McCarthy
AP Human Geography
Summer Assignment
2025-2026

Welcome to Mrs. McCarthy's AP Human Geography class. ☺ ☺

I am looking forward to a fabulous 2025-2026 Academic Year.

I am so happy that you have decided to take on this challenging but engaging course. This course is taught at the College Level and the pace rigor, expectations, and maturity required reflect that. It is reading, writing, and critical thinking intensive and you must be prepared to work hard both in and outside of the classroom.

Please note that Human Geography is not a typical geography class in that it does not focus on "place-name" geography and simply "knowing where things are" (although that is a critical component to the course). Instead, we will focus on the interactions between humans and the space they inhabit. The motto for AP Human Geography is "The Why of Where"-we seek to understand spatial relationships and spatial interactions.

You have a Summer Assignment for the purpose of getting a "jump start" on Unit 1: Thinking Geographically. We have a lot of material to cover throughout the year. The Summer assignment includes tasks that will help you prepare not only for the first few weeks of class but also the course as a whole. Successful completion of this work will ensure that you have a better understanding of what you're getting into with the course and that you are more prepared for the information we will cover.

Summer Assignment Instructions are below:

1. **Download or print the National Geographic: AP Human Geography Textbook pages for Unit 1 – Please Read and Complete the Guided Notes. Your responses will need to be handwritten.** (If you are unable to print, please use your own paper.)
2. **Please continue to review Unit 1 as there will be an assessment given when school begins. Assessment date will be discussed on the first day of class. Typically it is within the first 2 weeks of school beginning.**
3. **Have an excellent summer and if you have any questions, please feel free to contact me via email: paige.mccarthy@imgacademy.education**

I will be checking email periodically throughout the Summer so please be patient if you do not receive an immediate reply. ☺

Safeguarding Pristine Seas

Why is it important to have a rich diversity of species on Earth?

Thinking Geographically- How might the creation of relatively small marine reserves affect natural resources and sustainability in the rest of the world's oceans?

Chapter 1: The Power of Geography: Geographic Thinking

1.1What is Human Geography?

Studying Human Geography

What is geography?

What is Physical Geography?	What is Human Geography?

What are the 3 ways geographers differentiate geography from other fields in the physical and social sciences?

Geographic Perspectives

What is spatial perspective?	What is the ecological perspective?

Essential Elements of Geography

Question	Explanation of the question
Where?	
Why There?	
Why Care?	

Location and place

Term	Definition	Example
Location		
Absolute Location		
Relative Location		
Place		

How is place different from Location?

What does it mean to have a "strong sense of place?"

Explain how a place can change.

What is a mental map? Why and when would you use a mental map?

Factor	Definition	Example
Site Factor		
Situation Factor		

Space, pattern, and flow

What is space?

What is distributed?

Distribution concepts	Definition	Example
Density		
Pattern		

What is flow and why is it important in the study of geography?

Human-Environment Interaction

Theories of Interaction	Definition/explanation	Example and is it credible?
Environmental determinism		
Possibilism		

What is sustainability?

What is distance decay?

What is friction of distance?

What is the Time-space compression?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, make a note to open this question up for discussion in Mrs. McCarthy's class 😊
1. Explain whether the address of a restaurant is an absolute location or relative location 2. Describe how geographic concepts help to explain the distribution of phenomena on Earth. 3. Describe how technology "shrinks the world" using the time-space compression model 4. Compare the theories of environmental determinism and possibilism.

Case Study- New Orleans

Explain why New Orleans's founders decided that the advantages of the location's situation outweighed the disadvantages of its site.

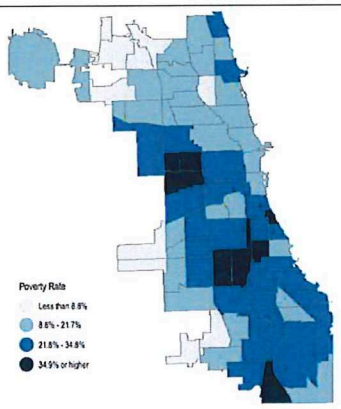
Conserving the Delta

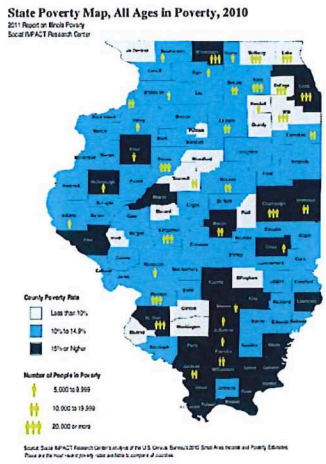
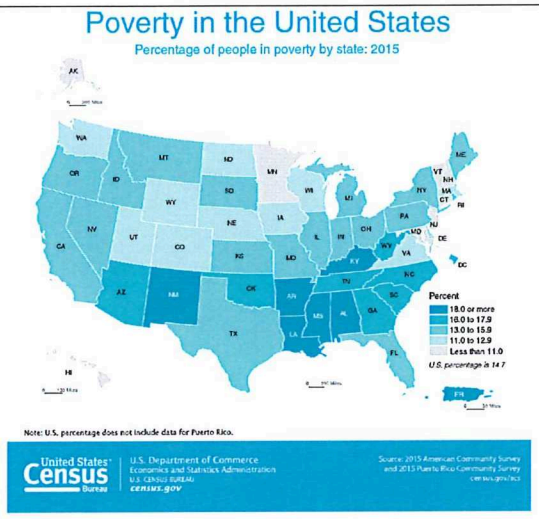
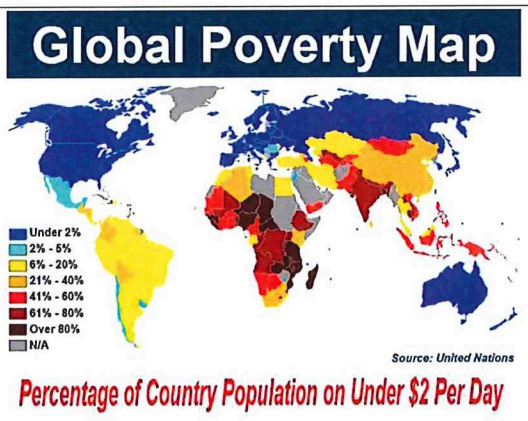
Identify and Explain the reasons why it is important to sustain the Okavango River Basin

1.2 Spatial Patterns: Scale and Region

Zooming in and Out

What is scale?

Scale	What it looks like	Advantages	Disadvantages
Local			

Regional			
National			
Global			

Why do geographers use different scales?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, make a note to open the question(s) up for discussion in Mrs. McCarthy's class. 😊
1. Explain how using different scales of analysis helps geographers and other scientists understand the ways climate change is affecting the planet 2. Describe how the analysis of the population of New England differs at a regional and local scale.

Unifying Features

What is a region?

Why are regions important?

Types of Regions	Definition	Example
Formal/Uniform Region		
Functional Regions		
Perceptual/Vernacular Region		

What is a node?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, make a note of the questions you would like to discuss in Mrs. McCarthy's class. 😊
1. Quebec is a province in Canada in which 83% of the population speaks French as a first language. Identify Quebec's region type. 2. Compare the functional region of a pharmacy in a dense city with few drivers to the functional region of a pharmacy in a sparsely populated suburb. 3. Describe the role that cuisine, or style of food, might play on the understanding of a vernacular region.

Explain why geographers might have concerns about growing inequality in India.

1.3 Globalization and Sustainability

Global vs. Local

What is Globalization?

What are some positive consequences of Globalization?

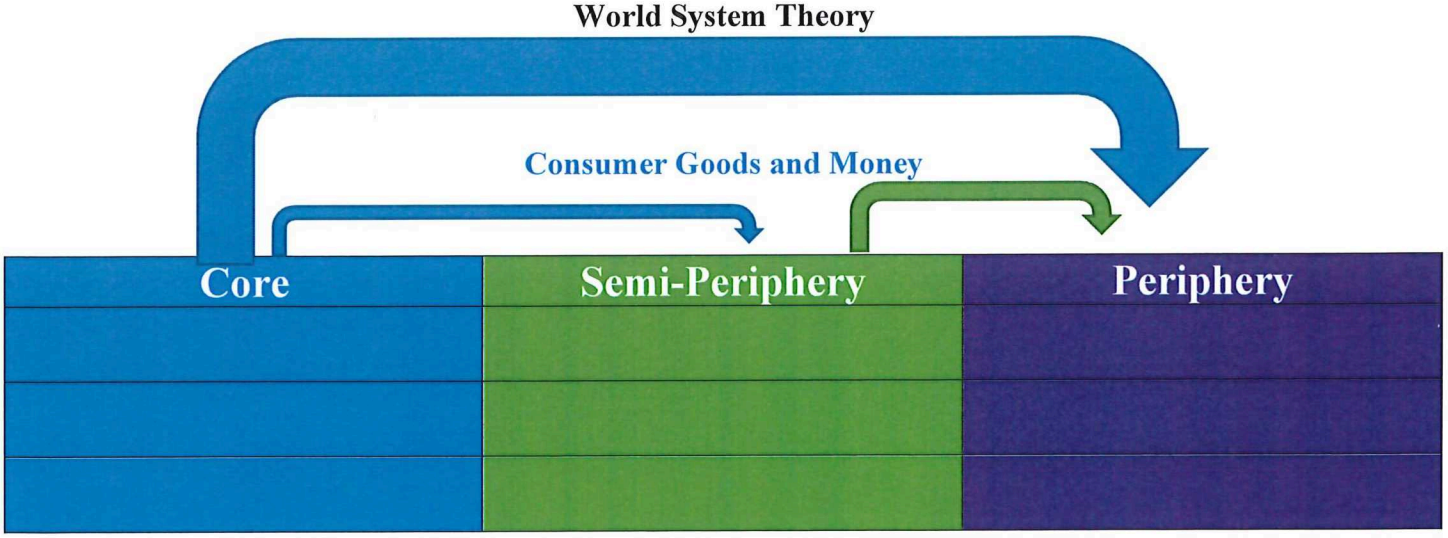
What are some negative consequences of Globalization?

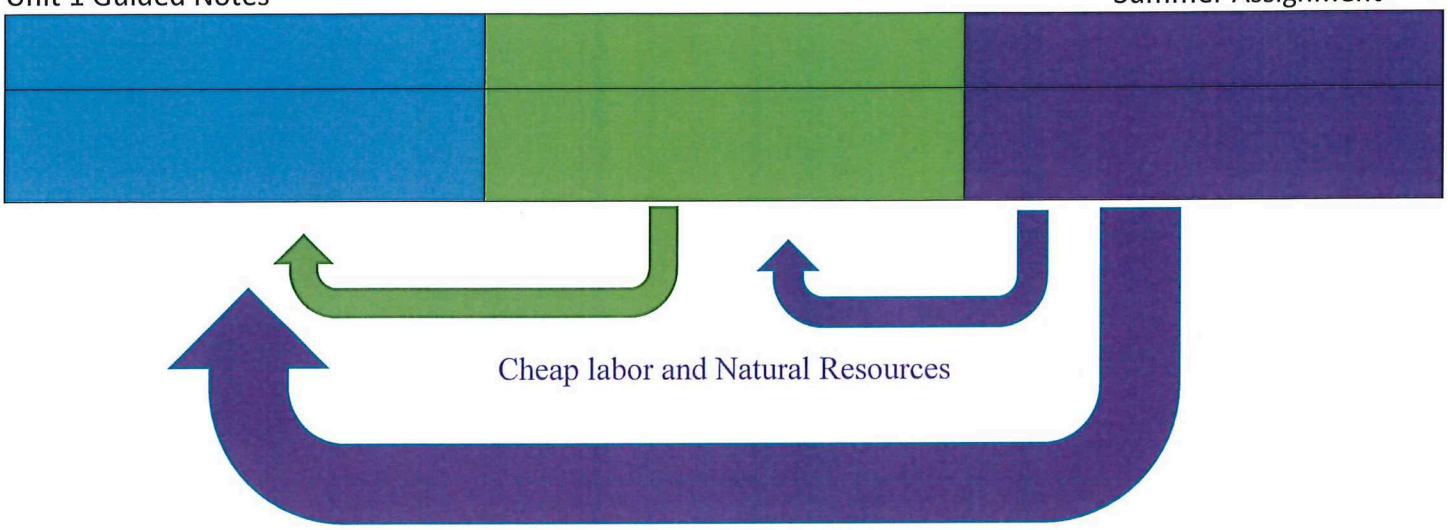
What is NAFTA? What is the USMCA? What is the EU? How are these examples of Globalization?

Wallerstein's World System Theory

What is a theory?
What is Wallerstein's world system theory?

Category of Country	Definition	Example
Core		
Periphery		
Semi-Periphery		





Sustainability

What is Sustainability?

What is Sustainable development?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, note the question(s) you would like to discuss in Mrs. McCarthy's class.
1. Explain why it might be difficult for a peripheral country to become a part of the core. 2. Describe how world system theory is related to globalization. 3. Explain why sustainability is an important human geography theme.

Chapter 2: Geographic Inquiry: Data, Tools, and Technology

2.1 Thinking like a Geographer: The Geo-Inquiry process

What are the 5 steps for thinking like a Geographer?

Step	What is it? What does it look like? Explanation of the step	Tips for carrying out each step
Ask		
Collect		

Visualize		
Create		
Act		

What is the Geo-Inquiry Process?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, make note of the question(s) you would like to review in Mrs. McCarthy's class 😊
1. Describe the Geo-Inquiry Process 2. Explain how thinking like a geographer benefits all decision-making 3. Identify 3 Geographic questions about any environmental, social, or economic issues that interest you, and then explain how your questions might change when considering different scales of analysis

2.2 Geographic Data and Tools

Collecting Data
What is geographic information?

What methods are used to collect data?

Type of Data	Definition	Example
Quantitative Data		
Qualitative Data		

Who Collects Data

What is a census?

How often is it done in the USA?

The census is a mandate by the Federal Government, but why is it important at the state and local level?

Geographic Information Systems

What is geographic information systems (GIS)?

What is topography?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, make note of the question(s) you would like to discuss in Mrs. McCarthy's class 😊
1. Describe the difference between quantitative and qualitative data and provide an example of each. 2. Explain what GIS is and how it is used to understand spatial patterns and relationships.

Other Remote Sensing Tools

What is remote sensing?

What is global positioning system (GPS)?

Case Study- Detroit- GIS helps find safer routes

Think about the mental mapping you did in Chapter 1. What would you expect to find if you followed Detroit's example in mapping routes to your school?

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, please make note of which question(s) you would like to discuss in Mrs. McCarthy's class. 😊
1. Identify 3 ways geographers collect data. 2. Describe how drones have impacted the acquisition of geospatial data. 3. Explain why it is important to collect data at the appropriate scale. 4. Describe one-way geographers could use GPS in their work.

National Geographic Explorer- Sarah Parcak
Explain how geospatial technologies used for data collection have impacted geographers' work.

2.3 Understanding maps

Mapmaking

What are cartographers?

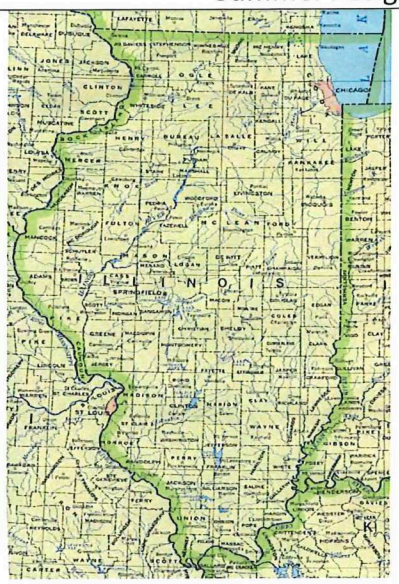
Why are maps important? What do maps show?

Term	Definition	Example
Absolute Distance		
Relative Distance		
Absolute Direction		
Relative Direction		

Explain how maps are an important problem-solving tool.

Map Scales

Map Scale	Definition	Example Map
Large-Scale Map		

Medium-Scale Map		
Small-Scale Map		

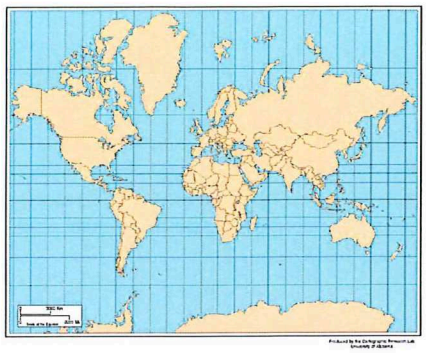
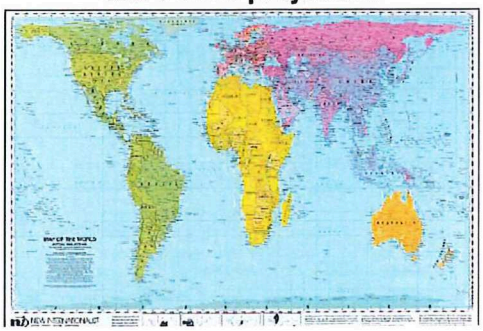
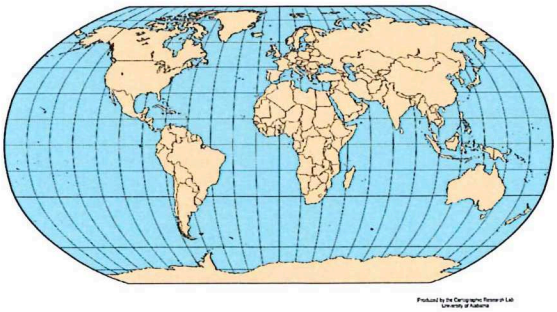
What is map scale?

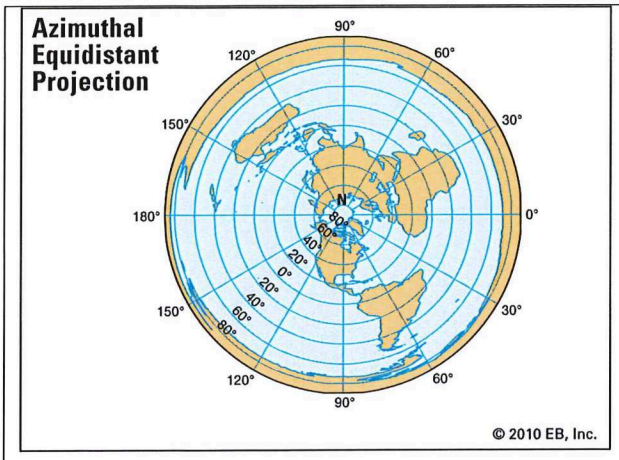
What are the 3 ways a map scale can be expressed?

Why is the scale of a map important?
Map Projections

What are map projections?

Map Projection	Advantages	Limitations
Mercator		

MERCATOR PROJECTION OF THE WORLD 		
Gall-Peters 		
Robinson ROBINSON PROJECTION OF THE WORLD 		
Azimuthal		

Map Projection	Advantages	Limitations
		

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, please make note of the question(s) you would like to discuss in Mrs. McCarthy's class. ☺

1. Describe 1 example of absolute distance and 1 example of relative distance
2. Compare the 3 ways scale is expressed on maps by explaining how they are alike and different
3. Explain why the Robinson projection is one of the most commonly used map projections

Types of maps

Type of Map	Definition	Examples (Picture or text)
Reference Map		
Thematic Map		
Isoline Map		
Graduated Symbol Map		
Cartogram Map		
Dot Map		
Choropleth Map		

Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, please note which question(s) you would like to discuss in Mrs. McCarthy's class 😊
1. Choose one of the thematic maps from this lesson. Based on specific details, describe one conclusion you can draw from the map. 2. Explain similarities and difference between dot maps and graduated symbols maps. Why might one or the other be preferable for different types of data?

2.4 The Power of Data

How Data are used

How are geographic data used?

Making decisions with Geographic Data

Explain how geographic data can influence a person's life.

Explain how geographic data can influence a business.

What is OpenStreetMap? How has it made an impact in the world?

Explain how geographic data can influence governmental decision-making.

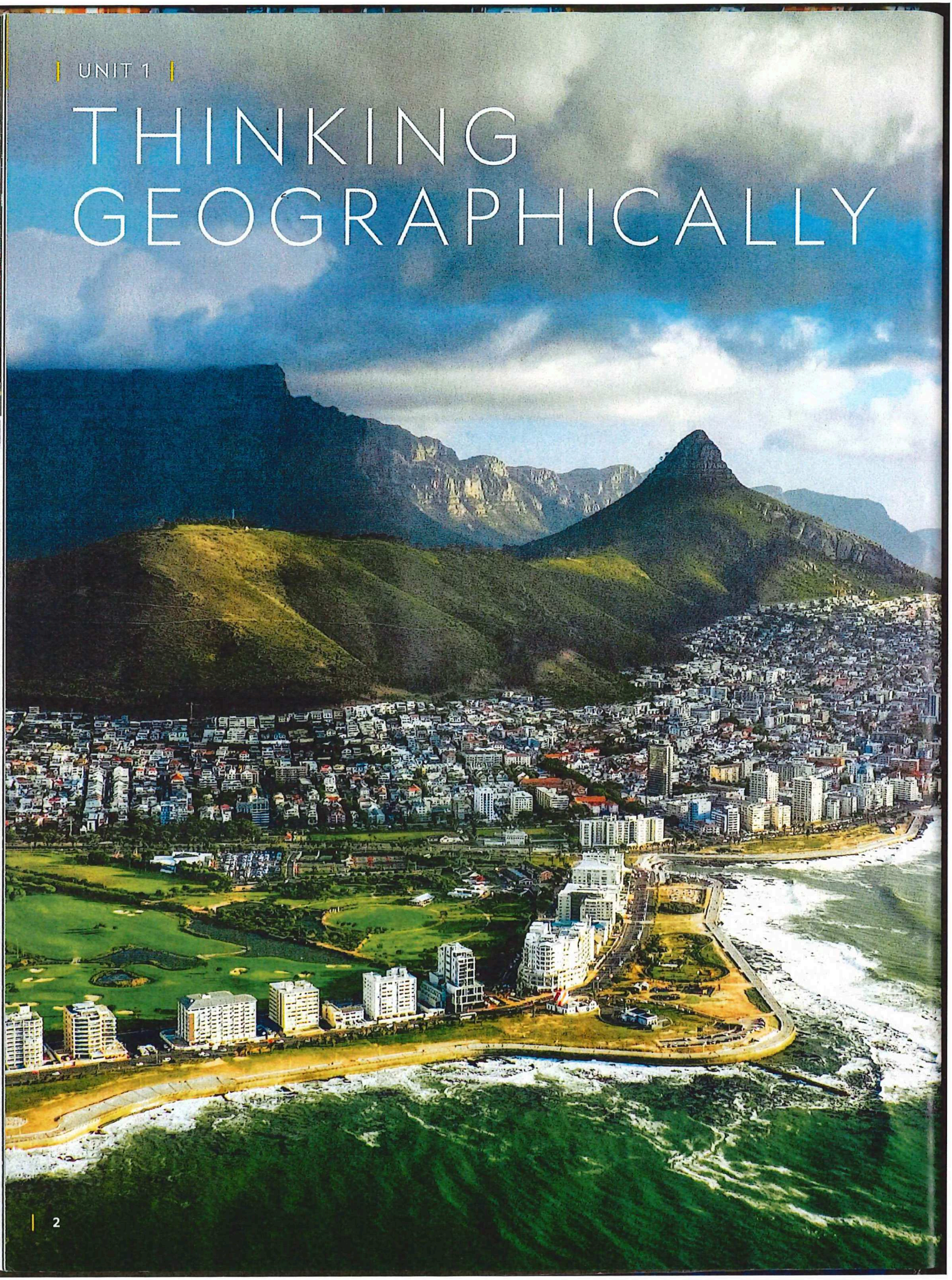
Time to Test your comprehension. If you can answer these questions you have a good understanding of this section. If not, please note which question(s) you would like to discuss in Mrs. McCarthy's class 😊
1. Explain how showing spatial patterns can help decision-making. Use an example from the text. 2. If you wanted to create a map that demonstrated to the public the seriousness of a certain city's homelessness problem, what type of thematic map would you use? Explain your thinking.

