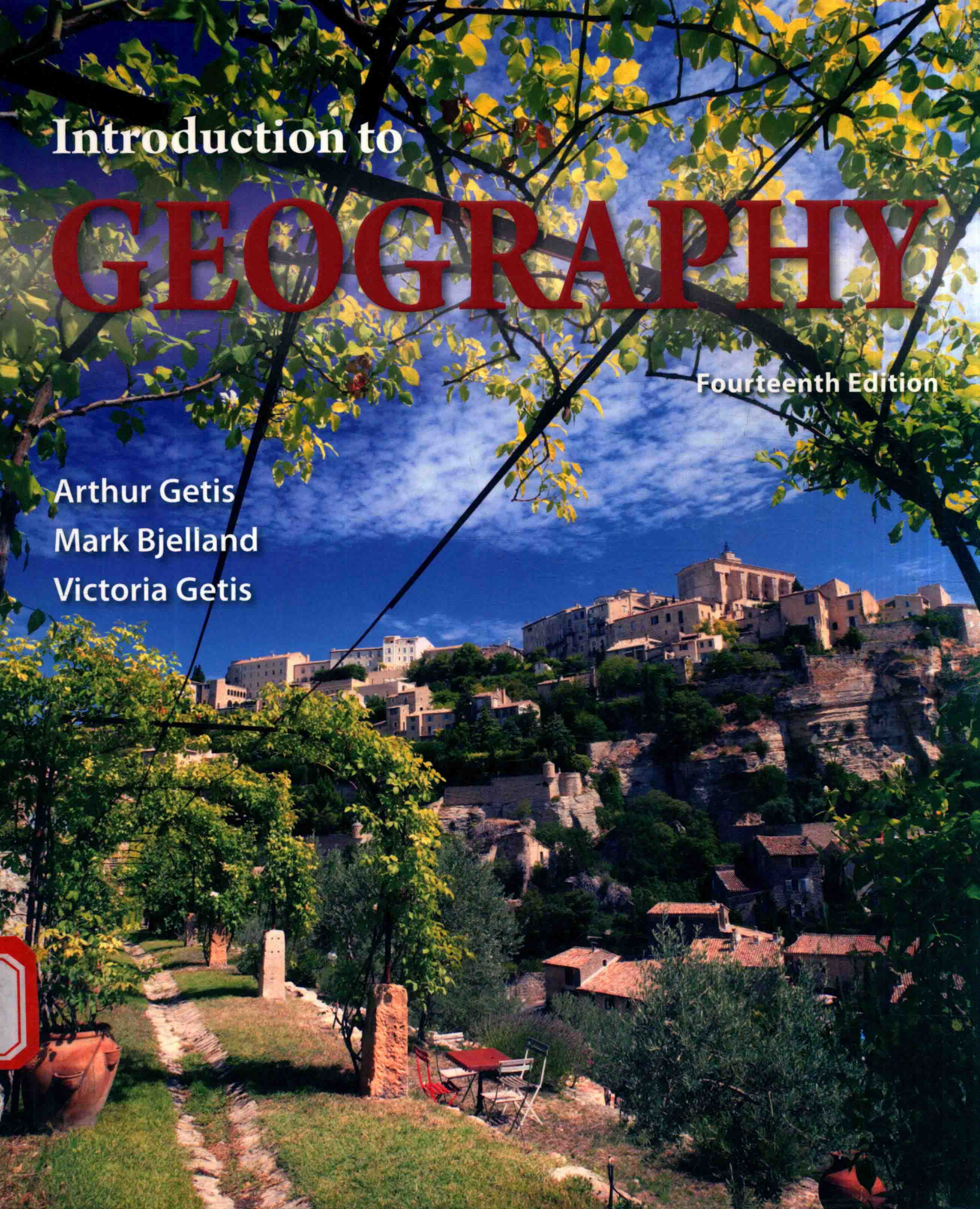
Introduction to GEOGRAPHY

Fourteenth Edition

Arthur Getis
Mark Bjelland
Victoria Getis



FOURTEENTH EDITION

Introduction to Geography

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Mc Graw Hill Education

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Arthur Getis received his B.S. and M.S. degrees from The Pennsylvania State University and his Ph.D. from the University of Washington. He is coauthor of several geography textbooks as well as several books dealing with the analysis of spatial data. Together with Judith Getis, he was among the original unit authors of the High School Geography Project sponsored by the National Science Foundation and the Association of American Geographers (AAG). He has published widely in the areas of infectious diseases, spatial analysis, and geographic information systems. He is honorary editor of the *Journal of Geographical Systems*, and he serves on the executive committee of the *Geographical Analysis* journal and on the editorial board of the *Annals of Regional Science*. He has had administrative appointments at Rutgers University, the University of Illinois, and San Diego State University (SDSU), where he held the Birch Endowed Chair of Geographical Studies. In 2002, he received the AAG Distinguished Scholarship Award. Professor Getis is a member and an elected fellow of the University Consortium of Geographical Information Sciences, the Western Regional Science Association, and the Regional Science Association International. Currently he is Distinguished Professor of Geography Emeritus at SDSU.

