIDS. Botswana is notable for its strong national response to HIV and its provision of free antiretroviral treatment (ART) to all people with HIV. The use of ART has reduced the number of deaths to AIDS-related illnesses and reduced transmission of HIV, especially from mothers to their newborn children. The availability of expensive ART medications has been made possible by international donor and aid agencies. The gains due to ART programs, however, are fragile and vulnerable to shifting priorities at donor agencies. In addition to funding challenges, an effective response to HIV must overcome gender inequalities which result in higher infection rates among women, lack of HIV testing, lack of education, and the social stigma associated with HIV status. In Kenya, the number of annual new HIV cases declined from about 250,000 in the early 1990s to about 100,000 in 2013. To achieve the goal of lowering new infections to near zero by 2030, the Kenyan Ministry of Health developed a comprehensive HIV prevention strategy. Central to that strategy was geographical analysis of HIV incidence and diffusion rates across Kenya. Based on a finding that 65 percent of new infections occurred in a cluster of nine counties that were home to just 23 percent of Kenya's population, the national HIV prevention strategy targets high priority geographic areas.

Population Pyramids

A **population pyramid** is a powerful means of visualizing and comparing a population's age and sex composition. The term *pyramid* describes the diagram's shape for many countries in the 1800s, when the display was created: a broad base of younger age groups and a progressive narrowing toward the apex as older populations were thinned by death. Now many different shapes are formed, each reflecting a different population history (**Figure 4.9**), and some suggest *population profile* is a more appropriate label. By showing the size of different age cohorts, the pyramids highlight the impact of "baby booms," population-reducing wars, birth rate reductions, and external migrations.

A rapidly growing country such as Nigeria has most people in the lowest age cohorts; the percentage in older age groups declines successively, yielding a classic pyramid shape with stepped sides. Typically, life expectancy is reduced in older cohorts of less-developed countries, so that for Nigeria, the proportion of the population in older age groups is lower than in, for example, New Zealand. Female life expectancy and mortality rates may also be affected by cultural rather than economic developmental causes (see the feature "Millions of Women Are Missing"). In New Zealand, a wealthy country with a very slow rate of growth, the population is nearly equally divided among the age groups, giving a "pyramid" with almost vertical sides. Below-replacement fertility rates create a pyramid with smaller cohorts at the bottom, as in the case of Japan. Among older cohorts, as Japan shows, there may be more women than men because of the greater life expectancy of the former. The impacts of war, as Russia's 2018 pyramid vividly demonstrated, were evident in that country's depleted age cohorts and male-female disparities. The sharp contrasts between the pyramids for Japan and Nigeria are representative of the differing population concerns of the developing and developed regions of the world. Within countries, people sort themselves out geographically in ways that are clearly revealed in the population pyramids for different communities (**Figure 4.10**).

The population profile provides a quickly visualized demographic picture of practical and predictive value. For example, the percentage of a country's population in each age group strongly influences demand for goods and services within that national economy. A country with a high proportion of young has a high demand for educational facilities and certain types of health delivery services. In addition, of course, a large portion of the population is too young to be employed (**Figures 4.10** and **4.11**). On the other hand, a population with a high percentage of elderly people is burdened with high costs for pensions and health care, and these

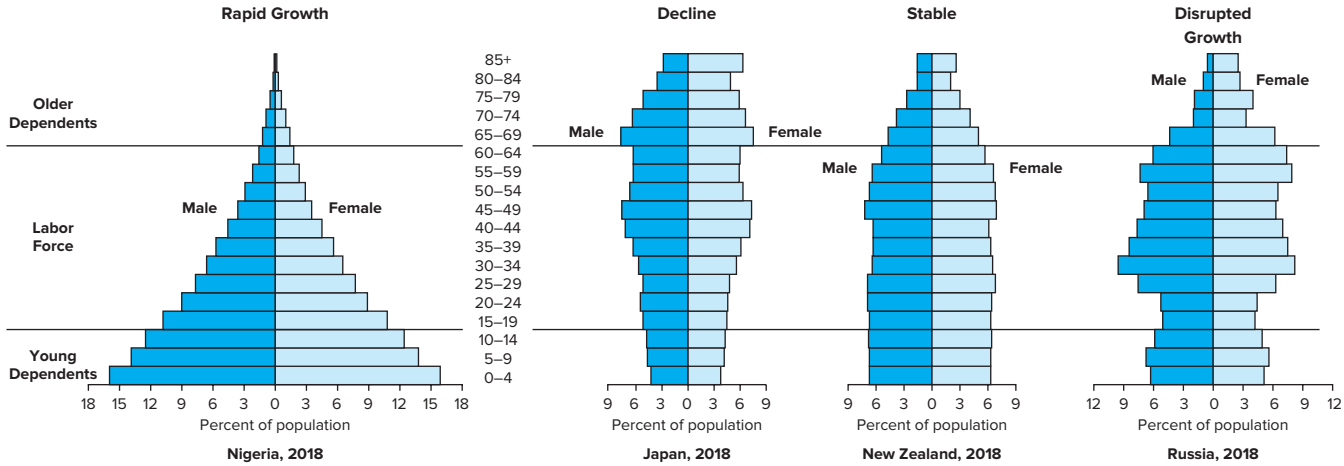


Figure 4.9 Four patterns of population structure. These diagrams show that population "pyramids" assume many shapes. The age distribution of populations reflects the past, records the present, and foretells the future. In countries such as Nigeria, social costs related to the young are important and economic expansion is vital to provide employment for new entrants in the labor force. Japan's negative growth means a future with fewer workers to support a growing demand for social services for the elderly. The 2018 pyramid for Russia records the sharp decline in births after the collapse of the Soviet Union in 1991 and during World War II as a "pinching" of the 0–24 and 70–74 cohorts, and showed in the large deficits of men above age 70 the sharp reductions in Russian male longevity.

Sources: The 2018 pyramids for Nigeria, Japan, New Zealand, and Russia: U.S. Bureau of the Census, International Data Bases.

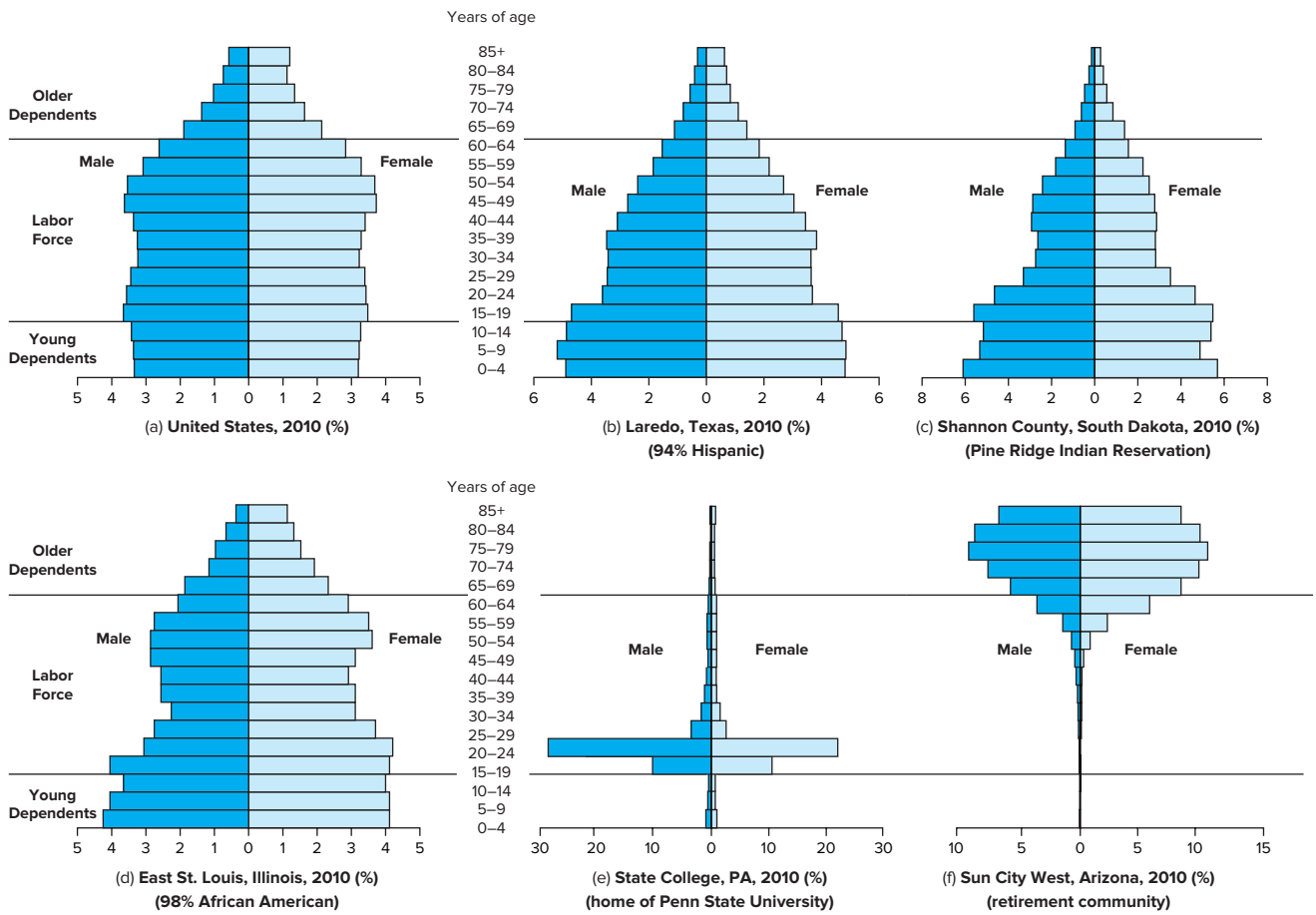


Figure 4.10 Population pyramids for different communities. The 2010 pyramids show the dramatic differences in the population structure across the United States. Laredo, Texas, on the U.S.-Mexico border, and Shannon County, South Dakota, on the Pine Ridge Indian Reservation, both display youthful populations with high birth rates. The pyramid for Shannon County also shows missing young adults and middle-aged adults who have moved away to urban areas. The pyramid for East St. Louis, Illinois shows the negative effects of high rates of incarceration and lower life expectancies for African American males. College towns and retirement communities create age-segregated places.

Source: U.S. Bureau of the Census, 2010.

Millions of Women Are Missing

Worldwide, according to one UN estimate, about 117 million women are demographically missing, victims of nothing more than their sex. Their absence is the result of sex-selective abortions, female infanticide, abandonment, neglect, and violence in countries where boys are favored.

The absence of millions of women is a tragic example of the interrelationship between the three subsystems of culture: technology (artifacts), social relationships (sociofacts), and belief systems (mentifacts). In some Asian cultures, the combination of a deeply ingrained cultural preference for boys and widespread availability of ultrasound technology has fueled the growth of sex-selective abortions. Traditionally in these societies, a married woman will care for her husband's parents in their old age. This practice has created the widespread perception that having a girl is an economic burden, while the birth of a boy is a blessing. Because higher-income families have greater access to ultrasound tests, they are more likely to abort a female fetus, even against government directives.

The evidence for the missing women starts with a comparision against a normal **sex ratio:** Between 103 and 106 males are conceived and born for every 100 females. Normally, girls are hardier and more resistant to disease than boys, and in populations where the sexes are treated equally in matters of nutrition and health care, the number of males and females tends to equalize as they age. However, in many Asian and southeastern European countries, the ratio of males to females has been rising since the introduction of prenatal sex selection. China has the most dramatic imbalances with a male-to-female sex ratio of 117 males for every 100 females for cohorts under 20 years of age. In small pockets of rural China and India, sex ratios as high as 150 have been reported. China's male-to-female sex ratio at birth increased from a normal ratio in the early 1980s to the distorted ratios witnessed today.

Sex ratio deviations are most striking for second and subsequent births. In South Korea, and Armenia, for example, the figures for first-child sex ratios are near normal, but rise to 142 boys per 100 girls for a third Korean child and to 177 per 100 for a third Armenian child.

Concern has been expressed over the lack of potential marriage partners for males reaching adulthood in India and China. The sex imbalance may exacerbate kidnapping and sex trafficking of women and girls.

But not all poor countries show the same disparities. In sub-Saharan Africa, where poverty and disease are perhaps more prevalent than on any other continent, but where there is no tradition of deadly violence against women, there are 102 females for every 100 males, and in Latin America and the Caribbean, there are equal numbers of males and females. To a lesser extent, the sex ratio disparities due to sex-selective abortions are also found among East Asian and South Asian immigrant communities in North America. Cultural norms and practices, not poverty or underdevelopment, seem to determine the fate and swell the numbers of the world's millions of missing women.

