



# GEOGRAPHY

*for life*

National Geography Standards, Second Edition

# *Geography for Life: National Geography Standards*

## *Second Edition*

Geography Education National Implementation Project (GENIP)

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**2012**

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On behalf of the  
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# Preface

*Geography for Life: National Geography Standards* was first published in October 1994. Since that time, every state has adopted geographic curricular standards for what students should know and be able to do. In most cases, state standards are based on the National Geography Standards. *Geography for Life* has been the basis for instructional materials—ranging from textbooks to lesson plans—for in-service programs for teachers conducted by the National Geographic Society and other organizations.

The world of 2012, however, is significantly different from that of 1994. Over the past 18 years, there have been changes in what we expect students to know and be able to do, in the nature of geography, in approaches to K–12 education, and in the publication and dissemination of ideas.

In 1994, geographic information systems (GIS) and global positioning systems (GPS) were used by relatively few people; nowadays hundreds of millions have everyday access to maps and locational information through mobile devices and computers. As a society, we must come to terms with a world in which the increasing globalization of human activities and global environmental change are reshaping everything from trade and travel to climate and coastlines. With the passage of the No Child Left Behind Act in 2001, academic expectations for students and performance demands on teachers and schools have been fundamentally reshaped. The digital revolution has transformed the method, content, and speed by which information is exchanged.

What has not changed is the crucial need for a geographically literate society. The opening words of the 1994 edition ring true today: “Geography is for life in every sense of that expression: lifelong, life-sustaining, and life-enhancing.” Fostering geographic literacy remains a prime responsibility of the K–12 education system.

Therefore, the Geography Education National Implementation Program (GENIP) has developed this second edition of *Geography for Life*, updating and refreshing the Standards. GENIP is a consortium of the major geography organizations: the American Geographical Society (AGS), Association of American Geographers (AAG), National Council for Geographic Education (NCGE), and National Geographic Society (NGS). Funding for the revision was provided by GENIP and the National Geographic Society.

In 2008 GENIP appointed a committee, the Standards Content Committee, composed of Sarah Bednarz, Judy Bock, Roger Downs (chair), Charlie Fitzpatrick, Paul Gray, Susan Heffron, Susan Hume, Lydia Lewis, Jim Marran, and Joe Stoltman. The committee had three goals: (1) to maintain essential continuity between the first and second editions; (2) to ensure that the new edition is relevant to students, teachers, and curriculum designers; and (3) to make the new edition flexible and user friendly. This process took several years, and the committee thanks the hundreds of people who, often on short notice, provided feedback and encouragement during this process. All who helped in the revision process are acknowledged in the following pages, but the committee is especially grateful for the working space and administrative support provided by the Association of American Geographers and the National Geographic Society.

The result is a consensus document, reflecting the views of teachers, curriculum developers, textbook writers, and media developers in schools, colleges, universities, and organizations across the United States. We believe that an understanding of geography will help to meet the nation’s educational goals by preparing students “for responsible citizenship, further learning, and productive employment in our nation’s modern economy.” (Goals 2000: Educate America Act, 1994).

Roger M. Downs, Chair  
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2012



# Acknowledgments

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# Introduction: The Geographically Informed Person

The world facing the high school graduates of 2025 will be even more crowded than the world of today. The physical environment will be even more threatened. The global economy will be even more competitive and interconnected.

Understanding and responding to the challenges and opportunities of the world in the twenty-first century will require many skills; the capacities to think and communicate mathematically and scientifically will remain at a premium. Geographic literacy will also be necessary for reasons of enhancing economic competitiveness, preserving quality of life, sustaining the environment, and ensuring national security. As individuals and as members of society, humans face decisions on where to live, what to build where, how and where to travel, how to conserve energy, how to wisely manage scarce resources, and how to cooperate or compete with others.

Making all of these decisions, personal and collective, requires a geographically informed person—someone who sees meaning in the arrangement of things on Earth’s surface, who sees relations between people, places, and environments, who uses geographic skills, and who applies spatial and ecological perspectives to life situations. Geographic skills enable a person to understand the connections between patterns of rivers and the physical processes that create them, between patterns of cities and the human processes that create them, and between what happens in the places in which we live and what happens in places throughout the world, near and far.

The goal of the National Geography Standards is to enable students to become geographically informed through

knowledge and mastery of three things: (1) factual knowledge; (2) mental maps and tools; (3) and ways of thinking. As with any discipline, geography is built on a basis of factual knowledge; we must know what is located where and the characteristics of places and environments. This knowledge is a prerequisite. Without rich mental maps of the world, we cannot put people and places into their human and environmental contexts.

To this base of factual knowledge are added the concepts that allow the geographically informed person to understand the context of world events, i.e., why and how an event occurs where it does. For example, during the first decade of the twenty-first century, for the first time in human history, more than 50 percent of the world’s population lived in urban areas. In the future, increasing numbers of people will live in megacities, which are dense urban concentrations of over 10 million people. To understand the rapid growth of megacities in South Asia, an understanding is required of the connections among subsistence farming, population growth rates, rural-to-urban migration, infrastructure, comparative economic advantage, and factors of production.

Factual knowledge and concepts are brought together by the tools and ways of thinking characteristic of geography. For example, to understand the possible effects of global climate change on coastal areas in Florida, the geographically informed person must understand rates of sea level rise. Maps of the elevation of coastal areas above sea level, together with maps of population distribution and density, and maps of critical parts of the infrastructure (e.g., schools, hospitals, interstate highways) are needed. Modeling of the effects of storm surges from hurricanes of varying intensities is required. In all of these steps, maps, graphs, and tables are used to analyze data. Effects at the local scale (e.g., on the Florida Keys) and statewide effects on such things as beaches, roads, and power lines are considered. Thinking geographically brings together ideas about space with graphics to allow for the visualization of what might happen where, why, and how.

The geographically informed person is prepared to meet the challenges of understanding what is happening in the world, why it is happening in a particular locale, how those things might change in the future, and how to make geographically informed and reasoned decisions. With a strong grasp of geography, people are better equipped to solve personal issues at the local level and collective issues at the global level. Geographic knowledge is invaluable.

But geographic knowledge is important for other reasons. From an intellectual perspective, geography captures the imagination. It stimulates curiosity about the world and its diverse inhabitants and places, as well as about local, regional, and global issues. By understanding their own places in the world, people can overcome parochialism and ethnocentrism. Geography focuses attention on fascinating people and places, on things worth knowing because they are absorbing, and because knowing them enables people to make better-informed and wiser decisions.



The twenty-foot EarthView globe on display in the Massachusetts State House offers students and legislators alike an enlarged spatial perspective of the world - from inside and out.

Image credit: Bridgewater State University/Ashley Costa

## *Introduction: The Geographically Informed Person*



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Geography lets the geographically informed person put humans and Earth into context. It provides an ethical grounding for understanding the future of the planet. Life is fragile; people are fragile. Geography provides knowledge of Earth's physical and human systems and of the interdependency of living things and physical environments. That knowledge, in turn, provides a basis for people to cooperate in the best interests of the planet and the future.

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In the future, increasing numbers of people will live in megacities, which are dense urban concentrations of over 10 million people.

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*Today more than 50 percent of the world's population live in urban areas contributing to the growth of megacities around the world. Sao Paulo, Brazil is a megacity with more than 11 million inhabitants and a growing metro area approaching 20 million people.*

# What's New in the Second Edition and Why

## Organization of the Second Edition

The outcome of *Geography for Life* is a geographically informed person who (1) applies spatial and ecological perspectives to life situations; (2) sees meaning in the spatial arrangement of things; (3) sees relations among people, places, and environments; and (4) uses geographic skills.

## Doing Geography: The Geographic Lens on the World

Explains how geographic perspectives, content knowledge and skills are all used in doing geography.

## Looking at the World in Multiple Ways: Geographic Perspectives

Details the spatial, ecological, and complementary perspectives that are used in geographic investigations.

## Knowing about the World: Geographic Content Knowledge

Identifies geographic content knowledge for three grade bands in terms of 18 Standards that are organized by six Essential Elements.

## Asking and Answering Geographic Questions about the World: Geographic Skills

Describes the skills students use in the systematic process of asking geographic questions, acquiring, organizing, and analyzing geographic information to answer geographic questions.

Education reflects what is happening in society and drives what will happen. According to the Goals 2000: Educate America Act (Public Law 109-227, signed into law in 1994), the K–12 standards were to reflect the most important and enduring ideas such that “[b]y the year 2000... all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matter.” The goal of schools was to “ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning, and productive employment in our Nation’s modern economy.”

In 2012, these goals are still relevant. The intention of this second edition of *Geography for Life*, is to ensure that the National Geography Standards continue to capture the most important and enduring ideas in geography and that the standards remain challenging to students. Much of the material in the first edition of *Geography for Life* has stood the test of time, challenging and educating students and teachers alike. For those reasons, much is to be found that is familiar in this new edition of *Geography for Life*.

Equally well, the geography education community recognizes where changes will enhance the effectiveness of the *National Geography Standards*. There are new ideas about geography that merit inclusion. There are new understandings of the processes of education derived from the learning sciences. There is the recognition that important skills transcend disciplinary boundaries. Thus problem-solving geospatial technologies such as geographic information systems (GIS), global positioning systems (GPS), and remote sensing (RS) may be used across the curriculum and are having profound and pervasive effects on career opportunities.

The first edition of *Geography for Life* made the case for geography, providing extensive essays for those who were not familiar with geography. It did so within the elegant but confining bounds of a one-size-fits-all, 272-page book. With digital media, presentation and publication methods are less restrictive. This second edition contains concise material that takes advantage of people’s increased familiarity with geography and the resources available to teachers and curriculum designers by replacing the essays with focused one-page statements of the underlying themes for each Standard. The second edition is organized to emphasize the importance of “Doing Geography.” Therefore, the sections on the geographic perspectives, content knowledge, and skills that are all necessary to do geography are included together in the main section of the document.

Extensive feedback from teachers, textbook writers, curriculum developers, and in-service professionals has resulted, therefore, in

restructuring of the contents and format of *Geography for Life*. There are three sets of changes: (1) changes to the geographical ideas in the Standards (2) changes to the educational underpinnings of the Standards and (3) changes to the design of the Standards.

## 1. The Geographical Ideas in the Standards

The subject-matter core of the *National Geography Standards* remains the same, reflecting the original success of the first edition of *Geography for Life* in identifying important and enduring understandings. The basic framework consists of two levels: Essential Elements and Standards. There are 18 Standards, grouped into six clusters of Essential Elements. An “Essential Element” is an idea that is central and necessary to an understanding of geography: it is a precise way of looking at the world. An “element” is a building block required for the whole.

The first element, “The World in Spatial Terms,” contains standards that capture the essence of the geographic eye: the structuring of geographic information, the ordering of knowledge into mental maps of the world, and the spatial analysis of geographic information. Given this grounding in geographic ways of approaching the world, the second element, “Places and Regions,” applies the geographic eye to the world. Places and regions are the basic units of geography, and those units are seen differently by different people. The third and fourth elements, “Physical Systems” and “Human Systems,” cover the specific content of geography. “Physical Systems” looks at physical processes (climate, landforms, etc.) and then organizes these processes into functional units, ecosystems, and biomes. “Human Systems” begins with population and then considers human activities, from culture to economics, settlement, and conflict and cooperation. The fifth element, “Environment and Society,” reintegrates the content of geography by emphasizing the systemic interactions between physical and human systems and identifying the central role of resources in environment–society links. The sixth element, “The Uses of Geography,” shows how geography, taken as a whole, enables students to understand the past, interpret the present, and plan for the future.

Within the basic framework, however, there are significant changes to the geographic content of the *National Geography Standards*. The titles of Geography Standards 1 and 8 are revised. The new title of Geography Standard 1 is “How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information.” This replaces *tools* in the original version with *geospatial technologies*, adds the idea of spatial thinking,

## What's New in the Second Edition and Why

Within the Standards, there are numerous changes that reflect the dynamic nature of geography as a way of looking at a changing world.



Image credit: iStockphoto.com

and simplifies the objective to that of understanding and communicating information. The development of geospatial technologies and the recognition that spatial thinking is central to geography are two of the major changes in geography since 1994. The new title for Geography Standard 8 is “The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface.” The addition of biomes reflects the increasing attention being paid to those regional-scale biophysical communities under threat from global environmental change.

Within the Standards, there are numerous changes that reflect the dynamic nature of geography as a way of looking at a changing world. Global processes, human and physical, are increasingly significant, placing a premium on students being able to see the multiple connections between events happening at local and global scales and between human and physical systems. Recognizing the vulnerability and resiliency of people and environments is crucial to successful adaptation to environmental challenges. Greater attention is being paid to the idea of a green world and to mandates for sustainability and environmental stewardship. As a consequence of the increasing availability of high-quality data, geospatial technologies are changing our capacity to understand the world, enhancing geography’s role as a practical problem-solving tool for individuals and societies. Topics such as megacities, terrorism, genocide, displaced persons, social justice, and perspectives related to age, gender, and ethnicity are changing the ways in which geographers look at the world. All of these critically important issues are reflected in the content of the Standards.

### 2. Changes to the Educational Underpinnings of the Standards

The most significant and visible differences from the Standards in the first edition are in the structure of the second edition content. The new edition’s Standards are designed with assessments in mind, whereas the previous Standards were explicitly separated from any linkage to assessment. This edition is shaped by the twin structures of scaffolding and alignment while the 1994 Standards were seen as a series of discrete building blocks with minimal overlap and integration. Each of these structural changes has significant effects on the framework of this new edition of the National Geography Standards.

The basic architecture for each standard comprises four components: introductory essay, knowledge statements, performance statements, and examples.

Each introductory essay follows a template. The objective is to foster a geographically informed person; therefore, each essay presents

what the geographically informed person must know and be able to do in a particular content area. Given the range of possible ideas within any content area, the content is captured by three or four themes. Each theme is briefly described, and the essay concludes with a clear statement as to why these themes are important. In a crucial change from the first edition Standards, the themes are used to organize the specific content in each Standard.

Each theme contains two to four knowledge statements—concise expressions of the specific content that students must know and understand. In turn, each knowledge statement is supported by two to four performance statements that capture what students should be able to do on the basis of their knowledge.

The final component is a set of three examples of activities that students can do to demonstrate an understanding of the knowledge statements. Each activity contains content in the form of context, vocabulary, and facts; process in the form of a required thinking process; and product in the form of a result that can be assessed to show that learning has occurred. The examples are nuggets of ideas that teachers can expand upon to help students meet the intent of the performance statements. They are not fully developed lesson plans because they do not specify the precise materials to be used, time to be allocated, process to be followed, and assessment procedures to be used. Examples are not directives of what a teacher *should* do; rather, they are illustrative of what teachers *might* do in the classroom.

The components of each Standard and all 18 Standards are bound together by three principles derived from the learning science approach to education: alignment, scaffolding, and intellectual skills. *Alignment* refers to the ‘vertical’ structure of a Standard. *Scaffolding* refers to the ‘horizontal’ structure within a Standard and between all of the Standards. In both cases, the goal is to build a structure that is integrated, cumulative, and progressive. Within a grade for a Standard, *alignment* asks, Do the sets of knowledge statements and performance statements clearly specify what the student should know and be able to do?

*Scaffolding* operates in two ways. First, among grades 4, 8, and 12 within a Standard, *scaffolding* asks, Does the set of knowledge statements cumulatively build the knowledge necessary for understanding the content knowledge? Second, where appropriate among Standards, do knowledge statements in one Standard provide the knowledge that is presumed within another Standard? If so, is the requirement met at the correct grade level?

*Intellectual skills* represent the ways in which students can think geographically. They are captured by a set of verbs that appear in

## What's New in The Second Edition and Why

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Taken together, alignment, scaffolding, and intellectual skills have resulted in a clear statement of what US students must know and be able to do to become geographically informed.

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the performance statements and the examples. There are seven verbs ordered in terms of intellectual challenge, as shown below. In the cases of all seven verbs, they may specify an intellectual skill that can be exercised at a range of levels. Thus one can identify the name of a capital city, or the location of the capital city, or identify the criteria used to define a capital city.

**Identify:** to recognize something by name (e.g., Paris is the capital of France), or to classify or catalog something with other items of similar appearance or function (e.g., that mound of rocks and clay is the terminal moraine from a glacier), or to locate (e.g., identify on a map or globe).

**Describe:** to give a detailed account that conveys the characteristics of something (e.g., a place, a region, a type of ecosystem).

**Construct:** to display information in a diagrammatic or logical form (e.g., use birth and death rates for Sri Lanka to create a population pyramid) or to create an argument by systematically arranging ideas (e.g., St. Louis is known as the Gateway to the West because it was the jumping-off point for the nineteenth-century settlement of the cross-Mississippi area of the Great Plains).

**Analyze:** to break down a complex situation into its component parts and their relationships (e.g., an ecosystem is maintained by the energy flows among the climate, biomass, and soils).

**Explain:** to give a detailed account of a situation in terms of causes or reasons (e.g., desertification is occurring in the Sahel because of the joint effects of persistent drought and population increases putting pressure on the system of subsistence agriculture).

**Compare:** to give an account of the similarities and differences between two or more situations (e.g., the land-use patterns in US cities before and after land-use policies were put into practice).

**Evaluate:** to make an informed appraisal of a situation by weighing relative strengths and weaknesses (e.g., long-term global warming is likely to continue as worldwide population increases result in increased use of carbon-based fuels such as coal to produce electricity).

Taken together, alignment, scaffolding, and intellectual skills have resulted in a clear statement of what US students must know and be able to do to become geographically informed.



Image credit: iStockphoto.com

# What's New in the Second Edition and Why

## 3. Changes to the Design of the Standards

The contemporary digital world offers opportunities not even dreamed of when the first edition was published in 1994. This updated version of *Geography for Life* is designed to be user friendly and flexible. Instead of dividing the Standards by grade, this version

presents each Standard with all three grade levels represented on the same page. Thus, one can read across to see how knowledge and understanding builds across the grades for each content area and read down to see how knowledge and understanding builds within one theme at one grade level.

Each Standard is grouped within an *Essential Element*.

Essential Element: The World in Spatial Terms

**GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information**

4 <sup>th</sup> GRADE <small>the student knows and understands:</small>	8 <sup>th</sup> GRADE <small>the student knows and understands:</small>	12 <sup>th</sup> GRADE <small>the student knows and understands:</small>
<b>Properties and Functions of Geographic Representations</b>	<b>Properties and Functions of Geographic Representations</b>	<b>Properties and Functions of Geographic Representations</b>
<p><b>1. Properties and functions of geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations</b></p> <p><i>Therefore, the student is able to:</i></p> <p>A. Identify and describe the properties (position and orientation, symbols, scale, perspective, coordinate systems) and functions of geographic representations, as exemplified by being able to</p> <ul style="list-style-type: none"> <li>▶ Identify and describe the properties of a variety of maps and globes (e.g., title, legend, cardinal and intermediate directions, scale, symbols, grid, principal parallels, meridians) and purposes (wayfinding, reference, thematic).</li> <li>▶ Identify and describe the functions of a variety of geographic representations.</li> <li>▶ Identify and describe the properties and functions of maps students collect from magazines, news articles, and tourist brochures.</li> </ul> <p>B. Describe how properties of geographic representations determine the purposes they can be used for, as exemplified by being able to</p> <ul style="list-style-type: none"> <li>▶ Identify the maps or types of maps most appropriate for specific purposes, (e.g., to locate physical and/or human features, to determine the shortest route from one town to another town, to compare the number of people living at two or more locations).</li> <li>▶ Describe how a variety of geographic representations (maps, globes, graphs, diagrams, aerial and other photographs, GPS) are used to communicate different types of information.</li> <li>▶ Describe how maps are created for a specific purpose (e.g., school fire-drill map, the route from home to school, classroom map of learning center materials).</li> </ul>	<p><b>1. The advantages and disadvantages of using different geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations for analyzing spatial distributions and patterns</b></p> <p><i>Therefore, the student is able to:</i></p> <p>A. Analyze and explain the properties (position and orientation, projections, symbols, scale, perspective, coordinate systems) and functions of geographic representations, as exemplified by being able to</p> <ul style="list-style-type: none"> <li>▶ Analyze geographic representations based on their properties (e.g., orientation, grid system, scale, resolution, and content) and purposes (e.g., using GISs and digital globes to explore geographic information and relationships at a range of scales).</li> <li>▶ Analyze the properties of three geographic representations of the same place (such as a street map, a topographic map, and a satellite image) and explain how each might be suitable for a different purpose.</li> <li>▶ Explain how different geographic representations are used in a variety of settings (e.g., a GIS in a computer lab, topographic map for backcountry hiking, GPS navigation for car travel).</li> </ul> <p>B. Evaluate the appropriate use of geospatial representations for specific geographic tasks, such as analyzing spatial distributions and patterns, as exemplified by being able to</p> <ul style="list-style-type: none"> <li>▶ Explain why particular maps are appropriate for a specific purpose (e.g., a cartogram to illustrate total population, a remotely sensed image to observe land use change, topographic maps to consider the best location for a wind farm, a highway map to consider best routes for new transportation corridors).</li> <li>▶ Identify and evaluate specific maps and/or geospatial technologies for use in different occupations (e.g., ambulance driver, airline pilot, ship's captain, cross-country truck driver, business analyst).</li> <li>▶ Compare the patterns shown by geographic representations at different scales (e.g., neighborhood, city, state, country).</li> </ul>	<p><b>1. The advantages of coordinating multiple geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations to answer geographic questions</b></p> <p><i>Therefore, the student is able to:</i></p> <p>A. Explain the advantages of using multiple geographic representations to answer geographic questions, as exemplified by being able to</p> <ul style="list-style-type: none"> <li>▶ Explain how multiple geographic representations and geospatial technologies (e.g., GIS, GPS, RS, and geographic visualization) could be used to solve geographic problems (e.g., help determine where to locate a new playground, or identify dangerous street intersections within a community).</li> <li>▶ Describe how an analysis of urbanization can be done using different geospatial technologies (e.g., RS for land use, GIS data layers to predict areas of high/low growth, GPS and GIS for identifying transportation issues regarding growth).</li> <li>▶ Explain how multiple geospatial technologies can be used to solve land use problems (e.g., effects of new farming technologies on the sustainable production of food, or preservation of wetlands in bird migration flyways).</li> </ul>

National Geography Standards, Second Edition

Part II: Standard 1: 22

Each *Standard title* is a summary of what the student should know and understand about a specific set of ideas and approaches.

Colored columns indicate the grade bands containing the detailed grade-level specific knowledge for each Standard.

Colored heading bars contain themes as organizers for the content in the Standard.

Knowledge statements explain exactly what a student should know and understand after completing a grade band.

Student performance statements state what the student should be able to do on the basis of this knowledge followed by three illustrative examples of learning opportunities.

Navigation aids are included to help identify the Standard and locate content.

# Doing Geography: The Geographic Lens on the World

The goal of teaching geography is to equip students with the knowledge, skills, and perspectives to do geography. Reaching this goal requires that students learn how to use geographic thinking and information to make well-reasoned decisions and to solve personal and community problems. Many valuable applications of K–12 geography education lie beyond the classroom walls. Geographic education enables students to use geographic perspectives, knowledge, and skills to engage in ethical action with regard to self, other people, other species, and Earth’s diverse cultures and natural environments. Geography connects students to world events, problems, and decisions throughout their lives.

## What Is a “Geographic Lens”?

The geographic lens enables students to acquire and use spatial and ecological perspectives to develop an informed worldview.

The geographic lens incorporates three enduring understandings:

1. Geographic representations, analyses, and technologies support problem solving and decision making by enabling students to interpret the past, understand the present, and plan for the future.
2. Human cultures and identities are deeply connected to the physical and human features that define places and regions.
3. Spatial patterns on Earth are ever changing, and human actions contribute to the changes as people constantly modify and adapt to the realities of their cultural and physical environments.

These three understandings capture the essence of what a geographically informed person knows and can do with geography.

Geography is not just a school subject. As the title of this document states, geography is for life. Geography applies to daily life and is valuable over a lifetime. The overarching goal of these National Geography Standards is to ensure that students become geographically informed citizens. Becoming an informed citizen requires going beyond only *knowing* the disciplinary content of geography. Students must also be able to use geographic reasoning and do geography.

## What Does “Doing Geography” Mean?

Doing geography requires students to actively use three main aspects of inquiry—geographic perspectives, knowledge, and skills. All three in combination are required to do geography. Considered separately, each is important but incomplete. If a teacher focuses on geography content knowledge alone, students may score well when tested on facts but will not be able to apply their memorized knowledge to make well-reasoned decisions or offer solutions to significant problems. If students focus on skills alone without an understanding of the spatial and ecological perspectives that primarily guide geographic thinking, they may not correctly formulate a geographic question to investigate.

Students use **geographic perspectives** to formulate questions and approaches to investigating the question. Students use **geographic knowledge** illustrated by the 18 Standards. Students use **geographic skills** to systematically conduct geographic investigations and construct answers and possible solutions. A geographically informed person simultaneously uses all three of these to do geography.

## What Does Doing Geography Look Like in a Classroom?

Consequently, doing geography is an active inquiry process that integrates geographic perspectives, geographic knowledge, and geographic skills. Each is important and essential. To connect the inquiry process involved in doing geography to the classroom, three vignettes are provided below.

A vignette for each of the three grade bands used in the Standards follows. Regardless of which band holds the most interest, reading and reflecting on all three will provide a more complete picture of what doing geography looks like in the classroom. Each of the five geographic skills is called out as it occurs. These do not always fit into a neat, orderly process but may involve some back and forth between questioning, acquiring, or organizing new geographic information as the inquiry progresses. It is not a lock-step process but rather an active, formative process that encourages students to become actively engaged.



# Doing Geography: The Geographic Lens on the World

## 4<sup>th</sup> GRADE

### Doing Geography: Grades K-4 Community - Based Observations and Investigations

Mr. Rice's fourth-grade students arrived to class on Tuesday morning excited by the installation of a new traffic signal at the corner near the school. Mr. Rice suddenly recognized a teachable moment and realized he could use geographic perspectives and skills to connect the students' interest in the new traffic signal event to the geography standards he would be teaching during the upcoming weeks as a part of his social studies curriculum (**Geography Standards 1, 2, and 3**). During social studies class that day, the students discussed why a new traffic signal might be needed at the corner. The students expressed concern about safety for all students walking to school. Mr. Rice guided the discussion and helped the students formulate their concerns into a geographic question. The students asked, "How many dangerous street crossings do students in our class make on their way to and from school, and where are these crossings located?" **[ASKING GEOGRAPHIC QUESTIONS]** The students talked about the factors that would make crossings more or less dangerous, such as speed limits, one-way traffic flows, the amount of traffic, crosswalks and traffic signals, and the presence of school crossing guards.

Mr. Rice asked each student to sketch a map of his or her route to and from school and identify each of the crossings the student makes on this route. Mr. Rice then asked the students to observe and record the safety details of the crossings identified on their maps during their walks to school during the next couple of days. **[ACQUIRING GEOGRAPHIC INFORMATION]** After recording their observations during this fieldwork phase of the activity, the students then found a satellite image of their school and the surrounding neighborhood using the Internet. Working in pairs, students took turns zooming in to view the details at the crossings identified on their maps. **[ACQUIRING GEOGRAPHIC INFORMATION]** They selected and displayed the traffic data provided by the online mapping service to determine if there were any potential traffic issues at the identified crossings.

## 8<sup>th</sup> GRADE

### Doing Geography: Grades 5-8 Investigating Water Use in the Colorado River Watershed

While reading the weekend newspaper, Ms. Ramirez noticed an article focused on a topic that would connect with the next curriculum unit on Environment and Society she would be teaching in her seventh-grade geography class (**Geography Standards 14, 15, and 16**). Her students would be learning about watersheds, water resources, and how human actions modify the physical environment. At the start of the unit, Ms. Ramirez shared the new article with her class. The students were shocked to discover that literally all of the water in the Colorado River gets used up before the river reaches the Gulf of Mexico and to learn about the controversy and conflicts over water resources from the river. Because they lived in Colorado, the students wanted to know where and how much Colorado River water is currently used. **[ASKING GEOGRAPHIC QUESTIONS]**

The students were asked to search the Internet for maps of the Colorado River watershed to launch their investigation into this geographic issue. Using digital maps, they discovered that this huge watershed actually covers a large part of the southwestern United States. They also learned that numerous laws and water compacts or agreements allocated much of the water from 'their' river for use in cities and states throughout the Southwest. Some of these cities, such as Phoenix and Los Angeles, are located hundreds of miles from the path of the river. Using various state maps, students identified canals or aqueducts that are used to transport the Colorado River water to these places. The maps also revealed the location of dams that are used to control water supplies along the river. Students learned that the level of water in the reservoirs behind the dams fluctuates depending on the amount of snowpack in the Rocky Mountains at the source of the river. **[ACQUIRING GEOGRAPHIC INFORMATION]**

## 12<sup>th</sup> GRADE

### Doing Geography: Grades 9-12 A Geographic Investigation of International Cooperation and Conflict

Ms. Lincoln started preparing for her tenth-grade geography class. The class was starting a unit focused on the geographic forces that drive political cooperation and conflict (**Geography Standard 13**). Ms. Lincoln thought about how best to apply a geographic perspective to a recent world event that would result in a variety of investigation questions on cooperation and conflict. Ms. Lincoln wanted her students to consider future aspects of cooperation and conflict as well as past conditions that shaped current patterns and processes.

When the students arrived at class the next day, Ms. Lincoln divided them into small groups and handed out a map of reported pirate attacks off the coast of Somalia in the Gulf of Aden. First, she asked students to study the geographic characteristics of the area with the greatest number of reported attacks. Then, she prompted them to formulate geographic questions about the physical and human characteristics that may contribute to the high incidence of pirate attacks in that location. **[ASKING GEOGRAPHIC QUESTIONS]** The students shared a list of questions from each of their groups.

- ▶What made the Gulf of Aden a place with a high number of pirate attacks?
- ▶How does the number of attacks at this location compare to the number of attacks in other similar locations?
- ▶What physical and human factors contribute to the high number of attacks in this location?

Ms. Lincoln then explained to students that locations where traffic is more congested due to narrow passages are often called "choke points." She handed out a world map and asked students to identify as many geographic choke points for maritime traffic similar to the Gulf of Aden as they could find. The students went to work identifying places where shipping traffic could be congested or slowed due to narrowed passages or straights, high density of shipping, and the location of canals that are important to many shipping routes. **[ACQUIRING GEOGRAPHIC INFORMATION]**

# Doing Geography: The Geographic Lens on the World

## 4<sup>th</sup> GRADE

### Doing Geography: Grades K-4 Community-Based Observations and Investigations

Based on this research, each pair of students then developed criteria for ranking the crossings as safe, dangerous, or very dangerous. The students then created a symbol for each of the three types of crossings and constructed a map of the neighborhood with each crossing identified by the appropriate symbol indicating its safety level. **[ORGANIZING GEOGRAPHIC INFORMATION]** After they finished creating this neighborhood map, the class was very surprised to learn there were two “very dangerous” crossings near the school.

Students were then asked to conduct a survey with the other members of their class to determine how many students used the two very dangerous identified crossings each day. The students graphed the survey results for each of the two crossings. The class discovered that 16 of the 29 students in the class used these very dangerous crossings. **[ANALYZING GEOGRAPHIC INFORMATION]** The class decided they should meet with school officials to discuss the very dangerous crossings they had identified.

As a culminating activity, Mr. Rice invited the school principal to visit the class to listen to the students give oral presentations on their research using the maps and graphs they created to illustrate their findings. **[ANSWERING GEOGRAPHIC QUESTIONS]** As a key part of their presentation, students suggested possible changes needed to make the crossings less dangerous in the future. Before she left class that day, the principal assured students that she would talk with the Parents’ Advisory Committee and city traffic officials about the two very dangerous crossings the students identified in their research.