Mark Bjelland earned his B.S. degree from the University of Minnesota and an M.S. degree from the University of Washington. He worked for six years as an environmental consultant on projects dealing with environmental justice, pollution cleanup, urban redevelopment, and water supply planning. He then earned a Ph.D. in geography from the University of Minnesota, writing his dissertation on abandoned, contaminated industrial lands in U.S. and Canadian cities. He taught geography for 15 years at Gustavus Adolphus College before taking his current position as professor of geography in the Department of Geology, Geography, and Environmental Studies at Calvin College. He has led geography field courses to the Midwest, western Canada, Pacific Northwest, and Great Britain. He has been granted two Fulbright awards to study urban environmental planning in Germany and Great Britain. His research has been published in the *Research Journal of the Water Pollution Control Federation,* the *Journal of Environmental Engineering, The Professional Geographer, Urban Geography,* and a number of book chapters.

Victoria Getis received her A.B. degree from Oberlin College and her M.A. and Ph.D. degrees from the University of Michigan. She has been a contributor to *Introduction to Geography* since its 10th edition. She is also the author of *The Juvenile Court and the Progressives* and the coauthor of *Muddy Boots and Ragged Aprons: Images of Working Class Detroit, 1900–1930.* She is currently at work on a coauthored textbook on America in the 1960s. Victoria is the Manager of Faculty Support Services at Northwestern University; formerly, she was the Director of the Digital Union at Ohio State University.

BRIEF CONTENTS

PREFACE

"If you build it, they will come" was the message that inspired the character played by Kevin Costner in the movie *Field of Dreams* to create a baseball field in his Iowa cornfield. A similar hope encouraged us when we first began to think about writing *Introduction to Geography* in 1975. At that time, very few departments of geography in the United States and Canada offered a general introductory course for students—that is, one that sought to acquaint students with the breadth of the entire field. Instead, most departments offered separate courses in physical and human or cultural geography. Recognizing that most students will have only a single college course and textbook in geography, we wanted to develop a book that covers all of the systematic topics that geographers study. Our hope, of course, was that the book would so persuasively identify and satisfy a disciplinary instructional need that more departments would begin to offer a general introductory course to the discipline, a dream that has been realized.

Approach

Our purpose is to convey concisely and clearly the nature of the field of geography, its intellectual challenges, and the logical interconnections of its parts. Even if students take no further work in geography, we are satisfied that they will have come into contact with the richness and breadth of our discipline and have at their command new insights and understandings for their present and future roles as informed adults. Other students may have the opportunity and interest to pursue further work in geography. For them, we believe, this text will make apparent the content and scope of the subfields of geography, emphasize its unifying themes, and provide the foundation for further work in their areas of interest.

A useful textbook must be flexible enough in its organization to permit an instructor to adapt it to the time and subject matter constraints of a particular course. Although designed with a one-quarter or one-semester course in mind, this text may be used in a full-year introduction to geography when employed as a point of departure for special topics and amplifications introduced by the instructor or when supplemented by additional readings and class projects.

Moreover, the chapters are reasonably self-contained and need not be assigned in the sequence presented here. The chapters may be rearranged to suit the emphases and sequences preferred by the instructor or found to be of greatest interest to the students. The format of the course should properly reflect the joint contribution of instructor and book, rather than be dictated by the book alone.

New to this Edition

Although we have retained the framework of presentation introduced in the previous edition of this book, we have revised, added, and deleted material for a variety of reasons.

- The material on economic geography has been split into two chapters, allowing greater coverage of agriculture (Chapter 9), manufacturing (Chapter 10), the emerging international division of labor, and the services industry.
- The chapter on natural resources has been moved and grouped with the chapter on human impacts on the environment (Chapter 12).
- Current events always mandate an updating of facts and analyses and may suggest discussion of additional topics. Examples include a new chapter opening vignette on Hurricane Sandy and the growth of hydraulic fracturing in the United States as a source of oil and natural gas.
- In every new edition, both changes in spatially variable patterns of population growth and decline and changes in the populations of major urban areas require updating. Maps and tables depicting the U.S. population were updated based on data from the 2010 census.
- Every table and figure in the book has been reviewed for accuracy and currency and has been replaced, updated, or otherwise revised where necessary.
- As always, we rely on reviewers of the previous edition to offer suggestions and to call our attention to new emphases or research findings in the different topical areas of geography. Our effort to incorporate their ideas is reflected not only in the brief text modifications or additions that occur in nearly every chapter but also in more significant alterations.
- The urban chapter (Chapter 11) incorporates recent scholarship on postindustrial cities and on world cities. It also focuses on changing patterns of urbanization and suburbanization in the United States, reflecting recent trends of a return to central cities and smaller growth in the suburbs. There are new data on homelessness. There is new information on the postcommunist city as economies change in Eastern Europe. And there is a new section on slums in cities in the developing world, emphasizing governments' efforts to upgrade slums.
- The political geography chapter reflects changes in current events. Chapter 8 includes a discussion of the oil pipeline dispute in the new country of South Sudan, updated information on women's participation in legislative bodies worldwide, and references to the euro crisis.
- Chapter 7 has been renamed Human Interaction rather than its original title Spatial Interaction. This in no way diminishes the importance of the spatial point of view, but puts into a more balanced perspective the influence of Internet types of communications such as e-mail, Facebook, and Twitter. These as well as other forms of human interaction are spatially nuanced, but by their very nature are considered to be more generally unconstrained by the friction of distance. The chapter reflects this more up-to-date point of view.
- At the beginning of each chapter the learning outcomes are listed.

