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INSIGHT FEATURES

Multi-part visual presentations that focus on a key concept or topic in the chapter

Chapter 1
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Diamond production and consumption

Chapter 3
Population densities
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Word usage and dialect regions in the U.S.

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PROCESS DIAGRAMS

A series or combination of figures and photos that describe and depict a complex process

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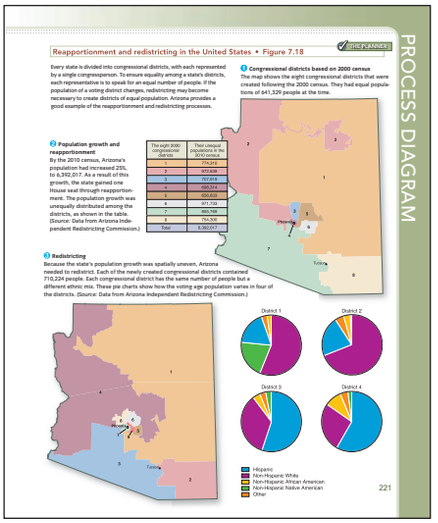

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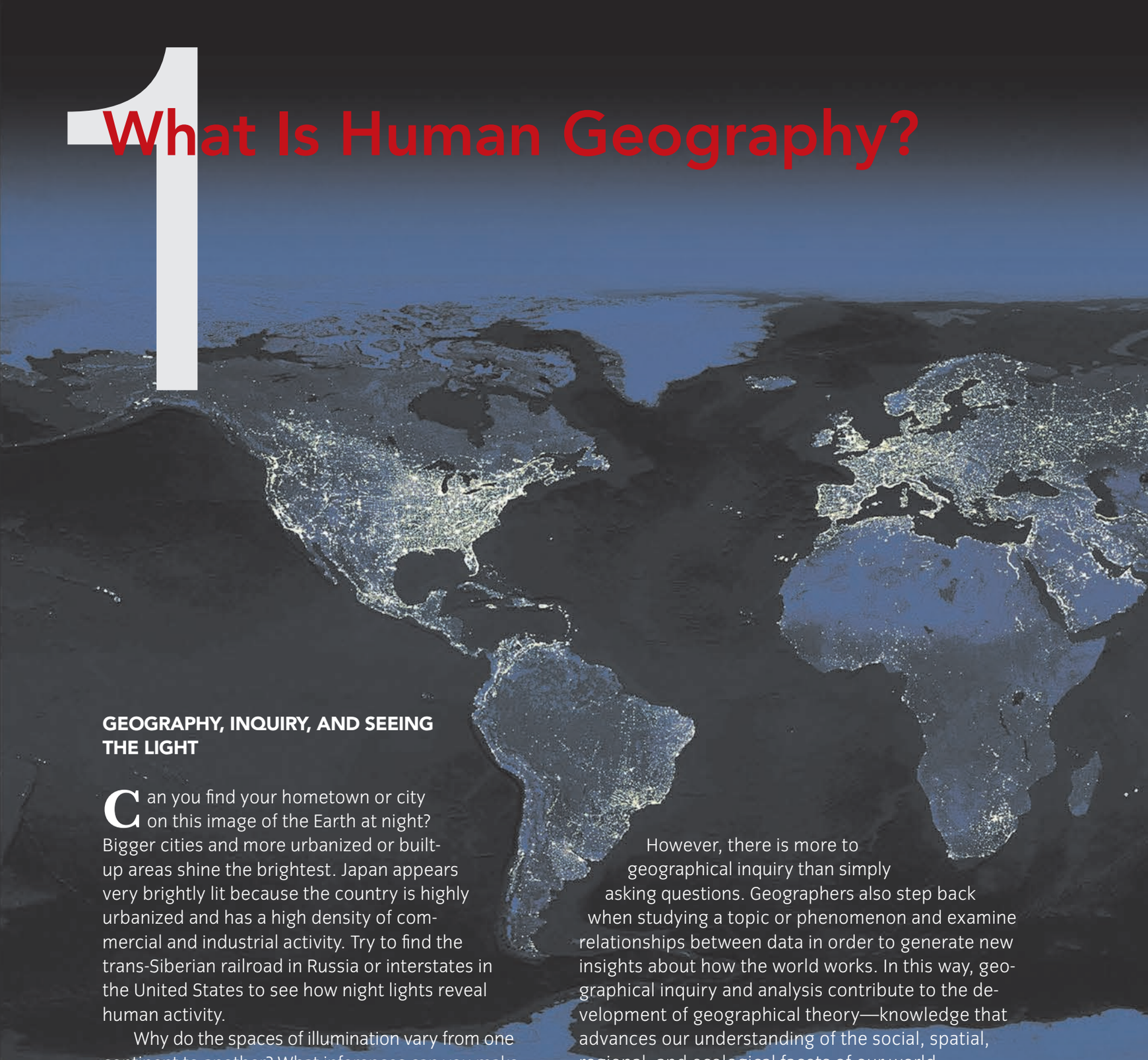
SECOND EDITION

VISUALIZING HUMAN GEOGRAPHY

1 What Is Human Geography?



GEOGRAPHY, INQUIRY, AND SEEING THE LIGHT

Can you find your hometown or city on this image of the Earth at night? Bigger cities and more urbanized or built-up areas shine the brightest. Japan appears very brightly lit because the country is highly urbanized and has a high density of commercial and industrial activity. Try to find the trans-Siberian railroad in Russia or interstates in the United States to see how night lights reveal human activity.

Why do the spaces of illumination vary from one continent to another? What inferences can you make about well-lit places and settlement patterns, wealth, or environmental modification? Geographers ask these and similar kinds of questions. Embedded within such questions are concepts relating to location, place, space, region, scale, distribution, and interconnectedness. Thus, geographical inquiry has its roots in a fundamental curiosity about the world.

However, there is more to geographical inquiry than simply asking questions. Geographers also step back when studying a topic or phenomenon and examine relationships between data in order to generate new insights about how the world works. In this way, geographical inquiry and analysis contribute to the development of geographical theory—knowledge that advances our understanding of the social, spatial, regional, and ecological facets of our world.

Simply stated, this book is designed to introduce you to geographical inquiry and theory through a perspective that emphasizes people and the spatial variation in their activities around the world. This chapter introduces human geography and illustrates how geographers approach their work, including some of the tools they use.

Data courtesy Marc Imhoff of NASA GSFC and Christopher Elvidge of NOAA NGDC. Image by Craig Mayhew and Robert Simmon, NASA GSFC

CHAPTER OUTLINE

CHAPTER PLANNER

- ❑ Study the picture and read the opening story.
- ❑ Scan the Learning Objectives in each section:
  p. 4 ❑ p. 12 ❑ p. 23 ❑
- ❑ Read the text and study all visuals.
  Answer any questions.

Analyze key features

- ❑ Geography InSight, p. 6 ❑ p. 24 ❑ p. 29 ❑
- ❑ Process Diagram, p. 16
- ❑ What a Geographer Sees, p. 21
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- ❑ Stop: Answer the Concept Checks before you go on:
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End of chapter

- ❑ Review the Summary and Key Terms.
- ❑ Answer the Critical and Creative Thinking Questions.
- ❑ Answer What is happening in this picture?
- ❑ Complete the Self-Test and check your answers.

Introducing Human Geography

LEARNING OBJECTIVES

1. **Describe** the scope of geography and its main branches of study.
2. **Outline** the four main geographical approaches to the relationship between nature and culture.
3. **Explain** how geographers study landscapes and regions.

We are going to let you in on a little secret: Geography majors go places—in their careers, that is. They also have a lot of fun in the process. This is quite likely because geography is a discipline that encourages people to find a topic or region they are passionate about and explore its many different dimensions. Are you interested in music? Music geographers are needed to understand the globalization of hip-hop as well as its local variations. If you are a sports fan, sports geographers help identify optimal locations for stadiums, golf courses, and other athletic facilities. If your passion is nutrition or health, medical geographers help track and limit the spread of epidemics and study ways to improve people's access to medical care. See *Where Geographers Click* to learn more about careers in geography.

Some nongeographers rather naively thought that globalization would make geography irrelevant. Globalization, they claimed, made the world smaller, more accessible, and therefore, easier to know and understand. Meanwhile, geographers politely noted that globalization was not a new phenomenon and that geography had, to the contrary, taken on even greater relevance. For example, understanding the consequences of global climate change on different countries, agricultural production, and coastal populations demands geographic awareness. Similarly, we cannot solve the problem of poverty until we know better its geographic dimensions—where it occurs, how spatially extensive it is, who it affects, and how it is related to access to resources, such as land, water, and housing. Globalization has moved geography to center stage. Simultaneously, improvements and innovations in technology have expanded the geographer's toolbox. These new tools include ways of acquiring data about the Earth with improved GPS receivers, higher resolution satellite imagery, and new ways of visualizing this information with virtual globes such as Google Earth.

The word *geography* derives from Greek words (*geo* + *graphia*) meaning *to write about or describe the Earth*. As previously noted, however, geography is much more than a description of the Earth or a factual listing of countries, their capitals, and resources.

Where Geographers CLICK

Visit the Jobs and Careers section of the Association of American Geographers (AAG) website for career preparation tips, job listings, and other resources.

Geography consists of two main branches: physical geography and human geography (**Figure 1.1** on the next page). Physical geography focuses on *environmental dynamics* (e.g., water quality, soil erosion, forest management) whereas **human geography** focuses on *social dynamics* (e.g., economic development, language diffusion, ethnic identity). Some physical and human geographers focus on *environment–society dynamics* and work on topics that span both branches of the discipline (e.g., vulnerability to environmental hazards, impacts of fossil fuel consumption, social consequences of global climate change). The unity of geography as a discipline stems from a shared philosophy that recognizes the urgency of better understanding the spatial aspects of human and environmental processes and using geographic knowledge to generate solutions to the social and environmental challenges in our world.

human geography
A branch of geography centered on the study of people, places, spatial variation in human activities, and the relationship between people and the environment.

Human geography, like the discipline of geography more broadly, is both a science and an art. The science of human geography stresses the importance of acquiring adequate knowledge about specific processes, events, or interactions in order to explain why they occur or produce the particular outcomes that they do. For example, a human geographer studying migration seeks to explain the causes and consequences that propelled people to move from one place to another.

In contrast, the art of human geography emphasizes a different way of knowing that focuses less on explanation and more on understanding and meaning. The human geographer studying migration also learns about the experiences of the families that migrated and the ways they dealt with challenges in order to better understand the perceptions, feelings, and meanings of the move to the people who made the journey. Thus, the artistic and scientific aspects of human geography are complementary.

Nature and Culture

What do the words *nature* and *culture* mean to you? At first they seem straightforward, but the longer you think about them the more you realize that they both have a variety of different meanings. For example, nature can refer to the intrinsic qualities of a person, or to the outdoors, and culture can refer to taste in the fine arts or to customary beliefs and practices. Because of this definitional looseness, geographer Noel Castree (2001, p. 5) calls *nature* "a promiscuous concept." The same can be said about *culture*. Nevertheless, these concepts are so fundamental to the practice of geography that we should examine them briefly here.

Very broadly speaking, **nature** is the physical environment; it is external to people and does not include them. People, because of their capacity for intellectual and moral development, are the bearers of culture, and it is culture that distinguishes people from nature. When understood in this way, these concepts yield a dualistic framework that sets nature and culture in opposition to one another.

This **nature–culture dualism** has had a significant impact on ways of thinking about social difference. During the 18th century, some European scholars used this distinction between nature and culture to argue that it was the human capacity for culture that made people *superior* to nature. This line of reasoning was subsequently extended and used to rank societies. So, for example, non-Westerners were seen as being closer to nature than so-called civilized and cultured Westerners, and therefore inferior. Although the origins of these ideas are difficult to unravel, they matter because the way we see human societies in relation to nature and to one another affects not just how we use the environment but also how we interact with others.

Today, many geographers and other social scientists reject the nature–culture dualism because of the way it separates nature from culture. These scholars stress instead that people—in spite of their capacity for culture—are very much a part of nature. This perspective is central to **cultural ecology**, an important subfield within human geography that studies the relationship between people and the natural environment.

When conceptualizing the relationship between people and nature, cultural ecologists and other geographers recognize several different approaches. We discuss four of these next: environmental determinism, possibilism, humans as modifiers of the Earth, and the Earth as a dynamic, integrated system.

Environmental determinism

The position that natural factors control the development of human physiological and mental qualities is called **environmental determinism**. We can trace the intellectual roots of environmental determinism in Western thought to the ancient Greeks, who speculated that human diversity resulted from both climatic and locational factors. For example, plateau environments seemed to produce people who were docile.