## 8<sup>th</sup> GRADE

### Doing Geography: Grades 5-8 Investigating Water Use in the Colorado River Watershed

Students then worked in pairs to create graphs that showed water levels in the reservoirs for the years 2000 through 2010. Next, they researched and graphed the amount of snowpack in the Colorado Rockies for the same years to determine if there was any connection between their two graphs of data. Students also made charts to show the amount of Colorado River water allocated yearly to each of the places. **[ORGANIZING GEOGRAPHIC INFORMATION]** They then compared the data on their graphs to determine in which years there might not have been enough Colorado River water to meet the amounts promised to each location.

Using their new understanding of the challenges facing Colorado River drainage in the Southwest, students then brainstormed possible solutions for cities and states during low-water years when the Colorado River water resources are scarce. **[ANSWERING GEOGRAPHIC QUESTIONS]** The class was surprised to learn that in most years, much of the water in the Colorado River was claimed for use by cities and states for agricultural production located far from Colorado. They began to understand the competition among places for shares of the water and the need for cooperative agreements and active participation in problem solving by citizens in diverse locations. Ms. Ramirez divided the students into groups to develop a presentation explaining possible solutions to water shortages in the region in the future.

Students wondered if other regions of the world experienced similar problems in sharing scarce water resources. **[ASKING GEOGRAPHIC QUESTIONS]** Ms. Ramirez said that question would require another investigation. During the discussion evaluating their research on the Colorado River watershed, the students concluded that what they learned had far-reaching implications on a wide range of economic and quality-of-life issues for people living in the region. They realized how a geographic perspective helped them understand more fully where the water came from as well as who and where it was being used. The use of water in the Southwest was an issue they would certainly be hearing more about in the future.

## 12<sup>th</sup> GRADE

### Doing Geography: Grades 9-12 A Geographic Investigation of International Cooperation and Conflict

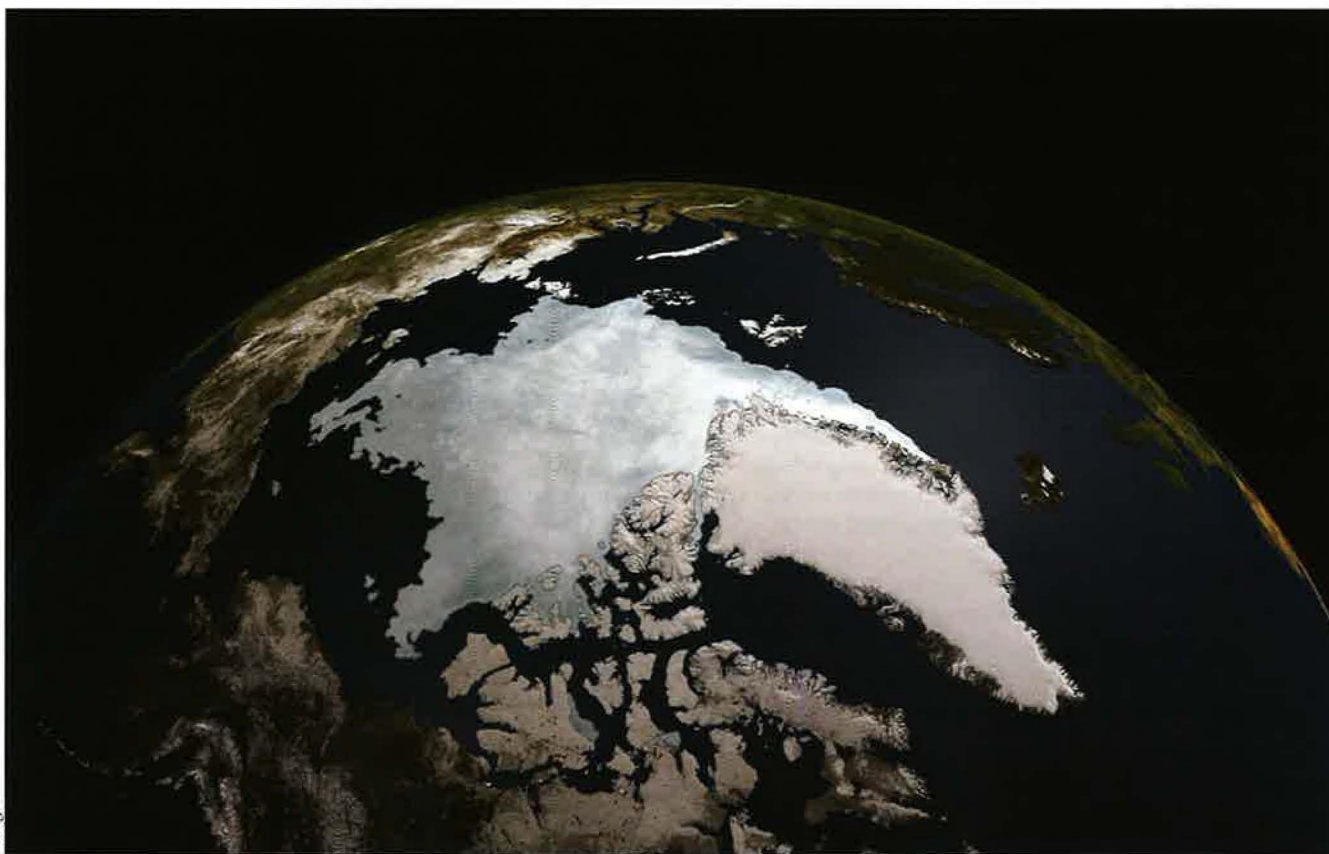
Ms. Lincoln projected a world map from her computer to the interactive white board at the front of the room and had a representative from each group locate the choke points his or her group identified as having characteristics similar to the Gulf of Aden location. Despite identifying many strategic world locations, the students failed to find any areas with as many pirate attacks as the Gulf of Aden. **[ANALYZING GEOGRAPHIC INFORMATION]** Students then were asked to focus on identifying the geographic conditions that might make the Gulf of Aden a more susceptible location for pirate attacks. **[ASKING GEOGRAPHIC QUESTIONS]** Ms. Lincoln pressed the students to brainstorm sources of data they would need to examine to answer the question.

The students brainstormed more questions about the human aspects of the Gulf of Aden location. Why did so many incidents take place at this particular location? Who provided insurance for ships and cargoes in this region? What type of governments controlled the countries at this location? Were there established navies or coast guards responsible for patrolling this location? This question raised the issue of territorial versus international waters and the Law of the Sea, which is a United Nations (UN) convention defining the boundaries, guidelines for maritime navigation, and exclusive economic zones (EEZ) that stretch out into the oceans. **[ACQUIRING GEOGRAPHIC INFORMATION]** Students used a GIS to identify the 12-mile territorial water boundary as well as the 200-mile EEZ boundary from a world coastline map to look for areas of overlap and potential disputes. **[ORGANIZING GEOGRAPHIC INFORMATION]**

Ms. Lincoln pointed out to students that the UN Convention on the Law of the Sea is an example of an international cooperation drafted and signed by many countries to prevent future conflicts. The student groups also cited the unstable political status of places such as Yemen and Somalia that border the passage and the high volume of shipping traffic that would be passing through this area to take advantage of the Suez Canal and its connection to the Mediterranean Sea. **[ANALYZING GEOGRAPHIC INFORMATION]**

## Doing Geography: The Geographic Lens on the World

The examples in each of the classroom vignettes illustrate how students use geographic perspectives, knowledge, and skills to do geography. Geography is a very content-rich discipline. It is always relevant because the world we live in changes daily; there are always questions to pursue, challenging issues to analyze, and problems to solve. It is essential that geography is taught at the K–12 level as the active and engaging discipline it is. The next sections provide more detail and explanation of the geographic perspectives, content knowledge, and skills that are necessary to be a geographically informed person.



This image taken on September 9, 2011 shows Arctic sea ice at its lowest coverage in that year. As a result of warmer summer temperatures, an ice-free Northwest Passage through the northern islands of Canada can be seen connecting the Atlantic and Pacific Oceans.

## 12<sup>th</sup> GRADE

### Doing Geography: Grades 9-12 A Geographic Investigation of International Cooperation and Conflict

Ms. Lincoln asked students to look back at their maps of identified choke points to predict the locations of future piracy issues or susceptibility to attacks. Students debated the characteristics of countries that controlled or claimed control of choke points, including those in close proximity to many oil-producing and shipping points in the world. Ms. Lincoln pressed the students to look at the map of choke points more closely to try to identify other potential future issues. **[ANALYZING GEOGRAPHIC INFORMATION]** The students were stumped by her insistence that there was more to see on the map than they had initially observed. Ms. Lincoln then changed the map they had been looking at to a polar projection of the Arctic Ocean. Suddenly, hands shot up immediately! This new view of the world's northernmost coastlines suddenly revealed locations where navigation and resource exploration could become an issue. Ms. Lincoln reminded them that as Arctic sea ice melts, new navigation and shipping lanes would need to be established and confirmed in the Arctic. She added a layer showing proposed shipping routes by the North Atlantic Treaty Organization Parliamentary Assembly to address these very issues. **[ANALYZING GEOGRAPHIC INFORMATION]** Territorial claims will definitely become more important in this part of the world in the future.

Ms. Lincoln then assigned the students to choose one choke point in the world and to write a geographic assessment of the location's physical and human characteristics to identify its susceptibility to future cooperation and/or conflict issues. **[ANSWERING GEOGRAPHIC QUESTIONS]** She reminded the students to be sure to include a map of the location along with their assessment and to be prepared to share their results with the class during the next class period. Key to her evaluation would be the students' abilities to apply geographic perspectives, knowledge, and skills in their presentations to discuss current and future examples of international cooperation and conflicts.

# Looking at the World in Multiple Ways: Geographic Perspectives

Where something occurs is the spatial perspective; how life forms interact with the physical environment is the ecological perspective. We need both perspectives to comprehend Earth as the home of people.

Perspectives, knowledge, and skills comprise the content of geography. In general, a perspective is a framework that can be used to interpret the meanings of experiences, events, places, persons, cultures, and physical environments. Having a perspective means looking at our world through a lens shaped by personal experience, selective information, and subjective evaluation. The perspectives and the questions to which they lead distinguish geography from other approaches, such as historic or economic. A perspective provides a frame of reference for asking and answering questions, identifying and solving problems, and evaluating the consequences of alternative actions.

It is essential to be aware that many different perspectives exist and that learning to understand the world from many points of view enhances our knowledge and skills. It is also essential to realize that our perspectives incorporate all life experiences and draw upon knowledge from many fields of inquiry. Therefore, people cannot be neatly boxed into specific categories based on their cultural experiences, ethnic backgrounds, age, gender, or any other life-status characteristic.

Acquiring, understanding, and using a wide variety of perspectives are essential to becoming a geographically informed person. Such a person knows that each individual has personal points of view based in unique life experiences; accepts the existence of diverse ways of looking at the world; understands how different perspectives develop; is aware that perspectives incorporate values, attitudes, and beliefs; considers a range of perspectives when analyzing, evaluating, and solving a problem; and understands that perspectives are subject to change.

Although the field of geography includes many different perspectives, geographers depend upon two perspectives in particular to frame their understanding of people and places in the world—the spatial perspective and the ecological perspective.

## The Spatial Perspective

A historical perspective focuses on the temporal dimension of human experience (time and chronology), while geography is concerned with the spatial dimension of human experience (space and place). The space of Earth's surface is the fundamental characteristic underpinning geography. The essential issue of *whereness*—embodied in specific questions such as, “Where is it? Why is it there?”—helps humans contemplate the context of spatial relationships in which the human story is played out. Understanding spatial patterns and processes is essential to appreciating how people live on Earth. People who approach knowing and doing with a habit of inquiring about whereness possess a spatial perspective.

## The Ecological Perspective

Earth is composed of living and nonliving elements interacting in complex webs of ecological relationships that occur at multiple levels. Humans are part of the interactive and interdependent relationships in ecosystems and are one among many species that constitute the living part of Earth. Human actions modify physical environments and the viability of ecosystems at local to global scales. The survival of humans and other species requires a viable global ecosystem. Understanding Earth as a complex set of interactive living and nonliving elements is fundamental to knowing that human societies depend on diverse small and large ecosystems for food, water, and all other resources. People who regularly inquire about connections and relationships among life forms, ecosystems, and human societies possess an ecological perspective.

Understanding and using the spatial and ecological perspectives helps geographers understand how to interpret nature and societies on Earth. Viewed together, the geographic perspective overall encompasses an understanding of spatial patterns and processes on Earth and its web of living and nonliving elements interacting in complex webs of relationships within nature and between nature and societies.

A fully developed geographic perspective, therefore, involves an integration of both spatial and ecological points of view, as well as a consideration of other related perspectives that may be useful in understanding and interpreting the world.

## Looking at the World in Multiple Ways: Geographic Perspectives

### Complementing the Two Geographic Perspectives

The two primary geographic perspectives, spatial and ecological, are supplemented by many other perspectives that help frame a distinctly geographic way of looking at the world. When used appropriately, these other perspectives expand our understanding of spatial patterns and human-environment interaction. Historical, economic, civic, and cultural perspectives may be used collaboratively with geographic perspectives to assist in formulating and informing investigations. A geographic perspective can be integrated with other systemic perspectives and with life-status perspectives to enrich and enlarge understanding of places, regions, and environments.

It is impossible to list, much less describe, the many types of perspectives people use to develop understandings about their own environments both near and distant from them in time and location. Still, it is useful to consider examples of systemic and life-status perspectives embraced by the geographic viewpoint. Using these perspectives in geography provides the framework for using geographic knowledge and skills to answer questions and solve problems.



Image credit: D.J. Zeigler

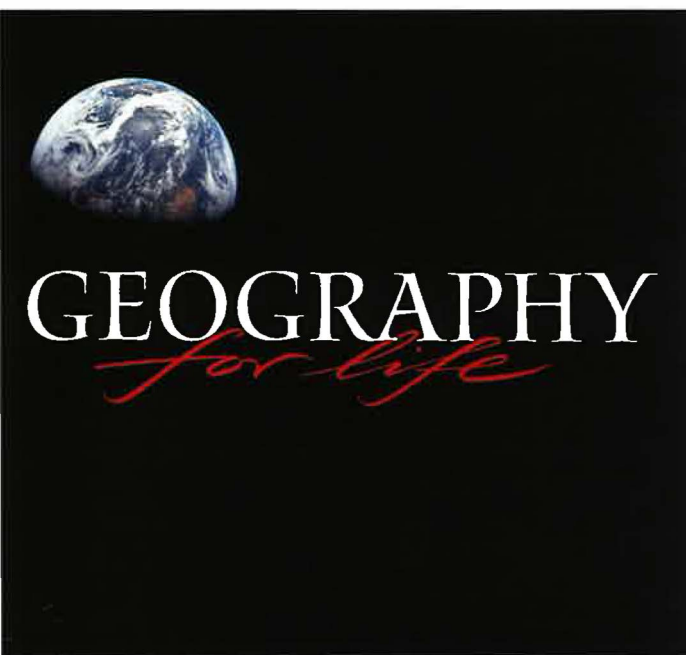
*Together, historic, economic, political, and geographic perspectives help explain why Russian colonizers in the 1800s selected a site on the Pacific coast, north of San Francisco Bay to establish Fort Ross as a southern outpost of imperial control.*

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Historical, economic, civic, and cultural perspectives may be used collaboratively with geographic perspectives to assist in formulating and informing investigations.

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# Knowing about the World: Geographic Content Knowledge



## 21 Essential Element: The World in Spatial Terms

### 21 Geography Standard 1

How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

### 27 Geography Standard 2

How to use mental maps to organize information about people, places, and environments in a spatial context

### 31 Geography Standard 3

How to analyze the spatial organization of people, places, and environments on Earth's surface

## 35 Essential Element: Places and Regions

### 35 Geography Standard 4

The physical and human characteristics of places

### 39 Geography Standard 5

That people create regions to interpret Earth's complexity

### 41 Geography Standard 6

How culture and experience influence people's perceptions of places and regions

## 43 Essential Element: Physical Systems

### 43 Geography Standard 7

The physical processes that shape the patterns of Earth's surface

### 47 Geography Standard 8

The characteristics and spatial distribution of ecosystems and biomes on Earth's surface

## 51 Essential Element: Human Systems

### 51 Geography Standard 9

The characteristics, distribution, and migration of human populations on Earth's surface

### 55 Geography Standard 10

The characteristics, distribution, and complexity of Earth's cultural mosaics

### 61 Geography Standard 11

The patterns and networks of economic interdependence on Earth's surface

### 67 Geography Standard 12

The processes, patterns, and functions of human settlement

### 71 Geography Standard 13

How the forces of cooperation and conflict among people influence the division and control of Earth's surface

## 75 Essential Element: Environment and Society

### 75 Geography Standard 14

How human actions modify the physical environment

### 79 Geography Standard 15

How physical systems affect human systems

### 83 Geography Standard 16

The changes that occur in the meaning, use, distribution, and importance of resources

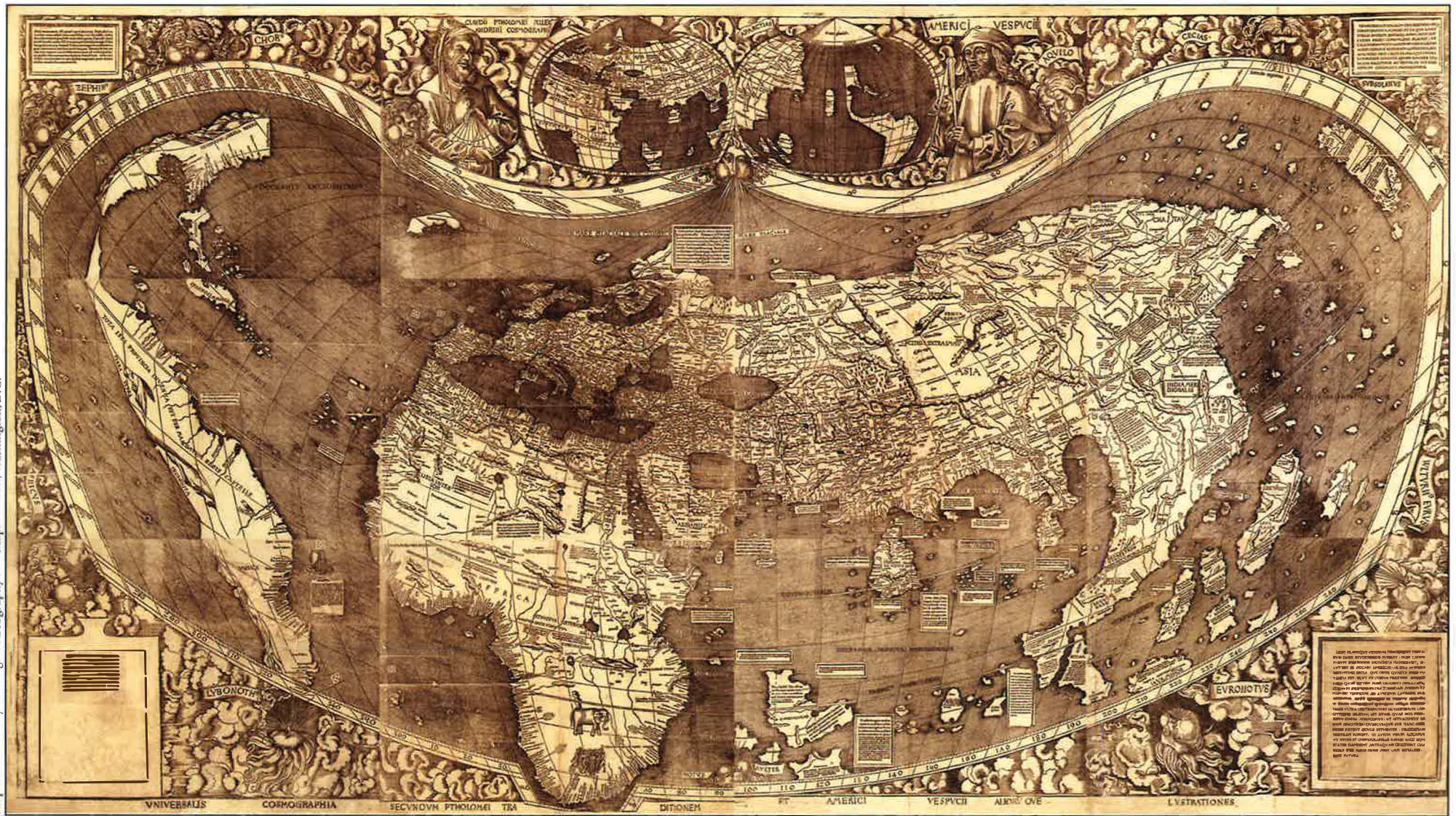
## 87 Essential Element: The Uses of Geography

### 87 Geography Standard 17

How to apply geography to interpret the past

### 91 Geography Standard 18

How to apply geography to interpret the present and plan for the future



As exploration expanded around the globe, perceptions of the world changed. This 1507 map by Martin Waldseemüller is the first known document to name America.

## GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information



Image credit: NOAA/Will von Dauster

Data visualization using Science On a Sphere® at the NOAA Earth System Research Lab, Boulder, CO.



Image credit: Joseph J. Kerski

Using a Global Positioning System (GPS) device, students can identify specific locations (georeference) where data are collected using latitude and longitude coordinates.

**The geographically informed person** must use maps and other geographic representations, geospatial technologies, and spatial thinking to acquire, understand, and communicate information. Knowing how to identify, access, evaluate, and use appropriate geographic representations will ensure college and career readiness for students. Students will have an array of powerful problem-solving and decision-making skills for use in both their educational pursuits and their adult years.

Therefore, Standard 1 contains these themes: Properties and Functions of Geographic Representations, Using Geospatial Data to Construct Geographic Representations, and Using Geographic Representations.

Thinking about the world in spatial terms (spatial thinking) allows students to describe and analyze the spatial patterns and organization of people, places, and environments on Earth. Spatial thinking skills are essential in processing geospatial data. Geospatial data link physical and human attributes of points or places on Earth's surface (such as roads, other built features, and rivers) and can be compiled, organized, stored, manipulated, and represented in many ways. Maps are graphic representations of selected aspects of Earth's surface and are still a key geographic mode of representation. Globes, graphs, diagrams, and aerial and satellite images (remote sensing) also allow us to visualize spatial patterns on Earth. No single representation, however, can show everything, and the features depicted on each representation are selected to fit a particular purpose.

Geospatial technologies such as geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS), as well as Internet-based mapping sites such as digital globes and geospatial visualizations, allow us to analyze and represent geospatial data in powerful ways.

At all grade levels, students need practice and experiences in how to collect and display information (data) on maps, graphs, and diagrams. They must understand what a map is and what it can—and cannot—do. They need to be able to read and interpret maps and other geographic representations. And finally, students must know how to make maps, from hand-drawn sketch maps to more complex representations using a range of appropriate technologies.

By learning to think spatially, students can understand such basic concepts as scale, alternative map projections that show Earth from different perspectives, and the relationships between spatial processes and spatial patterns. By understanding these themes, students will be equipped with tools that provide important problem-solving and decision-making skills in geography and across the entire K–12 curriculum.



## GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

### 4<sup>th</sup> GRADE

the student knows and understands:

#### Properties and Functions of Geographic Representations

##### 1. Properties and functions of geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations

Therefore, the student is able to:

- A. Identify and describe the properties (position and orientation, symbols, scale, perspective, coordinate systems) and functions of geographic representations, as exemplified by being able to
  - ▶ Identify and describe the properties of a variety of maps and globes (e.g., title, legend, cardinal and intermediate directions, scale, symbols, grid, principal parallels, meridians) and purposes (wayfinding, reference, thematic).
  - ▶ Identify and describe the functions of a variety of geographic representations.
  - ▶ Identify and describe the properties and functions of maps students collect from magazines, news articles, and tourist brochures.
- B. Describe how properties of geographic representations determine the purposes they can be used for, as exemplified by being able to
  - ▶ Identify the maps or types of maps most appropriate for specific purposes, (e.g., to locate physical and/or human features, to determine the shortest route from one town to another town, to compare the number of people living at two or more locations).
  - ▶ Describe how a variety of geographic representations (maps, globes, graphs, diagrams, aerial and other photographs, GPS) are used to communicate different types of information.
  - ▶ Describe how maps are created for a specific purpose (e.g., school fire-drill map, the route from home to school, classroom map of learning center materials).

### 8<sup>th</sup> GRADE

the student knows and understands:

#### Properties and Functions of Geographic Representations

##### 1. The advantages and disadvantages of using different geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations for analyzing spatial distributions and patterns

Therefore, the student is able to:

- A. Analyze and explain the properties (position and orientation, projections, symbols, scale, perspective, coordinate systems) and functions of geographic representations, as exemplified by being able to
  - ▶ Analyze geographic representations based on their properties (e.g., orientation, grid system, scale, resolution, and content) and purposes (e.g., using GIS and digital globes to explore geographic information and relationships at a range of scales).
  - ▶ Analyze the properties of three geographic representations of the same place (such as a street map, a topographic map, and a satellite image) and explain how each might be suitable for a different purpose.
  - ▶ Explain how different geographic representations are used in a variety of settings (e.g., a GIS in a computer lab, topographic map for backcountry hiking, GPS navigation for car travel).
- B. Evaluate the appropriate use of geospatial representations for specific geographic tasks, such as analyzing spatial distributions and patterns, as exemplified by being able to
  - ▶ Explain why particular maps are appropriate for a specific purpose (e.g., a cartogram to illustrate total population, a remotely sensed image to observe land-use change, topographic maps to consider the best location for a wind farm, a highway map to consider best routes for new transportation corridors).
  - ▶ Identify and evaluate specific maps and/or geospatial technologies for use in different occupations (e.g., ambulance driver, airline pilot, ship's captain, cross-country truck driver, business analyst).
  - ▶ Compare the patterns shown by geographic representations at different scales (e.g., neighborhood, city, state, country).

### 12<sup>th</sup> GRADE

the student knows and understands:

#### Properties and Functions of Geographic Representations

##### 1. The advantages of coordinating multiple geographic representations—such as maps, globes, graphs, diagrams, aerial and other photographs, remotely sensed images, and geographic visualizations to answer geographic questions

Therefore, the student is able to:

- A. Explain the advantages of using multiple geographic representations to answer geographic questions, as exemplified by being able to
  - ▶ Explain how multiple geographic representations and geospatial technologies (e.g., GIS, GPS, RS, and geographic visualization) could be used to solve geographic problems (e.g., help determine where to locate a new playground, or identify dangerous street intersections within a community).
  - ▶ Describe how an analysis of urbanization can be done using different geospatial technologies (e.g., RS for land use, GIS data layers to predict areas of high/low growth, GPS and GIS for identifying transportation issues regarding growth).
  - ▶ Explain how multiple geospatial technologies can be used to solve land-use problems (e.g., effects of new farming technologies on the sustainable production of food, preservation of wetlands in bird migration flyways).

# GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

## 4<sup>th</sup> GRADE

the student knows and understands:

### Using Geospatial Data to Construct Geographic Representations

#### 2. Geospatial data are connected to locations on Earth's surface

Therefore, the student is able to:

- A. Identify examples of geospatial data, as exemplified by being able to
  - ▶ Identify landmarks on the school grounds and describe their size, shape, and location.
  - ▶ Identify the spatial location of each student's assigned seat in the classroom.
  - ▶ Identify the locations and types of trees in the neighborhood of the school.
- B. Construct maps and graphs to display geospatial data, as exemplified by being able to
  - ▶ Construct a map that displays geospatial data using symbols explained in a key (e.g., a sketch map to illustrate a narrative story, a map of cars in the school parking lot showing type and color, a classroom map showing different types of tables, desks, and chairs).
  - ▶ Describe the results of a survey of classmates about a geographic question concerning their school (e.g., where to add another swing set, where to add a cover over existing playground equipment, where to place more drinking fountains) using graphs and maps.
  - ▶ Construct a map of the United States using symbols to show quantities by state (e.g., population, professional sports teams, mountain peaks over a certain elevation).

## 8<sup>th</sup> GRADE

the student knows and understands:

### Using Geospatial Data to Construct Geographic Representations

#### 2. The acquisition and organization of geospatial data to construct geographic representations

Therefore, the student is able to:

- A. Identify the variety of geospatial data sources (e.g., student-generated data such as surveys, observations, and fieldwork or data sources such as US Census data, US Geological Survey (USGS), and the United Nations) and formats (e.g., digital databases, text, tables, images), as exemplified by being able to
  - ▶ Identify examples of different sources of geospatial data related to population, land forms, road networks, weather, etc. (e.g., Census Bureau, [USGS], Environmental Protection Agency).
  - ▶ Identify the different data formats that can be used to organize data sets for population, land forms, road networks, weather, etc. (e.g., tables, graphs, maps, remotely sensed images).
  - ▶ Identify the data to include in student-generated geospatial data sets to capture human or physical characteristics of the school neighborhood (e.g., count and map the location, amount, and directions of pedestrian traffic on streets near the school).
- B. Construct maps using data acquired from a variety of sources and in various formats (e.g., digital databases, text, tables, images), as exemplified by being able to
  - ▶ Construct paper maps to illustrate the links between geographic patterns (e.g., examine associations among geographic phenomena such as water resources and population distribution or topography and Civil War troop movements).
  - ▶ Construct different types of maps to illustrate the distribution of population (e.g., cartograms, choropleth maps, isopleth maps, graduated circles maps).
  - ▶ Construct flow maps to explain the amount, source, and direction of movement (e.g., international petroleum trade, migration of refugees, flyways of bird migration, immigration to North America during the 1800s).

## 12<sup>th</sup> GRADE

the student knows and understands:

### Using Geospatial Data to Construct Geographic Representations

#### 2. The technical properties and quality of geospatial data

Therefore, the student is able to:

- A. Identify and explain the metadata properties (e.g., resolution, date of creation, and method of collection) of geospatial data, as exemplified by being able to
  - ▶ Explain how the metadata information is used to understand differences in the creation and design of datasets (e.g., land use/land cover, street/storefront property uses, terrain features, scale) and to determine the usefulness of the data for mapping.
  - ▶ Analyze the relationship between the quality of data and the source of the data (e.g., differences in reported population data by countries, boundaries as reported by different adjacent countries).
  - ▶ Describe how metadata assist in determining appropriateness of the data set in relation to use or layering with other data sets.
- B. Evaluate the quality and quantity of geospatial data appropriate for a given purpose, as exemplified by being able to
  - ▶ Describe the many purposes for which a data set would be appropriate (e.g., 1:1,000,000 scale maps, 30-meter pixel satellite images, tables of state health data).
  - ▶ Explain how data that are appropriate for a task at one scale may be inappropriate for a similar task at a different scale (e.g., census blocks and tracks for local data, county/parish for state or national data).
  - ▶ Analyze a variety of data sets that present variations in space and time (e.g., Arctic ice in January and July, population counts for metro areas at different time periods, location and number of influenza infections by month).

## GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information

### 4<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Geospatial Data to Construct Geographic Representations

#### 3. Geospatial technologies—Internet-based mapping applications, GIS, GPS, geovisualization, and remote sensing—display geospatial data

*Therefore, the student is able to:*

- A. Compare how different geospatial technologies are used to display geospatial data, as exemplified by being able to
  - ▶ Identify and describe the types of information communicated by different Internet-based mapping technologies.
  - ▶ Describe and analyze the similarities and differences among the results from different online navigation systems.
  - ▶ Compare the similarities and differences of information presented in online road maps, satellite images, or street-view data.

### 8<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Geospatial Data to Construct Geographic Representations

#### 3. Geospatial technologies—Internet-based mapping applications, GIS, GPS, geovisualization, and remote sensing—can be used to construct geographic representations using geospatial data

*Therefore, the student is able to:*

- A. Construct and analyze geographic representations using data acquired from a variety of sources (e.g., student-generated data such as surveys, observations, fieldwork, etc., or existing data files) and formats (e.g., digital databases, text, tables, images), as exemplified by being able to
  - ▶ Analyze environmental change by annotating a series of remotely sensed images of the same location taken at different dates.
  - ▶ Construct map overlays of GPS-based geospatial data using GIS (e.g., types of housing, local historical structures, neighborhood bus stops).
  - ▶ Construct a map displaying the results of a community survey on a local issue (e.g., locating a new park or school, stream flooding, zoning decisions).

