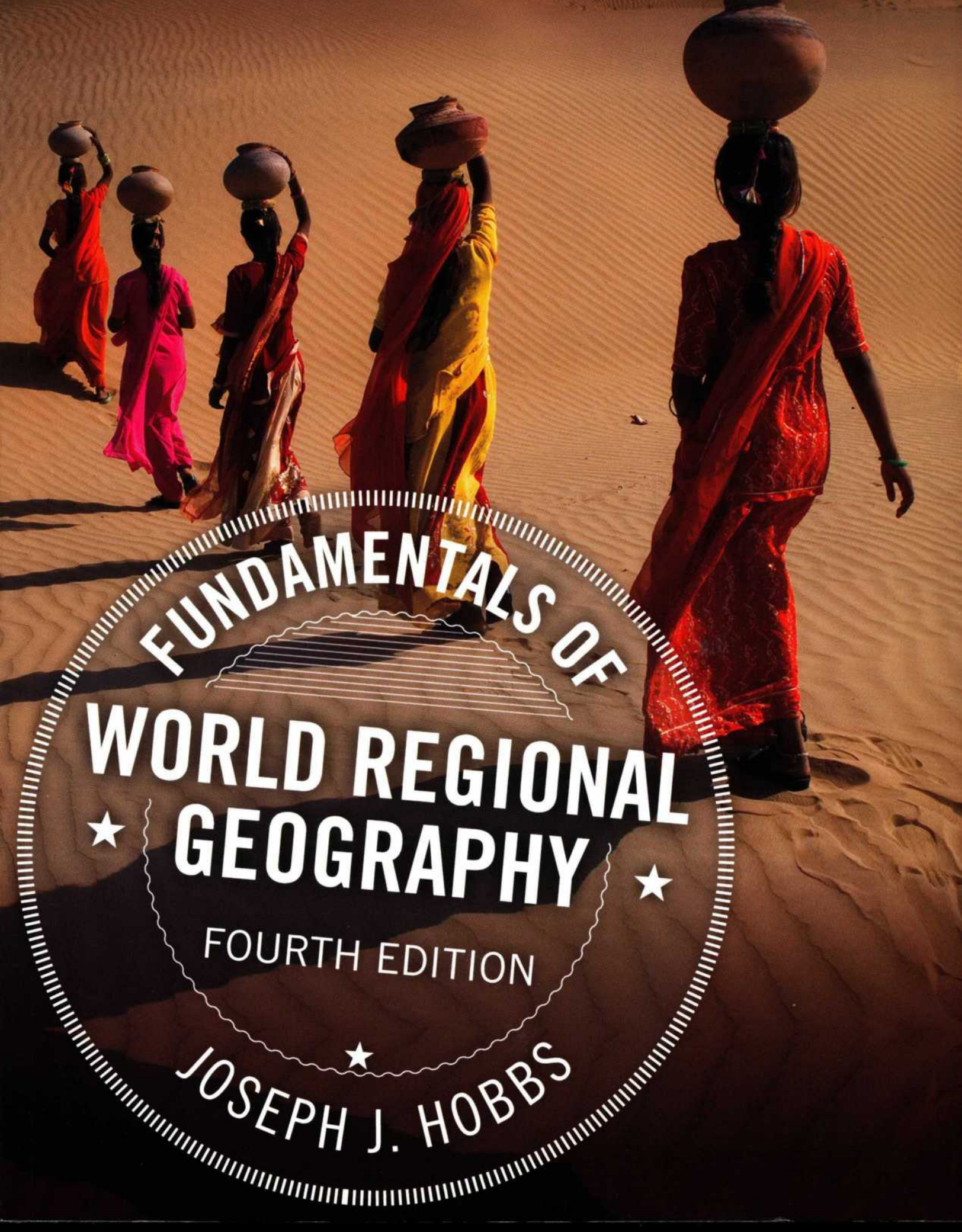
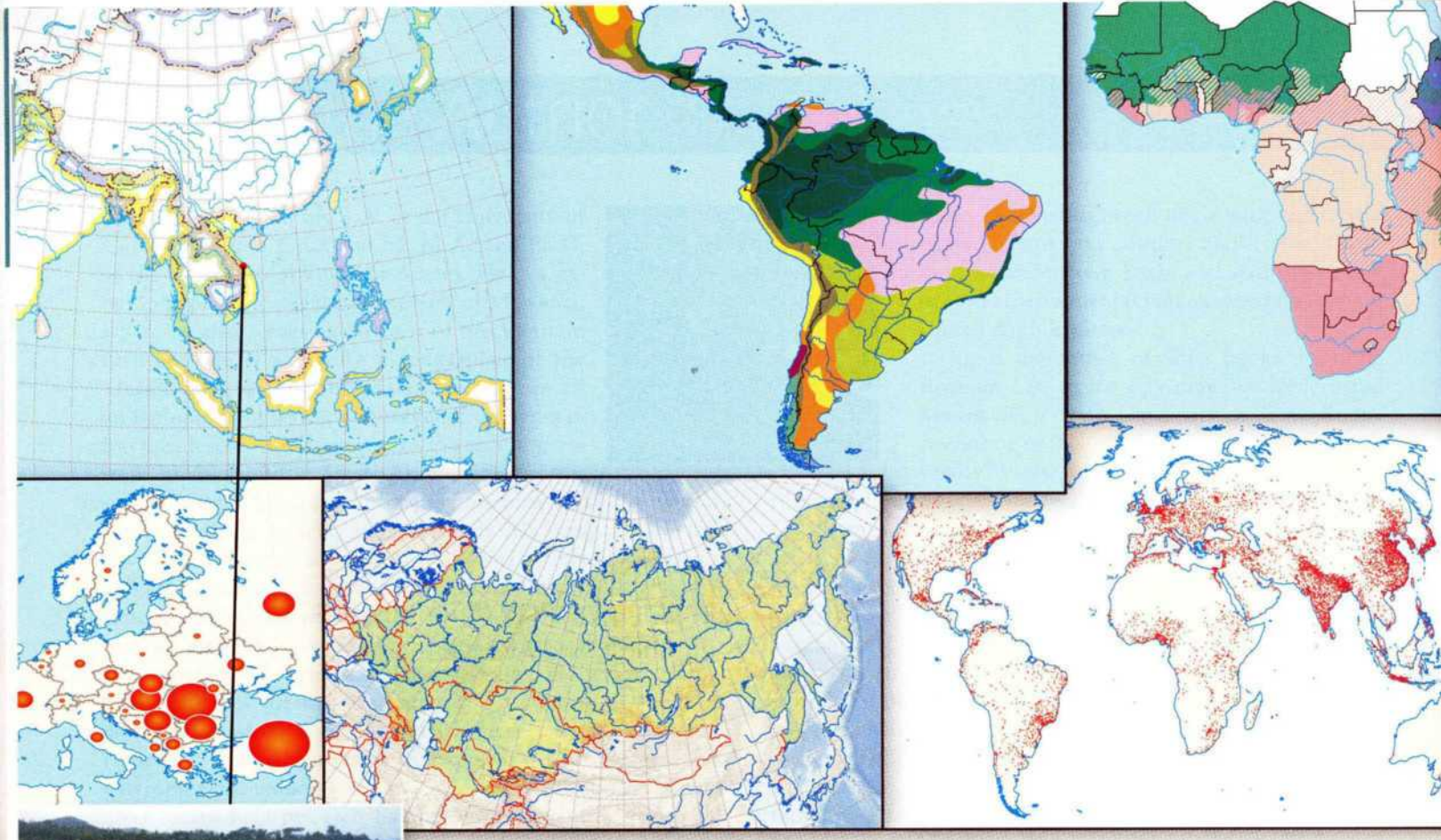

FUNDAMENTALS OF
WORLD REGIONAL
GEOGRAPHY
FOURTH EDITION
JOSEPH J. HOBBS



Above: Maps are the primary way geographers visualize spatial information of all kinds. Above is a selection of maps from this book, each focusing on a different relationship between people, places, and the environment.
Left: Paddling the Perfume River, central Vietnam. Joe Hobbs

1 Objectives and Tools of World Regional Geography

We are living in the era of the geographer.

—HAL MOONEY, STANFORD ECOLOGIST[1]

Welcome to world regional geography. What an important and useful field of study! In recent times the world has seemed endangered on so many fronts: great powers struggle for control in Ukraine; violent Islamists threaten the social and political fabric of the Middle East; China exerts its power over the marine territories of less powerful Asian countries; Ebola ravages West Africa and threatens other regions, for example. What on Earth is going on? But buried by the worrisome headlines are remarkable stories of breakthroughs in technology, communications, and agriculture as well as advancements in the eradication of disease and hunger. What are those all about? Where are we, Earth's peoples, headed?

Chapter Outline

Chapter Objectives

This chapter will enable you to

- Learn about the scope of geography as an academic discipline.
- Get acquainted with the essential themes, elements, and standards of geography.
- Learn some key concepts in geography.
- Appreciate the book's overall objectives.
- Learn the basic language of maps.
- Explore the "geospatial revolution," geographic information systems (GIS), and remote sensing.
- See how geographic knowledge is put to work in the job market.

1.1 What Is Where, Why There, and Why Care

In studying world regional geography, we seek to understand what is going on, ar why, and especially where. How are we doing? Many findings suggest "not ve well." A study carried out recently by professors in three Ivy League colleges r vealed that only one in six adult Americans could accurately locate Ukraine on world map. Asked to locate Ukraine on a world map with only country borde drawn in, the 2066 respondents were literally all over the map, placing Ukrai on every continent except Antarctica, which was not depicted. Ukraine turned u in a number of US states, especially in Alaska. A number of respondents put it Greenland.[2]

What difference does it make? Who cares if you know where Ukraine is, muc less Greenland? Long ago *geography* earned a reputation for mind-numbing memo rization of state capitals, and for driving students away (**•Figure 1.1**). Netflix's de scription of a 2014 film called *Geography Club* reads in part: "Looking for a have from the social hell of [high] school, the teens in this dramedy form a social clu they know no one else will join."[3] That's not very funny to geographers like m but I understand it. The truth is, by itself, a piece of knowledge like where Ukrai is probably means little. But geography is all about context and connections. Un derstanding *where* things are makes it much easier to appreciate and answer th *who, what, when, why,* and *how* questions in life, at every scale—from your dail activities to world affairs. Geography always starts with the *where* question, but is far more interesting and important than its old reputation for memorizing place suggests. Helping you to understand contexts and relationships, geography ca help you make better-informed judgments and decisions. My geographer colleagu Fritz Gritzner coined this definition of geography, which also serves as a methodol ogy and as a challenge for us to think critically: "*What is where, why there, an why care?*"[4]

To illustrate the importance of geographic insight, let's drill down a little deepe into that Ukraine study, which was conducted after Russia annexed the Crimea Peninsula in 2014 and appeared ready to take eastern Ukraine by force. The profes sors who conducted the study found that the farther away from the actual locatio of Ukraine the survey participants guessed Ukraine was, the more likely they wer to support US military intervention in Ukraine. Should that kind of disconnect con cern us as we think about expending American "blood and treasure" in the world' hotspots?