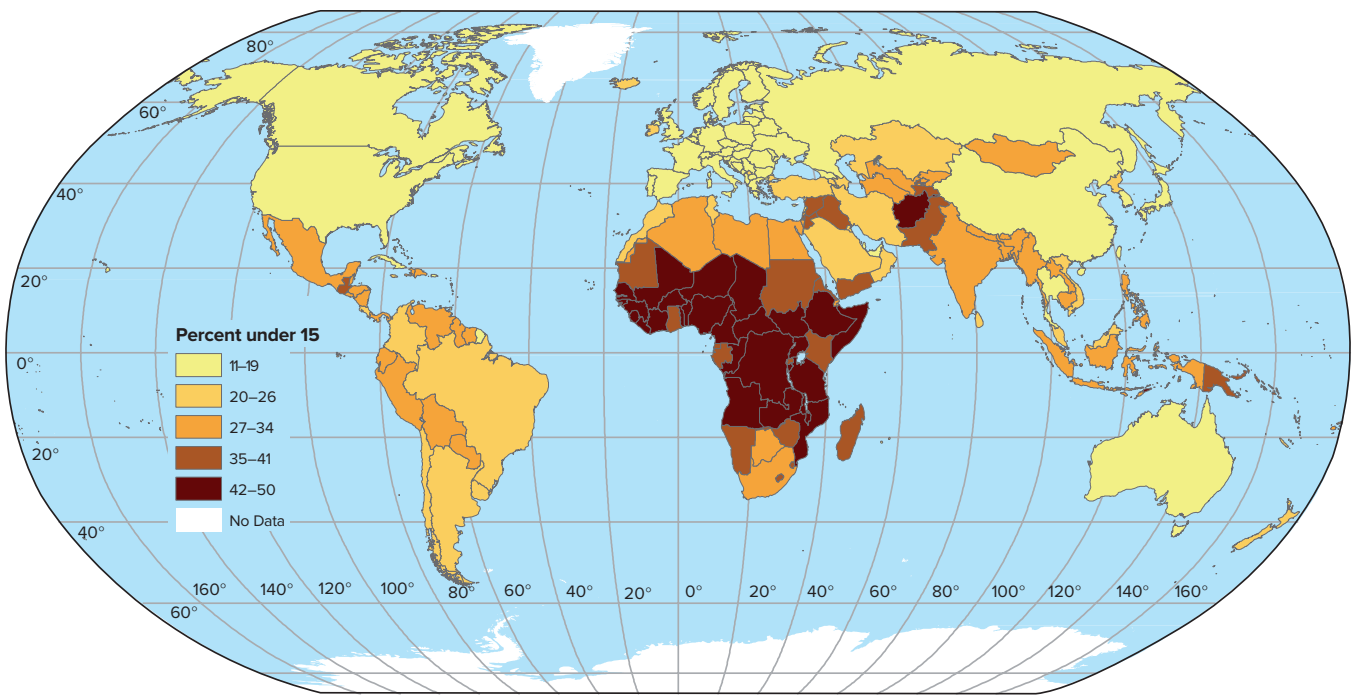


Figure 4.11 Percentage of population under 15 years of age. A high proportion of a country's population under 15 increases the dependency ratio of that state and promises future population growth as the youthful cohorts enter childbearing years.

Source: Data from Population Reference Bureau, 2017.

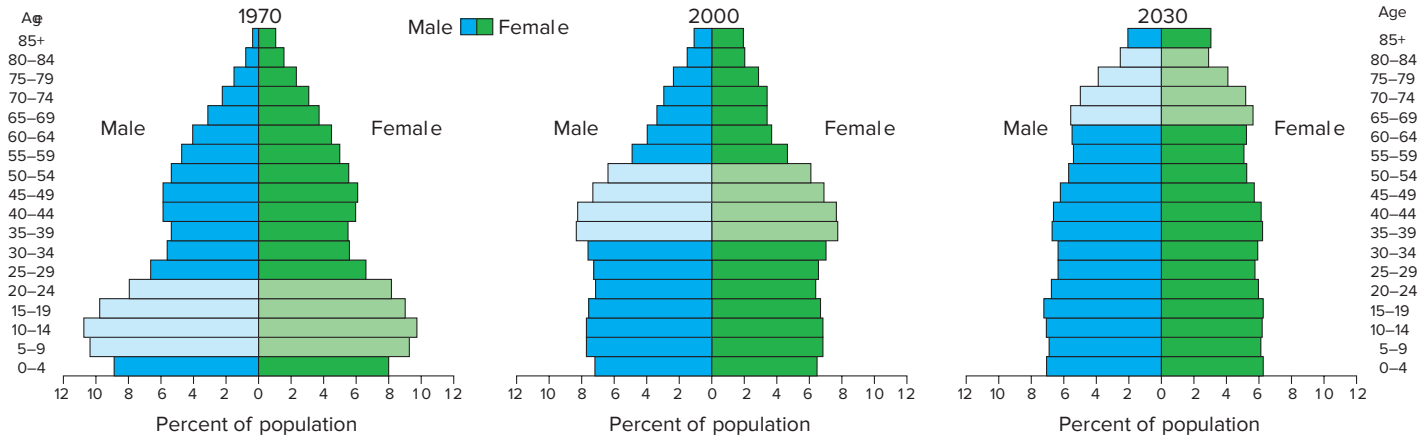


Figure 4.12 The progression of the "boomers"—the baby boom cohort born between 1946 and 1964—through the U.S. population pyramid has been associated with changing American lifestyles and expenditure patterns. In 1970, national priorities focused on the needs of children and young adults, such as building schools and expanding universities. At the turn of the 21st century, boomers formed the largest share of the working-age adult population, and their wants and spending patterns shaped the national culture and economy. By 2030, the pyramid foretells, their desires and support needs—now for retirement facilities and old-age care—will again be central concerns.

Source: Redrawn from Christine L. Himes, "Elderly Americans," Population Bulletin *56, no. 4 (December 2001), Fig. 1.*

people must be supported by a smaller working-age population. Thus, as the profile of a national population changes, differing demands are placed on a country's social and economic systems (**Figure 4.12**). The **dependency ratio** is a simple measure of the number of economic dependents, old or young, that each 100 people in the productive years (usually, 15–64) must support. Population pyramids give visual evidence of that ratio.

Population pyramids also foretell future problems resulting from present population policies or practices. The strict family-size rules and widespread preferences for sons in China, for example, skews the pyramid in favor of males. On current evidence, about 1 million excess males a year enter an imbalanced marriage market in China. The 40 million bachelors China is likely to have in 2020, unconnected to society by wives and children, may pose threats to social order and, perhaps, national stability not foreseen or planned when family control programs were put in place, but clearly suggested by population pyramid distortions.

Natural Increase and Doubling Times

Knowledge of a country's sex and age distributions also enables demographers to forecast its future population levels, though the reliability of projections decreases with increasing length of forecast (**Figure 4.13**). Thus, a country with a high proportion of young people will experience a high rate of natural increase unless there is a very high mortality rate among infants and juveniles or fertility and birth rates change materially. The **rate of natural increase** of a population is derived by subtracting the crude death rate from the crude birth rate. *Natural* means that increases or decreases due to migration are not included. If a country had a birth rate of 22 per 1,000 and a death rate of 12 per 1,000 for a given year, the rate of natural increase would be 10 per 1,000. This rate is usually expressed as a percentage, that is, as a rate per 100 rather than per 1,000. In the example given, the annual increase would be 1 percent.

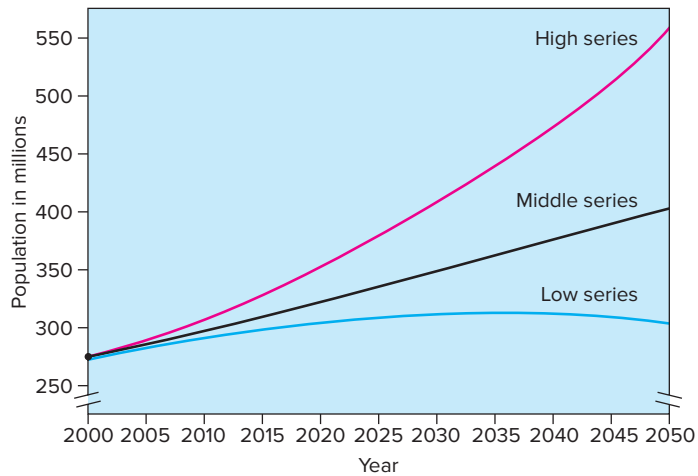


Figure 4.13 Possible population futures for the United States. Population projections account for age-specific birth and death rates for each ethnic and racial group as well as future changes in fertility and immigration rates. Longer term forecasts often diverge widely because of the effect of slightly different assumptions about fertility, death rates, or immigration.

Source: U.S. Bureau of the Census.

The rate of increase can be related to the time it takes for a population to double if the present growth rate remains constant—that is, the **doubling time.** **Table 4.2** shows that it would take 70 years for a population with a rate of increase of 1 percent (approximately the rate of growth of South America in 2017) to double. A 2 percent rate of increase—recorded in 2017 by Namibia—means that the population would double in only 35 years. (Population doubling time can be roughly estimated by applying the Rule of 70, which works for exponential growth and simply involves dividing 70 by the growth rate.) How could adding only 20 people per 1,000 cause a population to grow so quickly? The principle is the same as that used to compound interest in a bank.

Table 4.2

Doubling Time in Years at Different Rates of Increase

Annual Percentage Increase	Doubling Time (Years)
0.5	140
1.0	70
2.0	35
3.0	24
4.0	18
5.0	14
10.0	7

Table 4.3

Population Growth and Approximate Doubling Times Since C.E. 1

Year	Estimated Population	Time to Double
1	250 million	
1650	500 million	1650
1804	1 billion	154
1927	2 billion	123
1974	4 billion	47
World population may reach:		
2024	8 billion	50[a]

[a]No current projections contemplate a further doubling to 16 billion people.
Source: *United Nations Population Division.*

Until recently, for the world as a whole, the rates of increase have risen over the span of human history. Therefore, the doubling time has decreased (Table 4.3). Growth rates vary regionally, and in countries with high rates of increase (**Figure 4.14**), the doubling time is less than the 60 years projected for the world as a whole at 2017 growth rates. As world fertility rates continue to decline, the population doubling times will increase, as they have since 1990.

Here, then, lies the answer to the earlier question. Even small annual additions accumulate to large total increments because we are dealing with geometric or exponential (1, 2, 4, 8) rather than arithmetic (1, 2, 3, 4) growth. The ever-increasing world base population has reached such a size that each additional doubling results in an astronomical increase in the total. A simple mental exercise suggests the inevitable consequences of such doubling, or **J-curve,** growth. Take a very large sheet of the thinnest paper you can find and fold it in half. Fold it in half again. After seven or eight folds, the sheet will have become as thick as a book—too thick for further folding by hand. If you could make 20 folds, the

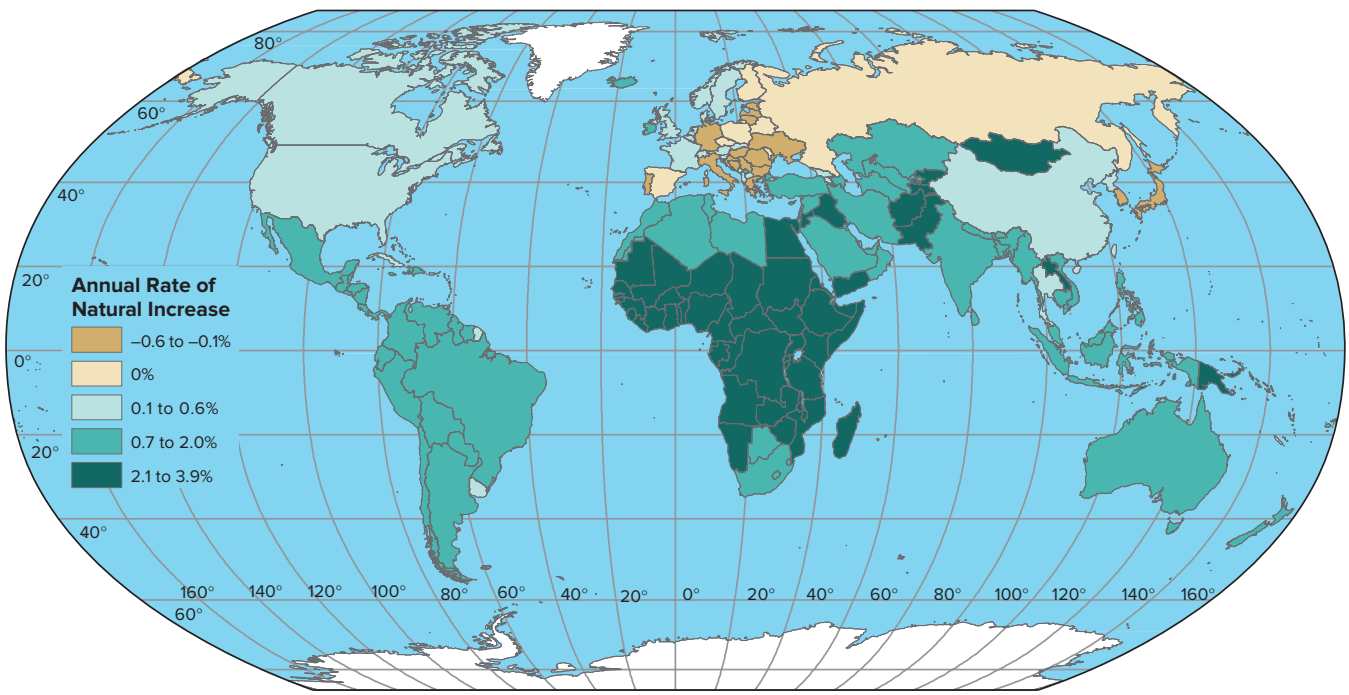


Figure 4.14 Annual rates of natural increase. The world's 2017 rate of natural increase (1.2 percent) would mean a doubling of population in 60 years. Because many demographers now anticipate world population will stabilize at around 11.2 billion (in about C.E. 2100) and perhaps actually decline after that, the "doubling" implication and time frame of current rates of natural increase reflect mathematical, not realistic, projections. Many individual continents and countries, of course, deviate widely from the global average rate of growth and have vastly different potential doubling times. Africa as a whole has the highest rates of increase, followed by southern and western Asia. Europe as a whole (including Russia) has a natural increase rate of 0.0.

