CENGAGE

WORLD REGIONAL GEOGRAPHY

SEVENTH EDITION

JOSEPH J. HOBBS

The World

Political

The World

Physical

WORLD REGIONAL GEOGRAPHY

SEVENTH EDITION

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Cartography by Andrew Dolan

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Seventh Edition
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Preface

To appreciate how our complex world works today, it is vital to have a solid grounding in the environmental, cultural, historic, economic, and geopolitical contexts of the world's regions and nations. *World Regional Geography* establishes that foundation and offers you an opportunity to explore the events, issues, and landscapes of our world in more detail.

Chapters 1 through 3 provide the basic concepts, tools, and vocabulary of world regional geography. In the first chapter, geography's uniquely spatial approach to the planet is introduced along with some of the discipline's milestone concepts and its considerable career possibilities—especially those growing from the "geospatial revolution." Chapter 2 covers the essential characteristics of the world's physical processes and how human activity has altered some of them. Climate change and the treaties to control it have a prominent role in the chapter. Chapter 3 traces the modification of landscapes by human actions from early times to the present, describes trends and projections of population growth, and considers sustainable development agendas to slow destructive trends in resource use and to limit climate changes.

Then come eight chapters exploring the world's regions through a consistent, thematic approach focusing in turn on five elements: Area and Population, Physical Geography and Human Adaptations, Cultural and Historical Geographies, Economic Geography, and Geopolitical Issues. The final section of each chapter, entitled "Regional Issues and Landscapes," contains a selection of short studies of the region's critical roles in global affairs and of exemplary or important problems in human or physical geography.

The book is built for use in either a one- or two-semester course. If time is limited, the five thematic elements of each chapter may be a priority, with limited use of the case studies in the "Regional Issues and Landscapes" section. After the three introductory chapters, it does not matter what order the regional chapters are read in; no regional chapter presumes that any other regional chapter has been read. While the text begins with Europe, this does not suggest any ranking in importance; each world region has thorough coverage, and developing countries have the weight they require. This book's signature feature is its unique cross-reference system, which ties a theme or issue introduced in one region to other examples of the concept, event, or place in other regions.

MindTap for World Regional Geography, 7e, implements the cross-reference system through easy-to-use links so that readers can instantly navigate to the related theme or issue. Read more about the powerful learning tools made available in MindTap in the "Course Support" section of the Preface.

Key Features

- Learning objectives are clearly articulated and tied to in-depth content in order to maximize geographic literacy.
- Students are prompted to think critically about the concepts and themes that span the world's regions and to be able to answer Fritz Gritzner's big geographic questions, "What is where, why there, and why care?"
- Geography's concepts, themes, findings, and methods are highlighted throughout the text, including with features such as *Perspectives from the Field* and *Geographic Spotlight,* and a host of subdisciplinary topics including urban and population geographies, and geographies of natural hazards and sacred spaces.
- The definitive 18 Standards of Geography authored by the National Council for Geographic Education (NCGE), presented in Chapter 1, served as a constant reference in shaping the content of the book. Readers will be enabled to match each standard with book content.
- The book's maps are outstanding and, along with photos and graphs, are tightly coordinated with the text. This updated map program aims to cut dependence on a separate atlas.
- Readers can be confident in the author's narratives, built upon decades of research and travel in more than 100 countries, and teaching of world regional geography and related classes.
- Each chapter's thorough Study Guide is carefully built upon content and is a useful tool for both teaching and learning.

New to the Seventh Edition

Both longtime and first-time users of *World Regional Geography* should be pleased with this edition. Much of the baseline content of the previous editions is retained, but this is the most extensive revision to date. And while several familiar issues are accentuated in importance, a number of new and important themes are also introduced here.

- Changing climates and associated issues are more pervasive than in earlier editions, with discussions of actual rather than hypothesized climate change refugees.
- Inequality became a prominent issue in this edition as awareness of it has grown across the globe.
- The virus pandemic and impacts of COVID-19 are covered in all world regions.
- The "birth dearth" accelerates around the world, with falling populations.
- There is more political geography, with the rise of nationalism and populism in multiple regions, including Europe and the US. Brexit is covered.
- More issues and practices of sustainability are covered throughout.

- There is more focus on human migration issues, including the European migrant crisis and US–Mexico border crises.
- The edition keeps and expands its characteristic attention to traditional, indigenous, and ethnic minority populations.
- The rise and expansion of China's interests around the globe permeate much discussion throughout the book.
- Changing technologies and views of alternative energies are more important than ever around the world.
- This edition features a dozen new maps, illustrating topics such as COVID-19, Pangaea, the slave trade, and the spread of Islam. In addition, the physical geography and land use maps in each regional chapter have been completely revamped.

Chapter-Specific Changes

- In Chapter 1, human–environment interaction is identified as the key concern of geography. There is a new discussion on the sense of place, and more information about the relevance of geography to other courses and to daily life, as well as encouragement to consider further studies and careers in this growing field. The definitive 18 Standards of Geography (authored by the National Council for Geographic Education) along with the Five Themes of Geography are introduced and intended to serve as a constant reference for instructors and students.
- Chapter 2, Physical Processes and World Regions, has additional material about the world's oceans and their roles in natural cycles and human uses. More attention is also paid to freshwater resources. International Panel on Climate Change (IPPC) emissions scenarios are updated, and the unexpected acceleration in climate change is discussed, with a focus on the polar realms. The Paris Agreement commitments are examined, along with mechanisms of the carbon market.
- In Chapter 3, Human Processes and World Regions, the difference between more and less developed countries is now based primarily on the quality of life measures of the Human Development Index (HDI) but still refers to GDP (gross domestic product) measures. COVID-19's capacity to change long-standing economic and migration patterns is introduced. The important research and publication on "A Good Life for All within Planetary Boundaries" introduces a new way for students to understand why and how sustainable development is needed and is achievable. The UN's Sustainable Development Goals (SDGs) are introduced so as to be called upon where relevant in the regional chapters.
- Chapter 4, the first regional chapter (on Europe), has new discussions and maps on the ongoing refugee crisis and about Brexit. The European Union's reluctance to accept new members, partly in reaction to the refugee crisis, is discussed. A new method of combining ethnic and linguistic geographies to aid teaching and learning is introduced here and is used in all subsequent chapters.
- Chapter 5, on the region of Russia and the Near Abroad, considers improvements in Russia's demographic outlook along with the downsides of being overly reliant on fossil fuels. The prospects for President Vladimir Putin to further expand Russia's sphere of influence are discussed, as is the rekindled war in Nagorno–Karabakh.
- Chapter 6 on the Middle East and North Africa has been reorganized to have a more detailed and current discussion of geopolitical issues, especially in light of the demise of the physical Islamic State. The Syrian Civil War now has a narrative leading from the Arab Spring to the situation today. The Arab Spring's outcomes and prescriptions for sustainable development in the MENA region are discussed. The Gulf Wars are simplified but analyzed for their enduring consequences. Turkey under authoritarian leader Erdogan has been rewritten, and the situation in Iran updated. A section on the Maghreb and the Berber peoples has been added.
- Chapter 7 on South and East Asia has an appropriate weight for the vast number of people living in the region and its rising prominence in global affairs. China's growing clout is a prominent theme, supported with studies of the Belt and Road Initiative (BRI); the three-child policy; impacts on Hong Kong governance; suppression of Uighur, Kazakh, and Tibetan minorities; threats to Taiwan; and sponge cities. The Rohingya crisis, Myanmar coup, and COVID-19 surge in India are discussed.
- Chapter 8 takes us across Oceania and Antarctica. There is more focus on marine ecosystems and threats to them, including coral bleaching from climate change–related warming. Rising sea levels are already forcing migrations of climate change refugees, and some small island states are becoming "deterritorialized," losing their ground to the sea. The human and physical geographies of Antarctica are discussed more thoroughly than ever before, and the reader's attention is directed to the future of the continent's ice shelves and glaciers in a warming world.
- Chapter 9 on Sub-Saharan Africa portrays the continent with careful thoroughness to ensure that the region escapes wide brushes and stereotypes. There are new discussions of Zimbabwe and of the plight of Tigray under pressure from Ethiopia and Eritrea. There is a new map of the slave trade, built around an extended study. Development in the region has seen some setbacks but is promising going forward, and, unlike most of the world, populations will continue to grow here. The theme of robbing Africans of their resources permeates the chapter, and China's regional interests are scrutinized.
- Chapter 10 on Latin America includes new features on Cuba, the Falklands War, and the sacred space of Mexico City's Lady of Guadalupe shrine. Hurricane impacts on Puerto Rico and the Golden Triangle region are described; the latter contribute to the refugee flow to the US. Inequities in landholding and other assets are pervasive. The US-oriented agenda of neoliberalism is introduced, along with the regional pushback against it. The United States–Mexico–Canada Agreement (USMCA) is viewed as North American Free Trade Agreement's (NAFTA's) successor. There are new developments in Venezuela's collapse and in the war on drugs. Sections on

Brazil and Amazonia are thoroughly extended to include the interwoven forces behind deforestation, regional and global climate changes, and pressures on the Yanomami and other indigenous peoples. The particular development problems related to President Bolsonaro's policies are described.

- Chapter 11 on the United States and Canada has been revised more thoroughly than ever. Current debates over legal and authorized immigration in both countries, as well as along the US–Mexico border, are discussed. The political, social, and economic geographies of America's minority populations, especially in the wake of killings of Blacks in police custody, are developed and include explanations of Black Lives Matter, inequalities, and racism. The Trump presidency and the transition to the Biden administration frame a new discussion of political geographic polarization and the Capitol Insurrection. New developments in America's changing settlement patterns, including outflows from California, are discussed. The megadrought in the American West is officially established. The race for the Arctic has heated up, and Russia's plans for the area are updated. Greenland has more treatment than ever, and its strategic location is examined. COVID-19's impacts on the US, Canada, and the world conclude the chapter and the book.

Acknowledgments

I am grateful to everyone who encouraged me throughout, especially my wife, Cindy; daughters, Katie and Lily; my brothers Greg, Ed, and Will, and sister Barbara; and our Mom, who has left us but remains a steady and positive influence on us all. I am deeply thankful for the contributions of my colleague Andy Dolan, who has done superb cartography, research, and editing for this edition and all of my world regional geography publications. I think his maps are exquisite—enjoy them!

I thank Senior Content Manager Martha Conway for her meticulous work on this book, the last in her long career as editor. She and Senior Product Manager Vicky True-Baker have always been encouraging and patient with me.

I may not have written this book without the relentless encouragement of MU Geography undergraduate student Jeff Ford, who urged me to do so because of his conviction that more students need to know more about the world.

Course Support Resources

The text is accompanied by a number of ancillary publications to assist instructors and enhance student learning, including full MindTap course support, thus creating a complete learning package!

MindTap for World Regional Geography, 7e

MindTap is a personalized, fully online digital learning platform of authoritative content, assignments, and services that engages your students with interactivity while also offering you choice in the configuration of coursework and enhancement of the curriculum via web apps known as MindApps. MindApps include ReadSpeaker, which reads the text out loud to students. *MindTap for World Regional Geography*, 7e, provides the following unique features to enhance your course:

- An interactive eBook with highlighting, note taking, and an interactive glossary
- Unparalleled content cross-referencing so students can make important connections across the regions of the world
- Pre-tests and post-tests for each chapter that are autograded in MindTap and include helpful hints for students
- Concept animation quizzes and video quizzes that bring concepts to life
- World Regional Geography in Context activities, where students read scientific articles and analyze and interpret real-world scientific findings
- Interactive mapping activities that tie in with the high-quality maps in the text and that enable students to interact with maps and develop geographic literacy and spatial reasoning skills

Instructor Resources

Instructor Companion Site

Additional instructor resources for this product are available online. Instructor assets include an Instructor's Manual, PowerPoint® slides, and a test bank powered by Cognero®. Sign up or sign in at **www.cengage.com** to search for and access this product and its online resources.

Cengage Learning Testing Powered by Cognero

This flexible online system allows the instructor to author, edit, and manage test bank content from multiple Cengage Learning solutions, create multiple test versions in an instant, and deliver tests from an LMS, a classroom, or wherever the instructor wants.

About the Author


Joe Hobbs

Joe Hobbs received his BA at the University of California Santa Cruz and his MA and PhD at the University of Texas at Austin. He joined the faculty of the Geography Department at the University of Missouri, where he also served as director of the Vietnam Institute, in 1988. Always interested in indigenous peoples, traditional lifeways, and natural history, he is mainly a geographer of the Middle East, with many years of field research on Bedouin peoples and natural environments in Egypt's deserts. Joe's interest in the region grew from his boyhood in Saudi Arabia. His profession in geography grew out of life abroad with his Mom and Dad, his travels, and especially from being the "wayfellow" of Saleh Ali, a Bedouin of Egypt's Ma'aza tribe. His research in Egypt has been supported by grants from Fulbright, the American Council of Learned Societies, the American Research Center in Egypt, and the National Geographic Society Committee for Research and Exploration. He served as the team leader of the Bedouin Support Program, a component of the St. Katherine National Park project in Egypt's Sinai Peninsula, and led an effort to establish a national plan for environmental management in the United Arab Emirates. He is a consultant focusing on Bedouin interests in environment and development projects in Saudi Arabia. His main current research examines the geography of Vietnam's indigenous Cao Dai religion. His most recent publications have come from field research with a team, funded by the Norwegian Research Council, studying the interactions between nomadic pastoralists and acacia trees in Egypt and Sudan; and from fieldwork on traditional architecture's contributions to urban development in the UAE and other Gulf countries (https://archnet.org/publications/12009).

Joe is the author of books including *Bedouin Life in the Egyptian Wilderness* and *Mount Sinai* (both University of Texas Press), coauthor of *The Birds of Egypt* (Oxford University Press), and coeditor and author of *Dangerous Harvest: Drug Plants and the Transformation of Indigenous Landscapes* (Oxford University Press).

Joe has taught graduate and undergraduate courses in world regional geography, geopolitics, environmental geography, the geography of the Middle East, the geography of caves, the geography of global current events, and the geographies of drugs and terrorism, as well as a field course on the ancient Maya geography of caves in Belize. He has received the University of Missouri's highest teaching award, the Kemper Fellowship, and awards for leadership in international education at MU. He has led adventure tours on small ships in remote areas in Latin America, Africa, the Indian Ocean, Asia, Europe, and the High Arctic. Joe lives in Missouri with his wife Cindy and a menagerie of domesticated and other animals.

For my girls,
Cindy, Katie, and Lily

Objectives and Tools of World Regional Geography

1

We are living in the era of the geographer.

—HAL MOONEY, STANFORD ECOLOGIST[1]

Above: Geography is all about human/environment interaction, and often involves exploration and discovery. These youngsters are exploring inlets of the Gulf of Tonkin between the karst towers of Ha Long Bay, Vietnam. Joe Hobbs
Right: The Juhayna Bedouin tribespeople I've been working with in northwestern Saudi Arabia are proud of their distinctive black camels. Dromedaries can be aggressive with strangers. Here I am offering my hand to see if this young female will allow me to get closer. I ended up sitting and petting her long nose and scratching behind her ears. Named Umm Raas, "the One with the (Big) Head," she responded by nuzzling my face with her nose—she kissed me! Joe Hobbs

Learning Objectives

1.1 Describe the scope of geography as an academic discipline.

1.2 Define these key terms in geography: map, region, landscape, culture, space, place, geospatial.

1.3 Describe two or three key concepts in geography, including the different types of regions, how maps display various kinds of spatial information, and how geography is both a physical and a social science.

1.4 Identify the roles of *scale*, *projections*, and *symbolization* on maps.

1.5 Define "geospatial revolution," geographic information systems (GIS), and remote sensing.

1.6 List two or three professions that use geographic knowledge.

1.1 Welcome to World Regional Geography

Welcome to world regional geography. What an important and useful field of study! In recent times the world has been in disarray on many fronts: the great powers of the United States, Russia, and China play a high-stakes game for geopolitical dominance; massive numbers of refugees have poured into Europe, even as the European Union has lost its lynchpin member Great Britain; North Korea continues to improve its nuclear weapon delivery systems; a pandemic coronavirus breaks out of China and rampages across the planet; climate change is accelerating so much that it is increasingly called "the climate crisis." But buried by these worrisome headlines are remarkable stories of breakthroughs in technology, communications, and agriculture, as well as advancements in the eradication of disease and hunger. Hundreds of millions of people have been lifted from poverty in recent years, while fears of a global "population bomb" have largely dissipated. What on Earth is going on?

We need to understand what is going on, where, and why. How much do your peers know about the world? Studies suggest "not enough." The National Geographic Society and the Council on Foreign Relations recently did a study on global literacy entitled "What College-Aged Students Know about the World." The survey of more than 1200 American college students and graduates "revealed significant gaps between what young people understand about today's world and what they need to know to successfully navigate and compete in it" (see •**Figure 1.1**).[2] The average correct score on questions about geography, the environment, demographics, U.S. foreign policy, recent international events, and economics was 55 percent. Only 29 percent of respondents earned a minimal pass—66 percent correct or better. Just over 1 percent earned an A, 91 percent or higher. Fewer than half correctly located Israel, Iran, and Iraq on a map; knew that Mandarin Chinese was the world's most widely spoken primary language; and knew that, in the previous five years, the number of Mexicans leaving the United States and returning to Mexico was greater than the number of Mexicans entering the United States. Remarkably, only 28 percent reported that they learned "a great deal" or "a lot" about global issues like these in their college classes. You will not be in these ranks!