### 12<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Geospatial Data to Construct Geographic Representations

#### 3. The appropriate and ethical uses of geospatial data and geospatial technologies in constructing geographic representations

*Therefore, the student is able to:*

- A. Evaluate the appropriate and ethical uses of different geospatial technologies and methods for acquiring, producing, and displaying geospatial data, as exemplified by being able to
  - ▶ Evaluate the appropriateness of using geospatial data that may identify particular individuals (e.g., use of cellular phone geolocation data, license plates and faces in street-view data).
  - ▶ Describe and evaluate the conditions under which geospatial data should be restricted (e.g., availability of infrastructure data on websites, sensitive areas not displayed on satellite imagery, confidentiality of individuals when displaying health data).
  - ▶ Describe and explain the appropriate documentation needed to assess the credibility of a GIS-based project (e.g., quality of data files used, processes used, steps to duplicate the project).

**GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information**

**4<sup>th</sup> GRADE**  
the student knows and understands:

Using Geographic Representations

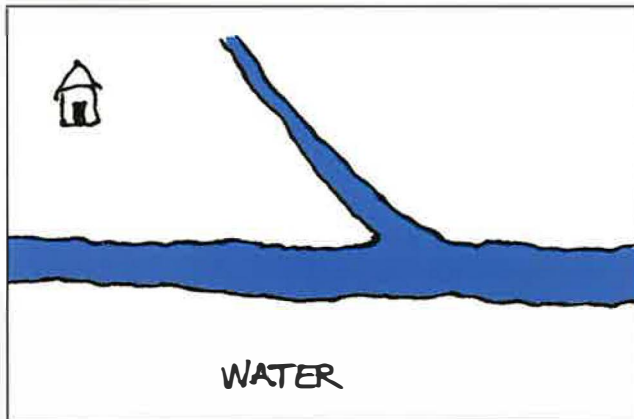
**4. The interpretation of geographic representations**

Therefore, the student is able to:

- A. Describe and analyze the ways in which geographic representations communicate geospatial information, as exemplified by being able to
  - ▶ Describe the purpose and components of a typical map key or legend.
  - ▶ Describe and analyze the similarities and differences in information displayed at different scales.
  - ▶ Analyze the different ways of symbolizing geospatial data (e.g., graduated circles, cartograms, choropleth versus isopleth maps).

**Where are bridges needed?**

Students can use the basic GIS concept of overlay to answer geographic questions.



Basic GIS Step 1: Sketch the first data layer, in this case water, and the location of a house that will serve as a reference point for all data layers.

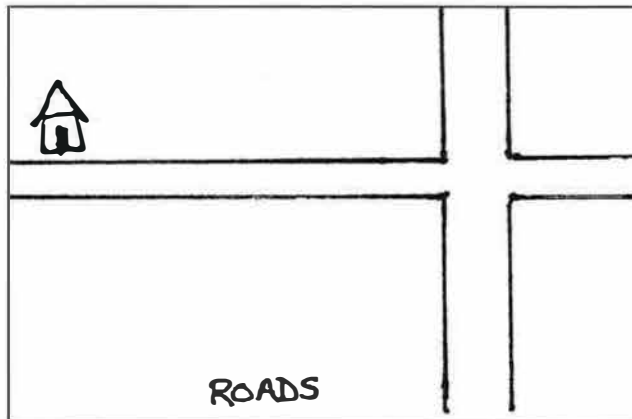
**8<sup>th</sup> GRADE**  
the student knows and understands:

Using Geographic Representations

**4. The use of geographic representations to ask and answer geographic questions**

Therefore, the student is able to:

- A. Analyze geographic representations to ask and answer questions about spatial distributions and patterns, as exemplified by being able to
  - ▶ Analyze printed and digital maps to observe spatial distributions and patterns to generate and answer geographic questions (e.g., use digital census data to determine demographic patterns in a state, or analyze census data and transportation routes to identify and locate services, such as a day-care center or stores needed in a region).
  - ▶ Analyze choropleth maps to examine spatial relationships (e.g., between the number of doctors and mortality rates, between corn production and hog production, between global energy production and consumption).
  - ▶ Analyze the overlap among multiple geospatial data layers to identify potential locations of interest (e.g., site for a new park, route for a new road, location of high incidences of crimes).



Basic GIS Step 2: Sketch the second data layer, in this case roads, and include the location of the house as the reference point.

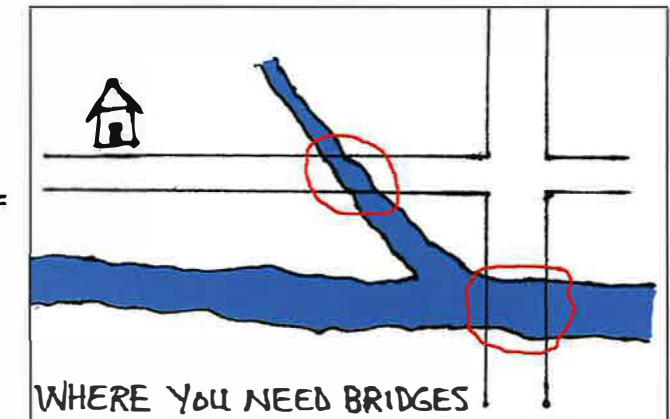
**12<sup>th</sup> GRADE**  
the student knows and understands:

Using Geographic Representations

**4. The uses of geographic representations and geospatial technologies to investigate and analyze geographic questions and to communicate geographic answers**

Therefore, the student is able to:

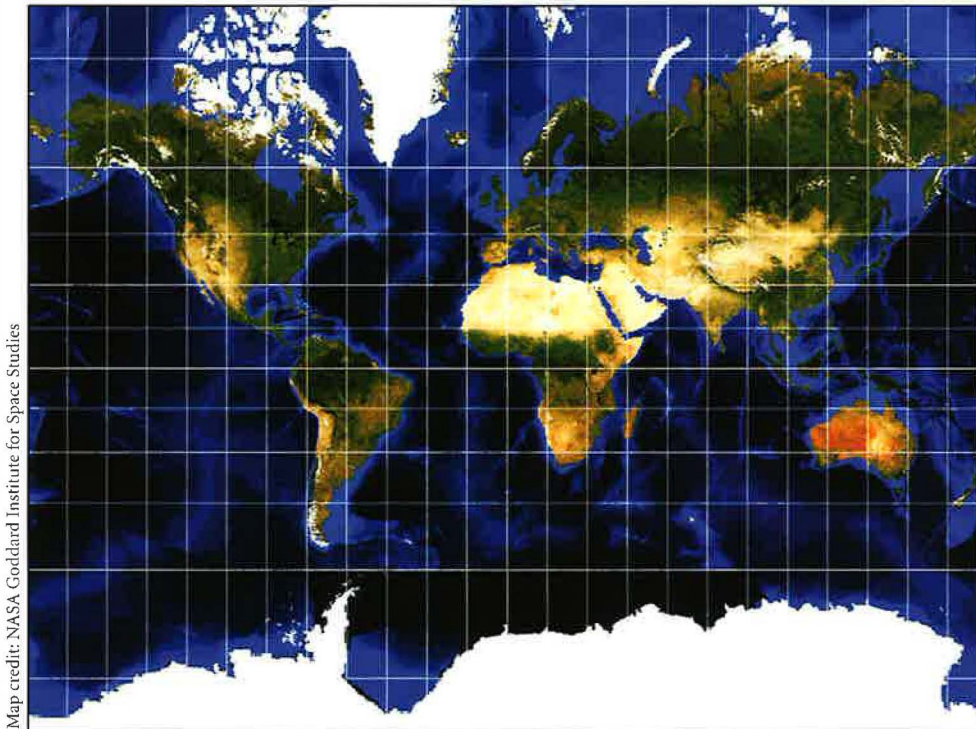
- A. Analyze geographic representations and suggest solutions to geographic questions at local to global scales using geographic representations and geospatial technologies, as exemplified by being able to
  - ▶ Construct a presentation using multiple geographic representations and geospatial tools that illustrates alternative views of a current or potential local issue.
  - ▶ Construct maps using Web-based mapping of national forest areas showing terrain, vegetation, roads, hiking trails, campsites, and picnic sites to identify possible new areas of public use, trails and roads, and areas to close for habitat recovery.
  - ▶ Analyze the possible relationships between global human and physical changes using GIS (e.g., the relationship between global climate change, sea level rise, and population distribution).



Basic GIS Step 3: Ask students to overlay the second data layer over the first using the house as the reference point and identify relationships between the two data layers, in this case where you need bridges for roads to cross the water.

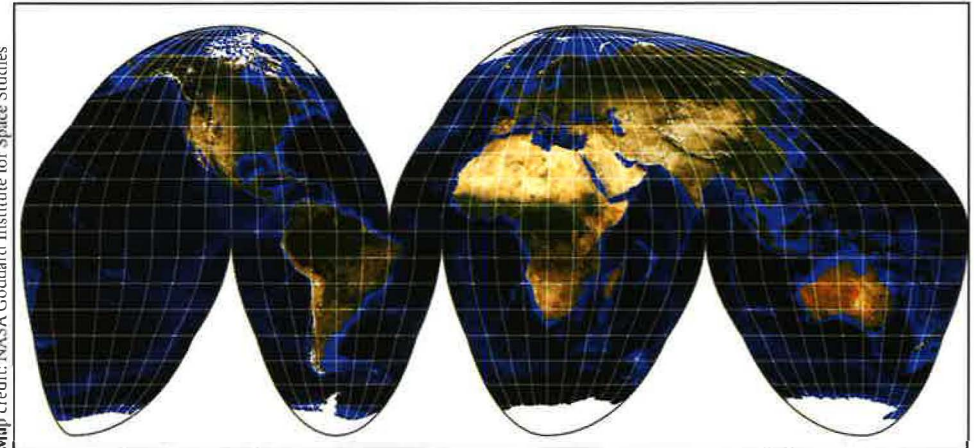
**GEOGRAPHY STANDARD 1: How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information**

Projecting the round Earth onto flat paper presents problems for geographers because it always introduces some degree of distortion in at least one of the following four spatial properties: shape, area, distance, and direction. The Mercator Projection presents true shape (except at the poles) and true direction, but wildly distorts relative areas of land masses. Compare the shape of Greenland and South America, for instance, on the Mercator Projection and a globe. The Goode Homolosine Projection was developed as an antidote for the widespread use of the Mercator Projection in the early twentieth century. It maintains true relative areas and tries to minimize distortion in the other three spatial properties by using “interruptions,” or cuts, through the oceans. It is called an equal-area projection. The Winkel Tripel Projection is a compromise because it tries to mediate between maintaining true shape and equal-area relationships, both of which still have some slight distortion.



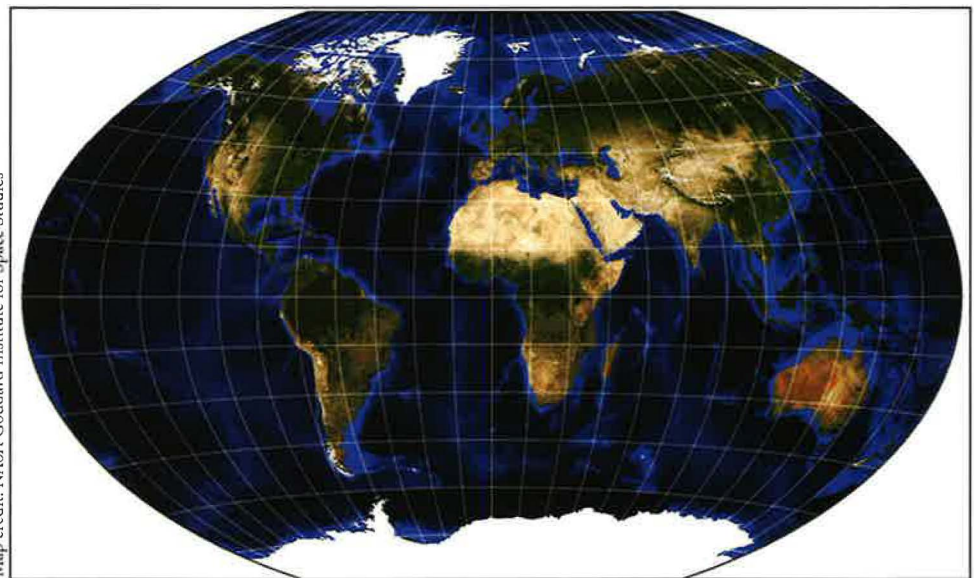
Map credit: NASA Goddard Institute for Space Studies

Mercator Projection.



Map credit: NASA Goddard Institute for Space Studies

Goode Homolosine Projection.



Map credit: NASA Goddard Institute for Space Studies

Winkel Tripel Projection.

## GEOGRAPHY STANDARD 2: How to use mental maps to organize information about people, places, and environments in a spatial context



Image credit: iStockphoto.com

*A spatial understanding of the environments people live in assists with making sense of the world.*



Image credit: iStockphoto.com

*Aboriginal Dreaming stories are sometimes told with sand drawings that contain symbols reflecting the locations of campsites and scarce water sources used by generations of people in desert regions of Australia.*

**The geographically informed person** must mentally organize spatial information about people, places, and environments and must be able to call upon and use this information in appropriate contexts. Knowing the locations and characteristics of people, places, and environments is a necessary precursor to—and outcome of—geographic learning and thinking. An effective way of doing this is to develop and use what is called a mental map: an individual’s internalized representation of aspects of Earth’s surface. These maps in the mind are what a person knows about the locations and characteristics of places at a variety of scales, from the local (the layout of a person’s bedroom) to the global (the distribution of oceans and continents across Earth). Mental maps are a mix of objective knowledge and subjective perceptions: precise knowledge about the location of geographic features as well as impressions of places, rough estimates of size and location, and a general sense of the connections between places.

Therefore, Standard 2 contains these themes: Developing Mental Maps, Using Mental Maps, and Individual Perceptions Shape Mental Maps.

Mental maps provide people with essential means of making sense of the world and of storing and recalling information about the patterns of Earth’s physical and human features. These maps represent ever-changing summaries of spatial knowledge and are indicators of how well people know the spatial characteristics of places. We develop and refine our mental maps through learning from teachers and the media and through personal experience, moving from simple to more complex levels of completeness and accuracy, continuing to add layers of information so that our mental maps reflect a growing understanding of a changing world. As people read, hear, observe, and think more about the world around them, they add more detail and structure to their mental maps and accumulate layers of information that can be used in problem solving and decision making. Students must understand the role that perception plays in the creation and development of their understandings of the world.

Students must build their mental maps to develop detailed understandings of peoples, places, and environments. By understanding these themes, students can build and apply the mental maps that are the foundations for learning geography and other subjects.

## GEOGRAPHY STANDARD 2: How to use mental maps to organize information about people, places, and environments in a spatial context

### 4<sup>th</sup> GRADE

the student knows and understands:

#### Developing Mental Maps

#### 1. The locations and characteristics of physical and human features are the basis for mental maps at local to global scales

Therefore, the student is able to:

- A. Identify from memory the position and arrangement of physical and human features, as exemplified by being able to
- ▶ Identify from memory the locations of physical and human features (landmarks) in the classroom or school setting.
  - ▶ Identify from memory the locations of physical or human features of interest to the student on their routes between home and school.
  - ▶ Identify from memory on a sketch map the locations of the setting from a favorite book or movie.

#### 2. Mental maps can change with direct experience (such as travel) and indirect experience (such as media exposure and looking at other maps)

Therefore, the student is able to:

- A. Identify from memory with increasing detail maps of a place or region, as exemplified by being able to
- ▶ Identify details in a student's mental map of a route used frequently (e.g., to and from the grocery store, to and from a park, to and from a relative's home) over a period of time with an emphasis of adding details to the map.
  - ▶ Identify from memory on a sketch map the locations of major community landmarks or boundaries.
  - ▶ Identify from memory on a sketch map the locations of state physical features and the political boundaries of the student's home state before and after studying a state map.

### 8<sup>th</sup> GRADE

the student knows and understands:

#### Developing Mental Maps

#### 1. The locations, characteristics, and patterns of physical and human features are the basis for mental maps at local to global scales

Therefore, the student is able to:

- A. Identify from memory and describe locations, patterns, and characteristics of physical and human features, as exemplified by being able to
- ▶ Identify from memory and describe the locations of state political boundaries and major physical features.
  - ▶ Identify from memory the locations of major land acquisitions to the United States following the settlement of the original 13 colonies, which resulted in the current political boundaries.
  - ▶ Identify from memory and describe the major climate and vegetation regions of the United States.

#### 2. Mental maps can change and become more accurate with direct experience (such as travel) and indirect experience (such as media exposure and looking at other maps)

Therefore, the student is able to:

- A. Identify from memory with increasing detail and accuracy mental maps of a place or region, as exemplified by being able to
- ▶ Identify from memory the locations of major cities in the student's state with accuracy in both the scale and locations.
  - ▶ Identify from memory the locations and boundaries of all adjacent states and major cities in those states.
  - ▶ Identify from memory the locations of major transportation routes in the state.

### 12<sup>th</sup> GRADE

the student knows and understands:

#### Developing Mental Maps

#### 1. The locations, characteristics, patterns, and relationships of physical and human systems are the basis for mental maps at local to global scales

Therefore, the student is able to:

- A. Identify from memory and explain the locations, characteristics, patterns, and relationships among human and physical systems, as exemplified by being able to
- ▶ Identify the pattern of human settlement in the world from memory and explain the common physical characteristics where the majority of settlements occur.
  - ▶ Identify the locations from memory and explain the connections between major transportation networks and population centers.
  - ▶ Identify the locations from memory of historical world civilizations and explain how cultural markers or examples still remain from the past (e.g., Roman place names in Europe, structures or architectural styles, spread of English language through the British empire).

#### 2. Mental maps can change through experience and iterative self-reflection

Therefore, the student is able to:

- A. Explain the development of completeness and accuracy in the student's mental map of places and regions, as exemplified by being able to
- ▶ Explain how a new experience or encounter in an unfamiliar location resulted in added details or accuracy of the student's mental map of that place.
  - ▶ Explain how the study of maps for game playing added details and accuracy to the student's mental map of a place or region.
  - ▶ Explain how using a GPS or Web-based mapping application can aid in the development of a more complete and accurate mental map of places and regions.

## GEOGRAPHY STANDARD 2: How to use mental maps to organize information about people, places, and environments in a spatial context

### 4<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Mental Maps

### 3. Mental maps are used to answer geographic questions about locations and characteristics of places and regions

*Therefore, the student is able to:*

- A. Identify from memory locations and geographic characteristics to answer geographic questions, as exemplified by being able to
  - ▶ Identify from memory the location and geographic characteristics of the most significant intersection near the student's home or school to answer geographic questions (e.g., What types of buildings are located at an important intersection near your home or school? What are the major landmarks used to help someone locate your home or school?).
  - ▶ Identify from memory the locations of landmarks in the school building and on the school grounds to answer geographic questions (e.g., Where is the closest fire exit to the classroom? What is the shortest route to the nurse's office? Where is the most popular playground equipment located?).
  - ▶ Identify from memory the map of North America to answer geographic questions (e.g., What are the countries to the north and south of the United States? Which state is located at the easternmost point of the United States? Which state is at the geographic center of the continental United States?).

#### Individual Perceptions Shape Mental Maps

### 4. Individuals may have different mental maps of places and regions

*Therefore, the student is able to:*

- A. Describe how an individual's views and understandings of places and regions differ, as expressed by his or her mental map, as exemplified by being able to
  - ▶ Identify and describe differences in students' sketch maps of their community, including differences in details on their maps, scale, labels, location of features, etc.
  - ▶ Describe differences in students' understandings of a story or setting of a book based on the details in their mental maps.
  - ▶ Describe the differences in students' views of a popular community attraction based on the details in their mental maps.

### 8<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Mental Maps

### 3. Mental maps are used to answer geographic questions about locations, characteristics, and patterns of places and regions

*Therefore, the student is able to:*

- A. Identify from memory and describe the locations, characteristics, and patterns of places and regions to answer geographic questions, as exemplified by being able to
  - ▶ Identify from memory and describe the patterns of coastal population density and place characteristics to explain why people may choose to live where they do in the world.
  - ▶ Identify from memory and describe the features that may have resulted in a change of route or engineering innovations in building the first US transcontinental railroad.
  - ▶ Identify from memory the distribution, pattern, and characteristics of major world deserts and mountain ranges that can be barriers to travel or settlement.

#### Individual Perceptions Shape Mental Maps

### 4. Mental maps are shaped by individual perceptions of people, places, regions, and environments

*Therefore, the student is able to:*

- A. Compare the mental maps of individuals to identify common factors that influence spatial understanding, perceptions, and preferences, as exemplified by being able to
  - ▶ Compare mental maps of the state sketched by students to identify examples of spatial understanding such as scale on the maps.
  - ▶ Compare mental maps sketched by students of the location or region of a historical event to identify the different perceptions students may have from the same information presented in the classroom.
  - ▶ Compare the details in mental maps sketched by students of their most preferred and least preferred state in which to live.

### 12<sup>th</sup> GRADE

*the student knows and understands:*

#### Using Mental Maps

### 3. Mental maps are used to answer geographic questions about locations, characteristics, patterns, and relationships of places and regions

*Therefore, the student is able to:*

- A. Identify from memory and explain the locations, characteristics, patterns, and relationships of places and regions to answer geographic questions, as exemplified by being able to
  - ▶ Identify from memory the locations and significant details that would inform a possible solution to a community-based environmental issue including an explanation of relationships or patterns in the details.
  - ▶ Identify from memory the pattern of world population and explain the relationship of population settlement to land features and available renewable resources.
  - ▶ Identify from memory the location of strategic choke points in shipping routes that are most likely to influence the route of trade goods in the future and explain the relationships between the United States and other countries controlling these strategic locations.

#### Individual Perceptions Shape Mental Maps

### 4. Changing perceptions reshape mental maps of people, places, regions, and environments

*Therefore, the student is able to:*

- A. Compare an individual's mental map before and after a geographic event or experience, as exemplified by being able to
  - ▶ Compare students' mental maps created before and after a school or family trip to identify changes in the details and accuracy of the maps.
  - ▶ Compare students' mental maps created before and after the study of world regions that are most likely to experience political change or restructuring.
  - ▶ Compare students' mental maps before and after studying a current news event to identify how additional information translates into changes in understanding of the location.

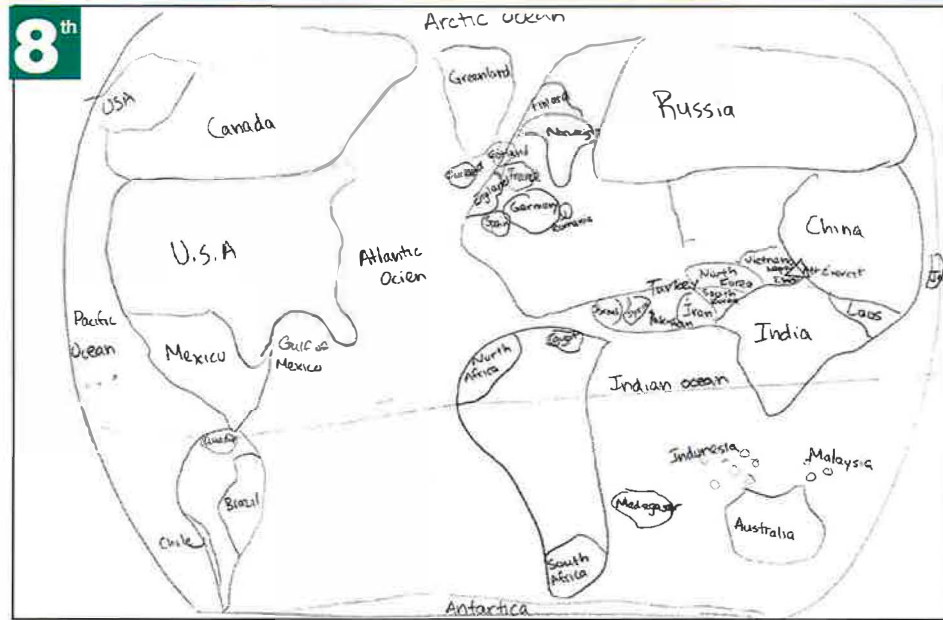


**GEOGRAPHY STANDARD 2: How to use mental maps to organize information about people, places, and environments in a spatial context**

4<sup>th</sup>



8<sup>th</sup>



12<sup>th</sup>



Asking students to sketch mental maps of the world can illustrate the level of detail and accuracy in their spatial perceptions of the world. These mental map examples were drawn by 4th grade (above), 8th grade (top right), and 12th grade (lower right) students.

**GEOGRAPHY STANDARD 3: How to analyze the spatial organization of people, places, and environments on Earth's surface**

*A satellite image of lower Manhattan captures the human and physical processes that give character to this place. Streets, highways, bridges, tunnels, ferries, and rivers are all part of the spatial pattern of transportation in New York City. Data source: ©Google Earth, ©DigitalGlobe.*



*This street map is a simplified model of the actual human and physical landscape from the above satellite image that helps visualize transportation patterns in and out of lower Manhattan. Note that a map can show some features, like tunnel routes into the city, that a satellite image cannot. Data source: 2005 TeleAtlas and Esri Streets.*

**The geographically informed person** must understand that physical and human phenomena are distributed across Earth's surface and see meaning in their arrangements across space. Geography usually starts with questions such as, "Where?" "What is it like here?" and "Why is this located there and not here?" When considering "where" questions, geographers seek regularities—that is, patterns as well as relationships among phenomena (the features of Earth and activities that take place on Earth). They describe and explain patterns in terms of distance, direction, density, and distribution. They use spatial concepts, processes, and models as powerful tools for explaining the world at all scales, local to global.

Therefore, Standard 3 contains these themes: Spatial Concepts, Spatial Patterns and Processes, and Spatial Models.

Spatial concepts provide a language for describing the arrangement of people, places, and environments. Arrangements can be characterized in terms of proximity, distance, scale, clustering, distribution, etc.

Once students start to identify spatial patterns and use maps and remotely sensed images to discover patterns, then they can begin to explore why the patterns and relationships among phenomena exist as they do, that is, what processes produce the patterns. Processes are the driving forces and underlying causes of observable patterns.

Students must understand the mechanisms underlying processes, from the physical activities that shape the environment to the human processes of economic development, urbanization, migration, and cultural change. Models are idealized and simplified representations based on assumptions about reality, and they can help students analyze spatial organization by demonstrating properties of physical and human features, by simplifying the complexity of reality, and by serving as a source of working hypotheses in research. Models can be organized along a continuum from concrete reality (a globe or a diorama) to higher degrees of abstraction and generalization (models of urban structures, spatial interactions, and physical processes).

Understanding these themes and related concepts enables students to explore the patterns of human and physical phenomena and the processes that influence these patterns. Students use models to convey knowledge and generalizations related to Earth's spatial organization. The use of spatial thinking brings a deeper understanding and appreciation of the complexity and interconnectedness of the physical and human world.

**GEOGRAPHY STANDARD 3: How to analyze the spatial organization of people, places, and environments on Earth's surface**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Concepts**

**1. The meaning and use of fundamental spatial concepts such as location, distance, direction, scale, movement, region, and volume**

*Therefore, the student is able to:*

- A. Describe and explain the spatial organization of people, places, and environments (where things are in relation to other things) using spatial concepts, as exemplified by being able to
  - ▶ Explain the meaning of the spatial concepts of next to, behind, in front of, left, right, inside, outside, and between (e.g., moving people or desks to new locations, labeling spots in the room).
  - ▶ Describe the meaning of the spatial concepts of distance, direction, and location used in selected literature (e.g., read an account of Paul Revere's ride and describe it in terms of locations [start to end], movement, region of action, distance, direction).
  - ▶ Construct a story built on spatial concepts using directions, locations, distances, and movements in the plot (e.g., cardinal directions, relative and exact locations, real or imaginary locations, statements of distances).

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Concepts**

**1. The meaning and use of spatial concepts, such as accessibility, dispersion, density, and interdependence**

*Therefore, the student is able to:*

- A. Describe the spatial organization of people, places, and environments (where things are in relation to other things) using spatial concepts, as exemplified by being able to
  - ▶ Describe spatial concepts, such as population density, transportation networks or linkages, and urban or city growth patterns using paper or digital maps.
  - ▶ Identify and describe related businesses and services needed in the vicinity of a popular vacation destination (e.g., hotels, restaurants, airport, ATM/banking for a theme park, hotels and camping equipment stores near national parks, tourist information centers in large cities, public transit options for stadiums and event centers).
  - ▶ Identify and describe service functions along US interstate highways using a digital globe or street-view maps (e.g., shopping malls, service stations, restaurants, hotels).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Concepts**

**1. The meaning and use of complex spatial concepts, such as connectivity, networks, hierarchies, to analyze and explain the spatial organization of human and physical phenomena**

*Therefore, the student is able to:*

- A. Analyze and explain the spatial organization of people, places, and environments (where things are in relation to other things) using spatial concepts, as exemplified by being able to
  - ▶ Construct various forms of geographic representations (hardcopy or digital maps, graphs, tables, or charts) to explain the spatial patterns of physical and human phenomena (e.g., maps that define a major watershed, composed of smaller watersheds and the hierarchies of streams and rivers within; maps that show the transportation networks within and between population centers of varying sizes to show hierarchies of cities, towns, and villages within a region).
  - ▶ Construct data tables and digital maps using US Census data to analyze and explain the variability of population density in relation to the location of transportation nodes and networks.
  - ▶ Construct and use various forms of geographic representations to explain that certain coastal urban centers gained locational, connectivity, and economic prominence (e.g., New Orleans, Calcutta, Rotterdam, Singapore).

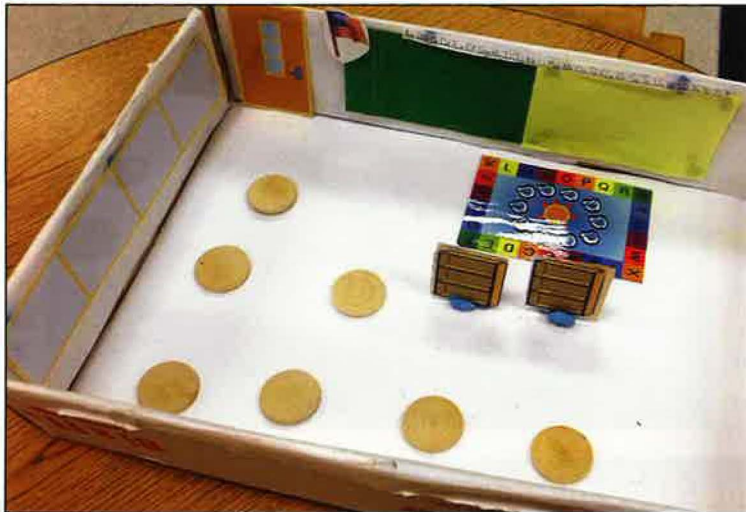


Image credit: Carol and Phil Gersmehl

*A model of a classroom can be used to teach spatial concepts such as next to, behind, in front of, left, right, inside, outside, and between.*

**GEOGRAPHY STANDARD 3: How to analyze the spatial organization of people, places, and environments on Earth's surface**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Patterns and Processes**

**2. The distribution of people, places, and environments form spatial patterns across Earth's surface**

*Therefore, the student is able to:*

- A. Describe and compare distributions of people, places, and environments to examine spatial patterns, sequences, regularities, and irregularities, as exemplified by being able to
  - ▶ Identify features and patterns on geographic representations or remotely sensed images and describe the differences in the features and patterns (e.g., straight lines of roads forming a grid, curving roads in mountain areas, farmland and pastures versus the patterns of cities and suburbs).
  - ▶ Compare distances and populations of towns and cities along a highway that runs through a state and look for patterns or trends (e.g., regularity of distances between towns of a certain size, the variability in distance from interstate highways between larger cities and smaller cities, sizes of towns closer or farther away from larger cities).
  - ▶ Describe and compare the natural features and human factors using geographic representations that may influence where people live (e.g., access to water, climatic conditions, rivers, and bridges).