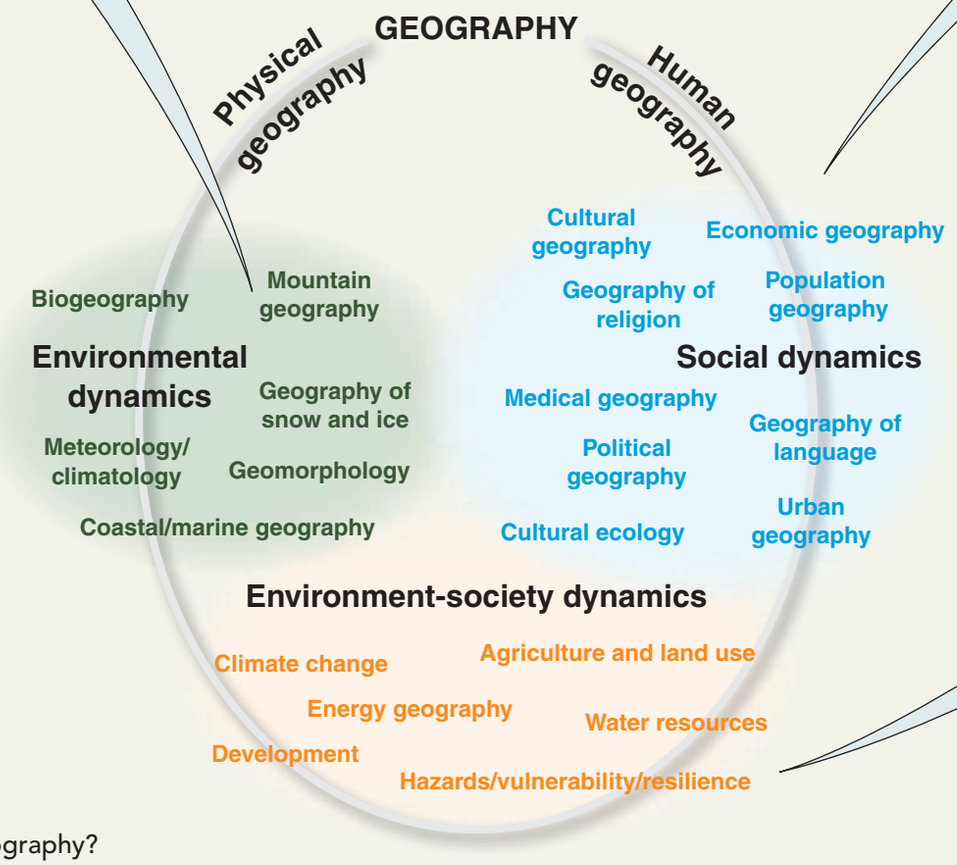
Geography InSight

The scope of geography • Figure 1.1

The two main branches of the discipline have given rise to three broad areas of emphasis. On the diagram, colored terms identify major subfields.

Stephen J. Stadler

a. Mount Vesuvius rises behind Naples
Mountain geography includes the study of alpine soils, landscapes, and environments.



b. Tourists in the Dominican Republic Economic geography studies tourism trends, patterns of trade, as well as business location data.

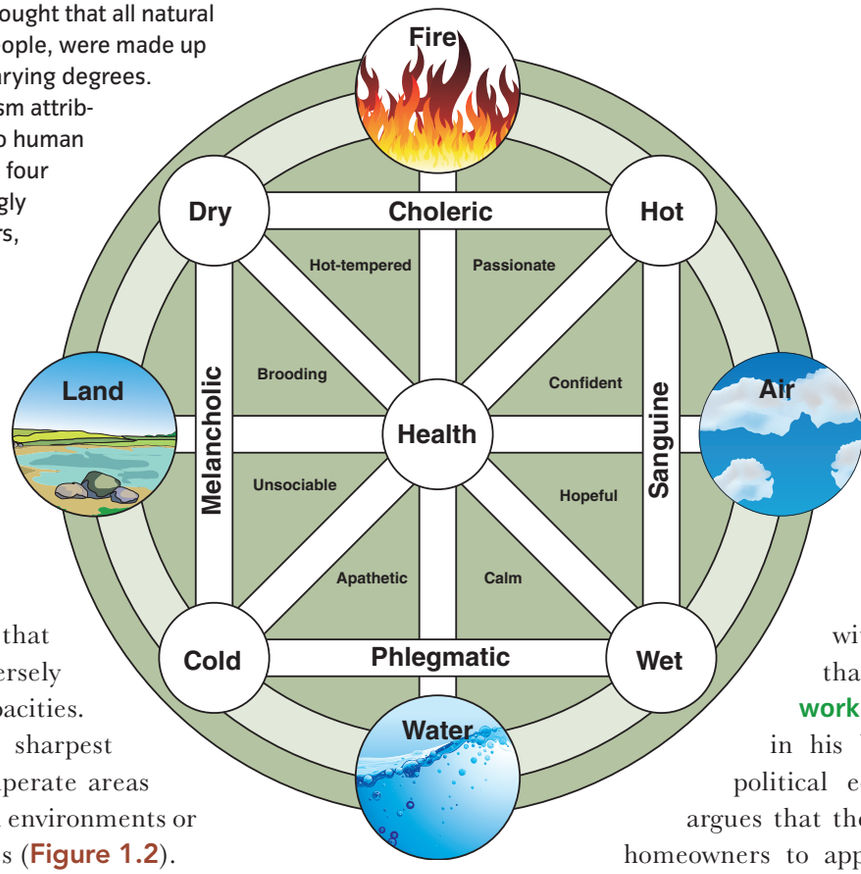
c. Devastation in Japan from the Fukushima-Daiichi nuclear accident This accident—the result of an earthquake, tsunami, and planning oversights—reveals the interconnectedness of people and the environment.

Ask Yourself

1. On the diagram, why are the borders between the different areas of emphasis shown as indistinct?
2. Using the photo in **a**, explain how the study of mountain geography could lead to a study in environment–society dynamics.

The four elements and environmental determinism • Figure 1.2

Some ancient scholars thought that all natural phenomena, including people, were made up of the four elements in varying degrees. Environmental determinism attributed cultural difference to human traits that reflected these four elements and were strongly shaped by physical factors, including climate.



Similarly, they thought that climatic extremes adversely affected mental capacities. The people with the sharpest minds came from temperate areas rather than hot, humid environments or extremely cold climates (**Figure 1.2**).

Environmental determinism prevailed among American geographers during the early 20th century and then fell quickly into disfavor. Three major criticisms of environmental determinism prompted this change in perspective. First, geographers found overly simplistic the linear, cause–effect relationship that forms the basis of environmental determinism. People, they argued, are more than automatons that simply respond to stimuli, such as the prevailing winds or temperatures in a specific place. Nonenvironmental factors, such as systems of government and law, also help explain human diversity. A second criticism of environmental determinism is that similar natural settings do not produce the same cultural practices or human behavior. Third, environmental determinism tends to contribute to ethnocentric interpretations of sociocultural differences. It is therefore not much of a surprise that some ancient Greek scholars attributed the flourishing of the Greek civilization to the temperate climate of the Mediterranean.

In recent years a radical reinterpretation of environmental determinism has emerged within **political ecology** that involves **actor–network theory**. For example, in his book *Lawn People,* the political ecologist Paul Robbins argues that the decision of American homeowners to apply pesticides or other chemicals to their lawns is the product of multiple interacting factors. These factors include the supply of and demand for lawn chemicals, the importance of property values, community pressure to maintain a well-kept lawn, lawn aesthetics (e.g., ideas about how a lawn should look), and the lawn itself (**Figure 1.3**).

political ecology
An offshoot of cultural ecology that studies how economic forces and competition for power influence human behavior, especially decisions and attitudes involving the environment.

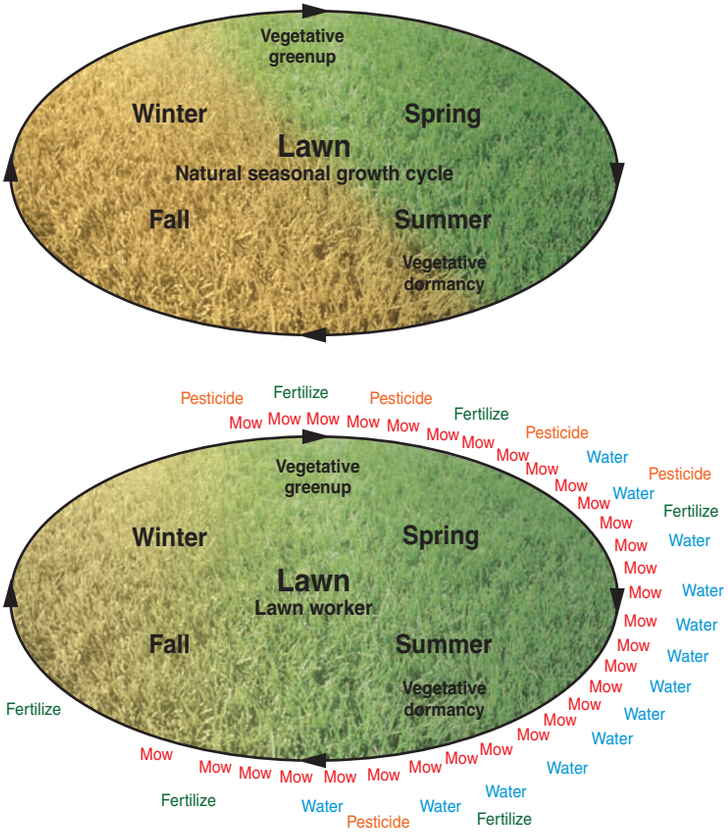
actor–network theory
A body of thought that emphasizes that humans and nonhumans are linked together in a dynamic set of relations that, in turn, influence human behavior.

Actor–network theory challenges the idea that people have free will. Rather, nonhuman entities gain agency (the ability to exert influence) by virtue of the networks of relations in which they are embedded. As Robbins observes, "the nonhuman world does have an active, ongoing, and crucial role in directing the conditions of the economy and the character of human culture" (2007, p. 137). Unlike environmental determinism, actor–network theory gives agency to natural factors as well as anything human-made (e.g., lawns, machines, or laws) but not in a simplistic cause–effect relationship.

Possibilism Reactions against environmental determinism in the early 20th century gave rise to **possibilism**—the view that people use

Actor–network theory • Figure 1.3

Actor–network theory acknowledges that our surroundings influence us. The lawn, the availability of fertilizers, and aesthetics influence human behavior by prompting a homeowner to mow, fertilize, and maintain it. (*Source:* Adapted from Robbins, 2007.)



their creativity to decide how to respond to the conditions or constraints of a particular natural environment. The word *constraints* is important here because it indicates that the environment is seen as limiting the choices or opportunities that people have. Possibilists, then, do not completely reject the idea of environmental influence; however, they are reluctant to view the environment as the sole or even the strongest force shaping a society. Thus, a possibilist sees technological diversification as one mechanism for expanding the range of choices a society has.

Humans as modifiers of the Earth A different approach to the relationship between people and the environment was advanced by geographer Carl Sauer (1889–1975), beginning in the 1920s. Sauer rejected environmental determinism and emphasized instead human agency, the ability of people to modify their surroundings. He observed that, over time, human activities transform natural landscapes into **cultural landscapes**. Significantly, Sauer's work helped raise awareness of the human role in landscape change. Visually, evidence of humans as modifiers of the Earth is all around us, from our cities to our cultivated agricultural fields (**Figure 1.4**).

An important extension of the humans as modifiers of the Earth approach involves seeing nature as a *social construction*—an invented concept derived from shared perceptions and understandings. This perspective acknowledges that people shape the natural environment through their practices *and* their ideas about what nature is or should be. A good example of this involves the idea of wilderness in the United States. The environmental historian, William Cronon, has shown that in the 18th century wilderness was equated with wasteland, but by the 19th century wilderness was strongly associated with natural beauty.

Earth as a dynamic, integrated system In this approach, geographers see people as intricately connected with the natural world. Two key principles sum up this approach: (1) the Earth functions as a system made up of diverse components that interact in complex ways; and

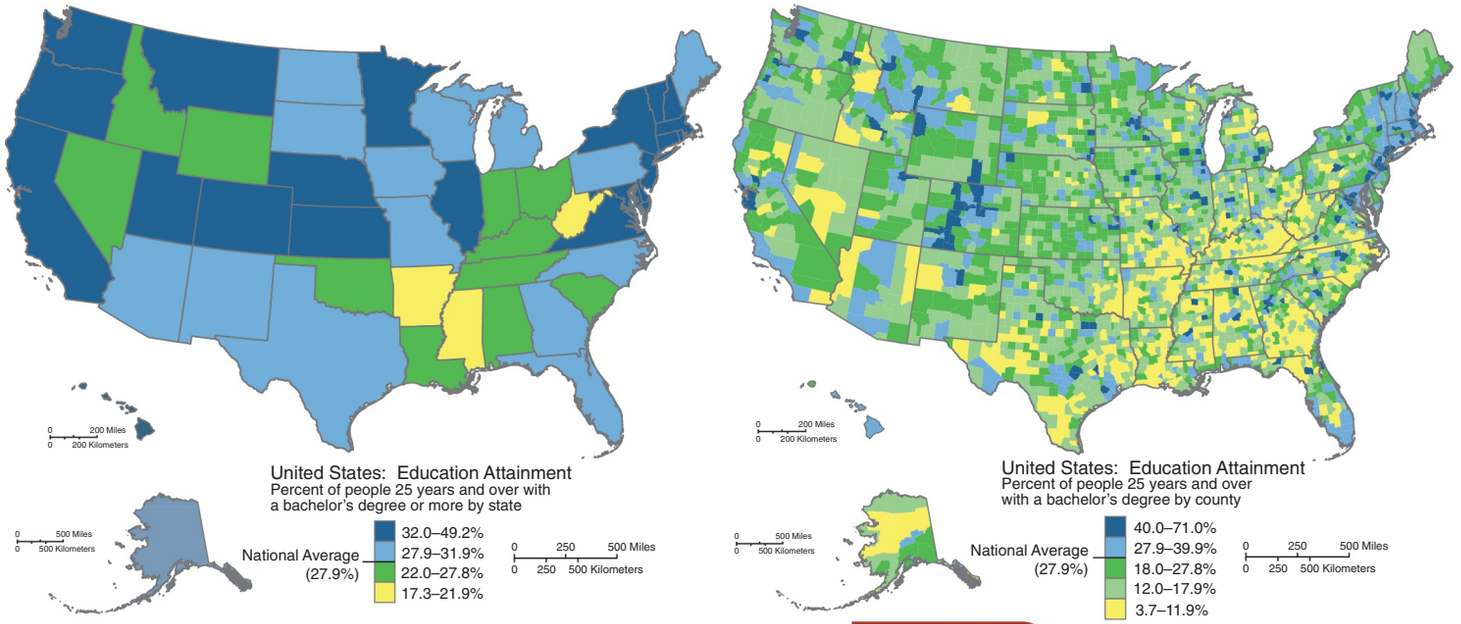
Mattias Klum/NG Image Collection

An extreme cultural landscape? • Figure 1.4

If your country lacks snow-covered mountains, why not manufacture them? This mountain-themed resort facility is in the United Arab Emirates and features year-round skiing even though outside temperatures rarely dip below 70° Fahrenheit.