New Figures and Tables

To reflect the most recent data, many figures have been revised or newly drawn for the 14th edition of *Introduction to Geography.* They include:

- New map illustrating the concepts of site and situation using the example of New Orleans (Chapter 1)
- New pair of maps to illustrate the concepts of spatial pattern and spatial association. The maps depict predominant religions and dry counties in Texas (Chapter 1)
- New map of vernacular regions of the United States based on Wilbur Zelinsky's work (Chapter 1)
- New pair of historic and contemporary photographs depicting landscape change, using the example of Dubai (Chapter 1)
- A new diagram illustrating the basic systematic structure of the discipline of geography (Chapter 1)
- A new series of maps representing the distortion of different map projections; the face used for the illustration now a woman rather than a man (Chapter 2)
- Maps representing population distribution in California and electoral results from the 2012 presidential election (Chapter 2)
- New photos illustrating the effects of the Japanese tsunami of 2011 and Hurricane Sandy of 2012 (Chapters 3 and 4, respectively)
- Figures providing new information on climate change and demonstrating more succinctly the altitude and form of different types of clouds (Chapter 4)
- All maps, graphs, charts, and tables related to population that required updating (Chapter 5)
- New set of population pyramids depicting a variety of U.S. communities including a retirement community, university town, Texas-Mexico border town, and Indian reservation (Chapter 5)
- Improved map of major world migrations since 1500 (Chapter 5)
- New map and graph of the distribution of the world's population by latitude using 2010 data (Chapter 5)
- Improved map of the U.S. regions that use the term *pop, soda,* or *coke* for a soft drink (Chapter 6)
- New map of Internet users around the world (Chapter 6)
- New map showing the diffusion of dialects across the United States (Chapter 6)
- Maps reflecting the latest data on flows of refugees, migration in the United States, and migration fields of California and Florida (Chapter 7)
- Figures listing new countries admitted to the UN, South Sudanese proposed oil pipelines, and geographic shifts in congressional apportionment. (Chapter 8)
- Improved map of accessibility and ocean shipping flows (Chapter 9)
- New table illustrating the importance of the informal economy in developing regions (Chapter 9)
- New figure illustrating the locational interdependence model (Chapter 10)
- Improved map of the major international financial centers and stock exchanges (Chapter 10)
- Figures and tables now reflecting 2010 census data and new UN Population Division data and projections (Chapter 11)
- Figures reflecting new research or data regarding world cities and their global networks; population density changes in Atlanta and Detroit; Megalopolis on the East Coast of the United States; racial/ethnic residential changes in Los Angeles; and the percentage of urban residents living in slums worldwide (Chapter 11)
- All maps, graphs, charts, and tables related to natural resource use that required updating (Chapter 12)
- New figure depicting the relationship between standard of living and the scale of environmental impacts (Chapter 13)
- New Appendix 3 using 2012 population data; a new data field showing the percentage of each country's population with access to improved drinking water sources in line with the United Nation's Millennium Development Goals

New/Revised Boxes

The boxed elements in the book have been updated if necessary or replaced with new discussion texts.

- Box on terrorism revised to reflect new country of South Sudan (Chapter 8)
- Updated information in the environmental justice box (Chapter 8)
- New box "Eating Locally on the College Campus" (Chapter 9)
- New box "Where Do Your Clothes Come From?" discussing the changing geographic patterns of the garment industry and ethical questions about working conditions (Chapter 10)
- Substantial revision to "Birds of a Feather" box, reflecting changes in technology and marketing (Chapter 11)
- Revised Geography & Public Policy box, "Fuel Economy and CAFE Standards" (Chapter 12)

New/Revised Topical Discussions

- New opening vignette about Hurricane Sandy in 2012
- New discussion of the 2010 Deepwater Horizon oil spill in the Gulf of Mexico
- New discussion of the 2011 Fukushima nuclear accident in Japan
- All resource-use data updated to reflect the most recent production, consumption, and reserve figures
- Population data and projections updated to reflect the latest available world, regional, and country information from UN population agencies, the Population Reference Bureau, and the U.S. Census Bureau
- New discussion of ethnoburbs
- Updated discussion of offshoring and a comparison of wages around the world
- Updated discussion of the growing Chinese economy, high-tech innovation, and transnational corporations
- New discussion of international commodity chains for consumer electronics such as the iPhone
- New discussion of the United Nation's Millennium Development Goals for addressing gender inequality