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Patterns and Processes**

**2. Processes shape the spatial patterns of people, places, and environments over time**

*Therefore, the student is able to:*

- A. Describe and compare the processes that influence the distribution of human and physical phenomena, as exemplified by being able to
  - ▶ Describe how changing transportation and communication technologies influence human distribution and settlement patterns using time lines, maps, and graphs (e.g., compare historic routes West, such as the Santa Fe Trail and Route 66 with current modes and routes of travel and discuss how these have influenced settlement, map the flow of emigrants to the United States by ethnic group, date, factors causing emigration, ports of entry, and settlement patterns, comparing early immigration to current immigration).
  - ▶ Describe and compare the changes in environmental systems that cause changes in cultural, political, or economic conditions (e.g., a species becoming endangered leads to protected locations and conservation management, climate change influences emissions control legislation, depletion of a natural resource results in higher costs and effects new technologies).
  - ▶ Describe and compare changes in natural vegetation zones and land uses on the slopes of a mountain (e.g., vertical zonation, tree lines in middle latitudes).

*In Morocco's High Atlas Mountains, land use zones are neatly patterned according to distance from the stream. Throughout the dry world, land near sources of fresh water is reserved for agriculture, while the villages where farmers live move out of the way and, in this case, upslope.*



Image credit: D. J. Zeigler

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Spatial Patterns and Processes**

**2. Complex processes change over time and shape patterns in the distribution of human and physical phenomena**

*Therefore, the student is able to:*

- A. Analyze and explain changes in spatial patterns as a result of the interactions among human and physical processes through time, as exemplified by being able to
  - ▶ Analyze and explain the human and physical characteristics of regions that have changed over time because of the interaction among processes (e.g., local economic patterns shift as international trade relationships evolve because of global social events, local populations of particular species rise or fall because changes in climate affect the viability of a region for other species).
  - ▶ Analyze vegetation maps for an area over different time periods and explain how changing patterns reflect changes in physical processes and human activities (e.g., desertification, deforestation, natural land cover, agricultural land use).
  - ▶ Explain how changes in the physical environment, political environment, and conflict influence changes in economic activity within a region. (e.g., interruption of economic activities and trade patterns in Africa, migration of people to economic trade zones in China).

**GEOGRAPHY STANDARD 3: How to analyze the spatial organization of people, places, and environments on Earth's surface**

**4<sup>th</sup> GRADE**  
the student knows and understands:

**Spatial Models**

**3. Models are used to represent features of human and/or physical systems**

Therefore, the student is able to:

- A. Describe and construct models illustrating the properties of human and/or physical systems, as exemplified by being able to
  - ▶ Construct a model of Earth and describe its shape, size, and key features (e.g., equator, poles, prime meridian, oceans, continents).
  - ▶ Construct a model of the community and identify the different land uses (e.g., residential, industrial, retail).
  - ▶ Construct a model of a watershed linked to a model of the hydrologic cycle and describe its key features and the interconnections to the local water supply (e.g., identify mountains, river systems, lakes, oceans, and groundwater that are a part of the system that supplies water to the local community).

**8<sup>th</sup> GRADE**  
the student knows and understands:

**Spatial Models**

**3. Models are used to represent spatial processes that shape human and physical systems**

Therefore, the student is able to:

- A. Describe the processes that shape human and physical systems (e.g., diffusion, migration, and plate tectonics) using models, as exemplified by being able to
  - ▶ Describe a model that illustrates the diffusion of cultural characteristics (e.g., music styles, clothing styles, fast-food preferences).
  - ▶ Describe how the demographic transition model explains historic changes in population and migration patterns (e.g., industrial revolution in Europe, declining birthrates in South Korea).
  - ▶ Describe urban models, such as sector or ring models, using a digital globe or map (e.g., Paris as an example of a sector model, Moscow as an example of a ring model).

**12<sup>th</sup> GRADE**  
the student knows and understands:

**Spatial Models**

**3. Models are used to represent the structure and dynamics of spatial processes that shape human and physical systems**

Therefore, the student is able to:

- A. Analyze and explain the spatial features, processes, and organization of people, places, and environments using models of human and/or physical systems (e.g., urban structure, sediment transport, and spatial interaction), as exemplified by being able to
  - ▶ Construct a model and explain the influence that spatial processes have on human and physical systems (e.g., urbanization and transportation; housing prices and environmental amenities such as water bodies, parks, or vistas; gardening associated with the growing season).
  - ▶ Construct physical or digital models of a river valley and evaluate locations that may be suitable for different purposes (e.g., recreational sites, residential housing, resort hotels, industrial sites).
  - ▶ Construct a model that shows how election strategists might determine which areas in the state should receive special attention and additional resources in advance of an election (e.g., political party membership, economic traits, past voter turnout).



Image credit: D.J. Zeigler

*In the 1970s, a new highway through the Brenner Pass reduced the time required to travel across the Alps from Austria to Italy. Greater accessibility along the route led to changes in the spatial organization of the region.*

## GEOGRAPHY STANDARD 4: The physical and human characteristics of places



Image credit: Rik Katz

*Shanghai illustrates both the physical and human characteristics of place. Located on the Yangtze River Delta in eastern China with a high population density, it is the busiest container port in the world.*



Image credit: D.J. Zeigler

*Both physical and human characteristics of the Great Plains define places like this abandoned farmstead in rural South Dakota.*

**The geographically informed person** must understand the genesis, evolution, and meaning of places. Places are locations having distinctive features that give them meaning and character that differs from other locations. Therefore, places are human creations, and people's lives are grounded in particular places. We come from a place, we live in a place, and we preserve and exhibit fierce pride over places. Places usually have names and boundaries and include continents, islands, countries, regions, state, cities, neighborhoods, villages, and uninhabited areas.

Therefore, Standard 4 contains these themes: The Concept of Place and The Characteristics of Places.

Places are jointly characterized by their physical and human properties. Their physical characteristics include landforms, climate, soils, and hydrology. Things such as language, religion, political systems, economic systems, and population distribution are examples of human characteristics. Places change over time as both physical and human processes change and thus modify the characteristics of a place. Places change in size and complexity as a result of new knowledge, ideas, human migrations, climatic changes, or political conflicts. Places disappear and are renamed (e.g., Czechoslovakia became the Czech Republic and Slovakia, the Spanish rebuilt Tenochtitlan and renamed it Mexico City, and St. Petersburg changed to Leningrad and then reverted back to St. Petersburg).

Knowing the physical and human characteristics of their own places influences how people think about who they are. Personal, community, and national identities are inextricably bound with a person's and a population's experiences in those places. Knowing about other places influences how people understand other peoples, cultures, and regions of the world. Such knowledge not only broadens a person's world perspective and allows a better understanding of places with which they have a strong personal identity.

Students must understand how physical and human characteristics give meaning to places. They must also understand that these characteristics vary from place to place and change over time. Understanding these themes enables students to comprehend and appreciate the similarities and differences in places in their own communities, states, and countries, as well as across Earth's surface.

**GEOGRAPHY STANDARD 4: The physical and human characteristics of places**

**4<sup>th</sup> GRADE**

the student knows and understands:

**The Concept of Place**

**1. Places are locations having distinctive characteristics that give them meaning and distinguish them from other locations**

Therefore, the student is able to:

- A. Describe the distinguishing characteristics and meanings of several different places, as exemplified by being able to
  - ▶ Identify and describe categories of characteristics that define a location as a place (e.g., weather characteristics, population density, architectural styles, landforms, vegetation, cultures, types of industry).
  - ▶ Identify and describe the defining characteristics of the student's community as a place.
  - ▶ Describe how certain places may have meanings that distinguish them from other places (e.g., cemetery, historical park or battlefield, religious shrines or temples, state or national parks).



River boats and bridges are human characteristics that contribute to the place-based identity of New Orleans.

**8<sup>th</sup> GRADE**

the student knows and understands:

**The Concept of Place**

**1. Personal, community, and national identities are rooted in and attached to places**

Therefore, the student is able to:

- A. Explain how personal, community, or national identities are based on places, as exemplified by being able to
  - ▶ Describe and explain the factors that contribute to the identity of being from a specific place (e.g., a “New Yorker,” a “Southerner,” a “Texan,” a postal code such as 90210).
  - ▶ Explain how a place-based identity results from the characteristics of a place (e.g., environmentally conscious Inuit of Northwest Canada, seafaring traditions of Gloucester Harbor, Massachusetts, nomadic herders in the eastern steppes of Mongolia).
  - ▶ Explain how place-based identities can sometimes result in stereotypes of people from a specific place (e.g., fitness-conscious people from Colorado, cowboys from Wyoming or Texas, miners from Appalachia, coffee-drinking people from Seattle).

**12<sup>th</sup> GRADE**

the student knows and understands:

**The Concept of Place**

**1. The effects of place-based identities on personal, community, national, and world events**

Therefore, the student is able to:

- A. Explain how and why place-based identities can shape events at various scales, as exemplified by being able to
  - ▶ Explain how place-based identities contribute to patterns of fan support for sporting events (e.g., the World Cup, Olympic competitions, the US National Football League).
  - ▶ Explain how neighborhood place-based identities can shape politics in urban areas (e.g., ethnicity, age, socioeconomic status, university communities).
  - ▶ Explain how regional identities can be the basis for nationalistic movements within a country (e.g., Catalonians or the Basques in Spain, Native Hawaiians in Hawaii, the end of Indonesian occupation in East Timor).



The city of New Orleans is heavily influenced by all the surrounding water features including the Mississippi River and Lake Pontchartrain. Data source: Landsat 7, USGS Center for Earth Resources Observation and Science Center (EROS).

## GEOGRAPHY STANDARD 4: The physical and human characteristics of places

**4<sup>th</sup> GRADE**

the student knows and understands:

## The Characteristics of Places

**2. Places have physical and human characteristics**

Therefore, the student is able to:

- A. Describe and compare the physical characteristics of places at a variety of scales, local to global, as exemplified by being able to
- ▶ Describe and compare the climatic conditions at different places in the United States (e.g., deserts, mountains, rainy regions of the Pacific Northwest).
  - ▶ Describe and compare the vegetation in different places in the world (e.g., deserts, mountains, rain forests, plains).
  - ▶ Describe and compare the physical environments and landforms of different places in the world (e.g., mountains, islands, valleys or canyons, mesas).
- B. Describe and compare the human characteristics of places at a variety of scales, local to global, as exemplified by being able to
- ▶ Describe and compare the types of clothing, housing, and transportation used in different countries located at different latitudes in the world.
  - ▶ Describe and compare the human characteristics of rural versus urban locations in the United States (e.g., single family homes versus apartment buildings, different languages and cultures in urban areas).
  - ▶ Describe and compare the types of grocery and food items from different countries in the local supermarket.

**8<sup>th</sup> GRADE**

the student knows and understands:

## The Characteristics of Places

**2. Physical and human characteristics of places change**

Therefore, the student is able to:

- A. Explain the ways that physical processes change places, as exemplified by being able to
- ▶ Describe and explain how places near a river may change over time (e.g., flood plains, alluvial soils, new channels).
  - ▶ Explain the ways in which islands and coastal places may change as a result of sea level rise.
  - ▶ Explain how changes in climate may result in changes to places (e.g., drought and stressed vegetation, more precipitation and increased vegetation, warmer temperatures and longer growing seasons at higher latitudes).
- B. Explain the ways that human processes change places, as exemplified by being able to
- ▶ Describe and explain how the introduction of a new industry or the closing of an existing industry could change the characteristics of a place.
  - ▶ Explain how the construction of a new bridge between two cities or creating a new traffic pattern could result in changes in those places.
  - ▶ Explain the ways in which a battle can change a place (e.g., the Battle of Gettysburg during the Civil War, the invasion of Normandy during World War II, the Battle of Salamis in ancient Greece, the American War for Independence).

**12<sup>th</sup> GRADE**

the student knows and understands:

## The Characteristics of Places

**2. The interaction of physical and human systems result in the creation of and changes to places**

Therefore, the student is able to:

- A. Explain how physical or human characteristics interact to create a place by giving it meaning and significance, as exemplified by being able to
- ▶ Describe and explain how community identities are formed by the characteristics of a place (e.g., New Orleans as a port city and as an enclave for French cultural heritage; New York as the centers for US finance, fashion, and art; Hong Kong as a port and financial center in China).
  - ▶ Describe and explain the reasons why the Himalayas are home to many Buddhist monasteries (e.g., Tashichhodzong or Tiger's Nest Monastery in Bhutan).
  - ▶ Explain how human mythology can create special meaning and significance to a place (e.g., Uluru [Ayers Rock] in Australia as part of the Aboriginal creation story, Delphi as the navel of the Earth in Ancient Greece, the construction of Stonehenge in England).
- B. Explain how physical or human characteristics interact to change the meaning and significance of places, as exemplified by being able to
- ▶ Explain how the reforms of India's education system provided a foundation for the expansion of high-tech industries in Bangalore and Hyderabad.
  - ▶ Explain how the post-World War II treaties created Berlin as a divided city that represented the Cold War conflict between the United States and the former Soviet Union.
  - ▶ Explain how the physical features in Panama made it a favorable location to build a canal to reduce the travel time around South America.



**GEOGRAPHY STANDARD 4: The physical and human characteristics of places**



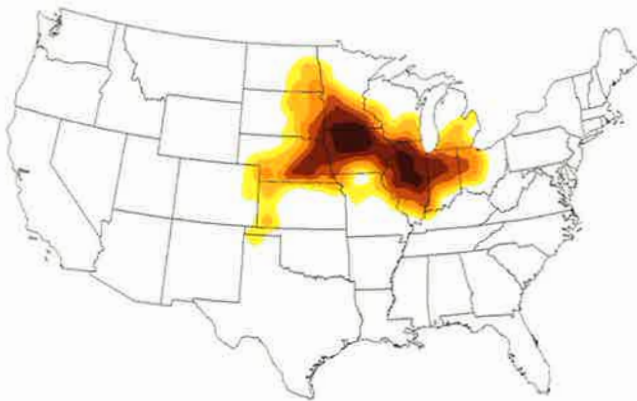
Image credit: Susan Gallagher Hefron

*Mesa Verde National Park preserves a place where Ancestral Puebloans built stone villages in the natural alcoves of the canyon walls of what is today southwest Colorado.*

**GEOGRAPHY STANDARD 5: That people create regions to interpret Earth's complexity**

Map credit: University of North Alabama/Lisa Keys-Mathews

This map displays the Physiographic Divisions in the conterminous United States representing 24 distinctive regions having common topography, rock types and structure, and geologic and geomorphic history. Data source: USGS.



Map credit: Eastern Illinois University/Chris Laingen

The US Corn Belt, an agricultural region, is defined in this thematic map by the density of acres of harvested corn based on the 2007 Census of Agriculture Data. The darkest color represents the highest density of harvested acres of corn.

**The geographically informed person** must understand the origins and functions of regions. Regions are human creations used to manage and interpret the complexity of Earth's surface. They help us understand and organize the arrangements of people, places, and environments. People's lives are structured within multiple regions.

Therefore, Standard 5 contains these themes: The Concept of Region and Regional Change.

A region has characteristics that give it cohesiveness and distinctiveness and set it apart from other regions. The boundaries and characteristics of a region are derived from a set of criteria that organizes Earth's complex surface on the basis of the presence or absence of selected physical and human characteristics. Regions can vary in scale from local to global; overlap or be mutually exclusive; be nested into a hierarchy (e.g., counties, states, countries); and exhaustively partition the entire world or capture only selected portions of it.

Geographers recognize three types of regions. The first type is the formal region characterized by a common human property, such as the presence of people who share a language, religion, nationality, political identity, or culture; or it is characterized by a common physical property, such as the presence of a type of climate, landform, or vegetation. The Rocky Mountain region, the Corn Belt, and Latin America are examples of formal regions.

The second type is the functional region. It is organized around a node or focal point, with surrounding areas linked by transportation systems, communication systems, or other associations such as manufacturing and retail trading. Chicago, with its highways, railways, Great Lakes shipping, airlines, and telecommunications, is a focal point in the north-central region of the United States.

The third type of region, the perceptual region, is based on human feelings and attitudes about areas and is defined by people's shared subjective images. Southern California, Dixie, the Riviera, and Australian Outback are perceptual regions. These spatial units may be without precise borders or even commonly accepted regional characteristics and names.

All types of regions are dynamic, changing as the physical and human properties of Earth's surface change. Thus, with global climate change, ecosystem and biome patterns will change. With economic globalization, structural relationships between trading regions will shift, as capital and people move to take advantage of changing opportunities.

Students must understand the meaning and complexity of regions, their physical and human characteristics, and how geographers use and analyze regions to interpret and organize Earth's surface. Understanding these themes enables students to put people, places, and environments into multiple spatial contexts.

## GEOGRAPHY STANDARD 5: That people create regions to interpret Earth's complexity

**4<sup>th</sup> GRADE**

the student knows and understands:

## The Concept of Region

**1. Regions are areas of Earth's surface with unifying physical and/or human characteristics**

Therefore, the student is able to:

- A. Describe the distinguishing characteristics and meanings of several different regions, as exemplified by being able to
- ▶ Identify unifying areas on a map that define those areas as regions (e.g., a zoo map showing how animal exhibits are organized by regions related to climate, landforms, and vegetation zones).
  - ▶ Identify the physical and human characteristics that can be used to define a region within the local community (e.g., the characteristics of a retail strip mall area, downtown or central business district, boundaries of ethnic neighborhoods).
  - ▶ Describe the characteristics that define a physical region in the state (e.g., Front Range in Colorado, Sand Hills in Nebraska, Hill Country in Texas).



Image credit: D.J. Zeigler

Chinatown in Adelaide, South Australia, is an example of an ethnic neighborhood, a region that includes Chinese style gates as cultural markers.

**8<sup>th</sup> GRADE**

the student knows and understands:

## The Concept of Region

**1. Different types of regions are used to organize and interpret areas of Earth's surface**

Therefore, the student is able to:

- A. Identify and explain the criteria used to define formal, functional, and perceptual regions, as exemplified by being able to
- ▶ Identify and explain the bases for the formal region(s), functional region(s), and perceptual region(s) for the community or state where the students live (e.g., for Michigan, the Kalamazoo–Battle Creek Metropolitan Statistical Area is a formal region, the fruit belt in Southwest Michigan is a functional region, Kalamazoo as the snow belt capital of Lake Michigan is a perceptual region).
  - ▶ Identify and describe the spatial extent of a local perceptual region by searching a web-based telephone directory or mapping site to identify businesses and their locations (e.g., Michiana, Cascadia, Cajun Country, Capital City, Twin Cities).
  - ▶ Analyze collected maps with regional labels as examples of formal, functional, or perceptual regions (e.g., maps of physical regions as formal, weather maps as functional, tourist maps as perceptual).

## Regional Change

**2. The boundaries and characteristics of regions change**

Therefore, the student is able to:

- A. Describe and explain the changes in the boundaries and characteristics of regions, as exemplified by being able to
- ▶ Describe and explain how the formal regional boundaries and names of US territories and states have changed over time.
  - ▶ Describe and explain the changes in regional boundaries and names of African states during colonization and after independence in the nineteenth and twentieth centuries.
  - ▶ Describe and explain how the transition of ethnic groups moving in or out of city neighborhoods results in changes in the names, boundaries, and characteristics of the neighborhoods.

**12<sup>th</sup> GRADE**

the student knows and understands:

## The Concept of Region

**1. Regions are defined by different sets of criteria, and places can be included in multiple regions of different types**

Therefore, the student is able to:

- A. Identify and explain how a place can exist within multiple regional classifications, as exemplified by being able to
- ▶ Construct a map showing the boundaries of the multiple regions within which the school is located (e.g., school district, city limits, county, state, physiographic region, US Federal Court Districts, Environmental Protection Agency (EPA) regions, Internal Revenue Service (IRS) regions, country, continent) and explain the basis for each of the regional boundaries.
  - ▶ Construct a perceptual region's boundary on a map, compare with the maps of other students, and explain why individuals can have different perceptions of a region's character and spatial extent (e.g., Pacific Northwest, New England, Midwest, South).
  - ▶ Identify a location in the world and explain a number of possible different regions that may include the location (e.g., Tunisia in the North African region, the Arabic speaking language region, and the Mediterranean region; Texas in the Great Plains region, the Southern US region, the Gulf Coast region).

## Regional Change

**2. Regional change is caused by multiple interacting processes**

Therefore, the student is able to:

- A. Describe and explain the processes that have resulted in regional change, as exemplified by being able to
- ▶ Describe and explain how the breakup of the Soviet Union led to changes in formal, functional, and perceptual regions in the areas that originally comprised that country.
  - ▶ Analyze how the boundaries and names of regions have changed over time and explain the reasons for those changes (e.g., political boundaries, economic or military alliances, land use, historic districts).
  - ▶ Explain some of the results expected from climate change models on the physical characteristics of selected world regions (e.g., effect of glacial melting in the Arctic on shipping lanes, deteriorating coral habitats in the tropics, changing vegetation patterns in midlatitude grasslands).

**GEOGRAPHY STANDARD 6: How culture and experience influence people's perceptions of places and regions**

Image credit: D.J. Zeigler

*As the urban landscape changes over time, so do our perceptions of the city and its functions. Two very different architectural styles reflect change in Kuala Lumpur, Malaysia.*



Image credit: iStockphoto.com

*Travel offers experiences that often change an individual's perceptions about people, places, and regions.*

**The geographically informed person** must understand that our own culture and life experiences shape the way we perceive places and regions. Perceptions are the basis for understanding a place's location, extent, characteristics, and significance. Throughout our lives, culture and experience shape our worldviews, which in turn influence our perceptions of places and regions. Children growing up in the Netherlands, for example, have a much different understanding of the role of water in their lives than their peers in the Sahara Desert. The difference between the abundance and scarcity of water in each of these physical environments affects every aspect of their respective cultures, including the global perceptions they will carry with them throughout their lives.

Therefore, Standard 6 contains these themes: The Perception of Places and Regions and Changes in the Perception of Places and Regions.

Worldviews, and therefore our cultural identities, reflect multiple factors. Ideology, race, ethnicity, language, gender, age, religion, history, politics, social class, and economic status influence how we perceive the place where we live and other parts of the world. The significance that an individual or group attaches to a particular place or region may be influenced by feelings of belonging or alienation, a sense of being an insider or outsider, a sense of history and tradition or of novelty and unfamiliarity. Some places and regions hold great significance for some groups of people, but not for others. For example, for Muslims the city of Mecca is the most holy of religious places, whereas for non-Muslims it has only historical and cultural significance.

Perceptions of places and regions change. In cities, perceptions of neighborhoods change over years as they pass through cycles of decline and gentrification, and regions such as the US Great Plains, once perceived as the Great American Desert, the Dustbowl, and now the Breadbasket of America, change over decades.

Students must understand the factors that influence their own perceptions of places and regions, paying special attention to the effects that personal and group points of view can have on their understanding of the worlds of other groups and cultures. Understanding these themes enables students to reflect on their own perceptions of places and regions, thereby avoiding the dangers of egocentric and ethnocentric stereotyping of the worlds of others.

## GEOGRAPHY STANDARD 6: How culture and experience influence people's perceptions of places and regions

**4<sup>th</sup> GRADE***the student knows and understands:*

## The Perception of Places and Regions

**1. People can have different views of the same places and regions***Therefore, the student is able to:*

- A. Describe how people view places in their community differently, as exemplified by being able to
- ▶ Identify and describe how people may view places in the community differently (e.g., teenagers and senior citizens responding to a skateboard park versus a senior citizens center).
  - ▶ Describe how students view three well-known places in the community (e.g., police station, hospital, grocery store, shopping mall, school, park) and use the descriptions to illustrate the differences in their views.
  - ▶ Identify and describe the different views that can exist about the design and use of places and objects in the community that are controversial (e.g., an abandoned railway right of way converted for use as a green space or trail, a public sculpture, the conversion of streets to a pedestrian mall, the addition of bike lanes to city streets).

## Changes in the Perception of Places and Regions

**2. People's perceptions of places and regions change as they have more life experiences***Therefore, the student is able to:*

- A. Describe how a place becomes more familiar the more it is experienced (e.g., being in a place at different periods in our lives, learning about and visiting new places), as exemplified by being able to
- ▶ Describe students' perceptions of what they thought their classroom/school setting would be like prior to attending and their current perceptions after attending.
  - ▶ Describe students' experiences with a favorite place they visit often and a new place they have only visited once to illustrate how their understanding of the frequently visited place may have changed over time.
  - ▶ Describe the experience of what it might be like moving to a new place (e.g., learning street names, finding such places as the library, parks, and playgrounds, grocery stores, and shopping malls).

**8<sup>th</sup> GRADE***the student knows and understands:*

## The Perception of Places and Regions

**1. People's different perceptions of places and regions are influenced by their life experiences***Therefore, the student is able to:*

- A. Describe examples of how perceptions of places and regions are based on direct experiences (e.g., living in a place, travel) and indirect experiences (e.g., media, books, family, and friends), as exemplified by being able to
- ▶ Describe students' perceptions of a place that are based on indirect sources (e.g., television, films, movies, travel brochures).
  - ▶ Describe students' perceptions of a place that are based on direct sources (e.g., visiting the place, multiple visits, or residing in the place).
  - ▶ Describe students' possible stereotypical perceptions of US regions (e.g., the West as open and sprawling region, the East Coast as densely populated and noisy, the South full of small towns where people move at a slower pace) and upon what experience or information their perceptions are based.

## Changes in the Perception of Places and Regions

**2. Perceptions of places and regions change by incorporating multiple direct and indirect experiences***Therefore, the student is able to:*

- A. Analyze the ways in which people change their views of places and regions as a result of media reports or interactions with other people, as exemplified by being able to
- ▶ Describe the changing views people may develop about places featured prominently in the news (e.g., Super Bowl site or World Series cities, the scene of a natural disaster, a venue hosting a significant international meeting).
  - ▶ Analyze the way in which traveling to a new place (city, state, or country) may change prior views of that place to more informed and developed views based on the experiences there (e.g., travel for sporting contests at schools, travel for outdoor recreational activities, travel for historical interests or visiting museums).
  - ▶ Analyze the effects of different sources of information that may cause people to change their views of a place or region (e.g., travel brochures or guidebooks, cable travel channels or documentaries, information from friends or family).

**12<sup>th</sup> GRADE***the student knows and understands:*

## The Perception of Places and Regions

**1. People can view places and regions from multiple perspectives***Therefore, the student is able to:*

- A. Explain how and why people view places and regions differently as a function of their ideology, race, ethnicity, language, gender, age, religion, politics, social class, and economic status, as exemplified by being able to
- ▶ Explain how and why gated communities in wealthy suburban areas may be viewed differently by people from different socioeconomic groups.
  - ▶ Explain how and why senior citizens and college students may view recreational destinations in Florida differently.
  - ▶ Explain how and why groups of people may view a place differently (e.g., Harney Peak, South Dakota, viewed by the Lakota Sioux or the US Forest Service; Mount Fuji viewed by Japanese citizens or foreign tourists).

## Changes in the Perception of Places and Regions

**2. Changing perceptions of places and regions have significant economic, political, and cultural consequences in an increasingly globalized and complex world***Therefore, the student is able to:*

- A. Explain the possible consequences of people's changing perceptions of places and regions in a globalized and fractured world, as exemplified by being able to
- ▶ Explain how international alliance networks are responses to changing views about places and regions (e.g., North Atlantic Treaty Organization [NATO], European Union [EU], Organization of American States [OAS]).
  - ▶ Analyze the changes in the US perceptions of increasing consumer demand and consumption in emerging national economies, especially in such Asian nations as China, India, Singapore, and South Korea.
  - ▶ Explain the consequences of people's changing perceptions of places due to natural and human disasters (e.g., reevaluating the use of artificial levees in New Orleans after Hurricane Katrina in 2005, decreased tourism after the eruption of Indonesia's Mount Merapi in 2010, responses to terrorist attacks on the World Trade Center in 1993 and 2001).

## GEOGRAPHY STANDARD 7: The physical processes that shape the patterns of Earth's surface



Image credit: D.J. Zeigler

*Geologic, atmospheric, and coastal processes along with gravity are at work shaping the painted cliffs on Maria Island in Tasmania.*

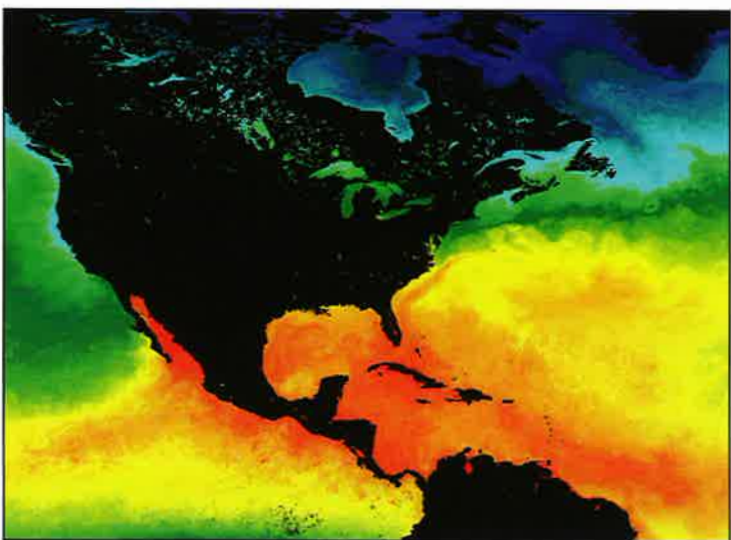


Image credit: University of North Alabama/Lisa Keys-Mathews

**The geographically informed person** must understand that physical systems create, maintain, and modify the features that constitute Earth's surface. The physical environment provides the essential background for all human activity on Earth.

Therefore, Standard 7 contains these themes: Components of Earth's Physical Systems, Earth–Sun Relationships, and Physical Processes.

There are four physical systems: the atmosphere, the biosphere, the hydrosphere, and the lithosphere. These constitute the essential units of the planet's physical systems. Recognizing the interactions within and among these four components offers insights on how Earth serves as the home of all living things—plants, animals, and humans.

Almost all of Earth's energy comes from the Sun. The synchronized Earth–Sun relationships are essential for the planet to be habitable and capable of supporting life as we know it. Earth's position relative to the Sun affects events and conditions in every part of the world. The amount of solar energy a place receives depends on the cyclically changing angles of the Sun's rays. The seasons result from the tilt of Earth and its revolution around the Sun causing variable heating patterns, and thus significantly influences climate and weather as well as human activity.

The physical processes on Earth create constant change. These processes—including movement in the tectonic plates in the crust, wind and water erosion, and deposition—shape features on Earth's surface.

Understanding how physical systems work can influence the choices people make about where they live, the types of buildings they construct, the travel networks they develop, and how they generally conduct their lives. Given the uncertain trajectory and effects of global climate change, knowledge about the factors that affect weather and climate is important for both personal and governmental decision-making. Global climate change is a public policy issue that must be addressed by governments, resulting in actions that determine the health, safety, and economic well-being of people across the world. Reasoned and responsible political decisions must derive from a clear understanding of the interactions among Earth's physical systems, as well as the processes creating them.

Students must understand the effects of physical systems on Earth's surface. Understanding these themes enables students to see how the changing physical environment is the stage for all human activity.