Formal, functional, and perceptual regions • Figure 1.5

A wide variety of business, government, and planning agencies make decisions based on spatial information related to these three types of regions.



a. Formal regions

These maps show formal regions based on the trait of educational attainment. Each color identifies a different formal region that spans multiple states. (*Source:* Data from U.S. Census Bureau, American Community Survey, 2005–2009.)

Think Critically

1. What kind of region is a county? What kind of region is a state?
2. What geographic patterns do these maps reveal about college graduates?

(2) the Earth is constantly changing as a result of natural and human-induced events. We explore these ideas further in Chapter 12.

Cultural Landscapes and Regions

As we have discussed, culture is sometimes used to refer to a person's intellectual improvement through education, particularly the development of an aesthetic appreciation for the arts. In other instances, culture refers to beliefs and practices—such as dietary customs, religious beliefs, and so on—held in common by a group of people. Thus, a cultural group shares certain traits or elements of culture. This understanding of culture guided much of the practice of human geography until the late 20th century. More specifically, two long-standing approaches to the study of culture emphasize reading the cultural landscape and performing regional analysis. The emphasis on cultural landscapes reflects Carl Sauer's influence on geography, especially his view that culture is the driving force for landscape change.

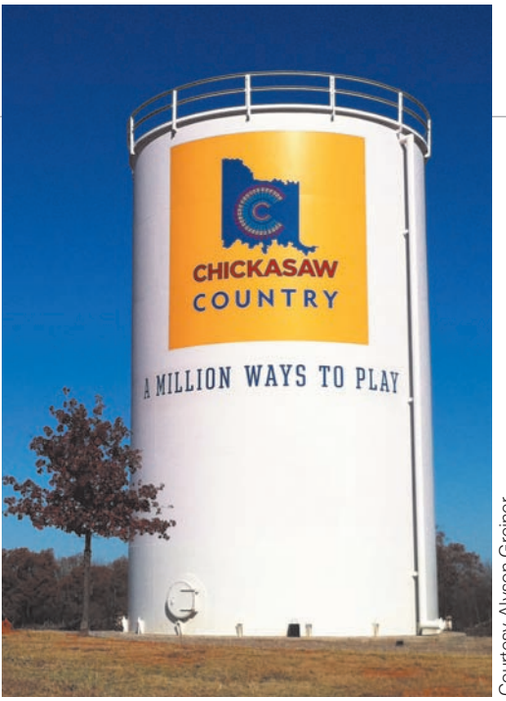
Reading the cultural landscape works from the premise that the cultural landscape constitutes a rich repository of information about cultural beliefs and practices. In other words, the cultural landscape resembles a *palimpsest*—a parchment that, though cleaned, still bears the traces of what was previously inscribed on it. To a human geographer, the visible expressions of culture—for example, the settlement patterns, the structures people build, the architectural styles they choose, and the ways people use land—all provide clues about people's values, identity, and more broadly, their cultures.

Regional analysis involves studying the distinctiveness of regions. In the United States, this might include understanding how and why the South differs from New England culturally, economically, and politically. Or, regional analysis might examine the ways in which the War in Iraq (2003–2011) altered the demographic and religious makeup of the country's provinces, and the ramifications of these changes.

Types of regions Geographers identify three types of regions: formal, functional, and perceptual. A **formal region** is an area that possesses one or more unifying physical or cultural traits. Unlike formal regions, a **functional region** is an area unified

David Sucsy/Getty Images

b. Functional region
A university campus is a functional region. On the University of Texas campus, the Tower is part of the Main Building, an administrative node that includes the president's and provost's offices, among others.



Courtesy Alyson Greiner

c. Perceptual region
Chickasaw Country is a perceptual region in Oklahoma that is associated with the territory of the Chickasaw Nation, depicted in dark blue in the photo. History, politics, recreation, tourism, and even aspects of the physical geography of an area can shape the characteristics of perceptual regions.

by a specific economic, political, or social activity. Every functional region has at least one node, usually the business, office, or entity that coordinates the activity. For example, each state in the United States constitutes a functional region with its state capital serving as the node. In contrast to both formal and functional regions, **perceptual regions** derive from people's sense of identity and attachment to different areas. The borders of perceptual regions tend to be highly variable since people often have very personal reasons for perceiving an area a certain way (Figure 1.5).

Culture reconceptualized Recently, certain geographers have stressed the point that we should think of culture as an abstract concept, not as a material item or collection of cultural traits. According to Don Mitchell, for example, "There's no such *thing* as culture" (emphasis added) (1995, p. 102). By this he means to caution people against trying to limit culture to specific and fixed habits of life. In his view, the visible and tangible expressions of culture are important, but they need to be understood in their dynamic context—in relation to prevailing economic, social, political, and other factors.

Similarly, other geographers stress that an understanding of culture that defines the term as a way of life fails to recognize other crucial aspects of culture. Consequently, over the past several decades there has been a significant reconceptualization of **culture** that draws on the following three attributes:

culture A social creation consisting of shared beliefs and practices that are dynamic rather than fixed, and a complex system that is shaped by people and, in turn, influences them.

1. Culture is a social creation that reflects diverse economic, historical, political, social, and environmental factors.
2. Culture is dynamic, not fixed, and can be contested. This is illustrated by the phrase "culture wars."
3. Culture is a complex system. Through interactions with one another, people create and express culture, and in turn, culture shapes and influences people.

The significance of this reconceptualization of culture is that it seeks to make the practice of human geography even more vigorous. For those who work within the reading the landscape approach, this reconceptualization

© Rich Legg/iStockphoto

Culture, power, and landscape • Figure 1.6

We can read the cultural landscape to discern that this gated residential community is exclusive. If our approach is informed by a fuller understanding of culture, however, we are better equipped to examine the invisible dimensions of power, identity, or class, for example, that also factored in this community's establishment.

of culture means that sometimes what remains on the landscape provides only a partial understanding of the complex and dynamic forces that created it. Consider, for example, gated residential communities (**Figure 1.6**).

CONCEPT CHECK STOP

1. **What** is the focus of cultural ecology?
2. **How** does actor–network theory conceptualize the relationship between people and the environment?
3. **How** are formal, functional, and perceptual regions different?

Thinking Like a Human Geographer

LEARNING OBJECTIVES

1. **Contrast** the concepts of place and space.
2. **Distinguish** between spatial variation and spatial association.
3. **Identify** four different types of diffusion.
4. **Explain** the relationship between globalization, spatial interaction, and time–space convergence.
5. **Review** the different scales used in geographical research.

All you need to begin to think like a human geographer is a curiosity about places in the world, whether they are nearby or far away. This curiosity might spur questions similar to those we raised about nighttime illumination in the chapter opener, or it might prompt questions about the connections between different places. Thus, to think like a human geographer is to cultivate a perspective that includes a consideration of one or more of the following: (1) place, (2) space, (3) spatial diffusion, (4) spatial interaction, or (5) scale.

Place

When geographers use the term **place** they are referring to a locality distinguished by specific physical and social characteristics. Every place can be identified by its *absolute location*, or position, reckoned by latitude and longitude on the globe, as well as its **site** and **situation** (**Figure 1.7**).

site The physical characteristics of a place, such as its topography, vegetation, and water resources.

situation The geographic context of a place, including its political, economic, social, or other characteristics.

Places matter because they contribute to the social, political, and economic functioning of our

Site and situation • Figure 1.7

By considering site and situation, we can make sense of the location and context of any place. What aspects of Istanbul's site and situation make it strategic?

a. Physically, Istanbul occupies a hilly site adjacent to a deep harbor and has grown on both sides of the Bosporus, a narrow and strategic waterway that connects the Mediterranean and Black seas. From left to right across the hilltop are the Hagia Sophia, now a museum, and the Blue Mosque.

b. These maps depict the situation of Istanbul, Turkey's largest city, in relation to the surrounding bodies of water, the rest of the country, and neighboring regions. By virtue of its situation, Istanbul straddles the regions of Europe and Asia.

MUSTAFA OZER/AFP/Getty Images

c. Istanbul's growth as a major port stems from attributes of its site and situation along an important strait. What this photo does not capture, however, is the dynamic nature of a place's situation. Numerous ferries and cargo ships ply the surrounding waters, but a workers' strike or inclement weather can quickly alter Istanbul's situation.

world. Indeed, the tourism industry capitalizes on the fact that no two places are identical and that people enjoy experiencing these differences. Places are also important because they provide anchors for human identity. When you meet someone for the first time and are learning about that person's identity, you typically ask, "What is your name?" and then "Where are you from?" The reverse is also true: Your sense of identity derives in part from your own place-based experiences. Geographers use the term *sense of place* to refer to the complex, emotional attachments that people develop with specific localities. The feeling of belonging is strongly linked to a person's sense of place. Similarly, a part of the collective identity shared by cultural groups often involves their sense of place and the feeling that they belong in a specific place.

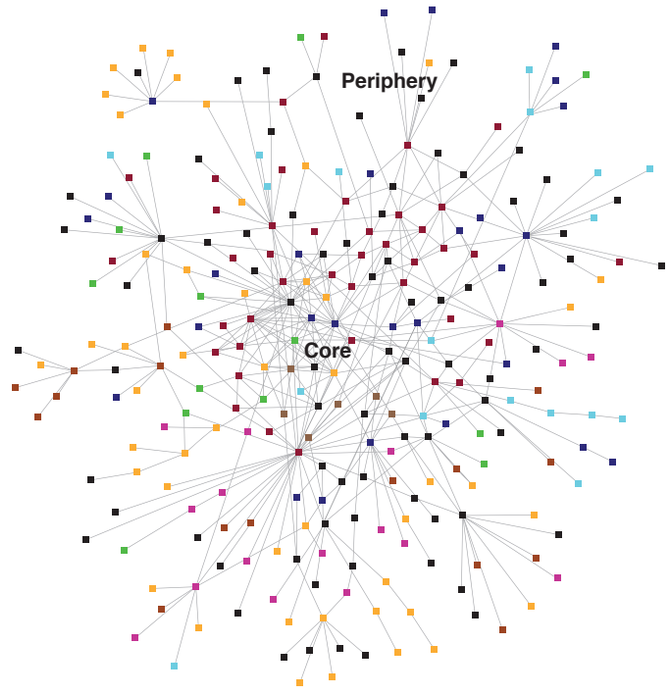
Space

If place refers to a specific locality, then **space** refers to either a bounded or unbounded area. Geographers identify two different kinds of space: absolute and relative. *Absolute space* refers to an area whose dimensions, distances, directions, and contents can be precisely measured. Geographers often draw an analogy between absolute space and a container in that it is possible to know a container's boundaries, dimensions, and contents. In fact, a formal culture region is a good example of a container-like space. The concept of absolute space dominated the practice of geography until about the 1960s. Until then, geographers were strongly interested in the study of regions. Since the 1960s, however, the concept of relative space has gained prominence.

Relative space refers to space that is created and defined by human interactions, perceptions, or relations between events. Relative space is defined less by precise boundaries and more by *contingency*—the idea that the outcome of human interactions and perceptions depends on who and what are involved. A good example of relative space and its contingent character is the space of trade. For trade to occur between two countries, each must be able to supply the products the trading partner needs and enter into a mutual agreement to do so. The contingency of trade, then, depends in part on the countries' ability to continue to supply the desired products and to maintain favorable diplomatic relations. When two countries or businesses engage in trade, they create a relative space of trade that exists between them as long as these contingent conditions are satisfied.

Relative space • Figure 1.8

If absolute space resembles a container, then relative space resembles a network of linked nodes, also referred to as a hub-and-spoke network. In the context of social networking, nodes or hubs represent individuals. (*Source:* Adapted with permission from The Monitor Company Group, L.P.)



As the trade example shows, political and economic interactions can shape the creation and production of relative space. So, too, can social interactions. In this way, relative space is socially produced. Social networking sites such as Google+ and Facebook provide great examples of this. When you log on and chat with your friends, you are creating and participating in a relative space. It is indeed fascinating, and even a little overwhelming, to think about the millions of relative spaces created not just on the Internet but globally, as people, businesses, and organizations interact. Can you list the different relative spaces you are a part of on a daily basis? More importantly, do you see how the concept of relative space involves horizontal linkages, as well as networks or webs of connections that defy containment (**Figure 1.8**)?