Most of us using this book are Americans, and our collective experience in re cent decades has prompted us to say this to our politicians: We are tired of gettin it wrong, and we can't afford to get it wrong. Our decision makers are responding Here is what the former US Secretary of Defense Robert Gates told cadets at the US Military Academy at West Point in 2011:

> Any future defense secretary who advises the president to again send a big American land army into Asia or into the Middle East or Africa should "have his head examined," as General [Douglas] MacArthur so delicately put it . . . Just think about the range of security challenges we face right now beyond Iraq and Afghanistan: terrorism and terrorists in search of weapons of mass destruction, Iran, North Korea, military modernization programs in Russia and China, failed and failing states, revolution in the Middle East, cyber-piracy proliferation, natural and man-made disasters, and more. And I must tell you, when it comes to predicting the nature and location of our next military engagements, since Vietnam, our record has been perfect. We have never once gotten it right.[5]

In his second term in office, President Obama depicted his foreign policy motto as "don't do stupid stuff."[6]

If only American presidents were advised by geographers . . . Geography is all about "getting it right" and "doing smart stuff" when it comes to understanding how the world works. Geographic knowledge of the *where, who,*

• **Figure 1.1** Geography used to be associated with memorizing mind-numbing facts. Not anymore!

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 community. Geographic insight has the power to transform our lives and contribute to the welfare of our communities and our countries.

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.

Before You Go On . . .

I have been teaching world regional geography (WRG) for more than 25 years, and I know the challenges you face as a student in taking on such a large and important subject as the world. Knowing the Earth gets a lot easier when you recognize the patterns that repeat themselves in different places, and also when you recognize the key points of what you are reading. So, before you continue reading, you need to know about some important features of the book that help you with WRG recognition. The first is its *cross-referencing system*. The book is written with global interconnections in mind. "Globalization" is understandable as a concept, but how exactly does it work? The page and figure numbers in the book's margins (and the hyperlinks in the ebook) tie the diverse strands of global issues together. For example, when you read in Chapter 3 how countries running low on productive agricultural land become "land grabbers" in other countries, page numbers in the margin lead you to the places where land grabbing is occurring (go to **page 65** to see what I mean). As you read about China's economic growth and its appetite for raw materials, you are likewise directed to places around the world where these forces come into play (see **page 65**). I put a lot of effort into making these connections for you, and I hope you will use this feature often and learn much from it.

I also want to draw your attention to features that will help you know what the most important points in the book are. My WRG students often ask me that famous question: "Do I need to know that for the test?" I cannot tell you what your professor or TA 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 more thoroughly after your reading and when you are preparing for the test. Another device that I am fond of as a writer and that should be useful to you is the *topic sentence* or *phrase* introducing or summarizing the main point or content of a given passage. Usually my topic sentence is at the beginning or end of a paragraph, but not always. Want a quick read of the chapter to get up to speed? Follow the topic sentences like highway signs.

What Is Geography?

Geography, a term first used by the Greek scholar Eratosthenes in the 3rd century BCE,[7] literally means "description of the Earth" but is probably best characterized as "the study of the Earth as the home of humankind." Focusing on interactions between people and the environments in which we live, the modern academic discipline of geography has its roots in the Greek and Roman civilizations and the Scientific Revolution in Europe.

Geography has unique properties as a scientific discipline. These traits are articulated especially well in the set of **National Geography Standards**, composed by the National Council for Geographic Education (NCGE) and promoted by the National Geographic Society.[8] The standards

are based on the NCGE's **six essential elements of geography**. Each of the six elements has a subset of geographic knowledge standards, eighteen in all, that "represent the most current conception of what it means to be geographically literate." These eighteen standards represent the substantive 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 eighteen standards. The standards are presented in • **Table 1.1**.

In this book, I have worked mainly behind the scenes to ensure that your geographic literacy is informed by these NCGE standards. The book's three introductory chapters employ all eighteen standards to set the world stage for you, and the chapter outline of each regional chapter reflects (but does not mirror) the six essential elements.

Another conceptual summary of geography's distinctive properties is known as the **Five Themes of Geography**. The National Council for Geographic Education and the **Association of American Geographers (AAG)** developed these themes. Because of their clarity and easy use, many geographers prefer them for teaching, and I encourage you to try them out for yourself (see Try It, **page 6**). Your prof may wish to use this set instead of or alongside the six essential elements and their eighteen standards. The Five Themes of Geography are listed here:[9]

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

Table 1.1 The Six Essential Elements and 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, process, patterns, and functions of human settlement.
- 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. http://education.nationalgeographic.com/standards/national-geography-standards/.

Try it The Geography of Anyplace

Try using the Five Themes of Geography to characterize **any** *place. Here is an example to work from, using Ground Zero in Manhattan.*

Geographic Characteristics of Ground Zero

Location: Lower Manhattan, New York City (with an exact location of latitude: 40 degrees, 42 minutes, 43 seconds N; and longitude: 74 degrees, 00 minutes, 49 seconds W (later in the chapter, we will look at latitude and longitude).

Place: Formerly, office buildings and firms at the heart of one of the world's great financial centers (a reason it was targeted for destruction); now, a place of historical significance and collective grief for people of the United States.

Human–Environment Interaction: Lower Manhattan occupies low-lying ground that once was marshy swampland. Construction of the twin towers of the World Trade Center, as well as the buildings erected after the 9/11 attacks, required special foundations to keep the Hudson River's water from pouring in.

Movement: Before 9/11, the daily comings and goings of office workers in the World Trade Center; on 9/11, the diversion of airplanes to target the buildings; after 9/11, the flow of tourists and construction crews to the site.

Region: Situated in region of the United States known as the Northeast, in a humid subtropical climate region (in the next chapter, we look at such physical regions).

You can use the five themes to appreciate any place geographically, from the Great Pyramids of Egypt to where you are now. Try it.

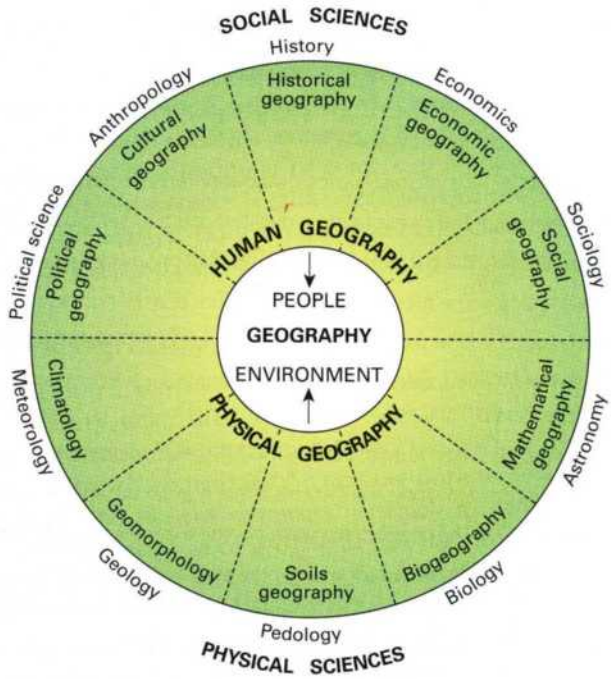
The National Geographic Society's educational division recommends, "While the five themes are still used, essential geography content knowledge for students is best described in the National Geography Standards, which were updated in 2012."[10]

The five themes, the six elements, and the eighteen standards cover a lot of ground. In its scope of interests, geography is the most all encompassing of the social sciences (a point of pride for us 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 (•**Figure 1.2**). Although we are classified as social scientists, we geographers often bridge the social and natural sciences and even the humanities in our research, publication, and teaching (another point of pride for us).

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 the Earth's most pressing problems—climate change, population growth, and hunger, for example—involve the coupling of human and environmental systems.

Geographers' interests in human–environment interaction, and especially in the ways in which people are changing the face of the Earth, 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."[11] A century and a half later, we are von Humboldt's future generations. Look at some of the most pressing global environmental issues that concern us today: they include deforestation and shortages of fresh water.

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."[12] 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 the Earth's surface—and in particular the roles that human ideas, activities, and cultures play in modifying the landscape. Sauer is credited with founding the **landscape perspective** in



• **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.

American geography, based on the method of studying the transformation through time of a **natural landscape** to a **cultural landscape**. Essentially, Sauer challenged us to think of what the world would look like without people and then understand what people have done to reshape the world through time.