What difference does it make? Who cares if you know where Israel, Iran, and Iraq are? Long ago, geography earned a reputation for mind-numbing memorization of state capitals. By themselves, kernels of knowledge like these may mean little. But geography is all about context and connections. Understanding *where* things are makes it much easier to appreciate and answer the *who*, *what*, *when*, *why*, and *how* questions in life, at every scale—from your daily activities to world affairs. Geography always starts with the *where* question, but it is far more interesting and important than its old reputation suggests. My geographer colleague Fritz Gritzner coined this definition of geography, which also serves as a methodology and as a challenge for us to think critically: "*What is where, why there, and why care?*"[3]

To illustrate the importance of **geographic literacy** (**geo-literacy**), let's consider a study conducted when tensions between North Korea and the United States escalated and made headlines regularly in 2017. The study showed that only 36 percent of 1746 American adults were able to find North

• **Figure 1.1** Despite its usefulness, geographic literacy (geo-literacy) has been neglected in American academic and popular cultures.

Korea on an unlabeled world map. The rest were literally all over the map, from Saudi Arabia to Australia. Those who correctly identified North Korea tended to view diplomatic and nonmilitary strategies—imposing economic sanctions, pressuring China to influence North Korea, conducting cyberattacks against the North Korean military—more favorably than those who did not. They also viewed direct military engagement—especially sending in American ground troops—much less favorably than those who could not locate North Korea.[4] The takeaway? Even basic geographic knowledge contributes to an increased appreciation of the complexities and nuances of global affairs. That appreciation is critical as we and our leaders think about expending American "blood and treasure" in the world's hotspots.

We need to get it right. Geography is all about getting it right when it comes to understanding how the world works. Geographic knowledge of the *where*, *who*, *what*, *when*, *why*, and *how* can help guide informed decision making at all scales, from whether and how the United States should commit troops to a ground war to how you can get from point A to point B in your own city. Geographic insight has the power to transform our lives and contribute to the welfare of our communities and our countries. What you learn from geography will inform and guide you for the rest of your life. Giving you the means to understand contexts and relationships, geography will help you make better informed judgments and decisions and may jump-start your career.

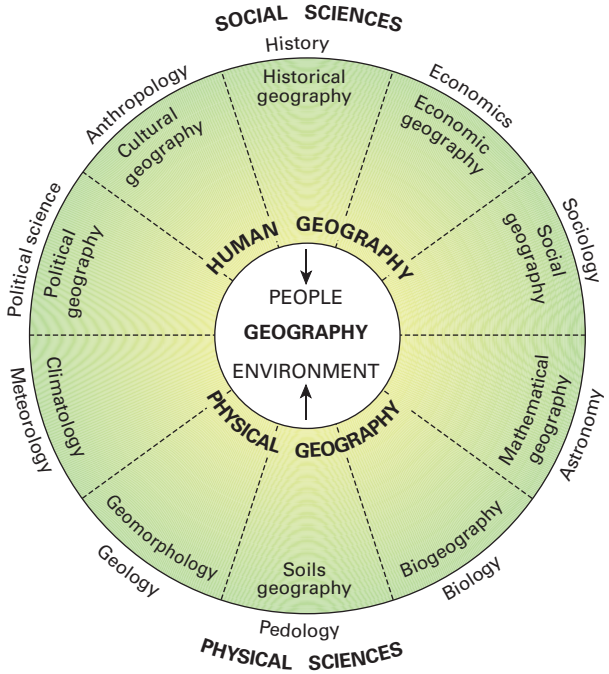
By the end of this chapter, you will know what geography is, recognize the benefits you can gain from learning world regional geography, understand the organization and objectives of this book, and learn some of the key concepts and tools of geography.

1.1a How to Use This Book

My students often ask me the familiar question, "Do I need to know that for the test?" I cannot tell you what your instructor or teaching assistant will put on your test or quiz, but I can help you recognize the ideas, issues, concepts, themes, and information that are *fundamental* to world regional geography (*fundamental* means "of central importance") and that are worthy of testing. I encourage you to use the *Study Guide* at the end of each chapter. It highlights the chapter's most important points and issues. If you want to double its usefulness, I recommend that you read the Study Guide even before you read the chapter and use it again and more thoroughly after your reading and when you are preparing for a test. Another device I use as a writer and that is useful for you is the *topic sentence* introducing or summarizing the main point of a given passage. Usually my topic sentence is at the beginning or end of a paragraph. Want a quick read of the chapter to get up to speed? Follow the topic sentences like highway signs.

1.1b What Is Geography?

Geography, a term first used by the Greek scholar Eratosthenes in the 3rd century BCE, literally means "description of the earth" but is perhaps best characterized as "the study of the earth as the home of humankind."[5] Focusing on interactions between people and the environments in which we live, the modern academic discipline of geography has roots in Greek and Roman civilizations and in the Scientific Revolution that began in sixteenth-century Europe.



• **Figure 1.2** Selected subfields of geography. These are the main subject areas in human geography and physical geography and their links with the most closely related disciplines in the social and natural sciences.

Geography is the most all-encompassing of the sciences, a point of pride for us as geographers. Broadly, the discipline has two major branches, **physical geography** and **human geography**, each of which has roots and relationships with other disciplines in the social and physical sciences (see •**Figure 1.2**). Geographers often bridge the social and natural sciences and even the humanities in our research, publications, and teaching (another point of pride).

As you can see in the center of Figure 1.2, where all the components of the discipline converge, *geography is almost always concerned with the theme of* ***human–environment interaction***. This concern has put geographers at the cutting edge of science and policy in the 21st century because so many of Earth's most pressing problems—conflict, poverty, and climate change, for example—involve the coupling of human and environmental systems. What do you think are the most important questions facing the world today? Chances are that some of yours will overlap with the 11 "strategic research directions" for students and scientists in geography, as defined by the American Association of Geographers (AAG, the leading organization of geographers in the United States):[6]

1. How Are We Changing the Physical Environment of Earth's Surface?
2. How Can We Best Preserve Biological Diversity and Protect Endangered Ecosystems?

3. How Are Climate and Other Environmental Changes Affecting the Vulnerabilities of Coupled Human–Environment Systems?
4. How and Where Will 10 Billion People Live on Earth?
5. How Will We Sustainably Feed Everyone in the Coming Decade and Beyond?
6. How Does Where People Live Affect Their Health?
7. How Is the Movement of People, Goods, and Ideas Transforming the World?
8. How Is Economic Globalization Affecting Inequality?
9. How Are Geopolitical Shifts Influencing Peace and Stability?
10. How Might We Better Observe, Analyze, and Visualize a Changing World?
11. What Are the Societal Implications of Citizen Mapping and Mapping Citizens?

Geographers' interests in human–environment interaction, especially in the ways in which people are changing the face of the earth (known as the "human agency"), go way back. The great German geographer Alexander von Humboldt (1769–1859) began geography's modern era in a series of classic studies on this theme. From field observations in Venezuela, he concluded, "Felling the trees which cover the sides of the mountains provokes in every climate two disasters for future generations: a want of fuel and a scarcity of water."[7] A century and a half later, we are Humboldt's future generations; water shortages and deforestation are among the most pressing global environmental issues that concern us today.

In Humboldt's wake, other geographers in Europe and the United States wrote about environmental changes due to deforestation and the expansion of agriculture and industry. The American geographer Carl Sauer (1889–1975) wrote:

We have accustomed ourselves to think of ever-expanding productive capacity, of ever fresh spaces of the world to be filled with people, of ever new discoveries of kinds and sources of raw materials, of continuous technical progress operating indefinitely to solve problems of supply. Yet our modern expansion has been affected in large measure at the cost of an actual and permanent impoverishment of the world. [8]

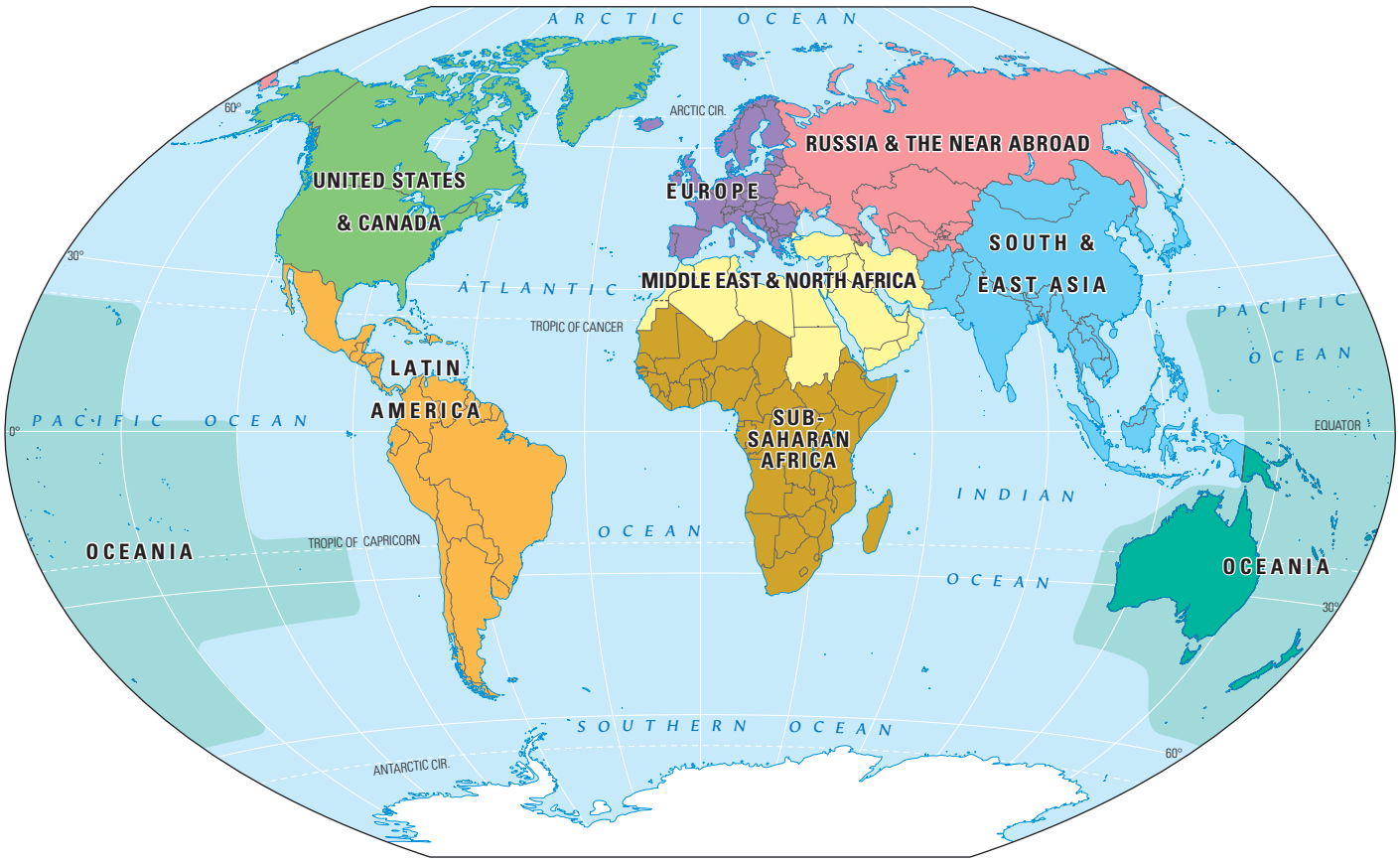
These words have a modern ring to them, but Sauer, a geographer at the University of California–Berkeley, wrote them in 1938. Sauer focused geographers' attention on how the forces of nature and culture shape the **landscape**—the collection of physical and human geographic features on Earth's surface. Sauer is credited with founding the **cultural landscape theory** in American geography, based on the method of studying the transformation, over time, of a **natural landscape** to a **cultural landscape**. "The cultural landscape is fashioned from a natural landscape by a cultural group," he wrote. "Culture is the agent, the natural area is the medium, the cultural landscape is the result."[9] The geographer "reads" the landscapes that cultures shape. **Culture**—the system of values, beliefs, and attitudes that shapes and influences perception and behavior—underlies many of our decisions about how to use and modify the landscape.[10] That is why geographers are so concerned with cultural features such as ethnicity, language, and religion and why you will learn much about them in this book.

1.1c The World Regional Approach to Geography

The **world regional approach to geography** ranges across the human and physical subfields of geography, synthesizing, simplifying, and characterizing the human experiences of Earth as home. It is impossible to deal with something as large and diverse as our planet without an organizing framework. World regional geography simplifies the task by dividing the world into **regions** (see •**Figure 1.3** and •**Table 1.1**). These subdivisions of space are human constructs, not "facts on the ground." People create and draw boundaries around regions that share relatively similar characteristics. A region is simply a convenience and a generalization, helping us become acquainted with the world and preparing us for more detailed insights. This world regional geography book recognizes eight world regions; others have more or fewer.

Geographers recognize three types of regions. Each is helpful in its own way in conveying information about different parts of the world:

- A **formal region** (also called a **uniform** or **homogeneous region**) is one in which all the population shares a defining trait or set of traits. A good example is a political unit such as a county or a state, where the regional boundaries are defined on a map. **Figure 4.2** is a formal region map showing the countries of Europe.
- A **functional region** (also called a **nodal region**) is a spatial unit characterized by a central focus on some kind of activity, often an economic activity. The activity is most intense at the center of a functional region and less intense toward the edges. A good example is the distribution area for a metropolitan newspaper, with the highest numbers of subscribers in the city and diminishing numbers at growing distances from the city.
- A **vernacular region** (or **perceptual region**) is a region that popularly exists in people's minds but has no definitive boundaries. This region may play an important role in cultural identity but does not necessarily have official or clear-cut borders. Good examples are the South, the Bible Belt, and the Rust Belt in the United States (see •**Figure 1.4**). These regional terms have cultural and economic connotations, but ten people might have ten different definitions of the attributes and boundaries of these regions. Created by individuals and cultures, vernacular or perceptual regions represent the regional identities that help us organize, simplify, and make sense of the world around us. This book's eight regions are vernacular regions; not all geographers agree which countries make up the Middle East, for example. In introducing each region, I will tell you what characteristics

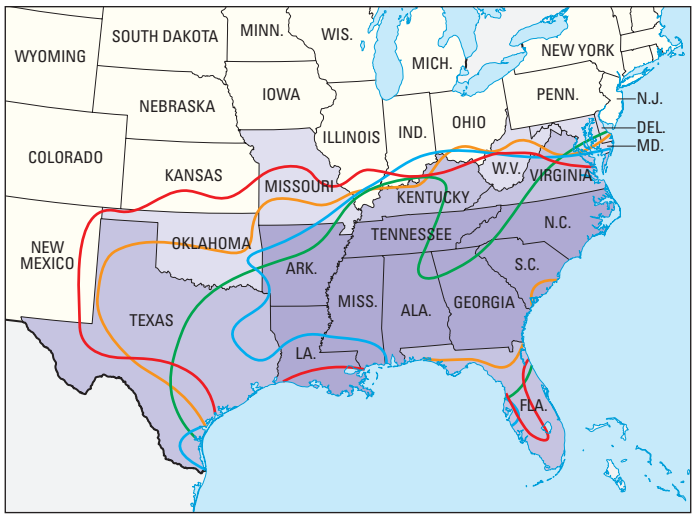


• **Figure 1.3** Map of world regions recognized in this book.

Table 1.1 Major World Regions: Basic Data

Political Unit	Area (sq mi, thousands)	Area (sq km, thousands)	Population (millions)	Rate of Natural Increase (%)	Net Migration Rate	Urban Population (%)	Population Under Age 15 (%)	Population Over Age 65 (%)	Agricultural Workers (%)	Per Capita GDP (PPP) ($US)	GDP ($US, billions)	Oil Production (million bbl/day)	Life Expectancy	Literacy (%)	HDI
World	**52,570.4**	**136,154.5**	**7,773**	**1.1**	**0**	**56**	**26**	**9**	**31**	**17,000**	**129,974**	**80**	**72**	**84**	**0.700**
Europe	1,959.3	5,072.0	543	0.1	3	75	16	20	3	41,100	22,240	3	81	98	0.891
Russia and the Near Abroad	8,533.2	22,100.8	293	0.3	0	65	20	12	16	19,700	5,686	13	73	99	0.782
Middle East and North Africa	5,416.1	14,027.8	591	1.7	1	63	30	5	26	19,500	10,990	30.5	74	80	0.713
South and East Asia	8,265.3	21,407.1	4,186	0.9	0	48	23	9	35	13,200	54,290	6.3	73	85	0.697
Oceania	3,306.8	8,564.5	43	1.0	6	68	23	12	23	36,300	1,505	0.3	79	88	0.819
Sub-Saharan Africa	8,655.2	22,417.2	1,094	2.7	0	41	43	3	58	3,700	3,890	3.6	60	62	0.510
Latin America	7,946.2	20,580.7	651	1.0	0	79	24	8	14	15,900	10,100	8	75	91	0.749
North America	8,488.2	21,984.3	368	0.3	3	82	18	17	2	58,600	21,273	15.2	81	99	0.921

Sources: World Population Data Sheet, Population Reference Bureau, 2020; Human Development Report, United Nations, 2020; World Factbook, CIA, 2020.