In the course of this discussion we have set up a dichotomy between absolute and relative space. However, the two concepts can and often do overlap. We realize this connection when we think about the relationship between perceptions and space. For example, how does human behavior change when people

move from one space to another? How does your own behavior change as you go from home or your dorm to a classroom or to the library? These buildings and rooms have characteristics of both absolute and relative space in that they are bounded, physical spaces but also zones or fields of perception and interaction. The fact that the range of acceptable behaviors changes from one space to another suggests that our perceptions of space can be significantly shaped by many factors, including power relations.

These relations between space and power, or authority, have been informed by the work of French philosopher and historian Michel Foucault (1926–1984). Foucault has shown, for example, that the power relations associated with space have a way of regulating and controlling—or as he calls it "disciplining"—human behavior. Look again at Figure 1.8. Where is the power in this network?

spatial variation
Changes in the distribution of a phenomenon from one place or area to another.

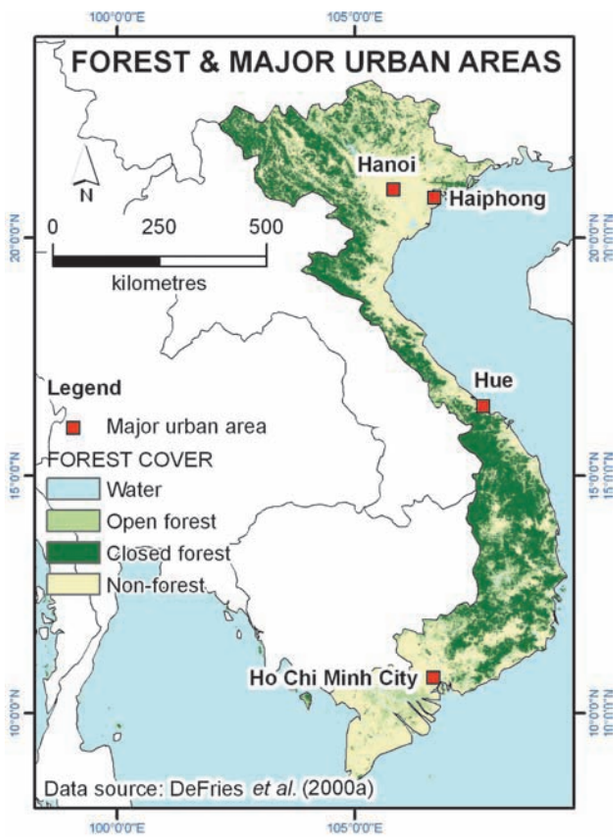
spatial association
The degree to which two or more phenomena share similar distributions.

distribution
The arrangement of phenomena on or near the Earth's surface.

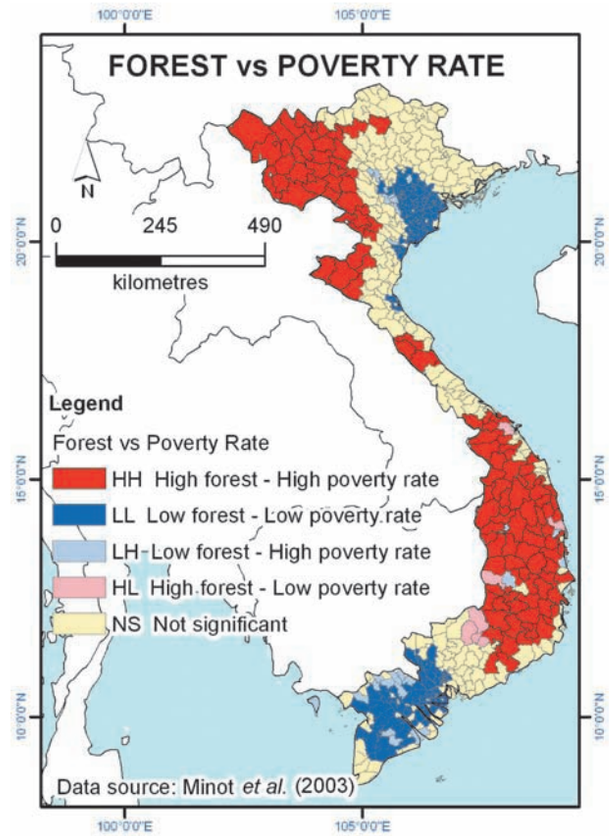
Grasping these aspects of space is a key part of understanding how the world works. Consequently, human geographers adopt and emphasize a *spatial perspective* in their work. That is, they pay particular attention to the variations from one place or space to another in society and environment–society dynamics. **Spatial variation** and **spatial association** are other key concepts geographers use; both concepts build on an understanding of **distribution** (**Figure 1.9**).

Spatial variation and spatial association • Figure 1.9

Adopting a spatial perspective helps to identify and explain distributions.



a. The spatial variation of closed forests in Vietnam changes markedly from north to south across the country. ▶ **What are some likely reasons for this?** (Figure 1.9 images from Sunderlin, Dewi, and Puntodewo, 2007, p. 17; used with permission from CIFOR, www.cifor.cgiar.org.)



b. There is a strong spatial association between forest cover and poverty rates in Vietnam, although this does not necessarily mean that one phenomenon has caused the other. Understanding this association demands an investigation of other factors, including economic forces, political policies, historical developments, and social practices.

PROCESS DIAGRAM

Understanding hierarchical diffusion • Figure 1.10

THE PLANNER

Hierarchical diffusion involves cascading or stair-stepping from one level or rank to another. In this example, BigApple Togs, a hypothetical fashion chain headquartered in New York City, launches a fashion innovation that is diffused hierarchically through the company.

a. The organization chart for BigApple Togs forms the framework in which the hierarchical diffusion of ideas can occur down through the ranks.

Spatial Diffusion

How does fashion, news, gossip, a flu virus, or the latest high-tech gadget spread through a population and from one place to another? These questions get at the core of **spatial diffusion**. Because spatial diffusion may occur rapidly or slowly, depending on the circumstances, time is always an essential dimension of diffusion.

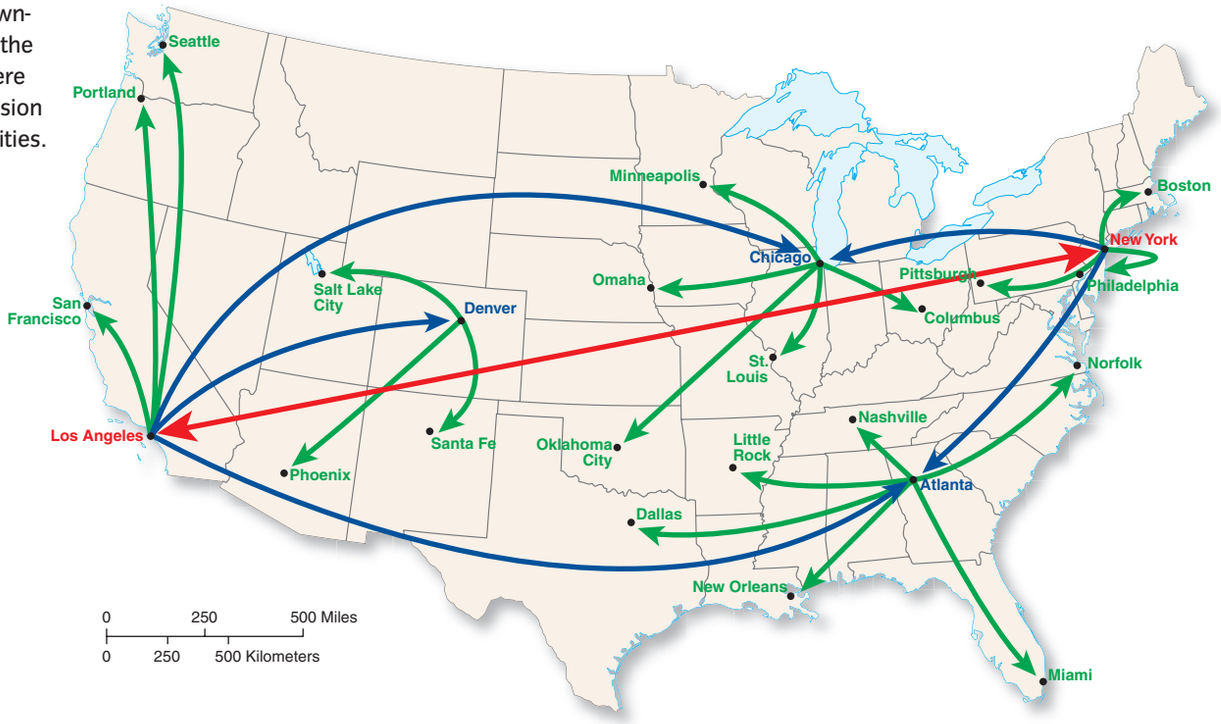
spatial diffusion
The movement of a phenomenon, such as an innovation, information, or an epidemic, across space and over time.

Geographers recognize four different types of diffusion: relocation, contagious, hierarchical, and stimulus. Migration is the most common type of *relocation diffusion*. *Contagious diffusion* occurs when a phenomenon, such as the common cold, spreads randomly from one person to another. In contrast, *hierarchical diffusion* occurs in a top-down or rank-order manner. See **Figure 1.10** for an explanation of hierarchical diffusion.

Stimulus diffusion occurs when the spread of an idea, a practice, or other phenomenon prompts a new idea or innovation. A great deal of stimulus diffusion affects the production and marketing of goods. We can see this readily in the automobile and fast-food industries, for example. The idea behind a successful product often triggers applications of that principle in other settings—whether it is a certain body style on a vehicle or the development of a new kind of fast-food restaurant.

Studies suggest that spatial diffusion often involves a mixture of types. The diffusion of H1N1 flu since April 2009 provides a good example. This flu virus was first detected in Mexico. It spread contagiously within Mexico and to persons in neighboring U.S. states. It then spread to New York City via the relocation diffusion of several students who had vacationed in Mexico. Contagious and relocation diffusion subsequently played a role in the worldwide spread of the disease, which was eventually classified by the World Health Organization as a *pandemic*—an epidemic on a global scale. Not only do the different types of diffusion often work simultaneously, but the presence of *absorbing barriers*—

b. In addition to the downward diffusion through the ranks of employees, there is also hierarchical diffusion from smaller to larger cities.



1. The President and CEO launches a new design. Knowledge of this innovation diffuses hierarchically to members of the top level (Rank 1) of the organization in the company's main offices in New York and Los Angeles. People at lower levels do not yet hear about it because knowledge of the innovation by-passes or leapfrogs them.
2. Individuals from Rank 1 hierarchically diffuse the idea down to people in Rank 2, located in major regional offices. A geographical leapfrogging also occurs because the managers work in different cities.
3. Individuals from Rank 2 spread the innovation to people in Rank 3, located in smaller cities around the country.

physical, legal, or other obstacles that stop diffusion—and *permeable barriers* can also affect both the rate and the direction of spatial diffusion.

Spatial Interaction and Globalization

We live in an increasingly globalized world. **Globalization** refers to the greater interconnectedness and interdependence of people and places around the world. Globalization propels and is propelled by **spatial interaction**—the connections and relations that develop among places and regions as a result of the movement or flow of people, goods, or information.

The term *spatial interaction* was first coined by geographer Edward Ullman in 1954, several decades before the word *globalization* was invented and popularized. For Ullman, a transportation geographer, the study of geography was synonymous with the study of spatial interaction. He identified three factors that influence spatial interaction: complementarity, transferability, and intervening opportunities.

Complementarity exists when one place or region can supply the demand for resources or goods in another place or region. In other words, complementarity provides a basis for trade. Leading coffee producers, such as Brazil, Colombia, and Indonesia, help satisfy the demand for coffee in major consuming regions, such as western Europe and North America, and create a condition of complementarity. Spatial interaction as a result of complementarity can involve short or long distances. Complementarity also exists when people travel from their homes to a movie theater or a gas station.

Complementarity stems from spatial variation. Such spatial variation may relate to the availability of natural resources or to particular economic conditions. For example, countries with scarce coal resources look to coal-rich countries to satisfy their demand for this resource. Economic conditions that are associated with spatial variation and

Justin Guariglia/NG Image Collection

NATIONAL GEOGRAPHIC

Transferability • Figure 1.11

Since the 1950s, the standardization of containers for movement by ship, tractor-trailer, or train has altered the transferability of freight by reducing the friction of distance.
▶ **How has the transferability of mail or photographs changed through time?**

lead to complementarity include low costs of production and economies of scale. Low labor or transportation costs, for example, may make the production of a good less expensive in one place than another, giving that place an economic advantage. Similarly, the ability to create an economy of scale can stimulate complementarity. An *economy of scale* refers to the reduction in the average production cost of an item as a result of increasing the number of items produced. Because certain costs are fixed—for example, the cost of machinery or equipment for an automobile assembly line—lower average costs per vehicle are obtained by producing more of them.

A second factor that influences spatial interaction is **transferability**—the cost of moving a good and the ability of the good to withstand that cost. High-value goods that are not bulky and can be easily transported, such as jewelry, have high transferability. Low-value, bulky goods, such as rocks or hay, have low transferability. In general, goods with low transferability are more likely to be used near their source. Transferability is affected by the *friction of distance*, or the way that distance can impede movement or interaction between places. Historically, distance has deterred spatial interaction, but changes in modes and speeds of transport have reduced the friction of distance (**Figure 1.11**).