National Geographic Explorer Shah Selbe

How were scale and information from indigenous people incorporated into Selbe's approach to gathering data?

UNIT 1

THINKING GEOGRAPHICALLY



THE HUMAN IMPACT

Greenmarket Square in Cape Town

Humans have left an indelible imprint on every part of the globe, as evidenced here by the sprawling communities and built-up shoreline of Cape Town, South Africa. At the same time, Earth's features and processes have molded profound and enduring aspects of human societies—our cultures, economies, and politics. Human geography focuses on the interactions between humans and the physical environment.

Geographers interpret the world through a lens that allows them to make connections between local, national, regional, and global issues to better understand our human stories.

In this course, you'll use this geographic lens to investigate the movement of people, cultures, and ideas; the political organization of countries; and the development of agriculture, settlements, and linked economies. You'll build an informed global awareness and discover the factors that influence the world's livability and sustainability.

SAFEGUARDING PRISTINE SEAS

Biodiversity makes our life possible. The rich diversity of species on Earth helps to keep our water clean and stabilize our climate, and contributes to food security. Enric Sala, National Geographic Explorer-in-Residence and founder of the Pristine Seas project, has made it his mission to preserve the biodiversity of Earth's oceans.

LEARNING OBJECTIVE

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

A MISSION TO PROTECT A team of scientists gathered by Enric Sala left for an expedition in 2005 to the Line Islands, a cluster of coral outcrops in the Pacific Ocean roughly 1,000 miles south of Hawaii. Some of the islands are U.S. territories, while the others belong to the nation of Kiribati (kee-rih-BAHS). In this remote patch of ocean, Sala's team conducted groundbreaking research on one of the few coral reef ecosystems that remain largely untouched by human activity. These studies provided scientific support for what would become an ecological triumph.

In January 2009, President George W. Bush signed into existence the Pacific Remote Islands Marine National Monument, which placed several U.S. territories, including the American Line Islands, off limits to commercial fishing and other for-profit activities. This protected zone was expanded in 2014 by President Barack Obama to more than 745,000 square miles—covering a greater area than all U.S. National Parks on land combined. The nation of Kiribati, meanwhile, has declared a 12-mile fishing exclusion zone around its Southern Line Island, which the team and Sala explored in 2009.

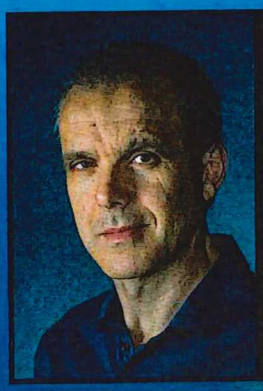
In 2008, Sala founded the Pristine Seas project to expand his work in exploration and conservation. Sala's methods, models, and data are intended to establish the threshold of ecosystem health that can be used to inform conservation priorities and efforts of governments and organizations. Pristine Seas expeditions have investigated some of the most isolated places on the planet in locations ranging from the South Pacific to the high Arctic. "These remote, untouched places are the only baseline we have left for what the oceans used to be like. They are like the instruction manual for the ocean," says Sala. The Pristine Seas team includes not only researchers but also filmmakers and policy and communications specialists who support the mission to discover, inform, and advocate for changes in the ways humans interact with the oceans. To date, Pristine Seas has inspired the protection of more than 3 million square miles in 22 of the largest marine reserves on the planet.

CHALLENGES TO CONSERVATION Enric Sala admits, "It is difficult to be optimistic about the ocean in my lifetime." Indeed, while Pristine Seas has cause to celebrate notable successes in protecting a number of fragile habitats, 2.2 million square miles is a tiny fraction of the oceans' total surface area. Notwithstanding all of the zones protected by the efforts of Pristine Seas and other groups, 97 percent of Earth's oceans are still open to fishing. Much of this vast area is vulnerable to overfishing and pollution, which Sala calls "ecological sabotage."

At the same time, fishing is a means of survival for millions of people. Recognizing this fact, Sala calls for governments to better manage fisheries, improve fish farming known as aquaculture, and enforce laws against marine pollution. He argues that marine conservation actually enhances the sustainability of the fishing industry, citing the example of a fishing community in Kenya where incomes doubled because marine reserves had helped restore the health of sea life in the region's waters. "We know what works," Sala says, "we just need the political will and the vision to protect much more of our waters."

GEOGRAPHIC THINKING

How might the creation of relatively small marine reserves affect natural resources and sustainability in the rest of the world's oceans?



Sala and the Pristine Seas team have completed 31 expeditions between 2009 and early 2020.

Sharks hunt off the Galapagos Islands, where Pristine Seas helped to create the Darwin and Wolf Marine Sanctuary, protecting the highest abundance of sharks known in the world.

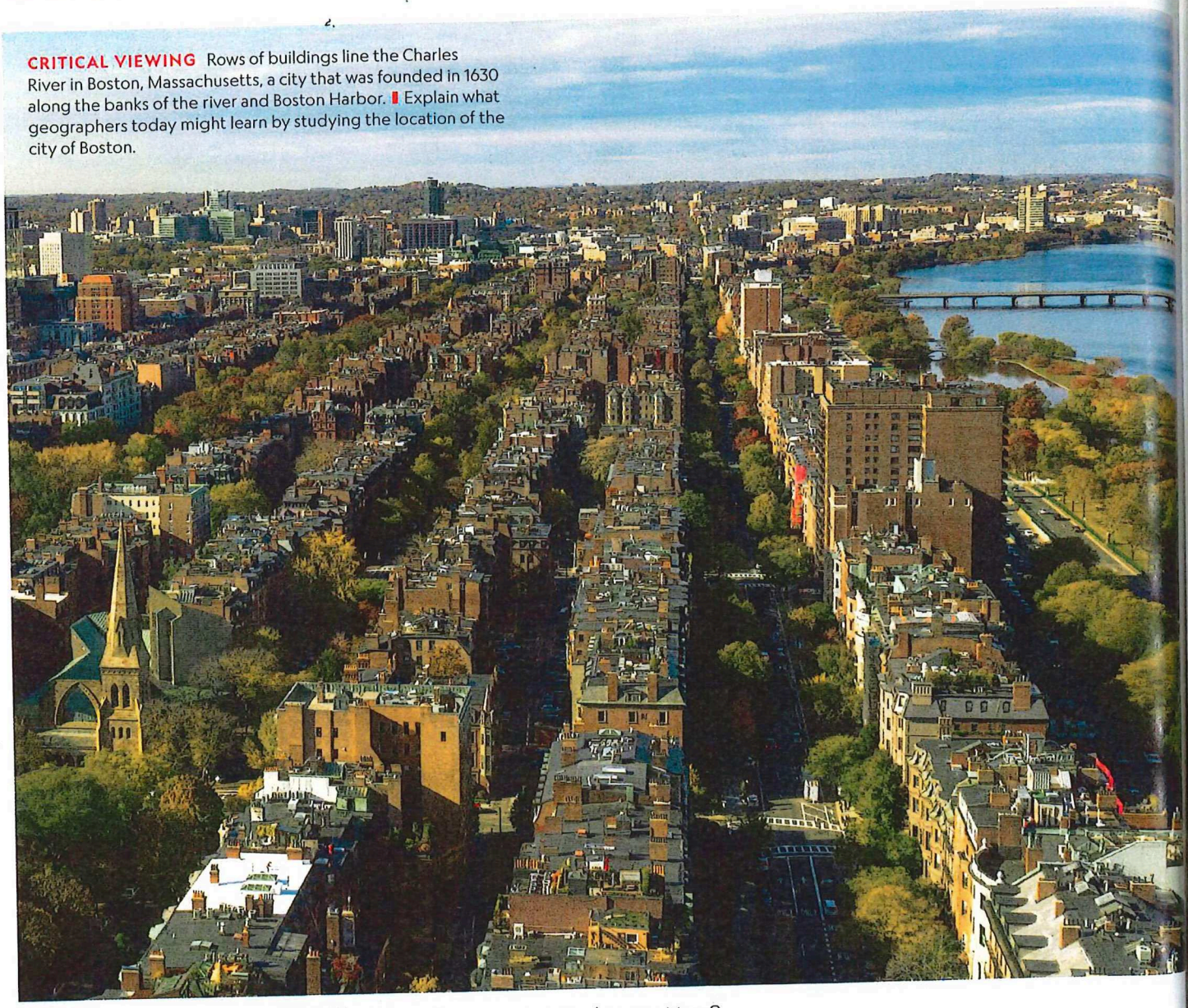
PRISTINE SEAS EXPEDITIONS & PROTECTED AREAS

Protected area Completed expedition

Source: © National Geographic Maps

CHAPTER 1

THE POWER OF GEOGRAPHY: GEOGRAPHIC THINKING



CRITICAL VIEWING Rows of buildings line the Charles River in Boston, Massachusetts, a city that was founded in 1630 along the banks of the river and Boston Harbor. Explain what geographers today might learn by studying the location of the city of Boston.

GEOGRAPHIC THINKING Why does geography matter?

1.1
WHAT IS HUMAN GEOGRAPHY?

CASE STUDY: New Orleans —Site vs. Situation

NATIONAL GEOGRAPHIC EXPLORER Adjany Costa

1.2
SPATIAL PATTERNS: SCALE AND REGION

CASE STUDY: India—Regional Differences in Scale

1.3
GLOBALIZATION AND SUSTAINABILITY

1.1 WHAT IS HUMAN GEOGRAPHY?

Exploring why things are located where they are can offer insights into how human activity shapes the world. Human geographers study the ways in which people use, adapt to, and change Earth, as well as how they are influenced by it. Establishing the concepts and perspectives that inform a human geographer's work will give you a context for the rest of this course.

STUDYING HUMAN GEOGRAPHY

LEARNING OBJECTIVE

PSO-1.A Define major geographic concepts that illustrate spatial relationships.

Whether you're aware of it or not, you are regularly engaged in geographic thinking. The simple act of traveling around your community requires you to know where your destination is, to plan a route, to consider distance and traffic, and to estimate how long your trip will take. When you perform these calculations, you are thinking geographically.

Geography is an integrative discipline that brings together the physical and human dimensions of the world in the study of people, places, and environments. Its subject matter is Earth's surface and the processes—continuous actions taking place over time—that shape it, as well as the relationships between people and environments, and the connections between people and places.

The discipline of geography is divided into two major areas. **Physical geography** is the study of natural processes and the distribution of features in the environment, such as landforms, plants, animals, and climate. For example, a physical geographer might focus on the movement of glaciers in different eras, or how a process like erosion changes a riverbed. **Human geography** is the study of the events and processes that have shaped how humans understand, use, and alter Earth. A human geographer studies how people organize themselves socially, politically, and economically and what impact they have on the natural environment.

Because geographers work on many of the same questions and problems as experts in other fields in the physical and social sciences, they face the challenge of differentiating geography from those fields. One distinguishing feature is geographers' focus on the relationship between humans and environments. Other disciplines tend to focus on either one or the other. Geography also recognizes the importance of where events and phenomena occur, focusing on how processes vary depending on location. For instance, a society will develop differently in a rural environment than in an urban setting. A third distinguishing feature is geographers' focus on geographic scales. You'll learn more about the importance of scale later in the chapter.

GEOGRAPHIC PERSPECTIVES

LEARNING OBJECTIVES

PSO-1.A Define major geographic concepts that illustrate spatial relationships.

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

Both branches of geography analyze complex issues and relationships from two key perspectives, or points of view. These perspectives help geographers interpret and explain spatial patterns and processes on Earth, and understand the complex relationships between nature and human societies.

The **spatial perspective** refers to where something occurs. In the same way that history is concerned with time and the chronological aspects of human life, geography is concerned with the spatial aspects—where things are located and why they are located there. When human geographers take a spatial perspective, they are studying how people live on Earth, how they organize themselves, and why the events of human societies occur where they do.

The second key perspective is the **ecological perspective**, which refers to the relationships between living things and their environments. Looking at an issue from an ecological perspective involves studying the interactive and interdependent relationships between living things, ecosystems, and human societies. This perspective helps explain human societies' dependence on diverse ecosystems for essential resources such as food and water. Taken together, these two perspectives help human geographers understand the complex relationship between humans and environments. The awareness that these and other perspectives exist is fundamental to a geographer's understanding of the world's people and places.

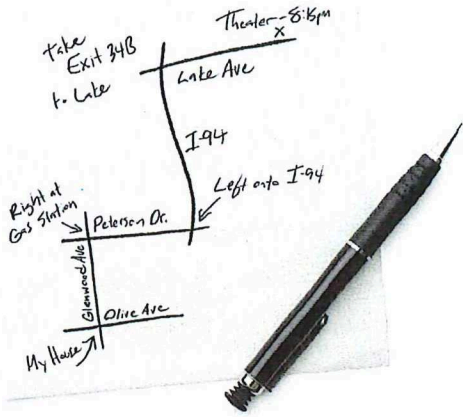
The essential elements of geography can be summed up neatly in the following three questions: Where? Why there? Why care? When geographers apply these questions, they are thinking geographically. Asking where something is located is the starting point for any geographic inquiry. Asking why it is located there pushes geographers to analyze the reasons behind processes and interactions. And asking why someone should care helps them establish the importance and relevance of their inquiries. Certain spatial concepts help geographers answer these questions. These concepts include location, place, space, flows, pattern, distance decay, and time-space compression.

LOCATION AND PLACE It should be no surprise by now that where things are found is an important geographic concept. **Location** is the position that a point or object occupies on Earth. Location can be expressed in absolute or relative terms. **Absolute location** is the exact location of an object. It is usually expressed in coordinates of longitude and latitude. The city of Budapest, Hungary, for instance, is located at 47.50° N, 19.04° E. With the proper means of transportation and a Global Positioning System (GPS), you could use these coordinates to get to Budapest from any other location on Earth. **Relative location** is a description of where a place is in relation to other places or features. A geographer might describe Budapest's relative location as 134 miles southeast of Vienna, Austria, or she might say that the city straddles the Danube River in the middle of the Carpathian Basin in north central Hungary.

The term **place** is related to but different from location. A place is a location on Earth that is distinguished by its physical and human characteristics. The physical characteristics of a place include its climate, landforms, soils, water sources, vegetation, and animal life; the human characteristics include its languages, religions, political systems, economic systems, population distribution, architecture, and quality of life.

When people say they feel a strong "sense of place," they are referring to the emotions attached to an area based on their personal experiences. The sense of place that people have for their hometown or certain buildings—a baseball stadium, for example—is stronger than it is for places they don't know, and it is tied to their sense of identity. Because humans create the concept of place in their encounters with the world around them, someone who grew up in Boston may strongly identify with the city or a particular neighborhood within it, just as a person who grew up in Berlin may strongly identify with that city. Their physical surroundings, the people they know, and the culture influence their perceptions. The attachment that Bostonians and Berliners form with their history, architecture, landforms, and people contribute to their identities.

Places change over time. As a society's values, knowledge, resources, and technologies evolve, the people within that society make decisions that alter the place they occupy. Cities grow, construction covers the land, wetlands are filled in, and mountains are mined for resources. Other places might shrink as people move away, and over time disappear altogether. Decisions about how to organize society and how to interact with other places cause changes as well. The relationships between places affect all involved, politically, economically, and culturally. Over a long enough period of time, empires rise and fall, climates change, and society evolves enough to change life significantly for the people who live in a place. If you've visited or seen pictures of cities that have been around for a long time, however, you've probably noticed that elements of the place's history—its original sense of place—usually remain.

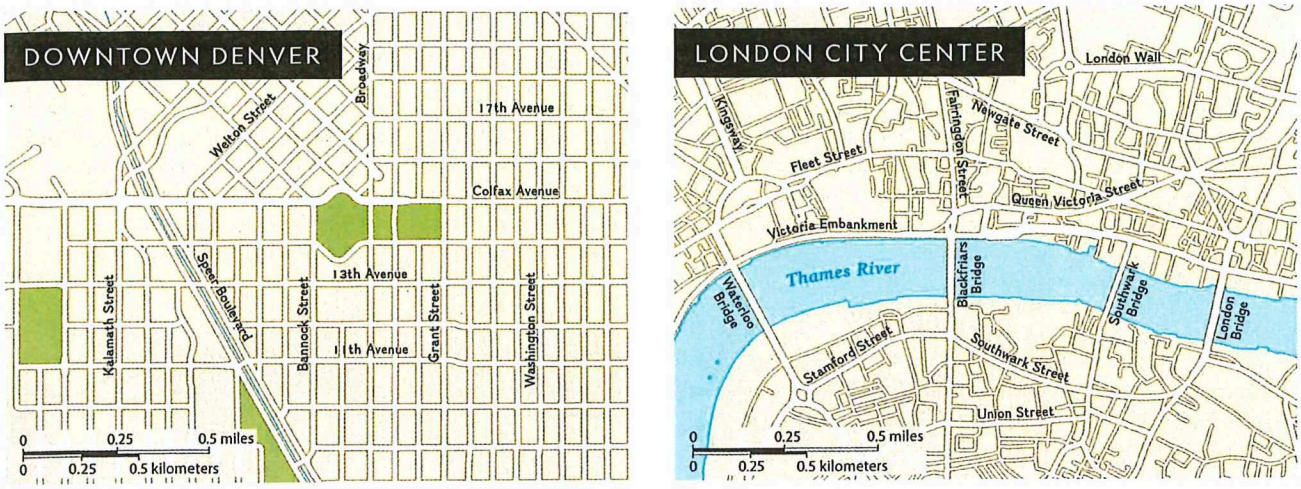


MENTAL MAPS

If you think about a place you go to regularly, you can probably imagine the route you take to get there. And you can likely draw a reasonably accurate map of your school, neighborhood, or town from memory. These internalized representations of portions of Earth's surface are called **mental maps**. Your mental map of different areas of the world depends on many factors. Your experiences, your age, where you live, and other factors contribute to the accuracy of your mental maps. For instance, what do you picture when you think of New England? How about the South, or the Pacific Northwest? Now compare your mental map to actual maps of these areas. You most likely have a clearer mental map of the area you live in than one that's far away.

Human geographers focus on two factors that influence how humans use a particular place. The first factor is **site**, which refers to a place's absolute location, as well as its physical characteristics, such as the landforms, climate, and resources. The second factor is **situation**, which refers to a place's location in relation to other places or its surrounding features. Situation describes a place's connections to other places, such as transportation routes (like roads, rail lines, and waterways), political associations, and economic and cultural ties.

When describing the site of the Spanish city of Barcelona, a geographer would say it is located on a plain with the Besós River to the north and the Llobregat River to the south. It lies between a rocky outcrop and a semicircle of mountains. It has a mild Mediterranean climate. Barcelona's situation, on the other hand, is that it is a port city on the Mediterranean Sea, which historically controlled the western portion of the sea along with Mallorca and Valencia. And because there are few navigable rivers in the region, Barcelona was well-situated as a major hub on the trade route from France to southeastern Spain.



The street maps of Denver and London illustrate contrasting urban patterns—a city like London that has evolved over a long period of time looks very different from a relatively newer city like Denver. The winding roads of London bear little resemblance to Denver's angular, gridlike layout.

SPACE, PATTERN, AND FLOW As you've read, when geographers think geographically, they are considering the arrangement of things in **space**. Space in this instance refers to the area between two or more things on Earth's surface. Studying the ways in which things are **distributed**, or arranged within a given space, can help human geographers describe and analyze the organization of people, places, and environments on Earth. Density and pattern are key concepts in the examination of distribution.

Density is the number of things—people, animals, or objects—in a specific area. For example, a geographer might compare the population density of a large city to that of a rural area. Manila, the capital city of the Philippines, has over 171,000 people per square mile. A rural area like the province of Davao del Sur, on the other hand, has about 850 people per square mile. Based on this statistic, what conclusions might a geographer be able to draw about the lives of a person in Manila and a person in Davao del Sur?

Pattern—how things are arranged in a particular space—is another factor of distribution. Depending on how humans settled and developed a place, and what their needs are for it, its features might be arranged in a neat, geometric pattern, or they might be arranged in a pattern that seems more random. Studying the patterns of phenomena in space can help geographers understand different processes, such as patterns of agricultural production, urban settlement, or the distribution of fast-food restaurants in a town. In Unit 5 you'll learn about different types of rural settlement patterns and the reasons why each pattern developed. Patterns can be observed in urban areas as well. Many old cities in Europe, for example, are made up of narrow, winding roads that are inconvenient for car traffic. But Denver, Colorado, was built on a grid system, with streets that intersect at right angles, which makes the city easier to navigate. How might getting around and dealing with traffic patterns differ in London than in Denver?

Obviously, geographers are not studying a world at rest. Any given space changes over time as things move from one place to another. The study of the **flow** of people, goods, and information and the economic, social, political, and cultural effects of these movements on societies is an important aspect of human geography. You will learn about the flow of people in Chapter 5 on migration, the flow of culture in Chapter 7 on cultural change, and the flow of goods in Chapter 20 on trade.

HUMAN-ENVIRONMENT INTERACTION

LEARNING OBJECTIVE

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

Regardless of where people live, they depend upon, adapt to, and modify the environment. They make decisions about how to live based on environmental features, and they make changes to the environment as a result of those decisions. Humans have always changed the landscapes they settled—using land for agriculture, tapping into natural resources, and building structures in which to live. But technologies and building techniques have given modern humans the ability to alter their environment in almost unlimited ways. Human geographers study how these changes affect both humans and the environment itself. Their views on the causes and effects of human societies' interactions with the natural environment have evolved over the years.

THEORIES OF INTERACTION In the 18th, 19th, and much of the 20th centuries, many geographers subscribed to a theory of human-environment interaction that has since been discredited, largely because some experts believe it inaccurately favors the accomplishments of certain societies over others. This theory—**environmental determinism**—argues that human behavior is largely controlled by the

COMPARE MODELS: DISTANCE DECAY AND TIME-SPACE COMPRESSION

A model is a representation of reality, which presents significant features or relationships in a generalized form. Models help geographers analyze spatial features, processes, and relationships. One example is the distance decay model. **Distance decay** is a key geographic principle that describes the effect of distance on interactions. The principle states that the farther away one thing is from another, the less interaction the two things will have. Cartographer and geographer Waldo Tobler's first law of geography states that while all things on Earth are related to all other things, the closer things are to one another, the more they are related. Think about an earthquake, flood, or revolution. The closer you are to any of these phenomena, the more you will be affected by it. Distance decay is connected to **friction of distance**, a concept that states that distance requires time, effort, and cost to overcome. Friction of distance applies to political, religious, and cultural movements as well, but because of modern advancements in technology and transportation, it has less impact today than in the past.

Time-space compression is a key geographic principle that is related to friction of distance. It describes the processes causing the relative distance between places to shrink. Modern transportation has greatly reduced travel times, and the internet and other forms of communication have made it easier to communicate with people anywhere on the planet and to send money around the world through online banking transfers. Through these technologies, humans have effectively caused the distances between places to seem shorter, as they are able to cross those distances more quickly and exchange goods and information more easily. The map below illustrates time-space compression. Why might Europe and North America seem closer together to a person today than they seemed to Columbus?

physical environment. According to the theory, a region's climate and soil fertility dictate how a society develops as it adapts to the environment. Environmental determinism has fallen out of favor, however, because it argued that the environment most suited to human development is that of western Europe and North America. This fails to take into account the fact that civilizations in other regions, such as North Africa and much of Asia, arose earlier than those in Europe and North America and were more advanced technologically and highly influential culturally for long periods of human history.