Source: Data from Population Reference Bureau, 2017.

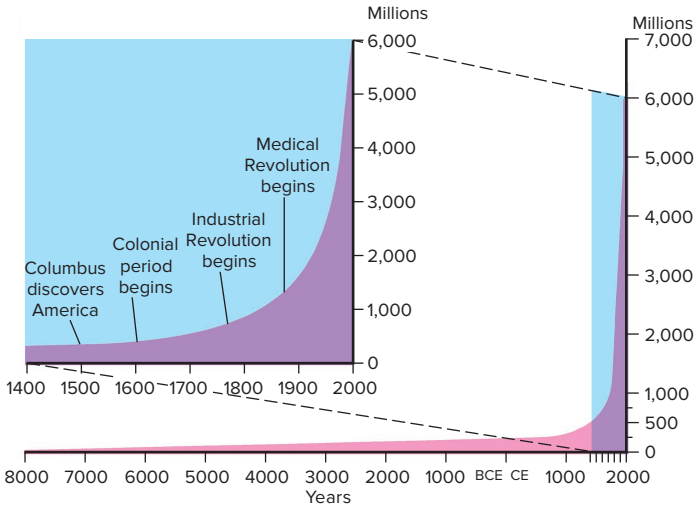


Figure 4.15 World population growth 8000 B.C.E. to C.E. 2000. Notice that the bend in the J-curve begins in the mid-1700s when industrialization started to provide new means to support the population growth through improvements in agriculture and food supply. Improvements in medical science, sanitation, and nutrition reduced death rates in the late 19th and early 20th centuries in the industrializing countries.

stack would be nearly as high as a football field is long. From then on, the results of further doubling are astounding. At 40 folds, the stack would be well on the way to the moon, and at 70, it would reach twice as far as the distance to the nearest star. Rounding the bend on the J-curve, which **Figure 4.15** suggests the world population did around 1900, fostered dire predictions of inevitable unsupportable pressures on the planet's population support capabilities.

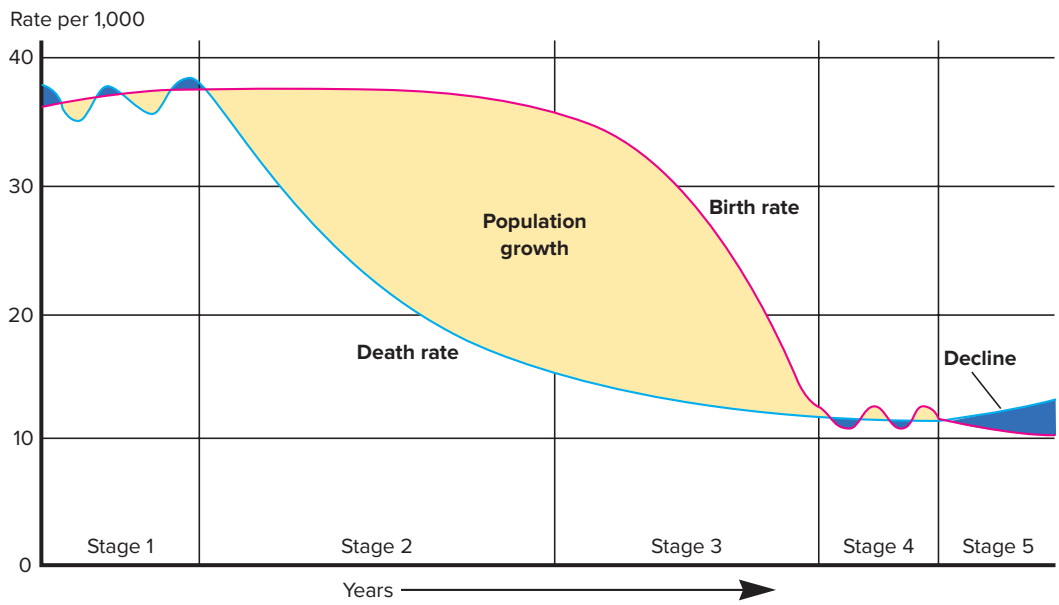
Today, rates of natural increase in developed countries, particularly in Europe, are approaching zero or even negative values. But individual country growth is also dependent on patterns of immigration and emigration. For example, Canada has a 0.3 percent rate of natural increase and a doubling time of 233 years; but with its high rates of immigration, it had, however, an *overall* growth rate of 1.2 percent with a doubling time of 58 years.

With replacement or below-replacement fertility rates throughout the developed world and declining fertility rates in most of the developing world, doubt is cast on the applicability of long-term doubling time projections. Although the doubling times are easier to understand than growth rates, they can be very misleading because they are based on the dubious assumption that present growth rates will continue indefinitely.

4.3 The Demographic Transition Model

Exponential population growth cannot continue indefinitely on a finite planet. Some form of braking mechanism must operate to control population growth. If voluntary population limitation is not undertaken, involuntary controls such as famine, disease, or resource wars may occur.

One attempt to summarize the observed voluntary population control that has accompanied economic development and modernization is the **demographic transition** model. The model traces the changing levels of human fertility and mortality associated with industrialization, health care improvements, urbanization, and changing cultural attitudes regarding childbearing. As societies move through the model's stages, high birth and death rates are replaced by low rates (**Figure 4.16**). During the intermediate stages of the model, populations grow rapidly before stabilizing in the final stage.



AP Figure 4.16 Stages in the demographic transition. During the first stage, birth and death rates are both high, and population grows slowly. When, during stage 2, the death rate drops while the birth rate remains high, there is a rapid increase in numbers. During the third stage, birth rates decline, and population growth is less rapid. The fourth stage is marked by low birth and death rates and, consequently, by stabilization of the population. The negative growth rates of many developed countries and the falling birth rates in other regions suggest that a fifth stage, one of population decline, is regionally—and ultimately worldwide—a logical extension of the transition model.

The *first stage* of the demographic transition model is characterized by high birth and high (but fluctuating) death rates. Birth rates and death rates are similar, and population grows slowly. Demographers think that it took from approximately 1 C.E. to 1500 C.E. for the population to increase from 250 million to 500 million, a doubling time of a millennium and a half. Growth was not steady, of course. There were periods of regional expansion that were usually offset by sometimes catastrophic decline. Wars, epidemics, poor harvests, and natural disasters took heavy tolls. For example, the bubonic plague (the Black Death), which swept across Europe in the 14th century, is estimated to have killed between one-third and one-half of the population of that continent and epidemic diseases brought by Europeans to the Western Hemisphere are believed to have reduced New World native populations by 95 percent within a century or two of first contact. The high birth rates, high death rates, and slow population growth of the first stage describe all of human history until about 1750 C.E., when Western Europe entered stage two of the transition. Over the past 150 years, the decline in death rates that signaled the transition to stage two diffused around the globe. Today, death rates in even the poorest countries are below 20 per 1,000 and no country remains in stage one of the demographic transition.

The *second stage* of the transition model is usually associated with the consequences of Europe's Industrial Revolution and modernization. Rapid population growth during the second demographic stage results as birth rates outstrip death rates. Life expectancies increase dramatically due to advances in medicine, sanitation, agricultural productivity, and food distribution. Urbanization during the second stage provides the stage on which sanitation, medical, and food distribution improvements are concentrated (**Figure 4.17**). Birth rates do not fall as soon as death rates; ingrained cultural beliefs and social relationships—mentifacts and sociofacts—change more slowly than technologies. In most traditional societies, large families are valued for their social and economic advantages. Children are the focus of activities and rituals by which culture is transmitted, and in low-income families, they contribute economically by starting work at an early age, especially on farms or family businesses, and by supporting their parents in old age.

Figure 4.17 London, England, in the late 19th century. A modernizing Europe experienced improved living conditions and declining death rates during that century of progress.

Source: Alfred Gilbert/Library of Congress Prints and Photographs Division [LC-DIG-ppmsc-08577].

The *third stage* of the demographic transition occurs when birth rates decline as people begin to control family size. In urbanized, industrialized cultures, raising children is expensive. In fact, such cultures may view children as economic liabilities rather than assets. The elderly rely on government pension programs rather than their children. In addition, declining childhood mortality rates make parents feel that they can have fewer children, knowing that most of them are likely to survive. When the birth rate falls and the death rate remains low, the rate of population increase slows.

The classic demographic transition model ends with a fourth and final stage characterized by very low, nearly equal birth and death rates. At this point, a condition of zero population growth approaches as natural increase rates drop to zero. With longer life expectancies and fewer births, a significant aging of the population accompanies this stage.

In some countries that have completed the demographic transition, death rates equal or exceed birth rates and populations are actually declining. This extension of the fourth stage into a fifth stage of population decrease has so far been largely confined to the rich, industrialized world—notably Europe and Japan—but increasingly promises to affect much of the rest of the world as well. The dramatic decline in fertility that has been recorded in almost all countries since the 1980s means that a majority of the world's population resides in areas where the only significant population growth is from **demographic momentum** (see the section "Population Prospects," later in this chapter).

The Western Experience

The original transition model was devised to describe the experience of northwest European countries as they transitioned from rural-agrarian societies to urban-industrial ones. It may not accurately predict the course of events for all developing countries. In Europe, church and municipal records, some dating from the 16th century, show that people tended to marry late, if at all. In England before the Industrial Revolution, as many as half of all women in the 15–50 age cohort were unmarried. Infant mortality was high, life expectancy low. With the coming of industrialization in the 18th and 19th centuries, immediate factory wages instead of long apprenticeship programs permitted earlier marriage and more children. Because improvements in sanitation and health came only slowly, death rates remained high. Around 1800, 25 percent of Swedish infants died before their first birthday. Population growth rates remained below 1 percent per year in France throughout the 19th century.

Beginning about 1860, first death rates and then birth rates began their significant, though gradual, decline. This "mortality revolution" came first, as an *epidemiological transition:* formerly fatal epidemic diseases became endemic (that is, essentially continual within a population). As people developed partial immunities, mortality rates declined. Improvements in livestock raising, crop rotation, fertilizer use, and new crops from overseas colonies (the potato was an early example) raised the level of health of the European population in general.

At the same time, sewage systems and sanitary water supplies became common in larger cities, reducing the frequency of water-borne illnesses such as cholera and typhoid (**Figure 4.18**). Deaths due to infectious, parasitic, and respiratory diseases and to malnutrition declined, while those related to chronic illnesses associated with an aging population increased. Western Europe passed from a first stage, the "Age of Pestilence and Famine," to the "Age of Degenerative and Human-Origin Diseases." However, recent increases in drug- and antibiotic-resistant diseases, pesticide resistance of disease-carrying insects, and such new scourges

Figure 4.18 Pure piped water replacing individual or neighborhood wells, and sewers and waste treatment plants instead of privies, became increasingly common in urban Europe and North America during the 19th century. Their modern successors, such as the Las Vegas, Nevada, treatment plant shown here, helped complete the *epidemiologic transition* in developed countries. Lynn Betts, USDA, Natural Resources Conservation Center

Source: Lynn Betts, USDA Natural Resources Conservation Service.

of both the less-developed and more-developed countries as HIV cast doubt on the stability of that ultimate stage (see the feature "Our Delicate State of Health"). Nevertheless, even old and new scourges such as malaria, tuberculosis, and Ebola are unlikely to have decisive demographic consequences on the global scale.

In Europe, the striking reduction in death rates was echoed by similar declines in birth rates as societies began to alter their traditional concepts of ideal family size. In cities, child labor laws and mandatory schooling meant that children no longer were important contributors to family economies. As "poor-relief" legislation and other forms of social welfare substituted for family support structures, the value of children as a social safety net declined. Family consumption patterns altered as the Industrial Revolution made widely available consumer goods that once were considered luxuries. For some, children came to be seen as hindrance rather than aid to social mobility, lifestyle improvement, and self-expression. Perhaps most important were changes in the education levels, career opportunities, and social status of women that spread the conviction that control over childbearing was within their power and to their benefit.