Intervening opportunities constitute the third factor that influences spatial interaction. An **intervening opportunity** is a different location that can provide a desired good more economically. Like the friction of distance, intervening opportunities can alter the spatial interaction between places. If you usually stop at the same gas station to fill up your car but decide to frequent another gas station because you have noticed it has lower prices, you have taken advantage of an intervening opportunity. Intervening opportunities are important because they help reconfigure the flows and relations between places. In addition, intervening opportunities point to the importance of accessibility. For geographers, *accessibility* means the ease of reaching a particular place. Different measures of accessibility exist. Accessibility is most commonly expressed in terms of travel time or cost. The greater the accessibility of a place, the lower the travel time to or from it. Public facilities, such as parks and libraries, are considered highly accessible because there are usually no fees to use them.

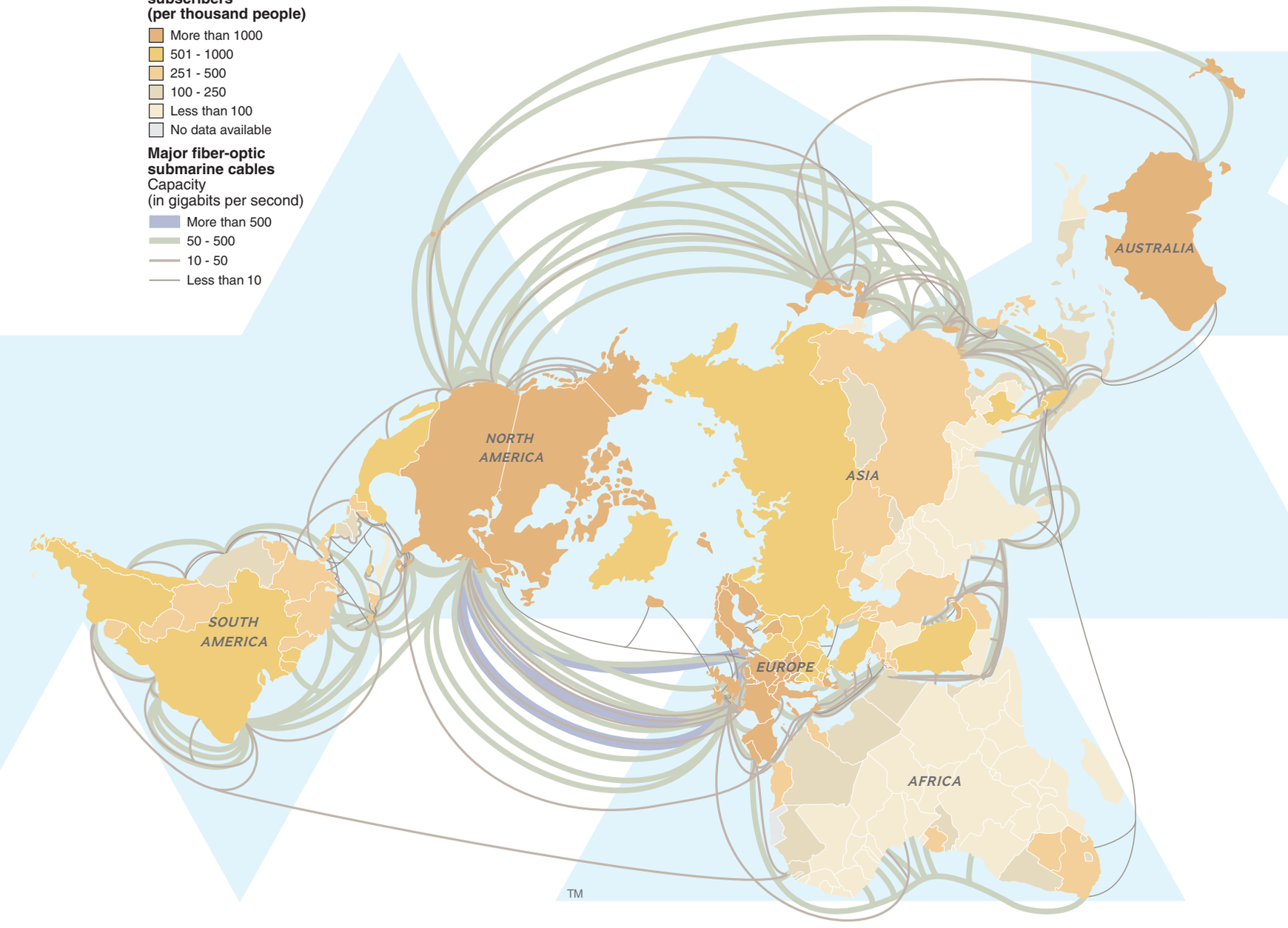
Distance is an important aspect of the accessibility of a place, but, as the previous example suggests, other aspects can be just as important as or even more important than distance. A business may locate a branch office in a place that is more distant from the market in order to take advantage of lower rents. Alternatively, accessibility can be expressed in terms of a place's *connectivity*—that is, the number and kind of linkages it possesses. Such linkages might include airports, the presence of interstate highways, or the availability of high-speed computer networks. Fiber-optic cables, technology that permits much faster transfer of data compared to copper wires, has helped connect the globe (**Figure 1.12**).

Distance decay In 1970, geographer Waldo Tobler, an expert in spatial interaction modeling, made the following observation: "[E]verything is related to everything else, but near things are more related than distant things." This simple statement, known as *Tobler's first law of geography*, highlights how spatial interaction is affected by **distance decay**. Within cities, population density usually diminishes with increasing distance from the downtown area. Similarly, people are willing to travel a few miles to a grocery store and will do so hundreds of times over the course of a year, but most people are not willing to travel long distances to reach a grocery store. Consequently, distance decay can be an important factor when deciding where to locate

distance decay
The tapering off of a process, pattern, or event over a distance.

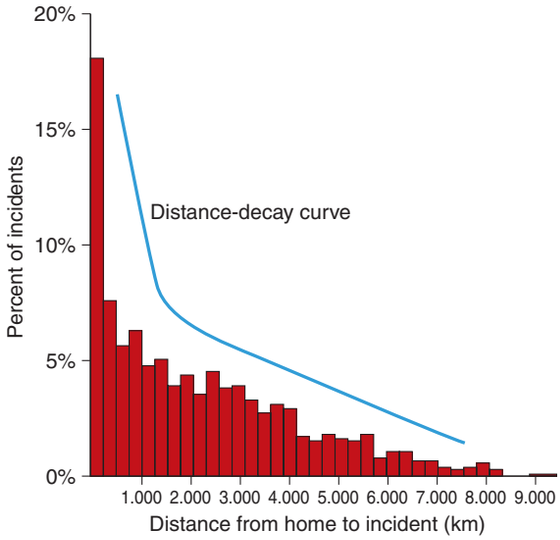
Spatial interaction and connectivity • Figure 1.12

Spatial interaction occurs in myriad ways as, for example, when you text message a friend, journey from home to work, or transfer funds electronically. Technologies, such as cellular networks, submarine cables, and telephone land lines, facilitate long-distance and international spatial interaction, although the map makes clear the global unevenness of these linkages. (*Source: College Atlas of the World*, 2007.)

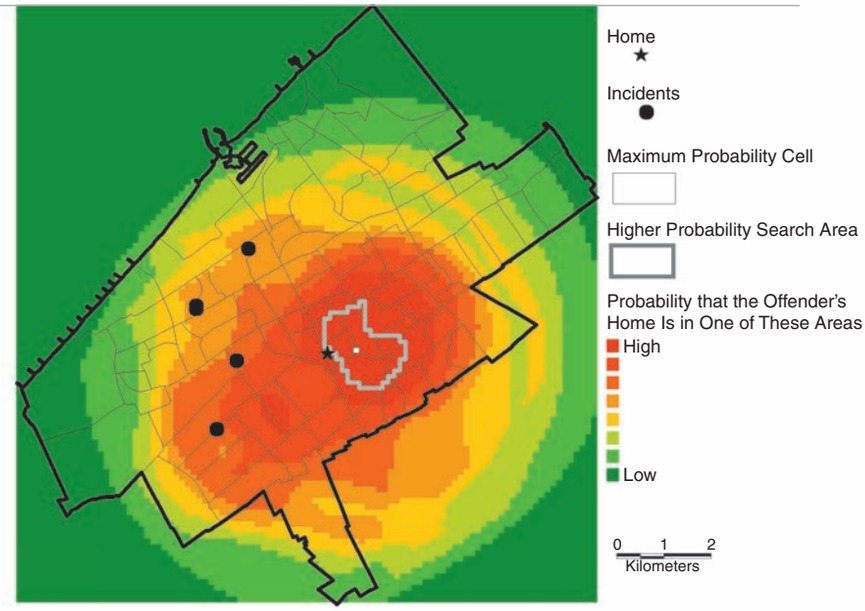


Distance decay • Figure 1.13

Certain offenses, such as burglaries, sometimes demostrate distance decay.



a. Burglars more often commit their crimes closer to home. (*Source:* Adapted from Block and Bernasco, 2008.)



b. Using what they know about distance decay for burglaries, investigators mapped incidents in The Hague, Netherlands, to identify the area where the burglar likely lived, thereby narrowing their search. (*Source:* Block and Bernasco, 2008.)

certain businesses or public services. It turns out that distance decay can factor in the patterns of some criminal offenses (**Figure 1.13**).

Time–space convergence As we saw previously in our discussion of transferability, technological innovations in transportation and communication have made it possible to reduce the friction of distance. When this happens, places seem to become closer together in both time and space. This process is known as **time–space convergence**, and it highlights the importance of relative distance. Whereas absolute distance refers to the physical measure of separation between points or places in meters or feet, for example, *relative distance* expresses the separation between points or places in terms of time, cost, or some other measure. Globalization does not alter the absolute distance between places, but it can change their accessibility as more places become interconnected. Moreover, globalization can reduce the friction of distance, bringing about a change in our sense of relative distance and making it seem as though distant places have become closer together.

Is it possible that even as time and space appear to converge, social relations experience a lengthening or distanciation? The sociologist Anthony Giddens argues that the same technological innovations that lead to time-space convergence also create *time–space distanciation*, the elongation of social systems across time and space. Such social distanciation occurs as remote interaction—for example, e-mail or cell phones—becomes more prevalent than face-to-face interaction. In his view, even writing is a technological innovation that leads to time–space distanciation.

Geographic Scale

The concept of scale is so fundamental to geography that many geographic works give direct or at least indirect attention to it. In its broadest sense, **geographic scale** provides a way of depicting, in reduced form, all or part of the world. For example, every globe is a scale model of the Earth.

Two classes of geographic scales exist: map or cartographic scale and observational or methodological scale. A *map or cartographic scale* expresses the ratio of distances on the map to distances on the Earth. Geographers also distinguish between large-scale maps and small-scale maps (see *What a Geographer Sees*).

Cartographic Scale

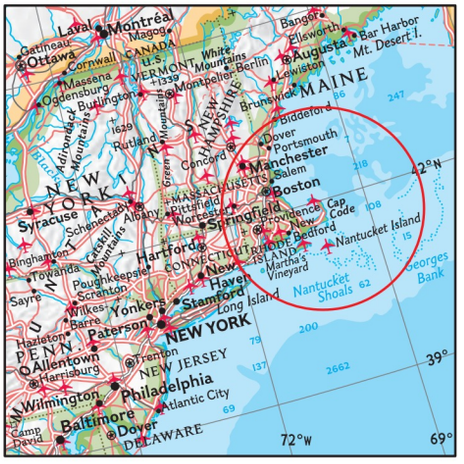
In making a map, the most basic decisions involve the area to cover and the scale. Mapping a vast area, such as North America, requires a small scale that cannot show much detail. At the opposite extreme, if you show a single town, you can use a very large scale that shows great detail, such as streets and buildings. **Figure a** shows this relationship; **Figure b** explains how we express map scales.

a. The choice of a map's scale controls how much detail can be shown. Note how the detail of Cape Cod changes at these three different scales.

Small scale ← → **Large scale**

1. Small-scale map: Eastern North America, with Cape Cod circled

Small-scale maps, such as this one, show larger areas, such as continents or several states, but in less detail.



2. Large-scale map: Northeastern U.S. and neighboring Canada, with Cape Cod circled

This map is three times larger scale than map 1, showing greater detail but a smaller area.

3. Even larger-scale map: Eastern Massachusetts, with Cape Cod circled

This map is about twenty-one times larger scale than map 1, showing much greater detail but a much smaller area. (*Source:* Maps 1, 2, and 3 from College Atlas.)

Verbal scale: 1 inch represents 36,000,000 inches or about 568 miles on the ground	**Verbal scale:** 1 inch represents 12,000,000 inches or about 189 miles on the ground	**Verbal scale:** 1 inch represents 1,750,000 inches or about 28 miles on the ground
Ratio scale: 1:36,000,000	**Ratio scale:** 1:12,000,000	**Ratio scale:** 1:1,750,000
Fractional scale: 1/36,000,000	**Fractional scale:** 1/12,000,000	**Fractional scale:** 1/1,750,000
Graphic scale:	**Graphic scale:**	**Graphic scale:**
0 KILOMETERS 600 800 1000 0 MILES 200 400 600 800 1000	0 KILOMETERS 200 300 0 MILES 100 200 300	0 KILOMETERS 30 40 50 0 MILES 10 20 30 40 50

b. Map scales can be expressed verbally, as a ratio or fraction, or graphically. The advantage of a fraction or ratio scale is that it works for any unit of distance. In the fraction and ratio examples for the Cape Cod map, 1 unit on the map represents 1,750,000 of the same unit on the Earth. Geographers frequently use centimeters or inches as units, but they could use any unit, even something whimsical, such as the width of an iPhone.