Modern geographers favor **possibilism**, a theory that argues that humans have more agency, or ability to produce a result, than environmental determinism would suggest. According to possibilism, individuals are active, not passive, agents. The environments in which they live offer individuals opportunities and challenges. Societies react to those opportunities and challenges in different ways depending on the decisions they make, their ingenuity, and the technologies available to them. The environment places some limitations on human activity, but societies have a range of options in deciding how to live within a physical environment. Think about settlements that have grown up in deserts. People divert rivers to irrigate land for agriculture and build dams and aqueducts for drinking water. They build whole cities in places that were once too barren and dry to support human life.

SUSTAINABILITY An important concept in thinking about human-environment interaction is **sustainability**, the use of Earth's land and natural resources in ways that ensure they will continue to be available in the future. Sustainable land use requires consideration of whether a particular natural resource is renewable, meaning nature produces it faster than people consume it, or nonrenewable, meaning people consume it faster than nature produces it. Solar and wind energy, for instance, are renewable resources, while coal and other fossil fuels are nonrenewable. The effects of a society's use of natural resources are important to consider as well. For example, what advice do you think a geographer concerned with sustainability might give to a government deciding what laws to pass to fight climate change?

GEOGRAPHIC THINKING

1. Explain whether the address of a restaurant is an absolute location or a relative location.
2. Describe how geographic concepts help to explain the distribution of phenomena on Earth.
3. Describe how technology "shrinks the world" using the time-space compression model.
4. Compare the theories of environmental determinism and possibilism.

CRITICAL VIEWING Lettuce and other produce grows in a garden behind center field at AT&T Park in San Francisco. Restaurants inside the ballpark use produce grown here to serve directly to baseball fans. ▮ Explain how this feature of the ballpark is an example of sustainability.

CASE STUDY

NEW ORLEANS—SITE VS. SITUATION

THE ISSUE New Orleans's proximity to resources, advantageous natural features, and transportation routes is ideal, but the land upon which it sits offers many challenges.

LEARNING OBJECTIVES

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

PSO-6.A Explain the processes that initiate and drive urbanization and suburbanization.

IN THE EARLY 18TH CENTURY, the French colonists who settled Louisiana needed a location for the colony's capital. They considered a variety of sites—some inland and some on the coast. After much consideration, they decided on an option that was slightly inland, on the Mississippi River. This would become the site of the city of New Orleans. Centuries later, residents of the city and the country are still grappling with the choice the original settlers made.

They knew the site wasn't ideal. Located on a sharp bend on the east bank of the Mississippi River, at the head of the delta leading to the Gulf of Mexico, and just south of Lake Pontchartrain, New Orleans floods easily and regularly and is subject to severe storms from the Gulf of Mexico. However, the city's situation was perfect. Its location at the southern end of the Mississippi meant that New Orleans would be connected to a huge area of the lands to the north. The Mississippi is the largest river system on the continent and has river links to two-thirds of the continental United States. Much of the continent's commerce traveled down the river right past the city. The city's founders decided that the advantages of the situation outweighed the disadvantages of the site. The city's situation is still valuable today—because of its location at the mouth of the Mississippi and its access to the Gulf of Mexico, New Orleans remains one of the busiest ports in the United States.

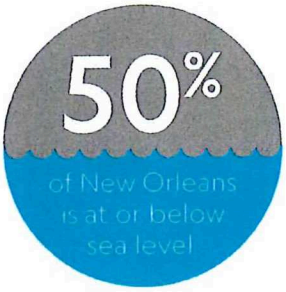
In order to deal with the site disadvantages, the city's early residents built artificial levees, or embankments, to keep the river from flooding the streets, and in the mid-1800s engineers figured out how to drain the wetlands between the river and Lake Pontchartrain, allowing the city's borders to spread out into low-lying terrain. Today roughly 50 percent of the city lies below sea level, a shallow bowl surrounded by more modern—but certainly not perfect—levees to keep the water out.

The imperfections of those levees were revealed in late August 2005, when Katrina, a destructive and deadly hurricane, slammed into New Orleans. The ten inches of rain that Katrina dumped, combined with a devastating storm surge, overwhelmed the levees that held back the waters of Lake Pontchartrain and nearby Lake Borgne. After the levees failed, water poured into the city, eventually flooding 80 percent of its land.

More than a million people evacuated the region before the storm, but tens of thousands remained because they could not or would not leave. Thousands of stranded residents took shelter at the Louisiana Superdome and the New Orleans Convention Center, but a lack of food and drinkable water and absence of sanitation created a public health emergency.

By September 6, the city had been almost completely evacuated, and fewer than 10,000 people remained. Much of the city was eventually rebuilt, and some of the displaced returned, but the population today remains lower than it was when Katrina struck. ▮

BY THE NUMBERS



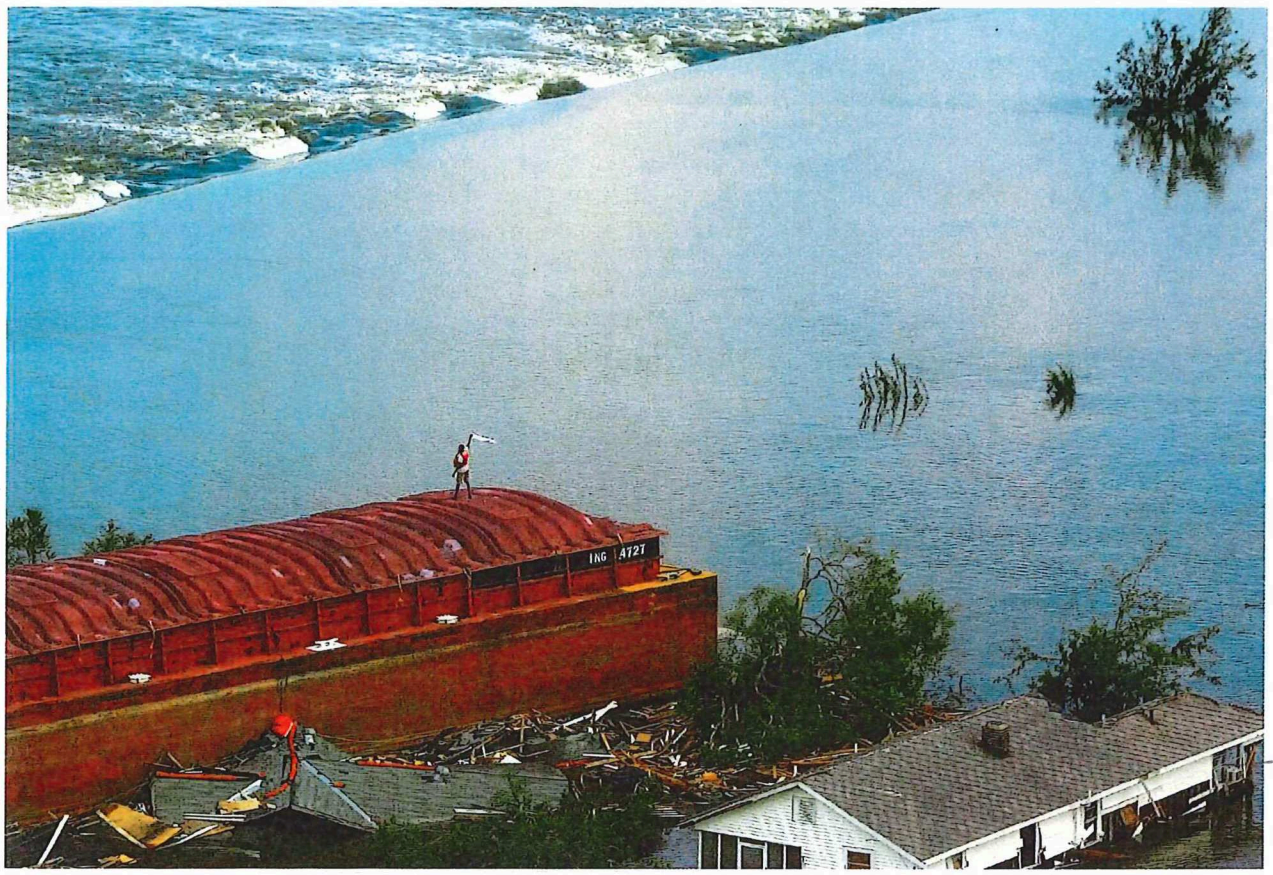
454,845
Population pre-Katrina

391,006
2018 population

Source: The Atlantic, United States Census Bureau

GEOGRAPHIC THINKING

Explain why New Orleans's founders decided that the advantages of the location's situation outweighed the disadvantages of its site.



Floodwaters flow over a failed levee along the Inner Harbor Navigation Canal near downtown New Orleans following Hurricane Katrina, while a trapped resident waves a white flag for help. A major flaw of New Orleans's site is found in its low-lying land along Lake Pontchartrain and the Mississippi River. Massive flooding devastated the region after Hurricane Katrina struck in 2005.

Though the site of New Orleans is far from ideal—an area prone to flooding and susceptible to strong storms—the city's situation was perfect when it was founded in the early 1700s. The maps highlight New Orleans's proximity to cities along the Mississippi River, as well as to the Gulf of Mexico.

Costa and her team are collecting scientific data that will be used to develop strategies to protect the Okavango River Basin and ensure sustainability.

NATIONAL GEOGRAPHIC EXPLORER **ADJANY COSTA**

CONSERVING THE DELTA

As climate change worsens and world population grows, sustainability becomes an ever more important topic in human geography. It is also a major concern of biologist Adjany Costa, the assistant director for National Geographic's Okavango Wilderness Project. Costa feels that the most effective human-environment interaction is to have as little impact on the environment as possible.

LEARNING OBJECTIVE

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

The Okavango River Basin is the largest freshwater wetland in southern Africa and provides water for a million people. Its delta in northern Botswana is rich with biodiversity and is home to the world's largest remaining elephant population, plus lions, cheetahs, wild dogs, and hundreds of species of birds.

Costa is a member of a team of scientists who have embarked on a series of canoe and mountain bike expeditions into the least known, most inaccessible areas of the watershed. As Costa explains, the basin's situation—its relationship with the surrounding areas—informs her work: "It's adjacent to a protected area in Namibia and two national parks, so it would create this whole square of conservation of land and ocean that are independent of each other but can still work together in regards to conservation."

In addition to research, another major part of Costa's job is advocacy and education. She meets with community leaders to educate them about the benefits of conserving the basin. The ultimate goal of the team's work is to help establish a sustainable management plan that will protect the Okavango watershed's source rivers forever.

GEOGRAPHIC THINKING

Identify and explain the reasons why it is important to sustain the Okavango River Basin.

1.2 SPATIAL PATTERNS: SCALE AND REGION

Human geographers examine issues from different angles. They might get a broad overview of the effects of a process on a large area and then move on to study how the same process affects a small space. They group areas together into cohesive units in order to identify and organize the space they study. These tools help them to interpret Earth's complexity.

ZOOMING IN AND OUT

LEARNING OBJECTIVES

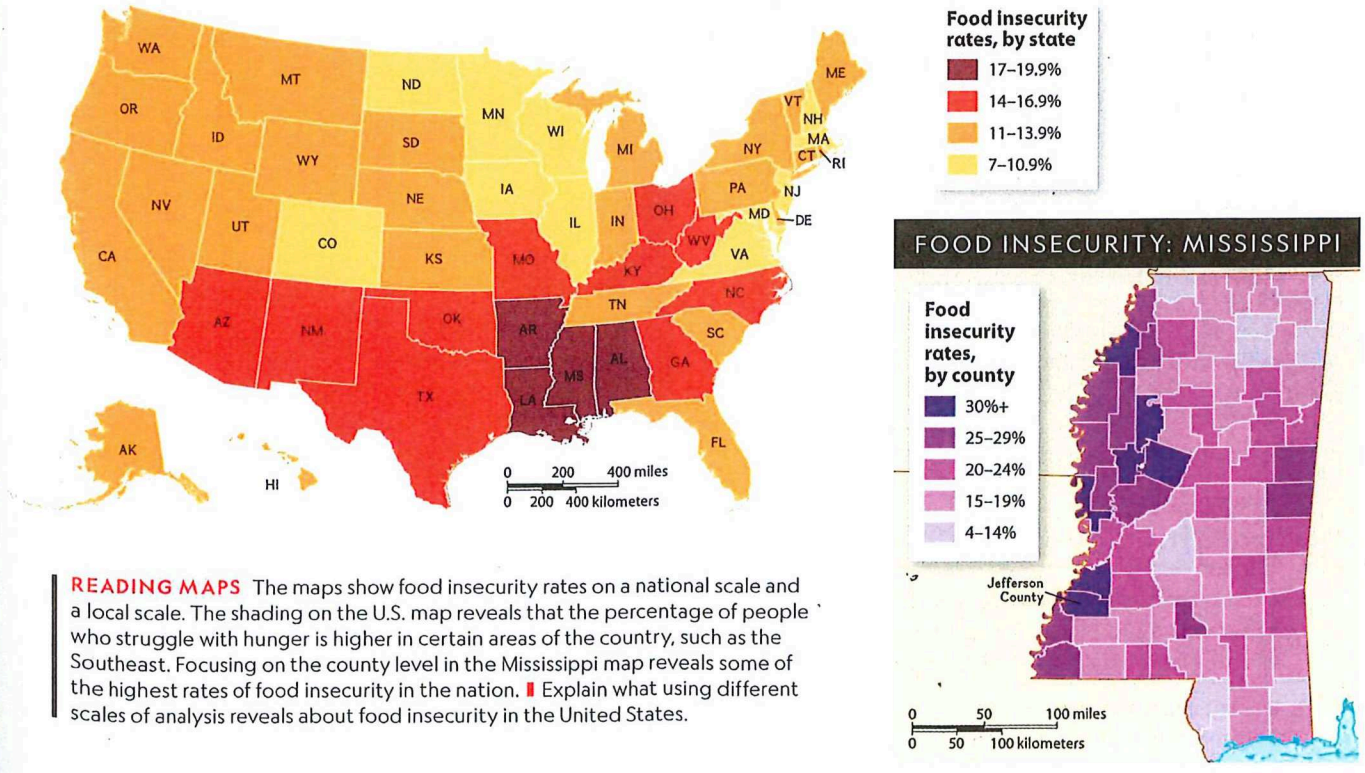
PSO-1.C Define scales of analysis used by geographers.

PSO-1.D Explain what scales of analysis reveal.

Think about an issue being covered in the news today. Is it a local, regional, national, or global issue? When answering a question like this, you are taking **scale** into account. This concept is different than scale on a map, which tells you how distance on the map compares to distance on the ground. Scale here refers to the area of the world being studied. Geographers use different scales of analysis as a framework for understanding how events and processes influence one another. For instance, a geographer might study the effects of air pollution in a city's industrial region, in the entire city, or in the country as a whole. Examining the effects of pollution at these different scales of analysis can help geographers gain a better understanding of the impacts of atmospheric processes on pollution.

The U.S. and Mississippi food insecurity maps reveal that on a national scale, about 12.5 percent of the U.S. population struggles to put food on the table. Examining the issue at a more local scale, however, it becomes clear that the problem is more serious in certain areas of the country. At the state level, Alabama, Arkansas, Louisiana, and Mississippi have food insecurity rates between 17 and 19.9 percent. Focusing on the county level reveals that in several counties in Mississippi, more than 30 percent of the population suffers from food insecurity. At an even more local level, Issaquena County in western Mississippi does not have a single grocery store, which means that many residents buy much of their food day-to-day at local convenience stores. With limited access to fresh foods,

SCALES OF ANALYSIS: FOOD INSECURITY IN THE UNITED STATES



READING MAPS The maps show food insecurity rates on a national scale and a local scale. The shading on the U.S. map reveals that the percentage of people who struggle with hunger is higher in certain areas of the country, such as the Southeast. Focusing on the county level in the Mississippi map reveals some of the highest rates of food insecurity in the nation. ▮ Explain what using different scales of analysis reveals about food insecurity in the United States.

some end up eating less healthy, processed convenience food rather than food with higher nutritional value. What happens at one scale affects processes at other scales, and data at different scales is necessary to fully understand issues such as food insecurity.

Observations at a local scale can also reveal details that might not be apparent at a regional scale. For instance, at the regional scale, an analysis of the population of New England reveals that 76.7 percent of the population is White, 9.6 percent is Hispanic, and 6.6 percent is African-American. Looking at the issue at a more local scale, however, reveals that Suffolk County, where Boston is located, is much more diverse, at 46.1 percent White, 19.3 percent Hispanic, and 22.5 percent African-American. In short, looking at diversity at a regional scale, New England is one of the least diverse regions in the United States. But when they look at diversity at a local scale focused on Suffolk County, geographers find a very different—and much more diverse—picture. It is important to note that scale can obscure actual spatial patterns. Suffolk may be a diverse county, but as geographers drill down even further, they find that the county-wide diversity does not apply to all Boston neighborhoods. The city is actually quite segregated. Some neighborhoods are more than 80 percent White, others are more than 80 percent African-American, and still others are more than 65 percent Hispanic.

Geographers' understanding of scale drives their research questions and data collection, and their findings then inform policy makers, hopefully to make better decisions. An issue that has a major effect on the planet, such as climate change, can be more fully understood by analyzing it at a variety of scales. For instance, scientists have determined that, globally, the planet is warming. As they drill down to a regional scale, however, the impacts differ depending on a variety of factors. Canada's Arctic region is warming at twice the global rate, potentially causing heat waves across the country and increasing risk of wildfires and drought.

In regions where climate change is occurring more slowly, its effects are more subtle. Additionally, sea level rise is not occurring uniformly across the planet. In certain regions, such as the Eastern Seaboard of the United States and in the Gulf of Mexico, sea levels have risen at higher than average rates. In other regions, like the U.S. West Coast and the oceans around Antarctica, sea levels have risen at lower than average rates. Understanding that the impacts of climate change will not be uniform helps governments prepare for problems that specifically affect their areas.

GEOGRAPHIC THINKING

1. Explain how using different scales of analysis helps geographers and other scientists understand the ways climate change is affecting the planet.
2. Describe how the analysis of the population of New England differs at a regional and local scale.

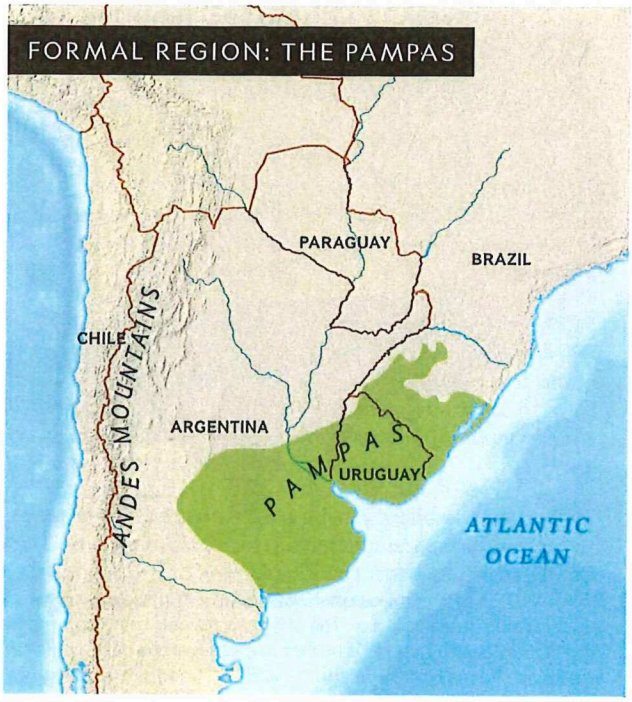
UNIFYING FEATURES

LEARNING OBJECTIVE

SPS-1.A Describe different ways that geographers define regions.

A **region** is an area of Earth's surface with certain characteristics that make it distinct from other areas. Regions are human constructs, meaning people decide how they appear. The boundaries between regions are typically not clearly defined and are often transitional, overlapping, and contested. In other words, regional boundaries can be fuzzy. For instance, the United States' Southwest is thought of as one distinct region, and El Norte (The North) in Mexico is also considered to be its own region, but because of the consistency with which the people and cultures cross the border, in some ways it is a single region. This is evident in the cities of El Paso, Texas, and Ciudad Juárez, Mexico, which share a regional economy where cultures and traditions blend and people cross the border, back and forth, on a regular basis.

Regions are a valuable tool for human geographers because they serve as an organizing technique for framing detailed knowledge of the world and for asking geographic questions. They are effective comparison tools as well. Knowing about the features of different regions is useful in discussing similarities and differences between parts of the world. Regions can be of any size, and they can act as a scale of analysis between the local, the national, and the global, helping geographers to synthesize their understanding of the world. Geographers define three types of regions based on the features that an area shares.



The Pampas of South America are grasslands that cover an area of 300,000 square miles. The region is defined by its moderate climate and is one of the richest grazing areas in the world.

FORMAL REGION A **formal region** is an area that has one or more shared traits. It is also referred to as a uniform region. The shared trait can be physical, such as a landform like a mountain range or a climate area like a desert. It can be cultural, such as a language or religion. Or it can be a combination of traits, defined by data such as measures of population, income, ethnicity, or precipitation. For instance, a country is a formal political region whose shared characteristics include its government, laws, services, and taxes. A smaller example of a formal political region is a state or a province within a country. The continent of Africa, with its distinct boundaries, is a formal region as well.

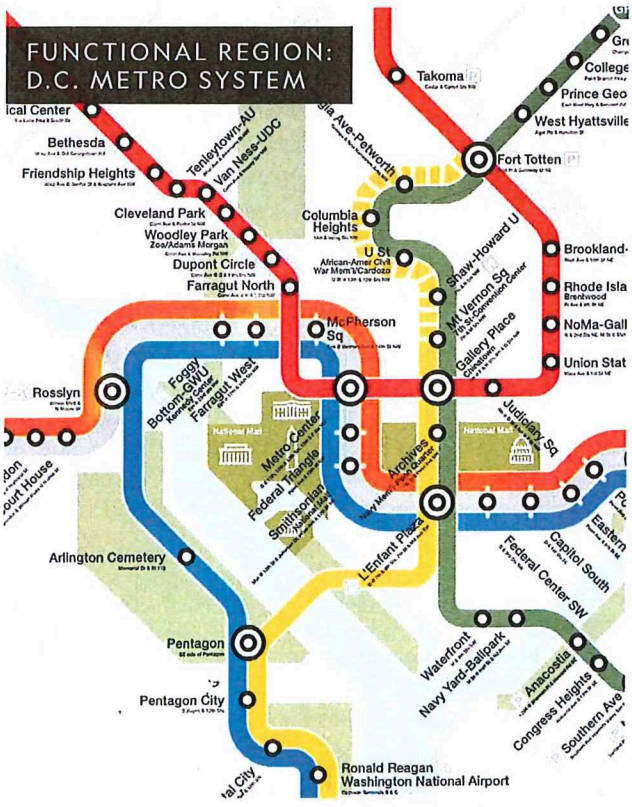
The Rocky Mountains make up a formal physical region in the United States, as do the Great Plains. The Pampas region of South America, shown on the "Formal Region: The Pampas" map, is defined by its moderate climate. Formal regions can also be defined by their agricultural growing season, such as temperate regions, which have long growing seasons. The corn belt, an area of the Midwest United States where corn and soybeans are the dominant crops, is a formal economic and agricultural region. The Pyrenees Mountains create a formal region along the French-Spanish border in Western Europe. People in this rugged region have developed their own culture over thousands of years.

At a more local scale, a city qualifies as a formal region as well. And within cities, shared traits can define small formal regions. The ethnic neighborhoods found in many large cities, for instance, may be considered formal regions. In the borough of Brooklyn in New York City, a large number of Hasidic Orthodox Jews live in the neighborhoods of Crown Heights, Williamsburg, and Borough Park. These neighborhoods form a region shaped by a shared religion and culture.

FUNCTIONAL REGION A **functional region** is defined as an area organized by its function around a focal point, or the center of an interest or activity. The focal point of a functional region is called a **node**. The node is the focus of the region, such as the downtown of a city. Nodes serve a particular function—often a political, social, or economic purpose—and have internal connections that tie the region together. For instance, the central business districts of some cities form the focal point for the cities' economic activity. Workers commute to this district, usually downtown, along the internal connections of roads and rail lines from other areas of the city, or from the suburbs. The central business district acts as the node for the functional region that consists of the metropolitan area.