A Divided World, A Converging World

The dramatic decline in mortality that had emerged gradually throughout the European world diffused with startling speed to developing countries after 1950. The increasing availability in developing countries of Western technologies of medicine and public health, including antibiotics, insecticides, sanitation, immunization, infant and child health care, and the eradication of smallpox, dramatically increased life expectancies. Such imported technologies and treatments accomplished in a few years what it took Europe 50 to 100 years to experience. Sri Lanka, for example, sprayed extensively with DDT to combat malaria; life expectancy there jumped from 44 years in 1946 to 60 only eight years later. With similar public health programs, India also experienced a steady reduction in its death rate after 1947. Simultaneously, with international sponsorship, food aid cut the death toll of developing states during drought and other disasters. Thus, the second stage of the demographic transition—declining death rates accompanied by continuing high birth rates—diffused worldwide.

Many countries in sub-Saharan Africa display the characteristics of the second stage in the model. Ghana, with a birth rate of 32 and a death rate of 8, is typical. The annual rate of increase for Ghana is 2.4 percent, and its population will double in about 30 years. Such rates, of course, do not mean that the full impact of modernization has been worldwide; they do mean that the underdeveloped societies have been beneficiaries of the life preservation techniques it generated.

Birth rate declines, of course, depend in part on technology, but even more important is social acceptance of the idea of fewer children and smaller families. That acceptance has diffused broadly but unevenly worldwide. The steep declines in birth rates in developing countries indicate that most of them have moved into the third or fourth stages of the demographic transition (**Figure 4.19**). In 1984, only 18 percent of world population lived

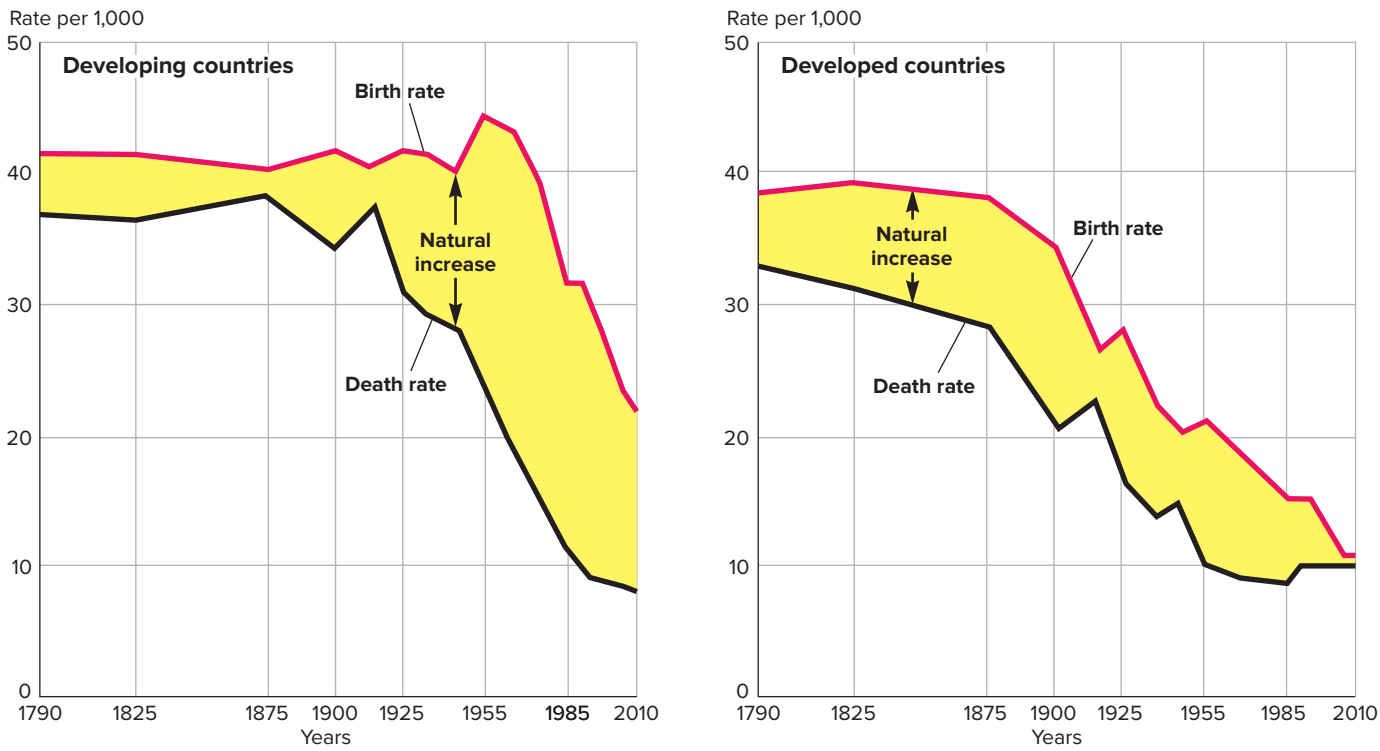


Figure 4.19 World birth and death rates to 2010. The "population explosion" after World War II (1939–1945) reflected the effects of drastically reduced death rates in developing countries without simultaneous and compensating reductions in births. Today, however, three interrelated trends appear in many developing countries: (1) fertility has overall dropped further and faster than was predicted; (2) contraceptive acceptance and use has increased markedly; and (3) age at marriage is rising. In consequence, the demographic transition had been compressed from a century to a generation in some developing states.

Source: Revised and redrawn from Elaine M. Murphy, World Population: Toward the Next Century, revised ed. *(Washington, D.C.: Population Reference Bureau, 1989) and Population Reference Bureau, annual World Population Data Sheet.*

Our Delicate State of Health

Death rates have plummeted, and the benefits of modern medicines, vaccines, antibiotics, and sanitary practices have enhanced both the quality and length of life worldwide. This epidemiological transition is the dominant story in global health. Far from being won, however, the struggle against infectious diseases is growing in intensity and is, perhaps, unwinnable. Almost a century after the discovery of antibiotics, both old and new disease-causing microorganisms are emerging and spreading all over the world. Infectious and parasitic diseases kill about 15 million people each year.

The five leading infectious killers are, in order, acute respiratory infections such as pneumonia, diarrheal diseases, HIV/AIDS, tuberculosis, and malaria. The incidence of infection, of course, is much greater than the occurrence of deaths. Nearly 30 percent of the world's people, for example, are infected with the bacterium that causes tuberculosis, but only 2 to 3 million are killed by the disease each year. More than 500 million people are infected with such tropical diseases as malaria, sleeping sickness, schistosomiasis, and river blindness, with perhaps 3 million annual deaths. Newer pathogens are constantly appearing, such as those causing Lassa fever, Rift Valley fever, Ebola fever, hantavirus pulmonary syndrome, West Nile encephalitis, hepatitis C, and severe acute respiratory syndrome (SARS). In fact, at least 30 previously unknown infectious diseases have appeared since the mid-1970s.

The 1918–1919 Spanish Flu pandemic demonstrates how diseases can diffuse globally with devastating effect. Striking as World War I was drawing to an end, the epidemic's spread was likely aided by massive troop movements as it diffused along shipping routes. The influenza virus struck down the young and healthy and killed an estimated 20 to 50 million people. The 2014–2015 Ebola outbreak emerged in rural areas and spread through Guinea, Sierra Leone, and Liberia along roadways leading to the capital cities on the coast. Diffusion was slower in the Democratic Republic of Congo where settlements are more isolated.

Figure 4C Workers practicing proper hand washing techniques at a health clinic in Guinea during the 2014 Ebola outbreak.

Source: Centers for Disease Control and Prevention/Conne Ward-Cameron

The spread and virulence of infectious diseases are linked to the dramatic changes so rapidly occurring in the Earth's physical and social environments. Climate change permits temperature-restricted pathogens to invade new areas and claim new victims. Deforestation, wetland drainage, and other human-induced alterations to the physical environment disturb ecosystems and simultaneously disrupt the natural system of controls that keep infectious diseases in check.

Rapid population growth and explosive urbanization, increasing global tourism, population-dislocating wars and migrations, and expanding world trade all increase the diffusion of diseases. Some disease-causing microbes have expanded their range as previously isolated areas are opened up by new roads and air routes.

The most effective weapons in the battle against epidemics are already known. They include improved health education; disease prevention and surveillance; research on disease vectors and incidence areas (using GIS and spatial analysis); drug therapy; mosquito control programs; clean water supplies; and distribution of such simple and cheap remedies as childhood immunizations and oral rehydration therapy. All, however, require expanded investment and attention to those spreading infectious diseases.

in countries with fertility rates at or below replacement levels (that is, countries that had completed the demographic transition). Today, about half live in such countries, and it is increasingly difficult to distinguish between developed and developing societies on the basis of their fertility rates. Those rates in many Indian states (Kerala and Tamil Nadu, for example) and in such countries as Sri Lanka, Thailand, South Korea, and China are below those of the United States and some European countries. Significant decreases to near the replacement level have also occurred in the space of a single generation in many other Asian and Latin American states with high recent rates of economic growth. Increasingly, it appears, low fertility is becoming a feature of both rich and poor, developed and developing states.

The demographic transition model assumes an inevitable course of events from the high birth and death rates of premodern (nonindustrialized) societies to the low and stable rates of advanced (industrialized) countries. The model fails to anticipate, however, that the European experience would not be matched by

all developing countries. Some developing societies remain in the second stage of the model, unable to realize the economic gains and social changes necessary to progress to the third stage of falling birth rates. Thus, despite a substantial convergence of fertility rates, many observers point to a continuing and growing demographic divide. On one side of the divide are the low-fertility countries that are home to 46 percent of the world's population. The low fertility rates of these mostly wealthy countries guarantee future population decline and rapid aging unless they attract significant immigration. On the other side of the divide are a group of high-fertility countries that account for just 18 percent of the world's population but are projected to triple in size and increase their global population share to 42 percent by 2100. Nearly all of the high-fertility countries are included on the United Nation's list of least-developed countries. Most of them are in sub-Saharan Africa, and all suffer from low per capita income, illiteracy, low standards of living, and inadequate health facilities and care.

The established patterns of both high- and low-fertility regions tend to be self-reinforcing. Low growth permits the expansion of personal income and the accumulation of capital to enhance the quality of life and make large families less attractive or essential. In contrast, in high-fertility regions, population growth requires spending on social services that otherwise might have been invested to promote economic expansion. Growing populations place ever greater demands on limited natural resources. As the environmental base deteriorates, productivity declines, undermining the economic progress on which the demographic transition depends (see the feature "International Population Policies"). The vastly different future prospects for personal and national prosperity between the high-fertility countries and the rest of the world make the demographic divide a matter of continuing international concern.

4.4 The Demographic Equation

Change in a region's population stems from three basic life events: people are born, they migrate, and they die. Migration involves the long-distance movement of people from one residence to another. When that relocation occurs across political boundaries, it affects the population structure of both the origin and destination regions. The **demographic equation** summarizes the contribution made to regional population change over time by the combination of *natural change* (births minus deaths) and **net migration** (difference between in-migration and out-migration). **Zero population growth (ZPG)** is the condition for individual countries when births plus immigration equals deaths plus emigration. On a global scale, of course, all population change is accounted for by natural change. The impact of migration on the demographic equation often increases as the population size of the areal unit decreases.

$$P_f = P_i + \text{Births} + \text{In-Migration} - \text{Deaths} - \text{Out-Migration}$$

where:

P_f = Final Population

P_i = Initial Population

Population Relocation

In the past, emigration proved an important device for relieving the pressures of rapid population growth during the demographic transition for many European countries (**Figure 4.20**). For example, in one 90-year span, 45 percent of the natural increase in the population of the British Isles emigrated, and between 1846 and 1935, some 60 million Europeans of all nationalities left that continent. Today, the major population relocations connect growing countries going through the second and third stages of the demographic transition with aging societies in the fourth stage. Yet, despite recent massive movements of economic and political refugees across Asian, African, and Latin American boundaries, emigration today provides no comparable relief valve for developing countries. Total population numbers are too great to be much affected by migrations of even millions of people. In only a few countries—Afghanistan, Cuba, El Salvador, Haiti, and Syria, for example—have as many as 10 percent of the population emigrated in recent decades.

Net migration, the balance between in-migration and out-migration, is positive for the developed countries as a group, and negative for the less-developed countries. Net migration rates are modest, but the direction of movement reflects the demand for additional workers in high-income countries that have completed the demographic transition and the ample supply of willing workers in rapidly growing, low-income countries. The highest negative (net out-migration) rates are found in war-torn Syria. The highest positive (net in-migration) rates are found in oil-producing states in the Near East.

Immigration Impacts

Where cross-border movements are massive enough, migration may have a pronounced impact on the demographic equation and result in significant changes in the population structures of both the origin and destination regions. Past European and African migrations, for example, not only altered but substantially created the population structures of new, sparsely inhabited lands of colonization in the Western Hemisphere and Australasia. In some decades of the late 18th and early 19th centuries, 30 percent to more than 40 percent of population increase in the United States was accounted for by immigration. Similarly, eastward-moving Slavs colonized under populated Siberia and overwhelmed native peoples.

Migrants are rarely a representative cross section of the population group they leave, and they add an unbalanced age and sex component to the group they join. A recurrent research observation is that emigrant groups are heavily skewed in favor of young singles. Although males traditionally far exceeded females in international flows, under some circumstances females outnumber males among transborder migrants.