- New discussion of sustainable agriculture
- New presentation of the locational interdependence theory for services
- New discussion of tourism and gambling
- Revised system for dividing economic activity into three sectors: primary, secondary, and tertiary. This three-part scheme follows standard practice and matches the format of major international economic databases. Within the tertiary or service sector, consumer services distinguished from business services
- New discussion of hydraulic fracturing and its significance for energy production from the Bakken Formation and Marcellus Shale
- New discussion of sustainable cities and green technologies to reduce greenhouse gas emissions
- New discussion of transboundary river basins
- New discussion of Not In My Backyard protests
- The discussion on climate change updated to be in line with current scientific thinking on the subject

Acknowledgments

A number of reviewers have greatly improved the content of this and earlier editions of *Introduction to Geography* by their critical comments and suggestions. Although we could not act upon every helpful suggestion, or adopt every useful observation, all were carefully and gratefully considered. In addition to those acknowledgments of assistance detailed in previous editions, we note the thoughtful advice provided by the following individuals.

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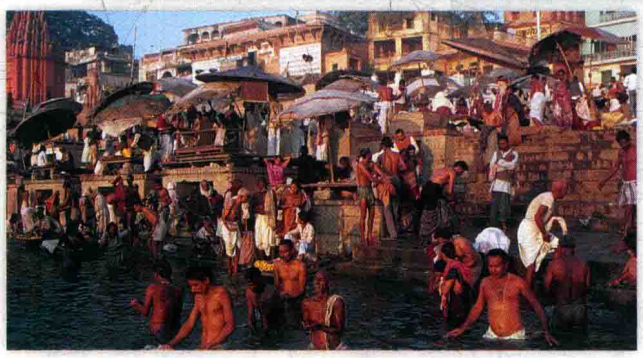
Arthur Getis
Mark D. Bjelland
Victoria Getis

Pedigogocal content in Introduction to Geography has been created to gain and retain student attention, the essential first step in the learning process.

CHAPTER 6

Cultural Geography



Hindu pilgrims worship at dawn in the sacred Ganga (Ganges) River at Varanasi, India. © *Porterfield/Chickering/Photo Researchers*

CHAPTER OUTLINE

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Numbered **Chapter Outlines** are included on the opening page of each chapter to clarify the organization of the chapter and to make it easy to locate specific topics of discussion.

Each chapter opens with **Learning Objectives** students can use to guide their study and help them focus on critical concepts. These objectives specify what students are expected to know, understand, and be able to do after studying the chapter.

Vignettes are used to begin each chapter with a brief real-life story intended to capture student interest and prepare them for the subject matter to follow.

LEARNING OBJECTIVES

After studying this chapter you should be able to:

3.1 Characterize the three classes of rock.
3.2 Define folding, joint, and faulting.
3.3 Illustrate how plate tectonics relate to earthquakes.
3.4 Explain how a tsunami originates.
3.5 Compare the effect of mechanical and chemical weathering on landforms.
3.6 Compare the effect of groundwater erosion with that of surface water erosion.
3.7 Relate how glaciers form and how their erosion creates landscapes.
3.8 Define landform features such as deltas, alluvial fans, natural levees, and moraines.
3.9 Understand the landform changes due to waves, currents, and wind.

Although too early for sunbathers and snorkelers, the Hawaiian Islands will have a new island to add to their collection, which contains such scenic beauties as Oahu, Maui, and Kauai. It is Loihi, 0.8 kilometer (0.5 mi) below sea level, just 27 kilometers (17 mi) from the big island of Hawaii. Because the speed of its ascent must be measured in geologic time, it probably will not appear above the water surface for another million or so years. It is a good example, however, of the ceaseless changes that take place on the earth's surface. As the westernmost of the islands erode and sink below sea level, new islands arise at the eastern end. In Loihi's most recent explosion in 1996, scientists feared that a giant wave would be set off at the surface that could devastate the islands, including the city of Honolulu and popular Waikiki Beach. Fortunately, this was not the case.

Humans on their trip through life continuously are in touch with the ever-changing, active, moving physical environment. Most of the time, we are able to live comfortably with the changes, but when a freeway is torn apart by an earthquake, or floodwaters force us to abandon our homes, we suddenly realize that we spend a good portion of our lives trying to adapt to the challenges the physical environment has for us.

For the geographer, things just will not stand still—not only little things, such as icebergs or new islands rising out of the sea, or big ones, such as exploding volcanoes changing their shape and form, but also giant things, such as continents that wander about like nomads and ocean basins that expand, contract, and split in the middle like worn-out coats.