Ask Yourself

1. What type of map scale is most desirable if you plan to use a copier to reduce or enlarge a map?
2. How does the perspective in a map differ from the perspective in a satellite image?

Observational or *methodological scale* refers to the level(s) of analysis used in a specific project or study. This might include the body, home, neighborhood, city, region, country, or global scale. When geographers talk about the range of observational scale, they say that it extends from small scale (the level of the body) to large scale (the global level). This is the opposite of how they use the terms *small-scale* and *large-scale maps*. With observational scale, the most detailed level of analysis is the body, whereas large-scale maps have the most detail. As with cartographic scale, the choice of observational scale always involves a sacrifice between the area covered and the level of detail of the data.

The body or self constitutes an important scale because it provides a basis for personal and individual identity (**Figure 1.14**). It also helps us see how scale relates to spatial differentiation and social control. In Western society, for example, the home has historically been characterized as a kind of private space and female domain. This contrasts with the realms of politics and work, which have often been characterized as a kind of public space and male domain. In this way, ideas about the female or male body can contribute to the development of segregated spaces. For another example that illustrates the importance of the scale of the body, see *Video Explorations*.

In addition to the different levels of observational scale, it is important to remember that scales are often interdependent. We see this in globalization as things that were once popular on a local, regional, or national scale expand to the global scale. Similarly, we are reminded of the interdependence of scales in the way that an anti-Muslim film that was made in the U.S. and appeared on YouTube triggered protests in the Middle East and Southeast Asia in 2012.

Contested bodies • Figure 1.14

The body is personal space and a scale that we control. Or is it? This photo shows Hind Ahmas, the first woman in France fined for wearing a full-face veil. France banned the wearing of these veils in public.

Franck Prevel/Getty Images

Video Explorations

THE PLANNER

Teeth Chiseling

National Geographic

In Indonesia, a chieftain's wife undergoes teeth chiseling to enhance her beauty. To this Sumatran group, beauty is more than skin deep; it is a matter of balance between the soul and body. At what point might cultural standards of beauty become a form of oppression?

CONCEPT CHECK STOP

1. **Why** does a formal region resemble absolute space?
2. **What** is meant by a spatial perspective, and how does it relate to the practice of geography?
3. **What** makes hierarchical diffusion more systematic than contagious diffusion?
4. **How** does globalization affect relative distance?
5. **Why** is the body considered a significant scale?

Geographical Tools

LEARNING OBJECTIVES

1. **Explore** how remote sensing works.
2. **Explain** the data structure of a GIS.
3. **Review** some of the applications of remote sensing, GPS, and GIS.

An appealing facet of geography is the ability to use a wide variety of research tools. This includes a mix of exciting and relatively new technologies—such as GPS devices, satellite images, geographic information systems, and interactive maps—as well as more traditional and long-standing research tools, including maps, photographic documentation, archival resources, and interviews.

The tool that has been most closely associated with geography is the map, a simple but powerful means of visualizing the world. Please see Appendix A to learn more about map projections and the challenges of representing the spherical Earth on a flat surface. This section focuses primarily on the more recent technological tools, in part because they have significantly expanded the geographer's toolbox. First, however, we need to distinguish between *skills* and *tools*. Skills are a product of our aptitude and learned abilities, whereas tools are the instruments we use to improve procedures or techniques, such as data gathering or visualization.

Like other scholars, geographers seek to cultivate their observational, analytical, and writing skills. Often, it helps to know another language, as well as statistics. Carrying out fieldwork, including extended or repeated visits to a research site or sites, is another skill many geographers hone. Those geographers whose fieldwork involves a great deal of outdoor exploration in remote places where daily luxuries, such as safe drinking water and air conditioning are not readily available, often describe themselves as "muddy-boots geographers."

Remote Sensing

When you scan the road in front of you as you drive, you are, in effect, engaging in a type of **remote sensing**—acquiring information about something that is located at a distance from you. In this case, the human eye acts as a *sensor* that responds to the stimulus of light and transmits certain signals to the brain. For geographers, remote sensing uses instruments or sensors to detect Earth-related phenomena and to provide information about them. As the term *remote sensing* suggests, the sensors are always located at a distance from the subject being studied. With greater reliance on satellite-mounted sensors, the distances between the sensor and

Geography InSight

Remote sensing of post-earthquake damage • Figure 1.15

Innovations in sensor and computer technology have led to improvements in resolution (the detail we can detect), as well as a virtual explosion in the different uses for remotely sensed data. Today, for example, it is possible to obtain remotely sensed images with submeter (less than 3 feet) resolution.

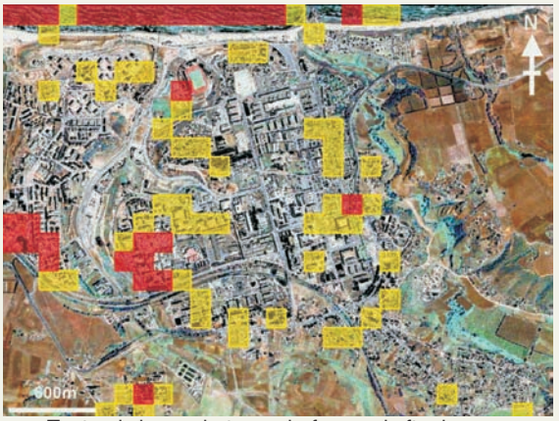
Earthquake epicenter

Collapsed apartment

Claude Paris/©AP/Wide World Photos

a. The earthquake that struck Boumerdes, Algeria, on May 21, 2003, registered a magnitude of 6.8 on the Richter scale and caused the deaths of more than 2,200 people. Structural damage in the city was severe and spatially variable.

b. The availability of high-resolution remotely sensed data with submeter resolution makes possible the rapid identification of structural damage across the affected area, because building collapse produces an identifiable textural signature not present in areas where buildings have not collapsed.

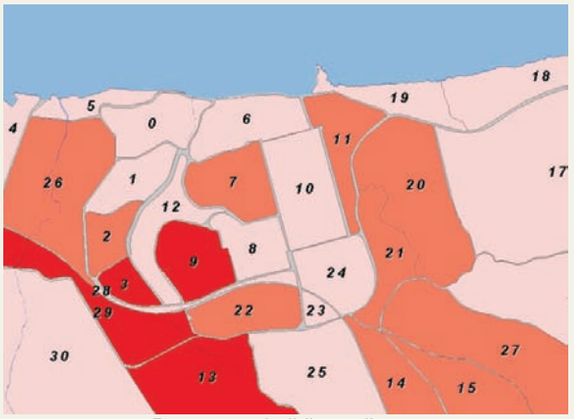


Textural change between before and after images

Modest | Significant | Extreme

Increasing textural change due to building collapse

c. Using these textural signatures, geographers can then create maps identifying regions with significant percentages of collapsed buildings. Identifying high-damage areas is essential to relief coordination following a natural disaster.



Percentage building collapse

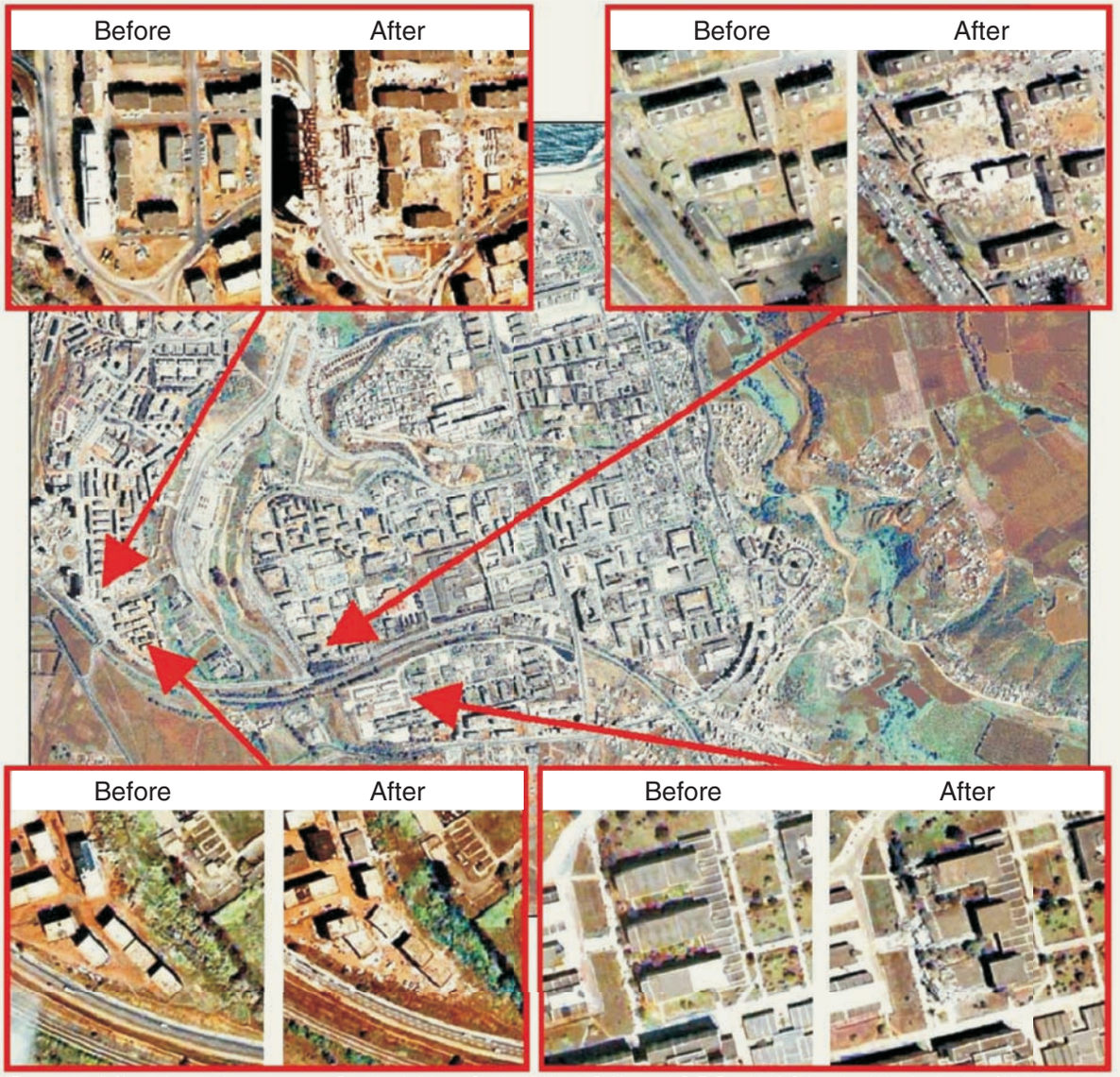
0% | 0-5% | >5%

Increasing concentration of building collapse

the target of study can be considerable, often spanning thousands of kilometers.

Many of the early applications of remote sensing involved detecting conditions in the natural environment, especially in the area of weather monitoring and forecasting. Human geographers are increasingly making use of remote sensing to study such things as the spatial extent of urban areas or to track oil spills and other

d. The collapse of buildings changes the cultural landscape, in effect creating more edges. Visually, we can see this pattern in the more chaotic and brighter appearance of the images, but the use of software to detect these changes speeds up the analytical process. Identifying high-damage areas is essential to relief coordination following a natural disaster.



(Figure 1.15a (left), 1.15b, 1.15c images courtesy Beverley J. Adams, Charles K. Huyck, B. Mansouri, R. T. Eguchi, M. Shinozuka. 2004. Application of High-Resolution Optical Satellite Imagery for Post-Earthquake Damage Assessment: The 2003 Boumerdes (Algeria) and Bam (Iran) Earthquakes. In *Research Progress and Accomplishments 2003-2004*, MCEER-04-SP01, MCEER, University at Buffalo, pp. 173–186.)

forms of water pollution. Some recent studies suggest that remotely sensed data on nighttime lights, as shown in the chapter-opening photo, might provide a basis for estimating populations in countries that do not have reliable censuses, or even estimating the wealth of a region. Those who study natural disasters are also able to use remote sensing to document and record the extent and damage caused by fires, hurricanes, or other natural hazards (**Figure 1.15**).

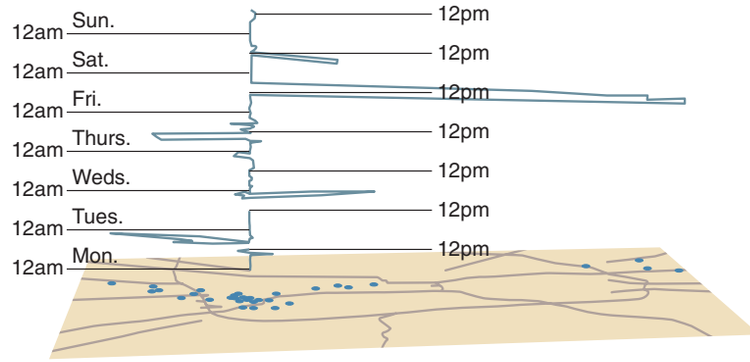
GPS applications • Figure 1.16

GPS technology helps to locate features on Earth and understand how individual and group patterns of mobility vary.

a. Cell phones equipped with GPS receivers make it possible to use location-based services to find friends in your area. ▶ **Is this kind of geographic awareness a benefit or hindrance to personal security?** (*Source:* NG Maps.)

© Thomas Gordon/iStockphoto © Mathias Wilson/iStockphoto

© Jacob Wackerhausen/iStockphoto



b. This diagram shows the time–space paths of a female teenager in one week in Marion County, Indiana. The dots represent waypoints (intermediate destinations) collected via a GPS-enabled cell phone as the young woman traveled from home and back. The squiggly lines to the left or right of the vertical axis represent the distances traveled away from home at different times. ▶ **How might time–space paths vary by age, gender, or ethnicity?** (*Source:* Wiehe *et al.*, 2008.)