The receiving country will have its population structure altered by an outside increase in its younger age cohorts. The results are both immediate in a modified population pyramid, and potential in future impact on birth rates. The origin area will have lost a portion of its young, active members in their child-bearing years. The outmigration may distort its young adult sex ratios,

AP Geography and Citizenship

International Population Policies

After a sometimes rancorous nine-day meeting in Cairo in September 1994, the U.N. International Conference on Population and Development endorsed a strategy for stabilizing the world's population at 7.27 billion by no later than 2015. The 20-year program of action accepted by 179 signatory countries sought to avoid the environmental consequences of excessive population growth. Its proposals were therefore linked to discussions and decisions of the U.N. Conference on Environment and Development held in Rio de Janeiro in June 1992.

The Cairo plan abandoned several decades of top-down governmental programs that promoted "population control" (a phrase avoided by the conference) based on targets and quotas and, instead, embraced for the first time policies giving women greater control over their lives, greater economic equality and opportunity, and a greater voice in reproduction decisions. It recognized that limiting population growth depends on programs that lead women to want fewer children and make them partners in economic development. In that recognition, the Conference accepted the documented link between increased educational access and economic opportunity for women and falling birth rates and smaller families. Earlier population conferences— 1974 in Bucharest and 1984 in Mexico City—did not fully address these issues of equality, opportunity, education, and political rights; their adopted goals failed to achieve hoped-for changes in birth rates in large part because women in many traditional societies had no power to enforce contraception and feared their other alternative, sterilization.

The earlier conferences carefully avoided or specifically excluded abortion as an acceptable family planning method. It was the open discussion of abortion in Cairo that prompted religious objections by the Vatican and many Muslim and Latin American states to the inclusion of legal abortion as part of health care. Although the final text of the conference declaration did not promote any universal right to abortion and excluded it as a means of family planning, some delegations still registered reservations to its wording on both sex and abortion. At conference close, however, the Vatican endorsed the declaration's underlying principles, including the family as "the basic unit of society" and the need to stimulate economic growth, and to promote "gender equality, equity, and the empowerment of women."

In follow-up conferences, the UN reported progress toward reaching the Cairo goals. The consensus was that much remained to be done to broaden sex education and family planning programs for the poorest population groups, to strengthen laws ending discrimination against women, and to encourage donor countries to meet their agreed-on contributions to the program.

Since 2012, one of the world's wealthiest private foundations, the Bill and Melinda Gates Foundation, has prioritized access to birth control and contributed more than $1 billion to providing contraception in developing countries. Declining fertility in most developing countries suggests that the combined efforts of government and the private sector are working. Some demographers and many women's health organizations interpret the falling fertility rates as the expected result of women assuming greater control over their economic and reproductive lives. The director of the U.N. Population Division noted: "A woman in a village making a decision to have one or two or at most three children is a small decision in itself. But . . . compounded by millions and millions . . . of women in India and Brazil and Egypt, it has global consequences."

That women are making those decisions, reflects important cultural factors emerging since Cairo. Satellite television brings contraceptive information to even remote villages and shows programs of small, apparently happy families that viewers want to emulate. Increasing urbanization reduces some traditional family controls on women and makes contraceptives easier to find, and declining infant mortality makes mothers more confident their babies will survive. Perhaps most important, population experts assert, is the dramatic increase in most developing states in female school attendance and corresponding reductions in the illiteracy rates of girls and young women who will soon be making fertility decisions.

Thinking Geographically

1. Many international aid agencies promote policies relating to reproduction and family planning. Should such agencies be involved in these as personal concerns? Should they be involved in them as national concerns? Write a one-page essay defending your position.
2. International concerns over population growth, development, and the environment often meet resistance from long-standing cultural norms and religious practices. Describe two examples of such resistance. Do you think international concerns are pressing enough to overcome these obstacles? Explain your reasoning.
3. Many environmentalists see the world as a finite system, unable to support ever-growing populations. Many economists counter that free markets will keep supplies of much needed commodities in line with growing demand. Conduct research to learn more about each of these opposing views. Then consider the following question: *In light of such diametrically opposing points of view on the consequences of population growth, is it a wise choice to base international programs solely on just one of them?* Create an oral presentation to defend your position.

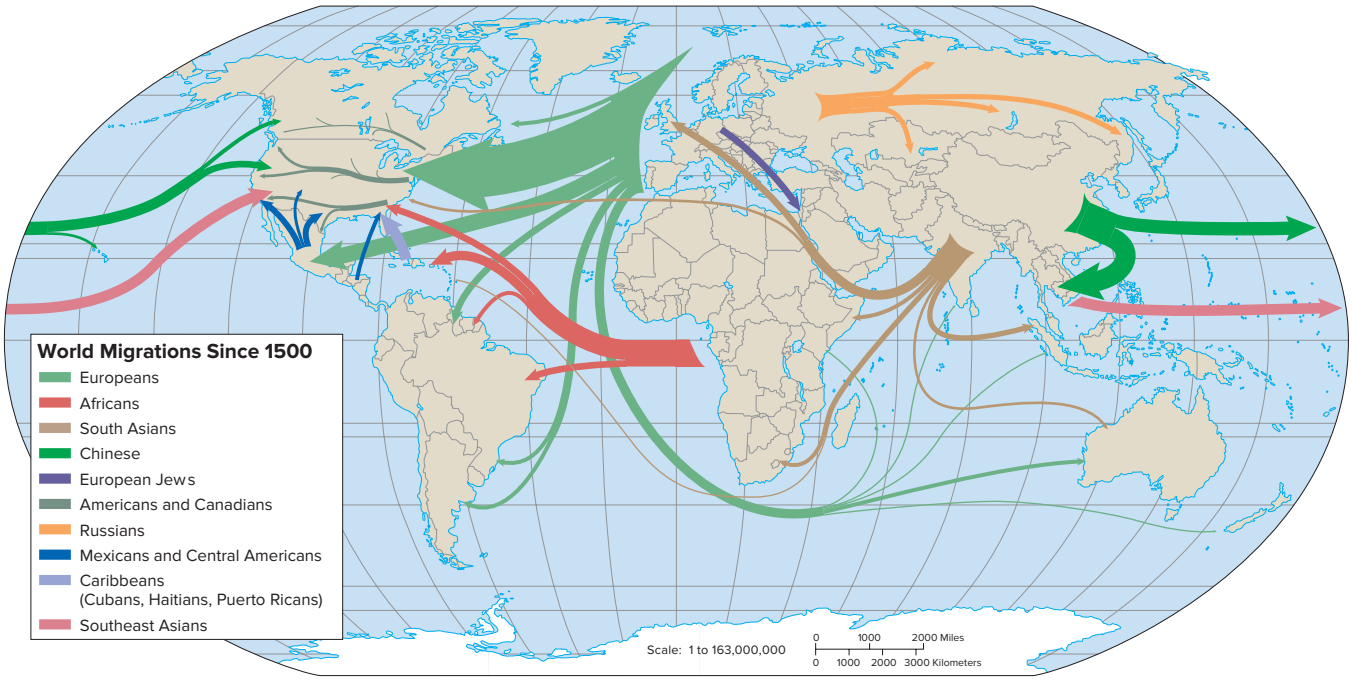


Figure 4.20 Principal migrations since 1500. The arrows show the direction and relative magnitude of the major voluntary and forced international migration since about 1500. More recently, there have been significant population movements into the United Kingdom, France, Belgium, and the Netherlands from their former colonies and from less-prosperous countries within the EU.

Source: Shaded zones after Daniel Noin, Géographie de la Population *(Paris: Masson, 1979), p. 85.*

and it certainly will contribute to statistical aging of its population. The destination country will likely experience increased births associated with the youthful newcomers and, in general, have its average age reduced.

4.5 World Population Distribution

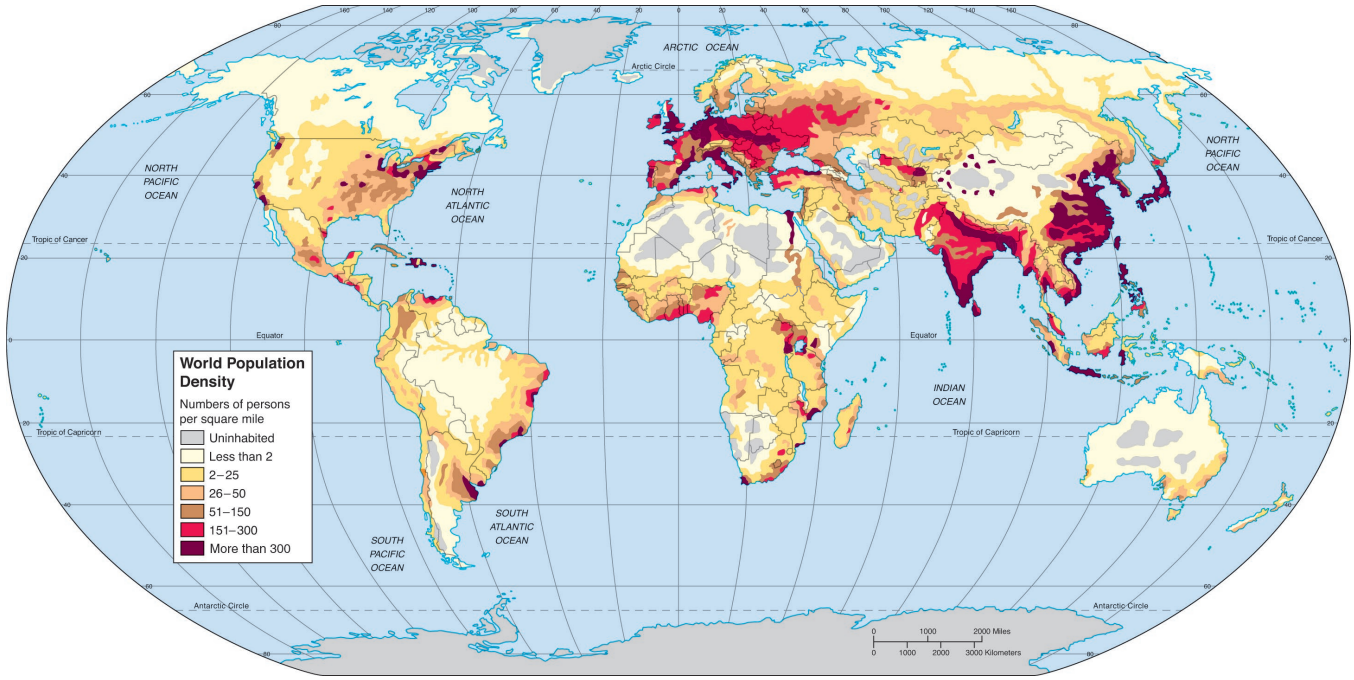
The world's population is not uniformly distributed over the Earth. The most striking feature of the world population distribution map (**Figure 4.21**) is the very unevenness of the pattern. Some land areas are nearly uninhabited, others are sparsely settled, and still others contain dense agglomerations of people. Until about 2007, rural folk outnumbered urban people. After 2007, however, urbanites will remain dominant with cities capturing most of the world's population growth.

Earth regions of apparently very similar physical makeup show quite different population numbers and densities, perhaps the result of differently timed settlement or of settlement by different cultural groups. Northern and Western Europe, for example, inhabited thousands of years before North America, contain as many people as the United States on 70 percent less land; the present heterogeneous population of the Western Hemisphere is vastly more dense than was that of earlier Native Americans.

We can draw certain generalizations from the uneven distribution of population shown in Figure 4.21. First, 88 percent of all people live north of the equator and two-thirds of the total dwell in the midlatitudes between 20° and 60° North (**Figure 4.22**). Second, a large majority of the world's inhabitants occupy only a small part of its land surface. More than half the people live on about 5 percent of the land. Third, people congregate in lowland areas; their numbers decrease sharply with increases in elevation. Temperature, length of growing season, slope and erosion problems, even oxygen reductions at very high altitudes, all appear to limit the habitability of higher elevations. One estimate is that 34 percent of all people live below 100 meters (330 ft), a zone containing about 17 percent of total land area.

Fourth, although low-lying areas are preferred settlement locations, not all such areas are equally favored. Continental margins have attracted the densest settlement. On average, density in coastal areas is twice the world's average population density. Low temperatures and infertile soils of the extensive Arctic coastal lowlands of the Northern Hemisphere have restricted settlement there. Mountainous or desert coasts are sparsely occupied at any latitude, and some tropical lowlands and river valleys that are marshy, forested, and disease-infested are also unevenly settled.

The world contains four great clusters of population, listed in order of decreasing size: South Asia, East Asia, Europe, and the northeastern United States/southeastern Canada. The *South Asia* cluster is composed primarily of countries associated with the Indian subcontinent—Bangladesh, India, Nepal, Pakistan, and the island state of Sri Lanka—and is the most populous cluster, containing a fourth of the world's people. The *East Asia* zone, which includes China, Japan, North Korea, South Korea,



AP Figure 4.21 World population density.

and Taiwan, is the second-largest in population. Together, the South and the East Asian concentrations are home to nearly one-half the world's people.

Europe—southern, western, and eastern through Ukraine and much of European Russia—is the third extensive world population concentration, about 10 percent of its inhabitants. Much smaller in extent and total numbers is the cluster in the *northeastern United States/southeastern Canada.* Other smaller but pronounced concentrations are found around the globe: on the island of Java in Indonesia and along the Nile River in Egypt.