*Satellite thermal imaging of sea surface temperatures often displays the uneven heating between the tropic and the arctic regions. These images can be used in oceanographic research including the prediction of tropical storms. Data source: NASA Aqua MODIS Sea Surface Temperature September 2011.*

**GEOGRAPHY STANDARD 7: The physical processes that shape the patterns of Earth's surface**

**4<sup>th</sup> GRADE**

the student knows and understands:

**Components of Earth's Physical Systems**

**1. There are four components of Earth's physical systems (the atmosphere, biosphere, hydrosphere, and lithosphere)**

Therefore, the student is able to:

- A. Identify attributes of Earth's different physical systems, as exemplified by being able to
  - ▶ Identify different attributes of physical systems in photographs (e.g., sky, clouds, plants, soil, oceans, lakes, mountains).
  - ▶ Identify examples of water features on Earth's surface that comprise the hydrosphere (e.g., oceans, rivers, lakes, water vapor, ground water, different types of precipitation).
  - ▶ Identify examples of landforms on Earth's surface (e.g., mountains, volcanoes, valleys, plains).



Wind, water, and freeze-thaw erosion has resulted in unusual rock formations including the spires or "hoodoos" in Utah's Bryce Canyon National Park.

**8<sup>th</sup> GRADE**

the student knows and understands:

**Components of Earth's Physical Systems**

**1. The four components of Earth's physical systems (the atmosphere, biosphere, hydrosphere, and lithosphere) are interdependent**

Therefore, the student is able to:

- A. Identify and describe patterns in the environment that result from the interaction of Earth's physical processes, as exemplified by being able to
  - ▶ Identify and describe the connections between ocean circulation system and climate (e.g., North Atlantic Drift and the mild climate of Western Europe, the climatic effects of El Niño or La Niña).
  - ▶ Identify and describe the patterns that result from the connections between climate and vegetation (e.g., examples of patterns of ecosystems and biomes).
  - ▶ Identify and describe the patterns of physical features that result from erosion and deposition (e.g., estuaries and deltas, canyons, alluvial plains, sand dunes).
- B. Analyze and explain patterns of physical features resulting from the interactions of Earth's physical processes, as exemplified by being able to
  - ▶ Analyze maps of tectonic plates to predict the location of physical features (e.g., mountain ranges, volcanoes, rift valleys).
  - ▶ Analyze the pattern of glacial features as a result of glacial retreat (e.g., moraines, kettle lakes, cirques).
  - ▶ Analyze and explain factors influencing precipitation patterns and predict where the patterns will occur (e.g., convectional, orographic, frontal).

**12<sup>th</sup> GRADE**

the student knows and understands:

**Components of Earth's Physical Systems**

**1. The interactions of Earth's physical systems (the atmosphere, biosphere, hydrosphere, and lithosphere) vary across space and time**

Therefore, the student is able to:

- A. Explain how the effects of physical processes vary across regions of the world and over time, as exemplified by being able to
  - ▶ Explain the changing relationships among climate, vegetation, and landforms (e.g., desertification and soil degradation, glacial advances and retreats).
  - ▶ Analyze and explain the differential effects on climate of the relationship between water and wind at different latitudes (e.g., cold currents influence the creation of deserts at 20 and 30 degrees north and south latitudes, the formation of hurricanes and tropical storms).
  - ▶ Analyze and explain the relationships between physical processes and the location of land features (e.g., river valleys, canyons, deltas, glaciated lakes and moraines, limestone deposits, caves, alluvial fans, canyons).
- B. Explain the ways in which Earth's physical processes are dynamic and interactive, as exemplified by being able to
  - ▶ Explain how volcanic eruptions and forest fires change atmospheric conditions and disrupt the nitrogen and carbon cycles.
  - ▶ Explain how increasing surface temperatures result in melting ice sheets and rising sea levels.
  - ▶ Construct a diagram illustrating how El Niño and La Niña form and how these influence weather in different locations on Earth.

## GEOGRAPHY STANDARD 7: The physical processes that shape the patterns of Earth's surface

**4<sup>th</sup> GRADE**

the student knows and understands:

## Earth – Sun Relationships

**2. Earth–Sun relationships affect conditions on Earth**

Therefore, the student is able to:

- A. Describe how Earth's position relative to the Sun affects conditions on Earth, as exemplified by being able to
- ▶ Describe the relationship between the cycle of seasons and months in the Northern and Southern hemispheres.
  - ▶ Describe the differences in seasons based on latitude (e.g., first and last frost in different locations, length of growing season, bird migrations).
  - ▶ Describe the changes in daily sunrise and sunset and length of daylight hours by recording the change in times over the span of the school year.

## Physical Processes

**3. Physical processes shape features on Earth's surface**

Therefore, the student is able to:

- A. Identify examples of physical processes, as exemplified by being able to
- ▶ Identify different cycles in Earth's systems (e.g., water cycle, carbon cycle, wind or water erosion, weathering, deposition, mass wasting).
  - ▶ Identify the components and relationships in the water cycle.
  - ▶ Identify the components and relationships in the erosion cycle (e.g., water carving canyons, wind sculpting mesas, landslides, avalanches).
- B. Describe how physical processes shape features on Earth's surface, as exemplified by being able to
- ▶ Describe **landforms** by constructing 3-D physical models and organize the models into groups formed by similar processes.
  - ▶ Describe the physical processes that shaped particular landform features using pictures of landforms such as canyons, mesas, and deltas.
  - ▶ Describe how **freeze–thaw** processes erode rock (e.g., potholes on local streets, rock slides in mountain regions).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Earth – Sun Relationships

**2. Earth–Sun relationships drives physical processes that follow an annual cycle and create patterns on Earth**

Therefore, the student is able to:

- A. Explain how Earth–Sun relationships drive Earth's physical processes and create annual patterns, as exemplified by being able to
- ▶ Explain the occurrences of weather phenomena in different locations due to annual changes in the Earth–Sun relationship (e.g., hurricanes in the fall in subtropical areas, monsoon rainfall, tornadoes in the mid-latitudes during the spring and summer).
  - ▶ Explain why the hours of visible sunlight changes with seasons (e.g., the equatorial region experiences approximately 12 hours of sunlight year round while places in the Arctic and Antarctic circles vary from 0 to 24 hours of visible sunlight).
  - ▶ Describe how the angle of the Sun's rays changes at different latitudes by shining a light directly on the equator of a globe and noting the change in the location (on the tropic lines) and angle of the direct rays as the tilted globe is moved to represent the different seasons.

## Physical Processes

**3. Physical processes generate patterns of features across Earth's surface**

Therefore, the student is able to:

- A. Analyze and explain the patterns that occur on Earth's surface as a result of physical processes, as exemplified by being able to
- ▶ Explain the effects of variations in seasonal precipitation on rivers or vegetation (e.g., amount of snowfall, flash floods, 100-year rain event on rivers, lakes, shorelines, forests).
  - ▶ Explain how physical processes related to plate tectonics form islands (e.g., Hawaiian Islands) or increase the elevation of mountains (e.g., Himalayan Mountains).
  - ▶ Explain the effects of erosion processes on landscape features over time (e.g., Chimney Rock, Devil's Tower, Grand Canyon, Arches National Park).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Earth – Sun Relationships

**2. Earth–Sun relationships are variable over long periods of time resulting in changes in physical processes and patterns on Earth**

Therefore, the student is able to:

- A. Explain how variability in Earth–Sun relationships affect Earth's physical processes over time, as exemplified by being able to
- ▶ Explain how cyclic changes (e.g., precession or Milankovich cycle) in Earth's orbit are responsible for changes in heating that result in climatic changes such as an ice age and glaciation of Earth's surface.
  - ▶ Describe the variability in climate over historic periods of time (e.g., over the last 1,500 years or during epochs such as the Pleistocene).
  - ▶ Explain how changes in sea coral (including current observations and fossil records) are due to sea level rise or fall as a result of climate variability.

## Physical Processes

**3. Physical processes interact over time to shape particular places on Earth's surface**

Therefore, the student is able to:

- A. Analyze and explain the results of interactions of physical processes over time, as exemplified by being able to
- ▶ Identify the landforms that comprise much of Bangladesh and explain the physical processes that make the country susceptible to river flooding, monsoon flooding, and cyclonic storms.
  - ▶ Analyze and explain the landscape of Iceland in terms of physical processes (e.g., volcanism, glaciation, plate tectonics of the mid-Atlantic ridge).
  - ▶ Compare and contrast the Great Lakes of East Africa and the Great Lakes of North America and describe physical processes that created each of these lake systems.



**GEOGRAPHY STANDARD 7: The physical processes that shape the patterns of Earth's surface**



Image credit: Lydia J. Lewis

*Glaciers, such as the Monacobreen Glacier in Spitzbergen, Svalbard, move and sculpt the land surface resulting in landforms including lakes, valleys, cirques, and moraines.*

## GEOGRAPHY STANDARD 8: The characteristics and spatial distribution of ecosystems and biomes on Earth's surface



Image credit: James F. Marran

*A desert biome near Pinnacle Peak, Arizona supports plant and animal species that have adapted to arid conditions.*



Image credit: Lydia J. Lewis

*Changes in the amount and patterns of Arctic sea ice may affect living things in fragile polar ecosystems.*

**The geographically informed person** must understand that Earth's surface is home to multiple biophysical communities. All elements of the environment, including the human, are part of many different but nested ecosystems that comprise different biomes. Ecosystems and biomes, defined by specific plant and animal communities interacting with the physical environment, are unevenly distributed on Earth's surface.

Therefore, Standard 8 contains these themes: Components of Ecosystems, Characteristics and Geographic Distribution of Ecosystems, and Characteristics and Geographic Distribution of Biomes.

Ecosystems and biomes are integral parts of the biosphere and interact with the atmosphere, hydrosphere, and lithosphere to form areas varying in size, shape, scale, and complexity. An ecosystem, for example, might be as small as a stand of oak trees or a pond or as large and complex as a vast desert or rainforest. Ecosystems that share similar characteristics of climate and vegetation can be grouped together to form regional-scale regions known as biomes. These biomes include Earth's tropical and temperate forests, savannahs and scrublands, grasslands, deserts, tundra, and oceans.

Changes in one ecosystem can have a ripple effect, with varying degrees of impact, as those changes influence other ecosystems, ultimately affecting the structures of the larger biomes. While ecosystems and biomes create both stability and equilibrium on Earth's surface, they can be altered by large-scale natural events such as volcanic eruptions, increases in surface temperature, or long-term droughts, or by human interventions such as overgrazing grasslands and clearing rainforests that may occur without an understanding of the environmental consequences.

Knowing how ecosystems and biomes function will enable students to make informed decisions about the sustainable uses of the natural world in the future. Global climate change is a reality with the potential of inflicting unimagined outcomes on the planet. The degree to which present and future generations understand the critical role they must play in maintaining healthy ecosystems and biomes will determine, in large measure, the quality of human life on Earth.

Students must understand how ecosystems and biomes form a fragile web of ecological interdependence. Understanding these themes enables students to appreciate our dependence on ecosystems and biomes and understand how we can live in environmentally sustainable ways.

**GEOGRAPHY STANDARD 8: The characteristics and spatial distribution of ecosystems and biomes on Earth's surface**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Components of Ecosystems**

**1. The components of ecosystems**

*Therefore, the student is able to:*

- A. Identify the components of different ecosystems, as exemplified by being able to
  - ▶ Identify the three major components of an ecosystem (i.e., biomass, climate, and soil).
  - ▶ Identify examples of each ecosystem component (e.g., pine trees versus grasslands, low versus high rainfall, clay versus sandy soils).
  - ▶ Describe local ecosystems by surveying and recording the properties of their components.

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Components of Ecosystems**

**1. Components of ecosystems are interdependent**

*Therefore, the student is able to:*

- A. Describe how the components of ecosystems are connected and contribute to the energy of their own cycles, as exemplified by being able to
  - ▶ Describe the flow of energy and the cycling of matter through an ecosystem (e.g., the food chain, photosynthesis).
  - ▶ Identify and describe how carbon can be absorbed and stored in Earth's physical systems (e.g., oceans, tropical forests, vegetation).
  - ▶ Identify and describe the variable components in an ocean ecosystem that influence the interdependencies in an ecosystem (e.g., water temperature, depth, salinity, acidity, plants, fish, and marine mammals in an aquatic ecosystem).
- B. Construct a model to explain how an ecosystem works, as exemplified by being able to
  - ▶ Construct a food chain or web of food chains by sequentially arranging pictures or samples of a variety of living things (e.g., fungi, insects, plants, animals) to identify interactions within ecosystems.
  - ▶ Construct an aquarium or terrarium to explain the interacting components in an ecosystem.
  - ▶ Construct a flow chart to explain the interactions of components within an ecosystem (e.g., water cycle, oxygen and carbon dioxide exchange, producers, consumers, and decomposers).

**12<sup>th</sup> GRADE**

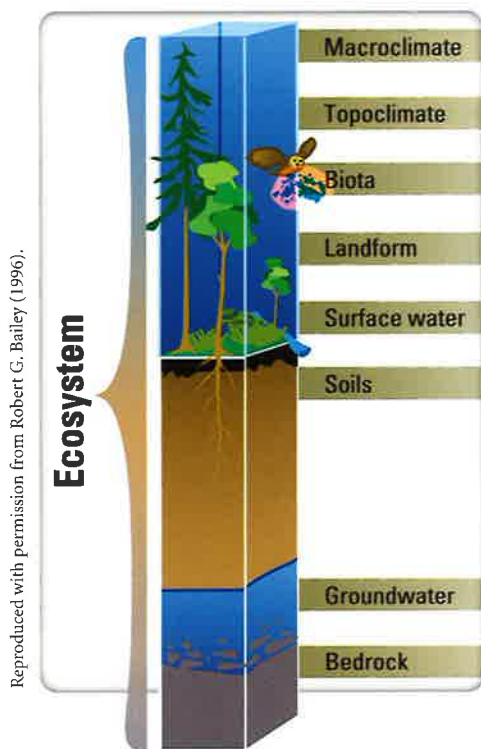
*the student knows and understands:*

**Components of Ecosystems**

**1. Ecosystems are dynamic and respond to changes in environmental conditions**

*Therefore, the student is able to:*

- A. Explain how there are short-term and long-term changes in ecosystems, as exemplified by being able to
  - ▶ Explain how there are short-term and long-term changes in ecosystems, as exemplified by being able to
  - ▶ Identify the sources of invasive species and explain the consequences for ecosystems (e.g., the impact of introduced species such as zebra mussels in the Great Lakes, Asian carp, Asian swamp eel, the impact of kudzu in the southeastern United States).
  - ▶ Explain the response of ecosystems to stress caused by physical events in terms of their characteristics and capacity to respond (e.g., changes in mangroves by tsunamis, changes in forest flora and fauna after a fire).
  - ▶ Explain how ecosystems respond to long-term changes in the physical environment (e.g., glacial retreat, volcanic eruptions, sea-level rise, increases in sea temperatures).
- B. Explain how local and global changes influence ecosystems, as exemplified by being able to
  - ▶ Explain how global climate change could influence the location and extent of existing ecosystems and the formation of new ones.
  - ▶ Analyze and predict how disruptions in local ecosystems force changes in cycles and sometimes result in new replacement ecosystems (e.g., beetles in pine forests, ecological succession after wildfires, drought, gypsy moth infestations in the eastern United States).
  - ▶ Explain how extreme localized weather events (e.g., hurricanes, tornadoes, wind storms) cause changes in ecosystems.



*The vertical structure of an ecosystem, showing the spatial integration of biological and nonliving components.*

Reproduced with permission from Robert G. Bailey (1996).

**GEOGRAPHY STANDARD 8: The characteristics and spatial distribution of ecosystems and biomes on Earth's surface****4<sup>th</sup> GRADE***the student knows and understands:***Characteristics and Geographic Distribution of Ecosystems****2. The characteristics of ecosystems***Therefore, the student is able to:*

- A. Identify and describe the characteristics of ecosystems, as exemplified by being able to
- ▶ Identify and describe the characteristics of an ecosystem (specific types of plants, climate, and soil) in which a favorite or interesting creature lives.
  - ▶ Identify and draw pictures of different plants and animals in various local ecosystems (e.g., a pond, forest, city park).
  - ▶ Compare the characteristics of different ecosystems (e.g., pond, deciduous forest, coral reef).

**Characteristics and Geographic Distribution of Biomes****3. The characteristics of biomes***Therefore, the student is able to:*

- A. Describe the characteristics of biomes, as exemplified by being able to
- ▶ Describe the defining characteristics of a biome as a large region of ecosystems with similar climate and vegetation characteristics.
  - ▶ Describe the temperature, precipitation, and vegetation characteristics of various biomes, (e.g., deserts, grasslands, savannahs, temperate forests, tropical forests, arctic tundra).
  - ▶ Identify the characteristics in photographs of different types of vegetation and match them to the appropriate sections of a world climate map (e.g., cacti and succulents on a desert climate region, tropical forest trees on a tropical climate region, coral in shallow, tropical marine waters).

**8<sup>th</sup> GRADE***the student knows and understands:***Characteristics and Geographic Distribution of Ecosystems****2. Physical processes determine the characteristics of ecosystems***Therefore, the student is able to:*

- A. Describe and explain how physical processes determine the characteristics of ecosystems, as exemplified by being able to
- ▶ Describe the rain shadow effect of orographic precipitation and identify the different ecosystems on the windward and leeward side of a mountain range or island (e.g., temperate rain forest on the windward side and high desert on the leeward side of the Cascade Mountain Range).
  - ▶ Explain how different locations can have similar ecosystems as a function of temperature, precipitation, elevation, and latitude by using climographs and vegetation maps.
  - ▶ Explain how ocean currents influence the characteristics of ecosystems (e.g., the Peru current and the Atacama Desert, the Benguela current and Namib Desert, East Indian current in the Bay of Bengal and monsoon season in India).

**Characteristics and Geographic Distribution of Biomes****3. Climate primarily determines the characteristics and geographic distribution of biomes***Therefore, the student is able to:*

- A. Describe and explain how climate (temperature and rainfall) primarily determines the characteristics and geographic distribution of biomes, as exemplified by being able to
- ▶ Construct climographs (using temperature and precipitation data) for several different biomes to explain the distribution of biomes.
  - ▶ Describe the changing vegetation zones with increasing altitude for a mountain located near the equator (e.g., Mount Kilimanjaro in Tanzania, Mount Chimborazo in Peru).
  - ▶ Explain how biomes do not always follow lines of latitude by identifying the influences of oceans and mountain ranges on the distribution of climate and vegetation.

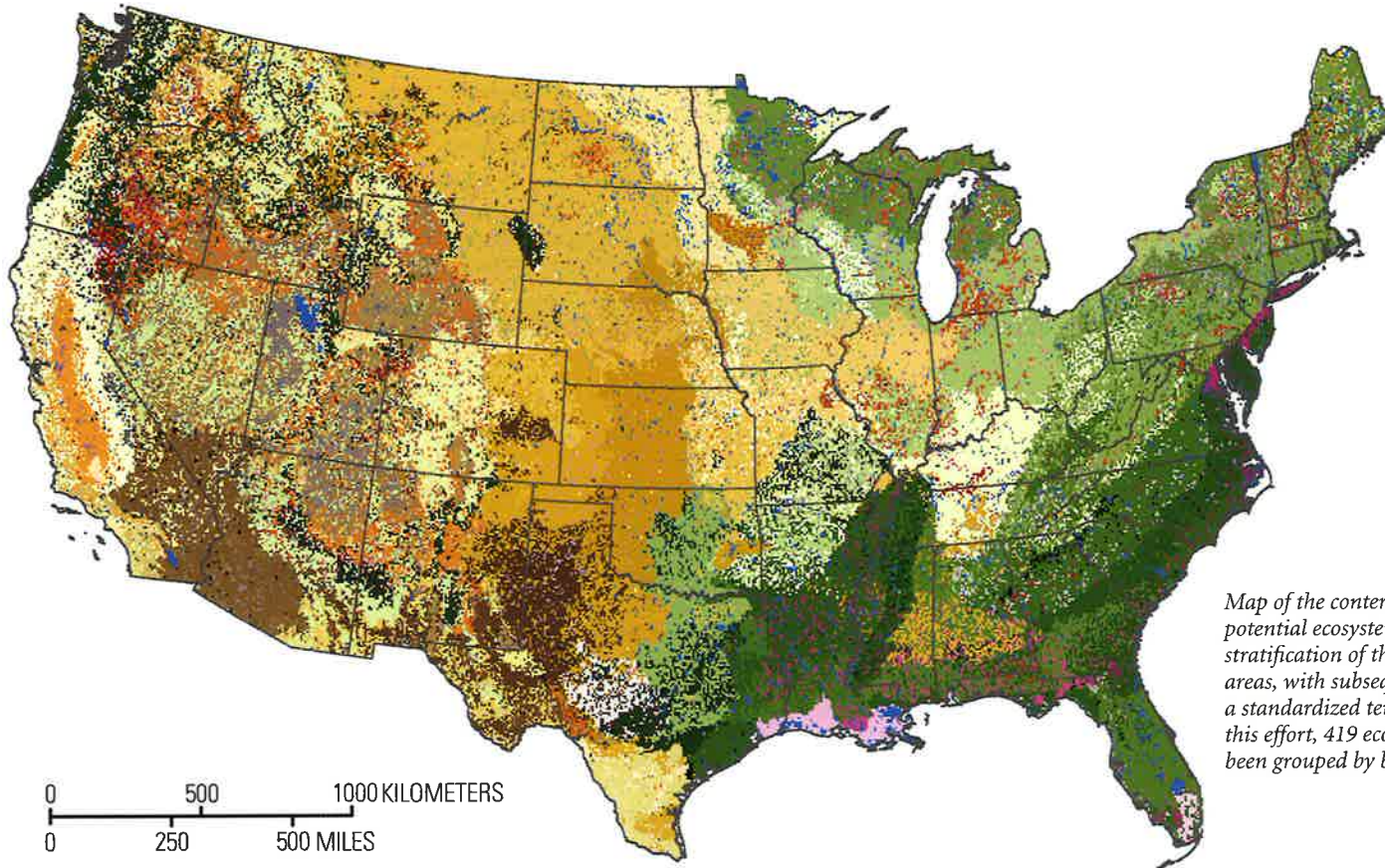
**12<sup>th</sup> GRADE***the student knows and understands:***Characteristics and Geographic Distribution of Ecosystems****2. The characteristics and geographic distribution of ecosystems***Therefore, the student is able to:*

- A. Explain the geographic distribution of ecosystems, as exemplified by being able to
- ▶ Describe and explain the factors that result in the geographic distribution of ecosystems (e.g., movement of tectonic plates creating the Galapagos Islands, Hawaiian Islands, Madagascar).
  - ▶ Analyze the impact of rising sea temperatures on the distribution and survival of coral reef ecosystems.
  - ▶ Analyze the impact of a river meandering or flooding on the distribution of wetlands over time.
- B. Evaluate ecosystems in terms of their biodiversity and productivity, as exemplified by being able to
- ▶ Evaluate ecosystems for their level of biodiversity and productivity (e.g., the low productivity of deserts and the high productivity of estuaries and tropical forests).
  - ▶ Compare the biodiversity and productivity in an ecosystem that is experiencing some form of stress with a similar healthy ecosystem.
  - ▶ Evaluate changes in the biodiversity and productivity of an ecosystem following the loss or introduction of a plant or animal species.

**Characteristics and Geographic Distribution of Biomes****3. The distribution and characteristics of biomes change over time***Therefore, the student is able to:*

- A. Explain how climate can influence and change the characteristics and geographic distribution of biomes, as exemplified by being able to
- ▶ Explain how rising global temperatures can cause changes in various biomes (e.g., melting permafrost in tundra, changes in the location of deserts, increases in the length of growing seasons).
  - ▶ Analyze the changes in the biomes of a particular region over time (e.g., the change of the Sahara from a grassland to a desert) and describe the climatic changes that caused these changes to occur.
  - ▶ Construct maps showing the post-Pleistocene changes in biomes in the Northern Hemisphere and explain the reasons for the changes.

**GEOGRAPHY STANDARD 8: The characteristics and spatial distribution of ecosystems and biomes on Earth's surface**



*Map of the conterminous United States showing potential ecosystems modeled from a biophysical stratification of the nation into physically distinct areas, with subsequent labeling of these areas using a standardized terrestrial ecosystem classification. In this effort, 419 ecosystems were mapped, and have been grouped by biomes in the legend.*

0 500 1000 KILOMETERS  
0 250 500 MILES

**Terrestrial Ecosystems**

- |  |   |
|--|---|
|  Forest and Woodland Ecosystems |  Woody Wetland Ecosystems      |
|  Herbaceous Ecosystems          |  Herbaceous Wetland Ecosystems |
|  Shrubland Ecosystems           |  Sparsely Vegetated Ecosystems |
|  Steppe/Savanna Ecosystems      |   |
|  Water                          |   |

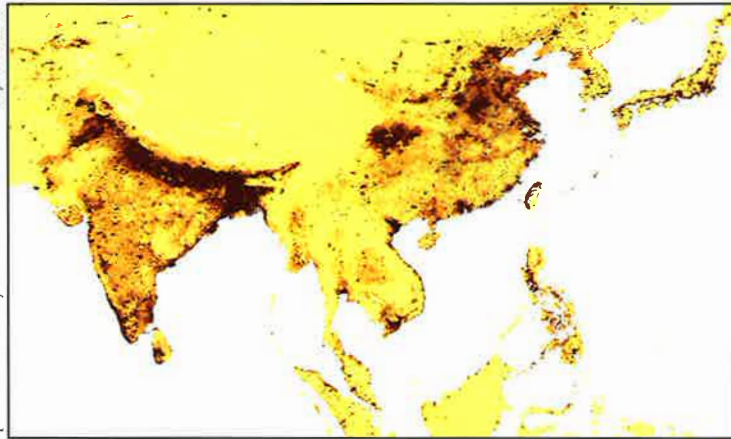
Map credit: US Geological Survey, 2009

## GEOGRAPHY STANDARD 9: The characteristics, distribution, and migration of human populations on Earth's surface



Image credit: William R. Strong

The population of the pilgrimage center of Shirdi, Maharashtra state, India is about 26,000, but each day more than 25,000 devotees visit the shrine of the popular guru Shirdi Sai Baba. During holidays that number may swell to 500,000 people.



Map credit: University of North Alabama/Lisa Keys-Matthews

A population density map shows the high population densities of regions in South and East Asia. Data source: Center for International Earth Science Information Network (CIESIN).

**The geographically informed person** must understand that the growth, spatial distribution, and movements of people on Earth's surface are driving forces behind not only human events but also physical events. Human population is a dynamic force in reshaping the planet. Advances in agriculture, sanitation, and health care have contributed to a dramatic increase in the number of people over the last few centuries. At the beginning of the twenty-first century, the world's population transitioned from being primarily rural to primarily urban.

Therefore, Standard 9 contains these themes: Characteristics of Population, Spatial Distribution of Population, and Migration.

The interaction between human and environmental conditions helps to explain the characteristics, spatial distributions, and movements of human populations. These characteristics can be described in terms of demographic concepts such as fertility and mortality rates, crude birth and death rates, natural increase and doubling time, race and ethnicity, and population structure (i.e., age distribution and age/sex ratio).

Population pyramids show the age and sex of a population. They also illuminate the impacts that wars or famine as well as education levels, urbanization, religion, or population policies have on the population in a country or region.

The spatial distribution and density of the world's population reflects a variety of factors. These include the influence of such physical features such as topography, soils, vegetation, climate types, and the availability of resources. Population distribution and density are also affected by human factors such as geopolitical structures, levels of economic development, and quality-of-life issues that address education, health care, housing, and employment opportunities. People move from place to place for voluntary and involuntary reasons. Pull factors may make another place seem more attractive and beneficial and therefore convince people to migrate. Push factors are often unpleasant or life-threatening conditions that force people to leave a place.

Movement occurs on many scales such as families moving to the suburbs, job seekers moving to a more prosperous part of the country, or mass migrations of people to other countries due to famine or political unrest. Moves may take place over distances from a few miles to thousands of miles. Some people move many times in their lifespans, others never. Some migration streams persist over several generations or centuries.

Students must understand how the characteristics, spatial distribution, and movement of human population change. Understanding these themes enables students to understand the essential connection between human population and social, political, and ecological issues.

**GEOGRAPHY STANDARD 9: The characteristics, distribution, and migration of human populations on Earth’s surface**

**4<sup>th</sup> GRADE**

the student knows and understands:

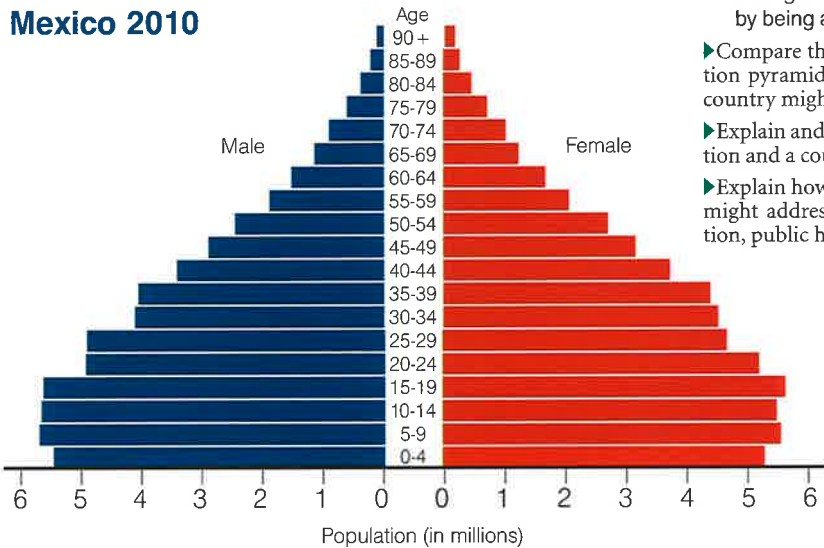
**Characteristics of Population**

**1. Demographic characteristics can be used to describe a population**

Therefore, the student is able to:

- A. Describe and compare the demographic characteristics of people in the local area, as exemplified by being able to
  - ▶ Identify and describe the demographic characteristics (e.g., age in months and sex) of the students in the classroom by constructing a population pyramid representing the student data.
  - ▶ Describe the demographic characteristics (e.g., age, sex, race/ethnicity) of the local community and identify the types of services or businesses that might be in demand (e.g., parks and schools for communities with younger populations, medical and senior centers for communities with older populations, restaurants and shops to meet the needs of ethnic groups).
  - ▶ Describe the demographic characteristics of a local county using the US Census data and compare it to the prior Census report to identify trends or changes in the population of the county over time.

**Mexico 2010**



A population pyramid shows the age and sex structure of Mexico’s population in 2010. The wide base shows a large number of children in the population. The small bars at the top show slightly more women living longer than men.

Data source: US Census Bureau International Data Base.

**8<sup>th</sup> GRADE**

the student knows and understands:

**Characteristics of Population**

**1. Demographic concepts help explain the structures of populations**

Therefore, the student is able to:

- A. Describe and explain the demographic concepts of fertility and mortality, crude birth and death rates, natural increase and doubling time, race and ethnicity, as exemplified by being able to
  - ▶ Describe the demographic and socioeconomic characteristics of countries that have high and low crude birth rates and high and low crude death rates.
  - ▶ Describe how the rate of natural increase is calculated and how it contributes to determining the population growth rate of a country.
  - ▶ Describe the role of population doubling time in planning for services and facilities in a country with population growth (e.g., building schools, hospitals, housing, transportation, food stability, employment).
- B. Compare the structures of populations in different places through the use of key demographic concepts, as exemplified by being able to
  - ▶ Compare the population structures of two countries using population pyramids and describe what the population structure for each country might be 20 years in the future.
  - ▶ Explain and compare the issues a country with a very young population and a country with a very old population might need to address.
  - ▶ Explain how countries with different types of population structures might address policies (e.g., national defense, education, immigration, public health care).