Geologic time is long, but the forces that give shape to the land are timeless and constant. Processes of creation and destruction are continually at work to fashion the seemingly eternal structure upon which humans live and work. Two types of forces interact to produce those infinite local variations in the surface of the earth called *landforms:* (1) forces that push, move, and raise the earth's surface and (2) forces that scour, wash, and wear down the surface. Mountains rise and are then worn away. The eroded materials—soil, sand, pebbles, rocks—are transported to new locations and help create new landforms. How long these processes have worked, how they work, and their effects are the subject of this chapter.

Much of the research needed to create the story of land-forms results from the work of geomorphologists. A branch of the fields of geology and physical geography, *geomorphology* is the study of the origin, characteristics, and development of landforms. It emphasizes the study of the various processes that create landscapes. Geomorphologists examine the erosion, transportation, and deposition of materials and the interrelationships among climate, soils, plant and animal life, and landforms.

In a single chapter, we can only begin to explore the many and varied contributions of geomorphologists. After discussing the contexts within which landform change takes place, we consider the forces that are building up the earth's surface and then review the forces wearing it down.

3.1 Earth Materials

The rocks of the earth's crust vary according to mineral composition. Rocks are composed of particles that contain various combinations of such common elements as oxygen, silicon, aluminum, iron, and calcium, together with less-abundant elements. A particular chemical combination that has a hardness, density, and definite crystal structure of its own is called a **mineral.** Some well-known minerals are quartz, feldspar, and micas. Depending on the nature of the minerals that form them, rocks are hard or soft, more or less dense, one color or another, or chemically stable or not. While some rocks resist decomposition, others are very easily broken down. Among the more common varieties of rock are granites, basalts, limestones, sandstones, and slates.

Although one can classify rocks according to their physical properties, the more common approach is to classify them by the way they formed. The three main groups of rock are igneous, sedimentary, and metamorphic.

Igneous Rocks

Igneous rocks are formed by the cooling and solidification of molten rock. Openings in the crust give molten rock an opportunity to find its way into or onto the crust. When the molten rock cools, it solidifies and becomes igneous rock. The name for underground molten rock is *magma;* aboveground, it is *lava. Intrusive* igneous rocks are formed below ground level by the solidification of magma, whereas *extrusive* igneous rocks are created above ground level by the solidification of lava (**Figure 3.1**).

The composition of magma and lava and, to a limited extent, the rate of cooling determine the minerals that form. The rate of cooling is mainly responsible for the size of the crystals. Large crystals of quartz—a hard mineral—form slowly beneath the surface of the earth. When combined with other minerals, quartz forms the intrusive igneous rock called *granite.*

The lava that oozes out onto the earth's surface and makes up a large part of the ocean basins becomes the extrusive igneous rock called *basalt,* the most common rock on the earth's surface. If, instead of oozing, the lava erupts from a volcano crater, it may cool very rapidly. Some of the igneous rocks formed in this manner

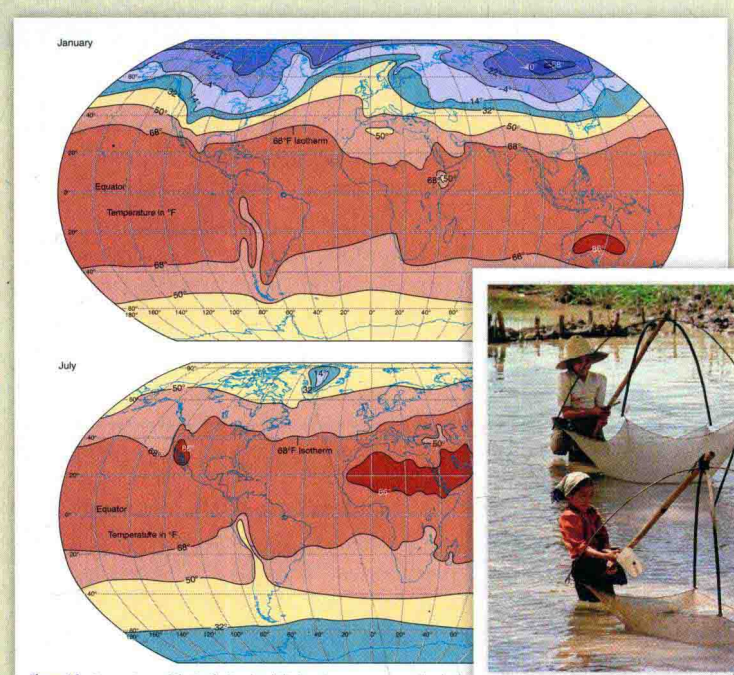


Figure 4.9 **Temperatures of the Earth.** At a given latitude, water areas are warmer than land ar
of equal Temperatures.