Global Positioning System

A **global positioning system (GPS)** uses a constellation of artificial satellites, radio signals, and receivers to determine the absolute location of people, places, or features on Earth. A GPS receiver uses the time it takes to receive a signal from a satellite to calculate how far away the satellite is. When radio signals are simultaneously transmitted from multiple satellites, it is possible to apply the geometric principles of triangles to determine the latitude, longitude, and altitude of locations on Earth.

When you use a GPS device (which basically functions as a receiver), you are tapping into a system that has been developed and funded by the U.S. Department of Defense. Thus, the term *global positioning system* refers specifically to the system developed by the United States and more generally to the use of multiple satellites as a way of locating things on or navigating between places on Earth. Although the first GPS satellite was put into orbit in the 1970s, GPS did not provide global coverage until 1995. Since then, civilian use of GPS has boomed, and annual global sales of GPS devices regularly amount to several billion dollars.

Like remote sensing, GPS has greatly expedited our ability to acquire data about the Earth. For example, locational information for map features can quickly be acquired and transferred to computers to make or update maps. GPS is regularly used to confirm the legal boundaries of property, to track and inventory different species of plants and animals, and to monitor conditions in agricultural fields. GPS has contributed to the growth in precision farming. For example, GPS can be used to record information on soil types, moisture, or pest infestations at different locations in a field. When this kind of information is combined with GPS-ready agricultural machinery, it is possible to manage pesticide application so that it is applied only where needed and in the smallest amounts possible, preventing waste.

Within the past decade, locational information has become a valuable commodity, as demonstrated by the rapid growth in location-based services. A *location-based service* (LBS) uses the location of a GPS receiver to provide information about nearby businesses and sometimes even people. For example, you can use a smartphone to search for nearby restaurants or ATMs and to find friends with GPS-equipped smartphones who are in the area (**Figure 1.16**).

GPS technology raises a host of thorny ethical questions. Often there is a fine line between a service and surveillance. Law enforcement officials can use GPS to track the locations of parolees, and parents can use it to know the whereabouts of their kids. Geographers Jerome Dobson and Peter Fisher coined the term *geoslavery* to refer to "a practice in which one entity, the master, coercively or surreptitiously monitors and exerts control over the physical location of another individual, the slave" (2003, pp. 47–48). In what other ways might GPS compromise personal privacy?

Geographic Information Systems

Many people—geographers and nongeographers alike—enjoy poring over paper maps and studying them for the patterns and trends they show. Of course, paper maps do have their limitations. If you need to know the area covered by a lake, for example, doing the calculation manually can be labor intensive and time-consuming. Just imagine trying to manually compute the area covered by lakes in a single country. The emergence of **geographic information systems (GIS)** has its roots in this very issue: how to improve the functionality of maps and the spatial analysis of *georeferenced data*—that is, data tied to locations on Earth.

There are two ways to georeference data: directly and indirectly. The most common system used for direct georeferencing is latitude and longitude. For indirect georeferencing, locations may be given by street address, zip code, school district, census tract, or other spatially defined entity (for which latitude and longitude could then be obtained). We can obtain georeferenced data from various sources, including paper maps, satellite imagery, aerial photography, and GPS devices, to name a few. A GIS, then, refers to a combination of hardware and software that enables the input, management, analysis, and visualization of georeferenced data. The usefulness of GIS as a tool stems from its ability to relate different kinds of georeferenced data (**Figure 1.17**).

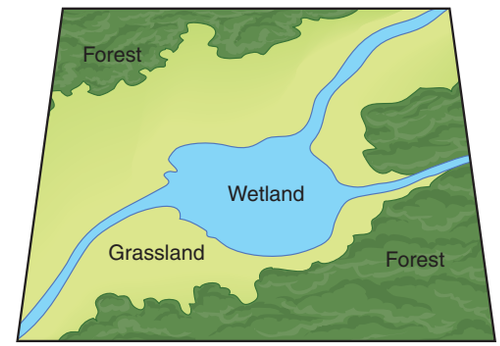
A GIS can link data, reveal new relationships, and visualize them with maps. In a GIS, maps are interactive, enabling a user to click on a map feature and obtain information about it, to turn different data "on" or "off" for viewing, and to query the data. Another facet of GIS is that

GIS data structure • Figure 1.17

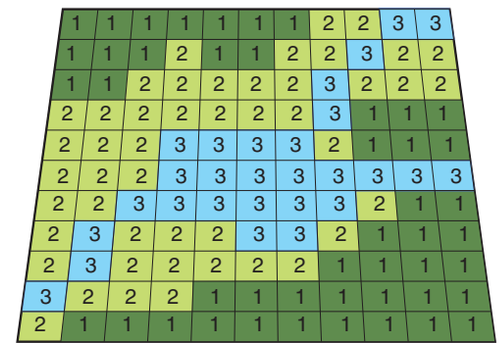
Every GIS is built around two types of information: spatial and attribute.

a. Spatial data consists of the latitude and longitude of the boundaries, cities and rivers shown on this map. Attribute information describes the geographic features, and is stored in tables like these for Venezuela, Lima, and the Amazon River. (*Source:* NG Maps.)

b. Georeferenced data are stored in a computer in one of two formats.



Vector data uses latitude and longitude coordinates to represent geographic features as points, lines, or other complex shapes.



Raster data uses equally-sized cells to represent features. Here, each pixel contains a value that identifies the land cover: 1–forest, 2–grassland, and 3–wetland.

NATIONAL GEOGRAPHIC

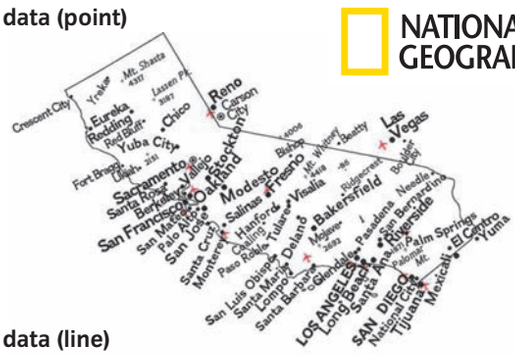
it can accommodate statistical analysis and perform calculations, such as identifying the most optimal route between locations.

One way to conceptualize this is to think of a GIS as a kind of database that stores information in different layers (**Figure 1.18**).

GIS data layers • Figure 1.18

GIS incorporates the ability to combine, through overlays, a wide variety of georeferenced data. In these examples, cities, roads, and rivers are represented by vector data whereas raster data is used to show elevation. (*Source: College Atlas of the World*, 2007.)

Vector data (point)



Vector data (line)

Raster data (relief)

Vector and raster data combined (political)

The possible applications for GIS are mind-boggling. For example, GIS has been used in Jamaica to evaluate proposed sites for new schools by examining the terrain and road network in combination with demographic data on the numbers and ages of school children. GIS has also been used to track deforestation in Bolivia over time and, through modeling, to rank and predict areas vulnerable to future deforestation. With support from the Food and Agriculture Organization of the United Nations, water resources, including inland fisheries in Sub-Saharan Africa, are being studied with a GIS to predict fish yield and to help local communities plan for adequate food supplies. In Iowa, GIS has been used to study the spatial associations between demography, ecology, and the incidence of West Nile virus (**Figure 1.19**).

As a tool, GIS has tremendous potential to help solve problems, model social and environmental conditions, and make planning decisions. For students and others who are thinking about career plans, GIS has dramatically transformed employment prospects for geographers by opening up a wide range of job and career options across the public and private sectors.

There are, however, three major criticisms of GIS. One is that to do GIS requires that users have access to the necessary hardware and software. Most GIS software is proprietary and has the greatest functionality on today's newest and fastest computers. Even though the prices for both computers and GIS software have become more affordable, purchasing just the minimum components can still cost a few thousand dollars. In addition, before you can use your GIS, you need data. Some GIS data are publicly available at no charge, but this is not always the case. Thus, you may have to purchase customized data from a GIS services firm or employ personnel to conduct fieldwork to obtain the data. These hardware, software, and data-related costs have prompted people inside and outside the GIS-user community to point out that GIS is still not very accessible.

A second and related criticism is that, given its constrained accessibility, GIS reinforces one power divide in society such that only those individuals and institutions that have the requisite financial resources can purchase and use GIS. This limitation has ramifications for mapmaking and for decisions made based on GIS-derived maps and analysis. On the one hand, access to GIS means we can make more maps than ever before. On the other, it is important to ask, Who is making those maps and whose economic, political, or other interests do they serve?

A third criticism of GIS is that it promotes a detached and strongly Western view of the world. It is entirely

Geography InSight

A GIS for studying disease incidence • Figure 1.19

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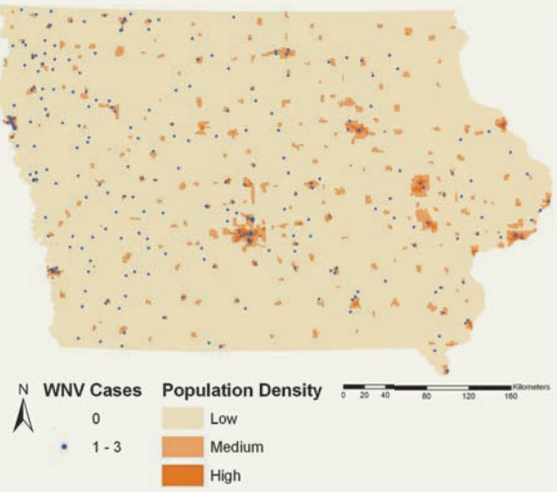
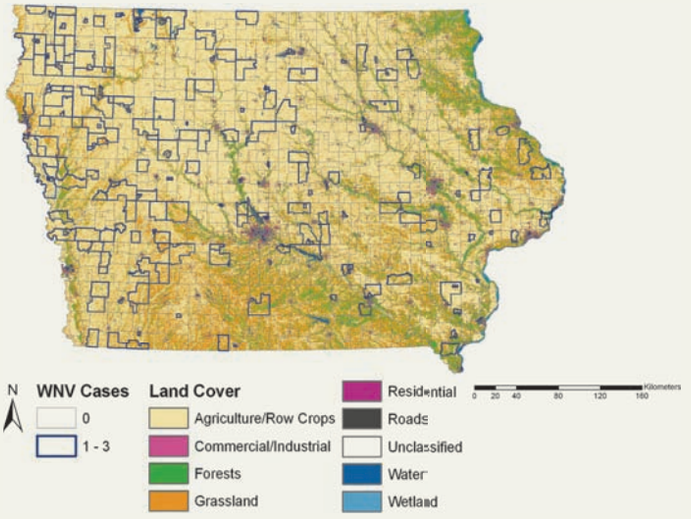
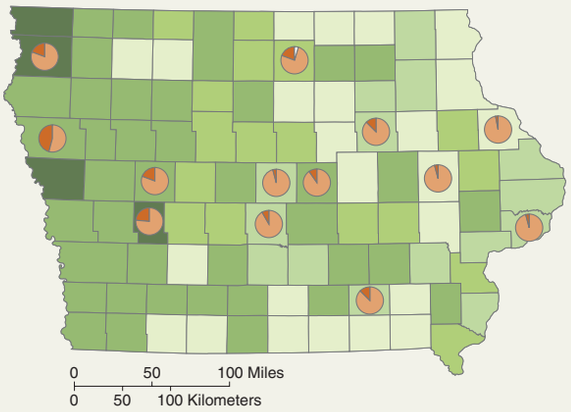
West Nile virus (WNV) is a disease that can be transmitted to humans and animals by certain mosquito species. The first outbreaks of WNV occurred in the United States in 1999. Nationally, Iowa and several other Midwestern states have recorded a high incidence of the disease. These maps illustrate the use of a GIS to study disease incidence. (*Source:* DeGroote et al., 2008.)

a. This map was created by overlaying a dot map of disease incidence on the map of population density. The scale of the study was conducted at the level of census block groups (a subdivision of a census tract). If WNV occurred in a block group, its center point is shown.



b. Census block groups have been overlaid on a land cover map of Iowa. Darker boundaries indicate block groups recording occurrences of WNV between 2002 and 2006. Using this map and the previous one, we can see that WNV is more concentrated in the western part of the state and associated with agriculture and row crops.





c. Several *Culex* species of mosquito are the most significant transmitters or vectors of the disease. This map shows disease incidence and mosquito species by county. ▶ **How might agricultural practices such as irrigation and animal feeding operations be associated with the spread of WNV?**

(Figure 1.19 images courtesy of J. P. DeGroote, R. Sugumaran, S. M. Bend, B. J. Tucker, and L. C. Bartholomay. 2008. Landscape, demographic, entomological, and climatic associations with human disease incidence of West Nile virus in the state of Iowa, USA. *International Journal of Health Geographics* 7(19). Original publisher: BioMed Central.)

possible to do GIS by simply sitting in front of a computer and never visiting the site being studied. What impact might this style of work have on the way decisions about a place are made? Although there have been some strides toward incorporating local knowledge into GIS, how places in the world are represented in a GIS remains anchored to concepts of absolute location, defined boundaries, and contemporary political states.

CONCEPT CHECK

STOP

1. **How** does remote sensing incorporate the concept of scale?
2. **How** does a GIS incorporate and make use of georeferenced data?
3. **What** are some limitations of remote sensing, GPS, and GIS?