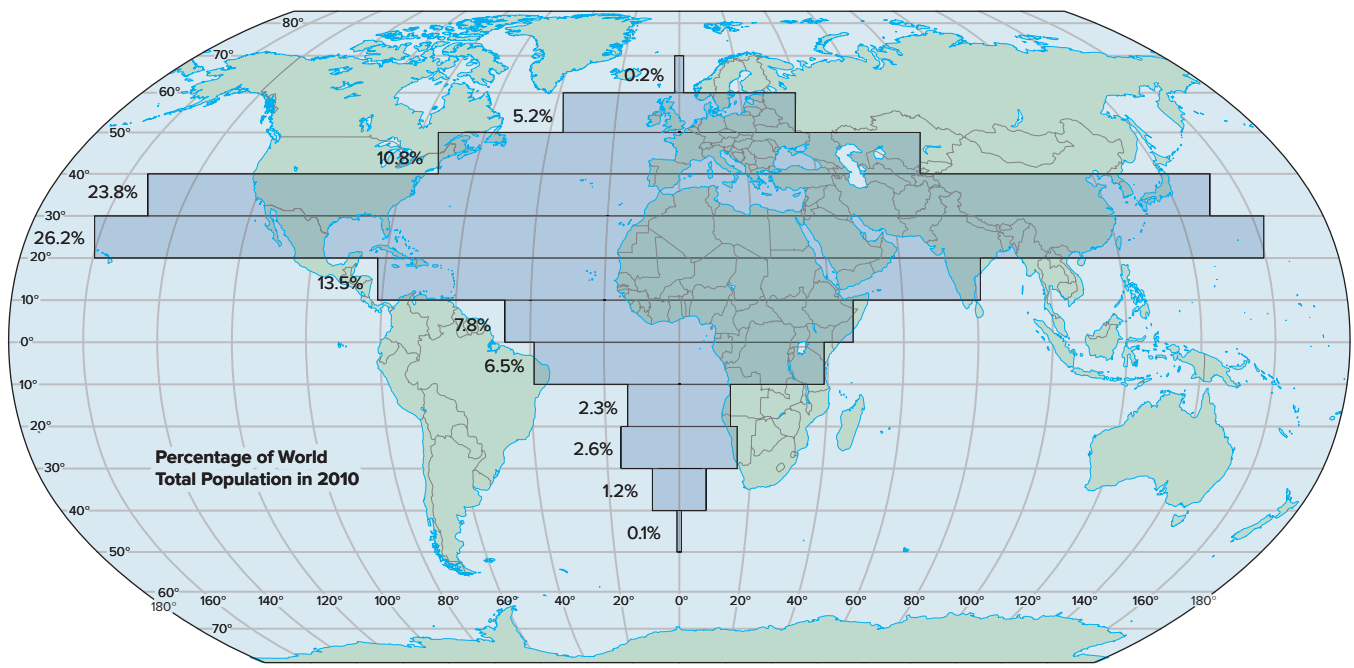


Figure 4.22 The population dominance of the Northern Hemisphere is strikingly evident from this bar chart. Only 12 percent of the world's people live south of the equator—not because the Southern Hemisphere is underpopulated, but because it is mainly water. The median latitude of the world's population is at 26° North, roughly that of Miami, Florida.

Data Source: Center for International Earth Science Information Network (CIESIN), Columbia University. 2005. Gridded Population of the World: Future Estimates (2011).

Figure 4.23 Terracing of hillsides is one device to extend a naturally limited productive area. The technique is effectively used here on the island of Bali, Indonesia.

©Photodisc/Houghton Mifflin Harcourt/Getty Images

The term **ecumene** is applied to permanently inhabited areas of the Earth's surface. The ancient Greeks used the word, derived from their verb "to inhabit," to describe their known, inhabited world between what they believed to be the unpopulated, searing hot "torrid" tropical zone and the permanently frozen northern "frigid" zone. Clearly, natural conditions are less restrictive than Greek geographers believed. Both ancient and modern technologies have rendered habitable areas that natural conditions make forbidding. Irrigation, terracing, diking, and draining are among the methods devised to extend the ecumene locally (**Figure 4.23**).

Although the ancient Greeks were wrong in labeling the tropics uninhabitable, the observation that some places are uninhabitable appears remarkably astute. The **nonecumene,** the uninhabited or very sparsely occupied zone, includes the permanent ice caps of the Far North and Antarctica and large segments of the tundra and coniferous forest of northern Asia and North America. But the nonecumene is not continuous, as the ancients supposed. It is discontinuously encountered in all portions of the globe and includes parts of the tropical rain forests of equatorial zones, deserts of both the Northern and Southern Hemispheres, and high mountain areas.

Even parts of these unoccupied or sparsely occupied districts have localized dense settlement nodes or zones based on irrigation agriculture, mining and industrial activities, and the like. Perhaps the most striking case of settlement in an environment elsewhere considered part of the nonecumene world is that of the dense population in the Andes Mountains of South America and the plateau of Mexico. Here Native Americans found temperate conditions away from the dry coast regions and the hot, wet Amazon basin. The fertile high basins have served a large population for more than a thousand years.

Even with these locally important exceptions, the nonecumene portion of the Earth is extensive. Some 35 to 40 percent of all the world's land surface is inhospitable and without significant settlement. This is, admittedly, a smaller proportion of the Earth than would have qualified as uninhabited in ancient times, or even during the 19th century. Since the end of the Ice Age some 11,000 to 12,000 years ago, humans have steadily expanded their areas of settlement.

4.6 Population Density

The boundaries of the ecumene could only be extended as humans learned to support themselves from the resources of new settlement areas. The size of the population that could be supported depended on the resource potential of the area and the technologies and social organization possessed by the occupying culture group. The term **population density** expresses the relationship between number of inhabitants and the area they occupy.

Density figures are useful representations of regional variations of human distribution. The **crude density,** or **arithmetic density,** of population is the most common and simplistic variation. It calculates the number of people per unit area of land, usually within the boundaries of a political entity. All that is required is information on total population and total land area, both commonly available for national or other political units. The figure can, however, be misleading and may obscure as much as it reveals. The calculation is a national average, and does not reveal whether a country's population is evenly distributed or contains extensive regions that are only sparsely populated (**Figure 4.24**) alongside intensively settled districts. In general, the larger the political unit for which crude or arithmetic population density is calculated, the less useful is the figure.

Its usefulness is improved if the area in question can be subdivided into comparable regions or units. For example, it is more revealing to know that in 2010, New Jersey had a density of 467 and Wyoming of 2 persons per square kilometer (1,196 and 5.8 per sq mi) of land area than to know only that the figure for the United States was 32 per square kilometer (99.6 per sq mi).

Another potential refinement of crude density relates population not simply to total area of national territory but to that area of a country that is or may be cultivated; that is, to *arable* land. When total population is divided by arable land area alone, the resulting figure is the **physiological density,** which provides a measure of the population pressure exerted on agricultural land. **Table 4.4** shows striking contrasts between crude and physiological densities of countries. The calculation of physiological density, however, has its own limitations. It depends on uncertain definitions of arable and cultivated land and assumes that all arable land is equally productive.

Agricultural density is another useful variant. It simply excludes city populations from the physiological density calculation and reports the number of rural residents per unit of agriculturally productive land. It is, therefore, an estimate of the number of farmers per unit area and offers insights into the type of agriculture practiced in a country.

Overpopulation

After comparing population densities, it is common to draw conclusions about overcrowding or overpopulation. However, it is

Figure 4.24 Tundra vegetation and landscape in the Alaska National Wildlife Refuge. While this area may contain underground petroleum deposits, it is part of the *nonecumene*—sparsely populated portions of the Earth's surface.

Source: Greg Weiler/U.S. Fish & Wildlife Service.

wise to remember that labeling a place overcrowded involves making value judgments regarding the amount of space needed per person. To someone from Wyoming, New York City might feel overcrowded, while to a New Yorker, Wyoming is likely to feel underpopulated. **Overpopulation** refers to the situation in which an environment or territory cannot support its present population and involves many factors other than just population density. Overpopulation is a reflection, not of numbers per unit area but of

Table 4.4

Comparative Densities for Selected Countries

	Crude Density		Physiological Density[a]		Agricultural Density[b]	
Country	sq mi	km²	sq mi	km²	sq mi	km²
Argentina	42	16	293	113	23	9
Australia	8	3	138	53	14	5
Bangladesh	3,276	1,265	5,497	2,122	3,573	1,380
Canada	10	4	218	84	39	15
China	383	148	3,012	1,163	1,295	500
Egypt	243	94	8,379	3,235	4,776	1,844
India	1,178	455	2,240	865	1,501	579
Japan	900	348	7,826	3,022	470	181
Nigeria	543	210	1,455	562	742	287
United Kingdom	709	274	2,858	1,103	486	188
United States	92	36	555	214	105	41

[a]Total population divided by area of agricultural land.
[b]Rural population divided by area of agricultural land.
Rounding may produce apparent conversion discrepancies.
Sources: *World Bank,* World Development Indicators 2017; *and Population Reference Bureau,* World Population Data Sheet, 2017. Calculations by authors.

the **carrying capacity** of the land, the prevailing agricultural technology, and the ability to afford imported food. A region devoted to energy-intensive commercial agriculture that makes heavy use of irrigation, fertilizers, and biocides can support more people at a higher level of living than one engaged in the slash-and-burn agriculture that will be described in Chapter 8. An industrial society that takes advantage of resources such as coal and iron ore and has access to imported food will not feel population pressure at the same density level as a country with rudimentary technology. In fact, we should be careful in borrowing the concept of carrying capacity from ecology because compared to other animals, humans are distinguished by their ability to adopt new production technologies, to increase their appetite for consumption far beyond biological requirements, and to trade resources globally.

In a world of growing global interdependence, high physiological densities alone do not indicate overpopulation. Few countries are agriculturally self-sufficient. Japan has a very high physiological density, as Table 4.4 indicates, and produces only about 40 percent of the calories that its population consumes. Nonetheless Japan ranks high on all indicators of national well-being and prosperity. For countries such as Japan, South Korea, Malaysia, and Taiwan—all of which currently import the majority of the grain that they consume—a sudden cessation of the international trade that permits the exchange of industrial products for imported food and raw materials would be disastrous. Domestic food production could not maintain the dietary levels now enjoyed by their populations and they, more starkly than many underdeveloped countries, would be *overpopulated*.

One measure of overpopulation might be a lack of **food security.** Food security means having access to safe and nutritious food supplies sufficient to meet individual dietary needs in accord with cultural preferences. Unfortunately, dietary insufficiencies—with long-term adverse implications for life expectancy, physical vigor, and mental development—are most likely to be encountered in developing countries, where much of the population is young and vulnerable (Figure 4.11). Over the past decades, sub-Saharan Africa saw its population grow faster than food production, widening the population-food gap and increasing reliance on imports. For poor countries, reliance on food imports means vulnerability to price volatility in international markets and rising rates of undernourishment whenever food prices are high. Although it may be tempting to conclude that a country with a high rate of undernourishment is overpopulated, the underlying causes are found in the interaction of poverty and population pressure, as discussed in Chapter 10.

It is difficult to draw meaningful conclusions about the relationship between population density and levels of development. As a group, the less-developed countries have higher densities than the more-developed countries. Densities in Australia, Canada, New Zealand, Norway, and the United States, where there is a great deal of unused and unsettled land, are considerably lower than those in Bangladesh, where most land is arable and which, with some 1,265 people per square kilometer (3,280 per square mile), is the most densely populated non-island state in the world. However, counterexamples abound. Mongolia, a sizable state between China and Siberian Russia, has 2 persons per square kilometer (5 per square mile), while Singapore, a highly urbanized island country in Southeast Asia has 7,930 persons per square kilometer (20,500 per square mile). Incomes are about 8 times higher in Singapore than in Mongolia. Many African countries have low population densities and low levels of income, whereas Japan combines both high densities and wealth.

4.7 Population Data and Projections

Population geographers, demographers, planners, governmental officials, and a host of others rely on detailed population data to make their assessments of present national and world population patterns and to estimate future conditions. Birth rates and death rates, rates of fertility and the age and sex composition of the population are all necessary ingredients for their work. In some countries, using the values for demographic variables specific to individual regions or ethnic groups is essential to making accurate projections.

Population Data

The data that demographers use come primarily from the United Nations Statistical Office, the World Bank, the Population Reference Bureau, and ultimately, from national censuses and sample surveys. Unfortunately, the data are far from perfect. A national census is a massive undertaking. In developing regions, isolation and poor transportation, insufficiency of funds and trained census personnel, high rates of illiteracy limiting the type of questions that can be asked, and populations suspicious of government data collectors serve to restrict the frequency, coverage, and accuracy of population reports.