• **Figure 1.4** Map of cartogaphic definitions of a vernacular region, the American South. Purple shading represents three state-based delineations, and colored lines delimit various religious, linguistic, and cultural "Souths." These are just a few of the many different interpretations of this vernacular region.

I chose to define it. Distinctive cultural traits and cultural landscapes often characterize a world region, which some geographers view as a **culture area**: "any region inhabited by people of a particular culture, the land upon which the visible imprint of that culture has been placed."[11]

Historically, there was a distinction between regional geography and **systematic geography**. Systematic geography dealt thematically with issues such as politics, urbanization, and climate, with the premise that these phenomena are universal and operate in the same way everywhere. However, most systematic geographical studies employed regional case studies. Systematic or thematic geography came to dominate the field, but the regional approach is arguably more vital than ever before: consider the current urgent need for specialists in Russian and Middle Eastern area studies, where understanding of universal issues is insufficient. Most regional geographers also speak their areas' languages—another vital skill set.

1.1d The Objectives of This Book

Knowledge of geography is more important than ever before in understanding our interconnected, globalized world. You will become more world-wise by using this book. Using the structure of world regions, its five main objectives are for you:

1. *To become geographically literate*. This book will empower you with a comprehensive geographic vocabulary and an advanced command of the language of world regional geography. Using the framework of world regions, this book offers all you need to achieve geographic literacy.
2. *To understand Earth's problems and their potential solutions*. Like geography broadly, world regional geography is concerned with problems in human–environment interaction. Some of these problems, such as overpopulation, poverty, and climate change, are global in scope, whereas others are national, regional, and local. We will see how these problems can be mitigated and even solved.
3. *To use geographic critical thinking to understand the world*. To grapple with Earth's problems such as climate change, we must consider many factors: natural environments and resources, population, economic development, history, and geopolitics, for example. Doing this, you will be using critical thinking, "the process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and evaluating information to reach an answer or conclusion."[12] Using geography's holistic and integrative approach in a regional framework, you will filter and synthesize information, techniques, and perspectives from the natural and social sciences (technically, though, geography is classified as a social science). Pulling these issues and perspectives together, thinking critically, and finding the links among them constitute doing geography, and doing this synthesis within a regional framework is doing world regional geography. With these methods, you *will* be able to understand Earth's problems and potential solutions.

   Growing your habit of geographic critical thinking will be rewarding for you. Your overall university experience will be richer as you connect the dots between your diverse courses. As you carry on through life, your insight and wisdom may reward you both professionally and personally. More complete knowledge of the world—good geography—is also good business. In the competitive environment of the global economy, better understanding of cultures and environments throughout the world helps boost the "bottom line." You will be surprised how much your geographic knowledge, enhanced by your ability to produce insight and advice from it, will help you in whatever your career turns out to be.
4. *To understand the geography of current events*. This book is carefully written to set the stage of world events for you. With the book and your instructor's guidance, you should become able to read and view news with a much better understanding of the issues underlying world events. Incidents like earthquakes and tsunamis in the western Pacific, viral disease epidemics originating in China, and Russia's incursions into neighboring countries are not random, unpredictable events. They are rooted in consistent, recognizable problems that have geographic dimensions. You will become an involved global citizen, finding it satisfying to be "pre-informed" about a problem that suddenly appears in the news. You will also become somewhat of an expert on **geopolitics**, the struggle for space and power played out in a geographical setting.[13]
5. *To develop the ability to interpret places and "read" landscapes*. In doing geography, you will be concerned both with **space**—the exact placement of locations on the face of the earth—and with **place**—*the mix of physical and human features that characterize and give meaning to a particular location*. Unlike space, place is subjective because, like a vernacular region, it is defined by the meaning or "character"

of a particular location. For example, your perceptions of New York City may be very different from those of your friend and may be shaped by your personal experience in the "Big Apple" or by photographs or movies you have seen. In this book, there is much discussion of the **sense of place**—the perceived combination of physical and human characteristics that makes a place special and unique—that individuals and groups have about locations and regions. As you work forward through your book and course, you will get better at identifying the many elements of place identity, including climate, vegetation, and landforms of the physical environment and the language, religion, history, and livelihoods of the people living in that environment. Your skill in interpreting places will even help make you a better traveler.

Sense of place involves the experience of identifying oneself in relation to a particular piece of land and in many contexts includes local knowledge and traditions.[14] Sense of place can have a very strong influence on how we make decisions and interact with others. We have a sense of "belonging" to a place or that a place belongs to us. Such attachments can shape an ethnocentric or geocentric outlook of who does and does not belong and of what should and should not be done in a particular place.[15] Sense of place can therefore even have a strong impact on world events. For example, in Chapter 6 on the Middle East, we will see how Jewish and Muslim perceptions of sacred places located within a few meters of each other in Jerusalem play crucial roles in conflict and peacemaking in the Middle East and beyond.

Understanding sense of place and learning to read landscapes involve critical thinking because, while they tap into your own perceptions, they also require you to see the place from the perspective of those who live there. To that end, I have chosen the book's photographs for your critical examination. You will draw impressions of world regions from these photos, and use the text or other sources to determine how representative these images are of the lived reality of these places. With •**Figure 1.5**, let's consider an example of how you can use your critical thinking skills to identify place in a photograph.[16]

Joe Hobbs

• **Figure 1.5** Do you have a sense of where this place might be? There are some clues on the natural and cultural landscapes. For more clues and the place identification, see note 16 in the end-of-chapter Notes.

1.2 The Language of Maps

We turn now to one of geography's most important tools: the map, described as "one of the **most effective** forms of communication ever developed."[17] As geographers study people, places, and environments, we usually collect and depict information that can be mapped. In other words, we are interested in the **spatial** context of things, and maps are the tools we use to visualize that spatial information. You will use and read maps critically throughout the book.

A **map** is a representation of selected phenomena over a part of or all of Earth's surface ("selected" because no map can display everything there is in a given area). Like a picture, a map is worth a thousand words. Maps in some form have probably always been part of the human experience. They help in our everyday lives and even save them. Commonly in the computerized formats you are about to explore, maps are the among the must-have tools of first responders to natural disasters like fires and hurricanes.

If someone were to ask you to draw a map of your neighborhood or city, you might quickly draw some lines, write down street names, draw some familiar landmarks, and apologize for how crude your map is (see the Try It: Mental Maps in this section). Your map would probably end up looking very different from that of another person asked the same question. Our understanding of location is not completely objective. Each of us has a personal sense of space and place and associations with them. A **mental map**, like a vernacular region, is a collection of personal geographic information that each of us uses to spatially organize the images and facts we have about places, both local and distant. We constantly draw upon that geographic information to make our way through daily life and are always revising and updating that information as we succeed or fail on our way. Sometimes we use that mental information to make a map. These maps are not necessarily accurate, precise, or scientific, but they convey useful information and tell us much about the individuals and cultures that create them.

The science of making maps is called **cartography**. Usually rendered on a flat surface such as paper or a computer monitor, there are two basic types of maps: reference maps and thematic maps. **Reference maps** are concerned mainly with depicting the locations of various features, both natural and human-made, on Earth's surface (road atlases are a good example, as are the opening maps for each regional chapter, such as Europe in •**Figures 4.1** and **4.2**. **Thematic maps** show the spatial distribution of one or more attributes across a given area. There are two categories of thematic maps: quantitative and qualitative. Quantitative thematic maps show the spatial distribution of numerical information (such as population density or income levels, as in •**Figure 3.21**), whereas qualitative thematic maps display non-numeric data (such as the distribution of climates or languages, as in •**Figure 2.5**).

Try it Mental Maps

You have mental maps in your mind. Try this: without referring to this book or any other source, draw your own map of the world. It does not need to be detailed. Just try to get outlines of the continents on your map, with their rough shapes and relative sizes. Then compare yours with a world map in the book or elsewhere. How did you do? You can laugh at yourself—this is not something that many of us are proficient at. Did you lean toward a certain projection you might be familiar with, like the Mercator with its large polar land areas? It is very likely that if you try this again when you are finished with your world regional class, your mental world map will be much improved.

As maps are an essential tool in your study of world regional geography, it is important that you know how to read them. The main elements of the "language of maps" are *scale*, *coordinate systems*, *projections*, and *symbolization*.

1.2a Scale

A map is a reducer; it depicts a large area at a much more manageable size. The ratio of a distance on a map to the equivalent distance in the real world is called the map's **scale**. The scale can be shown by describing a unit of distance on the map (such as inches or centimeters) and its equivalent distance on the Earth's surface in a different unit; for example, "1 inch = 25 miles." Another way to show scale is to use a dimensionless number called a representative fraction (RF); an example is "1:10,000." This means that one linear unit on the map represents 10,000 such real-world units; so 1 inch on the map equals 10,000 inches on the ground. Scale can also be indicated visually with a *scale bar*, which uses a line to show the corresponding real-world distance.

Compare the two maps in •**Figure 1.6**. **Figure 1.6a** is a map showing San Francisco and surrounding parts of the Bay Area, while Figure 1.6b "zooms in" on part of San Francisco. Note the difference between the scales used on these maps and the amount of the Earth's surface they cover. A map that portrays a relatively large area, such as a country or continent, or the Bay Area in Figure 1.6a, is called a **small-scale map**, while a map showing a relatively small area, such as a city or college campus, or part of the city of San Francisco in Figure 1.6b, is called a **large-scale map**. The distinction between large- and small-scale maps is relative, but larger-scale maps are usually more detailed than smaller-scale maps. *Remember that this is an inverse relationship: a small-scale map shows a large area, and a large-scale map shows a small area.*

1.2b Coordinate Systems

Maps cannot convey the subjective meanings associated with place, but they are very effective in conveying information about space and location. In this book you will be concerned with two kinds of **location**: relative location and absolute location.

Relative location defines a place in relationship to other places. You can derive this kind of information from many maps. Relative location is one of the most basic reference tools of everyday life; you might say you live south of the city, five miles from the shopping mall, or next door to a good friend.

(a) (b)

• **Figure 1.6** **(a)** Small-scale and **(b)** large-scale maps of San Francisco and environs.

Geographic Spotlight Tobler's First Law of Geography

Relative location is at the heart of a geographic axiom known as **Tobler's First Law of Geography:** *"Everything is related to everything else, but near things are more related than distant things."* This observation is especially useful in the quantitative realm of spatial data analysis, such as in maps and GIS. But it is useful in the qualitative or subjective realm as well. As we explore Russia, for example, we will peel back the layers of Russia's geopolitical concerns and see that Russia's periphery, or "Near Abroad," including Ukraine, is most relevant to its foreign policy.

As the Swiss American geographer Waldo Tobler himself admitted, his observation may be more a "principle" than a "law." In any case, as you practice geography, you will find that it is more often true than not. A related concept that geographers use often is known as **distance decay**: the farther away something is removed from a source, the less influence it has on it.

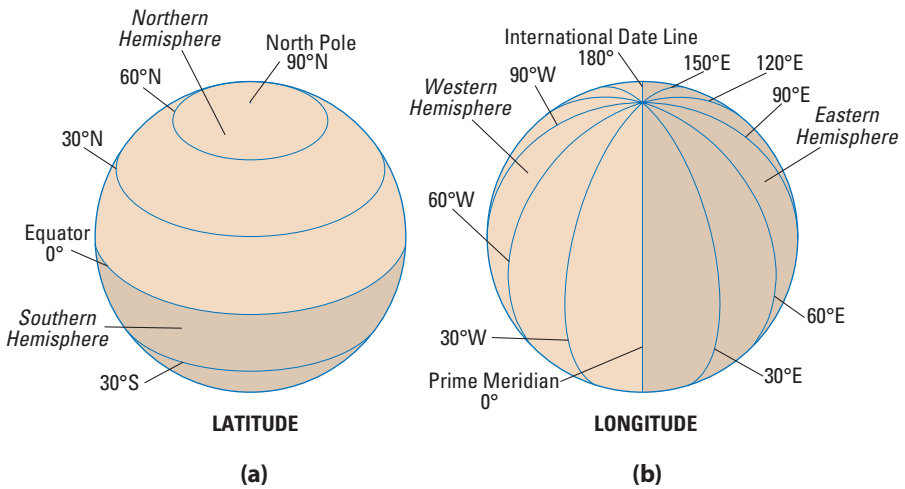
As you proceed through the book, relative location will become part of your basic geographic knowledge and your critical thinking about geography. You might look at •**Figure 5.26** to see, for example, how tantalizingly close the internationally recognized Ukrainian port of Sevastopol on the Crimean Peninsula is to Russia's southwestern border. Despite its vast size, Russia has few ports in warm waters accessible for seafaring throughout the year. Understanding the implications of relative location will prove quite useful for you in following world affairs; in this case, you can easily appreciate one of the reasons why in 2014 Russia asserted control over the Ukraine's Crimean Peninsula, which juts into the Black Sea (see **Section 5.5b** and the Geographic Spotlight: Tobler's First Law of Geography).

Absolute location refers to a point on the earth's surface. Also known as **mathematical location**, absolute location is essential in reference maps but not always in thematic maps. **Coordinate systems** are used to determine absolute location. These coordinate systems use a network of grids consisting of horizontal and vertical lines covering the entire globe. The intersections of these lines create addresses in a global coordinate system, giving each location a specific, unique, and mathematical placement (as appears, for example, as a "waypoint" in the common global positioning system or GPS device).

The most common coordinate system uses **lines of latitude** and **lines of longitude**. The term **latitude** denotes position with respect to the Equator (see •**Figure 1.7a**). Latitude and longitude are measured in **degrees** (°), **minutes** (′), and **seconds** (″); these coordinates can also be written as decimals (e.g., 45°30′ N is the same as 45.5°N). Each degree is made up of 60 minutes, and each minute contains 60 seconds. A degree of latitude is about 69 miles (111 km) apart; these distances vary a little because Earth is not a perfect sphere but rather a slightly flattened ("oblate") sphere or ellipsoid. The **Equator**, which circles the globe east and west midway between the poles, has a latitude of 0°. All other latitudinal lines are parallel to the Equator and to one another, which is why they are also called **parallels**.

Every point on a parallel has the same latitude (e.g., places on the Equator in both South America and Africa are located at 0° latitude). Places north of the Equator are in **north latitude**. Places south of the Equator are in **south latitude**. The highest latitude a place can have is 90°N (the **North Pole**) or 90°S (the **South Pole**). Places located between the **Arctic Circle** at 65.56°N and the North Pole, and between the **Antarctic Circle** at 65.56°S and the South Pole, form the most commonly recognized boundaries of the **high latitudes**. Places located between the **Tropic of Cancer** and the **Tropic of Capricorn**, at 23.44°N and 23.44°S, respectively, are said to be in **low latitudes**. Places occupying an intermediate position with respect to the poles and the Equator are said to be in the **middle latitudes**. The northern half of Earth between the Equator and the North Pole is called the **Northern Hemisphere**, and the southern half between the Equator and the South Pole is the **Southern Hemisphere** (a hemisphere is a half sphere).

Lines of longitude, also called **meridians**, run due north–south connecting the poles (see •**Figure 1.7b**). All meridians converge at the poles and are farthest apart at the Equator.



• **Figure 1.7** **(a)** Earth's lines of latitude (parallels) in increments of 30 degrees, from the Equator (0 degrees) to the North Pole (90 degrees north latitude). **(b)** Earth's lines of longitude (meridians) in increments of 30 degrees.

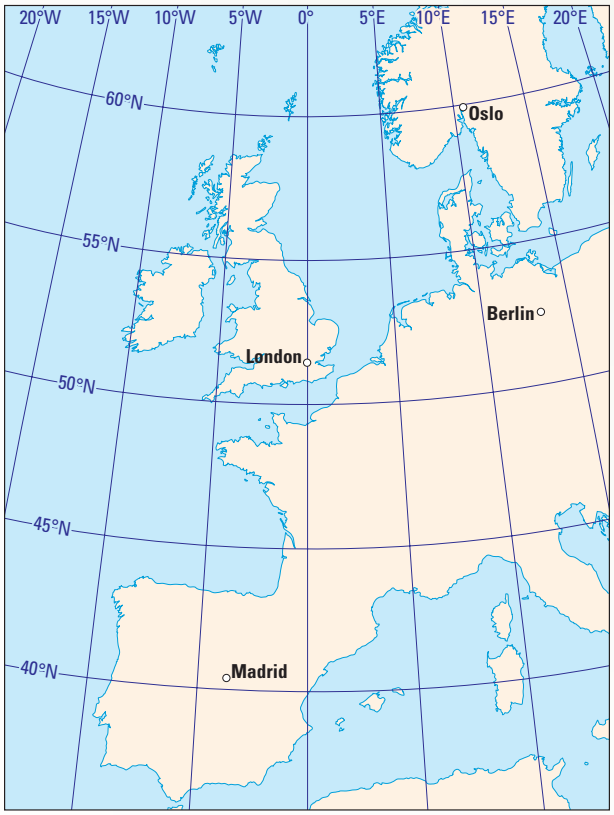
Try it Latitude and Longitude

Here is a useful exercise to ensure that you know how latitude, longitude, and absolute location work.

On the map in •**Figure 1.A**, the latitude of Madrid, Spain, is approximately 41 degrees north latitude, 4 degrees west longitude (41°N, 4°W).