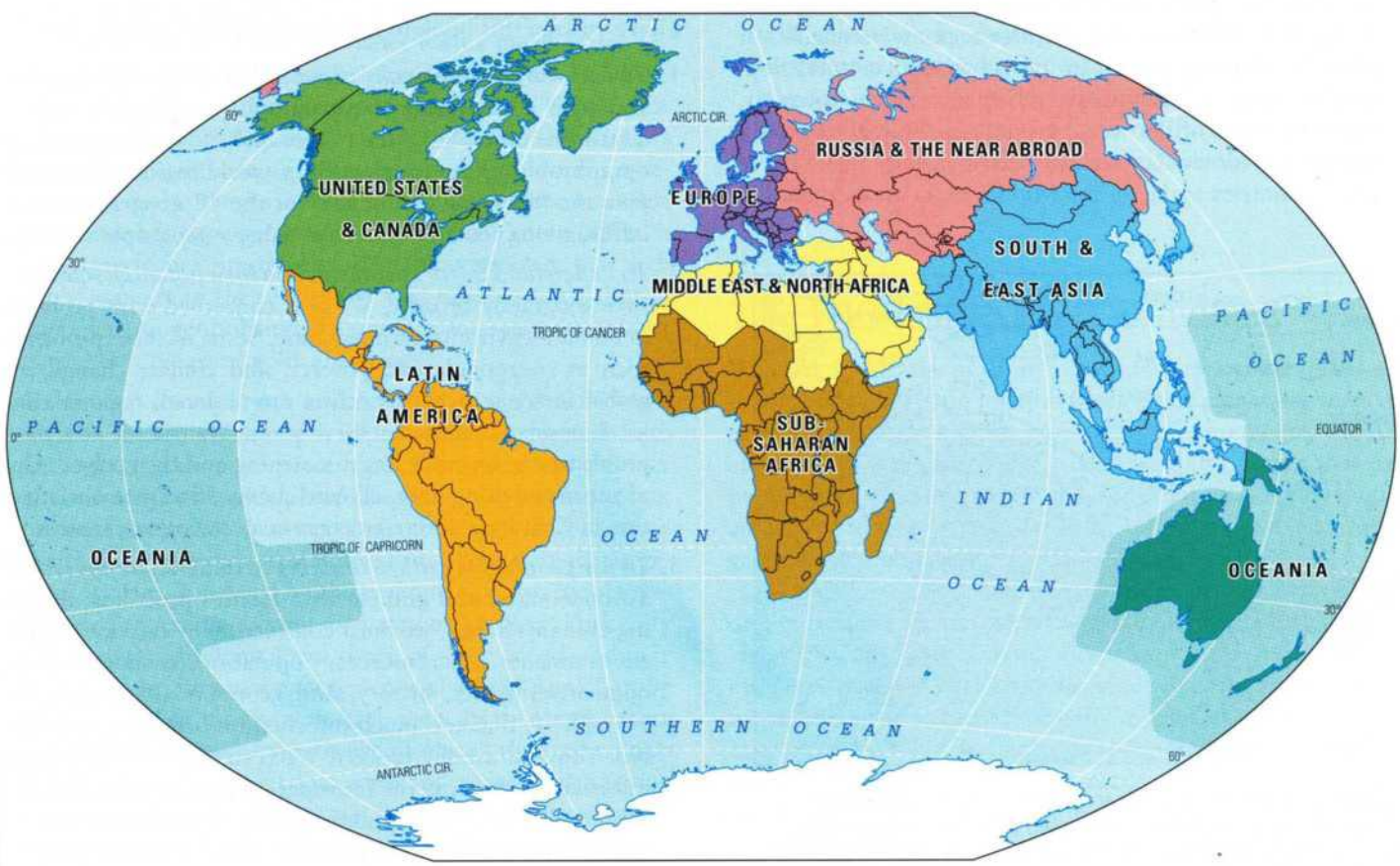
Culture—the system of values, beliefs, and attitudes that shapes and influences perception and behavior—underlies many of our decisions about how to use and modify the landscape.[13] That is why geographers are so concerned with cultural features such as ethnicity, language, and religion, and why you will learn much about them in this book.

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** (•**Figure 1.3** and •**Table 1.2**). 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 WRG book recognizes eight world regions; others have more or less.

Three types of regions are recognized by geographers. 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 on **page 91** 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). At the center of a functional region, the activity is most intense, whereas toward the edges of the region the defining activity becomes less important. 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



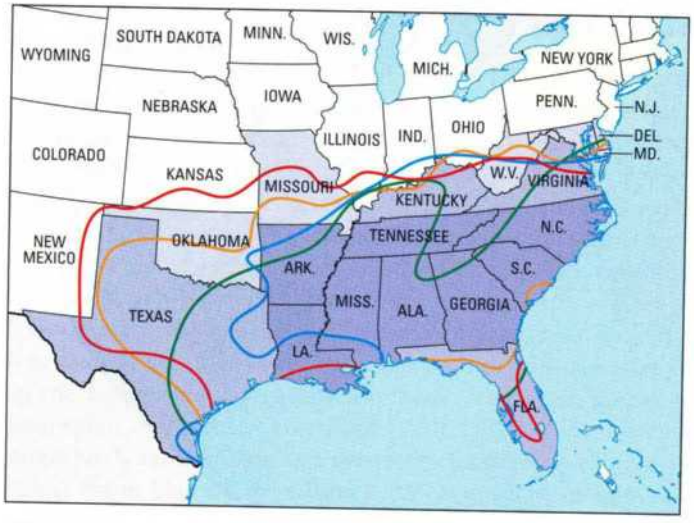
• **Figure 1.3** World regions as identified and used in this book.

Table 1.2 The Major World Regions: Basic Data

Political Unit	Area (sq mi, thousands)	Area (sq km, thousands)	Population (millions)	Rate of Natural Increase (%)	Urban Population (%)	Population Under Age 15 (%)	Agricultural Workers (%)	Per Capita GDP (PPP) ($US)	GDP ($US, billions)	Oil Production (million bbl/day)	Literacy, Female (%)	Literacy, Male (%)	HDI
World	**52,485.9**	**135,935.9**	**7,227.7**	**1.2**	**52**	**27**	**18**	**11,900**	**107,405**	**84**	**79**	**87**	**0.669**
Europe	1,959.3	5,072.0	532.2	0.1	73	16	3	32,400	19,145	3	98	98	0.878
Russia and the Near Abroad	8,533.2	22,100.8	284.5	0.4	65	19	9	12,900	5,068	13	99	98	0.745
Middle East and North Africa	5,416.1	14,027.8	531.2	1.9	63	30	10	11,600	9,150	29.5	77	87	0.694
South and East Asia	8,265.3	21,407.1	3,950.7	1.1	45	25	14	7,900	41,074	7.4	79	88	0.646
Oceania	3,306.8	8,564.5	38.4	1.1	70	24	10	31,200	1,311	0.5	86	89	0.808
Sub-Saharan Africa	8,655.2	22,417.2	919.5	2.6	37	43	61	2,600	3,275	5.7	52	69	0.462
Latin America	7,946.2	20,580.7	618	1.2	78	27	16	14,000	9,336	9.3	88	89	0.734
North America	8,403.8	21,765.8	353.2	0.4	81	19	2	51,800	19,046	15.3	99	99	0.913

Sources: World Population Data Sheet, Population Reference Bureau, 2014; Human Development Report, United Nations, 2014; World Factbook, CIA, 2014.

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 (•**Figure 1.4**). These regional terms have economic and cultural connotations, but ten people might have ten different definitions of the qualities and boundaries of these regions. Vernacular or perceptual regions, created by individuals and cultures, 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 I chose to define it.



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

The Objectives of This Book

I have written this book to help you achieve five objectives:

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 puts the "meat on the bones" of the 18 geographic standards, giving you all you need to achieve geographic literacy.
2. *To understand Earth's problems and their potential solutions.* Like geography broadly, WRG 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, or are manifested at these scales. We will see how these problems can be made less threatening and even solved. One of the overarching ones, climate change, first gets our attention in Chapter 2 and re-emerges in all the other chapters.
3. *To use geographic critical thinking to understand the world.* To understand and grapple with Earth's problems, including climate change, we must consider many factors: natural environments and resources, population, economic development, ethnicity, history, and geopolitical interests, for example. Is that too much information for you to take in? No. You will use the tools of WRG to filter and synthesize information, making the information more meaningful and memorable. You will think critically to recognize and reveal the geographic underpinnings of our world's problems. Critical thinking is "the process of actively and skillfully

conceptualizing, applying, analyzing, synthesizing, and evaluating information to reach an answer or conclusion."[14] Using geography's holistic and integrative approach in a regional framework, you will synthesize information, techniques, and perspectives from both the natural sciences and the social sciences. You will tread into the grounds of political science, history, economics, anthropology, sociology, geology, atmospheric science, and other areas. Pulling these issues and perspectives together, thinking critically and finding the links among them is doing geography. Doing this synthesis within a regional framework is doing world regional geography. Thinking critically in this framework, 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 may be surprised how much your geographic knowledge, enhanced by your ability to produce insight and advice from it, will help you in your career, whatever it 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 professor'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, disease epidemics originating in southern China, and Russia's invasions of neighboring countries are not random, unpredictable events. They are rooted in consistent, recognizable problems that have geographic dimensions. You will find it satisfying to be "pre-informed" about a problem that suddenly appears in the news. You will become somewhat of an expert on **geopolitics**, the struggle for space and power played out in a geographical setting.[15]

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 imprecise but important physical and cultural contexts of a location). Place is much more subjective than space because, like a vernacular region, it often is defined by the meanings 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 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" that individuals and groups have about locations and regions. Perception of place can have a very strong influence on how we make decisions and interact with others. Perception of place can even have a strong impact on world events. For example, in Chapter 6 on the Middle East, you 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. With **•Figure 1.5**, let's consider an example of how you can use your critical thinking skills to define and identify place.[16] 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.

Joe Hobbs

• Figure 1.5 Study this photograph, and name the country—or at least the region—where it was taken. What clues in the physical and human geographies of this place help you locate it? For more clues and the place identification, see note 16 on page 23.

1.2 The Language of Maps

We turn now to the most important tool that geographers use to explore and explain relationships on our planet: the map. As geographers study people, places, and environments, we usually (but not always) collect and depict information that can be mapped. In other words, we are interested in the **spatial** context of the things. As noted in the first essential element of geography, **spatial** means "of or relating to space."

A **map** is a representation of various phenomena over all or a part of the Earth's surface, usually rendered on a flat surface such as paper or a computer monitor. The science of making maps is called **cartography**. 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 the Earth's surface (road atlases are a good example, as are the opening maps for each regional chapter, such as Europe in **Figure 4.1**). **Thematic maps** show the spatial distribution of one or more attributes

Insights Mental Maps

When someone asks you, "Could you draw me a map of how to get there?" you might quickly draw some lines, write down some street names, talk about some familiar landmarks, and apologize for how crude your map is. 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.