**12<sup>th</sup> GRADE**

the student knows and understands:

**Characteristics of Population**

**1. Culture, economics, and politics influence the changing demographic structure of different populations**

Therefore, the student is able to:

- A. Explain the demographic history of countries using the demographic transition model, as exemplified by being able to
  - ▶ Compare the experiences of European countries that underwent the demographic transition in the 18th and 19th centuries and Asian countries experiencing the demographic transition in the 20th and 21st centuries.
  - ▶ Explain how the demographic transition model may be used to predict population trends in different countries (e.g., when moving from a subsistence agricultural economy to a more diverse market economy).
  - ▶ Describe and explain the effects of changing dependency ratios in a country during the demographic transition (e.g., slowing population growth requires proportionately fewer people to support more people in the upper ages of a population, faster growing populations have more workers to support aging populations).
- B. Evaluate the effects of governmental policies on population characteristics, as exemplified by being able to
  - ▶ Describe and evaluate the possible effects of a nation’s policies in terms of population growth (e.g., immigration limits, tax incentives or penalties influencing the number of births, foreign policy agreements affecting migration for documented workers).
  - ▶ Describe and explain possible obstacles a country or government might encounter in establishing limited population growth policies (e.g., cultural and religious beliefs, traditional beliefs about family size, gender roles in the society).
  - ▶ Explain and evaluate the effects of public health programs on population growth in different countries (e.g., Sweden, China, Saudi Arabia, Germany, Kenya).

**GEOGRAPHY STANDARD 9: The characteristics, distribution, and migration of human populations on Earth's surface****4<sup>th</sup> GRADE***the student knows and understands:***Spatial Distribution of Population****2. People live in many different places on Earth***Therefore, the student is able to:*

- A. Describe how the number of people varies from place to place, as exemplified by being able to
- ▶ Identify and describe the locations of types of places where different numbers of people live in the local area (e.g., city high-rise apartments, single-family suburban homes, row houses, apartment buildings and complexes).
  - ▶ Describe how ways of making a living influence how many people live in a certain place (e.g., farm communities versus cities).
  - ▶ Identify and describe places in the state where the greatest and fewest numbers of people live.
- B. Explain why people live in different types of places, as exemplified by being able to
- ▶ Describe and explain why the founders of the local community elected to settle there (e.g., easily accessible or defensible, acceptable climatic conditions, proximity to other resources or transportation routes).
  - ▶ Identify and describe the places in the world where the majority of people live using satellite images or population density maps and how these places may differ.
  - ▶ Explain why people sometimes settle in inhospitable environments (e.g., availability of valuable resources, economic opportunities, diminishing availability of more desirable locations).

**8<sup>th</sup> GRADE***the student knows and understands:***Spatial Distribution of Population****2. The distribution and density of population varies over space and time***Therefore, the student is able to:*

- A. Explain the concepts of population distribution and density and how they change over time, as exemplified by being able to
- ▶ Identify and explain how the distribution and density of populations shift through time (e.g., movement of people westward out of the 13 US colonies, rural to urban migration in China).
  - ▶ Explain how both rural to urban migration and internal growth rate are changing the population size and density of large world cities.
  - ▶ Analyze and explain the positive and negative consequences of the migration of large numbers of people in a country (e.g., shift in US population from the northern industrial cities to the Sunbelt cities after the decline in US manufacturing and assembly jobs beginning in the late 20th century, migration of African Americans from the rural South to northern cities).
- B. Analyze and explain the variations of population distribution on national and global scales, as exemplified by being able to
- ▶ Describe and analyze the current distribution of population in the United States (e.g., comparing the East and West Coasts, pattern of population east versus west of the 100th meridian).
  - ▶ Analyze and explain why the majority of the world's population is located close to coastlines.
  - ▶ Analyze and explain how the population distribution and density vary by continent.

**12<sup>th</sup> GRADE***the student knows and understands:***Spatial Distribution of Population****2. Population distribution and density are a function of historical, environmental, economic, political, and technological factors***Therefore, the student is able to:*

- A. Identify and explain how historical, environmental, economic, political, and technological factors have influenced the current population distribution, as exemplified by being able to
- ▶ Identify and explain the role technology plays in increasing the population density in cities (e.g., high-rise structures, sanitation, public transportation systems, concentration of business activities).
  - ▶ Identify and explain the factors contributing to the changing distribution of population in developing countries (e.g., growth of cities in eastern Africa as a result of drought in agricultural areas, growth in cities in India due to high-tech industries).
  - ▶ Explain how transportation routes create corridors of higher population-density clusters in rural areas and in between major cities (e.g., railroad access and routes, interstate highway systems, river and canal access).
- B. Analyze demographic data and identify trends in the spatial distribution of population, as exemplified by being able to
- ▶ Analyze US Census data and immigration tables to predict demographic changes that might influence future electoral politics in a state or region (e.g., Hispanic population growth in some regions, redistricting changing the number of congressional districts, shifts in retirement destinations).
  - ▶ Analyze the population growth rate for several countries and describe the pattern of population distribution that would most likely occur in each country as it grows over time.
  - ▶ Analyze the possible effects of climate change on the growth and distribution of people in areas such as the Sahel, Pakistan, China, etc.



## GEOGRAPHY STANDARD 9: The characteristics, distribution, and migration of human populations on Earth's surface

**4<sup>th</sup> GRADE**

the student knows and understands:

## Migration

**3. People move for a variety of reasons**

Therefore, the student is able to:

- A. Describe examples of different human migrations, as exemplified by being able to
- ▶ Describe why and how people moved west during the California Gold Rush.
  - ▶ Describe why and how the Pilgrims moved from England to the US colonies.
  - ▶ Describe why and how Native Americans moved to federally designated reservations.
- B. Explain why people move from one place to another, as exemplified by being able to
- ▶ Explain the reasons why people might be willing to move to a new location (e.g., for more or better jobs, for better living conditions).
  - ▶ Explain reasons why people may feel forced to leave their current homes to go to a new location (e.g., fear of war, religious persecution, famine).
  - ▶ Explain how groups of people may be forced to move against their wills (e.g., African slave trade, Cherokee Trail of Tears, Japanese internment camps in World War II).
- C. Describe how people and places change as a result of migration, as exemplified by being able to
- ▶ Describe how the movement of people into cities can change the need for housing and services.
  - ▶ Describe the ways in which immigrant groups coming to the United States change after arriving and living in the new location (e.g., learned a new language, change in jobs, change in types of available housing).
  - ▶ Describe how neighborhoods can change as new groups of people settle in close proximity to each other (e.g., new ethnic restaurants and grocery stores, signs in multiple languages, observance of new festivals and holidays based on ethnic or national tradition).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Migration

**3. There are multiple causes and effects of migration**

Therefore, the student is able to:

- A. Identify and describe the types of migrations in terms of time, distance, and cause, as exemplified by being able to
- ▶ Identify and describe examples of short-term migrations (e.g., temporary workers going to another country or region, people on pilgrimages, refugees from environmental hazards).
  - ▶ Identify and describe examples of involuntary versus voluntary migrations (e.g., war or famine refugees, emigrating for work or education, deployed military units, forced migration of the African slave trade).
  - ▶ Describe examples of migrations in the United States for work or recreation (e.g., seasonal fishing in Alaska; retirees spending part of the year in Florida, Texas, or Arizona; college students to spring break destinations).
- B. Identify and explain push and pull factors influencing decisions to migrate, as exemplified by being able to
- ▶ Identify and explain the role of pull factors (e.g., better jobs, cultural opportunities, better education) as reasons for migration.
  - ▶ Identify and explain the role of push factors (e.g., political unrest or war, famine, loss of jobs) as reasons for migration.
  - ▶ Explain reasons for temporary migration streams or chain migration (e.g., movements of seasonal workers in agriculture, movements of workers from Indonesia and Pakistan to the Persian Gulf states, movements of people from rural areas to nearby small towns to distant big cities).
- C. Describe the consequences of migration for people as well as on the origin and destination places, as exemplified by being able to
- ▶ Identify and describe positive and negative impacts that might occur at the places of origin for emigration (e.g., falling real estate prices, money being sent back home by migrants, fewer people to pay taxes resulting in reduced government resources in the original location).
  - ▶ Identify and describe positive and negative impacts that might occur at migration destinations (e.g., increased real estate prices, more competition for jobs and possible impact on local wage rates, increased tax base, increased economic activity).
  - ▶ Explain the effects on northern Plains states of long-term out migration, especially of graduating high school students (e.g., an aging population requiring social services, the closing of stores in small towns, schools closing as a result of declines in school-age populations).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Migration

**3. Migration is one of the driving forces for shaping and reshaping the cultural and physical landscape of places and regions**

Therefore the student is able to:

- A. Compare and explain different examples of migrations in terms of the "laws of migration," as exemplified by being able to
- ▶ Explain situations where the migration flow also produces a "counter-flow" in the opposite direction (e.g., stream of workers who return to their original locations, money sent back to original locations by migrant workers).
  - ▶ Compare examples of recent migrations that are rural to urban (e.g., rural residents into fast-growing cities in developing countries, workers in the suburbs moving into the cities to reduce commute times and expenses).
  - ▶ Explain reasons why most migrants traveling long distances usually settle initially in urban areas.
- B. Evaluate and explain the impact of international migration on physical and human systems, as exemplified by being able to
- ▶ Identify areas where transborder forced migrations have occurred and explain the effects on both areas (e.g., movements from Afghanistan into Pakistan, movements from central African nations, movements of Kurds among Turkey, Iran, and Iraq).
  - ▶ Explain the potential effects of cross-border migration to an area that is not able to easily absorb an influx of people (e.g., increased demand for food production, shortages of fresh water, shortages of sanitation services, pressure on medical facilities).
  - ▶ Analyze and evaluate the impacts of post-Soviet migrants on places such as Europe, the Middle East, and North America.
- C. Compare and explain the ways in which different groups and governments adjust to the departure and arrival of migrants, as exemplified by being able to
- ▶ Describe the benefits and challenges migrants face in bridging cultures and adjusting to a new place (e.g., resolving conflicts between old and new traditions, resolving differences between rates of adjustment when children may learn the language and adjust faster than parents, resolving differences in access to food items and traditional cooking methods in a new place).
  - ▶ Compare the immigration policies of different countries and explain the reasons contributing to the development of these policies (e.g., shortage of workers, high unemployment rates, concerns about cultural differences).
  - ▶ Explain the reasons for and effects of policies designed to deal with the results of diaspora (e.g., Israel's Law of Return, the origins of Liberia and Sierra Leone as colonies for freed enslaved persons).

**GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics**



Image credit: D.J. Zeigler

*Both boys and men wear traditional Sikh turbans. This group is resting at the Sikh Gurudwara Bangla Sahib, one of the most magnificent temple complexes in New Delhi.*



Image credit: D.J. Zeigler

*Bright colors and geometric designs decorate the traditional fishing boats in Malta's harbors.*

**The geographically informed person** must understand that culture is an intricate and complex idea. As the learned behavior of people, culture shapes each group's way of life and its own view of itself and other groups. An increasingly interdependent world results in different culture groups coming into contact more than ever before. Thus, it becomes essential to understand the characteristics and spatial distribution of Earth's cultural mosaics.

Therefore, Standard 10 contains these themes: Characteristics of Culture, Patterns of Culture, and Cultural Diffusion and Change.

Culture is a complex, multifaceted concept encompassing social structures, languages, belief systems, institutions, technology, art, architecture, dress, foods, and traditions of groups of humans. Each cultural group has a way of life that often results in landscapes and regions with distinctive features. Language, for example, represents and reflects many aspects of a culture and can be analyzed for clues about the values and beliefs of a culture group. Cultural landscapes may overlap, thus forming elaborate mosaics of peoples, places, and environments that can exist at various spatial scales.

Whichever characteristic of culture is considered, it is clear that the mosaics of cultural landscapes on Earth are not static. As the world becomes increasingly interconnected and interdependent, cultural groups have greater and more varied contacts with each other. This increased contact influences the way in which people can reject or borrow, adopt, and adapt new ideas, thus reshaping the characteristics of a cultural region. Culture changes as a result of the migration of people, the diffusion of ideas, and the development of new technologies. The processes of cultural change accelerate with improvements in transportation and communication. Cultures have borrowed attributes from other cultures whether knowingly or not, willingly or not, permanently or not. Cultures change and even disappear as old ways of doing things die out in response to the homogenizing forces of modern society.

As members of a multicultural society, students must understand the diverse spatial expressions of culture. Understanding these themes enables students to place their own cultural background and heritage into the context of a constantly changing multicultural world as well as to recognize and respect other cultures that may be different from their own.

**GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Characteristics of Culture**

**1. A culture has distinctive characteristics**

*Therefore, the student is able to:*

A. Identify and describe the characteristics of a culture, as exemplified by being able to

▶ Identify and describe distinctive characteristics of their own cultural heritage (e.g., cuisine or agricultural products, traditional festivals or celebrations, vocabulary terms that locals would know and understand but outsiders might find confusing).

▶ Identify and describe the distinctive characteristics of current US cultures (e.g., spoken and written languages, social organizations, beliefs and customs, forms of architecture, educational systems).

▶ Identify and describe the distinctive cultural characteristics of groups that immigrated to the United States in the past.

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Characteristics of Culture**

**1. There are many different cultures, each with its own distinctive characteristics**

*Therefore, the student is able to:*

A. Compare the cultural characteristics of different cultures, as exemplified by being able to

▶ Compare examples of distinctive cultural characteristics that can be observed in different neighborhoods in the local community.

▶ Describe and explain how a cultural characteristic from one culture may be adopted in another culture (e.g., sushi bar at a truck stop, African drumming patterns in US music, cultural holiday customs practiced in new locations).

▶ Describe and explain the spatial patterns of different cultural characteristics across regions or countries (e.g., the pattern of languages and dialects within a country, the architectural styles predominant in rural areas of European countries, the worldwide distribution of different religions).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Characteristics of Culture**

**1. Cultural systems provide contexts for living in and viewing the world**

*Therefore, the student is able to:*

A. Describe and explain the characteristics that constitute any particular cultural system (e.g., Amish, Japanese, Maori), as exemplified by being able to

▶ Describe and explain how the extended family networks and limited use of technology influence the Amish culture in the United States.

▶ Describe and explain the historical role of the caste system and arranged marriages in the Indian cultural system.

▶ Explain how local customs can contribute to a group's culture (e.g., lion hunting by Masai cattle herders in East Africa, outrigger canoe navigation by Pacific Island cultures).

B. Explain how different cultures provide contexts from which people may view the world differently, as exemplified by being able to

▶ Describe and explain how a current event might be viewed differently from the context of different cultures (e.g., the results of a US presidential election, the impact of a natural disaster such as Hurricane Katrina or a tsunami in the Indian Ocean, the global spread of US companies such as Wal-Mart, Starbucks, or McDonalds).

▶ Explain how cultures may view the roles of women in society differently.

▶ Explain how cultures may have differing views of business practices (e.g., markets where prices are negotiated rather than fixed, bartering for goods versus purchasing them).



*Spices for sale at a local market in Egypt are reflective of cultural traditions in food preparation.*

Image credit: Rik Katz

## GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics

**4<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Culture

**2. Cultures leave imprints on the physical environment in the form of cultural markers**

Therefore, the student is able to:

- A. Identify and describe examples of cultural markers (e.g., buildings, place names, monuments), as exemplified by being able to
  - ▶ Identify and describe the names of businesses in the local community that indicate a connection to a culture.
  - ▶ Identify and describe the place names of streets and buildings in the local community that may be connected to a cultural group that lived in the local area at some prior time.
  - ▶ Identify examples of different religious or institutional structures in the community and describe the connections to cultural groups in the community.



Catholic Spanish missions such as this one in Ranchos de Taos, New Mexico were constructed throughout the southwestern United States using local adobe building materials.

**8<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Culture

**2. Multiple cultural landscapes exist and vary across space**

Therefore, the student is able to:

- A. Explain how a cultural landscape is the physical expression of a culture, as exemplified by being able to
  - ▶ Describe how human settlements and archaeological remains illustrate the human imprint on the physical environments they occupied (e.g., the Cahokia Mounds left by Native Americans in southern Illinois, Pompeii ruins in Italy as a result of the volcanic eruption in ancient times, speculation about the stone statuary on Easter Island).
  - ▶ Describe the architectural styles of residential structures in selected world regions and explain how differences in the structures reflect differences in the respective cultures (e.g., yurts in Mongolia, pueblos in the American Southwest, villas in Italy).
  - ▶ Identify the place names of towns in a particular region and explain how they serve as cultural markers on the landscape (e.g., US town names connected to prior European homelands, locations with names from an indigenous language, names of immigrant settlements).
- B. Compare different cultural landscapes, as exemplified by being able to
  - ▶ Identify and compare the spatial patterns of retail sales areas in different cultural regions (e.g., suburban malls surrounded by large parking areas in the United States, densely packed pedestrian markets or souks in North Africa, floating markets on the rivers of Southeast Asia).
  - ▶ Compare the cultural landscapes of urban and suburban residential areas in terms of the amount of space, population density, and horizontal versus vertical use of space.
  - ▶ Compare the cultural landscapes of indigenous peoples with the societies that replaced them (e.g., the Sami people versus Nordic peoples, the Maori versus European settlements, South African !Kung versus Dutch settlements).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Culture

**2. Cultural landscapes exist at multiple scales**

Therefore the student is able to:

- A. Identify and analyze the spatial patterns of cultural landscapes at multiple scales, as exemplified by being able to
  - ▶ Describe the cultural landscapes of two large cities in the United States and analyze the commonalities and differences of their built environments (e.g., Boston versus Los Angeles, Seattle versus Phoenix).
  - ▶ Describe and analyze the characteristics of the cultural landscapes of different neighborhoods in a city (e.g., architectural styles, signage for businesses, density of the residents, amount of green space, type of economic activities conducted there).
  - ▶ Analyze and explain the varying impacts of tourism on local cultural landscapes (e.g., cruise ship ports of call such as Prince Edward Island, Cozumel, and Venice; crowds at Angkor Wat with the needs of the local residents; ecotourism impacts versus highly commercialized resorts).
- B. Explain differences in the human imprints on the physical environment of different cultures, as exemplified by being able to
  - ▶ Explain how predominant agricultural practices in different cultures result in different imprints on the physical environment (e.g., forest removal for cattle ranches in the Amazon, terrace construction for rice farming in China, changes in land use patterns as a result of center pivot irrigation in the western United States).
  - ▶ Explain examples of the imprints on the physical environment of past cultures (e.g., the landscape of Egypt with pyramids and irrigation, Mayan temples and agricultural fields, Ancestral Puebloan cliff dwellings and field systems).
  - ▶ Explain the differences in selected North American cultural hearths and how they influenced settlements (e.g., the French in the lower St. Lawrence Valley, the English and Africans in the southern Tidewater region, the Spanish in Mexico).

## GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics

**4<sup>th</sup> GRADE**

the student knows and understands:

## Cultural Diffusion and Change

**3. Cultures change and diffuse in multiple ways**

Therefore, the student is able to:

- A. Describe examples of changes in a culture, as exemplified by being able to
- ▶ Describe how the introduction of new technologies may create change in a culture (e.g., television, cellular or mobile phone, Internet).
  - ▶ Describe how increased educational opportunities may result in changes in a culture.
  - ▶ Describe how increasing employment opportunities for women create changes in a culture.
- B. Describe examples of the spread of a culture, as exemplified by being able to
- ▶ Describe how different cultural groups bring their cultural traditions (e.g., food, holidays, clothing, religion) with them when they move to new locations.
  - ▶ Describe how culture may spread as a result of increased communications technologies (e.g., television, films, Internet).
  - ▶ Describe how cultural arts and artifacts can spread through travel, education, and international marketing (e.g., weaving and cloth making, baskets, paintings, body adornment, sculptures).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Cultural Diffusion and Change

**3. Changes in cultural characteristics and the distribution of cultures result from migration of people and the diffusion of ideas and technology**

Therefore, the student is able to:

- A. Describe and explain the processes of cultural diffusion, as exemplified by being able to
- ▶ Describe and explain how connections between cultures may result in the sharing of cultural characteristics (e.g., migration, travel, educational exchange programs).
  - ▶ Describe and explain how the increased knowledge and use of a common language increases the opportunities for cultural diffusion.
  - ▶ Identify the origins of different music genres and describe the spatial role of music in cultural diffusion (e.g., Latin Salsa music, Jazz and Blues music, rock and roll music).
- B. Explain the diffusion of a cultural characteristic, such as religious belief, music style, and architecture, as exemplified by being able to
- ▶ Explain how the diffusion of Islam followed trade routes through North Africa and into Europe.
  - ▶ Explain how jazz music developed in the southern United States and then spread north primarily to cities along the Mississippi River.
  - ▶ Explain how the spread of religious structures follow from processes of colonization (e.g., Catholic cathedrals and missions spread from Europe to the New World as a result of European exploration and colonization).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Cultural Diffusion and Change

**3. Cultures change through convergence and/or divergence**

Therefore, the student is able to:

- A. Identify and explain examples of cultural convergence, as exemplified by being able to
- ▶ Explain examples of the spread of culture traits that contribute to cultural convergence due to globalization (e.g., US-based fast-food franchises in China and India, the dominance of the English language for use in business, replication of television programs or print media in other countries).
  - ▶ Analyze the ways technology contributes to cultural convergence on a global scale (e.g., role of television, the Internet, more affordable air travel, cellular or mobile phone technology).
  - ▶ Explain how multinational corporations and international business operations contribute to cultural convergence.
- B. Identify and explain examples of cultural divergence, as exemplified by being able to
- ▶ Identify and explain examples of immigrant cultural groups maintaining language or other cultural markers in a new location to distinguish themselves from other groups.
  - ▶ Explain how subculture groups in the United States adopt dress or other characteristics to distinguish themselves from other groups (e.g., Harley-Davidson motorcycle riders, Goths, the Amish).
  - ▶ Identify and explain how different types of housing styles and developments may contribute to cultural divergence (e.g., gated communities retirement communities, suburban developments with home owner association covenants).

**GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics**

Image credit: D.J. Zeigler



Image credit: D.J. Zeigler



US fast-food has diffused into distant parts of the world, adapting to new cultures in the process. Subway is found in Amman, Jordan (top left); Pizza Hut in Beersheba, Israel (lower left); and a culturally modified Ronald McDonald in Bangkok, Thailand.

Image credit: D.J. Zeigler



**12<sup>th</sup> GRADE**

the student knows and understands:

**Cultural Diffusion and Change**

**4. The rate of cultural change has increased as a result of globalization**

Therefore, the student is able to:

- A. Explain how and why globalization has increased the rate of change in cultures, as exemplified by being able to
  - ▶ Explain how media, such as television, music, and films, can influence the rate of change in cultures around the world (e.g., youth preferences for types of music, knowledge of India diffused through the Indian film industry).
  - ▶ Explain how the increased mobility of people, ideas, and information can result in increasing the rate of change in a culture (e.g., the spread of Internet social networking, development of smart phones and short-message-service [SMS] texting).
  - ▶ Explain how the increasing economic interdependence in the world may result in an increased rate of change in cultures (e.g., expanding use of the Internet as an international marketing tool, increased frequency of business and trade shows involving people from across the world, changes in peoples' diets due to the spread of US fast-food franchises).

**GEOGRAPHY STANDARD 10: The characteristics, distribution, and complexity of Earth's cultural mosaics**



Image credit: D.J. Zeigler

*The cultural landscape of the Brickfields area of Kuala Lumpur, Malaysia, has its roots in southern India. Traditional Indian shapes and colors are supplemented by popular Indian films from Bollywood, and the forces of globalization as exemplified by the presence of Western Union.*

## GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface



Image credit: D.J. Zeigler

*Economic activities can be found at all scales in India including this small traditional street market in Colaba, Mumbai.*



Image credit: iStockphoto.com

**The geographically informed person** must understand the spatial organization of the economic, transportation, and communication systems that support networks of trade in raw materials, manufactured goods, capital (human and monetary), ideas, and services. Resources are unevenly distributed on Earth, and no country has all of the resources it needs to survive and grow independently. Thus, people must trade with others in increasingly complex global networks.

Therefore, Standard 11 contains these themes: Economic Activities, Location and Spatial Patterns of Economic Activities, and Connecting Economic Activities.

Economic activities depend upon capital, resources, energy, labor, information, and land. The spatial patterns of resources create the networks of trade and economic interdependence that exist at local, regional, national, and international scales. Local and world economies mesh to create networks, movement patterns, transportation routes, communications systems, markets, and hinterlands.

The spatial dimensions of economic activity are increasingly complex. Raw materials may be shipped to locations thousands of miles away for processing and then transported again over equally long distances for assembly or sale. Subsistence farming often exists side by side with commercial agriculture. In many developing countries, millions of people leave rural areas for cities in search of jobs, some of which have been outsourced from industrialized countries. Technology and telecommunications have freed many jobs from being tied to specific locations. Work can be done collaboratively in different locations, taking advantage of different time zones to increase efficiency.

As world population grows, as energy costs increase, as time becomes more valuable, as resources become depleted or discovered, and as new products meet new demands, economic systems need to be more efficient and responsive.

Students must understand world patterns and networks of economic interdependence and realize that traditional patterns of trade, human migration, and cultural and political alliances are being reshaped as a consequence of global interdependence. Understanding these themes enables students to appreciate the impact of global economic processes on places regardless of their size and location.

*Container ships are part of the global economic network. The development of container shipping has greatly reduced the cost and time for shipping goods.*



**GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Economic Activities**

**1. People engage in economic activities, such as producing goods and offering services, in order to earn a living**

*Therefore, the student is able to:*

- A. Describe different ways in which people can earn a living, as exemplified by being able to
  - ▶ Identify and describe examples of jobs that produce goods in the local community (e.g., manufacturing, farming, forestry, mining, artists).
  - ▶ Identify and describe examples of jobs that provide services in the local community (e.g., taxi or bus drivers, hair stylists, doctors, teachers, bankers).
  - ▶ Describe how the types of jobs in the local community have changed over time (e.g., blacksmith to car repair, door-to-door salespersons to Internet-based sales, local grocers and butchers to supermarkets).



*A cardboard scavenger in Macau, one of China's Special Economic Zones, works as a gatherer collecting boxes to re-sell or recycle.*

Image credit: D.J. Zeigler

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Economic Activities**

**1. The functions of different types of economic activities**

*Therefore, the student is able to:*

- A. Describe and analyze the functions of economic activities in the primary, secondary, tertiary, and quaternary sectors, as exemplified by being able to
  - ▶ Analyze a list of economic activities and identify them as primary (e.g., forestry, copper mining, and growing coffee), secondary (e.g., producing furniture, copper wire, and grinding coffee beans), tertiary (e.g., furniture sales, selling copper wire, and selling latte) or quaternary (e.g., advertising and marketing research) activities.
  - ▶ Describe the sequence of activities that occur in the manufacture of products (e.g., in the production of a computerized sewing machine, the iron-ore mining is primary, smelting iron and steel are secondary, selling of the steel sewing machines is tertiary, and advertising is quaternary).
  - ▶ Identify a range of everyday items and describe the sequence of routes and steps that are followed as they are converted to a secondary and then a tertiary product (e.g., Canadian forests become lumber that is used to build housing in US communities, Australian copper becomes circuits in wireless telephones made in China that provide a communications service, fish caught in the North Atlantic Ocean are processed into fish fillets that are prepared and served in restaurants).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Economic Activities**

**1. The scale and organization of economic activities change over time**

*Therefore, the student is able to:*

- A. Explain how economic activities change over time, as exemplified by being able to
  - ▶ Explain how ways of organizing work processes change the structure of economic activities (e.g., the effects of assembly lines, just-in-time parts deliveries, and robots on automobile production, the effects of bulk purchasing, centralized warehouses, and just-in-time delivery in the success of Wal-Mart).
  - ▶ Explain how, where, and why companies expand (e.g., Starbucks, Wal-Mart, and McDonald's start as local stores, spread regionally, nationally, and then internationally).
  - ▶ Explain how air-freight companies have changed patterns of economic activity (e.g., fruit, flowers, and vegetables are shipped worldwide from East Africa, the Middle East, and South Africa; the role of the FedEx hub in Memphis as a center for repairing computers and electronic equipment).



Image credit: D.J. Zeigler

*This McDonald's restaurant in Tel Aviv, Israel is an example of a US-based business that has expanded internationally.*

## GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface

**4<sup>th</sup> GRADE**

the student knows and understands:

## Location and Spatial Patterns of Economic Activities

**2. Some locations are better suited than others to provide certain goods and services**

Therefore, the student is able to:

- A. Identify where goods and services are produced and consumed, as exemplified by being able to
- ▶ Identify on a map where produce items in the local grocery store are grown or produced.
  - ▶ Identify on a map where students' clothing items are produced.
  - ▶ Identify on a map where teachers and school employees received their post-secondary education.
- B. Analyze and explain why some goods and services are produced in certain places, as exemplified by being able to
- ▶ Analyze the connection between areas producing fresh fruits and vegetables and the area's growing conditions and seasons (e.g., Southern Hemisphere summer produce is transported to the Northern Hemisphere during its winter, tropical fruits requiring more consistent tropical temperatures are grown at certain latitudes).
  - ▶ Analyze a map of oil wells in the United States and explain why oil refineries are often located near the oil wells.
  - ▶ Analyze a map of cotton production and a map of climate zones to explain why cotton production is primarily located in certain regions of the world.

**8<sup>th</sup> GRADE**

the student knows and understands:

## Location and Spatial Patterns of Economic Activities

**2. Access to factors of production, such as capital, labor, raw materials, and energy, influence the location of economic activities**

Therefore, the student is able to:

- A. Compare and explain the advantages of one location over another in the access to factors of production, as exemplified by being able to
- ▶ Explain why certain locations have developed a reputation for producing specific goods or services (e.g., Wyoming is known for its coal and natural gas deposits, China is known for assembly and manufacturing labor, New York is known as a center for investment capital).
  - ▶ Construct and analyze maps of the relationships between the different resources in various manufacturing industries (e.g., automobiles with the sources for glass, tires, sheet metal, and assembly locations; computers with the sources for circuit boards, software, electrical components, wireless chips, and assembly locations).
  - ▶ Construct a map that explains good US locations for access to a young, highly educated workforce by comparing maps of population density, education levels, and age groups.

**12<sup>th</sup> GRADE**

the student knows and understands:

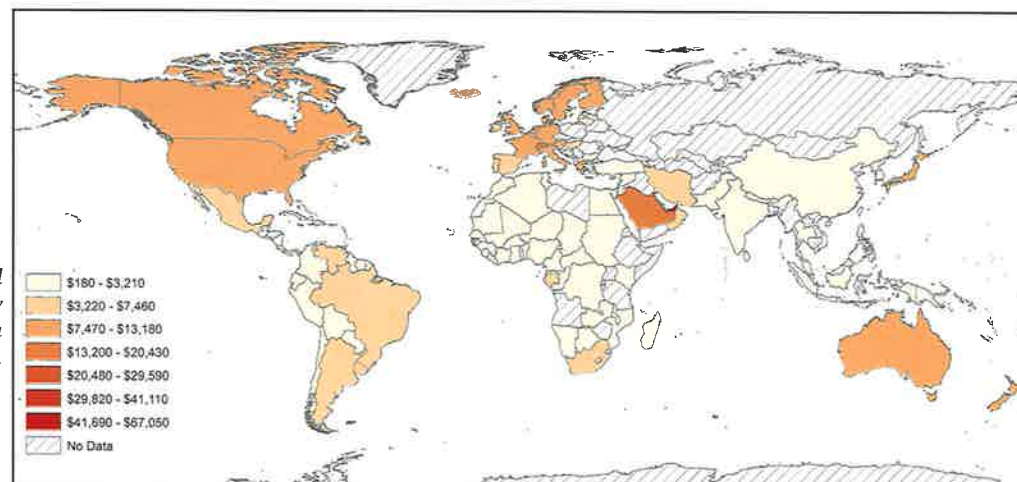
## Location and Spatial Patterns of Economic Activities

**2. Patterns exist in the spatial organization of economic activities**

Therefore, the student is able to:

- A. Identify and analyze the origins and development of and changes in patterns of economic activities, as exemplified by being able to
- ▶ Analyze cases that stretch or change interpretations of traditional theories of location, such as Weber's Least Cost (e.g., Japanese cars made in the United States, airline ticket and insurance claim processing in Ireland, US medical procedure results being read and interpreted by physicians in India).
  - ▶ Compare the changing patterns of production for major industries in the United States (e.g., the movement of the furniture industry from New England and the Upper Midwest to the Carolinas, the movement of the forestry industry from New England to the Carolinas and Georgia to the Northwest, textile production from New England to the Carolinas to overseas).
  - ▶ Analyze how the evolution and development of capitalism influenced human migrations (e.g., movement of people from rural areas to developing urban centers, European migration to the United States, colonialism and the African slave trade).