What are the approximate latitude and longitude coordinates of Oslo, Norway? In which hemispheres (Northern/Southern; Eastern/Western) is Oslo located?

The answer is in **note 19 in the end-of-chapter Study Guide**. Understanding absolute location is a simple and indispensable part of your interpretation of maps.



• **Figure 1.A** Map of European latitudes and longitudes. What are the approximate latitude and longitude coordinates of Oslo, Norway? For more clues and the place identification, see note 19 in the end-of-chapter Notes.

Lines of longitude are not the same distance from one another across the globe, so their values vary. At the Equator, the distance between lines of longitude is about 69 miles (111 km), whereas at the Arctic Circle it is only about 28 miles (45 km). Just as there is a zero reference line for latitude (the Equator), there is a zero reference line for **longitude**. Known as the **Prime Meridian**, it has a longitude of 0° and serves as the reference line from which longitude east and west is measured. Places east of the Prime Meridian are in **east longitude**; places west of it are in **west longitude**. The Prime Meridian is also known as the **Greenwich Meridian** because it passes through the Royal Astronomical Observatory in the Greenwich (pronounced "Gren-ich") neighborhood of London, England (see the Geographic Spotlight on Why Greenwich?).

The meridian of 180°, exactly halfway around the world from the Prime Meridian, is the other dividing line between places east and west of Greenwich. All of Earth's surface eastward from the Prime Meridian to 180° is in the **Eastern Hemisphere**, and all of Earth's surface westward from the Prime Meridian to 180° is in the **Western Hemisphere**. This meridian of 180° has another purpose in addition to complementing the Prime Meridian. It serves as the **International Date Line**, where the beginning of one day and the end of another day meet. The earth has 24 time zones, and there must be a line where the earth's clock begins and ends. The line has a few zigzags in it for political and practical reasons (especially to fit a country or part of a country into a single time zone; see •**Figure 8.2**). The date west of the line is one day ahead of the date east of the line. The person traveling west across the International Date Line gains a day (crossing from Monday to Tuesday, for example), and someone traveling east loses a day (crossing from Monday to Sunday).

You now have the ability to create and interpret the absolute location of any spot on Earth. Try it (see Try it: Latitude and Longitude).

1.2c Projections

While the truest cartographic representation of Earth is a globe, most maps are created on flat surfaces such as paper or computer monitors. How do cartographers render our 3D planet in two dimensions? Think of peeling an orange and pressing the peel, representing the surface of the spherical earth, onto a piece of paper (as in •**Figure 1.8f**). The peel can only lay flat by stretching or tearing it, distorting its original shape. Similarly, any map created on a flat surface will inevitably have some distortion.

A **map projection** mathematically transforms coordinates from the Earth's curved surface to a flat surface. Most projections work by transferring spherical locations onto a "developable surface" (a geometric surface that can be

Geographic Spotlight Why Greenwich?

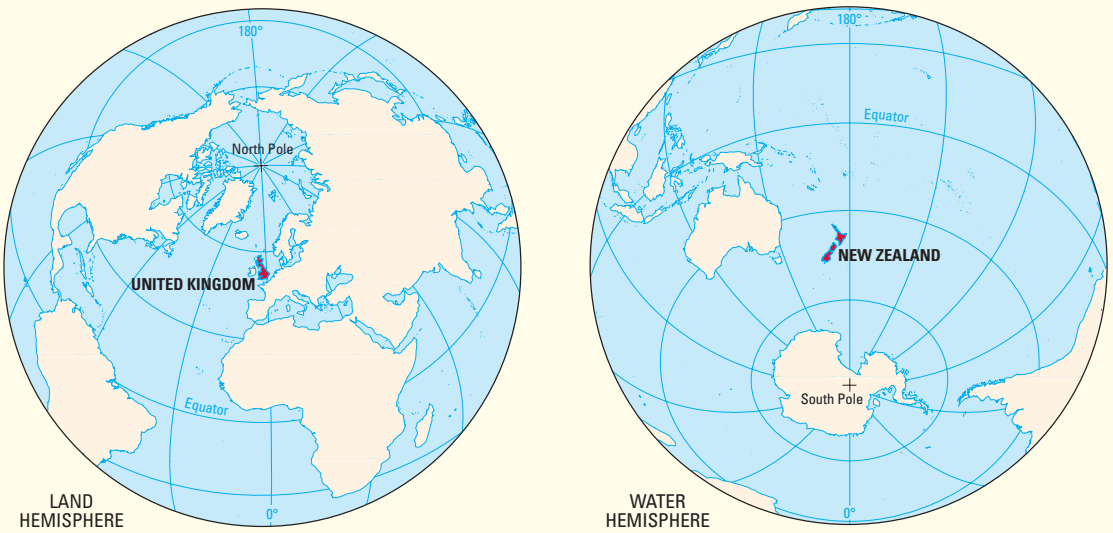
Why Greenwich? By the late 19th century, with the Industrial Revolution in high gear and global economic activities becoming increasingly interconnected, there needed to be universally accepted reference points of zero for both longitude and time. Conferring in Washington DC in 1884, 23 major world powers voted overwhelmingly for Greenwich over competing locations, mainly because—thanks to Britain's global reach—most nautical charts at the time already used Greenwich as the Prime Meridian. (France, which preferred Paris as the zero line, abstained from the vote on Greenwich.) The conference also established the world's 24-hour time zone system, with all zones based on Greenwich Mean Time (GMT; also referred to as Coordinated Universal Time, or UTC). You can straddle the Prime Meridian line in the Observatory so that one foot is in the Eastern Hemisphere and one foot is in the Western. Being in the world center of time and space is an appropriate metaphor for how Britain saw herself in 1884. (See Geographic Spotlight: Core Location and Peripheral Location.)

Geographic Spotlight Core Location and Peripheral Location

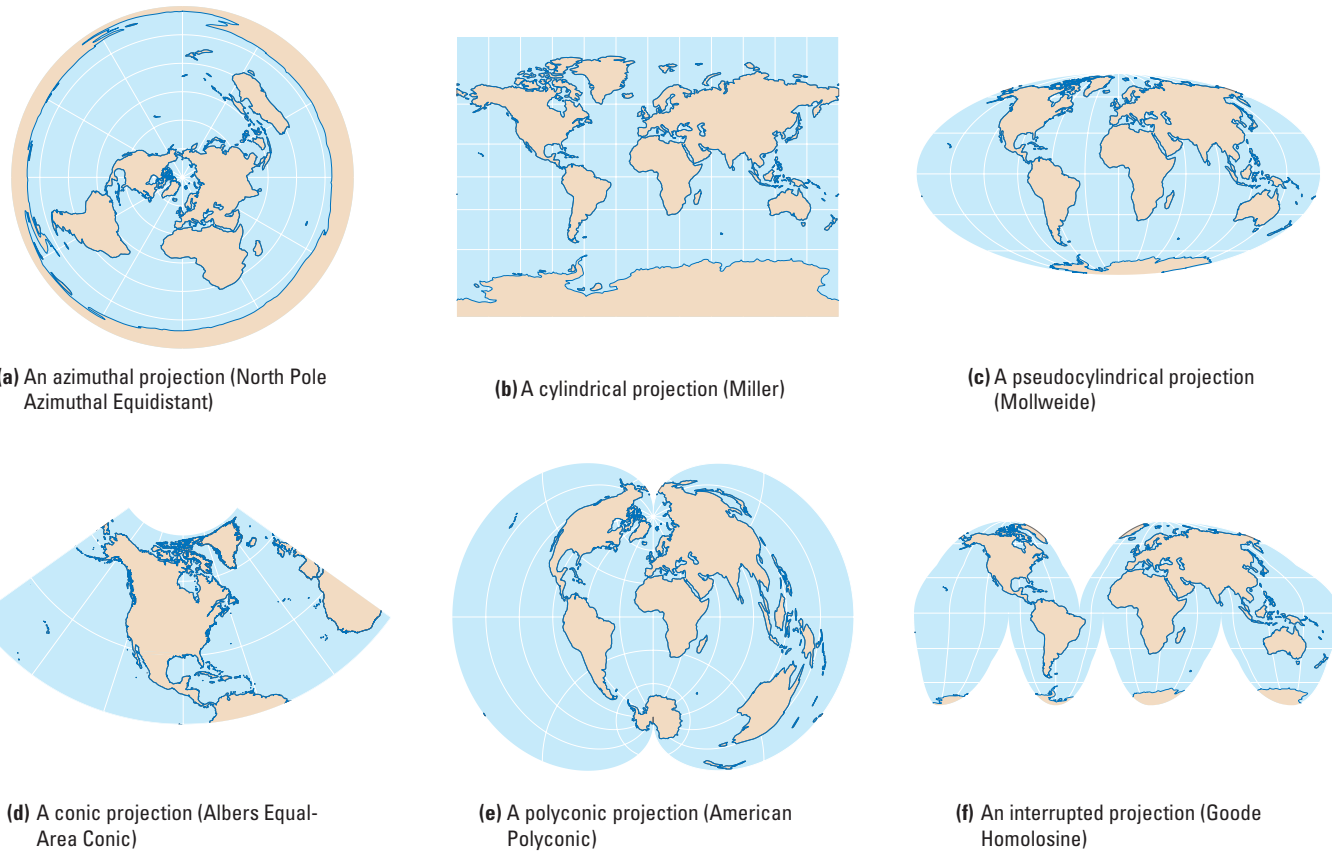
Among the geographical concepts used throughout this book are those of **core location** and **peripheral location** (I subdivide the region of Europe along these lines, for example; see **Section 4.1**). Some locales have greater importance in local, regional, or world affairs because they have central, or core, locations relative to others. Other, peripheral locales are less important because they are situated farther from "where the action is." A comparison of two countries, the United Kingdom (UK) and New Zealand, provides a good example (see •**Figure 1.B**). Both are island countries and their climates are remarkably similar, although they are in opposite hemispheres and are about as far apart as two places on Earth can be.

But there are important differences. The United Kingdom is located in the Northern Hemisphere, which has the bulk of the world's land and most of its principal centers of population and industry; New Zealand is on the other side of the Equator, surrounded by the vast expanses of water in the Southern Hemisphere and off the beaten track of global economic activity.

As •**Figure 1.B** illustrates well, the United Kingdom is located near the center of the world's landmasses; this figure depicts a hemisphere centered roughly on France that is known as Earth's **land hemisphere**, and a hemisphere centered roughly on New Zealand's Bounty Islands that is known as Earth's **water hemisphere**). Only a narrow channel separates the UK from the densely populated industrial areas of western continental Europe. Many major oceanic commercial routes converge on this western seaboard area of Europe (see •**Figure 2.12**). For centuries, the United Kingdom has played a major role in the economic and political development of northwestern Europe. New Zealand, meanwhile, has been a far outpost of that development and history. The United Kingdom has a core location in the modern framework of human activity on Earth, whereas New Zealand has a peripheral location. If we take a less anthropocentric and land-centered perspective, however, we can recognize New Zealand's position near the heart of the greatest contiguous portion of what makes up 71 percent of Earth's surface and contains almost 80 percent of its animal biomass: ocean water.[18]



• **Figure 1.B** Maps of land and water hemispheres. In the left map, note how the major landmasses are grouped around the margins of the Atlantic and Arctic Oceans. The British Isles and the northwestern coast of Europe lie in the center of the "land hemisphere," which constitutes 80 percent of the world's total land area and has about 90 percent of the world's population. In the map on the right, New Zealand lies near the center of the opposite hemisphere, or "water hemisphere," which has only 20 percent of the land and about 10 percent of the population.



(a) An azimuthal projection (North Pole Azimuthal Equidistant)

(b) A cylindrical projection (Miller)

(c) A pseudocylindrical projection (Mollweide)

(d) A conic projection (Albers Equal-Area Conic)

(e) A polyconic projection (American Polyconic)

(f) An interrupted projection (Goode Homolosine)

• **Figure 1.8** Examples of map projections.

flattened without tearing or stretching) such as a plane, cylinder, or cone. These projections are referred to as **azimuthal**, **cylindrical**, and **conic**, respectively (there are also subcategories, such as pseudocylindrical and polyconic). See •**Figure 1.8** for examples of these projections. Some projections are "interrupted," instead of contiguous; the most well-known of these is Goode's Homolosine, which has that "peeled orange" look (see •**Figure 1.8f**).

All flat maps have varying amounts of distortion among the four basic properties of a globe: area, shape, distance, and direction. Projections are also classified by which of these properties they preserve the most (or distort the least). **Conformal projections**, which include the Mercator projection discussed in Geographic Spotlight: The Mercator Projection, shown in •**Figure 1.C**, preserve shapes well. **Equal-area projections**, as the name suggests, preserve area (but no equal-area projection can preserve shapes, and no conformal projection can preserve area). **Equidistant projections** preserve distance from a specific point (but no others) to all other points. Map projections that do not preserve any one metric or that try to distort all properties about equally for aesthetic purposes (making the map "look right") are called **compromise projections**. The Winkel Tripel projection used for the world maps in this book (see •**Figure 1.3**, for example) is a compromise projection.

There is no single "correct" or "perfect" projection for any particular map. Thousands of map projections have been developed, but which one is used for a particular map depends on a variety of factors such as the size and shape of the mapped area, the type of map (reference or thematic), and aesthetic considerations. For maps of cities, the inherent distortions are small enough that they may be disregarded for most purposes, but distortions become increasingly noticeable as the map's scale becomes smaller.

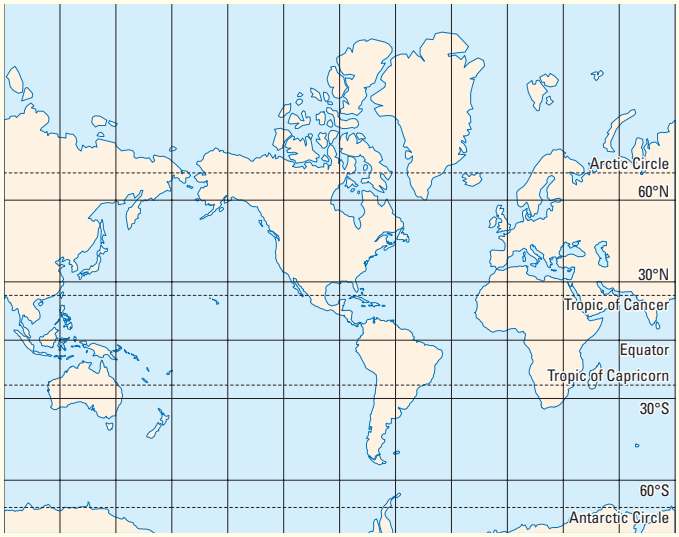
Another important property of a map is its **orientation**, the relationship between the direction on the map and the corresponding compass directions in reality. As a long-standing convention based on magnetic compasses and navigation by the North Star (Polaris), most maps place north at the top. There are sometimes reasons to orient a map differently, and it is possible to present a different perception of geographical space by changing a map's orientation. Information at the top of a map is typically perceived as being more important. Ancient Egyptian and early Arab cartographers placed south at the top of the map because it drew attention to most of their known world.[20]

One of the most interesting projections that literally turns the world upside down is the Australian "What's Up? South" world map that places south at the top, which you may find easily in an Internet search—check it out!

Geographic Spotlight The Mercator Projection

The most widely recognized map projection was developed by Gerardus Mercator (1512–1594) in 1569. This German-Flemish cartographer developed his cylindrical, conformal **Mercator projection** (see •**Figure 1.C**) for navigational use: it was designed to show lines of constant compass bearing ("rhumb lines") as straight lines, which was very important to assist sailing vessels in charting their courses. This was a significant improvement over previous projections, and Mercator projections are still used for marine navigation today. However, the projection is largely unsuitable for other purposes, including reference world maps. In order for the rhumb lines to be shown straight, the projection must continually increase the spacing between the parallels away from the Equator. This results in enormous distortions of size approaching the polar areas (in fact, the poles themselves cannot be shown on a Mercator map as they lie at infinity). On a Mercator map, Greenland and Africa appear similarly sized, whereas in reality Africa is about 14 times larger than Greenland! You can look at it this way too: the Mercator projection makes Canada and Russia appear to take up 25 percent of the Earth's landmass, but in reality they occupy 5 percent.

Despite the objections of cartographers for many decades, the Mercator world map projection is still common in classrooms, TV newscasts, and online mapping services such as Google's. Its straight lines and convenient rectangular shape help make it an attractive "go-to" default map of the world. But *think critically* about this map projection. On many maps, the Mercator projection depicts the United States or Europe, despite their northern locations, as being essentially at the "center of the world." This is done by removing most of Antarctica but keeping much of the Arctic in the frame. Indeed, the Mercator projection's exaggeration of midnorthern latitudes made it very popular in the West during the age of European colonialism. The Mercator projection was accepted as "authoritative" and intentionally or otherwise conveyed a geographic sense of Western dominance of the world. Although some people have been slow to abandon it for more suitable projections, the Mercator projection is fading in part because of biases like these. Most atlases and textbooks no longer use Mercator. But it is still prevalent enough in other media that it is important to recognize this projection's drawbacks and to think critically about how a map projection can influence our perceptions of the world.



• **Figure 1.C** The Mercator Projection.

1.2d Symbolization

Maps allow us to get information, to see patterns of distribution, and to compare these patterns with one another. But no map can offer a complete record of a given area. In a process called "cartographic abstraction," the cartographer selects which features to show (and which to ignore) on a map, and how to represent those features.