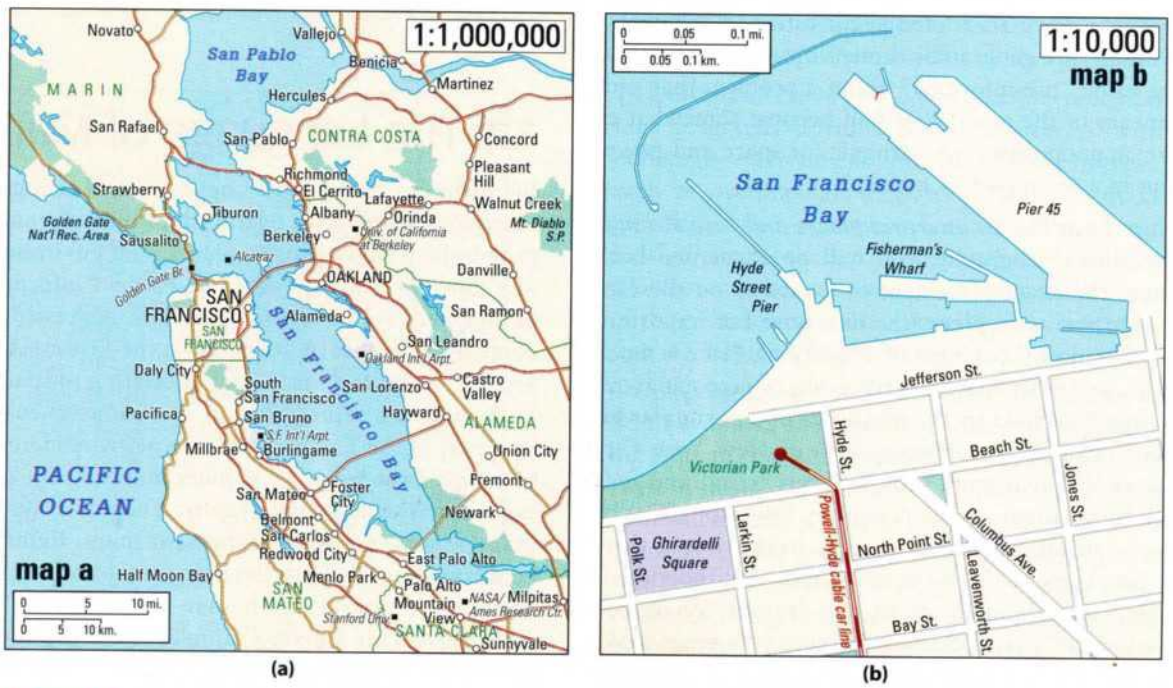
A **mental map**, like a vernacular region, is a collection of personal geographic information that each of us uses to spatially organize the images and facts we have about places, both local and distant. We constantly draw upon that geographic information to make our way through daily life, and are always revising and updating that information as we succeed or fail on our way. Sometimes we use that information to create actual maps. These maps are not accurate, precise, or scientific, but they portray useful information and tell us much about the individuals and cultures that create them.

across a given area. Thematic maps can be divided into two categories: quantitative and qualitative. Quantitative thematic maps show the spatial distribution of numerical information (such as population density or income levels, as in Figure 3.7 on **page 56**), whereas qualitative thematic maps display nonnumeric data (such as the distribution of climates or languages, as in Figure 2.4 on **page 30**).

As maps are an essential tool in the 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*.

Scale

A map is a reducer; it shrinks an area to the manageable size of a chart, piece of paper, or computer monitor. The amount of reduction appears on the map's **scale**, which shows the actual distance on Earth as represented by a given linear unit on the map. A common way to depict scale is with a fraction or ratio, such as 1:10,000 or 1:10,000,000. In the fraction, one linear unit on the map (for example, 1 inch or 1 centimeter) represents 10,000 or 10,000,000 such real-world units on the ground. A **large-scale map** is one with a relatively large representative fraction (for example, 1:10,000 or even 1:100) that portrays a relatively small area in more detail. A **small-scale map** has a relatively small representative fraction (such as 1:1,000,000 or 1:10,000,000) that portrays a relatively large area in more generalized terms. Compare the two maps in •**Figure 1.6**. Figure 1.6a is a small-scale map showing San Francisco and surrounding parts of the Bay Area. Figure 1.6b is a large-scale map that "zooms in" on part of San Francisco. *Remember this inverse relationship: a small-scale map shows a large area, and a large-scale map shows a small area.*



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

How good are you at reading maps? What about imagining or drawing them? (See the Try It feature on this page.) Did you ever wish you were better at it? This section should help you—and it will be useful as you navigate this book.

Mental Maps

Try it

You have mental maps in your mind. Try this: without referring to this book or any other source, draw your map of the world. It does not need to be detailed. But 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? Yes, you can laugh at yourself. This is not something that most 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 (see **page 16**)? It is very likely that if you try this again when you are finished with the course, your mental world map will be much improved.

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.

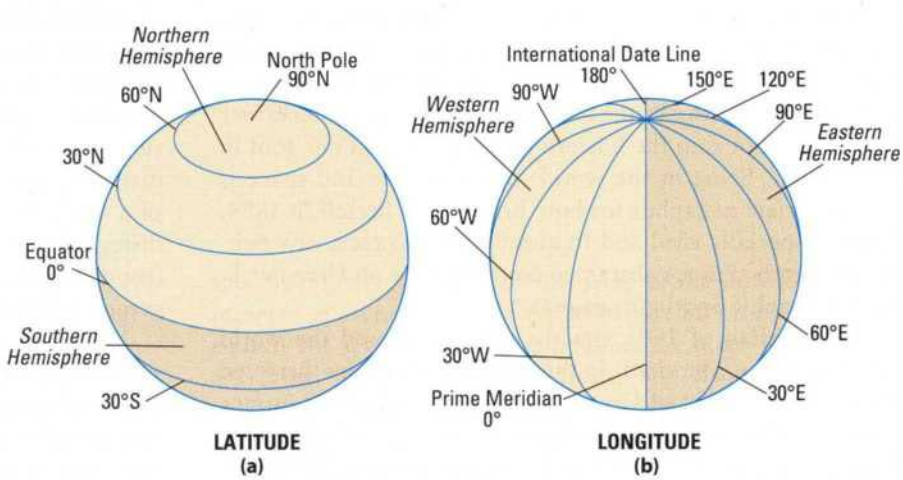
Relative location *defines a place in relationship to other places.* You can derive this kind of information from many maps. Relative location is one of the most basic reference tools of everyday life; you might say you live south of the city, just west of the shopping mall, or next door to a good friend. 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 5.33, on **page 193**, to see, for example, how tantalizingly close the legally-Ukrainian port of Sevastopol 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 Russia asserted control over the Ukraine's Crimean Peninsula, which juts into the Black Sea (see **page 180** and Geographic Spotlight, **page 12**).

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 (GPS) device).

The most common coordinate system uses **parallels** of **latitude** and **meridians** of **longitude**. The term *latitude* denotes position with respect to the Equator and the poles (see •**Figure 1.7**). Latitude and longitude are measured in **degrees** (°), **minutes** (′), and **seconds** (″). Each degree of latitude, which is made up of 60 minutes, is about 69 miles (111 km) apart; these distances vary a little because Earth is a slightly flattened ("oblate") sphere or ellipsoid. Each minute of latitude, which is made up of 60 seconds, is therefore roughly a mile apart. 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 each other, which is why they are called *parallels.*

Every point on a parallel has the same latitude (for example, 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**. Incidentally, there are no universally accepted definitions for the boundaries of the high, middle, and low latitudes. The northern half of the 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**.

Meridians of longitude are straight lines connecting the poles (see **Figure 1.7b**). Every meridian runs due north–south. All the meridians converge at the poles and are farthest apart



• **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.

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.[17]

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at the Equator. 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 must be a zero reference line for lines of latitude—the Equator—there must be a zero reference line for lines of 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 Greenwich (pronounced "Gren-ich"), England.

Why on Earth Greenwich? By 1884, 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, mainly because most nautical charts at the time already used Greenwich as Prime Meridian. The Royal Astronomical Observatory in Greenwich had state-of-art equipment, including the Transit Circle telescope whose crosshairs would exactly define the longitude 0° for the world. The 1884 conference also established the world's 24-hour time system, with all time zones referring back to Greenwich Mean Time (GMT; also referred to as Coordinated Universal Time, or UTC) on the Prime Meridian. You can straddle the Prime Meridian line in the Observatory so that one foot is in the Eastern Hemisphere and one foot in the Western. Being in the world center of time and space is an appropriate metaphor for how Britain saw herself in 1884. Others, especially rival and frequent enemy France, saw Britain differently. France abstained from the vote on Greenwich. (see Geographic Spotlight, **page 13**)

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 the Earth's surface eastward from the Prime Meridian to 180° is in the **Eastern Hemisphere**, and all of the 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 in a single time zone; see Figure 8.2, **page 370**). 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 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 the feature on **page 14**.

Projections

The truest and most reliable cartographic representation of Earth is a globe. But you can't be carrying a globe to class, and to depict Earth we unfortunately almost always have to flatten it out. Think of peeling an orange and pressing the peel, representing the surface of the Earth, onto a piece of paper (as in Figure 1.8f on **page 15**); the spread-out peel represents the sphere but cannot recreate its shape. How do cartographers render our 3D planet in two dimensions? Because the Earth is spherical, any map created on a flat surface will inevitably have some distortion. **Map projections** are mathematical applications to minimize this distortion. There are thousands of projections, but there is no single "correct" or "perfect" projection for any particular map. All flat maps have varying amounts of distortion among the four basic properties of a globe: area, shape, distance, and direction. On large-scale maps (such as a map of a city), the distortions are small enough that they may be disregarded for most purposes, but on maps of smaller scales (countries, continents, the entire world) distortion becomes a greater problem as the scale becomes smaller.