*As an economic indicator, Gross National Income (GNI) per capita is commonly used by geographers to show disparities in the level of wealth per person by country.*



Data source: The World Bank 2009. Map credit: Department of Geography, University of North Alabama/Lisa Keys-Mathews

## GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface

**4<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**3. People and countries trade locally produced goods and services for goods and services that are produced in other places**

Therefore, the student is able to:

- A. Identify items produced locally for consumption elsewhere and items produced elsewhere that are consumed locally, as exemplified by being able to
- ▶ Identify items produced in the local region for consumption in another location (e.g., raw and processed agricultural products, paper products, furniture, tires, plastics).
  - ▶ Identify the types of products that were historically produced in a region and the places to which these products were shipped.
  - ▶ Identify items students depend on in their daily lives (e.g., gasoline for transportation, food, clothing, power for electricity) and identify which of these are produced in other places.
- B. Describe the reasons why people and countries trade goods and services, as exemplified by being able to
- ▶ Describe the reasons why students trade different food items in the lunchroom or cafeteria.
  - ▶ Identify where common household items originate or are manufactured (e.g., appliances, furniture, food items, clothing) and describe why the items were made or grown in that location (e.g., good soil and climate conditions, raw materials needed for production, available labor, transportation hubs).
  - ▶ Describe how trade affects the way people earn their living in different regions (e.g., the flow of fuels from Southwest Asia to industrialized, energy-poor regions of the world, the flow of electronic goods from Pacific Rim nations to the United States).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**3. The world is increasingly interdependent as a result of flows of people, capital, information, raw materials, and goods**

Therefore, the student is able to:

- A. Explain why increasing economic interdependence, and therefore globalization, depend on systems that deliver goods and services within and between regions, as exemplified by being able to
- ▶ Analyze the spatial variations in the production of goods and services with the variations in the demand for goods and services and explain the resulting interdependence (e.g., animal antibiotics produced in Europe and used in Africa, seed corn harvested in Iowa and planted in South America, silicon computer chips made in California installed in computers manufactured in China).
  - ▶ Analyze the routes used by container shipping to transport internationally and nationally (e.g., on ships, railways, and semi-trailer trucks).
  - ▶ Analyze the advantages and disadvantages of different countries and regions in the production of a commodity (e.g., athletic shoes made in China with low-cost labor versus distance from markets, wireless electronics produced in California because of entrepreneurial capitalism and a skilled workforce versus offshore production of low-cost substitutes).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**3. Economic systems are dynamic organizations of interdependent economic activities for the production, exchange, distribution, and consumption of goods and services**

Therefore, the student is able to:

- A. Explain how the economic systems of countries and regions consist of multiple coordinated economic activities, as exemplified by being able to
- ▶ Analyze the importance of location and geographic distribution in relation to the advantage for countries that belong to the European Union (EU), North American Free Trade Agreement (NAFTA), and Central American Free Trade Agreement (CAFTA) (e.g., common boundaries to expedite movement of goods and products, reduction of transport time and distance, complementary production so that products made in one country are in demand in several others, cooperative arrangements for piecework on parts that are eventually assembled in one or more of the membership countries).
  - ▶ Construct flow maps showing the movement of resources to production centers and the flow of finished products to consumption points and analyze the impact of the production process on regional and national economies (e.g., flows of petroleum, clothing products, electronics).
  - ▶ Explain why places become major hubs of economic activity (e.g., research universities provide ideas and skilled labor to Silicon Valley's computer manufacturing companies, low-cost labor in Chinese cities provide the incentive to move manufacturing jobs from the United States and Europe).
- B. Explain why and how economic systems change, as exemplified by being able to
- ▶ Explain how technological developments in transportation systems have changed production and consumption patterns and increased the flow of commerce around the world (e.g., the roles of wagons, railroads, canals, container shipping, air travel, and satellites in moving goods, people, and information).
  - ▶ Explain how the development of communication systems changed the way in which economic systems operate (e.g., the effects on speed and volume of communications from mail to telegraph to telephone to cell phone to Internet).
  - ▶ Analyze the impact of globalization on less-developed and developed regions and nations in terms of costs and benefits. (e.g., manufactured products at a lower price and economies of scale have both negative and positive consequences).

## GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface

**4<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**4. Networks of transportation and communications are used to move information, products, and people**

Therefore, the student is able to:

- A. Describe and analyze different modes of transportation and communication used to move people, products, and ideas from place to place, as exemplified by being able to
- ▶ Describe the different modes of transportation used for specific products and ideas (e.g., barges and trains for bulky heavy items, airplanes for high-cost perishables, pipelines for liquids and gases, telephones or Internet for ideas and information).
  - ▶ Describe the different modes of transportation and communication used by students' families in their work and daily lives and construct a graph with the results to analyze which modes are employed most often.
  - ▶ Describe how transportation and communication have changed economic activities by constructing a timeline of technological developments (e.g., opening of the American West with the trans-continental railroad, improved road construction and increases in long-distance trucking, refrigerated trucking resulting in more fresh fruits and vegetables, air cargo increasing the distances goods may be shipped).
  - ▶ Describe the time and distance required by different methods of shipping to transport products globally (e.g., ships are least expensive, slower, and require large cargoes; trains are confined to railway track routes, are relatively fast, and less expensive for long hauls than trucks; trucks have access everywhere there are roadways, are fast for delivery; airplanes are the most expensive and are used to transport goods with high value and small mass/weight; Internet reduces the time and cost of transporting digital goods and information).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**4. Economic systems are dependent on integrated transportation and communication networks**

Therefore, the student is able to:

- A. Identify and describe examples of how people, products, and ideas move using integrated transportation and communication networks, as exemplified by being able to
- ▶ Analyze systems for the movement of people and goods (e.g., hub and spoke systems for air travel, US mail, United Parcel Service and FedEx use airplanes, large trucks, and small trucks for global delivery depending on the size and weight of the cargo and its origin and destination).
  - ▶ Explain the methods for tracking shipments of commodities and products through different transportation networks locally and globally (e.g., use of GPS-based technologies to track and manage inventory and transport, use of tracking codes available to the customer, barcodes that permit scanning of containers for location, radio frequency identification [RFID] tags and location-based technology systems).
  - ▶ Explain the geographic implications of the Internet for the shopping, purchasing, transporting, delivering, and paying for customer items (e.g., shopping is completed without regard to distance from vendor, shipping costs are dependent on distance and method of conveyance, travel is eliminated for the customer, purchase may be made on a 24-hour schedule and delivered next day to the door).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Connecting Economic Activities

**4. Improvements in transportation and communication networks reduce the effects of distance and time on the movement of people, products, and ideas**

Therefore, the student is able to:

- A. Explain the effects of technological changes in communications and transportation systems on the speed and distances over which people, products, and ideas move, as exemplified by being able to
- ▶ Explain how time-space compression has changed modern locational decision-making (e.g., distributed remote office locations, international staffing to optimize time zones, telecommuting options in the workplace).
  - ▶ Identify and explain technological developments over the past 75 years having the most impact on overcoming time and distance (e.g., container shipping, air freight, Internet connections, satellite communications).
  - ▶ Explain the technologies that allow migrants to maintain their linguistic culture and identities longer than prior immigrant groups (e.g., mobile phones, Internet connectivity, Web-based translation services).

Image credit: Susan Gallagher Heffron



Shipping companies use canal systems to transport finished products from glass factories on Murano Island in Italy.

**GEOGRAPHY STANDARD 11: The patterns and networks of economic interdependence on Earth's surface**



*A segment of the 800-mile-long Trans-Alaska Pipeline System winds through the wilderness making connections between Prudhoe Bay and Valdez for the transport of oil.*



*The route of the Trans-Alaska Pipeline System. The pipeline serves as one type of transportation network used in the global oil trade.*

## GEOGRAPHY STANDARD 12: The processes, patterns, and functions of human settlement



Image credit: D.J. Zeigler

From Victoria Peak, people can quickly see why Hong Kong ranks as one of the world's most densely populated places, with an average approaching 7,000 people per square kilometer.



Image credit: University of North Alabama/Lisa Keys-Matthews

The settlement pattern of the densely populated Kibera slum appears in sharp contrast to the golf course (top center) and urban neighborhood (top right) in Nairobi, Kenya. Data source: ©Google Earth, ©2012 GeoEye.

**The geographically informed person** must understand the varying forms of human settlements in terms of their size, composition, location, arrangement, organization, function, and history. People seldom live in isolation. Instead, they live in clusters ranging from small villages with hundreds of people to megacities with tens of millions of people. The organized groupings of human habitation are the intense focus of most aspects of human life: economic activities, transportation systems, communications media, political and administrative systems, education, culture, and entertainment.

Therefore, Standard 12 contains these themes: Functions of Settlements, Patterns of Settlements, and Urban Forms and Functions.

Of great importance to understanding human spatial organization are the relationships among settlements: their spacing, arrangement, functional connections, and economic specialties. Relationships between settlements are shaped by trade and the movements of raw materials, finished products, people, capital, and ideas. Patterns of settlement across Earth's surface differ markedly from region to region and place to place. Settlement patterns change through time.

Cities, the largest and densest human settlements, are the major nodes of human society. Throughout the world, cities are growing rapidly, but none so rapidly as those in developing regions. Urbanization is changing the current patterns of both rural and urban landscapes around the world.

Settlements and the patterns they etch on Earth's surface provide not only information on current economic, political, and social conditions, but also a historical record of past conditions. Today's settlement patterns provide information about past settlement processes and land-use patterns.

Students must understand the processes underlying the patterns of human settlement over space and time. Understanding these themes enables students to see settlements as a record of human history and as the fulcrum of many of the human processes that are changing Earth's surface.

## GEOGRAPHY STANDARD 12: The processes, patterns, and functions of human settlement

**4<sup>th</sup> GRADE**

the student knows and understands:

## Functions of Settlements

**1. People benefit from living in settlements**

Therefore, the student is able to:

- A. Explain the benefits gained by living in settlements, as exemplified by being able to
- ▶ Identify and describe the services (e.g., movie theaters, hospitals, religious centers, schools, banks, shopping malls, museums, libraries) available in the student's town or city and explain why people may view these as benefits to living in the community.
  - ▶ Describe and explain how the number and types of services (e.g., movie theaters, hospitals, religious centers, schools, banks, shopping malls, museums, libraries) differ for small and large settlements.
  - ▶ Describe how different people in the community might value services (e.g., movie theaters, hospitals, religious centers, schools, banks, shopping malls, museums, libraries) differently.

**2. Settlements occur where locations provide opportunities and therefore advantages**

Therefore, the student is able to:

- A. Explain why some locations are better for settlement than others, as exemplified by being able to
- ▶ Identify and explain the factors that might make a location good for settlement (e.g., flat land for building, access to a river or the sea, resources nearby for building).
  - ▶ Describe and explain the advantages of locations where settlements developed in the United States (e.g., Boston on a natural harbor, New Orleans at the mouth of the Mississippi, Chicago at the intersection of Great Lakes water traffic and the railroads).
  - ▶ Describe the factors that contributed to successful settlement locations (e.g., harbors, resources for housing and fuel, reliable fresh water supply, nonhostile neighbors, natural defenses, reliable food sources, suitable land for agriculture).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Functions of Settlements

**1. Different types of functions can influence the success or failure of settlements**

Therefore, the student is able to:

- A. Describe the typical functions of settlements and explain how they might influence the success or failure of a settlement, as exemplified by being able to
- ▶ Describe and explain the reasons people may choose to settle in cities (e.g., diverse employment opportunities, educational and cultural opportunities, sports and entertainment venues, health and social services, public transportation alternatives, retail shopping centers).
  - ▶ Describe and explain the reasons why people may choose to move away from cities (e.g., high crime rates, congested traffic, lack of adequate health and social services, inadequate education facilities).
  - ▶ Describe the role that the routes of transportation systems (e.g., steam railroad requiring water stations, the Pony Express, overland trails, stagecoach lines) played in the growth or decline of frontier settlements during the late 1800s and early 1900s in the United States.

**2. A combination of a favorable location and human activities lead to the growth of settlements**

Therefore, the student is able to:

- A. Explain the human activities in favorable locations that attracted people and resulted in the development of settlements, as exemplified by being able to
- ▶ Describe and explain the human activities (e.g., trade, political administration, transportation, exploiting resources) that led to the development of cities (e.g., Shanghai is a major world port and commercial city, Pittsburgh was a transportation and iron and steel center near large deposits of coal, Singapore is located along one of the world's major ocean transportation corridors).
  - ▶ Analyze the growth of three major world cities and explain reasons why their locations may have been favorable for human activities resulting in the development of these places.
  - ▶ Describe and explain how recent human activities contributed to the development of cities in different locations (e.g., development of electrical energy capacity and air conditioning in southern US cities, irrigation to increase the number of golf courses in resort towns, tax incentives or policies encouraging new business development).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Functions of Settlements

**1. The numbers, types, and range of the functions of settlements change over space and time**

Therefore, the student is able to:

- A. Explain how and why the number and range of functions of settlements have changed and may change in the future, as exemplified by being able to
- ▶ Analyze the reasons for and results of policies of municipal governments on the internal structure of cities (e.g., zoning ordinances to determine the location and characteristics of residential, commercial, and industrial sectors, incentives to encourage development, legislation of flood-plain regions restricting development).
  - ▶ Analyze the effects that a nearby resource discovery has on the internal structure and functions of an urban place (e.g., petroleum and Houston, Texas, gold and Anchorage, Alaska, lithium and Salar de Uyuni, Bolivia).
  - ▶ Explain the changes in the size and spatial organization of cities as a result of gains or losses of particular industries (e.g., gain of automobile manufacturing in Spartanburg, South Carolina, loss of steel manufacturing in Birmingham, England, gain of a high-tech corridor in Boston, loss of textile manufacturing in the Carolinas as a result of offshore production).

**2. Settlements can grow and/or decline over time**

Therefore, the student is able to:

- A. Explain and compare the factors that contribute to the growth or decline of settlements over time, as exemplified by being able to
- ▶ Analyze and explain the factors that led to the decline and/or disappearance of towns and cities (e.g., rail lines did not connect with the town, relocation of the county seat, decline in resource extraction or production, single-industry towns in periods of recession, bypassed by road development, out-migration of people, especially young people).
  - ▶ Analyze and explain how historic changes in transportation may have contributed to the growth or decline of settlements (e.g., shift from overland to water routes with improved navigation, growth of river port cities following the invention of the steamboat, effect of access to railroads, interstate highway system, establishment of regional airports).
  - ▶ Analyze the fastest growing cities in different world regions and explain the reasons for growth (e.g., access to education, natural resources, presence or absence of conflict, reliable food supplies, employment opportunities, health care, human rights).

## GEOGRAPHY STANDARD 12: The processes, patterns, and functions of human settlement

**4<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Settlements

**3. There are different types of settlements**

Therefore, the student is able to:

- A. Compare and explain the different types of settlements in the local region and the United States, as exemplified by being able to
- ▶ Analyze satellite images and compare the patterns of different types of settlements (e.g., rural farmsteads and small towns, urban centers and corridors, suburban, wilderness).
  - ▶ Analyze and compare the patterns of settlement of selected US cities (e.g., suburban sprawl of Los Angeles, linear mountain valley town of Aspen, Colorado, riverfront settlement of Charleston, South Carolina, the planned city of Washington, DC).
  - ▶ Analyze a map of US population density and describe where the major clusters of settlements are located.

**8<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Settlements

**3. There are patterns of settlements in regions**

Therefore, the student is able to:

- A. Compare and explain the location, number, and sizes of settlements in regions, as exemplified by being able to
- ▶ Analyze maps and satellite images and compare different types of settlement patterns observed across regions (e.g., linear rural settlement along roadways, railways, and rivers; urban centers that spread from a central node; village clusters or rural landscapes; seaport settlements that are interrupted by water, such as a water body or a large river).
  - ▶ Explain possible reasons why some locations can support more population in settlements than other locations.
  - ▶ Compare the settlement patterns in three different regions of the world and describe the particular patterns (e.g., linear patterns, clustered patterns, dispersed patterns).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Patterns of Settlements

**3. The spatial patterns of settlements change over time**

Therefore, the student is able to:

- A. Compare and explain the changing functions, sizes, and spatial patterns of settlements, as exemplified by being able to
- ▶ Analyze late 20th-century changes in urban patterns and functions (e.g., edge cities, gentrified districts, more specialized services in sub-urban areas, urban sprawl).
  - ▶ Compare satellite images of cities to identify the growth or decline of different sectors in the settlement (e.g., squatter settlements, central business district [CBD], green spaces, government buildings).
  - ▶ Analyze and explain the differences in the patterns of cities in light of automobile transportation (e.g., London versus Los Angeles, Rome versus Dallas).
- B. Analyze and explain the structure and development of megacities and megalopoli, as exemplified by being able to
- ▶ Analyze and explain the factors contributing to the development of urban corridors in megalopoli such as the Boston–Washington, DC, corridor and the Taiheiy Belt (Tokyo–Osaka corridor) in Japan.
  - ▶ Analyze the spatial pattern of cities with populations larger than 10 million (megacities) to determine if the pattern is associated with specific features (e.g. coastal locations, major rivers, inland waterways, political centers) or with particular regions (e.g., South America versus South Asia).
  - ▶ Analyze the technological developments that have contributed to the growth and changing spatial distribution of megacities and megalopoli (e.g., changes in agricultural production; infrastructure developments such as sanitation, railroads, interstate highways, airports; construction technologies).

*This night lights satellite image illustrates the settlement patterns of the most urbanized areas, but not necessarily the most populated. These urban areas tend to grow along coastlines and transportation routes.*



Image credit: NASA Visible Earth



**GEOGRAPHY STANDARD 12: The processes, patterns, and functions of human settlement**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Urban Forms and Functions**

**4. There are different types of urban land uses**

*Therefore, the student is able to:*

- A. Analyze the different ways land is used in the community, as exemplified by being able to
  - ▶ Analyze community maps and satellite images to describe the different ways land is used (e.g., parks and recreation, sports complexes, shopping areas, medical facilities, residential areas, educational institutions, parking lots, industrial parks, airports).
  - ▶ Analyze a community history to describe changes in land use over time (e.g., farms developed into suburbs, factory buildings changed to urban malls, unused train depots transformed to restaurants or art centers).
  - ▶ Describe the different land uses along a waterfront in a port or river city (e.g., warehouses or industry, residential, entertainment or recreation, commercial).

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Urban Forms and Functions**

**4. Land uses in urban areas are systematically arranged**

*Therefore, the student is able to:*

- A. Describe and analyze the spatial patterns of land use in cities, as exemplified by being able to
  - ▶ Analyze a city map and describe the differences in the spatial patterns of the central business district (CBD) versus residential areas (e.g., flowing traffic patterns to facilitate business versus cul-de-sac design in residential areas that restricts traffic).
  - ▶ Describe how transportation systems are arranged to provide access to the commercial and industrial areas of a city (e.g., locations and routes of public transit systems, locations and proximity of railroads to power stations and industrial parks).
  - ▶ Identify and describe a controversial land-use issue in the community and analyze the advantages and disadvantages of making the change in use (e.g., widening a street for more lanes of traffic, tearing down an old building for a new park, converting green space into a new building complex).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Urban Forms and Functions**

**4. Urban models are used to analyze the growth and form of urban regions**

*Therefore, the student is able to:*

- A. Explain and compare the growth and structure of cities using different urban models, as exemplified by being able to
  - ▶ Identify and analyze the structure of urban places in comparison to general models of urbanization (e.g., concentric rings, sectors, specialized functions, walled cities).
  - ▶ Construct a map of a hypothetical city and explain the internal spatial structures (e.g., central business district, industrial zones, residential, service activities, suburban retail, and information-based activities).
  - ▶ Identify and explain contemporary urban conditions that may not be addressed in urban models (e.g., homelessness, squatter settlements, transitions in ethnic neighborhoods, low-income public housing, gentrification).



Image credit: D.J. Zeigler

*Port cranes in Auckland, New Zealand are prominent in the foreground of this view of the city skyline.*

Image credit: NASA Earth Observatory



*Due to its location, water-based transportation is important to the busy ports of Auckland, New Zealand that have access to harbors on both the Tasman Sea and Pacific Ocean.*

## GEOGRAPHY STANDARD 13: How the forces of cooperation and conflict among people influence the division and control of Earth's surface



Image credit: J. Stoltman

The demilitarized zone (DMZ) dividing North and South Korea is a political geography and military flash point. The blue buildings are in the Joint Security Area where the North and South Koreans meet to discuss issues of concern to each side. Military units guard their respective territories. The buildings are bisected by the line of demarcation, with half the building in the south and half in the north. Beyond the blue buildings is Panmun Hall, from which North Korean military personnel observe activities in the south. The roadway in the foreground is in front of Freedom House (from where the photo was taken) on the South Korean side.



Image credit: D.J. Zeigler

People protesting in London's Trafalgar Square show support for southwest Asia's Kurdish population, a cultural group that does not have its own independent state.

**The geographically informed person** must understand how and why different groups of people have divided, organized, and unified areas of Earth's surface. Competing for control of areas of Earth's surface, large and small, is a universal trait among societies and has resulted in both productive cooperation and destructive conflict between groups. Conflicts over trade, human migration and settlement, ideologies and religions, and exploitation of marine and land environments reflect how Earth's surface is divided into fragments controlled by different formal and informal political, economic, and cultural interest groups.

Therefore, Standard 13 contains these themes: Territorial Divisions, Cooperation, and Conflict.

The primary political division of Earth is by state sovereignty—a particular government is recognized by others, such as members of the United Nations, as having supreme authority over a carefully delimited territory and the population and resources within that space. Regional alliances among nations for military, political, cultural, or economic reasons constitute examples of human cooperation on Earth's surface.

Events of the twenty-first century illustrate that the process of seeking to control parts of Earth's surface continues unabated at all scales of human society. World wars, regional wars, civil wars, terrorist attacks, and urban riots often are manifestations of the fierce intensity of feeling humans hold for the right to own and control parts of Earth according to their particular beliefs and values. Traditionally, most territorial disputes have been over the land surface, but with the increasing value of resources in the ocean and control of access to air and outer spaces, these regions have become arenas for international debate. Cooperation and conflict will occur in all of these spatial contexts.

Students must understand the evolution, structure, power, and implications of these divisions. Additionally, they must understand the ways in which divisions generate conflicts or encourage cooperation. They must appreciate their own roles within a world that is globally interdependent and yet locally controlled. Understanding these themes provides students with the contexts into which to set past, present, and future examples of cooperation and conflict between and among groups of people.

**GEOGRAPHY STANDARD 13: How the forces of cooperation and conflict among people influence the division and control of Earth's surface**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Territorial Divisions**

**1. There are multiple types of territorial divisions used to manage and control Earth's surface**

*Therefore, the student is able to:*

- A. Explain different types of territorial divisions (e.g., township, city, county, state, and country) and how they are used to manage and control Earth's surface, as exemplified by being able to
  - ▶ Construct maps based on interviews with local school officials, fire-fighters, and police officers to show the spatial boundaries of their responsibilities (e.g., school district boundaries, local fire districts, police precinct districts, county jurisdiction for sheriff).
  - ▶ Describe the responsibilities of the set of governmental units within which the student lives (e.g., town or city, county, state, and country).
  - ▶ Describe how all continents, with the exception of Antarctica, are divided into nation states.

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Territorial Divisions**

**1. The types of boundaries used to define territorial divisions**

*Therefore, the student is able to:*

- A. Explain the types of boundaries based on physical and human characteristics, as exemplified by being able to
  - ▶ Describe and explain the use of physical and human characteristics to establish political boundaries (e.g., streets as political boundaries between local units of government, water features as boundaries between countries, watershed divides as boundaries between countries, boundaries delimited by political agreement such as the 49th parallel between the United States and Canada).
  - ▶ Identify and describe examples of disputed borders and explain the reasons for the dispute (e.g., Kashmir border between India and Pakistan, border between Algeria and Morocco, border between El Salvador and Honduras).
  - ▶ Identify and explain the use of defense lines and frontier outposts to control Earth's surface (e.g., China's Great Wall, Hadrian's Wall, Berlin Wall, Maginot Line, Korean Peninsula Demilitarized Zone).
  - ▶ Explain why states in regions of the United States typically have different kinds of boundaries (e.g., the eastern state lines reflect metes and bounds, the Midwest has baselines of latitude and longitude and water boundaries, the use of township and range system in the West).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

**Territorial Divisions**

**1. The functions and consequences of territorial divisions**

*Therefore, the student is able to:*

- A. Explain how territorial divisions are used to manage Earth's surface, as exemplified by being able to
  - ▶ Analyze and explain the impacts of regional alliances intended for political, military, cultural, or economic control (e.g., the political integration of the European Union [EU] countries, United Nations [UN] oversight of the military division of the Korean Peninsula, the economic and cultural impacts of North American Free Trade Agreement [NAFTA]).
  - ▶ Explain where and how nations (i.e., ethnic groups) seek territorial and national identity (e.g., the Kurds in Turkey, Iraq, and Iran; Palestinians in Israel, Lebanon, and Jordan; Tamils in Sri Lanka and India).
  - ▶ Explain how the "Law of the Sea" defines the extent and rights of the territorial jurisdiction of a nation state (e.g., control of passage of warships, rights to minerals on the ocean floor).
- B. Compare the reasons for and consequences of different systems for dividing and controlling space, as exemplified by being able to
  - ▶ Compare the spatial expansion and extent of different empires and describe the reasons for and effects of the resulting boundaries (e.g., Chinese dynasties, Roman Empire, British Empire).
  - ▶ Analyze the patterns of territorial divisions that arose during the European colonialism era and compare the different responses to this expansion (e.g., the 1823 Monroe Doctrine against European expansion in the Western hemisphere, Berlin Conference 1884–1885, Battle of Adwa in Ethiopia, Sino-French War 1884).
  - ▶ Describe and compare the different forms of governmental structures for administering nation states (e.g., federations such as Canada versus unitary states such as France).



Image credit: D.J. Zeigler

*States serve as territorial and governmental units within the United States. The capitol building in Baton Rouge serves as the location for Louisiana's state government.*

# GEOGRAPHY STANDARD 13: How the forces of cooperation and conflict among people influence the division and control of Earth's surface

## 4<sup>th</sup> GRADE

the student knows and understands:

### Cooperation

#### 2. The role cooperation has in managing Earth's surface

Therefore, the student is able to:

A. Explain how people cooperate in managing and using Earth's surface, as exemplified by being able to

► Explain how international water boundaries are examples of people cooperating in dividing and using Earth's surface (e.g., 200-mile territorial limit, Great Lakes are divided between Canada and the United States, for river boundaries it is sometimes the center of the water in the river).

► Analyze activities in the local community to describe ways in which people solve problems by cooperating (e.g., working in groups to pick up trash along a road, participating in a neighborhood crime-watch group, participating in community house-building projects).

► Describe how communities and states cooperate in providing relief efforts during and after natural disasters (e.g., donations of money and food aid, sending medical teams and supplies, construction workers and equipment).

## 8<sup>th</sup> GRADE

the student knows and understands:

### Cooperation

#### 2. Countries and organizations cooperate through treaties, laws, and agreements to manage resources, maintain the environment, and mediate disputes

Therefore, the student is able to:

A. Describe and explain examples of cooperation that focus on solving human and environmental issues, as exemplified by being able to

► Describe and analyze the positive and negative effects of cooperation in controlling territories (e.g., Great Lakes environmental issues are cooperatively managed by the United States and Canada, United Nations [UN] Heritage sites are cooperatively maintained by the UN and host countries, regional planning agencies coordinate local land use policies).

► Analyze the places where international monitors have maintained borders, keeping conflicting groups apart and maintaining peace (e.g., Cyprus Green Line, Golan Heights, Lebanon–Israel border, North Atlantic Treaty Organization [NATO] in the Balkans in the 1990s).

► Describe and analyze the effectiveness of nongovernmental organizations (NGOs) in responding to human issues (e.g., Heifer International providing expertise on hunger mitigation, Doctors Without Borders providing medical assistance to countries, Oxfam providing food relief).

## 12<sup>th</sup> GRADE

the student knows and understands:

### Cooperation

#### 2. Cooperation between countries and organizations may have lasting influences on past, present, and future global issues

Therefore, the student is able to:

A. Evaluate how countries and organizations cooperate to address global issues, as exemplified by being able to

► Evaluate the success of United Nations (UN) agencies in dealing with global issues (e.g., peacekeeping and prevention of terrorist activities, disease prevention, emergency aid, climate change, education).

► Analyze how globalization has contributed to the development of regional organizations and describe how those organizations have changed over time (e.g., European Union [EU], North Atlantic Treaty Organization [NATO], North American Free Trade Agreement [NAFTA], African Union, Organization of Petroleum Exporting Countries [OPEC]).

► Identify and describe the potential results of recommendations generated by international efforts to address global climate change (e.g., the series of agreements at Montreal, Kyoto, and Copenhagen).



Image credit: iStockphoto.com

Formed following World War II, the United Nations is an international organization that works to promote global cooperation.

International cooperation has brought vaccination programs and better health to people around the world.



Image credit: iStockphoto.com

# GEOGRAPHY STANDARD 13: How the forces of cooperation and conflict among people influence the division and control of Earth's surface

## 4<sup>th</sup> GRADE

the student knows and understands:

### Conflict

#### 3. Conflicts arise when there is disagreement over the division, control, and management of Earth's surface

Therefore, the student is able to:

A. Analyze examples of disagreements over land uses in their community, as exemplified by being able to

► Identify and describe the reasons for disputes over play space on the playground or lunchroom, analyzing the situation from the perspectives of the key stakeholders.

► Identify local land-use issues in which there are disagreements and analyze the perspectives of the key stakeholders (e.g., protection of environmentally sensitive areas, land use for commercial purposes, locating waste disposal sites).

► Describe the means by which communities resolve disputes over land-use issues (e.g., decisions by planning commissions, by elected officials, by judges, by community voting).

## 8<sup>th</sup> GRADE

the student knows and understands:

### Conflict

#### 3. There are multiple sources of conflict resulting from the division of Earth's surface

Therefore, the student is able to:

A. Explain how conflicting territorial claims can erupt over resources, land use, and ethnic and national identities, as exemplified by being able to

► Explain why countries have overlapping claims for island territories (e.g., the Spratly [claimed by six countries] and Kurile [claimed by two countries] island groups for their resources).

► Describe and explain examples of the different types of land-control conflicts that may erupt between and among countries (e.g., conflicts due to natural resources, water sources or access, economic sanctions or embargoes, religious or sacred sites).

► Analyze the types of conflicts that can occur over the use of rivers (e.g., US states competing for water from the Colorado River, ongoing conflicts over the Amur River between China and Russia, Jordan and Israel competing for water from the River Jordan).

## 12<sup>th</sup> GRADE

the student knows and understands:

### Conflict

#### 3. Changes within, between, and among countries regarding division and control of Earth's surface may result in conflicts

Therefore, the student is able to:

A. Explain the ways conflict affects the cohesiveness and fragmentation of countries, as exemplified by being able to

► Describe and explain the effects of interventionist policies by developed countries on lesser-developed countries (e.g., United States in Iraq, China in Tibet, Soviets in Afghanistan).