Maps must use symbols to represent various objects and characteristics. **Symbolization** is the coding of map features to communicate meaning. Graphic elements such as lines, fills, shapes, colors, and type are used to portray various kinds of spatial information. The political map of Europe in •**Figure 4.2**, for example, depicts the relative importance of cities with varying type size and boldness, makes different countries easier to tell apart by using different colors for each, and shows coastlines and rivers as solid blue lines to contrast with the dashed gray lines indicating country boundaries.

Thematic maps often (but not always) use just one kind of symbolization to display their data and are classified by which symbol they use. **Choropleth maps**, the most common type of thematic map in this book, display their data by filling in political units with differing colors. A good example of a choropleth map is the Human Development Index map (see •**Figure 3.7**). **Isarithmic maps** do not use political units but instead use lines or bands of color to join points of equal value across the mapped area. A topographic map showing contour lines is an example of an isarithmic map, as is the map of world precipitation in •**Figure 2.3**. **Graduated symbol maps** use simple symbols, such as circles, scaled proportionally to the quantity of the attribute being mapped. The graduated symbol map of the distribution of the Roma people across Europe in •**Figure 4.52** is a good example. **Dot density maps**, such as the world population map in •**Figure 3.21**, use dots to represent a stated amount of some phenomenon within a political unit; for example, if one dot equals 1,000 people, 12 dots in an area indicate 12,000 people. **Flow maps** use arrows of various widths to indicate the movement of people or goods from one area to another; the map of the movements of Palestinian refugees in •**Figure 6.44** is an example.

1.3 The Geospatial Revolution

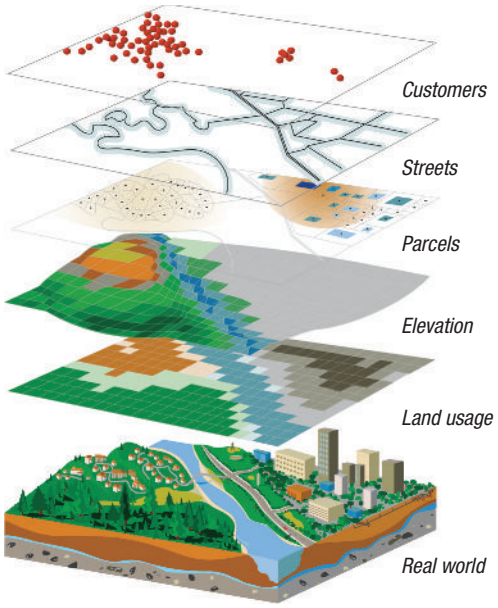
Before discussing how you or someone you know might become part of the action in this growing field, we now consider some of the most innovative tools and breakthroughs in geography. This section will open your eyes to some of the newest ways of gaining both an easier and deeper understanding of the world's regional geographies.

Technological advances in the field of geography and related sciences have evolved and accelerated so quickly and with such impact that they can truly be called "revolutionary." These advances are not confined to the laboratory or library. Like information on the Web, they have been democratized: you can use the power of geographic tools on your own computer, tablet, or smartphone for many purposes, including crowdsourced (volunteered) geographic information for reference, humanitarian, and other objectives; a fine example is OpenStreetMap.org. The geospatial revolution is still underway, and it will touch your life in many ways.

This relatively new term relates to most of these technological advances: **geospatial**, which means "pertaining to the geographic location and characteristics of natural or constructed features and boundaries on, above, or below the Earth's surface, especially referring to data that are geographic and spatial in nature."[21] Even with simple paper maps, geographers have always worked with geospatial information. But the word *geospatial* has connotations of powerful computer hardware, software, and information-gathering tools including satellites.

Two of the most important geospatial technologies are GIS and remote sensing. **GIS**—an acronym for **geographic information systems**—is a computerized data management system that allows people to create, capture, retrieve, manipulate, analyze, view, and display spatial information. GIS data are created and displayed in "layers"—databases storing the locations and attributes of features belonging to a single theme (e.g., individual layers showing a road network, boundaries, water features, parks, buildings, and more, as in •**Figure 1.9**). A GIS often has numerous layers displaying all kinds of geospatial data for a given area. The real strength of GIS is in data **attributes**—various types of information about each individual geographic feature stored in tables. While a paper map can show you where a road is and maybe one or two other details, in GIS that same road can have dozens of attributes associated with it, such as its name, its length and width, when it was last repaved, its speed limit, whether it is owned by the city, county, or state, the amount of traffic it receives in a certain time frame, how many lanes it has, and more. The GIS user can then choose which of those attributes to display or run analyses on (see •**Figure 1.10**).

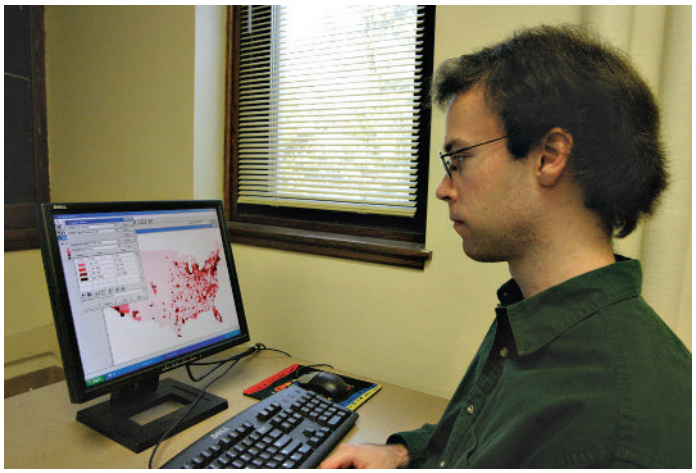
The ability to query and selectively view certain types of geospatial data, as well as to add other information—such as from a handheld GPS device, from a digitized paper map, or from an image taken by an orbiting satellite—allows users to view and interpret spatial relationships much more clearly. The knowledge to be gained from understanding geographic relationships is extremely valuable for decision making and



• **Figure 1.9** Geographic information systems (GIS) create and use layers of spatial data. GIS data, images, and models have an enormous range of applications.

explains why GIS is known as a critical thinking technology. Omnipresent in today's world, GIS has thrust geography into the spotlight in an unprecedented fashion; it has been described as "the only technology that actually integrates many different subjects using geography as its common framework."[22]

Remote sensing, also known as **Earth observation**, is the science of acquiring information about Earth's surface without being in direct contact with it. Most remote sensing data are obtained by sensors on Earth-orbiting satellites or by aerial photography, with cameras mounted on airplanes taking pictures of the ground. Remote sensing is not limited to cameras that capture visible light; much important information about processes and features on the surface or in the atmosphere is



Joe Hobbs

• **Figure 1.10** GIS users query data attributes to answer a set of spatial questions. Here the book's cartographer, Andrew Dolan, is using GIS to create a population density map of the United States.

gleaned from sensors that can "see" other parts of the electromagnetic spectrum, such as infrared and microwave wavelengths. *Radar* (radio detecting and ranging, which measures the reflection of radio waves bouncing off ground features), and *LIDAR* (light detecting and ranging, which uses light in the same way) are also remote sensing technologies.

Remote sensing is an exceptionally good tool for helping geographers understand how people and natural processes modify the earth. This book uses remote sensing images introducing you to various places, patterns, and problems. Remote sensing images like those you see in Google Earth reveal a wealth of information about natural and cultural landscapes (see Try it: Google Earth). The revelations are sometimes stunning; remote sensing has, for example, revolutionized archaeology by unveiling ancient settlements, missed by generations of earlier scholars, beneath Egypt's sands and under tropical forest canopies. Some of the most informative remote sensing images are "before" and "after" sequences. A good example in this book is the breathtaking imagery of Banda Aceh, Indonesia, revealing the devastation wrought by the huge tsunami of 2004 (see •**Figure 7.52**).

As with GIS, there is a wide range of customers for remote sensing products in applications for agriculture, forestry, government, defense, intelligence, energy infrastructure, business intelligence, insurance, and more. Why not explore the wealth of applications of both remote sensing and GIS at www.gisgeography.com?

Immensely valuable in intelligence and military applications, remote sensing images have a way of bringing out the detective in all of us. Even students like you can use Google Earth to practice the tradecraft of remote sensing-based intelligence. Where we consider the importance of North Korea's geopolitical situation in Chapter 7, we will see that remote sensing and other geospatial tools are indispensable in documenting North Korea's nuclear program. One intelligence project's data have been crowdsourced by students and other laypersons described as "citizen cartographers" who contribute geospatial information as, what the project director calls, a form of "democratized intelligence." A Russian intelligence official said of Google Earth, "Terrorists don't need to reconnoiter their target. Now an American company is working for them."[24] The quality of available imagery varies significantly across the world, but the highest resolution imagery available on Google Earth has a resolution of about 1.5 feet (50 cm) per pixel. In contrast, American intelligence services can capture images at least nine times better, sharp enough to see a phone in someone's hand.

Google Earth — Try it

Two tools can greatly enhance your understanding and enjoyment of world regional geography. One is a globe. As we saw earlier, flat maps distort representations of the earth, but a globe puts a representation of the real world in your hands. If you keep a globe handy and use it as you work your way through the book, it will help you with learning about Earth and remembering what you learn.

The other tool is a "virtual globe" software program like Google Earth, the National Oceanic and Atmospheric Organization (NOAA)'s Science on a Sphere (https://sos.noaa.gov/What_is_SOS/), NASA's WorldWind (https://worldwind.arc.nasa.gov), Digital Globe (https://www.digitalglobe.com), and Planet (https://www.planet.com). These provide you with robust search engines for satellite imagery of any place on Earth, along with stunning galleries of remotely sensed imagery. Some, like Google Earth, are free, while others offer a free trial period or a subscription.

With Google Earth, you are in control of an easy-to-use but remarkably powerful set of geospatial tools. Navigate on the PC or Mac to https://www.google.com/earth (apps are also available for most smartphones and tablets). Bookmark or download, open, enjoy, and use Google Earth often. You will interact with this platform in MindTap and other features of this book. If you are using Google Earth for the first time, you may want to search for your place of residence and enjoy flying there before exploring other places on Earth. Google Earth even offers stunning 3D views of the world's natural and cultural wonders. You might also be interested in the "global awareness" Google Earth layer that lets you explore some of the world's environmental problems. One of its valuable subsets is the United Nations Environmental Programme's *Atlas of Our Changing Environment* (or access it directly at http://www.uneplive.org, where you have options to search by world regions and countries). And then there is the "Street View" layer for many locations, infamous for news stories like this: "A woman, checking out a female friend's house on Google Maps, was surprised to see her husband's Range Rover out front. A divorce is underway."[23]

Google Earth's base map is composed of many thousands of remotely sensed images, from both aerial photography and orbiting satellites, put together as a giant mosaic. Although Google Earth is not a full-fledged GIS (it is primarily for data visualization, not analysis), its "Layers" sidebar works in a similar fashion: you can turn on and off certain features like country boundaries and road networks. With the "weather" layer, you can get real-time views of storm systems and temperatures. How hot or cold is it in Arabia or Siberia right now? It's easy to find out.

1.4 Organizing Principles of Geography

Now that we have a solid introduction to geography, its innovative tools, and its world regional subfield, let's consider some organizational and conceptual schemes that will help you recognize geographical patterns and ask and answer geographical

questions. You will see some overlapping themes between these conceptual frameworks, and your instructor may prefer that you use one or more of them.

Geography's unique properties as a scientific discipline are summarized especially well in the **National Geography Standards**, composed by the National Council for Geographic Education (NCGE) and promoted by the National Geographic Society.[25] The standards are based on the NCGE's **Six Essential Elements of Geography**:

1. The World in Spatial Terms
2. Places and Regions
3. Physical Systems
4. Human Systems
5. Environment and Society
6. Uses of Geography

Each of the six elements has a subset of geographic knowledge standards, 18 in all, that "represent the most current conception of what it means to be geographically literate" (see •**Table 1.2**). These 18 standards represent the fundamental content of the field of geography, and they also underpin this book's contents. You should be able to take any issue discussed in the text and match it with one or more of the 18 standards. I have worked mainly behind the scenes to ensure that your geographic literacy is informed by the NCGE standards. The book's three introductory chapters employ all 18 standards to set the world stage for you, and the organization of each regional chapter reflects (but does not mirror) the six essential elements.

Table 1.2 The Six Essential Elements and the 18 Standards of Geography

1	*The World in Spatial Terms.* Geography studies the relationships among people, places, and environments by mapping information about them into a spatial context (*spatial* means "of or relating to space").
	Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information
	Standard 2: How to use mental maps to organize information about people, places, and environments
	Standard 3: How to analyze the spatial organization of people, places, and environments on Earth's surface
2	*Places and Regions.* The identities and lives of individuals and peoples are rooted in particular places and in human constructs called "regions."
	Standard 4: The physical and human characteristics of places
	Standard 5: That people create regions to interpret Earth's complexity
	Standard 6: How culture and experience influence people's perception of places and regions
3	*Physical Systems.* Physical processes shape the Earth's surface and interact with plant and animal life to create, sustain, and modify ecosystems.
	Standard 7: The physical processes that shape the patterns of Earth's surface
	Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface
4	*Human Systems.* People are central to geography; human activities, settlements, and structures help shape the Earth's surface, and humans compete for control of the Earth's surface.
	Standard 9: The characteristics, distribution, and migration of human populations on Earth's surface
	Standard 10: The characteristics, distributions, and complexity of Earth's cultural mosaics
	Standard 11: The patterns and networks of economic interdependence on Earth's surface
	Standard 12: The process, patterns, and functions of human settlement
	Standard 13: How forces of cooperation and conflict among people influence the division and control of Earth's surface
5	*Environment and Society.* The physical environment is influenced by the ways in which human societies value and use the Earth's physical features and processes.
	Standard 14: How human actions modify the physical environment
	Standard 15: How physical systems affect human systems
	Standard 16: The changes that occur in the meaning, use, distribution, and importance of resources
6	*Uses of Geography.* Knowledge of geography enables people to develop an understanding of the relationships among people, places, and environments over time—that is, of the Earth as it was, is, and might be
	Standard 17: How to apply geography to interpret the past
	Standard 18: To apply geography to interpret the present and plan for the future

Source: National Council for Geographic Education, 2012. *Geography for Life: National Geography Standards*, 2012.

Another conceptual framework for geography is known as the **Five Themes of Geography**, published by the National Council for Geographic Education and the American Association of Geographers, the leading professional organization for U.S. geographers. Because of their clarity and brevity, many geographers prefer them for teaching, and I encourage you to try them out for yourself: which themes are relevant to any given passage in this book?

The Five Themes of Geography are:

1. Location
2. Place
3. Human–Environment Interaction
4. Movement
5. Region.[26]

The National Geographic Society's educational division recommends, "While the five themes are still used, essential geography content knowledge for students is best described in the National Geography Standards."[27]

1.5 Jobs and Careers in Geography

The opportunities open to you by studying Geography are abundant and exciting.

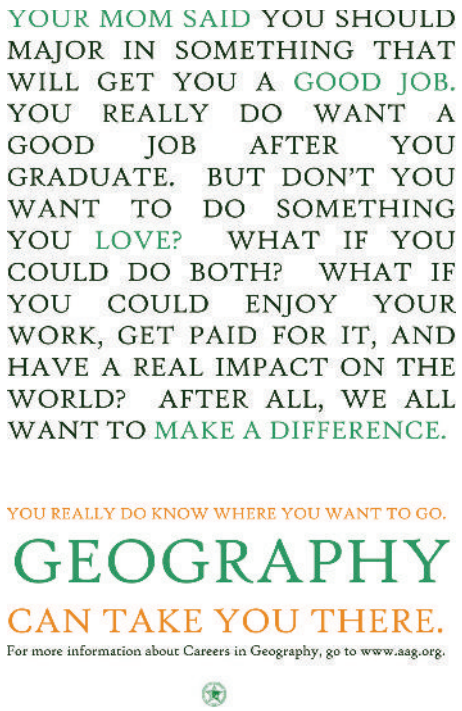
The persuasive message in •**Figure 1.11** was written by the American Association of Geographers, using data about how young people in the United States choose their career paths.[28] Whether you are a geography major or just taking world regional or other classes, your integrated, wide-ranging knowledge as a student of geography will make you a better employee candidate. The AAG president notes that "employers today are particularly seeking employees who can apply broad, interdisciplinary perspectives and diverse expertise to the specific needs of their unique organizations and industries."[29] Geography students' transferable skills, including critical thinking and problem solving, enhance their attractiveness to employers. "Geography graduates are least likely to be unemployed," journalist Alison White writes:

Studying geography arms graduates with a mix of skills employers want to see: Geography students generally do well in terms of their relatively low unemployment rates. You could attribute this to the fact that the degree helps develop a whole range of employability skills including numeracy, teamwork through regular field trips, analytical skills in the lab and a certain technical savviness through using various specialist computing applications. Also, the subject area in itself cultivates a world view and a certain cultural sensitivity. These all potentially help a geographer to stand out in the labor market.[30]

What do geographers do? Geography opens the door to studying almost anything, and our employment trends reflect that diversity. More and more students are graduating with geography degrees—bachelors, masters, and doctoral—and finding jobs. Many of these are not defined specifically as jobs in geography. Among other things, geography graduates work as environmental consultants and campaigners and as urban, emergency, and transportation planners; cartographers, geospatial engineers, GIS experts in public and private organizations, surveyors, landscape architects, meteorologists, travel agents, tour leaders, and journalists; in nongovernmental organizations (NGOs) specializing in development, poverty, water and other resources, and climate change; as civil servants in local, state, and federal posts; in geospatial intelligence (GEOINT) and human intelligence (HUMINT); in business, finance, marketing, public relations, and sales; as researchers and decision makers in research institutions, "think tanks," and foundations all around the world; and as educators.[31]

Much of this job growth is in professions in which people feel like they are having a positive impact. The AAG recognizes global trends that are contributing "to a renaissance of geography and its potential for making a difference in society and the world":

These include globalization at an increasing pace and scale, phenomena that compel greater understanding of the world, places, people, and natural systems that affect us as a planet and as global citizens and consumers. It includes a recent proliferation of geographic technologies, once fairly obscure and now pervasive in our daily lives, such as GPS in cell phones and cars, online mapping at your fingertips, cable news reports using spatial visualizations, and many more applications in modern business and government services that underlie operations, planning, and progress in all sectors



• **Figure 1.11** Geography is awesome.
Source: Dr. Patricia Solís, American Association of Geographers, copyright registered 2004. Reprint permission granted for educational and dissemination purposes only; please do not reprint, translate, or otherwise alter without express written permission by the author.