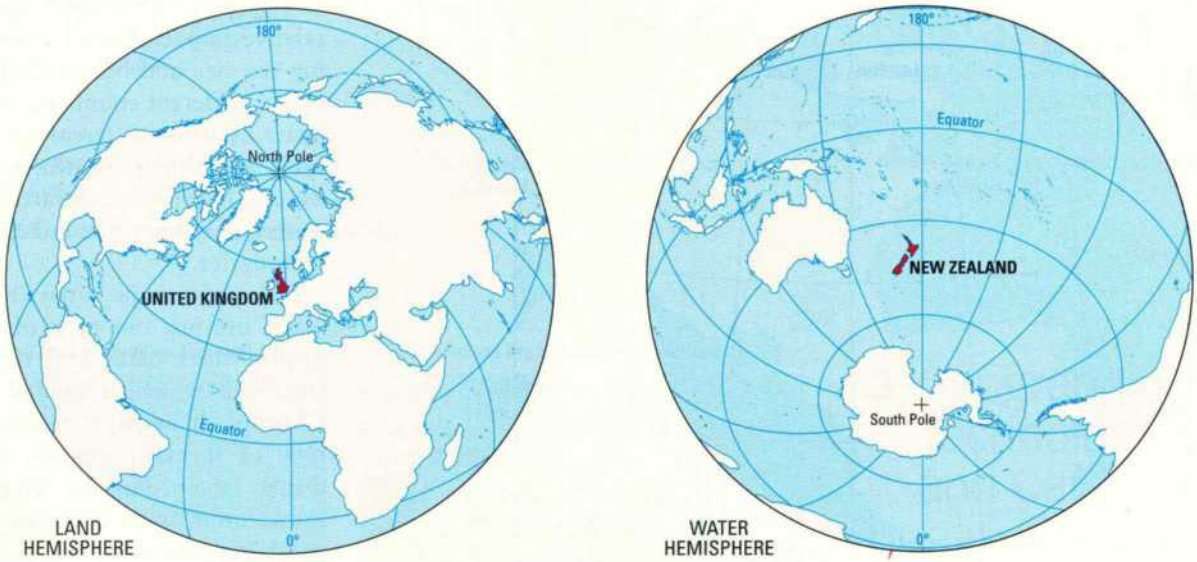
Most projections work by transferring the features of the spherical Earth onto a "developable surface" (a geometric surface that can be flattened into a plane without tearing or stretching) such as a plane, cylinder, or cone. These projections are referred to as **azimuthal**, **cylindrical**, and **conic**, respectively (there are also notable subsets of these categories, such as pseudocylindrical and polyconic). See **•Figure 1.8** for examples of these projections. A few projections are

Geographic Spotlight Core Location and Peripheral Location

Among the geographical concepts used throughout this book are those of **core location** and **peripheral location** (the region of Europe is subdivided along these lines, for example). Some locales have greater importance in local, regional, or world affairs because they have a central, or core, location 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 (• **Figure 1.A**). Both are island countries. Their climates are remarkably similar, although they are in opposite **hemispheres** (half spheres) and are about as far apart as two places on Earth can be. Westerly winds blow off the surrounding seas, bringing abundant rain and moderate temperatures throughout the year to both.

But there are important differences. The United Kingdom is located in the Northern Hemisphere, which has the bulk of the world's land (it is sometimes described as Earth's **land hemisphere**) 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 (sometimes known as Earth's **water hemisphere**) and off the beaten track of the globe's economic activity.

As Figure 1.A illustrates well, the United Kingdom is located near the center of the world's landmasses. Only a narrow channel separates it 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 2.11). 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 central, or core, location in the modern framework of human activity on Earth, whereas New Zealand has a peripheral location.



• **Figure 1.A** 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.

"interrupted," instead of contiguous; the most well known of these is Goode's Homolosine, which has a "peeled orange" look (see **Figure 1.8f**).

Projections are also classified by which metric property they preserve (or distort the least). **Conformal projections,** which include the Mercator projection discussed in the feature on **page 16**, 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 to all other points. Map projections that do not preserve any one metric, or 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 (**Figure 1.3** is an example) is a compromise projection.

Another important property of a map is its **orientation,** the relationship between the direction on the map and the corresponding compass directions in reality. Almost all maps place north at the top, but there are sometimes reasons to orient a

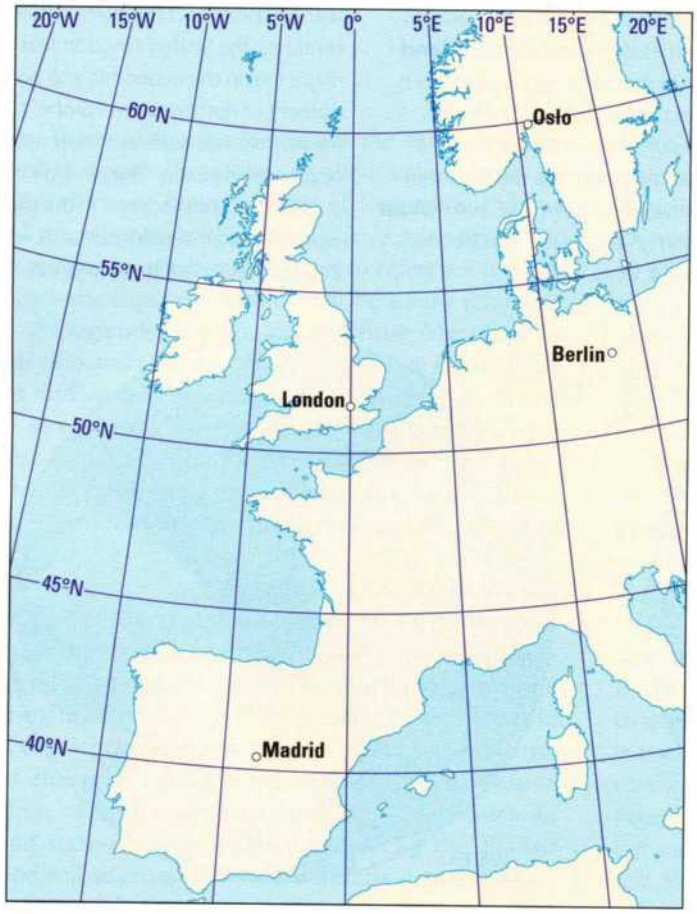
Try it Latitude and Longitude

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

On the map in •**Figure 1.B**, 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 (north/south; east/west) is Oslo located?[18]

The answer is in note 18 on **page 23**. Understanding absolute location is a simple and indispensible part of the language of maps.



• **Figure 1.B** What are the approximate latitude and longitude coordinates of Oslo, Norway? (The answer is in note 18 on page 23.)

map differently, and it is possible to present a different perception of geographical space by changing a map's orientation. There are some radical orientations that literally turn the world upside down. One of the most interesting is Australian—the "What's Up? South" world map with south at the top, that you may find easily in an Internet search.

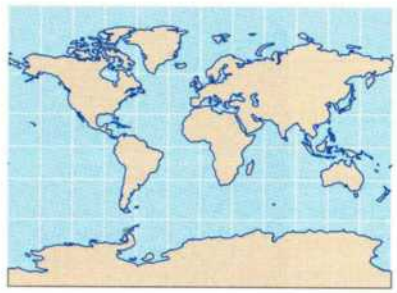
Symbolization

Maps allow us to get information, to see patterns of distribution, and to compare these patterns with one another. But no map can be a complete record of a given area. In a process called "cartographic abstraction," the map's cartographer chooses important details to convey the map's information. As a map user, you must keep in mind that no map can be complete and that many details must be simplified or omitted to keep a map legible. All maps must "lie" to some degree to inform their readers (a truth that is told in an interesting book entitled *How to Lie with Maps*). In some instances, you should look at maps very critically, in case details are altered or left out in order to deceive you. Could a "hidden agenda" be lurking in a map you're looking at? See •**Figure 1.9** on **page 15**, and the issue of Israel not appearing on some maps in note 19.

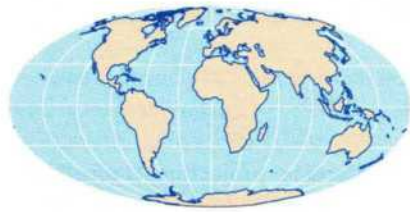
Symbolization refers to the need for geographic features shown on maps to be represented by symbols, such as lines, fills, shapes, colors, and type. For example, the political map of Europe in Figure 4.2 indicates the relative importance of cities by varying the size and boldness of the type, makes different countries easier to tell apart by using different fill colors for each, and shows coastlines and rivers as solid blue lines, contrasting with the dashed gray lines that indicate country boundaries.

Thematic maps often (but not always) use just one type of symbol to display their data, and they can be 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 (Figure 3.8 on **page 57**). **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. See **Figure 4.50**, showing the distribution of the Roma people across Europe, for an example. **Dot density maps** (such as Figure 3.21, the map of world population, on **page 75**) use dots to represent a stated amount of some phenomenon within a political unit (for example, if one dot equaled 1000 people, twelve dots in an area would indicate 12,000 people). **Flow maps** use arrows of various widths to indicate the movement of people or goods from one area to another (see Figure 6.41, the map of the movements of Palestinian refugees, on **page 251**).

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

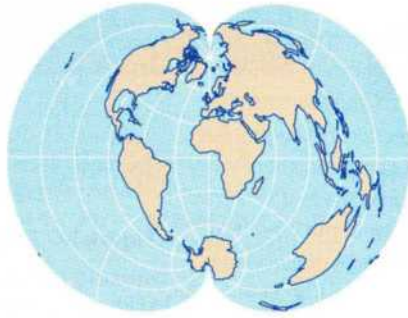


(b) A cylindrical projection (Miller)



(c) A pseudocylindrical projection (Mollweide)

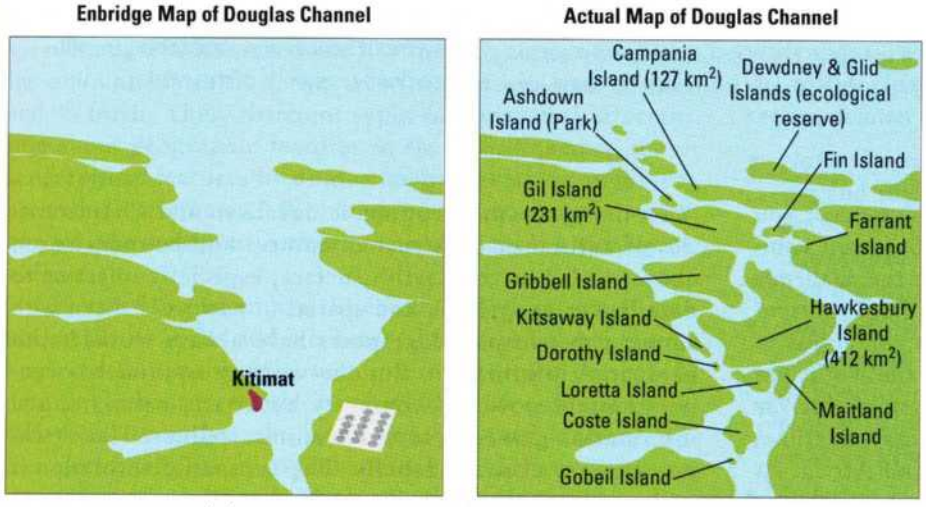
(d) A conic projection (Albers Equal-Area Conic)



(e) A polyconic projection (American Polyconic)

(f) An interrupted projection (Goode Homolosine)

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



• **Figure 1.9** Maps are not always objective renditions of the landscape. Some have an agenda, and it is possible to "lie" with maps. **(a)** Depicts an open, easy access to the sea through the Douglas Channel, while **(b)** depicts a passage with islands that require ships to navigate with caution.