Figure 9.21 **Fish farming in China.**
fastest-growing sectors in world food pr
supplying the vast majority of the total f
here, fish farming can be done in floode
enhance soil fertility and the fish eat ins
© *AP Photo/Greg Baker.*

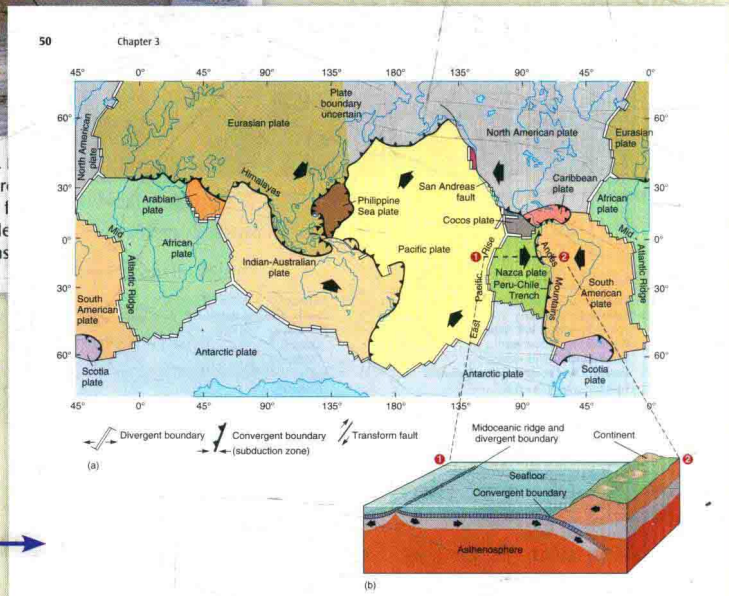
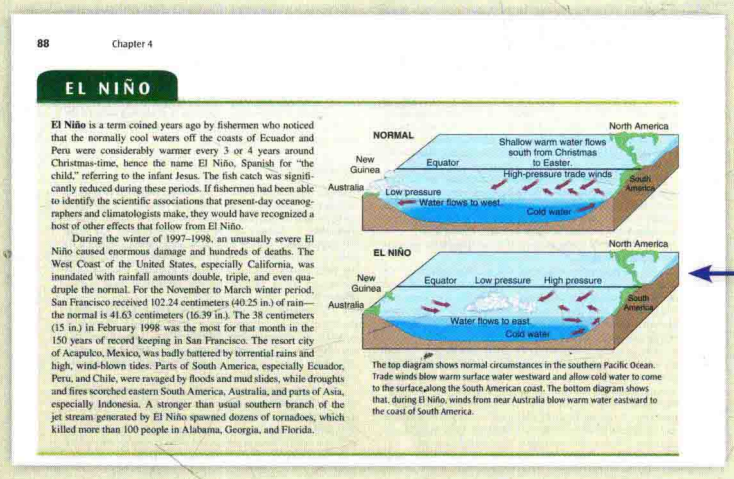


Figure 3.6 **(a) Principal lithospheric plates of the world.** Arrows indicate the direction of plate motion. **(b) Plate motion away from a divergent boundary toward a convergent boundary.**

More than **450 full-color maps, charts, and photographs**, along with information and explanations, serve as an extension of the text. World maps have been created using the Robinson projection and colors have been chosen to accommodate most color-blind students. The Fold-out world map at the back of the text can be easily referenced for any chapter in the text.



88 Chapter 4

EL NIÑO

El Niño is a term coined years ago by fishermen who noticed that the normally cool waters off the coasts of Ecuador and Peru were considerably warmer every 3 or 4 years around Christmas-time, hence the name El Niño, Spanish for "the child," referring to the infant Jesus. The fish catch was significantly reduced during these periods. If fishermen had been able to identify the scientific associations that present-day oceanographers and climatologists make, they would have recognized a host of other effects that follow from El Niño.

During the winter of 1997–1998, an unusually severe El Niño caused enormous damage and hundreds of deaths. The West Coast of the United States, especially California, was inundated with rainfall amounts double, triple, and even quadruple the normal. For the November to March winter period, San Francisco received 102.24 centimeters (40.25 in.) of rain—the normal is 41.63 centimeters (16.39 in.). The 38 centimeters (15 in.) in February 1998 was the most for that month in the 150 years of record keeping in San Francisco. The resort city of Acapulco, Mexico, was badly battered by torrential rains and high, wind-blown tides. Parts of South America, especially Ecuador, Peru, and Chile, were ravaged by floods and mud slides, while droughts and fires scorched eastern South America, Australia, and parts of Asia, especially Indonesia. A stronger than usual southern branch of the jet stream generated by El Niño spawned dozens of tornadoes, which killed more than 100 people in Alabama, Georgia, and Florida.

The top diagram shows normal circumstances in the southern Pacific Ocean. Trade winds blow warm surface water westward and allow cold water to come to the surface along the South American coast. The bottom diagram shows that, during El Niño, winds from near Australia blow warm water eastward to the coast of South America.

Boxed inserts are written to further develop ideas and enhance student interest in the course material. Chapters generally include three to five boxes and most chapters include a box on gender-related issues.

Geography & Public Policy boxes highlight important or controversial issues, encouraging students to think about the relevance of geography to real-world concerns. Critical thinking questions at the end of each box prompt students to reflect upon and form an opinion about specific issues and serve as a catalyst for class discussion.