Geographic Spotlight Reflections on Earth

We have seen in this chapter that geography is *a lot* more than rote memorization of state capitals. Geography asks you to address important spatial and other questions about the changing processes and patterns of life on Earth. By examining and answering these questions in the context of world regional geography, you will gain deep and lasting insights into what astronomer and cosmologist Carl Sagan described as that "pale blue dot" in which "we float like a mote of dust in the morning sky" (see **•Figure 1.12**):[32]


NASA/JPL

• Figure 1.12 At the request of Carl Sagan, as the Voyager 1 spacecraft was leaving our solar system in 1990, NASA instructed it to photograph Earth from a distance of 6 billion kilometers (3.7 billion miles). This is the "pale blue dot" image of our home that inspired Sagan's tribute.

Source: https://www.nasa.gov/feature/jpl/pale-blue-dot-revisited

Look again at that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there—on a mote of dust suspended in a sunbeam.

The Earth is a very small stage in a vast cosmic arena. Think of the endless cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner, how frequent their misunderstandings, how eager they are to kill one another, how fervent their hatreds. Think of the rivers of blood spilled by all those generals and emperors so that, in glory and triumph, they could become the momentary masters of a fraction of a dot.

Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.

The Earth is the only world known so far to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment the Earth is where we make our stand.

There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known.

everywhere we live and work. It also includes an academic trend toward greater interdisciplinarity, especially a renewed focus on big questions that matter but that require a breadth of knowledge and multiple fields to tackle. Geography's long-standing intellectual traditions in crossing those usual disciplinary boundaries are now better understood, increasingly seen as relevant and more widely respected in scholarly circles. These trends have produced unprecedented growth in the field.[33]

The employment trends in favor of geography since 2000 have been remarkable. The job market for bachelors' graduates of geography was expected to grow by 13.3 percent between 2016 and 2026.[34] The U.S. Department of Labor describes geospatial technology as one of the most important emerging and evolving fields in the technology industry. This agency reports that the geospatial market is growing at an annual rate of almost 35 percent, with the commercial subsection of the market expanding at the rate of 100 percent each year. Salaries are competitive, with the median salary for geographers with a BA degree 43 percent higher than the median salary of all American workers.[35] An excellent window into the vast range of subjects we are interested in and find jobs in is to look at the roughly 60 specialty groups of the American Association of Geographers at http://www.aag.org/cs/membership/specialty_groups.

Study Guide

Summary

- Recent studies suggest that American citizens generally have poor knowledge of world geography. More and better geographic knowledge serves us well in many contexts.
- The discipline of geography may be divided into physical and human, as well as into regional and systematic specialties. Geographers' concerns overlap many disciplines in the natural and social sciences.
- Geography means "description of the earth" and is also defined as "the study of the earth as the home of humankind."
- Using the structure of world regions, the five main objectives of the text are for you: (1) to become geographically literate, (2) to understand Earth's problems and their potential solutions, (3) to use geographic critical thinking to understand the world, (4) to understand the geography of current events, and (5) to develop the ability to interpret places and "read" landscapes.
- Maps are geographers' most basic tools. The language of maps includes the concepts and terms of scale, coordinate systems, projection, and symbolization. Maps can depict spatial data in a variety of ways.
- Individuals and cultures generate their own unique "mental maps." Regions are in effect mental maps that help us make sense of a complex world.
- Modern geographic thought derives from a long legacy of interest in how people interact with the environment. The dominant approach has been to understand how people have changed the landscape or the face of the earth.
- There are six essential elements of the national geography standards: the world in spatial terms, places and regions, physical systems, human systems, environment and society, and the uses of geography. Each of these has a subset of standards, totaling 18.
- The five themes of geography are: Location, Place, Human–Environment Interaction, Movement, and Region.
- Geographers are employed in many private and public capacities. The strongest growth area with the most jobs is in geographic information systems (GIS) and other geospatial technologies, including remote sensing.

Review Questions

1. What is geography? How does it bridge both natural and social sciences? What are some of its characteristic approaches to the world around us?
2. What transformation was Carl Sauer concerned with in his cultural landscape theory?
3. What does *spatial* mean, and how does geography's interest in space differentiate it from other disciplines?
4. What geographic features make the United Kingdom and New Zealand different?
5. What are the major terms and concepts associated with scale, coordinate systems, projections, and symbolization?
6. Why is a map made with the Mercator projection more suitable for navigation than a map made with a compromise projection, such as the Winkel Tripel?
7. What is the difference between a dot density map and a choropleth map?
8. What is a mental map?
9. What is GIS, and what typically makes it different from old-fashioned manual cartography? What are some applications of GIS and remote sensing?
10. What do geographers study, and what do they do for a living?
11. What are the six "essential elements" of geography as defined by the National Council for Geographic Education? What does each element indicate about geography's concern with space, place, or the environment? How do the 18 standards help inform geographic literacy?

Key Terms + Concepts

Antarctic Circle
Arctic Circle
attributes
cartography
choropleth map
coordinate systems
core location
culture area
cultural landscape
cultural landscape theory
culture
culture area
degrees
distance decay
dot density map
Equator
Five Themes of Geography
flow map
formal region (uniform region or homogeneous region)
functional region (nodal region)
geographic information systems (GIS)
geography
geo-literacy
geopolitics

geospatial
graduated symbol map
hemisphere
  Eastern Hemisphere
  land hemisphere
  Northern Hemisphere
  Southern Hemisphere
  water hemisphere
  Western Hemisphere
human–environment interaction
human geography
International Date Line
isarithmic map
landscape
large-scale map
latitude
  high
  low
  middle
  north
  south
lines of latitude
lines of longitude
location
  absolute location (mathematical location)
  relative location
longitude
  east
  west
map
map projection
  azimuthal
  compromise
  conformal
  conic
  cylindrical
  equal-area
  equidistant
  Mercator
mathematical location
mental map
meridian
minutes
National Geography Standards
natural landscape
North Pole
orientation
parallel
peripheral location
physical geography
place
Prime Meridian (Greenwich Meridian)
projection
reference map
region
remote sensing (Earth observation)
scale
seconds
sense of place
Six Essential Elements of Geography
small-scale map
South Pole
space
spatial
symbolization
systematic geography
thematic map
Tobler's First Law of Geography
Tropic of Cancer
Tropic of Capricorn
vernacular region (perceptual region)
world regional approach to geography

Notes

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4. Kevin Quealy, May 14, 2017. "If Americans Can Find North Korea on a Map, They're More Likely to Prefer Diplomacy." *The New York Times*. https://www.nytimes.com/interactive/2017/05/14/upshot/if-americans-can-find-north-korea-on-a-map-theyre-more-likely-to-prefer-diplomacy.html?_r=0.
5. The abbreviation "bce" stands for "before the Common Era," which is a reference to the dating system invented by European Christians that sets the birth of Jesus Christ as year 1. In Christian cultures, dates before that year are expressed as "BC," meaning "before Christ," and later years are identified as "AD," which stands for "*anno Domini*" (Latin, "in the year of our Lord"). Religion-neutral dating systems such as the one used in this book employ bce and CE ("Common Era"), respectively, but the years are numbered the same in the two systems.
6. Committee on Strategic Directions for the Geographical Sciences in the Next Decade, National Research Council, *Understanding the Changing Planet: Strategic Directions for the Geographical Sciences* (Washington, DC: National Academies Press, 2010).
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14. Art of Geography. 2016. *The Sense of Place: What Is the Sense of Place?* Accessed at http://www.artofgeography.com/info/the-sense-of-place.
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16. Where is this place? (It is in the US.) There are some natural landscape clues: the body of water is a bay or inlet, and the long stretch of fog in the upper left suggests an oceanic influence. With bodies of water on both sides, the land feature running left-right across the top must be a peninsula or island. The cultural landscape on the right hints at a large urban area, connected by two bridges to another urban area on the peninsula or island. One particular American city is famous for its fog. This is a view from over the southern San Francisco Bay Area, looking toward towards San Francisco, which is situated at the upper right, at the end of a long peninsula. (See the map in Figure 1.4a.) The general area of Silicon Valley is on that peninsula at the upper left. The vibrant colors are artificial salt ponds used to extract and harvest salt from the bay water near Newark.
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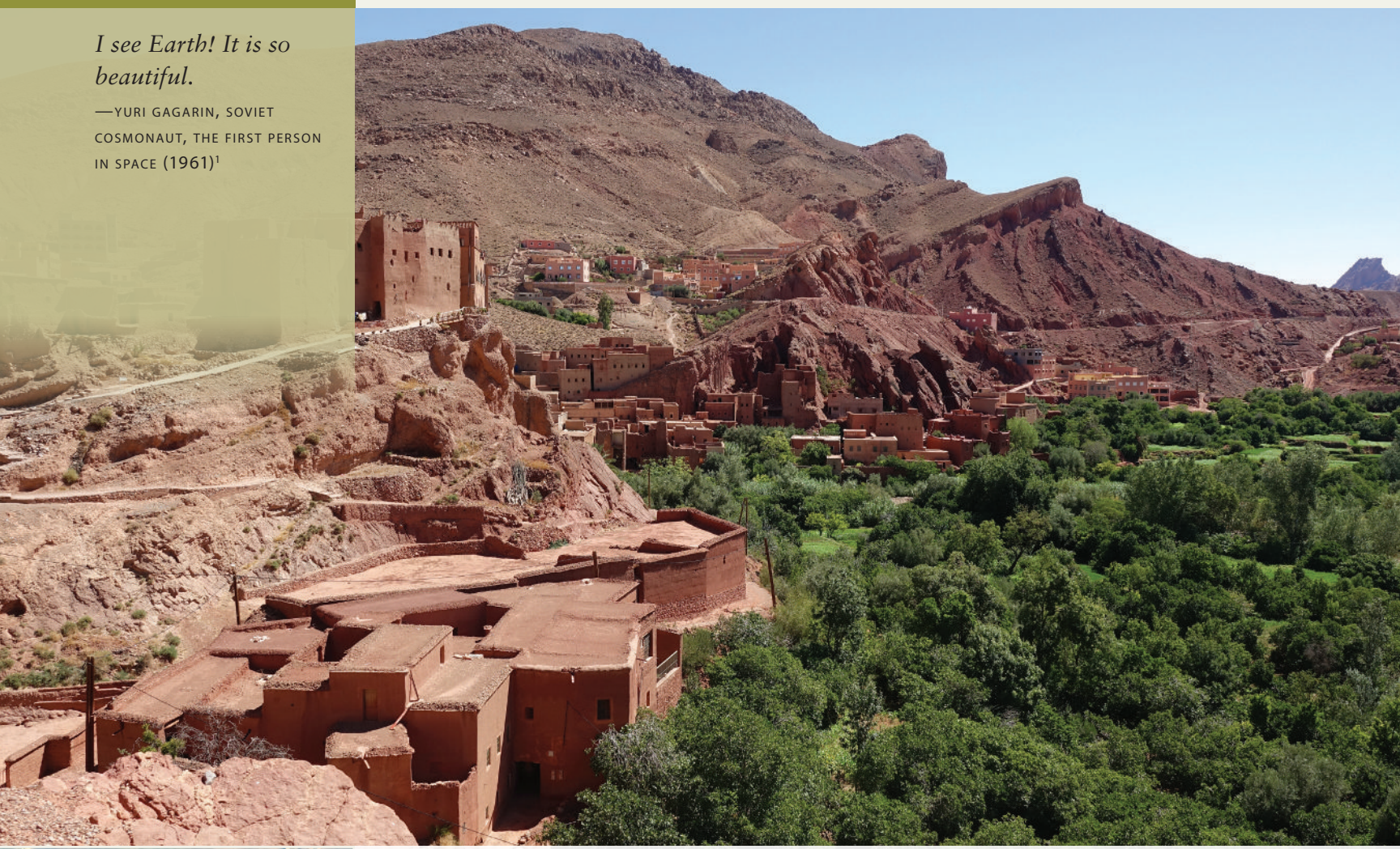
2 Physical Processes and World Regions

I see Earth! It is so beautiful.

—YURI GAGARIN, SOVIET COSMONAUT, THE FIRST PERSON IN SPACE (1961)[1]



Above: Geologic processes are clearly evident in the spectacular Atlas Mountains of Morocco. You have likely seen mountains, oases, and historic buildings like these in films and series, including *Game of Thrones*. Joe Hobbs
Left: Goosenecks of the San Juan River in southeast Utah, where an entrenched meander cuts 1000 feet deep through limestone, siltstone, sandstone, and shale beds lain down by ancient seas. I recommend you sit in a window seat when you can, as I did when taking this photo. Joe Hobbs

Learning Objectives

2.1 Describe the tectonic forces behind some of the world's major landforms and natural hazards.

2.2 Identify correlations in the distribution of climates and biomes.

2.3 Discuss how natural areas are threatened by human activity and how natural habitat loss may endanger human welfare.

2.4 Explain the important roles of the world's oceans.

2.5 Describe the potential impacts of global climate change and international efforts to prevent them.

Many issues in world regional geography relate to the interaction of people and the natural environment and to how these relationships have changed the face of the Earth. Physical processes are the main focus in this chapter and human processes the focus in Chapter 3. But these processes are so intertwined that human forces receive much attention in this chapter, as do natural forces in the following chapter.

We begin our exploration of Earth's physical geography with the four "spheres" that make up the Earth's habitable environment: the **lithosphere**, its outer crust or "rind" of rock; the **hydrosphere**, made up of all the world's water features; the **atmosphere**, the five layers of gases surrounding the Earth; and the **biosphere** (also known as the **ecosphere**), which is the sum total of all of the world's ecosystems, including all the relationships played out among the living and nonliving components of the lithosphere, hydrosphere, and atmosphere. In this chapter, we will see how the Earth's continually changing surface provides both opportunities and threats to people. We will consider the climate and vegetation types that play such large roles in human activities and appreciate the rich diversity of wild plant and animal species. We will look briefly at the planet's often overlooked oceans and the resources they hold. Finally, we will examine how the climate is changing, what these alterations may mean for life on Earth, and what people can do to adapt to or mitigate some of the most serious climatic changes.

2.1 Plate Tectonics

The jigsaw puzzle–like geometry of Africa's west coast and South America's east coast has been widely noted in the scientific community since the 16th century. Numerous observers suggested that the Americas had been torn apart from Africa by some kind of violent cataclysm or by the Earth physically expanding in size. In 1912, German scientist Alfred Wegener published his theory of "continental drift," proposing that the continents were once joined in a supercontinent (which he named Pangaea) but that they "drifted apart" over time. However, at that time many in the scientific community believed that the major features of the Earth's surface were immutable, and they dismissed Wegener's ideas. Wegener—a meteorologist, not a geologist—was unable to explain the forces behind these movements, and detractors denounced his conclusions as "utter damned rot" and "mere geopoetry."[2] Not until the 1970s would Wegener's theory become widely accepted, thanks to important discoveries over the previous two decades in fields such as oceanography, paleontology, and magnetism that all pointed to the slow movement of continents across the earth's surface. These movements are collectively called **plate tectonics** (see •**Figure 2.1**).

The lithosphere is composed of two types of crust: oceanic, which is thin and dense (about 60 miles [100 km] thick), and continental, which is thicker and lighter (up to about 150 miles [250 km] thick). The lithosphere is fractured into eight giant and many smaller slabs of rock called **plates**. These plates, many of which carry both oceanic and continental crust, are set in motion by convection currents of viscous hot rock in the mantle (which sits between the Earth's core and lithosphere and makes up the bulk of the planet's interior).