Source: http://sumofus.org/campaigns/enbridge/?sub=fb.

THINKING CRITICALLY: The Canadian energy company Enbridge wants to ship oil out of Kitimat, British Columbia. A straight channel without islands would minimize the prospect of a catastrophic oil spill. Such geographic conditions, as suggested in the Enbridge map of this area **(a)**, would help win public and regulatory approval for this energy project. **(b)** Includes more islands in the passage, reflecting site and situation more accurately. What's going on here? To turn Fritz Gritzner's phrase, "What is not where, why not there, and why care?"

1.3 Geographic Technologies and Careers

To close this chapter, we turn to some of the most innovative tools and breakthroughs in geography and consider how you (or someone you know) might become part of the action in this growing field. This section will also open your eyes to some of the newest tools for gaining both an easier and deeper understanding of the world's regional geographies. The opportunities that may open to you by studying geography are abundant and exciting.

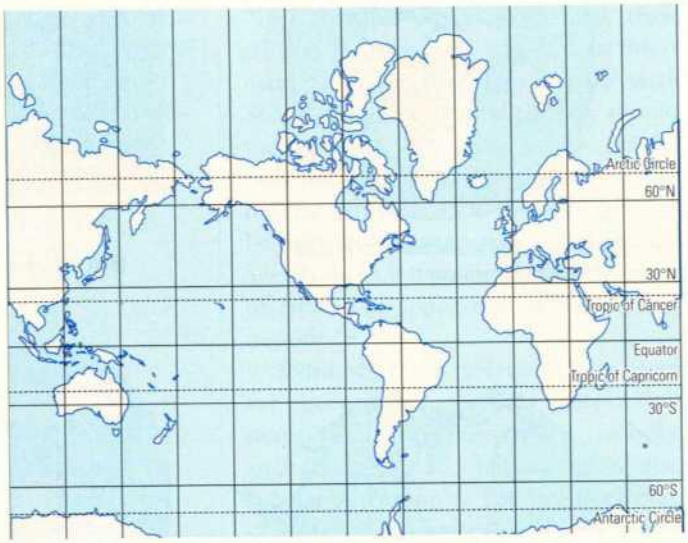
The Geospatial Revolution

In recent decades, technological advances in the field of geography and related sciences have 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

Geographic Spotlight The Mercator Projection

The most widely recognized map projection is the one developed by Gerardus Mercator in 1569. Mercator (1512–1594) developed his cylindrical, conformal **Mercator projection** (**Figure 1.C**) mainly for navigational use: it was designed to show lines of constant compass bearing (known as "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 water navigation today. However, the projection's usefulness at sea makes it 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!

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 map images, 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 mid-northern latitudes made it very popular in the West during the age of European colonialism. The Mercator projection was long accepted as being "authoritative," and intentionally or otherwise conveyed a geographic sense of Western dominance of the world. Although some people are slow to abandon it for less distorted projections, the Mercator projection is fading in part because of such perceived biases. 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.



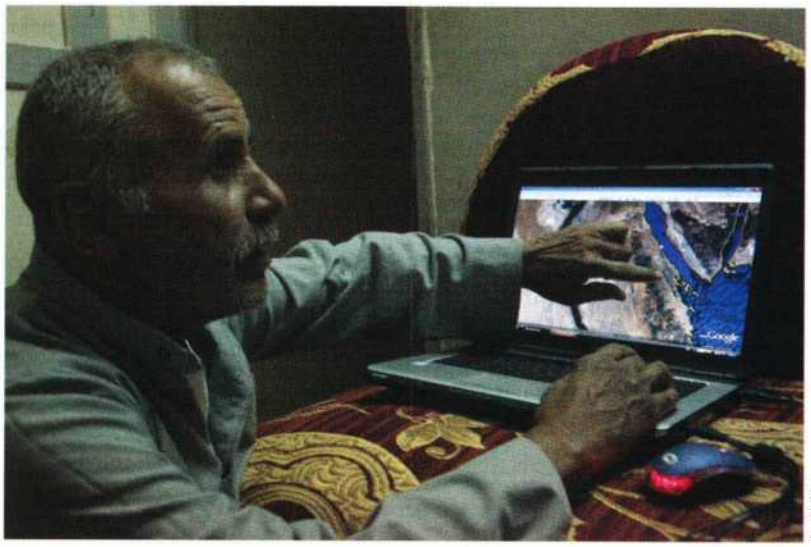
• **Figure 1.C** The Mercator Projection.

THINKING CRITICALLY: Examine the Mercator projection of the world in Figure 1.C, and compare it with other projections in Figure 1.8. What issues do you see with Mercator and the similar cylindrical projection in Figure 1.8b? What about that issue of the size of Greenland? Do you see why we favor the Winkel Tripel projection used in Figure 1.3?

information on the Web, they have been democratized: you can use the power of geographic tools on your own computer, tablet, or smartphone, and even accept the challenge of *Wikimapia: "Let's Describe the Whole World!"* (http://wikimapia.org). Digital cartography has given you access to newer, better, and more accurate maps than the world has ever seen. Lost perhaps are the romance and mystery of *terrae incognitae*, the unknown lands inscribed across sometimes vast regions of old maps of South America and Africa. As recently as the 1980s, I worked in the deserts of Egypt with very old, small-scale paper maps where large wilderness areas were blank. My nomadic Bedouin desert companions and I spent much time walking, talking, and filming to fill in these blanks. We could not have foreseen that 30 years later technology would allow us to probe the remotest corners of their vast territory. Recently, one of these old Bedouin friends, now settled down, gave me a tour of his desert, using Google Earth on his laptop! (•**Figure 1.10**)

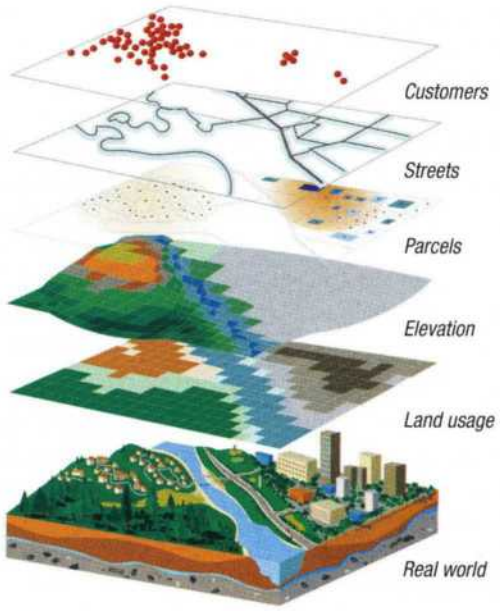
A relatively new term relates to most of these technological advances: **geospatial**. This adjective *geospatial* means "pertaining to the geographic location and characteristics of natural or constructed features and boundaries on, above, or below the Earth's surface, especially referring to data that is geographic and spatial in nature."[20] 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. These technologies are evolving rapidly. The geospatial revolution is still underway, and it will touch your life in many ways. Chances are that you have used or seen a GPS device in a car or on a mobile device in hand. You have probably looked up directions on Google Maps or MapQuest. Underlying these devices and applications are enormous and sophisticated technologies. Two of the most important geospatial technologies are geographic information systems (GIS) and remote sensing.

GIS—the familiar acronym for **geographic information systems**—is a computerized data management system that allows people to create, capture, retrieve, manipulate,



Joe Hobbs

• **Figure 1.10** Abdel Zaahir Sulimaan 'Awda of the Khushmaan Ma'aza Tribe in his home in Hurghada, on Egypt's Red Sea Coast. I was astonished when he pulled out his laptop, powered it up, and used Google Earth to show me around the rugged desert wilderness of the Ma'aza. Thirty years earlier, when his family was nomadic, I walked with him in that desert, and we used primitive paper maps to find our way to the summit of mainland Egypt's highest mountain, Shaayib al Banaat (2187 m). And now we correspond on Facebook!



• **Figure 1.11** Geographic information systems (GIS) create and use layers of spatial data. GIS data, images, and models have an enormous range of applications.

analyze, view, and display spatial information. GIS is our discipline's leading area of growth and employment because of its value in addressing so many real-world problems. Like a conventional paper map, a GIS view can offer you a road map. But do a mouse click on the road, and you unleash the power of GIS: Up comes a box displaying the road's 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; and so forth. These different types of nonspatial information about geographic features in the GIS, linked to those geographical features by unique identifiers stored in tables, are called "attributes." People spend an enormous amount of time and energy to compile these data from a variety of sources.

GIS data are created and displayed in "layers"—databases storing the locations and attributes of features belonging to a single theme (for example, with layers showing a company's potential customers, the streets on which those customers live, their land ownership, the land's elevation, and land uses in their community, as in •**Figure 1.11**). A GIS can have dozens of layers displaying all kinds of geospatial data for a given area. GIS users can select and highlight certain attributes in various layers that relate to their interests or analysis, while turning off those attributes that are not needed. The ability to query and selectively view certain types of geospatial data, as well as to add other data (such as from a handheld GPS device, from a digitized paper map, or from an image taken by an orbiting satellite), allows users to see spatial relationships with extraordinary ease and clarity. The knowledge they gain from understanding geographic relationships is extremely valuable for decision making and explains why GIS is known as a "critical thinking technology" (see Geographic Spotlight GIS in Action on **page 19**).