However derived, detailed data are published by the major reporting agencies for all national units even when those figures are of poor quality. For years, data on the total population, birth and death rates, and other vital statistics for Somalia were regularly reported and annually revised. The fact was, however, that Somalia had never had a census and had no system whatsoever for recording births. Seemingly precise data were regularly reported as well for Ethiopia. When that country had its first-ever census in 1985, at least one data source had to drop its estimate of the country's birth rate by 15 percent and increase its figure for Ethiopia's total population by more than 20 percent. And a disputed 1991 census of Nigeria officially reported a population of 89 million, still the largest in Africa but far below the then generally accepted and widely cited estimates of between 105 and 115 million Nigerians. The 2006 census in Nigeria was surrounded by protests, boycotts, and fraud charges despite leaving out questions about religious and ethnic identity that were controversial in a country with more than 250 ethnic groups and a population nearly evenly divided between Muslims and Christians.

Fortunately, census coverage is improving. Almost every country has now had at least one census of its population and most have been subjected to periodic sample surveys (**Figure 4.25**). However, only about 10 percent of the developing world's population live in countries with anything approaching complete systems for registering births and deaths. Sub-Saharan Africa has the

Figure 4.25 To encourage complete participation in the 2000 census, the U.S. government created this billboard and other advertisements aimed at Hispanic residents.

©The McGraw-Hill Education/Barry Barker, photographer

highest percentage of unregistered births (65 percent), according to UNICEF. Apparently, deaths are even less completely reported than births throughout Asia. And whatever the deficiencies of Asian states, African statistics are still less complete and reliable. It is, of course, on just these basic birth and death data that projections about population growth and composition are founded.

Population Projections

For all their inadequacies and imprecisions, current data reported for country units form the basis of **population projections,** estimates of future population size, age, and sex composition based on current data. Projections are not forecasts, and demographers are not the social science equivalent of meteorologists. Weather forecasters work with a myriad of accurate observations applied against a known, tested model of the atmosphere. The demographer, in contrast, works with sparse, imprecise, out-of-date, and missing data applied to human actions that will be unpredictably responsive to stimuli not yet evident.

Population projections, therefore, are based on assumptions for the future applied to current data that are, themselves, frequently imperfect. Because projections are not predictions, they can never be wrong. They are simply the inevitable result of calculations about fertility, mortality, and migration rates applied to each age cohort of a population now living, and the making of birth rate, survival, and migration assumptions about cohorts yet unborn. Of course, the perfectly valid *projections* of future population size and structure resulting from those calculations may be dead wrong as *predictions*.

Because those projections are invariably treated as scientific expectations by a public that ignores their underlying qualifying assumptions, agencies such as the UN that estimate the population of, say, Africa in the year 2050, do so by not one but by three or more projections: high, medium, and low, for example. For areas as large as Africa, a medium projection is assumed to benefit from compensating errors and statistically predictable behaviors of very large populations. For individual African countries and smaller populations, the medium projection may be much less satisfying. The usual tendency in projections is to assume that something like current conditions will be applicable in the future.

Projections for the world population in 2050 do not vary by much because many of those expected to be living in 2050 are already alive. Projections for 2010 differ significantly because small variations in birth rates can make a large difference in the long term.

Population Controls

As the number of humans and the extent of the ecumene have expanded, attention has turned to the possibility of overpopulation and the need for population control (**Figure 4.26**). Ancient Chinese thinker Confucius warned against rapid population growth, and ancient Greek philosophers Plato and Aristotle gave careful thought to the ideal population size for a city-state. All population projections include an assumption that at some point in time, fertility rates will stabilize at replacement levels and population growth will cease. Otherwise, future numbers become unthinkably large. At present growth rates, there would be 1 trillion people living on the Earth four centuries from now. Although there is reasonable debate whether the world is now overpopulated and what its optimum or maximum sustainable populations might be, totals in the trillions are beyond our imagination.

Population pressures do not come from the amount of physical space that humans occupy. For example, it has been calculated that the entire human race could easily be accommodated within the boundaries of the state of Delaware. The problems stem from the energy, food, water, and other resources necessary to support the population and absorb its waste products. Past technological changes have increased the carrying capacity of the Earth, allowing humans to achieve higher plateau populations (**Figure 4.27**). Nonetheless, population will have to stop increasing at some point. The demographic transition model provides the reassuring message that the decreases in birth rates that accompany modernization will automatically bring about a condition of zero population growth. However, the presence of a significant demographic divide between the nearly stable populations of the developed countries and rapidly growing populations in developing regions lead some observers to question the model's universality. According to these observers, completion of the demographic transition in the least-developed countries will not take place soon enough, if at all. If the demographic transition is not completed soon enough, environmental limits will appear in more dramatic fashion.

Thomas Robert **Malthus** (1766–1834), an English clergyman and economist, published *An Essay on the Principle of Population* in 1798, which set the framework for ongoing debates on population and resources. Prior to Malthus, most European economic and political thinkers were **pronatalist**—that is, they supported population growth to increase the number of workers and military might of a state. According to Malthus, the biological potential for population growth outstripped the potential for increasing food supplies to meet human subsistence needs. Malthus wrote:

> Taking the populations of the world at any number, a thousand million, for instance, the human species would increase in the ratio of –1, 2, 4, 8, 16, 32, 64, 128, 256, 512, & c. and subsistence as –1, 2, 3, 4, 5, 6, 7, 8, 9, 10, & c. (9)

Figure 4.26 Protesters in India calling for increased government action to reduce the country's high fertility rate.

©Hindustan Times/Getty Images

In essence, Malthus argued that if unchecked, human population would increase at a geometric rate while food supplies expanded at an arithmetic rate. If humans did not restrain their reproductive capacity with "private" means of moral restraint such as late marriage, or celibacy, nature would enact "destructive" checks on overpopulation:

> The power of population is so superior to the power in the earth to produce subsistence for man that premature death must in some shape or other visit the human race. The vices of mankind are active and able ministers of depopulation. . . . But should they fail in the war of extermination, sickly seasons, epidemics, pestilence, and plague, advance in terrific array, and sweep off their thousands and ten thousands. Should success be still incomplete, gigantic inevitable famine stalks in the rear, and with one mighty blow, levels the population with the food of the world. (44)

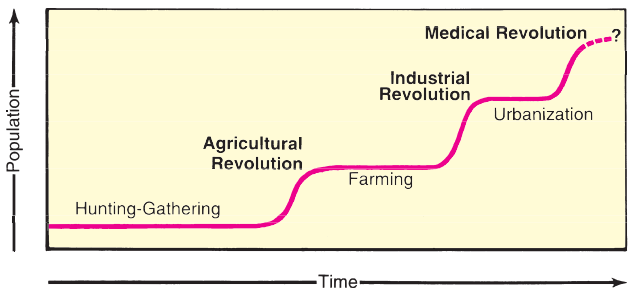


Figure 4.27 The steadily higher plateau populations achieved by humans are evidence of their ability to increase the carrying capacity of the land through technological advance. Each new plateau represents the conversion of the J-curve into an **S-curve**. *Medical revolution* implies the range of modern sanitary and public health technologies and disease preventative and curative advances that reduced morbidity and mortality rates.

Allied with the property-owning elite, Malthus was pessimistic about the lower social classes' ability to restrain their reproduction. He argued against charity because alleviating the suffering of the hungry would merely encourage them to increase in number, while discouraging thrift and hard work. Malthus was not alone in drawing pessimistic conclusions about population growth and resources; Hung Liangchi of China wrote in the 19th century that "Within a hundred years or so, the population can increase from fivefold to twentyfold, while the means of subsistence . . . can increase only from three to five times."

Malthus did not have the benefit of witnessing the demographic transition that was just getting underway or more recent advances in contraceptives and food production technology. Yet that did not stop the revival of his ideas after World War II, when many developing countries entered the second stage of the demographic transition. **Neo-Malthusians,** most notably Paul **Ehrlich,** a Stanford University biologist and author of the best-seller *The Population Bomb,* updated Malthus's arguments for the 20th century. As a population biologist, Ehrlich was familiar with animal studies that showed a steep J-curve of population growth followed by dieback when numbers exceeded the carrying capacity of the environment. Sounding the alarm in 1968, Ehrlich wrote:

> The battle to save humanity is over. In the 1970s and 1980s hundreds of millions of people will starve to death despite any crash programs embarked upon now. At this late date, nothing can be done to prevent a substantial increase in the world death rate, although many lives could be saved through dramatic programs to "stretch" the carrying capacity of the earth by increasing food production and providing for more equitable distribution of whatever food is available. But these programs will only provide a stay of execution unless they are accompanied by determined and successful efforts at population control (1968, xi).

Neo-Malthusianism gained popularity among environmentalists and international development specialists who viewed

rapid population growth as damaging the environment and diverting scarce resources from capital investment. In order to lift living standards, the existing national efforts to lower mortality rates had to be balanced by governmental programs to reduce birth rates. Thus, neo-Malthusian thinking became the basis for national and international programs of population control. These programs were promoted around the world by the United Nations and non-governmental organizations and were especially influential in Asian countries such as China and India.

Arrayed against the pessimism of Malthus and the neo-Malthusians are a number of competing perspectives, most notably the Marxist critique of Malthus and the economic theories of Esther Boserup and Julian Simon. **Karl Marx** rejected the Malthusian interpretation of poverty, arguing that what appeared to be overpopulation was actually the unemployed surplus labor population needed by the capitalist system. Danish economist Esther Boserup developed the **Boserup thesis,** on the basis of detailed historical and field studies, which argues that past agricultural improvements occurred as a result of population pressure. In order to feed more people, farmers developed new ways to use their land and labor more intensively. In other words, population growth was a stimulus, not a deterrent, to development. American economist **Julian Simon** went further, developing an optimistic cornucopian perspective on population growth. Simon argued that resources do not exist in nature but are created by human ingenuity, which is the world's ultimate resource base. For example, a resource such as oil was just a black gooey substance until humans discovered ways of refining it and capturing its energy content. For cornucopians, more people means more scientists and inventors. Since the time of Malthus, they observed, the world's population had grown from 900 million to more than 7 billion without the predicted dire consequences—proof that Malthus failed to recognize the importance of technology in raising the carrying capacity of the Earth. Still higher population numbers, they suggest, are sustainable, perhaps even with improved standards of living for all.

An intermediate view admits that products of human ingenuity, such as the Green Revolution (discussed in Chapter 8), allowed food production to keep pace with rapid population growth but warns that continued gains in food production technology are not guaranteed. Both complacency and inadequate research support have hindered continuing progress in recent years. And even if further advances are made, they observe, not all countries or regions have the social and political will or capacity to take advantage of them. Those that do not will fail to keep pace with the needs of their populace and will sink into varying degrees of poverty and environmental decay, creating national and regional—though not necessarily global—crises.

Drawing upon both nationalistic and Marxist concepts, many less-developed countries rejected the neo-Malthusian population control programs promoted by Western states (See the feature "International Population Policies"). They maintained that remnant colonial era social, economic, and class structures, rather than population increase, hindered their development. Some government leaders recognized a link between population size and power and pursued pronatalist policies that encouraged childbearing, as did Mao's China during the 1950s and early 1960s. Africa and the Middle East have been generally less receptive to neo-Malthusian arguments because of established cultural preferences for large families. Islamic fundamentalist resistance to birth restrictions has had an influence in the Near East and North Africa, although the Muslim theocracy in Iran has endorsed a range of contraceptive options and supports an aggressive family planning program. Predominantly Roman Catholic countries in southern Europe, Central America, and South America have witnessed substantial fertility declines despite the official pronatalist policies of the church.

4.8 Population Prospects

Regardless of population philosophies, theories, or cultural norms, the fact remains that many or most developing countries are showing significantly declining population growth rates. Global fertility and birth rates are falling to an extent not anticipated by pessimistic Malthusians and at a pace that suggests a peaking of world population numbers sooner—and at lower totals—than previously projected and possible decline in the developed world. In all world regions, steady and continuous fertility declines have been recorded over the past years, reducing fertility from global 5-children-per-woman levels in the early 1950s to 2.5 per woman today. Most continuing population growth in developed countries is due to momentum from the past, and aging will be an inevitable consequence of the recent changes in fertility patterns.

Population Implosion in the Developed World?

For much of the last half of the 20th century, demographers and economists focused on a "population explosion" and its implied threat of a world with too many people and too few resources of food and minerals to sustain them. In the 21st century, those fears were replaced by a new prediction of world regions with too few rather than too many people.

That possibility was suggested by two related trends. The first became apparent by 1970 when total fertility rates (TFRs) of 19 countries, almost all of them in Europe, had fallen below the **replacement level**—the level of fertility at which populations replace themselves—of 2.1. Simultaneously, Europe's population pyramid began to become noticeably distorted, with a smaller proportion of young and a growing share of middle-aged and retirement-age inhabitants. The decrease in native working-age cohorts had already, by 1970, encouraged the influx of non-European "guest workers" whose labor was needed to maintain economic growth and to sustain the generous security provisions guaranteed to what was becoming the oldest population of any continent.