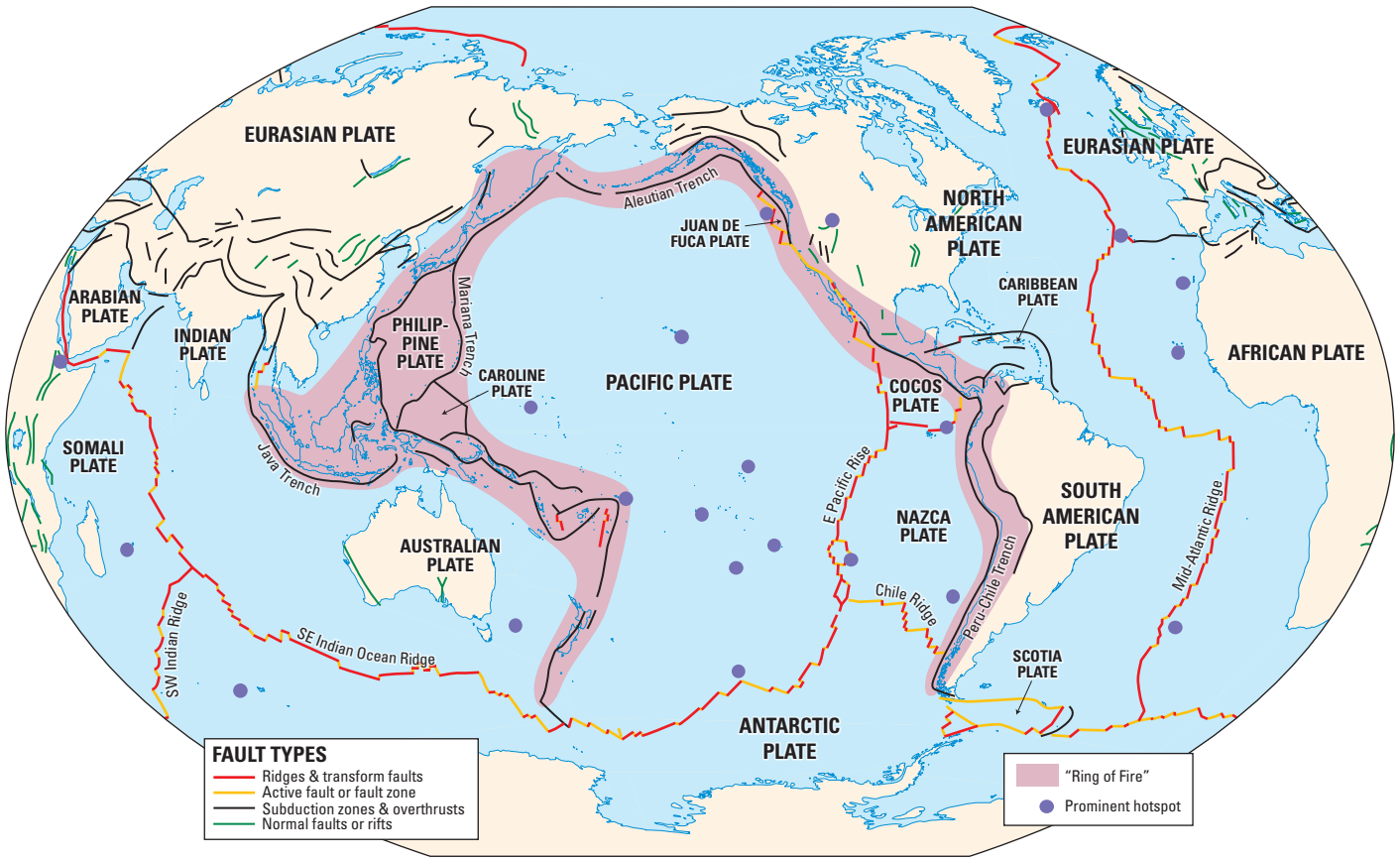
Plate tectonics are often explained by the analogy of a "conveyor belt" in constant motion (see •**Figure 2.2**). On the ocean floor, in places such as the Mid-Atlantic Ridge and the East Pacific Rise, new lithosphere is "born" as molten material rises from the Earth's mantle and flows outward, cooling into solid rock. On either side of these long, roughly continuous ridges, plates are continuously pushed away from one another in a process called **seafloor spreading**. When this spreading process occurs under continental crust (as is happening in Africa's Great Rift Valley), it is called **rifting**. The boundary between two plates moving away from each other is called a *divergent boundary*.

What happens on the other end of the "conveyor belt," where plates bump into each other (at a *convergent boundary*), depends on the type of crust. When two pieces of oceanic crust meet, one plate will dive underneath the other plate in a process called **subduction**. The descending rock is melted again as it sinks into the superheated mantle along a linear feature known as a **trench**, marking some of the deepest places on Earth; the Mariana Trench in the western Pacific Ocean lies at a crushing 35,814 feet (10,916 m) below sea level. Subduction weakens both plates at the boundary and often results in the creation of seafloor volcanoes, some of which eventually grow tall enough to rise above the waves and become islands (as in Hawaii).

If a plate carrying oceanic crust encounters a plate carrying continental crust, the oceanic rock will subduct below the continent, creating a mountain range dotted with volcanoes on the continent's edge. This is happening along parts of the west coasts of both North and South America. Continental crust is too thick and buoyant to be subducted, so if two plates carrying continental crust meet, they simply collide with each other. The edges crumple, deform and uplift, resulting in a mountain range—the Himalayas formed this way when the Indian plate collided with Asia—typically with few volcanoes (see the origins of the Himalaya Mountains in Chapter 7).

Areas where plates meet, grinding and sliding horizontally past each other, are called *transform fault boundaries*. Most transform fault boundaries are on the ocean floor, but some occur on land; the notorious San Andreas Fault in California is a prime example. A **fault** is a fracture or discontinuity in the lithosphere, where stress that builds up over time between moving areas of rock is released, sometimes violently, in the form of earthquakes. Most faults and the processes of faulting are associated with plate boundaries, but some can be found deep in the interiors of plates, such as the New Madrid Fault Line that produced a devastating series of earthquakes in Missouri in the early 19th century.

The **tectonic forces** that cause the lithosphere's plates to diverge, converge, and transform are key to understanding the spatial distribution of earthquakes and volcanoes. The vast majority of **seismic activity** (*seismic* refers to Earth vibrations, mainly earthquakes) and **volcanism** (movement of



• **Figure 2.1** Major tectonic plates and their general direction of movement. Earthquakes, volcanoes, and other geologic events are concentrated where plates separate, collide, or slide past one another. Where they separate, rifting produces very low land elevations (well below sea level at the Dead Sea of Israel and Jordan, for example) or the emergence of new crust on the ocean floor (in the middle of the Atlantic Ocean, for example). Note the so-called Ring of Fire around the edges of the Pacific Plate, and the presence of geologic hotspots where magma is near or at the earth's crust.

Source: Adapted from NASA, "Global Tectonic Activity Map of the Earth," DTAM-1, 2002.

molten earth material, especially in volcanoes) occurs along plate boundaries, particularly in areas of subduction. The Pacific Ocean is almost completely encircled by subduction zones, making it the globe's most frequent and deadly realm of tectonic activity; for this reason, its rim is often called the **Ring of Fire.** (See **Figure 2.1**.)

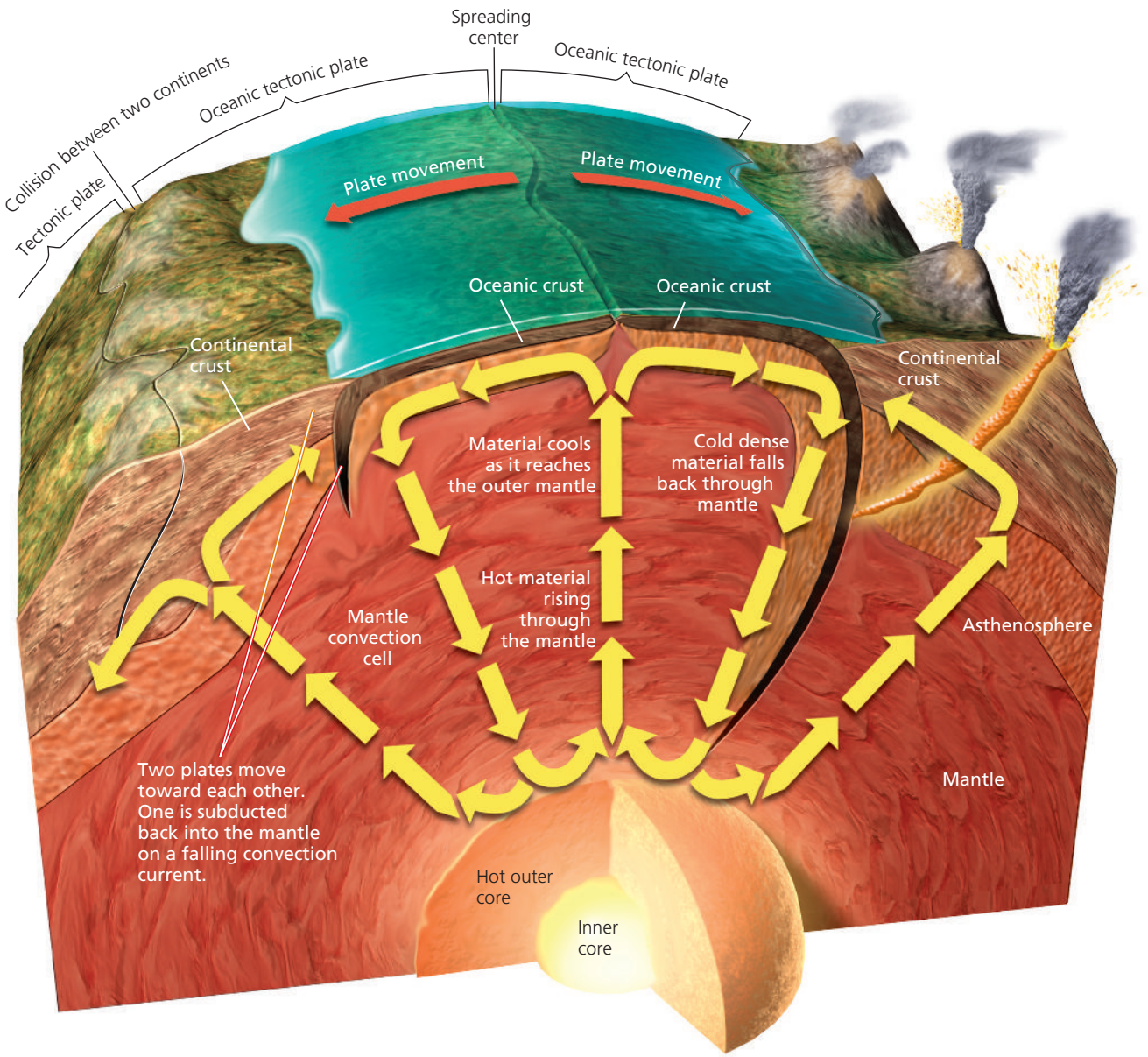
Subduction can release enormous amounts of energy. The world's largest recorded earthquakes—registering 9.5 (Chile, 1960), 9.2 (Alaska, 1964), 9.1 (Indonesia, 2004), and 9.0 (Japan, 2011) on the **moment magnitude scale (MMS)**, which measures the strength of the earthquake at its source—have struck along these subduction zones (the MMS has replaced the long-used Richter scale). This sudden displacement of a section of oceanic crust often triggers a **tsunami**, a large sea wave that can be one of nature's most powerful and destructive processes when it hits land (see **Sections 7.6c** and **8.2b** for more insight into tsunamis, and see the Geographic Spotlight: Natural Hazards feature). The MMS is logarithmic, so that an increase of one unit of magnitude is equivalent to an increase of 10 times the amplitude (the sizes of the wave "wiggles" recorded by a seismograph) and about 32 times the energy. This means that a magnitude 9.0 quake is 32 times as energetic as a magnitude 8.0 quake, and 1000 times as energetic as a 7.0!

In addition to plate boundaries, volcanism also occurs in the world's several dozen **geologic hotspots,** where molten material has broken through the crust as a "plume" (as in Yellowstone National Park and in Hawaii; see **Section 11.2**). Volcanoes have beneficial qualities, despite posing a host of natural hazards to people living on their slopes or downwind—including pyroclastic flows (fast-moving currents of rock fragments, hot gases, ash, lava flows, ashfalls, and other dangers; see **•Figure 2.3**). Volcanic rock usually breaks down to form fertile soils (as in Ethiopia and the Nile Valley), and the wide range of climate and vegetation types on their slopes creates fine opportunities for growing crops and raising livestock.

We turn now to global patterns of climate and vegetation.

Geographic Spotlight Natural Hazards

Volcanoes, earthquakes, tsunamis, tornadoes, tropical storms: these impressive and unforgiving phenomena are some of Earth's **natural hazards**, defined by geographers who pioneered their study as "those elements of the physical environment, harmful to man and caused by forces extraneous to him."[3] People are key in natural hazards: a volcanic eruption that does not impact people is a natural phenomenon rather than a natural hazard. Natural hazards represent one of the most important and useful subfields of geography. Geographers equipped with the intellectual and material tools of natural hazards research are in high demand in planning and in emergency response offices at all levels of civil administration. One of the specialty groups of the AAG is *Hazards, Risks, and Disasters*, falling right in the crosshairs of geography's scope of human–environment interaction. In this book, we consider several case studies of natural hazards and examine situations in which poverty and income inequality play a role in natural hazards; typically the poor suffer more than the better-off.



• **Figure 2.2** The Earth is composed of core, mantle, and crust. Dynamic forces within the core and mantle have major effects on what happens in the crust and on the surface, including impressive but dangerous events like earthquakes and volcanoes. These forces create many of Earth's landforms. The yellow arrows illustrate how the lithosphere is "recycled."

Fotos593/Shutterstock.com

• **Figure 2.3** Tectonic movement along the southeastern "Ring of Fire" created the Andes Mountains of South America. Subduction of the eastern rim of the Nazca plate beneath the continental South American plate continues to ignite volcanic and mountain-building activity. This Ecuadorian stratovolcano Tangurahua (16,480 feet or 5025 meters) has had dozens of fiery lava eruptions since written records began in 1534.

2.2 Patterns of Climate and Vegetation

"Everybody talks about the weather, but nobody does anything about it," Mark Twain reportedly quipped. We will see in this chapter that we have actually done a lot about the weather and even more about the climate. First we will look at natural patterns in vegetation and climate that present different opportunities for people and other life forms around the world. You will see these patterns repeated in the world's eight regions.

As you experience a warm, dry, cloudless summer day or a cold, wet, overcast winter day, you are encountering **weather**—the atmospheric conditions occurring at a given time and place. **Climate** is the average weather of a place over a long time period. Dr. J. Marshall Shepherd of the National Weather Service offers this analogy: "Weather is your mood; climate is your personality."[4] Along with surface conditions including elevation and soil type, climatic patterns have a strong correlation with patterns of natural vegetation and, in turn, with human opportunities and activities on the landscape.

Temperature and precipitation are the key variables in weather and climate. Temperature is largely a function of latitude and elevation: lower latitudes and elevations are warmer, while higher latitudes and elevations are cooler. Clouds, which are created by condensation of moist air cooling as it rises, are required for **precipitation** to form. There are two main categories of precipitation—liquid (rain, drizzle, and mist) and freezing (snow, sleet, and hail). Precipitation brings water to Earth's landmasses, and water is essential for life on Earth. Some geographers will tell you this is why the map of the world's precipitation—here in • **Figure 2.4**—is the most important map of all for understanding life on Earth.

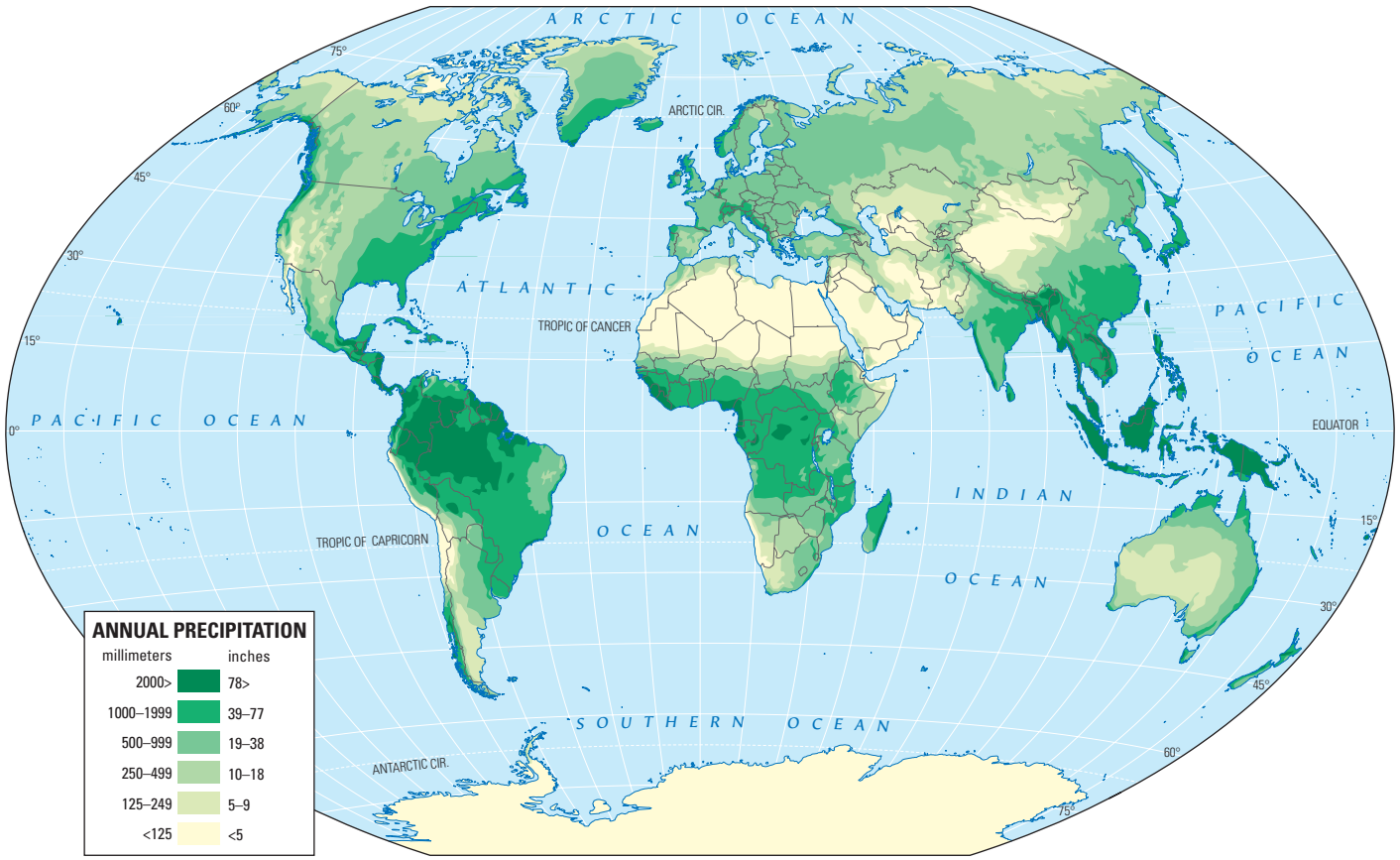
2.2a Climate

Geographers have employed a number of systems for categorizing climates, but the most widely used is the **Köppen climate classification system (KCC),** initially devised by the German scientist Wladimir Köppen early in the 20th century. Köppen's climate types are based on annual and monthly measurements of temperatures and precipitation. There are about 30 different climate types and variants in the KCC, designated by letters such as *BSk* and *Dfa*. These labels are not very user-friendly, so for easier use and for the sake of correlation with biome types, this book distills the KCC into 11 climate types (see • **Figure 2.5**).