GIS makes it possible to see geographic patterns, problems, and connections easily and efficiently—a capability that Esri, the world's largest GIS software maker, calls "The Geographic Advantage."[21] One of the best ways to see what GIS can do is to visit Esri's website "gis.com," where you will see many ways that GIS is being used all around you—and all around the world. Here are a few examples of the geographic advantage as defined by Esri.

- *Natural resource management.* In forestry, caring for existing and future trees ensures a steady supply of wood for the world's building needs. GIS provides tools to help determine where to cut today and where to seed tomorrow, while minimizing negative impacts.
- *Business.* Every day, businesses deliver goods and services to clients all around a city. Each truck driver needs a route of how to most efficiently visit each client. GIS provides tools to create efficient routes that save time and money and reduce pollution.
- *Defense.* In the military, leaders need to understand terrain to make decisions about how and where to deploy their troops, equipment, and expertise. They need to know which areas to avoid and which are safe. GIS provides tools to help get personnel and materials to the place where they can best do their job.
- *Emergency preparedness and response.* During floods and hurricanes, emergency response teams save lives and property. GIS provides tools to help locate shelters, distribute food and medicine, and evacuate those in need.

- *Communications and media.* In telecommunications, when phone service is out, it means part of the network may be disconnected. GIS provides tools to help find out what part of the network is affected, and brings that information to the field so workers can get everyone talking again.
- *Planning.* Planners of all kinds—business analysts, city planners, environmental planners, and strategists from all organizations—use GIS to lay out a framework so that growth can occur in a managed way. As you will see in Chapter 7, GIS can even help us plan for a warmer world in which rising sea levels threaten to flood coastal cities and farms.

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Remote sensing, also known as *Earth observation*, is the science of acquiring information about the 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 (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 gleaned from satellite 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 satellite-emitted radio waves bouncing off of ground features) and lidar (light detecting and ranging, which uses light in the same way) are also examples of remote sensing.

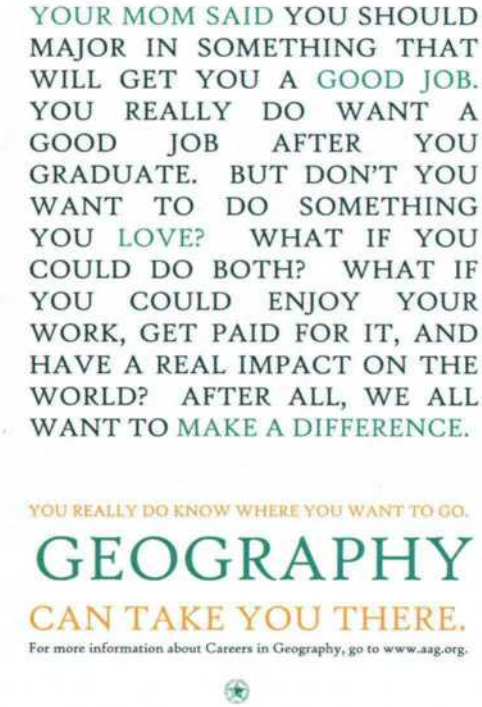
Remote sensing is an exceptionally good tool for helping geographers understand how people and natural processes modify the Earth. This book uses remote sensing to introduce you to many places, patterns, and problems. "A picture is worth a thousand words," the adage says, and remote sensing images like those you see in Google Earth go far in describing natural and cultural landscapes (see Geographic Spotlight on **page 20**, and Try It on **page 21**).

Careers in Geography

This striking poster in •**Figure 1.12** was produced by the Association of American Geographers, using data about how young people in the United States choose their career paths.[25] The employment trends in favor of geography since 2000 have been remarkable. The US Department of Labor has identified 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.[26]

Much of this job growth is in professions in which people feel like they can have a positive impact. The Association of American Geographers had these observations of 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 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.[27]



• **Figure 1.12** Geography is awesome.

Source: Dr. Patricia Solis, Association of American 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.

More and more students are graduating with geography degrees—bachelors, masters, and doctoral—and more of them are finding jobs. At my *alma mater*, the University of Texas at Austin, recent B.A. grads in geography have become a Nature Conservancy preserve manager, a transportation planner, a natural science teacher, and a geospatial engineer. Masters students became a US Geological Survey water specialist, the chief executive officer of an insurance company in the West Indies, and a vice president for market research in real estate. Many Ph.D. graduates became geography professors (ask your prof which of the 60 specialty groups of the AAG she or he belongs to), whereas others took executive positions in GIS departments and companies or became decision makers in foundations and research institutions all around the world.[28] Every

Geographic Spotlight GIS in Action

The geographic advantages of the geospatial revolution can be deployed to peer into the future and to reveal the past, and to help us understand the spatial affiliations of both modern, complex, and globalized peoples and of traditional peoples practicing a subsistence economy. One of the most remarkable applications of GIS, and one that clearly employs the geographic advantage, is the documentation of indigenous geographical knowledge. The Inupiat people of Alaska's North Slope are dealing with unprecedented changes in the Arctic environment that, as we will see in the next chapter, are related to global processes of climate change. Anxious to preserve their highly detailed and previously undocumented environmental knowledge for future generations, they have asked geographers to create a GIS database of indigenous knowledge. The response is the **Arctic Cultural Geography Project**, funded by the National Science Foundation. In videotaped interviews, more than 50 Inupiat elders, hunters, and berry pickers discussed their activities, landforms, environmental changes, and other issues, and identified related locations of satellite images and topographic maps (• **Figure 1.D**). Geographers categorized and created GIS attributes on appropriate layers. Endowed with this detailed and deep body of knowledge, geographers and other scientists are using these data to understand climate change, landform processes, and other problems. The Inupiat are using this body of knowledge for educational and resource management tools.

In many places around the world where indigenous and local peoples retain traditional knowledge and practices, there are opportunities like this to render indigenous mental maps as geospatial data and put them to practical, beneficial use. It is vital at the same time to ensure this information is not used for nefarious purposes. In the Inupiat case, you may view the GIS at http://www.arcticmapping.org, but only after explaining your interest in a short email.

Dr. Wendy R. Eisner

• **Figure 1.D** Interviewing an Inupiaq elder in the Arctic Mapping Project.

year we see growing numbers of undergraduate students in our Geography Department's courses positioning themselves for careers in geospatial intelligence (GEOINT) and human intelligence (HUMINT) in the federal government's intelligence agencies.

In this chapter, we have seen clearly that Geography is *a lot* more than rote memorization of state capitals. What do you think are the most important questions facing the world today? Chances are that some of yours will overlap with the AAG's eleven "strategic research directions" for students and scientists in Geography.[29]

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?

These are some of geography's big questions, and we will begin to answer *all* of them in the next two chapters and beyond. By examining and answering these questions in the context of world regional geography, you will gain deep and lasting insights into what cosmologist Carl Sagan described as that "pale blue dot" in which "we float like a mote of dust in the morning sky":[30]

> 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.

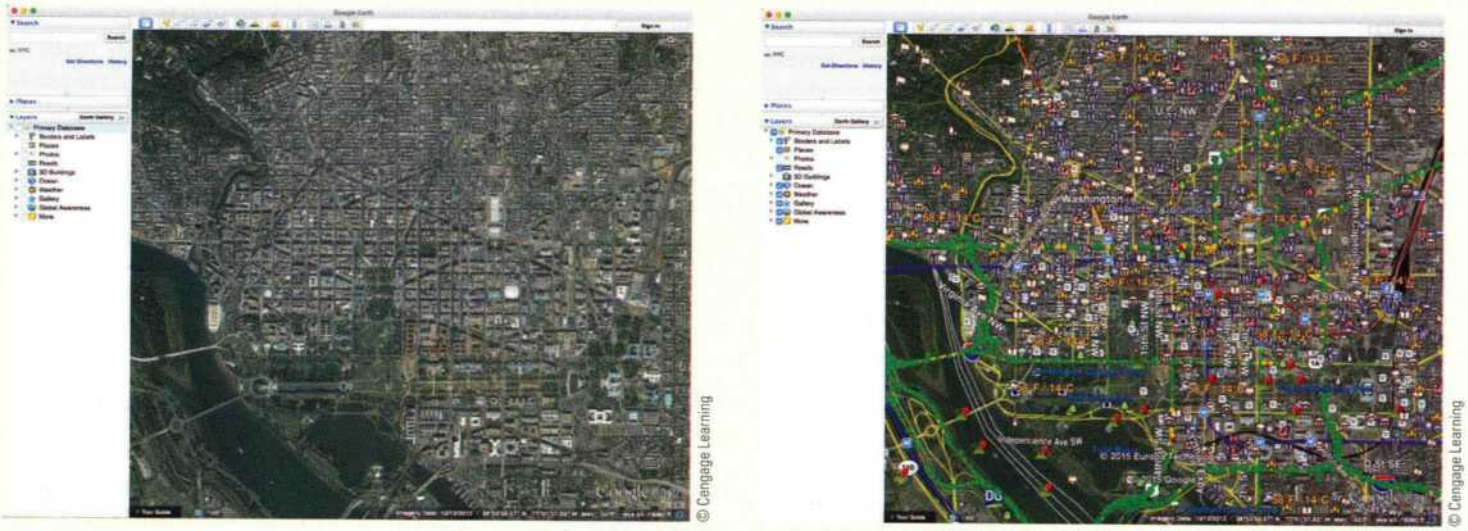
Geographic Spotlight Google Earth

There are two tools that 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 true 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 learn about the Earth and remember what you learn.

The other tool is a virtual globe, map, and geographic information software program like Google Earth or NASA's World Wind (• **Figures 1.E** and **1.F**). If you have not already done so (and if you have permission to do so), on the PC or Mac, navigate to *earth.google.com* (apps are also available for most smartphones and tablets). Download the free Google Earth application, open it, bookmark it, and use it often—*PLEASE!* With Google Earth you are in control of an easy-to-use but incredibly powerful geospatial set of tools. It is so powerful, in fact, that it enables you to become a rather effective spy: you can see not only your home or apartment, but also top secret North Korean and Iranian nuclear facilities. A Russian intelligence official said of Google Earth, "Terrorists don't need to reconnoiter their target. Now an American company is working for them."[22]

By the way, when I photograph a bridge, power plant, or dam (as I do often, thinking I might use the photo in one of my classes or for this book), I am sometimes detained and questioned by security guards (this has happened in Ethiopia, Egypt, Lebanon, and even at the Navajo power plant in Arizona (see **page 545**); and so far, I have thankfully been released, without having to give up any photos). That is ironic, considering what Google Earth can do.