Functional regions exist at a range of scales and can apply to a variety of geographic activities. The "Airline Flight Routes" map shows the functional region created by a major airline's flights from the Hartsfield-Jackson Atlanta International Airport to locations throughout the Americas. The airport acts as the region's node—a major hub for

Delta Airlines flies to cities throughout the Americas from the Hartsfield-Jackson Atlanta International Airport. These cities form a functional region with the airport as the node.



The Metrorail system connects Washington, D.C., to its surrounding suburbs. L'Enfant Plaza and Metro Center serve as nodes from which six color-coded lines branch off.

The Midwest is a perceptual region comprising 12 states. It is defined in part by people's perceptions of the region—for example, as a largely rural area with a friendly population.

national and international flights. All flights from some smaller airports in the U.S. South go through Hartsfield-Jackson, making it the only connecting point for air travel between these locations.

The hub-and-spoke design of many public transportation systems form functional regions as well. The hub at the center of the system is a node, at which a great deal of economic or cultural activity occurs. From there, rail lines branch off toward the suburbs. An example is the rapid transit system of Washington, D.C., depicted in the "D.C. Metro System" map, which has six rail lines that connect the outskirts of the city to the city center.

Cities with ports, or large commercial shipping facilities, form functional regions with their surrounding areas, called hinterlands. The ports act as nodes of these regions. Goods come in on ships and are distributed to the appropriate processing plants and shipping centers in the hinterlands. At these facilities, goods are received, produced, processed, and shipped out, either through the port or into the interior of the country.

A more local example of a functional region is the service area of a pizza shop. At the node is the shop, which might limit its delivery range to a two-mile radius. The edge of the service area is the limit of the pizza shop's functional region.

PERCEPTUAL REGION A **perceptual region**, also called a **vernacular region**, is a type of region that reflects people's feelings and attitudes about a place. A perceptual region, therefore, is defined by people's perceptions of the area—that is, their subjective understanding of the world as influenced by their culture and experience. What are the characteristics that make up the Midwest region of the United States, for example? Most people think about farms—especially corn and dairy products—and polite, down-to-earth people. The Midwest is generally not thought to be very ethnically or racially diverse, and politicians and pundits sometimes belittle it as "flyover country," meaning that it's nothing but a place you fly over to get from one coast to another. Each of these characteristics influence people's perceptions of the Midwest.

People often disagree on the boundaries of perceptual regions. Someone from the East Coast might perceive the Midwest to include Ohio, Indiana, Michigan, and parts of Pennsylvania, but people living in Minnesota, Wisconsin, or Kansas might feel strongly that they're Midwesterners. And while these regions may help to impose a personal sense of order and structure on the world, they often do so on the basis of stereotypes that may be inappropriate or incorrect. The Midwest does have large swaths of rural areas, for example, but it also contains large, diverse cities.

Outside of the United States, Eastern Europe is an example of a perceptual region. According to the United Nations, Eastern Europe consists of 23 countries including the Czech Republic, Poland, Romania, Russia, and the countries of the Balkan Peninsula. But the region exists in most people's minds based on its political, historical, and cultural characteristics. The area makes up most of what was known as the Eastern Bloc during the Cold War—the countries that were ruled by Communist governments in the years after World War II. Culturally and historically, the region was influenced by several empires. Together these characteristics define a region that exists separately in people's perceptions from Western Europe.

GEOGRAPHIC THINKING

3. Quebec is a province in Canada in which 83 percent of the population speaks French as a first language. Identify Quebec's region type.
4. Compare the functional region of a pharmacy in a dense city with few drivers to the functional region of a pharmacy in a sparsely populated suburb.
5. Describe the role that cuisine, or style of food, might play in the understanding of a vernacular region.

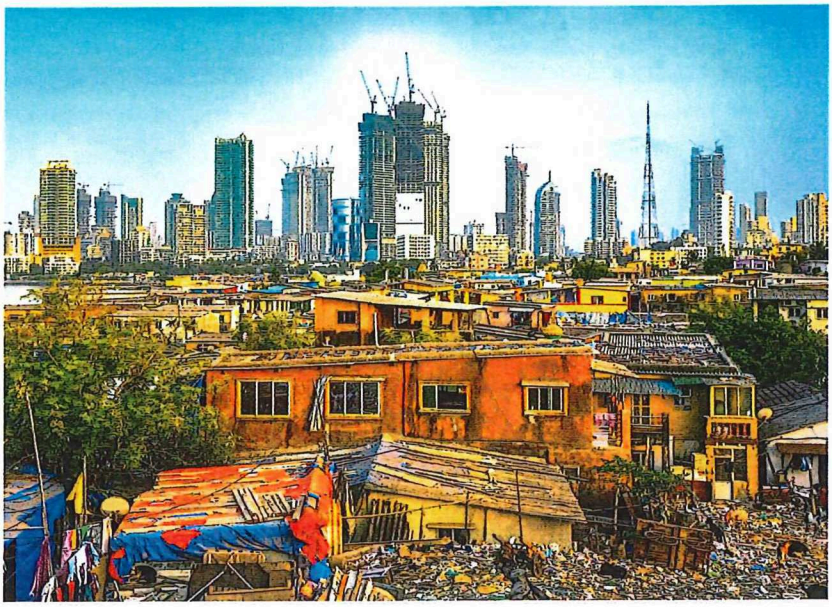
CASE STUDY

INDIA—REGIONAL DIFFERENCES IN SCALE

THE ISSUE India has experienced impressive economic growth this century, but large portions of its population aren't experiencing a fair share of the benefits.

LEARNING OBJECTIVE

PS0-1.C Define scales of analysis used by geographers.



The contrast between poverty and wealth is evident in Mumbai, India, where skyscrapers rise behind an informal housing settlement on the city's outskirts.

SINCE THE TURN OF THE 21ST CENTURY, India has experienced astonishing economic growth, seeing its gross domestic product (GDP) increase from $452.7 billion in 2000 to 2.6 trillion in 2017, a 474 percent increase in the size of its economy. To put that into perspective, the U.S. economy has grown by 88 percent during the same timeframe.

However, as geographers focus on more local scales of analysis, they find that this new wealth is not distributed evenly throughout the country. Indians in some regions have become very rich, while many parts of the country remain very poor. Much of the wealth is concentrated in just a handful of states, such as Maharashtra, Kerala, and Tamil Nadu. Since economic growth began to accelerate in India 20 years ago, the wealth divide between certain regions has continued to expand.

Before the acceleration of economic growth, incomes between different states were converging. Since the acceleration, incomes have diverged, with the average person in the three richest states having three times more wealth than the average person in the three poorest states. Looking at patterns within states reveals a rural-urban divide—a large proportion of the new wealth is being generated in cities like Mumbai and Delhi. Mumbai, a port city located on the Arabian Sea in southwestern India, is considered to be the financial and commercial center of India. The country's central bank is located in Mumbai, as is a government-owned life insurance corporation, investment institutions, and the Bombay Stock Exchange. In addition to its robust service sector, the economy of Delhi, which is where the country's capital is located, has created many jobs in trade, finance, public administration, and professional services.

In the less wealthy regions of India, fewer people are living in abject poverty, but the growing wealth divide concerns geographers. Most of the country's wealth—77 percent of the total national wealth—is held by just 10 percent of the population. Many accusations of corrupt dealings between India's politicians and the rich have been made, giving rise to anger and protests among the less wealthy. Without political reforms to fight corruption and expand social services to people who are being left behind, geographers worry the problems will continue to get worse.

BY THE NUMBERS

$452.7 BILLION

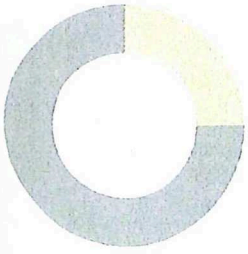
GDP in 2000

2.6 TRILLION

GDP in 2017

25%

Poverty rate in rural areas



Source: *World Bank*

GEOGRAPHIC THINKING

Explain why geographers might have concerns about growing inequality in India.

1.3 GLOBALIZATION AND SUSTAINABILITY

Time-space compression describes how technology is causing people around the globe to become more connected—able to interact with and travel to far-off locations faster than ever before. Human geographers study how this process is changing the world, in ways both positive and negative, and consider how the needs of human societies today can be met without using up resources that will be needed in the future.

GLOBAL VS. LOCAL

LEARNING OBJECTIVES

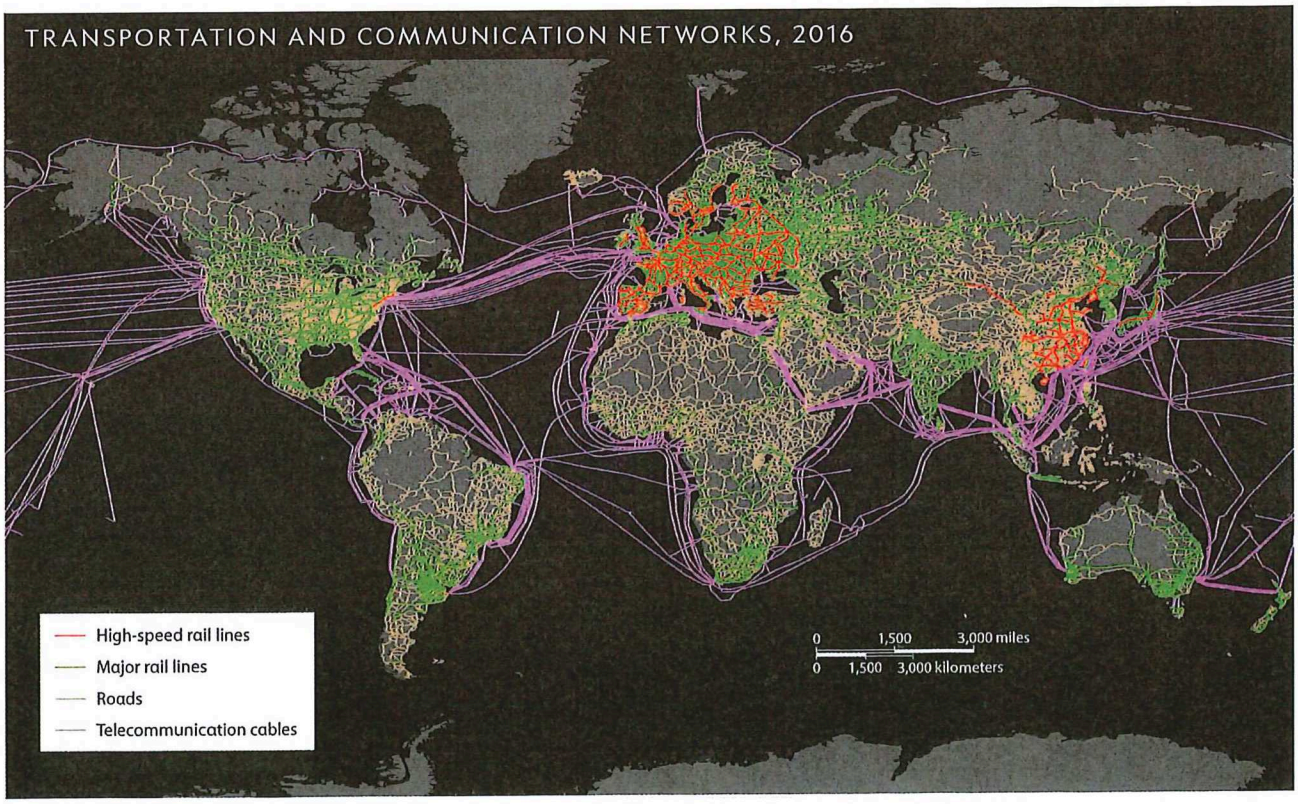
PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

SPS-7.E Explain different theories of economic and social development.

PSO-7.A Explain causes and geographic consequences of recent economic changes such as the increase in international trade, deindustrialization, and growing interdependence in the world economy.

Over the past half century, the nations of the world have become increasingly connected and integrated through **globalization**, the expansion of economic, cultural, and political processes on a worldwide scale. Globalization is an important, overarching theme in human geography. A number of factors have contributed to globalization. Lower production costs and advances in transportation technology have expanded many companies' reach outside of the borders of their home country. The internet gives people in different countries the ability to easily communicate with one another, allowing for the spread of cultural ideas faster than ever before. Social media apps allow people to share their views instantaneously, becoming instrumental in the spread of political movements such as the Arab Spring, a series of pro-democracy protests that took place in Southwest Asia (also referred to as the Middle East) and North Africa in 2011.

Government policies have played an essential role in globalization as well. Trade deals throughout the world have lifted restrictions and made the movement of goods and jobs across borders happen more easily. Beginning in 1994, for instance, the North American Free Trade Agreement (NAFTA) allowed companies in the United States, Canada,



READING MAPS The map highlights ways in which locations in the world have become increasingly interconnected by transportation and communication networks. ▮ Choose two locations on the map and describe the connections between them.

and Mexico to sell goods and hire workers in any of the three countries. In 2018, the countries renegotiated NAFTA and drafted a similar pact called the U.S.-Mexico-Canada Agreement (USMCA). In Europe, the European Union (EU) formed in 1993, in part to allow people and goods to easily pass from country to country. International trade has had detractors in recent years—the Trump administration in the United States imposed tariffs on China and other countries starting in 2018, for example—but the overall trend since World War II has been toward more international trade, and this trend has completely reshaped the global economy.

Globalization is a process that affects all aspects of human life today. It is related to the geographic concepts of location, space, place, and flows, and human geographers study the influence that it has on the patterns they observe. As you study each unit in this course, think about the advantages, challenges, and issues surrounding globalization.

WALLERSTEIN'S WORLD SYSTEM THEORY

Throughout your study of human geography, you'll come across tools that can help you understand geographic concepts. A **theory** is a system of ideas intended to explain certain phenomena. In the 1970s, sociologist Immanuel Wallerstein developed the **world system theory** to describe the spatial and functional relationships between countries in the world economy. The theory helps to explain the history of uneven economic development among countries and the reasons why certain regions have held onto political and economic power over long periods of time. It is based on the idea that interdependence between countries has created a world system with an economy that is a single entity with a single market and division of labor. In other words, companies are not limited to selling or hiring within the borders of the country in which they're located. They can open factories and sell products around the world.

World system theory categorizes countries into a three-tiered structure: core, periphery, and semi-periphery. Wealthier countries with higher education levels and more advanced technology are considered part of the **core**. Core countries are highly interconnected, with good transportation and communication networks and infrastructure that supports economic activity. They have stable governments and strong political alliances. Core countries are economically (and thus politically) dominant, and they control the global market. Countries that have less wealth, lower education levels, and less sophisticated technology are considered part of the **periphery**. Peripheral countries tend to have less stable governments and poorer services such as health care. They are less connected than core countries, with inferior transportation networks and inadequate infrastructure for supporting economic activity. Countries where both core and periphery processes occur are labeled **semi-periphery**. Semi-peripheral countries are in the process of industrializing. They are often active in manufacturing and the exporting of goods. They have better connections than peripheral countries, with better transportation and communication networks. Semi-peripheral countries have the potential to grow into core countries.

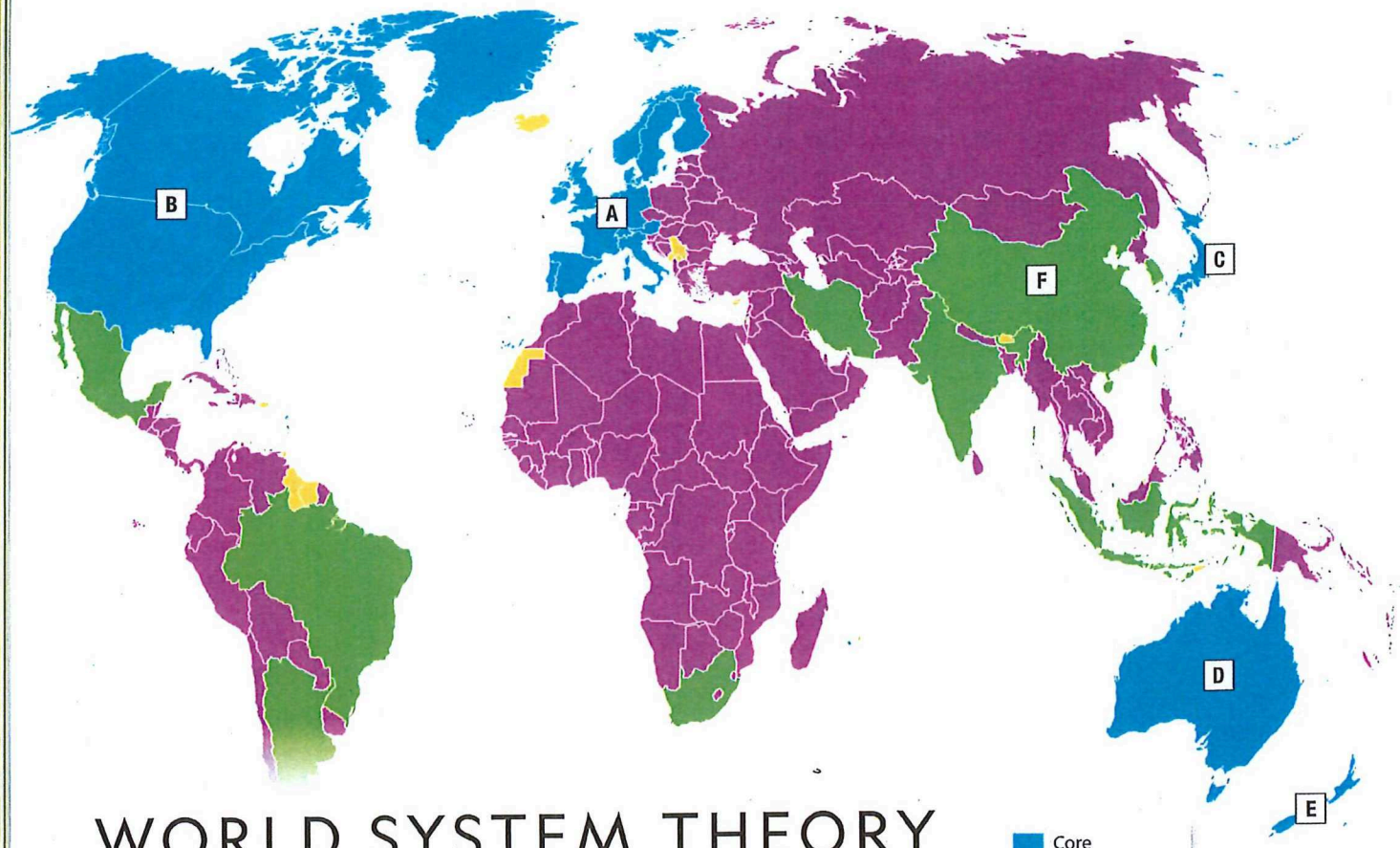
World system theory states that the three types of countries form a power hierarchy, with core at the top, periphery at the bottom, and semi-periphery in between. The strong central governments, trade partnerships, and skilled labor of core countries allow them to control and benefit from the world economy. They exploit peripheral countries for cheap labor and natural resources. The weaker, less stable governments and poor infrastructure of peripheral countries mean they have little power outside their borders. Semi-peripheral countries act as an economic and political link between the core and the periphery. They can be exploited by core countries but might exploit peripheral countries.

Because of this exploitation, it is difficult for peripheral countries to improve their situation. Historically, the colonial powers of Europe in the 17th, 18th, and 19th centuries were core countries. They exploited their colonies, which were part of the periphery, for crops, labor, and raw materials. Many of the colonizers of this period have remained core countries to the present day.

The core-periphery model doesn't only apply at the global scale. It can also be observed at the national, regional, state, and city level. For instance, while the United States is a core country, core characteristics are not distributed evenly throughout. A state like California is known for its wealthy cities and innovative tech-driven economy, but also has much poorer rural areas. New York City has core areas like Manhattan, where the real estate and financial sectors generate significant amounts of wealth, as well as peripheral areas like the Bronx, which is far less wealthy, with an economy driven by retail, hospitality, and service industries.

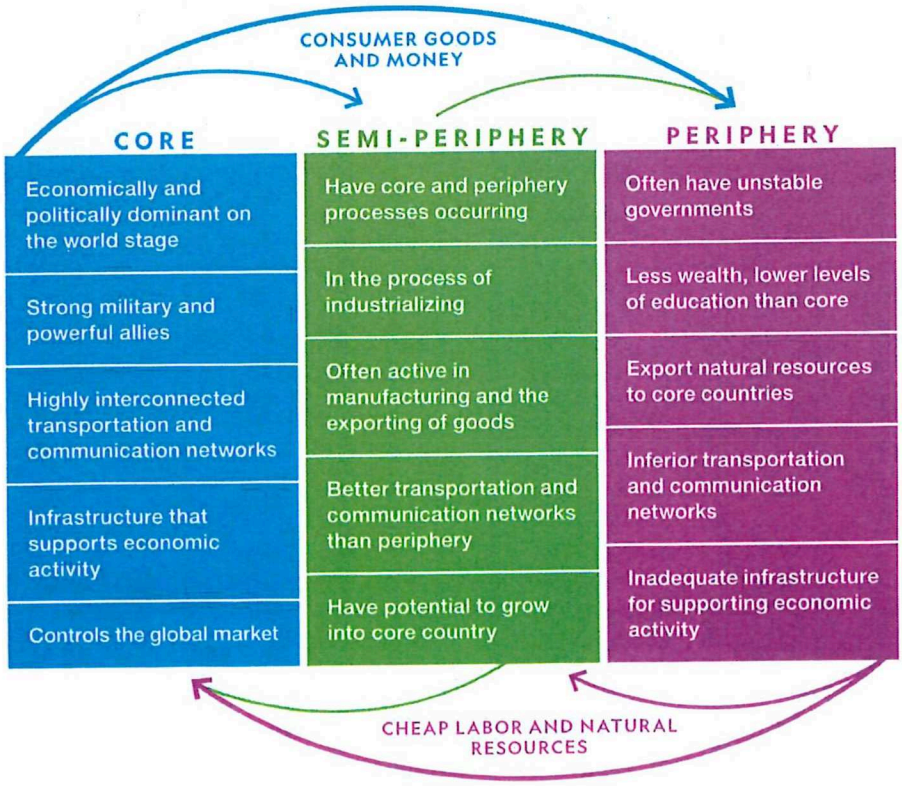
CORE-PERIPHERY TERMINOLOGY

For decades, geographers have used terms to describe the differences among global economies. You may be familiar with the term *developed countries*, which is sometimes used to describe industrialized countries with strong economies, and *developing countries*, sometimes used to describe less industrialized countries with weaker economies. Those terms became a common way to divide the world beginning in the 1950s. However, critics argue that this terminology is problematic for several reasons, including its focus on economic growth and its assumption that developing or traditional societies need to "catch up" to Western ideals. Instead, the terminology of the core-periphery model is used throughout this course to describe global differences. Using core-periphery terminology helps to distinguish the status and hierarchy of the world's diverse countries. It also helps to better illustrate the relationships that exist between countries.



WORLD SYSTEM THEORY

At the top of the hierarchy, core countries control and benefit from the world economy. Peripheral countries are exploited for cheap labor and natural resources. Semi-peripheral countries act as a political and economic link between the two. ▮ Explain how core countries are connected economically to periphery countries.



CORE COUNTRIES include Western Europe [A] and most of North America [B], along with Japan [C], Australia [D], and New Zealand [E].

China [F] has the world's second-largest economy, but its per capita income ranks 71st and the country is considered part of the **SEMI-PERIPHERY**.

Many countries that were colonized in the 17th, 18th, and 19th centuries are today part of the **PERIPHERY**.

Water is distributed to residents in the city of Bouaké in the Ivory Coast in West Africa after the lake that provided water to 70 percent of the city's population dried up. Organizations work to come up with sustainable solutions to prevent the depletion of essential resources.