Three climates are designated "tropical," with their defining characteristic being consistently warm to hot temperatures; every month has an average temperature of 18°C (64°F) or higher. Looking at Figure 2.5, you can see that all three tropical climates are found in the Amazon basin of South America, in the following sequence poleward from the Equator. The **tropical rain forest climate** is hot, humid, and rainy year-round, with little seasonal variation in temperature or precipitation. The **tropical monsoon climate** has a short dry season, when the otherwise heavy rains taper off for one or more months. The **tropical savanna climate** (also called the tropical wet-dry climate) has marked wet and dry seasons, each typically lasting roughly half the year.

Two climates are defined by their **aridity,** as a condition in which precipitation amounts are less than the **potential evaporation (PE).** PE is a measure of how much water would be evaporated in a given area if a sufficient amount of water were available there. Hot areas have higher PE than cold areas; low precipitation in low latitudes (close to the Equator) results in sparse vegetation, while the same amount of precipitation at higher latitudes can support much more flora. The **desert climate** is very dry year-round, with low annual precipitation. The Sahara in Africa has the world's largest contiguous desert climate region. The **semiarid climate** zone receives more precipitation than the desert climate and is commonly a transition zone between deserts and more humid climates. A good example is the Sahel, the orange stripe just south of the Sahara in Figure 2.5. Although arid climates are usually thought of as hot, desert and semiarid climates are also found in colder, higher latitudes, such as in the Gobi Desert of northern China and southern Mongolia. Places that are characteristically arid are known as **drylands.**

Adjacent to arid climates along coastlines in several world regions is the **Mediterranean climate** (or **dry summer subtropical climate**), which is more humid than arid climates but has a pronounced summer dry season with little or no precipitation. Winters are mild, and summers are generally hot. The fringes of the Mediterranean Sea and most of California enjoy this pleasant climate. Poleward of the Mediterranean climate lies the **oceanic climate** (also known as the **maritime** or **marine west coast climate**). Proximity to the ocean moderates the temperature; it rarely gets too hot in summer or too cold in winter. Precipitation falls in roughly equal amounts in each season. Much



• **Figure 2.4** World precipitation map. Some geographers consider this to be the most important of all world maps for understanding life on Earth.

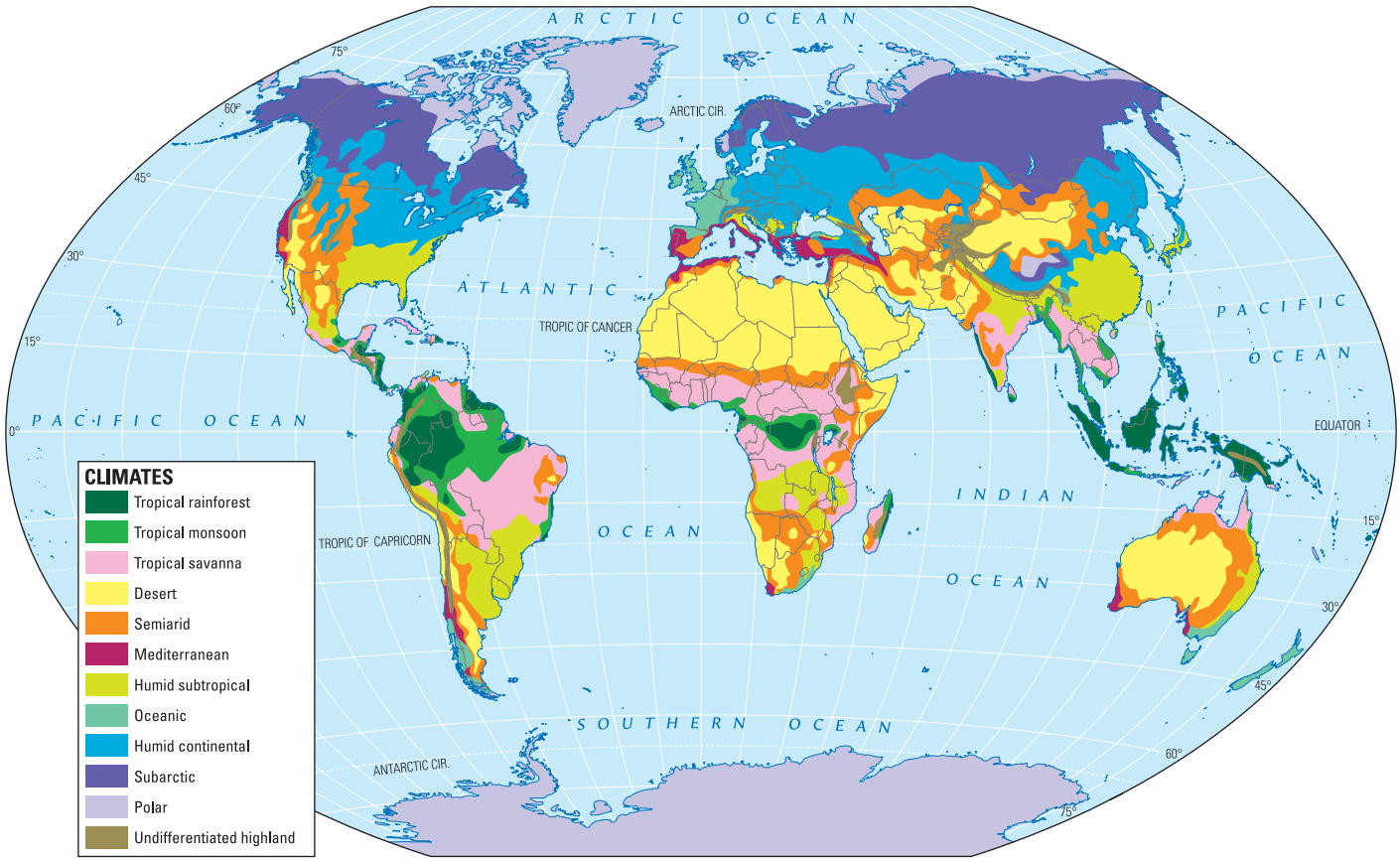
THINK CRITICALLY What consistent pattern do you see in comparing South and East Asia on this map and on the human population map in • **Figure 3.20**?

of Europe experiences this climate. The oceans' moderating influences are also apparent on the global scale. Water covers 81 percent of the Southern Hemisphere but only 61 percent of the Northern. Seasonal variations are, as a result, more moderate in southern latitudes than at the corresponding northern latitudes.

The **humid subtropical climate** receives abundant precipitation, spread roughly evenly throughout the year, although some areas with this climate experience a monsoonal, dry-winter precipitation pattern. The humid subtropical climate features hot and muggy summers, and mild winters with occasional cold snaps. This is the climate of the southeastern United States. The **humid continental climate** also receives ample year-round precipitation but less than in the subtropical climate zone. Because of its higher latitude and distance from the moderating influence of the seas, the humid continental climate has large temperature swings between cold winters and the often subtropical-like hot summers. This is the climate of much of the Northeastern and Midwestern United States.

Found exclusively in the Northern Hemisphere, the **subarctic climate** (also called the subpolar, boreal, or taiga climate) has short, mild summers and long, cold, severe winters. Most of Siberia and much of Canada have a subarctic climate. Annual precipitation amounts tend to be low in subarctic areas; however, this climate is more humid than true deserts. Cold air cannot hold as much moisture as warm air, so less evaporation occurs (its PE is low). Low PE values are also the reason why the **polar climate**, despite very low precipitation totals, can support numerous lakes, rivers, and wetlands in tundra areas and permanent ice cover elsewhere. In polar climates, no month has an average temperature above 10°C (50°F), and in ice-covered areas the average temperature is always below freezing. As we will see in this chapter, rising temperatures across the polar realms are thawing ice and the ground it lies on in a serious manifestation of climate change.

On our climate maps, mountainous areas of the tropics and midlatitudes are designated as **undifferentiated highland**. These are not climate zones per se but are mountainous regions where no single climate dominates. Instead, these locales, such as in the Rocky Mountains and the Himalayas, have many small microclimates in close proximity, which vary greatly depending on elevation and exposure to wind, precipitation, and sunlight.



• **Figure 2.5** World climates.

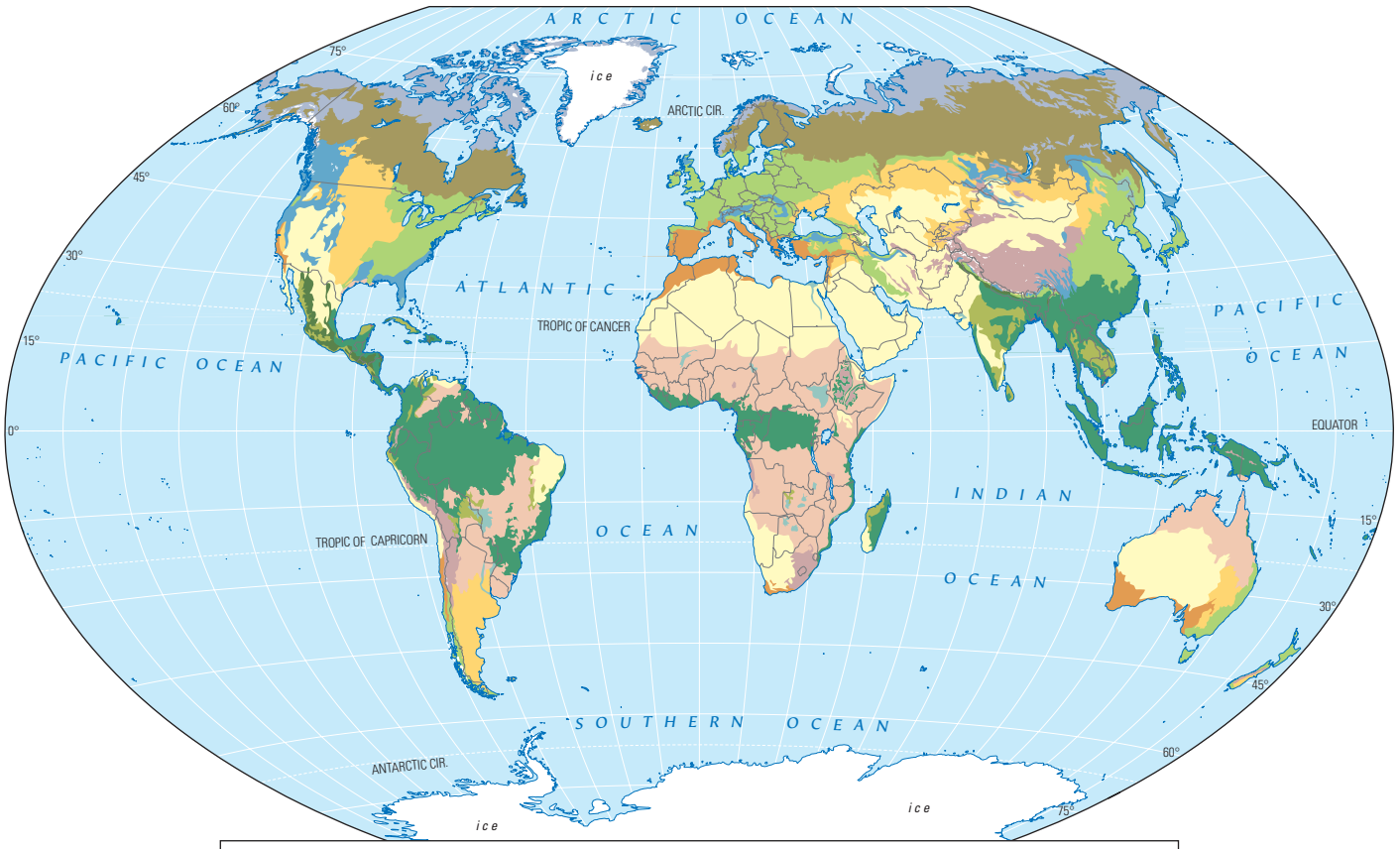
THINK CRITICALLY Are Figures 2.4 and 2.5 large-scale or small-scale maps?

2.2b Biomes

As with climate, scientists have developed a number of ways to categorize Earth's natural communities. This book uses the 14 **biomes**—regions distinguished by their associations of climate, fauna, and especially flora, as they are named after their dominant vegetation types—developed by the World Wide Fund for Nature (World Wildlife Fund, or WWF, well known by its panda logo) (see •**Figure 2.6**). Temperature and precipitation have major influences on the types of vegetation found around the world. You may easily see the geographic links between climate and vegetation by comparing the maps in Figures 2.5 and 2.6. The spatial distributions of climate and vegetation types do not overlap perfectly, but there is a high degree of correlation in many cases (see Try it: Your Global Environmental Counterparts feature).

As you use Figure 2.6, it is important to keep in mind that this map depicts vegetation *potential*—the flora that would dominate in the absence of human activity. It depicts for example a vast, unbroken area of temperate broadleaf and mixed forest in the eastern United States, but, of course, agriculture and urbanization have transformed much of this region. A measure of how many natural resources people use to support their characteristic lifestyles, the "human footprint" as mapped in •**Figure 3.6** represents what people have done to impact biomes and change the face of the Earth. The human footprint is known as "natural capital degradation" in some sources. By comparing •**Figure 3.6** with •**Figure 2.6** you can, for example, see that cities and transportation corridors have replaced many forests of the eastern United States. Maps of land use and/or land cover, including those in each of this book's regional chapters, also depict human activities and impacts—Geography's "human agency"—on the landscape.

The highest biodiversity in the world is found in the **tropical and subtropical moist broadleaf forest biome**. The forests of this biome are mainly a thick cover of broadleaf evergreen trees, and include the tropical rain forests (the "jungle" of popular imagination; see •**Figure 2.7a**). It is estimated that as many as half of all species on Earth inhabit tropical rain forest areas, the largest of which is in the Amazon Basin. In humid areas of higher latitudes, where the **temperate broadleaf and mixed forests** biome dominates, broad swathes of deciduous forests are peppered with evergreen needle-leaf trees. These forests cover much of Europe and the eastern United States (see •**Figure 2.7b**).



• Figure 2.6 World biomes (natural vegetation) map.
Source: Based on World Wildlife Fund ecoregions data, 1999.

Joe Hobbs

• Figure 2.7a Tropical moist broadleaf forest (tropical rain forest) at the ancient Maya site of Tikal, northern Guatemala.

The **tropical and subtropical dry broadleaf forest** occurs in hot areas with pronounced wet and dry seasons, as in central India and parts of mainland Southeast Asia. To conserve water during the dry season, tropical deciduous trees drop their leaves, just as temperate deciduous trees do before the onset of the cold winter (see **•Figure 2.7c**). Wooded tropical areas with lower amounts of precipitation and more pronounced seasonal temperature changes make up the **tropical and subtropical coniferous forest** biome, as found in mountainous regions of Mexico and Guatemala (see **•Figure 2.7d**). Evergreen trees such as conifers are better adapted to poor soils and cool, dry conditions than broadleaf deciduous trees are.

Needle-leaf trees also predominate in the **temperate coniferous forest** biome, which is found in both warm, humid coastal climates like the southeastern United States and in cooler, drier inland and mountainous regions (see **•Figure 2.7e**). Farther north, in snowy, cold-winter areas such as Siberia and Canada, lie the vast, nearly unbroken tracts of the coniferous