GEOGRAPHY & PUBLIC POLICY

International Population Policies

After a sometimes rancorous 9-day meeting in Cairo in September 1994, the United Nations 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 UN Conference on Environment and Development held in Rio de Janeiro in June 1992.

The Cairo plan abandoned several decades of top-down government programs that promoted *population control* (a phrase avoided by the conference) based on targets and quotas and, instead, for the first time embraced 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 had 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 had carefully avoided or specifically excluded abortion as an acceptable family planning method. It was the more open discussion of abortion in Cairo that elicited much of the spirited debate that registered religious objections by the Vatican and many Muslim and Latin American states to the inclusion of legal abortion as part of health care, and to language suggesting approval of sexual relations outside marriage. 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 the conference's 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."

A special United Nations "Cairo+5" session in 1999 recommended some adjustments to the earlier agreements. It urged an emphasis on measures ensuring safe and accessible abortion in countries where it is legal, called for schoolchildren at all levels to be instructed in sexual and reproductive health issues, and told governments to provide special family planning and health services for sexually active adolescents, with particular stress on reducing their vulnerability to AIDS.

In 2004, the UN reported progress toward reaching Cairo and Cairo+5 goals. The consensus was that much remained to be done to broaden programs for the poorest population groups, to invest in rural development and urban planning, to strengthen laws ending discrimination against women, and to encourage donor countries to fully meet their agreed-upon contributions to the program. Nevertheless, positive Cairo plan results were also seen in declining fertility rates in many of the world's most-populous developing countries. Some demographers and many women's health organizations pointedly claim that those declines had little to do with government planning policies. Rather, they assert, current lower and falling fertility rates were the expected result of women's assuming greater control over their economic and reproductive lives. The director of the UN 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, population specialists have observed, reflects important cultural factors emerging since Cairo. Satellite television takes contraceptive information even to remote villages and shows programs of small, apparently happy families that viewers think of emulating. 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, with corresponding reductions in the illiteracy rates of girls and young women, who will themselves soon be making fertility decisions.

Considering the Issues

1. Do you think it is appropriate or useful for international bodies to promote policies affecting such purely personal or national concerns as reproduction and family planning? Why or why not?
2. Do you think that current international concerns over population growth, development, and the environment are sufficiently valid and pressing to risk the loss of long-enduring cultural norms and religious practices in many of the world's traditional societies? Why or why not?
3. The Cairo plan called for sizable monetary pledges from developed countries to support enhanced population planning in the developing world. For the most part, those pledges have not been honored. Do you think the financial obligations assigned to donor countries are justified in light of the many other international needs and domestic concerns faced by their governments? Why or why not?
4. Many environmentalists see the world as a finite system unable to support ever-increasing populations; to exceed its limits would cause frightful environmental damage and global misery. Many economists counter that free markets will keep supplies of needed commodities in line with growing demand and that science will, as necessary, supply technological fixes in the form of substitutes or expansion of production. In light of such diametrically opposed views of population growth consequences, is it appropriate or wise to base international programs solely on one of them? Why or why not?

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44 Chapter 2

Summary of Key Concepts

- Maps are as indispensable to the geographer as are words, photographs, and quantitative techniques of analysis. Also relying on maps are people involved in the analysis and solution of many of the critical issues of our time, such as climate change, pollution, national security, and public health—all issues that call for the accurate representation of elements on the earth's surface.
- The geographic grid of longitude and latitude is used to locate points on the earth's surface. Latitude is the measure of distance north and south of the equator, while longitude is the angular distance east or west of the prime meridian.
- All systems of representing the curved earth on a flat map distort one or more earth features. Any given projection will distort area, shape, distance, and/or direction.
- Among the most accurate and most useful large-scale maps are the topographic quadrangles produced by a country's chief mapping agency. They contain a wealth of information about both the physical and the cultural landscape and are used for a variety of purposes.
- Remote sensing from aircraft and satellites employing a variety of sensors is an important source of spatial data. The need to store, process, and retrieve the vast amounts of data generated by remote sensing has spurred the development of geographic information systems, which provide a way to search for spatial patterns and processes.

As you read the remainder of this book, note the many different uses of maps. For example, notice in Chapter 3 how important maps are to your understanding of the theory of continental drift; in Chapter 6, how maps aid geographers in identifying cultural regions; and in Chapter 7, how behavioral geographers use maps to record people's perceptions of space.