SUSTAINABILITY

LEARNING OBJECTIVE

PSO-1.B Explain how major geographic concepts illustrate spatial relationships.

The study of the impact that human societies have on nature is important to the field of human geography. Whether that impact is sustainable is essential to the survival of humanity. Sustainability, as you've read, is the use of natural resources in such a way that they will not be irreversibly depleted. Like globalization, sustainability is an essential theme of human geography, related to the geographic perspectives and key concepts to which you've been introduced. Geographers study sustainability and sustainable practices, and promote the idea that sustainability should drive decisions about how humans react to and influence other geographic processes.

Globalization and economic expansion have made the world more connected, but the advantages have disproportionately gone to core countries. Climate change, depletion of the world's resources, and wealth inequality are worldwide problems that continue to grow. To help people face these challenges and to save the planet from the ravages of climate change, global leaders are taking steps to encourage governments and industries to operate and grow more sustainably. In 2015, the United Nations launched its 2030 Agenda for Sustainable Development, a plan that lays out 17 goals to increase peace, freedom, and prosperity around the world. **Sustainable development** is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability requires consideration of the availability of natural resources, innovations to make better use of renewable resources, and efforts to reduce pollution and waste, but it's also important to ensure that these goals are spread across core, peripheral, and semi-peripheral countries. The UN's goals also include the elimination of poverty and hunger, increased access to quality education, and gender equality.

You'll learn more about these goals in Unit 7, but like globalization, sustainability is an idea that is important to all aspects of human geography. It is a theme that drives much of the work that human geographers do. As you go through this course and learn the ways in which humans are impacting their environments—whether through agriculture, economic development, political or cultural activity, in rural or urban settings—keep sustainability in mind.

GEOGRAPHIC THINKING

1. Explain why it might be difficult for a peripheral country to become a part of the core.
2. Describe how world system theory is related to globalization.
3. Explain why sustainability is an important human geography theme.

CHAPTER 1 SUMMARY & REVIEW

CHAPTER SUMMARY

Geography can be divided into two major areas: physical geography and human geography. Physical geography is the study of natural processes and the resulting distribution of features in the environment. Human geography is the study of the processes that have shaped how humans understand, use, and alter Earth's surface.

- Spatial patterns refer to the arrangement and placement of objects and events on Earth's surface.
- Geographers analyze complex issues and relationships from two key perspectives: the spatial perspective and the ecological perspective.
- Human geographers use spatial concepts to study how humans interact with the environment: absolute and relative location, place, space, flows, patterns, distribution, distance, time-space compression, and distance decay.

Geographers study events at different scales as a framework for understanding how processes influence one another. A region is an area of Earth's surface with shared characteristics that make it distinct from other areas.

- Scales of analysis include global, regional, national, sub-national, and local.
- Geographers use different scales to reveal details that might not be apparent at one scale.
- Regions are human constructs with subjective boundaries.
- A formal region is an area that has shared physical or cultural traits, such as landforms or language.
- A functional region is an area organized around a connection or focal point, such as a river system or a port and its surrounding hinterlands.
- A perceptual region, or vernacular region, is a type of region based on people's understandings of places and mental maps, such as the boundaries of the Midwest.

Over the past half century, globalization has created an increasingly connected and integrated world. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

- World system theory explains the way globalization functions in practice. It categorizes countries into three tiers: core, periphery, and semi-periphery. Core countries have wealth, high education levels, and advanced technology. Peripheral countries have less wealth, low education levels, and less developed technology. Semi-peripheral countries have a mix of core and periphery characteristics.
- Sustainable growth has become a challenge as economic expansion and globalization have increased.

KEY TERMS AND CONCEPTS

Use complete sentences to answer the questions.

1. **APPLY CONCEPTUAL VOCABULARY** Consider the terms *place* and *region*. Write a standard dictionary definition of each term. Then provide a conceptual definition—an explanation of how each term is used in the context of this chapter.
2. Describe the absolute location of your town or city. Then describe the relative location of your town or city.
3. Explain how the terms *site* and *situation* are related.
4. Describe the spatial perspective using the terms *space* and *distribution*.
5. How are the concepts of *time-space compression* and *distance decay* related?
6. Use the city of Las Vegas, Nevada, which was built in a desert, as an example to explain the theories of environmental determinism and possibilism.
7. How can conducting an analysis at different scales be informative?
8. Describe a technological advancement that has contributed to globalization and explain how it has had an impact.
9. Explain how ethnic or racial diversity can differ at different scales of analysis.
10. Define the concept of *sustainability* and explain why it has become a growing challenge.
11. Compare the terms *node* and *functional region*. How are the terms related?
12. Define the term *perceptual region* and provide an example.

INTERPRET MAPS

Study the map and caption and then answer the following questions.

13. **IDENTIFY DATA & INFORMATION** Identify the type of region represented in this map. How do you know?
14. **ANALYZE VISUALS** Describe how the two media markets might have an impact on daily life in South Jersey and North Jersey.
15. **ANALYZE GEOGRAPHIC CONCEPTS** Explain why the boundaries of the regions shown in the map are more distinct than they would be if the map depicted the extent of a sports team's fans.
16. **SYNTHESIZE** Explain why the reach of New York and Philadelphia's media markets might have less impact today than it would have 30 years ago.

A media market is a region covered by local television and radio stations. The people living within a particular media market receive the same programs from their local stations.

GEO-INQUIRY | MAKING CONNECTIONS

Part of geographic thinking is understanding how complex human and natural systems interact at different scales. The Geo-Inquiry Process enables you to think like a geographer looking for spatial patterns—and encourages the use of this type of geographic thinking to take informed action. You will learn more about Geo-Inquiry in Chapter 2. For now, let's take a look at the components and an example.

ASK A Geo-Inquiry question is an open-ended inquiry into a problem or issue. It is more than just a what, how, or why question. For example, a Geo-Inquiry question might be: *How can we decide the best location for a new regional technology-based school?*

COLLECT Gather geographic information to answer your question. This allows you to analyze data from a spatial perspective, looking for patterns and solutions. Using our example: *City officials would gather data on bus routes and analyze locations of land for sale and their proximity to services such as electricity and water.*

VISUALIZE Geographers organize data into maps, charts, and infographics to help communicate complex information. Using visuals allows patterns to emerge and leads to a better understanding of spatial complexities that make one potential school site better than another.

CREATE Use the visuals to develop a Geo-Inquiry story with a message or call to action based on the data. Using our example: *City officials might create a presentation to the Board of Education.*

ACT Finally, the call to action is shared with decision-makers in order to make a change. Using our example: *The Board of Education would then vote on the location of the new regional school.*

CHAPTER 2

GEOGRAPHIC INQUIRY: DATA, TOOLS, AND TECHNOLOGY

CRITICAL VIEWING As part of a mapping project initiated by UNICEF, Fatima Wariou, a university student from Niamey, Niger, captures GPS coordinates in the Sahara desert. Other participants of the MAP4DEV group study the movement of the sand toward an inhabited area nearby. ▮ Explain how collecting data helps these geographers to analyze the progression of the sand.

GEOGRAPHIC THINKING What tools do geographers use to depict spatial relationships?

2.1 THINKING LIKE A GEOGRAPHER: THE GEO-INQUIRY PROCESS

Geographers use spatial analysis to explain patterns of human behavior and understand how places and societies are organized. They seek to understand where things are, why they are there, and how they develop and change over time.

THINKING LIKE A GEOGRAPHER

Geographers think spatially in terms of space, place, arrangement, and interconnections between humans and the environment. Understanding the complexities of the world, or even of a small community, involves observing the environment, aspects of culture, politics, economics, and more. Therefore, thinking like a geographer requires the integration of many topics and disciplines. Geographic thinking calls for asking questions, collecting and organizing data from a myriad of sources, making connections, and presenting data in a usable way. Only then can people make informed decisions and take appropriate action.

Using the National Geographic Geo-Inquiry Process supports geographic thinking. Tools such as maps, globes, graphs, photographs, and satellite imagery provide geographers with vast amounts of data about the world that is analyzed to understand the processes driving human geography. Following the Geo-Inquiry Process provides geographers a systematic way to examine complex issues at various scales—local, regional, or global. It also helps users make connections among various components of an issue, identify patterns, and draw conclusions to make informed predictions and decisions that can impact communities.

THE GEO-INQUIRY PROCESS

The Geo-Inquiry question is at the heart of the process. Geographers ask questions about spatial distributions, such as *Why do the majority of people migrate to urban areas?* or *Why did many settlements on rivers grow to become cities?*

Suppose local leaders have proposed building a new school in your community, but they have not determined where it should be built. To address this issue, you might first ask: *Where should the school be located?* Note that even this basic geographic question can generate multiple responses and lead to further questions depending on the purpose

THE GEO-INQUIRY PROCESS

The Geo-Inquiry Process is a five-step method, summarized here. As you read this chapter, you will find tips on carrying out each step.

- **ASK** In the first step of the process, you explore an issue or problem through a geographic lens that addresses the three basic questions you're already familiar with: *Where? Why there? Why care?* As you explore the problem or issue further, you reach a more complex understanding of the issue that will help narrow your focus into an overarching Geo-Inquiry question. This question will drive your project.
- **COLLECT** In the second step, you collect the data you need to answer the question. You might collect this data through interviews, fieldwork, by contacting experts or organizations, or other forms of research.
- **VISUALIZE** Once you've collected your data, you will have a large amount of information that you need to organize. Visual representation is critical. Data can be displayed in maps or through other visuals. Visuals can make complex information easier to understand and better reveal connections and patterns.
- **CREATE** In this step, you create a Geo-Inquiry story that answers your Geo-Inquiry question. This step walks people through the issue. The way you choose to create and communicate your story should be well matched to your audience.
- **ACT** This final step includes sharing your Geo-Inquiry story with decision-makers in order to inspire them to take action. Ask yourself: *What action should be taken based on the findings?*

of the question. One answer might focus on the school's potential site, which refers to its physical characteristics, such as its location in a flood zone. The description might also include its situation, which refers to the place's location in relation to other places. In addition to asking where something is, geographers seek to understand *why*. As you consider locations, you should ask yourself: *Why is this a good location and not somewhere else? Why do people care about the school's location?* These questions ultimately lead to further investigation.

Identifying and gathering the data you need to answer the Geo-Inquiry question is the second step in the Geo-Inquiry Process: *Collect*. As in any scientific process, the evidence derived from the data you collect will be chosen based on relevancy to the topic or issue. To determine the best location for the school, identify data that tells where other schools in the community are located, which schools are overcrowded, where student populations are located, and how trends in the community's population or demographics might impact this data in the future. Information about site characteristics like major roads, available land, and building costs is also necessary. You might examine satellite or aerial photos to identify areas with sufficient room to build a school. In addition, you could consider interviewing local school principals and superintendents to have them identify key characteristics of good school locations that might include efficient bus routes or proximity to other schools.

Now you're ready for the next step: *Visualize*. Visualizing your data is key to sharing your data and telling your story. For example, you might use a map to show the location of schools in your community and land that is available. You could share data that shows population and other demographic information. As your Geo-Inquiry story takes shape, think about the visuals that would help others better understand the issue and resulting actions that can be taken.

Create is the next step of the process. In this step, you organize your supporting evidence in a format that puts your data into context. A multimedia presentation is a good choice for displaying your data. You can use storyboarding to organize the visual, audio, and text elements of your story. In the storyboard, you can sketch what each component of your story will look or sound like and indicate the visual elements that will appear on the screen. This is also the time to anticipate what elements of your presentation—either spoken or visual—the stakeholders will want to know more about. Think about responses to possible questions.

In the final step of the process, called *Act*, you present your information to decision-makers. Since your Geo-Inquiry project focuses on the location of the new school, you may want to share your data with local leaders and try to convince them to consider the location you have identified.

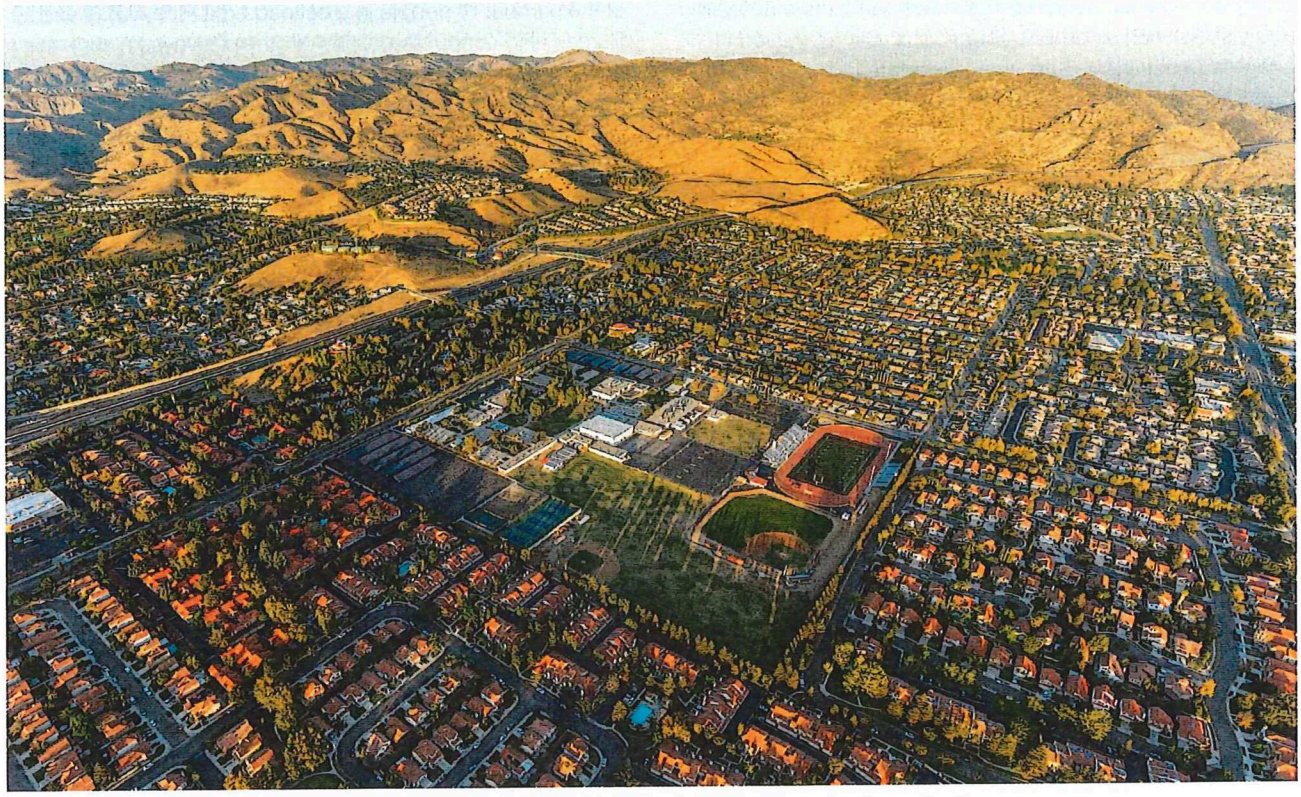
GEOGRAPHIC THINKING

1. Describe the Geo-Inquiry Process.
2. Explain how thinking like a geographer benefits all decision-making.
3. Identify three geographic questions about any environmental, social, or economic issues that interest you, and then explain how your questions might change when considering different scales of analysis.

THE GEO-INQUIRY PROCESS | TIPS FOR SUCCESS

ASK

- Choose a topic that you want to investigate. Developing Geo-Inquiry questions can help you examine a community issue.
- Brainstorm for three minutes. Write as many questions during this time as possible without editing them. This will help you think of numerous questions beyond the first basic questions that come to mind.
- Write additional need-to-know questions after researching your topic or issue. Your initial research may spark additional interesting questions.
- Choose a Geo-Inquiry question of appropriate scope. If you can answer the question by looking at a map or doing a 10-minute search on the internet, it is not sufficient to drive the Geo-Inquiry Process.
- Choose a Geo-Inquiry question that you can research. You will need to be able to collect data or information pertinent to the question. A good question will require multiple sources of information and encompass the need to understand various related questions.
- Think of questions that will help you make connections. *Why is that there? How does that being there affect the people living nearby or the surrounding natural environment? What are the various perspectives about the issue? Does spatial analysis inform actions that could be taken?*



CRITICAL VIEWING An aerial photograph is a tool that gives geographers information about the site and situation of a place. The photo shows a school nestled in the Santa Susana Mountains north of Los Angeles, California. ▮ Identify some questions geographers may have asked about the location when considering whether or not to build a school there.

2.2 GEOGRAPHIC DATA AND TOOLS

Geographic data is information about the characteristics of locations on Earth. Geographers use data to explore and better understand places and the processes that influence these locations.

COLLECTING DATA

LEARNING OBJECTIVE

IMP-1.B Identify different methods of geographic data collection.

Geographers use a variety of methods for collecting data. Geographic information is any data with a location tied to it, such as a street address or its elevation. It is information at a given spot whether it is about the human world, natural world, or anything else. Approximately 80 percent of the world's data is spatial.

The methods by which data are collected include observing and systematically recording information, reading and interpreting maps and other graphic representations of spaces and places, reading reports and policy documents, and interviewing people who can provide both information and perspectives about places and issues. The data collected through these methods are **quantitative** or **qualitative**. Information measured by numbers is called quantitative data. The population of a city is quantitative data. Qualitative data are interpretations of data sources such as field observations, media reports, travel narratives,

policy documents, personal interviews, landscape analysis, and visuals such as art or photographs. Skills involved in analyzing quantitative and qualitative data involve seeking patterns, relationships, and connections.

The data geographers collect has to be at the appropriate scale and align to the nature of the research questions. So, for example, answering a question about the migration patterns out of a country would require population data at the country level but not at the neighborhood level.

Suppose you want to determine the effects of the use of pesticides and herbicides in your community. A number of data sources should be considered. You could first collect information about the pesticides and herbicides used locally—the benefits and risks of their use, and data about where and how often they are used. Initial data might be gathered from media reports and other online sources to determine the effects of the chemicals on the land and humans. Field observations and personal interviews with local farmers and gardeners can provide invaluable insights about the location and frequency of use of the chemicals.

Land-use maps and aerial photography could also be analyzed to see if areas of high use are adjacent to waterways or neighborhoods. In addition, you might seek policy documents from government agencies such as the Environmental Protection Agency, Food and Drug Administration, or the county agricultural agent about the regulations and guidance regarding the use of pesticides and herbicides. All of these sources provide evidence about the impact of humans and their use of chemicals on the land that could be used to frame an argument and take action.

WHO COLLECTS DATA? Countless organizations, both public and private, collect and analyze data. The U.S. Census Bureau, for example, conducts a **census** of the U.S. population every 10 years. A census is an official count of the number of people in a defined area. The U.S. Census Bureau also conducts dozens of other surveys, including the American Community Survey, which gathers information about educational attainment, employment, income, language proficiency, migration, and housing. The Census Bureau also gathers information from American businesses as part of its Economic Census. All information collected by the U.S. Census Bureau is available to the public through written reports as well as online, where a search feature enables users to gather information at a range of scales, about a particular city, county, or zip code.

The federal government also collects census information on agriculture every five years. The U.S. Department of Agriculture collects and analyzes data on meat, dairy products, and crops to ensure the quality and availability of food and to help American farmers and businesses make informed decisions. In addition, the Economic Research Service provides a wealth of data related to food security.

U.S. government agencies also collect information about elections at a range of spatial scales to observe patterns of voting behavior. Results of past elections are kept by the Federal Election Commission and the National Archives, and state and local governments also keep election records.

In addition to making use of the data gathered by organizations, individuals conduct their own data-gathering efforts based on the specific question they want to answer. Data gathering takes multiple forms, such as written surveys or in-person or phone interviews that gather information about people and their experiences. Individuals also conduct field observations using photography, sensors, and scientific probeware, a tool connected to probes and sensors to collect real-time data and to record information about specific locations and spatial elements. Travel narratives that describe the physical and cultural characteristics of a place are useful as well.

THE GEO-INQUIRY PROCESS | TIPS FOR SUCCESS

COLLECT

- Identify types of data that will help you answer your Geo-Inquiry question. Use multiple sources to obtain a full picture.
- Consider primary sources (surveys, interviews) and secondary sources (census data, topographic data, satellite imagery).
- Use reliable data sets. Make sure they are credible, reliable, and timely. Don't be afraid to collect the data you need in the field.
- Keep your data organized and have a backup copy. Create a spreadsheet, image folder, or other method to stay organized.
- When collecting data through interviews or surveys, design your questions so they elicit the data you want. Write them in a way so participants can take the survey quickly.
- With parent or teacher approval and the participant's permission, use a smartphone or other device to record interviews. Notify the participant before starting the recording.
- Take precautions when gathering data in the field. Wear protective gloves or a life jacket. Do not go to remote areas or approach strangers alone when conducting interviews.

GEOGRAPHIC INFORMATION SYSTEMS

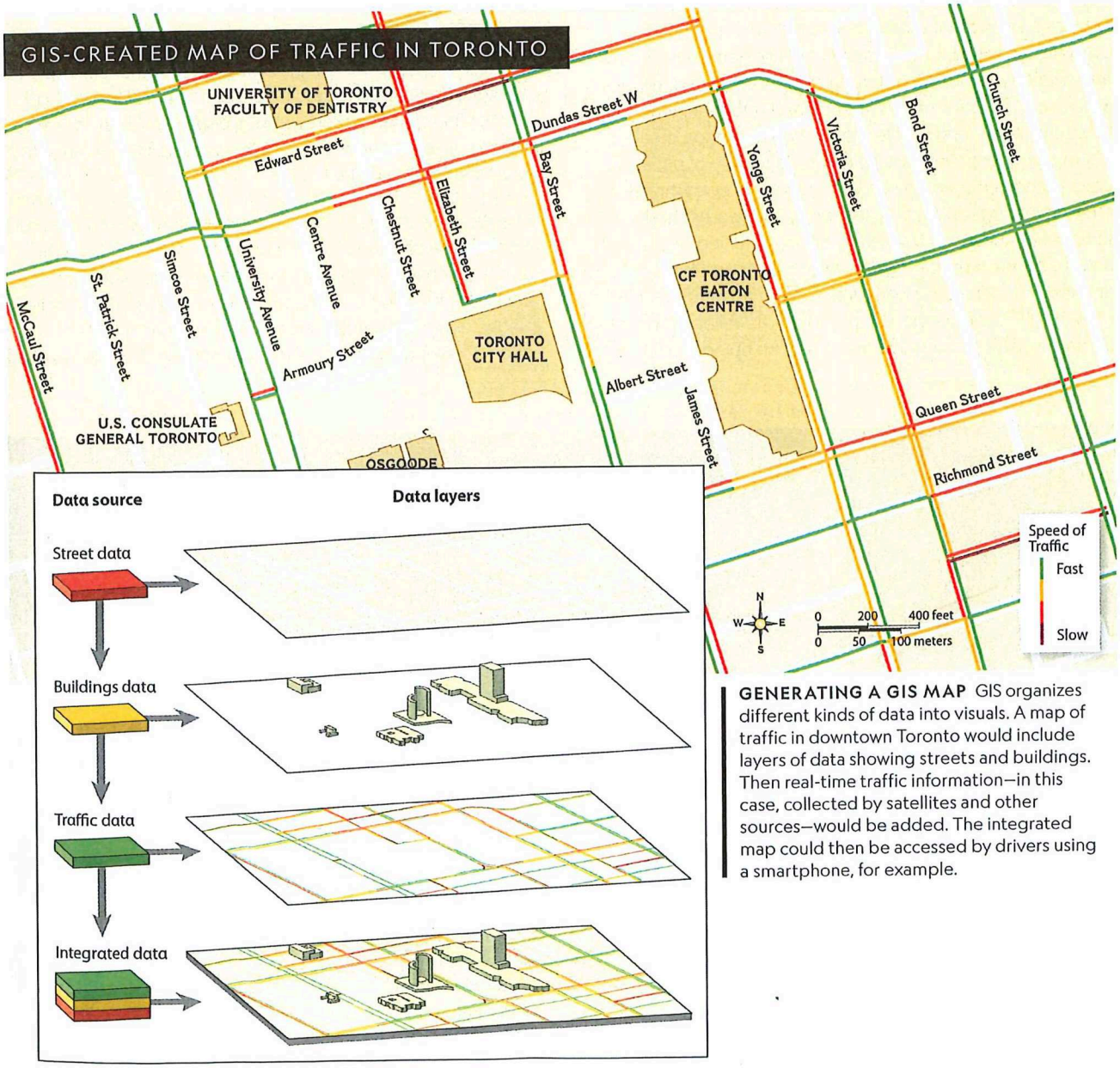
LEARNING OBJECTIVES

IMP-1.A Identify types of maps, the types of information presented in maps, and different kinds of spatial patterns and relationships portrayed in maps.