Many countries of Western and Eastern Europe sought to reverse their birth rate declines by adopting pronatalist policies. The communist states of the East rewarded pregnancies and births with generous family allowances, free medical and hospital care, extended maternity leaves, and child care. France, Italy, the Scandinavian countries, and others gave similar bonuses or awards for first, second, and later births. Despite those inducements, however, reproduction rates continued to fall. By the early 21st century, every European country and territory had fertility rates below replacement levels. The personal decisions that

produced sub-replacement fertility were influenced by cultural changes, increased educational levels of women, opportunities for women to work in challenging careers, and the increasing cost of rearing children. Cultural expectations about ideal family size have shifted downward, and an increasing number of adults are choosing personal pursuits over family obligations. The effect on national growth prospects has been striking. Every country in eastern Europe and most in southern Europe are projected to shrink in population by 2050. Germany's willingness to accept more than one million Syrian refugees in 2015 to 2016 was strongly influenced by the country's prospect of population decline. Europe as a whole is forecast to shrink in population by mid-century. "In demographic terms," France's prime minister remarked, "Europe is vanishing."

Europe's experience has been echoed in other societies with advanced economies. By the late 20th century, Canada, Australia, New Zealand, Japan, Taiwan, South Korea, Singapore, and other older and newly industrializing countries (NICs) registered fertility rates below the replacement level. As they have for Europe, simple projections foretold their aging and declining population. Japan's elderly population outnumbers its youth population more than twofold and its total population is projected to shrink by 20 percent by 2050.

The second trend indicating to many that world population numbers could stabilize during the lifetimes of today's college cohort is a simple extension of the first: TFRs are being reduced to or below the replacement levels in countries at all stages of economic development in all parts of the world. Exceptions to the trend are found in sub-Saharan Africa, and in some areas of South, Central, and West Asia; but even in those regions, fertility rates have been decreasing in recent years. "Powerful globalizing forces [are] at work pushing toward fertility reduction everywhere," was an observation of the French National Institute of Demographic Studies.

Achievement of zero population growth has social and economic consequences not always perceived by its advocates. These inevitably include an increasing proportion of older citizens, fewer young people, a rise in the median age of the population, and a growing old-age dependency ratio with ever-increasing pension and social service costs borne by a shrinking labor force.

Momentum

Reducing fertility levels to the replacement level of about 2.1 births per woman does not mean an immediate end to population growth. Because of the age composition of many societies, births will exceed deaths even as fertility rates per woman decline. The reason is to be found in **population** (or **demographic**) **momentum,** which is similar to a car continuing to coast for some time after the driver has lifted their foot from the accelerator pedal. The key to momentum is the **age structure** of a country's population.

When a high proportion of the population is young, the product of past high fertility rates, larger numbers enter the childbearing age each year; that is the case for major parts of the world today. The populations of developing countries are far younger than those of the established industrially developed regions (see Figure 4.11), with more than 40 percent in Africa below the age of 15. The fertility of these young people has yet to be realized. A population with a greater number of young people tends to grow rapidly regardless of fertility rates. The results will continue to be felt until the youthful cohorts mature and work their way through the population pyramid (**Figure 4.28**).

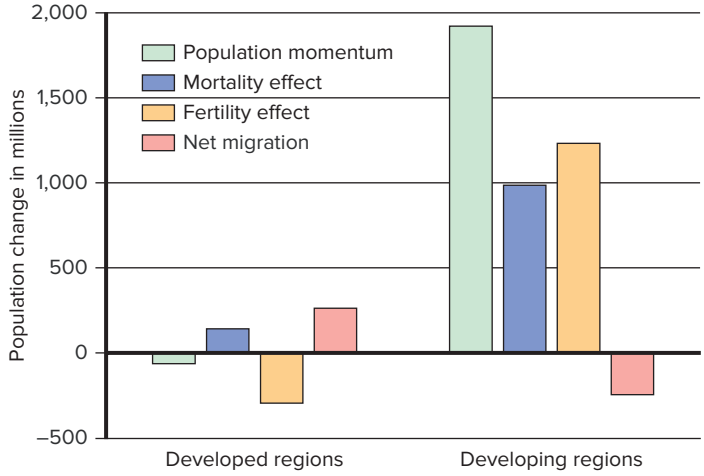


Figure 4.28 Components of population change, 2010–2100. The most dramatic population changes will take place in developing regions where momentum is the largest component of growth. Population momentum represents the lingering effects of past high fertility. Worldwide declines in total fertility rates will not immediately be reflected by equivalent declines in the growth of population. Because of past high fertility, the numbers of women in their childbearing years are increasing both absolutely and relative to the rest of the population.

Source: United Nations Population Division, 2013.

Inevitably, while this is happening, even the most stringent national policies limiting growth cannot stop it entirely. A country with a large youth population will experience large numerical increases despite declining birth rates. Indeed, the higher fertility was to begin with and the sharper its drop to low levels, the greater will be the role of momentum even after rates drop below replacement. For example, Iran has recently implemented strong population policies that have lowered fertility rates to 1.9, well below replacement values. However, due to momentum, the population is projected to grow by 12 million by 2050. Population momentum also works in reverse. Low fertility rates create a top-heavy population pyramid containing momentum for future population decline.

Aging

Eventually, of course, young populations grow older, and even the youthful developing countries are beginning to face the consequences of that reality. The problems of a rapidly aging population that already confront the industrialized economies are now being realized in the developing world as well. Throughout human history, young people outnumbered the elderly; sometime between 2015 and 2020, persons 65 years and older surpassed those under 5 years of age. Europe is the oldest world region and Africa is the youngest. Japan leads the world in the percentage of its population aged 65 and older, Italy and Germany are close behind.

The progression toward older populations is considered irreversible, the result of longer life expectancies and the now-global demographic transition from high to low levels of fertility and mortality. The youthful majorities of the past are unlikely to occur again.

In the developing world, older persons are projected to make up 20 percent of the population by 2050 in contrast to the 8 percent over age 60 there in 2000. Because the demographic transition took place more quickly, the pace of aging will be much faster in the developing countries. Thus, they will have less time than the developed world did to adjust to the consequences of that aging. And those consequences will be experienced at lower levels of personal and national income and economic strength.

In both rich and poor states, the working-age populations will face increasing burdens and obligations. The potential support ratio, or PSR (the number of persons aged 15–64 years per one citizen aged 65 or older), has steadily fallen. Between 1950 and 2000, it dropped from 12 to 9 workers for each older person; by mid-century, the PSR is projected to drop to 4. The implications for Social Security programs, private pension plans, health insurance, government finances, and social support obligations are ominous. Exacerbating the strain on resources, the sharp increase in the oldest population (80 years or older) will require greater expenditures for health and long-term care. We can expect strained government budgets to become normal. The consequences of population aging appear most intractable for the world's poorest developing states that generally lack health, income, housing, and social service support systems adequate to the needs of their older citizens. To the social and economic concerns of their present population momentum, therefore, developing countries must add the consequences of future aging (**Figure 4.29**).

Figure 4.29 These senior residents of a Moroccan nursing home are part of the rapidly aging population of many developing countries. Worldwide, the over-60 cohort will number some 22 percent of total population by 2050 and be larger than the number of children less than 15 years of age. By 2020, a third of Singapore citizens will be 55 or older, and China will have as large a share of its population over 60—about one in four—as will Europe. Already, the numbers of old people in the world's poorer countries are beginning to dwarf those in the rich world. There are nearly twice as many persons over 60 in developing countries as in the advanced ones, but most are without the old age assistance and welfare programs that developed countries have put in place.

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AP KEY WORDS

Use the terms below with a ❙ to focus your study of AP Human Geography key words in this chapter.

age distribution
❙ age structure
❙ agricultural density
❙ anti-natalist policies
❙ arithmetic density
Boserup thesis
carrying capacity
cohort
❙ crude birth rate (CBR)
❙ crude death rate (CDR)
crude density
demographic equation
demographic momentum
❙ demographic transition
demography
❙ dependency ratio
❙ doubling time
ecumene
Ehrlich, Paul
food security
infant mortality rate
J-curve
❙ life expectancy
Malthus, Thomas Robert
❙ Malthusian theory
Marx, Karl
❙ migration
❙ mortality rate
neo-Malthusianism
net migration
nonecumene
overpopulation
❙ physiological density
population (demographic) momentum
population density
population geography
population projection
❙ population pyramid
❙ pro-natalist policies
❙ rate of natural increase
rates
replacement level
S-curve
❙ scale of analysis
Simon, Julian
sex ratio
❙ total fertility rate (TFR)
zero population growth (ZPG)

AP TEST PRACTICE

Multiple Choice Questions

1. **Which of the following does NOT strongly impact the birth rate of a country?**
   (A) The age and sex structure of its population.
   (B) The customs and family size expectations of its inhabitants.
   (C) The physiological density of the country.
   (D) The population policies of its government.
   (E) The availability of birth control.

2. **Why is the total fertility rate (TFR) of a country a better measurement of fertility than the crude birth rate (CBR)?**
   (A) It shows the average number of children born per woman.
   (B) The TFR, unlike the CBR, is not affected by the age distribution of the population.
   (C) A rate of 2.1 to 2.3 children per woman is considered to be replacement level.
   (D) It is not affected by the child mortality rate.
   (E) They show the difference between high and low fertility countries.

3. **Population pyramids such as those shown in Figure 4.9 on page 107 and in Figure 4.12 on page 109 can be used to illustrate all of the following EXCEPT**
   (A) age and sex distribution patterns of the population.
   (B) a comparison of males to females in various age brackets.
   (C) the economic problems countries will have if they have too many old people and not enough young people.
   (D) the problems of developing countries that have a high dependency ratio.
   (E) the reasons for fluctuations during certain years.

4. **The changes occurring in the increased rate of the world's population growth and doubling time mean that**
   (A) the world's population is beginning to shrink, and the doubling time is decreasing.
   (B) a small increase in the world's population results in a huge increase in numbers even as the doubling time starts to rise.
   (C) increases in population in developed countries will continue to offset the decreasing birth rate in developing countries.
   (D) when doubling time decreases, world population is growing more slowly.
   (E) a J-curve graph of the world's population shows that the population is decreasing.

5. **All of the following are causes for the rapid population growth that began to occur in the mid-18th century EXCEPT**
   (A) improvements in agriculture and food supply meant fewer famines.
   (B) birth rates decreased, allowing for more food and better care.
   (C) new medical treatments and technology led to longer life spans.
   (D) industrialization and the accompanying urbanization concentrated people into cities where other developments were more available than in rural areas.
   (E) improvements in sanitation led to a decrease in death rates.

6. **The spread of infectious diseases**
   (A) has become less frequent over time, resulting in decreased mortality rates.
   (B) is affecting fewer people, although mortality rates have risen.
   (C) began with the Spanish Flu Epidemic of 1918–1919.
   (D) is linked to climate change and deforestation, population growth, and urbanization.
   (E) can be overcome only by quarantining affected populations.

7. **The demographic equation means that**
   (A) the number of people being born is equal to the number of people who die, so population growth is equal to zero.
   (B) the final population of an area is equal to the initial population, plus births, minus deaths (rate of natural increase).
   (C) the final population of an area is equal to the initial population, plus births, minus deaths, plus the number of migrants coming in and out.
   (D) the population growth of an area is rising due to demographic factors.
   (E) population growth is declining due to education programs and use of birth control.

8. **A major change in family planning, the Cairo Plan for population management in 1994**
   (A) advocated harsh measures to control population.
   (B) was not signed by many United Nations member states because it advocated birth control.
   (C) legalized abortion in all United Nations member countries.
   (D) targeted education and more rights for women as a way to slow population growth.
   (E) was implemented through religious organizations in developing countries.

9. **The nonecumene, the very sparsely inhabited or uninhabited parts of the world,**
   (A) may have localized dense areas of population based on irrigation, agriculture, or mining.
   (B) is only found around the polar ice caps.
   (C) does not count deserts and high mountaintops where no one could live anyway.
   (D) has only been settled by humans in recent years due to advances in technology.
   (E) makes up only 10% of the earth's land surface area.

10. **Food production will grow arithmetically, and without checks, and that population will grow geometrically, causing people to starve. Where does this idea come from?**
   (A) It comes Danish economist Esther Boserup's study of agricultural improvements due to population pressures.
   (B) It comes from Thomas Robert Malthus' *An Essay on the Principle of Population*.
   (C) It comes from Neo-Malthusians, such as Paul Ehrlich who wrote *The Population Bomb.*
   (D) It was a key belief of communist philosopher, Karl Marx.
   (E) It was essential to the theories of American economist, Julian Simon.

Free Response Questions

1 **Choose two of the three countries below and discuss how each of their population policies has changed over the years. What were the results of these policies?**
   (A) Singapore
   (B) China
   (C) India

2. **Answer Parts A, B and C below, using the population pyramids for Nigeria and Japan in Figure 4.9 on page 107.**
   (A) Briefly explain the stages of the demographic transition model.
   (B) Explain the stage of the model Nigeria is in. What is one advantage and one disadvantage of this stage?
   (C) Explain the stage of the model Japan is in. What is one advantage and one disadvantage of this stage?

3. **Answer Parts A, B and C using the migration map in Figure 4.20 on page 118.**
   (A) Which is the largest migration stream shown on the map? Where are the migrants coming from and going to? Explain one economic and one social reason for this migration stream.
   (B) Choose a migration stream that shows a forced migration and explain the reason for it.
   (C) Explain two reasons why people from South Asia migrate to the countries indicated on the map.