Summary

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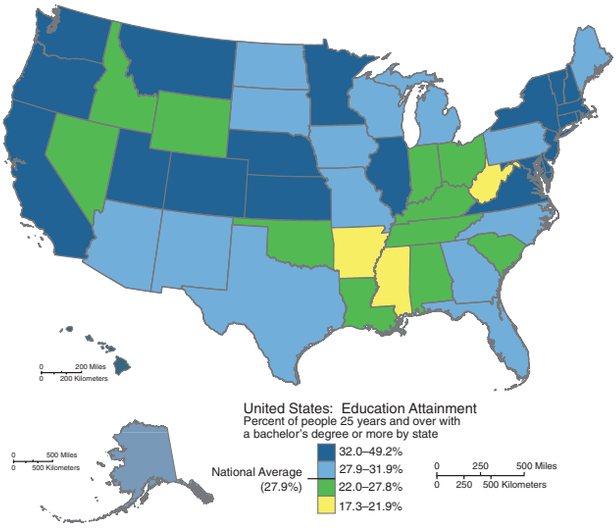
1 Introducing Human Geography 4

- The discipline of geography consists of two main, and sometimes intersecting, branches: physical and human. The scope of **human geography** is broad and encompasses the study of places, spatial variation, and human–environment relationships.
- The terms **nature** and **culture** rank among the most complex words in the English language. Dualistic thinking that separates nature from culture has shaped Western thought, but many geographers reject the **nature–culture dualism**.
- Very broadly defined, **cultural ecology** focuses on the relationships between people and the environment. Four different ways of understanding that relationship include **environmental determinism**, **possibilism**, humans as modifiers of the Earth, and the Earth as a dynamic, integrated system. Of these, environmental determinism has received the most strident criticism.
- **Political ecology**, a branch of cultural ecology, places greater emphasis on the role of economic forces and power relations in shaping nature–society dynamics. **Actor–network theory**, for example, seeks to reinsert a consideration of environmental influence in such studies.
- Culture can refer to shared beliefs and practices of a group. Reading the **cultural landscape** and performing **regional analysis** have long been associated with this conceptualization of culture. Regional analysis frequently involves the study and mapping of **formal regions**, like the ones shown on the map, as well as **functional** and **perceptual regions**.

Formal, functional, and perceptual regions • Figure 1.5



- There has been a significant reconceptualization of culture within human geography. This reconceptualization sees culture not only as a collection of cultural traits but also as a social construction that is dynamic and contested.

2 Thinking Like a Human Geographer 12

- Geographical inquiry is informed by five key topics or approaches, including **place**, **space**, **spatial diffusion**, **spatial interaction**, and **geographic scale**.
- Places are essential to the spatial functioning of society. Different attributes of **site** and **situation,** depicted in the photo, convey information about the geographic context of a place.

Site and situation • Figure 1.7

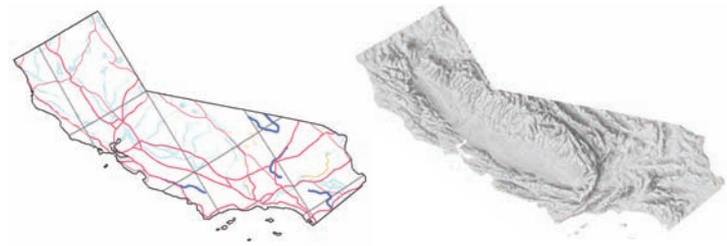
MUSTAFA OZER/AFP/Getty Images

- When geographers talk about space, they are referring to either absolute or relative space. Spatial diffusion occurs when some phenomenon spreads across space, but such diffusion is rarely a uniform process. Thus, the study of diffusion is also intimately associated with questions about **distribution** and **distance decay**.
- The practice of adopting a spatial perspective, whether that includes studying **spatial variation**, **spatial association**, or how people create and perceive relative space, distinguishes geography from other fields of study.
- Spatial interaction increasingly fuels **globalization**, but the particular geographies of globalization are shaped by complex contingencies related to uneven diffusion, complementarities of trade, and the accessibility and connectivity of places.
- We perceive the effects of globalization through **time–space convergence** in the way that distant places seem to become closer together as technologies reduce travel time and cost. Although the geographic scale of the globe remains unchanged, time–space convergence affects relative distance.

3 Geographical Tools 23

- From the paper map to the interactive map, the geographer's toolbox continues to expand through technological advances related to **remote sensing**, **GPS**, and **GIS**. Remote sensing has extended the visual horizons of geography by enabling us to see and detect things not visible to the naked eye. GIS has improved our ability to examine spatial associations and visualize them, especially by creating maps such as the ones shown here, and overlaying them.
- These exciting technologies do raise serious ethical questions about privacy and surveillance. GPS has been criticized for its potential to contribute to geoslavery.

GIS data layers • Figure 1.18



Key Terms

- actor–network theory 8
- complementarity 17
- cultural ecology 5
- cultural landscape 9
- culture 11
- distance decay 18
- distribution 15
- environmental determinism 5
- formal region 10
- functional region 10
- geographic information system (GIS) 27
- geographic scale 20
- global positioning system (GPS) 26
- globalization 17
- human geography 5
- intervening opportunity 18
- nature 5
- nature–culture dualism 5
- perceptual region 11
- place 12
- political ecology 8
- possibilism 8
- raster data 27
- regional analysis 10
- remote sensing 23
- site 12
- situation 12
- space 14
- spatial association 15
- spatial diffusion 16
- spatial interaction 17
- spatial variation 15
- time–space convergence 20
- transferability 18
- vector data 27

Critical and Creative Thinking Questions

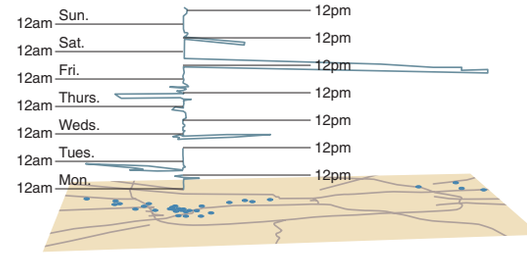
1. Applying what you have learned about diffusion, is it feasible to close borders between countries when an epidemic appears to be intensifying and becoming global in scale?

2. Do national parks and protected areas reflect a nature–culture dualism? Explain your reasoning.

3. Do you agree with the actor–network theory? Discuss your answer.

4. Propose a GIS project and identify the spatial and attribute data you would need to conduct it.

5. Plan a research project that would enable you to cartographically depict the boundaries of a perceptual region.



6. Keep a geographical diary in which you record the times and the places you go during a week. (You can also do this by collecting waypoints if you have a GPS-enabled cell phone or other GPS receiver.) Use the Internet to find a suitable base map and plot out your time–space paths, using this figure as an example. If you know how, you could even make a mash-up and include photos of your favorite places.

What is happening in this picture?

A flash mob protest assembles in Terminal 5 at Heathrow Airport in London. Flash mobs are large groups, often coordinated via social networking sites, that gather in a public place for a specific purpose.

Steve Parsons/PA Wire/AP Photo

Think Critically

1. How does a flash mob challenge taken-for-granted notions of space?
2. What type of diffusion drives flash mob formation?

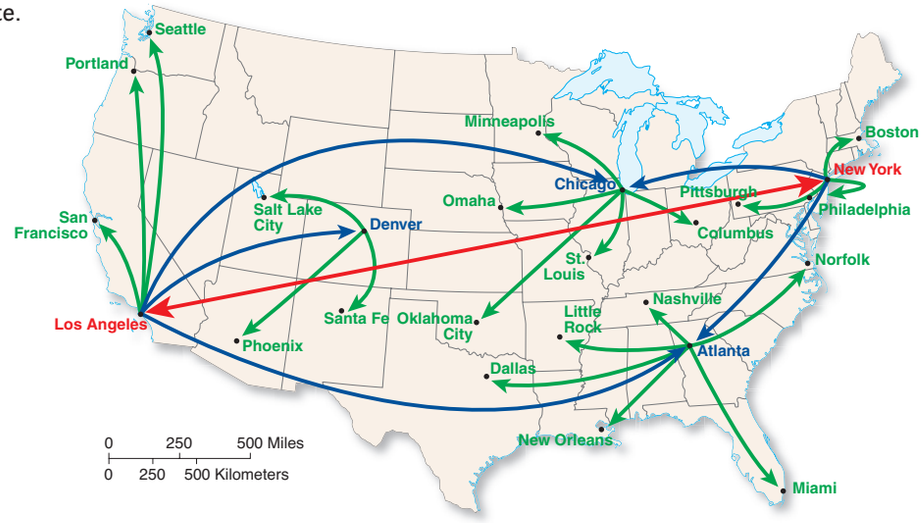
Self-Test

(Check your answers in Appendix B.)

1. Which of the following statements about place is FALSE?
   a. Studies of place may begin with a consideration of site characteristics.
   b. Every place has a unique absolute location.
   c. The situation of places can change.
   d. Sense of place is related to the ability to navigate.

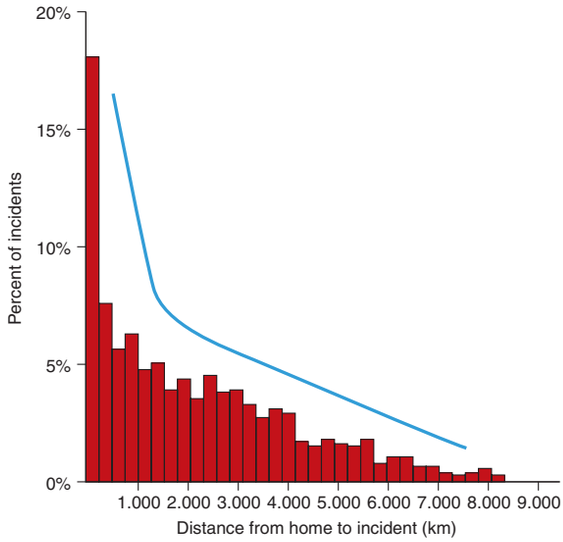
2. Which of the following is most closely associated with relative space?
   a. a GPS receiver
   b. trade between two cities
   c. site
   d. formal regions

3. _____ diffusion, shown here, involves _____, where certain individuals or places are skipped because of their rank or status.
   a. Stimulus; bypassing
   b. Contagious; overlapping
   c. Stimulus; randomization
   d. Hierarchical; leapfrogging



4. As discussed in the chapter, key factors that influence spatial interaction include all of the following *except* _____.
   a. transferability
   b. intervening opportunities
   c. complementarity
   d. relative distance

5. What spatial process is illustrated in this graph?
   a. distance decay
   b. connectivity
   c. accessibility
   d. hierarchical diffusion



6. Globalization and time–space convergence affect our perception of _____.
   a. culture
   b. relative distance
   c. regions
   d. absolute distance

7. The statement, "there is no such thing as culture" is most closely associated with _____.
   a. the nature-culture dualism
   b. actor–network theory
   c. culture reconceptualized
   d. stimulus diffusion

8. Which of the following situations is *not* likely to involve remote sensing?
   a. measuring the extent of an oil spill
   b. overlaying different mapped datasets
   c. identifying a pest infestation in an agricultural field
   d. locating new settlements in rural areas

9. GPS is associated with all but one of the following. Which item does *not* belong?
   a. absolute location
   b. navigation
   c. location-based services
   d. indirect georeferencing

10. Which of the following statements does *not* describe a characteristic of a GIS?
    a. A GIS can relate settlement density to elevation.
    b. A GIS can use raster or vector data.
    c. A GIS can use directly but not indirectly georeferenced data.
    d. A GIS links attribute data to spatial data.

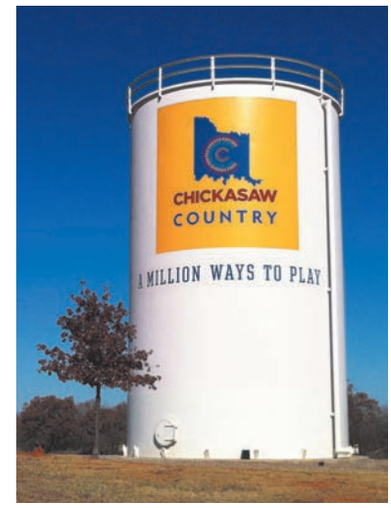
11. As discussed in the chapter, which of the following is *not* a major criticism of GIS?
    a. If all the data are on the computer, GIS users may feel no need to know a place firsthand.
    b. Because of its reliance on state or regional data, GIS can reinforce conventional views of society.
    c. GIS data may not be publicly available for a specific place or project.
    d. GIS is a recognized low-cost solution to decision making and planning.

12. Consider this statement: "Houses constructed with steep roofs or heavy thatch roofs are just two examples of responses to wet environmental conditions." Which viewpoint does it best express?
    a. possibilism
    b. Earth as a dynamic system
    c. environmental determinism
    d. cultural ecology

13. A good example of a functional region is _____.
    a. Red Sox Nation
    b. a wealthy residential community
    c. the area served by a TV station
    d. an area with a high percentage of college graduates

14. An approach that uses the cultural landscape as a clue to people's values and priorities is _____.
    a. reading the landscape
    b. political ecology
    c. regional analysis
    d. actor–network theory

15. This photo illustrates _____.
    a. the presence of a permeable barrier
    b. the concept of contagious diffusion
    c. the existence of a perceptual region
    d. the presence of an absorbing barrier



Courtesy Alyson Greiner

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Review your Chapter Planner on the chapter opener and check off your completed work.