IMP-1.B Identify different methods of geographic data collection.

Geospatial technologies encompass the modern tools used to analyze data about specific locations across the globe. Organizations and individuals use the technologies to find precise locations, collect and share data, create maps, and track changes in characteristics of places on Earth's surface. The development of sophisticated mapping software systems called **geographic information systems (GIS)** has immensely helped geographers and others with their work. GIS captures, stores, organizes, and displays geographic data that can then be used to configure both simple and complex maps. Such maps are created by organizing layers of information to form a combined image. Each type of information is stored in a separate layer that represents a specific theme and dataset, such as roads, population, voting district boundaries, and much more. The layers that are selected to display will vary depending on the goals of the project and the question that geographers seek to answer.

A wide range of spatial data is easily compared and analyzed using GIS. A GIS map can display information about the physical geography of the land, such as elevation or **topography**, which is the shape and features of land surfaces. It can also display demographic information about the people who live in a certain place, such as age, ethnicity, income, or family size. Combining the data from these layers



GENERATING A GIS MAP GIS organizes different kinds of data into visuals. A map of traffic in downtown Toronto would include layers of data showing streets and buildings. Then real-time traffic information—in this case, collected by satellites and other sources—would be added. The integrated map could then be accessed by drivers using a smartphone, for example.

makes it easy for geographers to make connections, for instance, understanding how natural resources impact the economic activities that take place in a region.

GIS maps support geovisualization, which is the process of creating visuals for geographic analysis using maps, graphs, and multimedia. This process allows users to analyze geospatial data interactively, aiding visual thinking and providing insights into the issues geographers are studying. One common use of GIS involves comparing natural features with human activity. GIS could be used to evaluate environmental risks to a community such as flood potential or human-made risks such as industrial pollution levels. Such information can help communities plan for future sustainable development.

Geospatial technologies collect and analyze immense amounts of data—data accessible to anyone with internet access—leading to a revolution in spatial decision-making. The geospatial revolution encompasses nearly every aspect of human life, from the relatively mundane, or common, everyday activities, to the most critical of decisions. Today, in an instant, individuals and organizations can send, receive, and broadcast information about where they are, where they have been, and where they are going. Maps created out of this geospatial data have a wide variety of uses. Locally, these maps provide information on everything from recommending restaurants to finding the nearest hospital to tracking criminals. Many U.S. cities are using geospatial data to address problems with public transportation or food access in underserved communities. On an international scale, multi-layer geospatial maps can aid relief efforts after an earthquake, track global trade and shipping, document the potential impacts of climate change, support the deployment of troops during conflict, or assist in the drawing of territorial boundaries as a part of peace-making.

GEOGRAPHIC THINKING

1. Describe the difference between quantitative and qualitative data and provide an example of each.
2. Explain what GIS is and how it is used to understand spatial patterns and relationships.

OTHER REMOTE SENSING TOOLS

LEARNING OBJECTIVES

IMP-1.B Identify different methods of geographic data collection.

IMP-1.C Explain the geographical effects of decisions made using geographical information.

A variety of geospatial technologies gather data; some do so remotely, or without making physical contact. This method of collecting data is called **remote sensing**. Most remote sensing used by geographers relies on satellites or aircraft-based sensors to collect data.

Satellites take images of sections of Earth at regular intervals to determine changes that occur on the surface. Then the remotely-sensed images are brought into GIS along with other data for comparison and analysis. Comparing satellite images can help identify phenomena such as trends in urban development or the shrinking of the polar ice caps.

Geographers use data acquired from satellite images to study environmental and developmental changes. This image of Earth at night, compiled from more than 400 satellite images, provides insights into the location of urban populations and economic development using the nighttime lights cities emit.

CASE STUDY

DETROIT—GIS HELPS FIND SAFER ROUTES

THE ISSUE Getting to and from school safely was a problem for some students in Detroit, as an economic decline contributed to abandoned houses and urban blight.

LEARNING OBJECTIVES

IMP-1.B Identify different methods of geographic data collection.

IMP-1.C Explain the geographical effects of decisions made using geographical information.

BY THE NUMBERS

672,662

population of Detroit in 2019

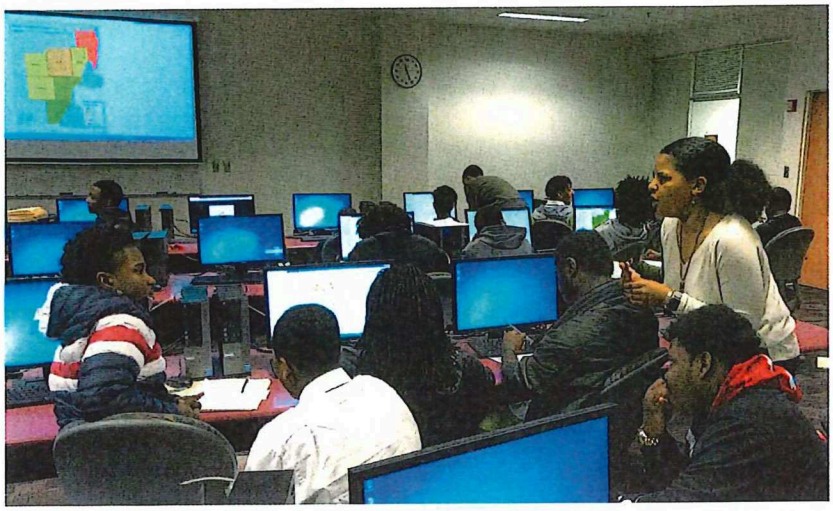
51,000

students enrolled in Detroit Public Schools Community District in 2019

30,000+

estimated number of abandoned houses in Detroit in 2018

Sources: World Population Review; Chalkbeat; Detroit Metro Times



At Wayne State University's Center for Urban Studies in Detroit, middle and high school students learned how to use GIS to map their neighborhoods and discover safer routes to and from school.

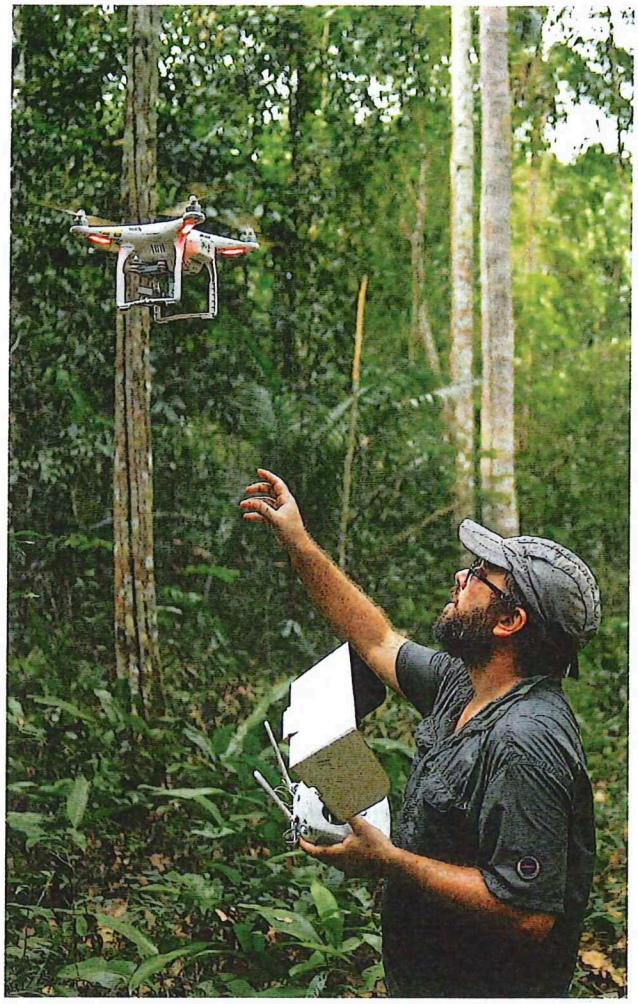
GEOGRAPHIC INFORMATION SYSTEMS have a wide range of real-world applications. They assist in displaying and analyzing data to make evidence-based decisions in a range of situations. In Detroit, Michigan, for example, GIS has been used to map safer school routes. Since 1999, the Detroit Public Schools Community District has used GIS to divide the district into patrol sectors and blocks. The city collects and analyzes data from each of the sectors to identify safe routes to school for students.

Nonprofit organizations and the school district also enlisted students to address urban blight, or areas in disrepair. Studies show that vacant structures are a strong predictor of assault risk. The number of vacant houses in Detroit had grown following an economic decline. One assessment put the number around 22,000, but an investigation by a Detroit newspaper suggested the number was at least 30,000. Because abandoned buildings often lack easily identifiable addresses, no one had been able to pinpoint the locations of the vacant structures. Even as the city struggled to board up or sell the vacant homes, new abandoned buildings appeared. In an innovative program called Mapping Out A Safer Community, middle and high school students used GIS software and handheld GPS to map the vacancies. The technology allowed them to identify the exact locations of abandoned buildings and vacant properties. The students then compiled their data, presented it to local government officials, and suggested areas to target for code enforcement. Using the students' information, the city boarded up abandoned buildings. The students taking action is an example of the last step in the Geo-Inquiry Process.

The student initiative was just one part of a broader data-gathering initiative, however. Members of the AmeriCorps Urban Safety Project walked the school routes and conducted surveys of parents, students, and school personnel to identify hazards. In addition to abandoned buildings, they mapped issues related to lighting, sidewalks, and dangerous intersections. This information has been used as part of a broader, federally-funded program called Safe Routes to School (SRTS) that continues to work to ensure safe travel for Michigan students to and from school.

GEOGRAPHIC THINKING

Think about the mental mapping you did in Chapter 1. What would you expect to find if you followed Detroit's example in mapping routes to your school?



A forestry conservation analyst from the World Wildlife Fund (WWF) uses an unmanned drone to map an area of the Western Amazon rain forest in Brazil. Unmanned drones can be used in more locations than traditional aircraft and they provide the same data-collection capacity at a fraction of the cost. This makes them an increasingly valuable data-collection tool.

Satellites are also used for real-time decision-making. For example, satellites can track the path of a hurricane and the speed it is traveling. This data can be used to help predict where a hurricane will land. After an event, it also can be used to show the extent of damage, enabling aid to be directed appropriately. Days after Hurricane Maria devastated much of Puerto Rico in 2017, satellite images showed dramatic changes to the landscape and helped identify the hardest-hit areas.

Remote sensors mounted on aircraft or drones are another source of data. In addition to satellite images, aerial photographs were taken of the land months after Maria's damage. The photographs, along with GIS, helped the U.S. Army Corps of Engineers analyze existing and new data about the island's electrical power grid so they could make repairs and provide generators to those without power even in remote areas. Airplane-mounted sensors are also used to measure the gradual sinking of land along the Gulf Coast to assess risk to local communities. As the technology advances and becomes less expensive, drones are making remotely-sensed data more accessible than ever. They enable scientists, including cartographers and other geographers, to take detailed measurements between features or places on Earth's surface. Drones collect data that is then brought into GIS to determine changes in land use or environmental conditions. For example, farmers can use the data to get a bird's-eye view of the condition of their crops. The use of drones to identify a cluster of diseased plants in a large field or areas in need of water helps farmers treat targeted areas of their land and save resources.

Another source of geographic data is a **global positioning system (GPS)**, an integrated network of at least 31 satellites in the U.S. system that orbit Earth and transmit location data to handheld receivers. Essentially, a GPS receiver uses the time it takes to receive a transmitted signal to measure the distance to each satellite. The receiver uses this data to pinpoint the exact location of the receiver. The accuracy of the information allows people to determine the precise distance between two points, making GPS especially useful for navigation purposes. Pilots of airplanes and ships use GPS to stay on course. Smartphones and automobiles also are equipped with GPS receivers, enabling motorists to receive instructions for the fastest or most direct route to a desired destination. GPS-based mapping systems provide users with both maps and verbal directions to follow while traveling. GPS also uses information collected from other receivers to determine the speed of travelers and where traffic is stopped. GPS is used for several geospatial applications beyond GIS.

One of the challenges that geographers face today is the enormous amount of available data. In addition to the GPS satellites that provide positioning data and satellites that collect images of Earth, there are hundreds of satellites collecting information about population, migration, soils, ocean currents, and more. Online mapping services collect and share even more data through aerial photographs and street-level cameras. The amount of real-time data, or information that is available for analysis immediately after being collected, has grown tremendously. Now internet-based supercomputer systems are being developed to help geographers manage, analyze, and share this data.

GEOGRAPHIC THINKING

3. Identify three ways geographers collect data.
4. Describe how drones have impacted the acquisition of geospatial data.
5. Explain why it is important to collect data at the appropriate scale.
6. Describe one way geographers could use GPS in their work.

NATIONAL GEOGRAPHIC EXPLORER **SARAH PARCAK**

PROTECTING ARCHAEOLOGICAL SITES

Sarah Parcak analyzed satellite images and maps to identify priorities for protecting archaeological sites in Egypt.

LEARNING OBJECTIVES

IMP-1.B Identify different methods of geographic data collection.

IMP-1.C Explain the geographical effects of decisions made using geographic information.

Throughout the world, expanding development and natural environmental changes can put archaeological sites at risk. Looting, the stealing of artifacts from a site, presents another challenge. The demand for ancient artifacts fuels a black market that pays looters handsomely. Archaeologist Sarah Parcak has used geospatial technologies to preserve and protect archaeological sites in Egypt.

Parcak is a professor of archaeology at the University of Alabama at Birmingham. She specializes in Egypt, which is where she had her first dig almost two decades ago. In her early work, she recognized that archaeological sites were in danger of being lost forever as a result of encroaching urban development and the rampant looting of artifacts. She posed an important geographic question: *How could her team preserve and protect these irreplaceable records of human history?* This guiding question led to others: *Where are Egypt's archaeological sites? What is the most efficient way to find them? Which sites are in greatest need of protection? How can we encourage people to recognize the importance of protecting these sites?*

Parcak set about gathering data to help answer these questions. She conducted extensive background research and examined satellite images showing discolored soil, changes in vegetation, or other differences in the landscape that might suggest that ancient ruins lay under the surface.

Following Egypt's political upheaval in 2011, Parcak learned from social media that people were digging illegally at various sites and stealing artifacts. Comparing satellite images of the region taken in 2010 to images taken after 2011 (such as the one above) revealed a landscape increasingly scarred by looting pits, and confirmed that the theft of artifacts was on the rise. Parcak used the satellite images and maps to show government officials where looting was taking place. The government used her data to improve its protection of the endangered sites. As a result, Parcak not only helped Egypt solve a problem that it didn't know it had, but she facilitated the preservation of ancient artifacts for future generations.

GEOGRAPHIC THINKING

Explain how geospatial technologies used for data collection have impacted geographers' work.

2.3 UNDERSTANDING MAPS

Maps are the way geographers depict relationships of time, space, and scale. Maps are indeed among the geographer's most important tools because they display data in a spatial way. Geographers use many different types of maps to help them answer the three questions you've already learned about: *Where? Why there? Why care?*

MAPMAKING

LEARNING OBJECTIVE

IMP-1.A Identify types of maps, the types of information presented in maps, and different kinds of spatial patterns and relationships portrayed in maps.

Maps are the fundamental tool most uniquely identified with geography. People have used maps to depict information for thousands of years, and they continue to use increasingly sophisticated maps today. As you know, maps come in all shapes, sizes, and formats, and have a wide variety of uses and purposes. One of the most common uses of maps is to locate something, such as a country or a river. The purpose of many maps, such as road maps or subway maps, is to communicate how to get from one place to another. Centuries ago, **cartographers** created maps to help explorers follow the routes of those who came before them and to estimate how long it might take to travel to uncharted lands. These explorers then collected critical data for the creation of new maps.

Patterns in our world are seldom random; spatial features tend to be clustered, dispersed, or linear. For example, geographers use maps to illustrate the clustering or

CRITICAL VIEWING This map from Ortelius's atlas shows the world in two dimensions. ▮ Explain what this map reveals about geographers' knowledge of the world in 1570. Then compare it to today's maps.

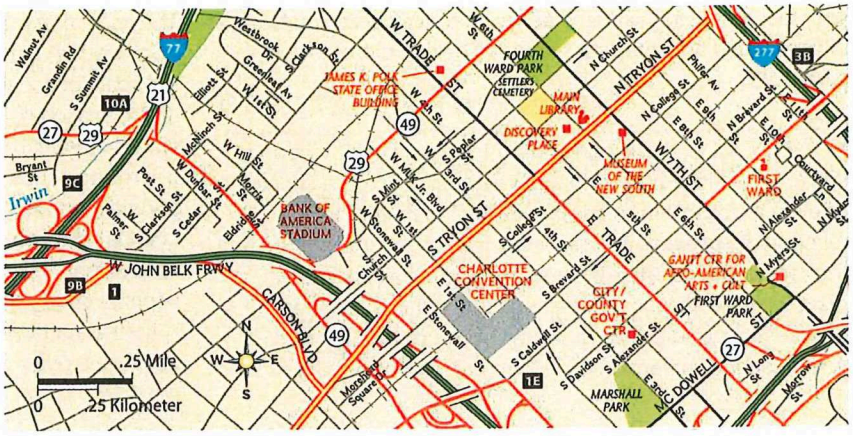
dispersal of patterns of the distribution of populations. To describe the spacing of places or people, the terms **absolute distance** and **relative distance** are used. Absolute distance is distance that can be measured using a standard unit of length. Relative distance is measured in terms of other criteria such as time or money. For instance, it takes approximately 7 hours to fly from New York City to Paris, France, or a ride share in New York City from Manhattan to LaGuardia airport costs $40. The terms **absolute direction** (the cardinal directions north, south, east, and west) and **relative direction** (left, right, up, down, front, or behind based on people's perceptions) are used to describe direction and location when interpreting maps.

Maps are important problem-solving tools. For example, depicting the spread of a disease epidemic on a map can often be the first step in finding its cause and stopping further outbreaks. Mapping cholera cases in the mid-1800s helped doctors recognize that outbreaks of the disease tended to happen near water supplies. That helped them identify the use of contaminated water as the cause. About 150 years later, geographer Korine N. Kolivras used GIS to analyze dengue fever outbreaks in Hawaii. Dengue fever is a disease carried by a particular type of mosquito, so Kolivras's work included analyzing the breeding conditions needed for this mosquito to thrive. By mapping the precipitation, vegetation, and other related variables, Kolivras was able to predict the places at greatest risk of dengue fever and other mosquito-borne illness.

As representations of the entire world or part of the world, maps are selective in the information they represent. It is impossible to fit every feature or piece of data onto a single map. So mapmakers must decide how much of Earth to show and how to show it. These decisions are driven by the purpose of the map. Maps have many different purposes—to show location, distance, or some other spatial relationship. Maps can also be used

MAP SCALES

On a walk through a city, such as Charlotte, North Carolina, you might use a highly-detailed map that shows only the downtown area. To drive up the Atlantic coast, however, you would use a map that covers a large area, including several states. These maps have different scales.



LARGE-SCALE MAP This detailed map shows only the city of Charlotte, North Carolina. The map scale shows that a half inch on the map represents a quarter mile on Earth's surface.

MEDIUM-SCALE MAP This map shows the entire state of North Carolina. It includes fewer details than the large-scale map and shows a larger area. The map scale shows that three-quarters of an inch on the map represents 100 miles on Earth's surface.

SMALL-SCALE MAP This map identifies the Atlantic coast states from Florida to Maine. It covers a large area and shows even fewer details than the medium-scale map. The map scale shows that a half inch on the map represents 200 miles on Earth's surface.

to measure change over time. Comparing a map of Boston from 1775 with one of the city today reveals how humans have altered the landscape over time.

As with any secondary source material, it is important to evaluate maps critically by considering the source of the data and the intent of the cartographer. You might ask yourself, *What story is this map trying to tell?* Learning to critically read and interpret maps will help you create your own maps.

MAP SCALE Maps can show information at almost any scale, from the entire world to a neighborhood, to a school, or even a classroom. A **map scale** is the mathematical relationship between the size of a map and the part of the real world it shows. It allows you to measure absolute distance. The scale can be expressed in three ways: as a representative fraction, a written scale, or graphically. A representative fraction is often expressed as a ratio, for example a scale of 1:1,000,000 means 1 unit on the map represents 1 million of the same units on Earth's surface. An example of a written scale is 1 inch represents 200 miles. A graphic scale is expressed with a bar line showing the relationship between the distance on the map and the distance on Earth's surface.

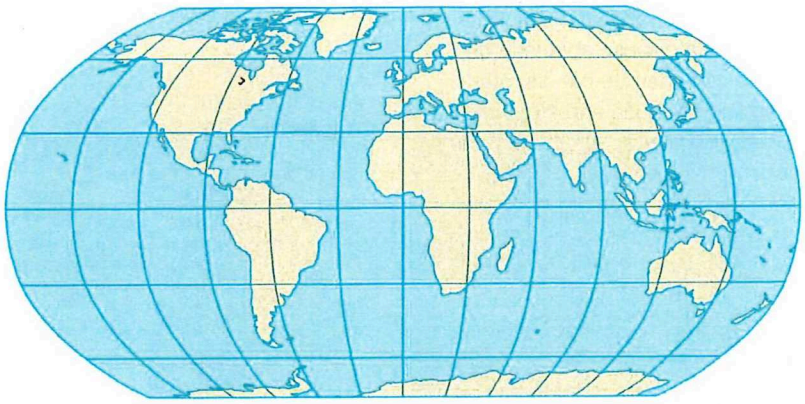
The scale of a map is an important clue to the level of detail portrayed on the map as well as the purpose of the map. As the scale of analysis varies, so does the kind and amount of information shown on the map. For example, a city map shows streets, buildings, and landmarks. A map of a state or province shows less detail—cities, rivers, and highways—and covers a larger area. A map of an entire country or continent shows even less detail; perhaps just the major natural features and national borders. The scale of a map impacts the analysis of the map and therefore its purpose. A certain pattern may be obvious at one scale, but as you zoom out, other patterns may become clear. When making

MAP PROJECTION TYPES

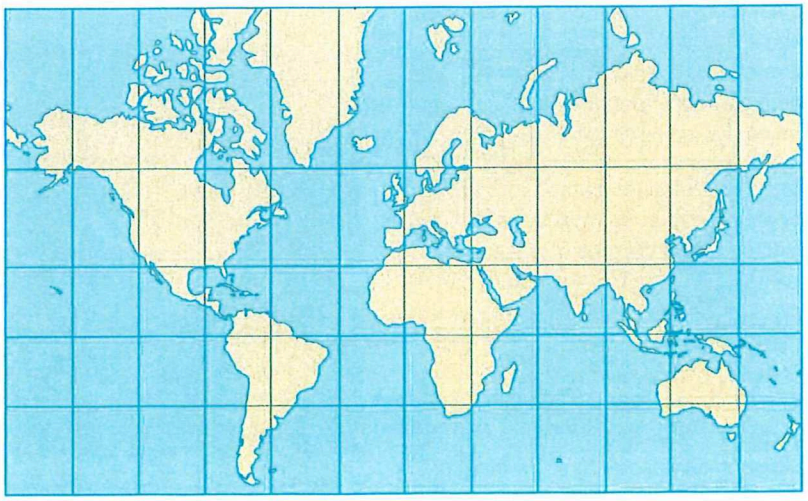
Within the broad categories of projections, including conformal, cylindrical, and equal-area, are four common projection types: Robinson, Mercator, Gall-Peters, and azimuthal. Each projection has advantages and limitations and distorts the sizes and shapes of Earth's landmasses in different ways. The different projections also handle direction differently.