Key Words

area cartogram (value-by-area map) 31
azimuthal projection 26
cartography 20
choropleth map 30
conformal projection 26
contour interval 30
contour line 28
equal-area (equivalent) projection 23
equidistant projection 26
flow-line map 32
geographic database 41
geographic grid 21
geographic information system (GIS) 40
Global Positioning System (GPS) 37
globe properties 23
International Date Line 22
isoline 32
Landsat satellite 36
latitude 21
longitude 22
map projection 23
prime meridian 22
remote sensing 34
scale 27
topographic map 27

Thinking Geographically

1. What important map and globe reference purpose does the *prime meridian* serve? Is the prime, or any other, meridian determined in nature or devised by humans? How is the prime meridian designated or recognized?
2. What happens to the length of a degree of longitude as one nears the North and South Poles? What happens to a degree of latitude between the equator and the poles?
3. From a world atlas, determine, in degrees and minutes, the locations of New York City; Moscow, Russia; Sydney, Australia; and your hometown.
4. List at least five properties of a globe.
5. Briefly make clear the differences in properties and purposes of *conformal*, *equivalent*, and *equidistant* projections. Give one or two examples of the kinds of map information that would best be presented on each type of projection.
6. Give one or two examples of how maps can be misused.
7. In what different ways can *map scale* be presented? Convert the following map scales into their verbal equivalents.

   1:1,000,000 1:63,360 1:12,000

8. What is the purpose of a *contour line*? What is a *contour interval*? What landscape feature is implied by closely spaced contours?
9. What kinds of data acquisition are suggested by the term *remote sensing*? To what uses are remotely sensed images put?
10. What are the basic components of a *geographic information system*? What are some of the applications of a GIS?

Chapters **Summaries of Key Concepts** appear at the end of each chapter as a way to reinforce the major ideas of the chapter and guide student understanding of key concepts.

Thinking Geographically questions are easily assignable and provide students an opportunity to check their grasp of chapter material.

A **Key Words** list with page references makes it easy for students to verify their understanding of the most important terms in the chapter.

Appendix 1: Map Projections include a discussion of methods of projection, globe properties and map distortion, and classes of projection. **Appendix 2: Climates, Soils, and Vegetation** supplements Chapter 4 *Physical Geography: Weather and Climate* by providing information about soil formation, soil profiles and horizons, soil taxonomy, and natural vegetation regions.

Appendix 3: 2012 World Population Data Sheet for the Population Reference Bureau (a modified version) includes basic demographic data and projections for countries, regions, and continents, as well as selected economic and social statistics helpful in national and regional comparisons. The comparative information in the appendix data is useful for student projects, regional and topical analyses, and the study of world patterns.

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McGraw-Hill's ConnectPlus (www.mcgrawhillconnect.com/Geography) is a Web-based assignment and assessment platform that gives students the means to better connect with their coursework, with their instructors, and with the important concepts that they will need to know for success now and in the future. The following resources are available in ConnectPlus:

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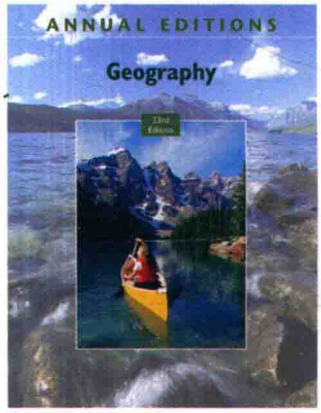

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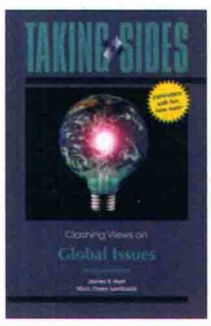

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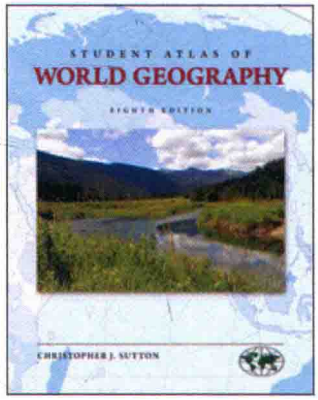

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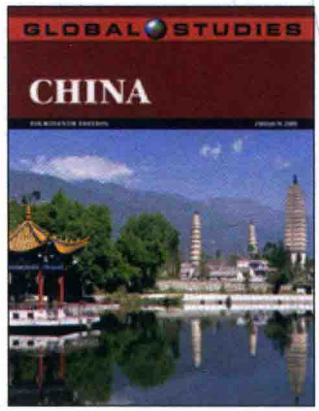

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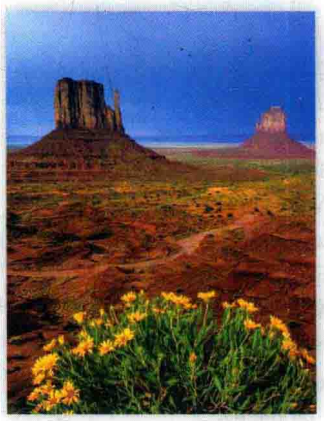

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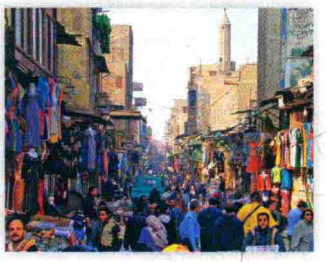

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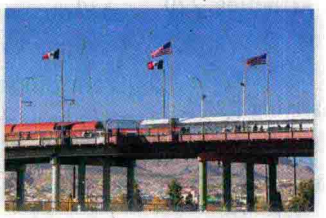

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