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. And although Google Earth is not a full-fledged GIS (it can display geographic information, but cannot analyze or modify that data), 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. You might also be interested in the "global awareness" layer that lets you explore some of the world's environmental problems. 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]



• **Figures 1.E and 1.F** Opening Google Earth without (E) and with (F) layers checked to view Washington, DC.

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.

—Carl Sagan

Reading the Landscape with Remote Sensing Try it

Remote sensing images have a way of bringing out the detective in us. Have a look at the before and after remote sensing images of Sendai, a town in northeastern Japan. • **Figure 1.G** is an image taken on April 4, 2010, by a satellite about 450 miles above the Earth. • **Figure 1.H** shows how nature reclaimed Sendai. On March 11, 2011, a magnitude 9.0 earthquake thrust a section of the Earth's crust upward from the seafloor about 80 miles from Sendai. The displaced water roared ashore as devastating tsunami waves as high as 40 feet. Compare Figures 1.G and 1.H, examining and describing the details of the cultural landscape and its transformation. Use the "before" remotely sensed image of Sendai (**Figure 1.G**) to make some of your own observations about the Japanese cultural landscape.

Use the "after" image of Figure 1.H to observe changes that this natural disaster wrought on Sendai. I have written some of my own observations in note 24.

GeoEye/EyeQ

GeoEye/EyeQ

• **Figures 1.G and 1.H** The shoreline of Sendai, Japan, before and after the gigantic earthquake and tsunami on March 11, 2011.

Study Guide

Summary

- Recent studies suggest that US citizens generally have poor knowledge of world geography. More and better geographic knowledge would serve us well in many contexts.
- 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.
- Geography means "description of the Earth" and is also defined as "the study of the Earth as the home of humankind."
- Five main objectives of the text are for readers (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 the geographers' most basic tools. The basic 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 face of the Earth.
- The discipline of geography may be divided into regional and systematic specialties, with the systematic fields having the most followers. Their concerns overlap many disciplines in the natural and social sciences. Geographers are employed in many private and public capacities. The strongest growth area with the most jobs is in geographic information systems (GIS).

Review Questions

1. What is geography? Is it usually classified as a natural or a social science? What are some of its characteristic approaches?
2. 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 eighteen standards help inform geographic literacy?
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?

Key Terms + Concepts

Antarctic Circle (p. 11)
Arctic Circle (p. 11)
Arctic Cultural Geography Project (p. 19)
Association of American Geographers (AAG) (p. 5)
cartography (p. 9)
choropleth map (p. 14)
coordinate systems (p. 11)
core location (p. 13)
cultural landscape (p. 7)
culture (p. 7)
degrees (p. 11)
dot density map (p. 14)
Equator (p. 11)
Five Themes of Geography (p. 5)
flow map (p. 14)
formal region (p. 7)
functional region (p. 7)
geographic information systems (GIS) (p. 16)
geography (p. 4)
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graduated symbol map (p. 14)
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Tobler's First Law of Geography (p. 12)
Tropic of Cancer (p. 11)
Tropic of Capricorn (p. 11)
uniform region (p. 7)
vernacular region (p. 7)
world regional approach (p. 7)

Notes

1. Personal communication between Hal Mooney and Tom Wilbanks, cited in *Understanding the Changing Planet: Strategic Directions for the Geographical Sciences* (2010). National Academies Press.
2. 2014 Americans: Ukraine is in . . . Greenland? http://www.bbc.com/news/blogs-echochambers-26943479, BBC Online, April 8, 2014 (on misplacing Greenland).
3. Netflix.com description of film *Geography Club*.
4. Charles F. Gritzner, "Defining Geography: What Is Where, Why There and Why Care?" AP Central, accessed September 10, 2014, http://apcentral.collegeboard.com/apc/members/courses/teachers_corner/155012.html.
5. Secretary of Defense Speech, US Department of Defense, http://www.defense.gov/speeches/speech.aspx?speechid=1539.
6. David Rothkopf, "Obama's 'Don't Do Stupid Shit' Foreign Policy." June 4, 2014. http://foreignpolicy.com/2014/06/04/obamas-dont-do-stupid-shit-foreign-policy.
7. 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 ("before the Common Era") and CE ("Common Era"), respectively, but the years are numbered the same in the two systems.

8. National Council for Geographic Education. The Eighteen National Geography Standards, http://www.ncge.org/publications/tutorial/standards/.
9. To learn more about the Five Themes, visit the National Geographic Society's Education FAQ at http://education.nationalgeographic.com/education/faq/?ar_a=1.
10. http://education.nationalgeographic.com/education/faq/?ar_a=1.
11. Quoted in Geoffrey J. Martin and Preston E. James, *All Possible Worlds: A History of Geographical Ideas* (New York: Wiley, 1993), p. 150.
12. Quoted in Andrew Goudie, *The Human Impact on the Natural Environment* (Oxford: Blackwell, 1986), p. 6.
13. Kathleen A. Dahl, "Culture," https://docs.google.com/viewer?a=v&pid=sites&srcid=ZW91LmVkdXxrYXRobGVlbi1kYWhsfGd4OjMyOTM4NDFlNjdhZTJhZWU.
14. Dictionary.com, "critical thinking," in Dictionary.com's 21st Century Lexicon, accessed June 22, 2013, from http://dictionary.reference.com/browse/criticalthinking.
15. This definition is by Robert Strausz-Hupé, *Geopolitics: The Struggle for Space and Power. Foreign Affairs* (New York: Arno Press, October 1942).
16. This is a rehearsal for a community cultural event in the city of Ha Giang in northern Vietnam. By looking at faces, you may conclude this place is in Asia. Other clues would call on your knowledge of Vietnam's recent past, when North Vietnam's communist forces, led by Ho Chi Minh, prevailed in a war with the US-backed South Vietnamese government (see page 344). "Uncle Ho's" name appears on the right in Vietnamese language, which has a "romanized" script. Ho Chi Minh also strikes a heroic prose in the statuary. The predominant ethnic group here is Hmong, and you can see Hmong flutes being waved by a number of the participants. The luxuriant vegetation around this park points to a humid region, as do the peoples' umbrellas.
17. Waldo Tobler, "On the First Law of Geography: A Reply," *Annals of the Association of American Geographers*, 94(2), 2004, pp. 304–310.
18. Using this map, you should determine Oslo's location as about 60 degrees north, 11 degrees east (60°N, 11°E). Oslo is therefore in the Northern Hemisphere, the Eastern Hemisphere, and the land hemisphere.
19. Activist David Eaves proposes that Enbridge is "lying with maps;" see his blog at http://eaves.ca/2012/08/15/lying-with-maps-how-enbridge-is-misleading-the-public-in-its-ads/. In 2015, the publisher HarperCollins was widely criticized for omitting the political name "Israel" in a world atlas designed to be used in the Arab Gulf States of the Middle East. It is still common in the Arab World to see maps omitting the name "Israel," instead leaving the land area blank or using the label "Palestine." This reflects regional animosities dating back to the 1967 Arab-Israeli War. HarperCollins quickly pulled the Atlas from circulation when this controversy emerged.
20. Defined in www.dictionary.com.
21. Esri, at www.gisday.com/cd2009/fliers/what_is_gis.pdf.
22. Lieutenant General Leonid Sazhin, Federal Security Service, quoted in Katie Hafner and Saritha Rai, "Google Offers a Bird's-Eye View, and Some Governments Tremble," *New York Times*, December 20, 2005, p. 1.
23. http://gawker.com/5191459/cheating-husband-said-caught-via-google-street-view.
24. Each person may see different features in these images. Here are some of the things I see; what about you? Figure 1.E is a remotely sensed snapshot of a Japanese cultural landscape. Just inland from the concrete wave breakers and scalloped shoreline, people have built homes between a greenbelt of trees and an irrigation canal. The canal is a straight and uniform feature—a good indication that it is the handiwork of people rather than of nature. Bridges and streets also stand out as built features. Continuing westward (left) across the image, you see many more homes, including some nestled against a patch of trees (the Japanese prize their forests and go to great lengths to protect them). Finally, at the far left of the image, the long brown rows of empty land are fields for wet rice, which would become green when planted and irrigated from the nearby canal. This satellite image provides an excellent snapshot of how the people of Japan have modified nature to suit their needs. Figure 1.F shows in breathtaking fashion how nature reclaimed Sendai: almost every feature on the landscape, both natural and cultural, has been destroyed or transformed by the tsunami waves. You can describe this destruction feature by feature, using the terms *before* and *after*.
25. http://www.aag.org/cs/jobs_and_careers/geography_can_take_you_there.
26. http://www.doleta.gov/brg/indprof/geospatial_profile.cfm.
27. 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: The National Academies Press, 2010).
28. Information courtesy of Bill Doolittle, University of Texas at Austin.
29. National Academies Press. *Understanding the Changing Planet: Strategic Directions for the Geographical Sciences* (Washington, DC: National Academies Press, 2010).
30. Carl Sagan, *Pale Blue Dot: A Vision of the Human Future in Space*, http://www.goodreads.com/author/show/10538.Carl_Sagan.

Global Geoscience Watch

Global Geoscience Watch is your portal into the full GREENR database (Global Reference on the Environment, Energy, and Natural Resources). For starters, take a tour of the interactive Google Map found at the top of the GREENR database home page. Click on the "World Map" menu item found on the Global Geoscience Watch homepage. Chapters 4–11 of the text cover eight major regions of the world. Refer to the Table of Contents and select one of these regions to explore on the interactive map. Explore that region on the map by identifying and reviewing maps of countries in the region. Click some of the "pins" on the county maps to see the extensive information available within GREENR database. Write a paragraph about what you were able to learn from this exercise. Include the names of the countries you explored in your tour of the database.

Online Resources

For access to MindTap and additional study materials visit www.cengagebrain.com. Read your textbook, take notes, complete activities, take practice quizzes and more.