The Robinson projection has curved lines of longitude and straight lines of latitude, which means directions are true only along the parallels (including the equator) and the central meridian. Its unique, globe-like appearance makes the Robinson projection useful for many different types of maps.

The Mercator and Gall-Peters projections show true direction, which is direction measured with reference to the north geographic pole. These two projections are often used for navigation. The azimuthal projection is well-suited for maps of the Arctic and Antarctic.



ROBINSON PROJECTION The shapes of the continents become more distorted farther away from the equator or the map's central meridian.



MERCATOR PROJECTION The continents' shapes are maintained and direction is displayed accurately, but the sizes of the continents are very distorted.

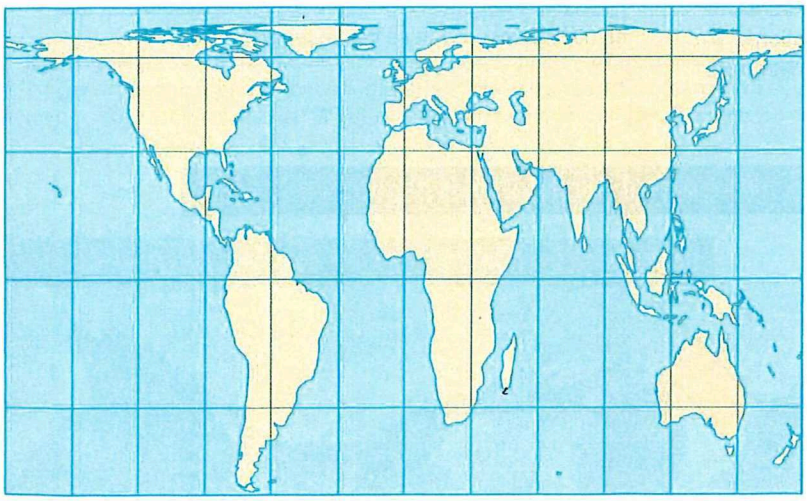
decisions or conducting spatial analysis, it is important to use a map at the appropriate scale that shows pertinent details. The scale of a map must fit the purpose.

MAP PROJECTIONS Cartographers are tasked with using just two dimensions to represent a three-dimensional object—Earth. A sphere cannot be flattened onto a piece of paper or screen without altering its original shape. Over time, cartographers have developed various mathematical equations to handle the distortion, or misleading impressions, of Earth's surface that occur during the mapmaking process.

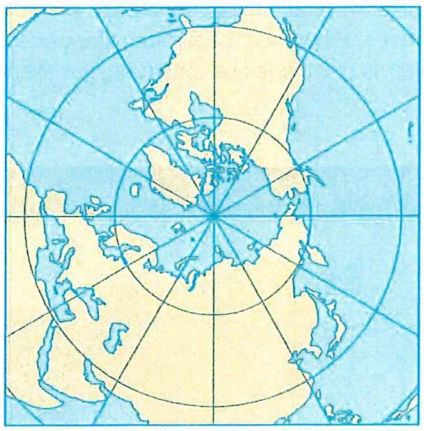
A map projection is any method used to represent the world or part of the world in two dimensions. Different projections distort spatial relations in shape, area, direction, or distance. All map projections create distortion, but the types and degrees of distortion vary considerably. The purpose of the map should guide the type of projection used. A conformal projection distorts area but keeps the shapes intact, giving the impression that some continents are larger than they actually are. Cylindrical projections also distort shapes, but they preserve direction. Equal-area projections, on the other hand, attempt to distribute the distortion of area equally throughout the map; however, in so doing, they distort the shapes of landmasses.

GEOGRAPHIC THINKING

1. Describe one example of absolute distance and one example of relative distance.
2. Compare the three ways scale is expressed on maps by explaining how they are alike and different.
3. Explain why the Robinson projection is one of the most commonly used map projections.



GALL-PETERS PROJECTION The relative size of the continents is more easily displayed than with other projections, but the shapes of the continents is distorted.



AZIMUTHAL PROJECTION A flattened disk-shaped portion of Earth is shown from a specific point.

MAP PROJECTION	ADVANTAGES	LIMITATIONS
MERCATOR	• Shows true direction • Good for navigation purposes	• Distorts area • Size is distorted increasingly near the poles
GALL-PETERS	• Shows true direction • Area is relatively precise	• Distorts shape • Continents appear elongated
ROBINSON	• A globe-like appearance that "looks real" • Distorts size and shape, but not too much	• Imprecise measurements • Extreme distortion at the poles; flat on the poles and compressed near the equator
AZIMUTHAL	• Preserves direction • When used from the point of the North Pole, no country is seen as center	• Distorts shape and area • Only shows one half of Earth

TYPES OF MAPS

LEARNING OBJECTIVE

IMP-1.A Identify types of maps, the types of information presented in maps, and different kinds of spatial patterns and relationships portrayed in maps.

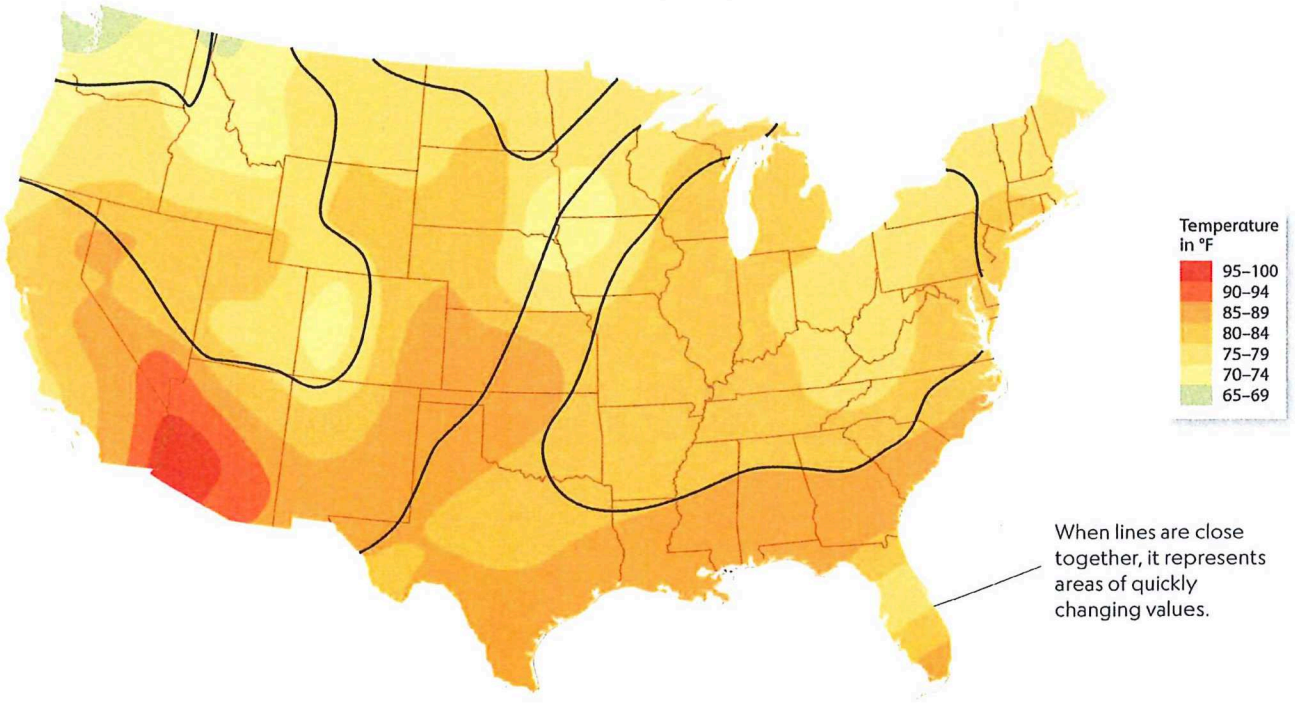
There are two major categories of maps: reference and thematic. **Reference maps** are generalized sources of geographic data and focus on location. Thematic maps have a theme or specific purpose and focus on the relationship among geographic data. A reference map might show streets and other general city features, while a thematic map might show the spread of disease across a city, or trade patterns around the world.

REFERENCE MAPS Reference maps illustrate the boundaries, names, and other unique identifiers of places and regions. They focus on the location of geospatial elements such as countries, cities, lakes, and other features of a landscape. Physical maps, which primarily show landforms and other natural features, and political maps, which primarily show boundaries between governmental units like countries or states, are examples of reference maps. Reference maps often show absolute location in terms of latitude and longitude. For example, the absolute location of Portland, Oregon, is 45.52° N latitude and 122.68° W longitude. You can locate Portland on any map marked with latitude and longitude using these coordinates.

Beginning in 2005, online mapping services began to use satellite imagery, aerial photography, street maps, and panoramic views of streets to enable users to see reference maps of almost any place on Earth at almost any scale. Mapping services take advantage of GPS-enabled software systems to provide real-time traffic conditions and route planning that includes estimated travel time. In addition to travel by car, mapping services offer reference maps for travel on foot, by bicycle, and by public transportation.

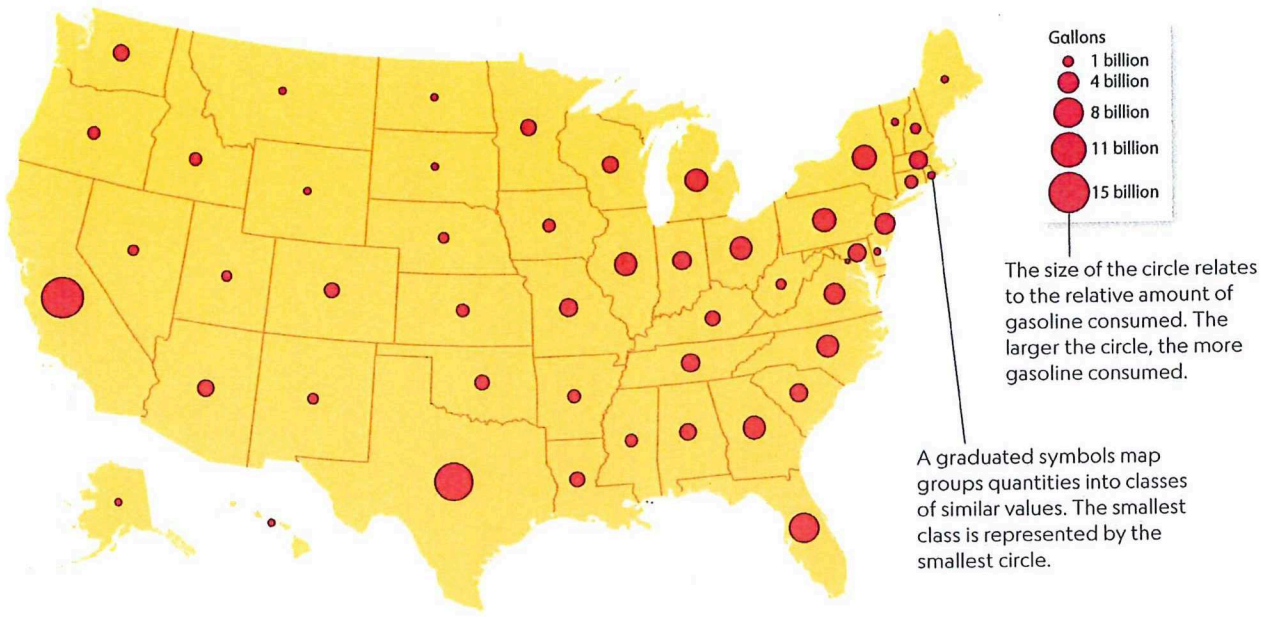
THEMATIC MAPS Thematic maps are maps focused on a particular topic or theme. For example, a map showing early human migrations out of Africa and their rate of dispersion to other parts of the world can be shown on a thematic map. Thematic maps can show the distribution, flow, connection of, or relationship among one or more attributes. They might focus only on population density, or multiple attributes, such as ethnicity, election results, and population density. Showing too many attributes on the same map can confuse its message.

SURFACE TEMPERATURES OF THE CONTIGUOUS UNITED STATES, JULY 25, 2019



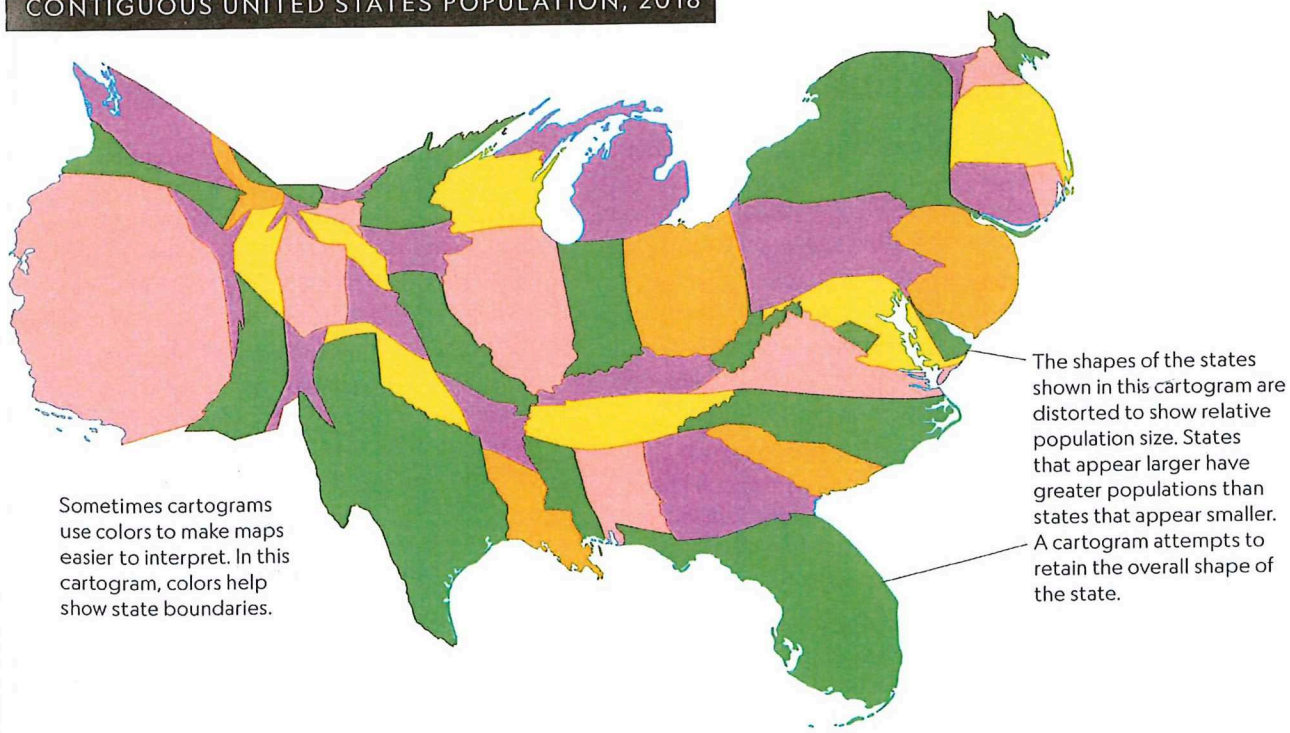
ISOLINE MAP Lines connect data points of the same value. Isoline maps are used to show particular characteristics of an area. On this temperature map, isolines create bands of similar surface temperatures and the black lines show areas of high and low air pressure across the United States.

GASOLINE CONSUMPTION BY STATE, 2018



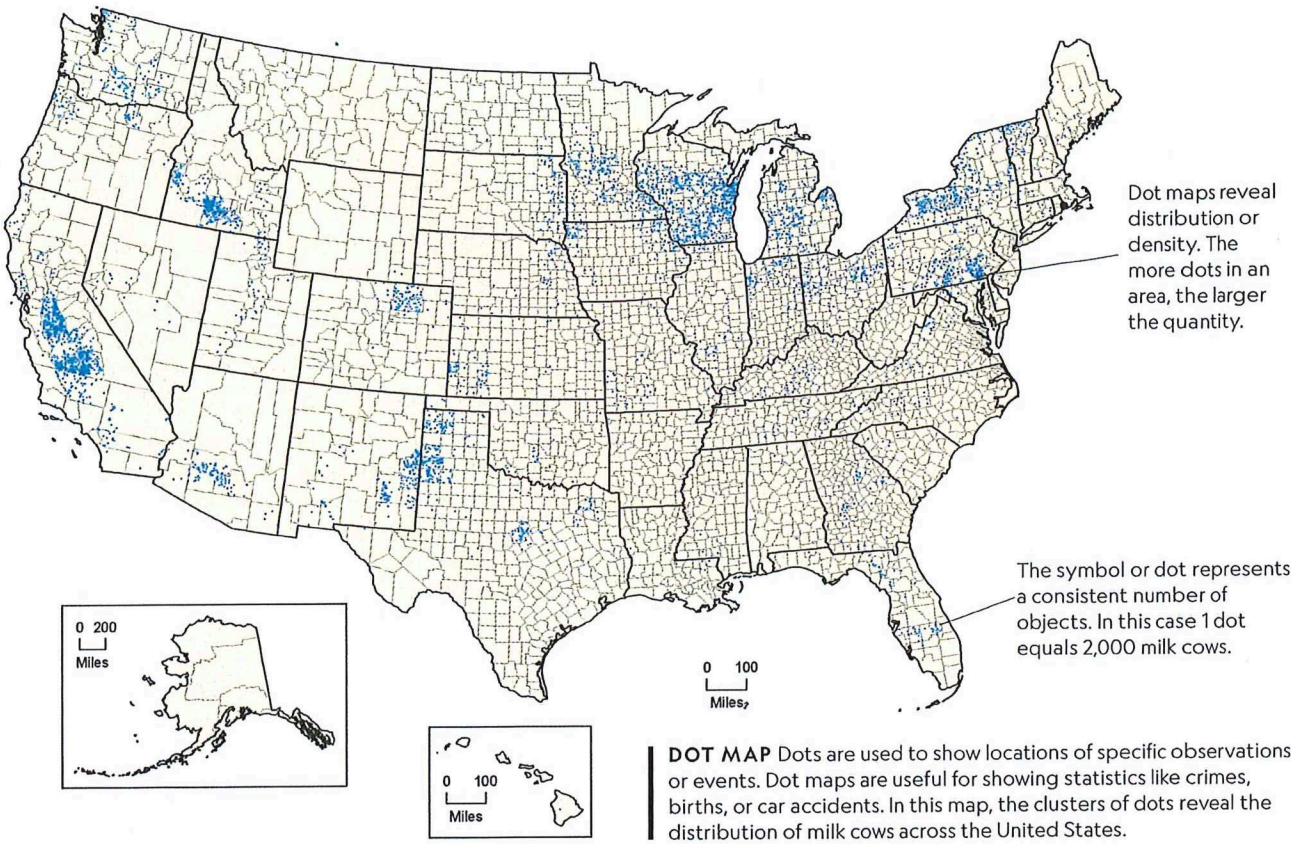
GRADUATED SYMBOLS MAP Differently sized symbols are used to indicate quantitative data. Bigger circles or icons represent a larger numerical value of a particular attribute. A graduated symbols map is useful for showing population, earthquake magnitude, or, as in this map, gasoline consumption.

CONTIGUOUS UNITED STATES POPULATION, 2018



CARTOGRAM Statistical data and geographic location are combined to communicate information at a glance. Cartograms show the relative size of an area based on a particular attribute, like population or energy consumption. Sometimes geographic regions are distorted to convey quantity or extent.

MILK COW INVENTORY OF THE UNITED STATES, 2017

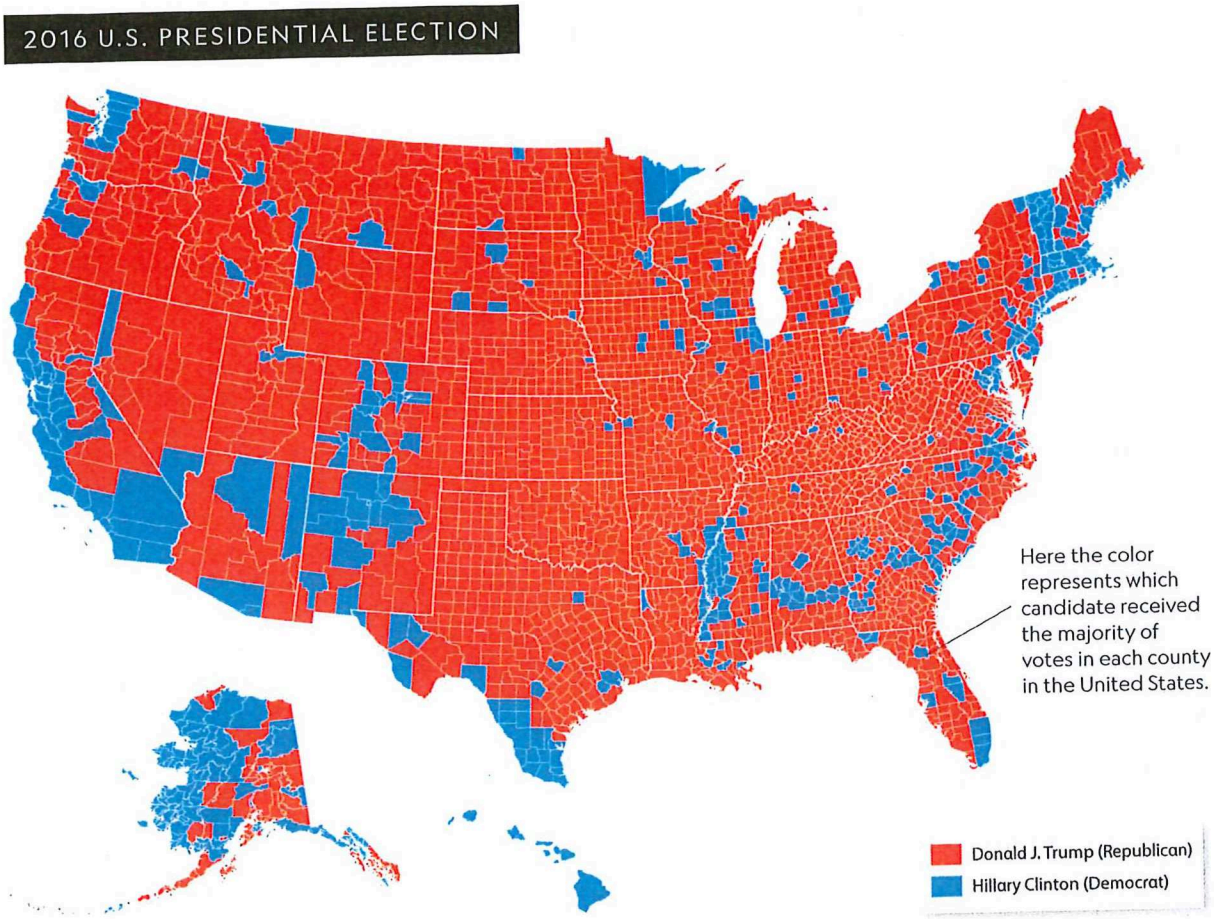


DOT MAP Dots are used to show locations of specific observations or events. Dot maps are useful for showing statistics like crimes, births, or car accidents. In this map, the clusters of dots reveal the distribution of milk cows across the United States.

THE GEO-INQUIRY PROCESS | TIPS FOR SUCCESS

VISUALIZE

- Begin to organize your data and consider how best to display it. Your goal is to demonstrate your understanding of the data you researched and your overall inquiry.
- Maps will probably be a key visual component of your inquiry. You can create a basemap of the area you are studying and add data layers using online mapping tools and sources.
- Consider adding images and text to your map. You can cut and paste or use online programs. Online mapping tools allow you to turn items on and off, so you can look at one type of data at a time.
- Add any first impressions you have about the area you are visualizing to your map. Attach sticky notes to printed visuals, or add markers if you are using an online mapping program.
- How you organize your data depends on the data type. Quantitative data can be organized using a spreadsheet program and then shown in graphs and charts. Add other visuals to help explain the data and further the story you're telling. Be sure that all your data is linked back to specific locations on your basemap.
- Analyze your data and notice any trends or patterns. Do the patterns relate to or answer your Geo-Inquiry question? Consider adding colors or symbols to your map to help display patterns or trends. Then analyze your map. You should be able to answer your Geo-Inquiry question at this point. If you can't, revisit your data and conduct further research.
- Finalize your map once you know it can answer your Geo-Inquiry question. Make adjustments to your maps and your other visuals so they are clear and clean. Include a title and make sure all labels are clear and relevant.



CHOROPLETH MAP This thematic map uses colors or shading to represent categories of data for predetermined geographic areas such as census tracts, counties, states, provinces, or countries. Choropleth maps are useful for communicating quantitative data, such as demographics or election results.

Basemaps form the foundations of both reference and thematic maps. Many thematic maps use a basemap showing coastlines, city locations, and political boundaries. The map's theme is then layered onto this basemap. Political divisions, cities, or natural features provide reference points to help users understand the data that is presented on a thematic map, which can focus on any number of topics.

Most geographic data relates to specific points, lines, and areas. The way maps display these types of data affects analysis. Clusters are best illustrated in maps that use dots or graduated symbols, for instance. Isoline maps connect data points of equal value, like elevation, temperature, or precipitation. Choropleth maps use color or shading to display quantitative data in preset regions. Graduated symbols represent differences in size or extent of something in an area, like populations of a state or traffic volume by county. Greater numbers are represented by larger symbols.

A cartogram is a unique type of map that conveys information by making the areas on a map proportional to the variable being mapped. As one example, a cartogram might redraw the spatial features of the U.S. states according to population distribution, so that New York state or Massachusetts appears much larger than Alaska or Montana.

GEOGRAPHIC THINKING

4. Choose one of the thematic maps from this lesson. Based on specific details, describe one conclusion you can draw from the map.
5. Explain similarities and differences between dot maps and graduated symbols maps. Why might one or the other be preferable for different types of data?

2.4 THE POWER OF DATA

Geographic data help people make informed decisions at all scales—from individuals making personal decisions to businesses determining their marketing strategy, and from communities engaged in development planning to countries and international organizations looking to solve the world's most pressing problems.

HOW DATA ARE USED

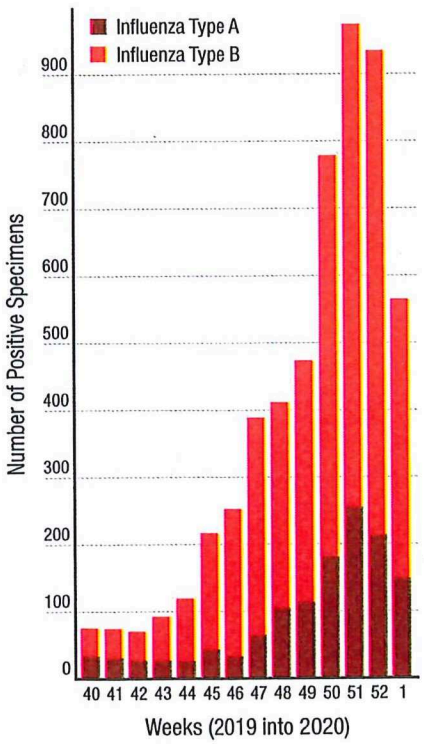
LEARNING OBJECTIVE

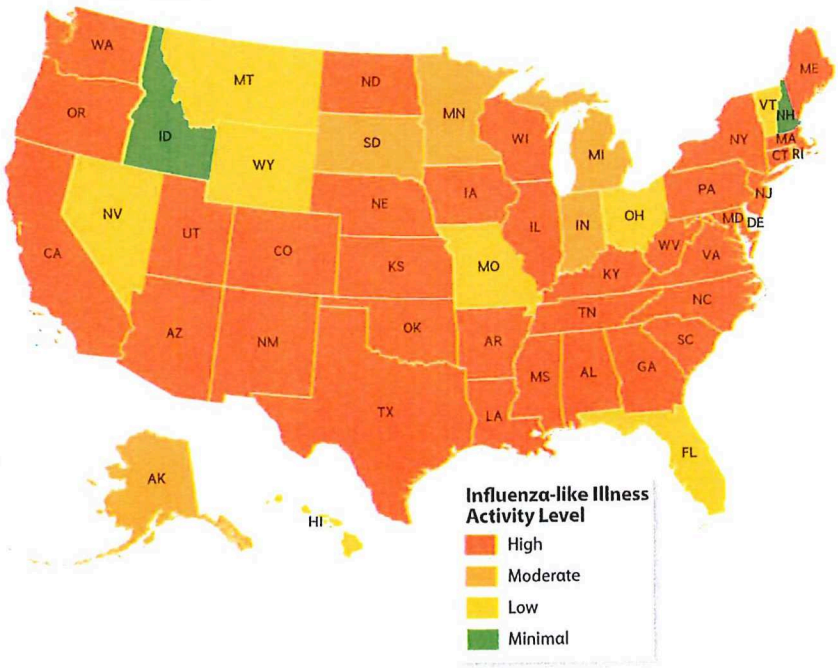
IMP-1.C Explain the geographical effects of decisions made using geographical information.

Geographic data are used to help people understand problems, consider options that lead to making decisions, and measure the effects of those decisions. For example, understanding common behaviors—where people work and shop, and their commuting habits—helps city planners determine the future location of roads or make decisions about land use. Data can convince people to take action. Examining data about people's shopping habits can help determine how many parking places are needed for a new shopping center.

U.S. health officials use data to help public health departments make decisions when planning for the annual flu season. Data from the Centers for Disease Control and Prevention (CDC), the leading national public health institute in the United States, are used to provide feedback, inform policy, and make recommendations for new and better flu vaccines. The CDC receives and characterizes the genetic make-up of thousands of influenza viruses each year from across the United States and around the world. Compiling and analyzing this data allows the CDC to track when and where flu activity is occuring, determine what flu viruses are circulating, detect changes in the viruses, and measure the impact of the virus on hospitalizations and deaths. In addition, using data from past seasons helps to determine the severity of the virus each season. The CDC shares this information with health officials and agencies to help them make better decisions about what goes in each year's flu vaccine. It also helps evaluate viruses for their pandemic potential, allowing health agencies to better prepare for and prevent the spread of illness.

INFLUENZA ACTIVITY IN THE UNITED STATES, WEEK 48, 2019





Mapping the activity level of influenza helps health workers prepare for sick patients and lets the public know where there are a high number of reported cases. The number of people infected with both types of flu virus (Influenza Types A and B) continued to rise throughout December 2019 and into 2020, as indicated by the chart.

MAKING DECISIONS WITH GEOGRAPHIC DATA

LEARNING OBJECTIVE

IMP-1.C Explain the geographical effects of decisions made using geographical information.

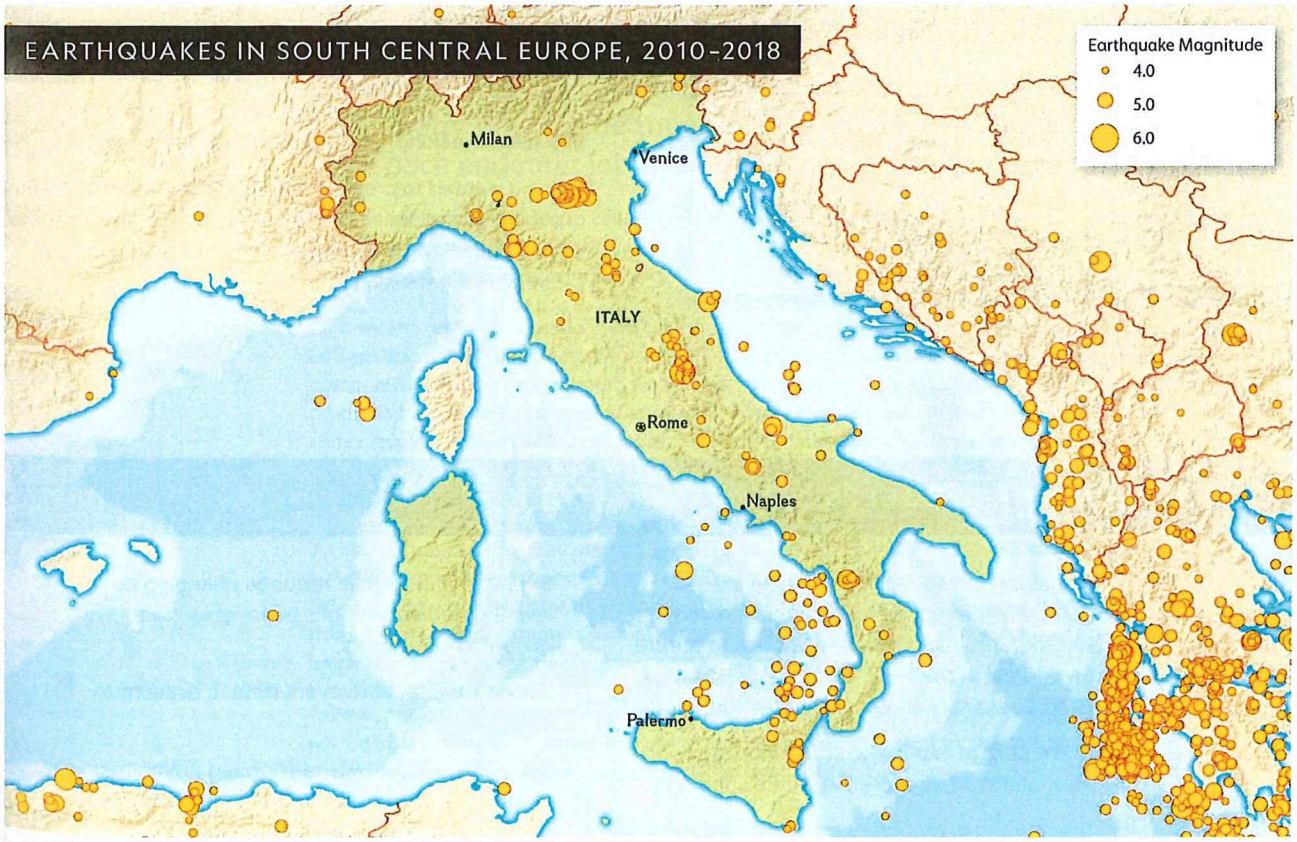
Improving health and wellness is only one use of data. Individuals and businesses also make use of a variety of geographic data, formally and informally.

PERSONAL AND ORGANIZATIONAL DECISION-MAKING Geographic data influence where people decide to live. People in the market for a home consider its proximity to work and walkability. They also may look at property taxes, crime statistics, school zones, floodplain or earthquake data, and other risks. People may study sources that provide information on the neighborhood and commute time. Individuals looking to sell their home will also employ geographic data in order to determine their property's value. For example, how much other homes in the area have been sold for can help predict a home's value.

Businesses make location decisions in ways similar to individuals. When deciding where to locate, businesses typically review demographic data on potential customers, the workforce, tax rates, and more. Some organizations need data and maps that are specialized. For instance, a home insurance company may look at floodplain maps.

Other groups seek to expand data related to quality of life, mapping public health, education, and public safety services, for instance. OpenStreetMap has become a catalyst for such purposes. OpenStreetMap was founded in 2004 by software developers who wanted to create an open-source network for mapmaking. Today, it maintains data about locations—roads, parks, railway stations, and more—all over the world. OpenStreetMap has become important in mapping lands of Native Americans and other indigenous peoples. It also has played an important role in saving lives. Following a devastating earthquake that struck Haiti in 2010, volunteers used satellite imagery to create detailed digital maps of roads, buildings, and other features, facilitating recovery and relief services.

Similar efforts have resulted following other disasters. After Hurricane Harvey hit Houston, Texas, in 2017, people stranded in their homes or neighborhoods used online mapping services as a tool for assistance. An app enabled them to mark their location; some apps enabled people to add notes indicating the type of help required, such as "WOMAN IN LABOR!!"



READING MAPS GIS software can be used to display the location and intensity of earthquakes. This map shows earthquakes that occurred in Italy and surrounding countries between 2010 and 2018. Each circle corresponds to an earthquake of varying intensity. ▮ Describe how the information in this map might be used by individuals, businesses, and governments.

GOVERNMENTAL DECISION-MAKING

Governments at all levels use GIS data for myriad purposes. Researchers indicate that as much as 80 percent of data stored by the government has a spatial component.

Local governments use GIS data for addressing local problems. For instance, a police department may use spatial data with one layer showing where various types of crimes have occurred and another showing the presence of streetlights or surveillance cameras. In addition to helping communities identify places to target for police presence and enforcement, this can help the government analyze the effectiveness of lighting and other deterrence strategies.

The risk for homelessness varies in different parts of Los Angeles. The darker colors represent higher levels of risk.

National governments often focus their GIS efforts on disaster prevention and mitigation. Data published by the U.S. Geological Survey helps officials assess the risk of earthquakes in specific regions and develop strategies for mitigating such risks. The Environmental Protection Agency uses GIS to monitor air quality by overlaying spatial information with environmental data, like ground-level ozone. The data are used to identify areas with poor air quality.

In Los Angeles County, GIS produces maps used to address homelessness. Agencies have mapped the distribution and characteristics of the homeless population, as well as various risk factors. The maps enable decision-makers to recognize and analyze spatial patterns, using the data to weigh options for locating shelters and other resources for homeless populations. In addition to considering where the homeless populations are today, decision-makers have mapped where people were when they became homeless. Analysis of spatial data is used to predict where people are likely to become homeless and is factored into homelessness prevention efforts.

GEOGRAPHIC THINKING

1. Explain how showing spatial patterns can help decision-making. Use an example from the text.
2. If you wanted to create a map that demonstrated to the public the seriousness of a certain city's homelessness problem, what type of thematic map would you use? Explain your thinking.

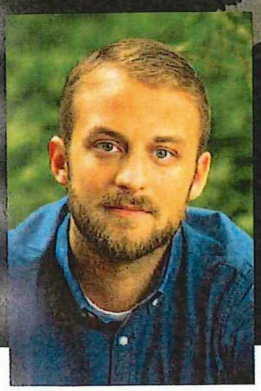
THE GEO-INQUIRY PROCESS | TIPS FOR SUCCESS

CREATE

- Consider how to tell your story in a compelling way. Use infographics, maps, photographs, and personal stories to create an interest in the topic and an emotional tie. Storyboarding can help organize your story.
- Make sure to explain your findings, answer your question, and outline viable solutions.

ACT

- Identify the audience of decision-makers for presentation of your story, and answer questions you think they will have about the topic. If the issue requires changing a law, the audience might be local or state government officials.
- Choose the most relevant data to present to your audience.
- Consider whether your proposed action has spatial connections beyond the immediate locale or could be transferable to other communities.



Shah Selbe began his career as a rocket scientist but left to pursue his true passion: saving the planet.

NATIONAL GEOGRAPHIC EXPLORER **SHAH SELBE**

DEPLOYING TECHNOLOGY FOR CONSERVATION PURPOSES

LEARNING OBJECTIVE

IMP-1.C Explain the geographical effects of decisions made using geographical information.

Scientists can be limited by the high cost of data-collection technology. Shah Selbe thought he could help, so he left his aerospace engineer job to become a conservation technologist.

Shah Selbe founded a group called Conservify, which builds data-collection technology using the same kinds of affordable parts found in your average smartphone. At Conservify, Selbe is essentially helping scientists complete the Geo-Inquiry Process.

One recent research question was asked about humans' impact on the Amazon (shown above): *What effects might some 400 proposed dams have on the river and its communities?* After determining what data was needed, Selbe customized different sensor modules to measure such things as rainfall, windspeed, air and water temperatures, and water levels. He also used geographic information about indigenous people's interactions with the river to assess changes in water quality, the presence of fish species, and flooding over time.

To help visualize what it all meant, Selbe built software called FieldKit, which receives transmitted data from sensors and organizes it for analysis. The data showed that damming the Amazon would disrupt migratory paths, flooding patterns, indigenous people's transportation and fishing systems, and the overall connectivity of the river. Action based on the findings has yet to unfold.

Take note that Selbe's work may impact yours. FieldKit is being refined so that everyone will be able to use it. Whether you are a geographer or a student in need of data for a project, reliable, data-driven research will be available to everyone.

GEOGRAPHIC THINKING

How were scale and information from indigenous people incorporated into Selbe's approach to gathering data?

CHAPTER 2 SUMMARY & REVIEW

CHAPTER SUMMARY

Geographers use a spatial perspective to interpret the world.

The Geo-Inquiry Process provides a systematic way to investigate and understand the world through the patterns, processes, and interactions between human and natural systems. There are five phases of the Geo-Inquiry Process:

- Ask: Developing a Geo-Inquiry question
- Collect: Acquiring geographic information
- Visualize: Organizing and analyzing geographic information
- Create: Developing Geo-Inquiry stories
- Act: Sharing Geo-Inquiry stories

Maps are among a geographer's most important tools. Maps depict data spatially, representing relationships among time, space, and scale.

- There are two main categories of maps:
  - Reference maps focus on location and phenomena.
  - Thematic maps focus on the spatial variation of one or more characteristics.
- Map scale shows the relationship of the size of the map to the size of the area it represents on Earth's surface. It determines the level of detail of a map.
- All maps are distorted because of the problems of representing a three-dimensional spherical object (Earth) in two dimensions. Maps distort shape, area, direction, or distance.
- Each type of map projection has both advantages and disadvantages. The projection used depends on the purpose of the map.
- Types of maps include dot maps, choropleth maps, isoline maps, graduated symbols maps, and cartograms.

Today's technologies enable complex data to be gathered in real time by individuals and organizations. Geographers collect a range of data that can help individuals, businesses, organizations, and governments make informed decisions.

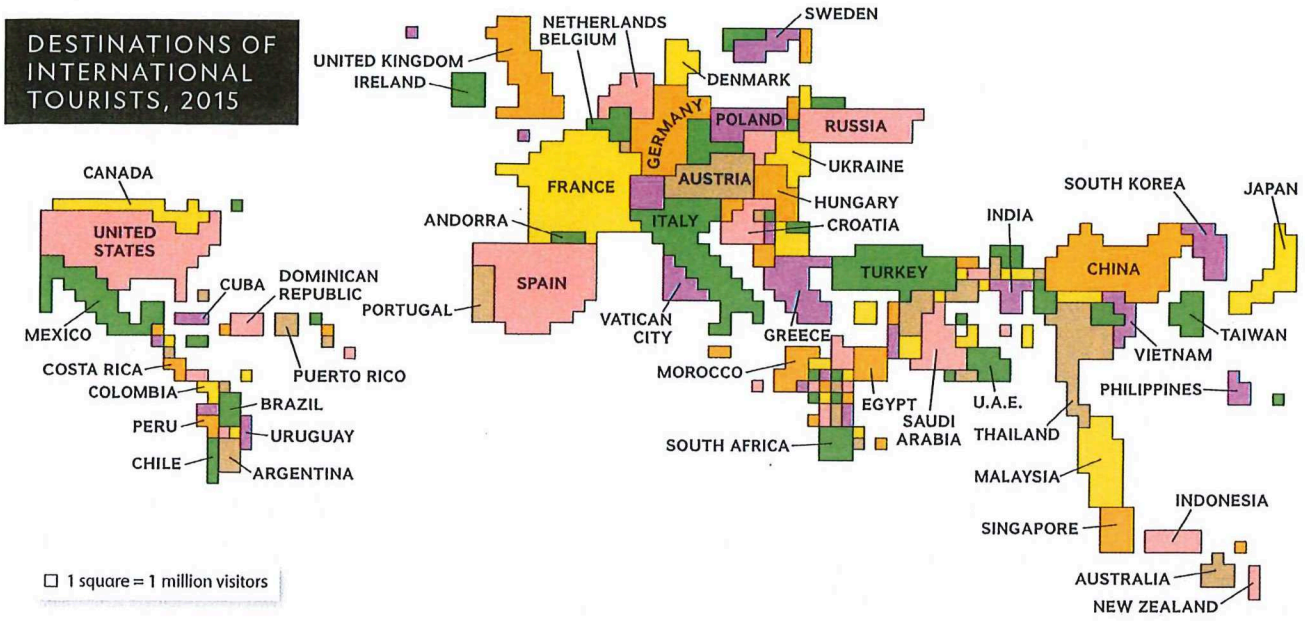
- Geographers gather data through a variety of remote sensing methods, including satellite images and aerial photographs, as well as through field observation and interviews, and written accounts including media reports and policy documents.
- Geographic information systems (GIS) capture, store, analyze, and display geographic data. The data can be used to create map layers that are combined on a single map. Location is the key aspect that links these data layers.
- The global positioning system (GPS) enables geographers (and others) to determine the precise distance between two points on Earth's surface.

KEY TERMS AND CONCEPTS

Use complete sentences to answer the questions.

1. **APPLY CONCEPTUAL VOCABULARY** Consider the term *distortion*. Write a standard dictionary definition of the term. Then provide a conceptual definition—an explanation of how the term is used in the context of the chapter.
2. How might a cartographer show the topography of a region or country?
3. Describe how remote sensing tools have improved the work geographers do. Provide an example.
4. What is the primary difference between GPS and GIS?
5. Differentiate between reference maps and thematic maps. Give an example of each.
6. How does map scale affect cartography?
7. How are the terms *map projection* and *distortion* related?
8. What is the Mercator projection and how does it distort?
9. Explain similarities and differences between choropleth maps and isoline maps. Give a common use for each.
10. Do you think the U.S. census contains mostly quantitative or qualitative data? Explain.
11. Describe the absolute distance and the relative distance between your school and where you live.

INTERPRET MAPS



Study the cartogram and then answer the questions.

12. **DESCRIBE GEOGRAPHIC CONCEPTS** What aspects of the map tell you it is a cartogram?
13. **EXPLAIN SPATIAL RELATIONSHIPS** Why is the United States so much larger than Canada?
14. **EVALUATE MODELS & THEORIES** What is the advantage of using a cartogram to show this data?
15. **SYNTHESIZE** How might different countries use this map when considering how to promote tourism in the future?

GEO-INQUIRY | A NEW COMMUNITY RESOURCE

A good Geo-Inquiry project begins with an overarching topic and question that guides inquiry. For example, *How might a new grocery store location support the reduction of obesity in our community?* Use the Geo-Inquiry Process below to explore an issue in your community.

ASK Start with an authentic investigation into issues in the community. Many need-to-know questions will arise as you think about the issue, but the Geo-Inquiry question is an open-ended question that prompts further investigation. Using the example, need-to-know questions would include *Where are the nearest grocery stores? What is the obesity rate in adults and children? Where do most people shop for food? What types of food are available?*

COLLECT Decide the geographic information you need in order to answer your original question. Explore local sources of information, such as maps of the community or demographic data about particular neighborhoods. You might survey community members or experts.

VISUALIZE Organize and analyze the information you collected. Use a chart to analyze the results of surveys you conducted, or a map of current businesses to help you think about your community spatially. Look for patterns to help you draw conclusions.

CREATE Focus on how to tell a Geo-Inquiry story that will support your recommendation. Keep your audience in mind. Will you be pitching your story to a developer interested in building a grocery store? Consider using images, videos, compelling storylines, and charts and graphs to help tell your story.

ACT Consider how your project can inform decisions regarding the location of community resources, thereby improving the health, educational, or economic options for residents. Take informed action by reaching out to community leaders who determine the location of community resources and share your ideas with them.