► Describe and explain the formation of alliances during World Wars I and II and explain how those alliances influenced the territorial divisions and occupations following the wars.

► Compare the positive and negative effects conflict has on the cohesiveness of countries (e.g., response to outside threat can lead to unifying effect of protecting a nation state, ultranationalism can lead to discrimination against immigrant groups).

B. Explain the causes and consequences of political and social revolutions resulting from issues of control of land and resources, as exemplified by being able to

► Explain the geographical reasons for and consequences of wars and revolutions (e.g., Eritrean war of independence, Vietnamese wars with France and the United States, Iraqi invasion of Kuwait).

► Analyze examples of how political and social unrest stem from competition for control of space and resources (e.g., Greeks and Turks in Cyprus; Taliban in Afghanistan, Hutu and Tutsi in Rwanda, actions of certain terrorist groups [Irish Republican Army or Hamas]).

► Analyze the effect that extracting and trading of resources has on conflicts in developing nations (e.g., lithium, conflict diamonds, petroleum, uranium).

Map credit: Courtesy of the University of Texas Libraries, The University of Texas at Austin



Since 1947 unsettled border claims have remained in the region of the former princely state of Jammu and Kashmir (outlined in red) between Pakistan and India as well as India and China.

**GEOGRAPHY STANDARD 14: How human actions modify the physical environment**

Image credit: iStockphoto.com

*Farmers modify the physical environment by building terraces on steep slopes, like these in Nepal, to increase the land area for farming different types of crops.*

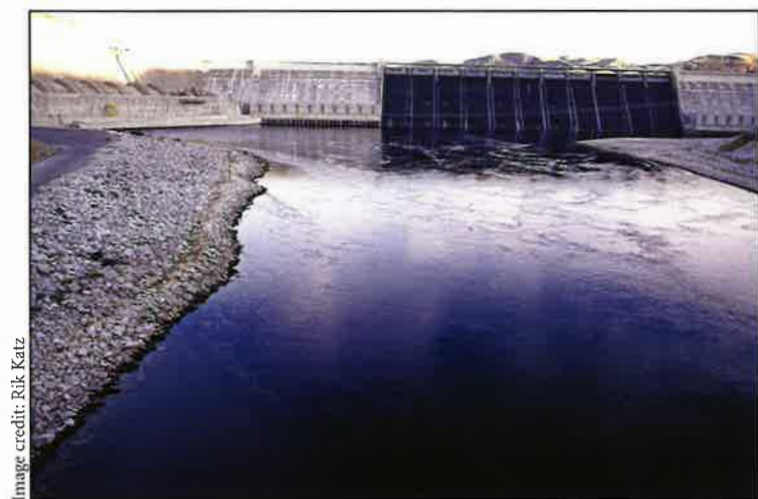


Image credit: Rik Katz

*The Grand Coulee Dam on the Columbia River in Washington is an example of human modification of the physical environment. Dams can be used for generating energy and flood control.*

**The geographically informed person** must understand the human imprint on the physical environment. Many of the important issues facing modern society are the result of human modifications of the physical environment. Some of these modifications are intended and positive; others unintended and negative. These changes have political, economic, and social implications at all scales, from the global to local.

Therefore, Standard 14 contains these themes: Modification of the Physical Environment, The Use of Technology, and Consequences for People and Environments.

To survive, people depend on the physical environment. They adapt and modify it to suit their changing needs to meet life's necessities. In the process, they bring knowledge and technology to bear on physical systems. Alterations to the environment have brought economic prosperity to some areas at some times and created environmental crises in others. Resulting modifications that vary in scope, scale, and duration often place enormous demands on the capacity of physical systems to absorb and accommodate such changes. Contrast the benign long-term consequences of terracing hillsides to grow rice for food with the dramatic depletion of Arctic sea ice as a result of global warming since the Industrial Revolution. Because of these significant spatial and temporal variations in impact, students must understand both the potential benefits and costs of changes to an environment.

Understanding global interdependence begins with awareness of the continuous modification of Earth to meet human wants and needs. When successful, the relationship between people and their environment is adaptive in the short- and long-term; when modifications are excessive or inappropriate, the relationship is fractured. Increasingly, students will be required to make decisions about connections between human needs and the physical environment.

Students must understand the consequences their actions have on the physical environment and make informed, sustainable choices as they modify the current physical environment. Understanding these themes enables students to see how human actions modify the physical environment and set those changes in a local to global context that ensures sustainability.

## GEOGRAPHY STANDARD 14: How human actions modify the physical environment

**4<sup>th</sup> GRADE**

the student knows and understands:

## Modification of the Physical Environment

**1. People modify the physical environment**

Therefore, the student is able to:

A. Identify and describe ways in which humans modify the physical environment, as exemplified by being able to

► Identify and describe examples of human modifications to the physical environment surrounding the school or neighborhood (e.g., paving over vegetated areas, constructing buildings, building bridges, installing culverts or drainage ditches, removing or adding trees or shrubs).

► Describe human-generated changes in the physical environment during different time periods using aerial photographs or satellite images of the same location (e.g., farmland to subdivisions, open fields to baseball diamonds, traditional downtown areas to new shopping centers).

► Describe examples of changes that would occur if people decided to build a new road, water park, or shopping center in the local community (e.g., changes in ecosystem, land cover, landforms, drainage patterns or runoff).

## The Use of Technology

**2. People use technology to get what they need from the physical environment**

Therefore, the student is able to:

A. Describe and explain ways in which people use technology to get what they need from the physical environment, as exemplified by being able to

► Describe and explain examples of the technology used in different industries in the United States (e.g., high-tech farming and irrigation, excavating machinery in strip mining, drilling in oil production).

► Explain how the use of technology in students' daily lives (e.g., rototiller in the garden, applying plant fertilizer, pumps that provide bore or well water, hybrid or disease resistant seeds) can help people get things they need from the physical environment.

► Describe and explain how inventions helped people settle the Great Plains (e.g., barbed wire, steel plow, railroad, steamboat, threshing machines).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Modification of the Physical Environment

**1. Human modifications of the physical environment in one place often lead to changes in other places**

Therefore, the student is able to:

A. Describe and explain how human-induced changes in one place can affect the physical environment in other places, as exemplified by being able to

► Describe and explain how the construction of dams and levees on rivers in one region affects places downstream (e.g., water availability for human consumption and agriculture, flood control, electricity generation, aquatic and riparian ecosystems).

► Describe how human changes to land cover can have negative impacts on other areas (e.g., deforestation and downstream flooding, siltation, soil erosion).

► Explain how industrial activities (e.g., factories, electric power generating plants) affects other locations (e.g., acid rain downwind, thermal inversions, smog).

## The Use of Technology

**2. The use of technology has changed the scale at which people can modify the physical environment**

Therefore, the student is able to:

A. Describe and explain the ways in which technology has expanded the scale of human modification of the physical environment, as exemplified by being able to

► Describe and explain how strip-mining technology has altered the physical environment of the United States (e.g., mountaintop removal in West Virginia, culm heaps in the anthracite region of northeastern Pennsylvania, deep craters in the Powder River Basin strip mine).

► Describe how changes in technology have altered the methods and amount of travel and therefore the effects on the physical environment (e.g., car emissions, road building, airplane jet exhaust and noise).

► Describe and explain how green construction techniques may increase sustainability and reduce the scale of human-induced effects on the physical environment (e.g., reduced energy use, the use of new sustainable building materials).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Modification of the Physical Environment

**1. Human modifications of the physical environment can have significant global impacts**

Therefore, the student is able to:

A. Explain the global impacts of human changes in the physical environment, as exemplified by being able to

► Explain the spatial consequences, deliberate and inadvertent, of human activities that have global implications (e.g., dispersal of plant and animal species, fungi, and disease worldwide; global petroleum production, transport, and consumption; global climate change).

► Explain how changes in human behavior can result in the introduction of aerosols into the atmosphere that have effects on a global scale (e.g., dust from Chinese agriculture and industry affecting Hawaii's weather, dust from the Saharan Africa affecting weather in Florida).

► Explain the implications of modifying the physical environment in Brazil to grow soybeans for global export (e.g., siltation, desertification, deforestation, global climate change).

## The Use of Technology

**2. The use of technology can have both intended and unintended impacts on the physical environment that may be positive or negative**

Therefore, the student is able to:

A. Evaluate the intended and unintended impacts of using technology to modify the physical environment, as exemplified by being able to

► Evaluate how the technologies used in petroleum production and transportation have expanded the scale of the industry from local or regional to global over the last century (e.g., offshore oil drilling, oil sands, supertankers, pipelines).

► Evaluate various types of contemporary agricultural techniques (e.g., no-till farming, herbicides, pesticides, center-pivot application of chemicals, crop rotation, irrigation, increased acreage in production), and compare the positive and negative implications of using these techniques.

► Evaluate the environmental impact of road building into remote locations (e.g., rain forests in Brazil, old growth forests in Oregon, agricultural land in China, Alaskan pipeline in the Arctic).

## GEOGRAPHY STANDARD 14: How human actions modify the physical environment

**4<sup>th</sup> GRADE**

the student knows and understands:

## Consequences for People and Environments

**3. The consequences of human modifications of the physical environment**

Therefore, the student is able to:

- A. Identify and describe examples of how human activities impact the physical environment, as exemplified by being able to
- ▶ Identify and describe the changes in local habitats that resulted from human activities.
  - ▶ Identify and describe the impacts that students' dietary choices may have on the physical environment.
  - ▶ Describe examples of human modifications to the physical environment as a result of improving transportation routes (e.g., bridges, drainage ditches, widening streets or roads, divided highways).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Consequences for People and Environments

**3. The physical environment can both accommodate and be endangered by human activities**

Therefore, the student is able to:

- A. Analyze the positive and negative consequences of humans changing the physical environment, as exemplified by being able to
- ▶ Analyze the positive and negative effects of human actions on the lithosphere (e.g., land degradation and erosion, soil salinization and acidification).
  - ▶ Analyze the proportion of built area to vegetation land cover around a community and identify possible consequences in changes to that proportion (e.g., habitat changes, heat island effect, water and wetland patterns).
  - ▶ Analyze the ways humans can have positive effects on the physical environment (e.g., open green space protection, wetland restoration, sustainable forestry).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Consequences for People and Environments

**3. People can either mitigate and/or adapt to the consequences of human modifications of the physical environment**

Therefore, the student is able to:

- A. Describe and evaluate scenarios for mitigating and/or adapting to environmental changes caused by human modifications, as exemplified by being able to
- ▶ Compare the costs and benefits of alternative solutions for a human-caused environmental problem, such as acid rain (e.g., coal with lower sulfur content, scrubbers on smokestacks, nuclear waste disposal, use of alternative energies) or urban heat islands (e.g., green roof construction, increased public transportation, energy efficient buildings).
  - ▶ Explain and evaluate the policy implications of managing upstream development in relation to downstream impacts (e.g., flooding, dam construction or removal, zoning).
  - ▶ Evaluate the feasibility, costs, and benefits of green construction techniques (e.g., Leadership in Energy and Environmental Design [LEED] certification) and describe how these efforts may increase sustainability and mitigate human impact on the physical environment.
  - ▶ Construct a plan for a public-awareness campaign about a hazardous issue including suggestions for mitigation and adaptation (e.g., radon gas, potential flooding, lead paint, water quality, industrial pollutants).



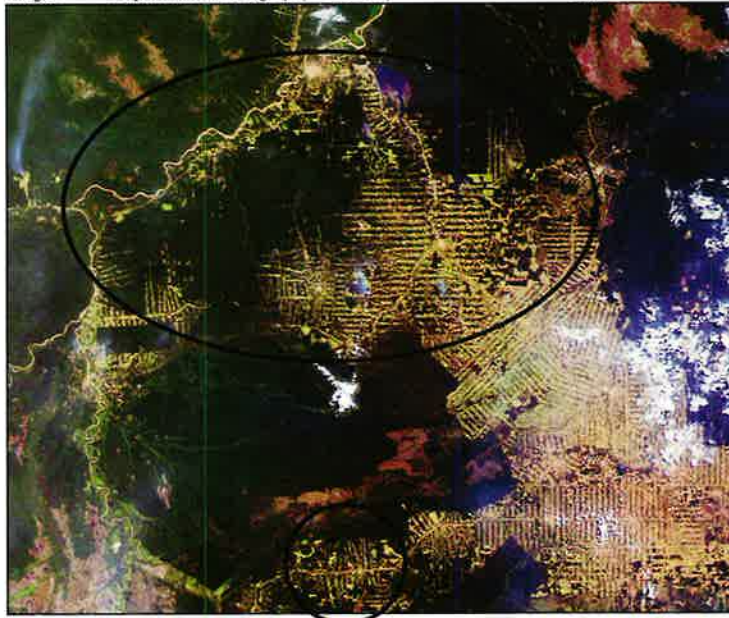
Image credit: D.J. Zeigler

As a result of evaporation and poor irrigation practices, salt accumulates on the surface of a field in northern Syria, reducing its productivity.



**GEOGRAPHY STANDARD 14: How human actions modify the physical environment**

Images credit: Department of Geography, University of North Alabama/Lisa Keys-Mathews



*Satellite images from 2000 (top left), 2005 (top right), and 2010 (lower left) show the increased deforestation in the Brazilian rainforest. Note the changes in vegetation along the river in the upper left and lower center regions of each image.*

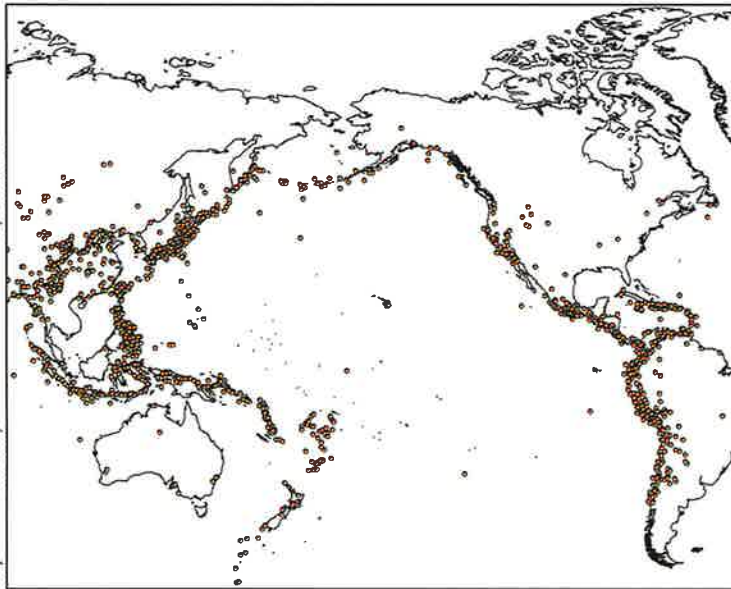
Data source: NASA Earth Observatory.

## GEOGRAPHY STANDARD 15: How physical systems affect human systems



Image credit: D.J. Zeigler

Coastal barrier formations, such as Alabama's Dauphin Island, are desirable locations for housing developments, but building so close to the sea brings devastating risks and vulnerabilities such as storms like Hurricane Katrina in 2005.



Map credit: University of North Alabama/Lisa Keys-Mathews

**The geographically informed person** must understand how humans are able to live in various physical settings and the role the physical features of those settings play in shaping human activity. Regardless of spatial scale, Earth's surface is diverse in terms of climates, vegetation, fauna, soils, underlying geology, and topography. That diversity offers a range of environmental contexts where people can live and work. Physical systems and environmental characteristics do not, by themselves, determine the patterns of human activity; however, they do influence and constrain the choices people make.

Therefore, Standard 15 contains these themes: Environmental Opportunities and Constraints, Environmental Hazards, and Adaptation to the Environment.

To live in any physical environment, no matter how accommodating or how challenging, people must develop ways to take advantage of its opportunities and minimize its risks. If the incentives are great enough, people can adapt to the harshest of environments, often regardless of cost or risk.

A concept central to understanding environments is the idea of carrying capacity: the maximum number of animals and/or people a given area can support at a given time under specified levels of consumption without incurring significant environmental deterioration. Environments vary in their carrying capacities. Failure to recognize that reality can lead to environmental disaster. Increasingly, people are recognizing their responsibility to manage the environment in ways that are sustainable for future generations.

Humans employ evolving technologies when possible to reduce the negative effects of physical systems on human activities. However, there are trade-offs that result in unintended consequences. Dam building to control river flooding is a case in point. In some parts of the world, dams have diminished soil replenishment and increased water salinity and riverbank erosion. Environmental hazards such as hurricanes, tornadoes, earthquakes, wildfires, and flash floods also take their toll despite early warning systems, improved building design, and public education programs.

Students must understand the characteristics of physical environments in relation to human activities. Whether it is an issue of mitigating an environmental hazard or recognizing the carrying capacity of a given area, students must be able to envision the physical processes and patterns of a place as a potential home for people. Understanding these themes enables students to recognize that there are limits to growth and to weigh the challenges of environmental opportunities and constraints when they measure the effects of physical systems on human activities.

*The Pacific Rim is easily identified by mapping the distribution of earthquakes. Due to tectonic movements, their frequency increases along the edges of the Pacific plate.*  
Data source: USGS/Esri Data & Maps Media Kit.

## GEOGRAPHY STANDARD 15: How physical systems affect human systems

**4<sup>th</sup> GRADE**

the student knows and understands:

## Environmental Opportunities and Constraints

**1. The physical environment provides opportunities for and imposes constraints on human activities**

Therefore, the student is able to:

- A. Describe examples in which the physical environment provides opportunities for human activities, as exemplified by being able to
  - ▶ Identify and describe the characteristics of the community's physical environment that first attracted people and enabled them to thrive and prosper (e.g., climate, water, soil, landforms).
  - ▶ Identify and describe examples of places that offer vacation activities for people because of the physical environment (e.g., snow skiing, ocean beaches, boating, river rafting).
  - ▶ Describe how people take advantage of the physical environment of their local community (e.g., water supply, farming, gardens, recreational activities).
- B. Describe examples in which the physical environment imposes constraints on human activities, as exemplified by being able to
  - ▶ Describe how human activities are limited by landforms such as flood plains, deltas, mountains, and slopes in choices of land use (e.g., agriculture, human settlement, transportation networks).
  - ▶ Describe examples in which human activities are limited by different types of climates (e.g., cold or polar, rainy or dry, equatorial).
  - ▶ Describe how transportation routes are shaped by the physical environment (e.g., horseshoe curves, tunnels, bridges).

**8<sup>th</sup> GRADE**

the student knows and understands:

## Environmental Opportunities and Constraints

**1. The characteristics of a physical environment provide opportunities for and impose constraints on human activities**

Therefore, the student is able to:

- A. Explain how the characteristics of different physical environments offer opportunities for human activities, as exemplified by being able to
  - ▶ Describe and explain the environmental characteristics that people consider when deciding on locations for human activities (e.g., locating a waterwheel at a river's fall line for power, locating a ski resort in a high snowfall area with easy access for recreational skiers, farming on fertile flood plains for high crop yields).
  - ▶ Explain how physical features in the local community provide opportunities for future development (e.g., tourist river-walk development, beachfront resorts, solar and wind farms).
  - ▶ Explain how agricultural practices developed rapidly and successfully in favorable physical environments (e.g., along flood plains and in river valleys, in flat lands with adequate rainfall).
- B. Explain how the characteristics of different physical environments place constraints on human activities, as exemplified by being able to
  - ▶ Explain how environmental characteristics (e.g., rainfall, length of growing season, temperatures, soil) restrict the range of crops that can be grown successfully in an area.
  - ▶ Explain how building technologies are designed to respond to the constraints of the environment (e.g., building on permafrost in polar climates, designing buildings to withstand earthquakes).
  - ▶ Explain how the development of a city can be influenced by the physical environmental characteristics of the area (e.g., requirement of bedrock to support skyscrapers, filling in water areas to add buildable space, reduction of hills to level areas, mountain valleys with limited usable land area).

*This ski run at Copper Mountain, Colorado offers the perfect environment for downhill skiing. It overlooks the highway below that can be a challenge to keep open in winter but is essential to connect skiers to the ski slopes.*

**12<sup>th</sup> GRADE**

the student knows and understands:

## Environmental Opportunities and Constraints

**1. Depending on the choice of human activities, the characteristics of the physical environment can be viewed as both opportunities and constraints**

Therefore, the student is able to:

- A. Explain how people may view the physical environment as both an opportunity or a constraint depending on their choice of activities, as exemplified by being able to
  - ▶ Explain how mountainous terrain may constrain some farming techniques due to a lack of flat areas and yet offer opportunities in growing crops that are only suited to high-elevation growing conditions.
  - ▶ Explain how the ski industry and state roads departments may view the same mountainous region and its weather patterns as presenting both opportunities and constraints.
  - ▶ Explain how the physical environment of the arid West of the United States presents both opportunities and constraints for human activities (e.g., the construction, use, and maintenance of golf courses, cultivation of cotton and citrus fruits, numerous outdoor swimming pools, water intensive lawns and landscaping).

Image credit: Susan Gallagher Hefron



**4<sup>th</sup> GRADE***the student knows and understands:*

## Environmental Hazards

**2. Environmental hazards affect human activities***Therefore, the student is able to:*

A. Identify and describe the locations of environmental hazards, as exemplified by being able to

- ▶ Identify on a US map the locations of occurrences of tornadoes, earthquakes, and hurricanes and overlay a map of population density and identify locations where people and hazards are both located.
- ▶ Identify on a map of the Pacific basin the occurrences of earthquakes and volcanoes and describe the pattern that results (e.g., the Pacific Ring of Fire).
- ▶ Identify the types of environmental hazards that occur in the student's state or region, graph the occurrences during a five-year period, and map the locations of the occurrences.

B. Describe and analyze the effects of environmental hazards on human activities, as exemplified by being able to

- ▶ Describe how people change their behaviors in response to environmental hazards (e.g., knowing evacuation routes, building a storm shelter, conducting earthquake or tornado drills).
- ▶ Describe how people might build their houses differently on a coast or beach as compared to another location (e.g., elevated footings for storm surge, shutters over windows, metal reinforced roof trusses for wind).
- ▶ Construct a disaster preparedness manual for your community or school that includes a list of actions people should take in an emergency situation due to a local environmental hazard event.

**8<sup>th</sup> GRADE***the student knows and understands:*

## Environmental Hazards

**2. The types, causes, and characteristics of environmental hazards occur at a variety of scales from local to global***Therefore, the student is able to:*

A. Describe and explain the types and characteristics of hazards, as exemplified by being able to

- ▶ Identify and explain the types of threats posed to human settlement by different types of environmental hazards (e.g., wind destruction, fires, flooding, collapse of structures).
- ▶ Construct a table of climate-related and tectonic-related hazards and explain the characteristics of each type of hazard.
- ▶ Identify the locations of environmental hazards in the student's state or region, describe the characteristics of each, and explain how people adapt to living in these areas.

B. Explain the causes and locations of various types of environmental hazards, as exemplified by being able to

- ▶ Describe the physical environmental conditions that create or result in different environmental hazards (e.g., plate tectonics causing earthquakes, sea surface temperatures contributing to hurricane development in the Atlantic, strong frontal systems in thunderstorms spawning tornadoes).
- ▶ Identify the tectonic plate boundaries on a map and analyze the most likely locations of future earthquakes and volcanoes based on an explanation for the causes of these environmental hazards.
- ▶ Explain where and why tornadoes are most likely to occur in the United States.

**12<sup>th</sup> GRADE***the student knows and understands:*

## Environmental Hazards

**2. Humans perceive and react to environmental hazards in different ways***Therefore, the student is able to:*

A. Explain and compare how people in different environments think about and respond to environmental hazards, as exemplified by being able to

- ▶ Construct a list of environmental hazards and compare and contrast how people in developed and developing world regions prepare for and cope with the aftermath of these disasters.
- ▶ Construct and compare maps of recent wildfires and population distribution in Southern California and explain the reasons for and consequences of people building structures in the most vulnerable areas in this region (e.g., fire protection, insurance, financing, land values, quality of life, fuel suppression of vegetation).
- ▶ Explain how people from different parts of the country might have differing views on federal government insurance programs for areas susceptible to environmental hazards (e.g., hail insurance programs in Kansas, national flood insurance in Louisiana).

B. Explain how environmental hazards affect human systems and why people may have different ways of reacting to them, as exemplified by being able to

- ▶ Explain how volcanoes have sometimes been incorporated into local cultural traditions and lore by people who live with the unpredictability of eruptions rather than to relocate farther away from the hazard.
- ▶ Describe and explain the short- and long-term effects of hurricanes in the Gulf of Mexico and Atlantic coast on beaches, buildings, and human activities (e.g., insurance rates, zoning, building codes, beach replenishment, displaced populations).
- ▶ Compare the human responses to the potential predicted effects of climate change on different regions of Earth (e.g., people living in coastal versus landlocked areas, high- versus low-latitude areas, Northern versus Southern Hemisphere areas).

**GEOGRAPHY STANDARD 15: How physical systems affect human systems**

**4<sup>th</sup> GRADE**

the student knows and understands:

**Adaptation to the Environment**

**3. People adapt to the conditions of the physical environment**

Therefore, the student is able to:

- A. Describe how people adapt to conditions of the physical environment, as exemplified by being able to
  - ▶ Identify and describe how people adapt to the physical environment through choices of clothing, housing styles, food choices, recreational activities, and land use.
  - ▶ Describe how people adapt differently to different physical environments (e.g., clothing in Florida versus Alaska, houses in Hawaii versus Minnesota).
  - ▶ Describe different types of transportation needed in different environments (e.g., boats versus cars, air boats in swamps, sleds and snowmobiles).

**8<sup>th</sup> GRADE**

the student knows and understands:

**Adaptation to the Environment**

**3. People use tools and technologies in adapting to the physical environment**

Therefore, the student is able to:

- A. Explain how people use tools and technologies in adapting to the physical environment, as exemplified by being able to
  - ▶ Compare the tools and technologies used in agriculture in different environmental regions (e.g., terraced farming, center-pivot irrigation, slash-and-burn plots).
  - ▶ Explain how humans use technologies (e.g., pipelines, air conditioning, water recycling) to adapt to different physical environments.
  - ▶ Explain how people developed new building technologies to adapt to the physical environment (e.g., skywalks in Minneapolis, tunnels in downtown Montreal).

**12<sup>th</sup> GRADE**

the student knows and understands:

**Adaptation to the Environment**

**3. Societies use a variety of strategies to adapt to changes in the physical environment**

Therefore, the student is able to:

- A. Explain how societies adapt to reduced capacity in the physical environment, as exemplified by being able to
  - ▶ Explain how societies historically adapted to reduced capacity in the physical environment (e.g., migration, limiting population growth, building aqueducts and cisterns) and predict locations where adaptation strategies might be required in the future.
  - ▶ Explain how societies use technology in dealing with resource shortages amidst growing human populations (e.g., recycling used water, recycling paper products, converting to drip irrigation systems, development of new alternative energy sources).
  - ▶ Describe and explain how societies may change their use of building materials in response to changes in the physical environment.
- B. Analyze the concept of “limits to growth” to explain adaptation strategies in response to the restrictions imposed on human systems by physical systems, as exemplified by being able to
  - ▶ Analyze how people have adapted to physical environments that vary in carrying capacity (e.g., slash-and-burn agriculture practices, nomadic herding or hunting, importation of needed products).
  - ▶ Analyze the lifestyles of humans in extreme or island environments and explain strategies inhabitants use to survive and not overwhelm the limits of their environments (e.g., water collection and rationing in arid climates, Inuit seasonal seal hunting and fishing practices, Antarctic researchers using sustainable living practices).
  - ▶ Identify world locations that have vulnerable environmental conditions (e.g., extreme temperatures, limited access to water, steep topography) and high population density and explain adaptation strategies used in these locations that address the limits to growth.



*The people of Amsterdam have a long history of using dikes and canals to control flooding and reclaim land from the sea. Canals and bicycles are practical forms of transportation in a city with limited land area and flat terrain.*

Image credit: Susan Gallagher Heffron

**GEOGRAPHY STANDARD 16: The changes that occur in the meaning, use, distribution, and importance of resources**

Image credit: Mary Claire May

*Large-scale processing equipment at the Black Thunder Mine in the Powder River Basin of Wyoming extracts and moves approximately 10 percent of the total US coal production each year.*



Image credit: Mary Claire May

*Large turbines use wind as a flow resource in the production of electrical power at a wind farm near Palm Springs, California.*

**The geographically informed person** must understand that a “resource” is a cultural concept. A resource is any physical material constituting part of Earth that people need and value. Natural materials become resources when humans value them. The uses and values of resources change from culture to culture and from time to time. Resources are spatially distributed varying in quantity and quality. Some resources are finite, while others can be replenished at varying rates. However, humans need to balance short-term rates of use against long-term availability to ensure a sustainable future.

Therefore, Standard 16 contains these themes: Types and Meanings of Resources, Location and Distribution of Resources, and Sustainable Resource Use and Management.

Three basic resources—land, water, and air—are essential to survival. The characteristics and quantity of a resource are defined by whether it is a renewable, nonrenewable, or flow resource. Renewable resources can be replenished if their environments remain intact. Nonrenewable resources can be extracted and used only once. Flow resources, such as water, wind, and sunlight, must be used when and where they occur because they are neither renewable nor nonrenewable.

Resource location influences the distribution of people and their activities. People settle where they can make a living and where the needed resources are available—resources such as fertile soils, potable water, fuel, and building materials. The patterns of population distribution resulting from the relationship between resources and employment change as needs and technologies change. New technology alters how people appraise resources, influences where they live and work, and affects how economic systems adapt.

Students must understand how and why resources are valued, why they cause fierce competition among countries, and how resources are distributed across Earth’s surface. In addition, they must recognize that maintaining renewable resources at a sustainable level is a local and global responsibility.

Sustainable resource use and management is a key solution to many ecological problems. Understanding these three themes enables students to address a fundamental question: In the absence of regulation and prudent public policy, can our present industry-based and consumer-oriented lifestyle continue without causing irreversible ecological damage and perhaps even ecological collapse?

**GEOGRAPHY STANDARD 16: The changes that occur in the meaning, use, distribution, and importance of resources**

**4<sup>th</sup> GRADE**

*the student knows and understands:*

**Types and Meanings of Resources**

**1. The characteristics of renewable, nonrenewable, and flow resources**

*Therefore, the student is able to:*

- A. Identify and explain the characteristics of renewable, nonrenewable, and flow resources, as exemplified by being able to
  - ▶ Explain the meaning of the term “resource” and then illustrate the idea of renewable, nonrenewable, and flow resources by sorting example photographs into each of the three categories.
  - ▶ Identify the types of energy resources that students and their families use in their everyday lives and then categorize each as renewable, nonrenewable, or flow resources.
  - ▶ Identify the types of nonrenewable resources students and their families use in their everyday lives and identify renewable and flow resources that could be used instead of nonrenewable resources.

**8<sup>th</sup> GRADE**

*the student knows and understands:*

**Types and Meanings of Resources**

**1. People can have different viewpoints regarding the meaning and use of resources**

*Therefore, the student is able to:*

- A. Describe examples of how cultures differ in their definition and use of resources, as exemplified by being able to
  - ▶ Describe differences in the types of resources used in different geographic contexts in various parts of the world (e.g., the use of wood or animal dung versus electricity or natural gas as a cooking fuel, the use of electrical appliances versus doing household chores by hand).
  - ▶ Describe the size and effect on the environment of the ecological footprint of an US school student versus a young person living in a rural area of a developing country.
  - ▶ Describe how cultures value things differently in terms of resource use (e.g., Old Order Amish choose not to use petroleum and electricity, Muslims and Jews choose not to use pork as a food source, many cultures around the world choose not to use insects as food source).

**12<sup>th</sup> GRADE**

*the student knows and understands:*

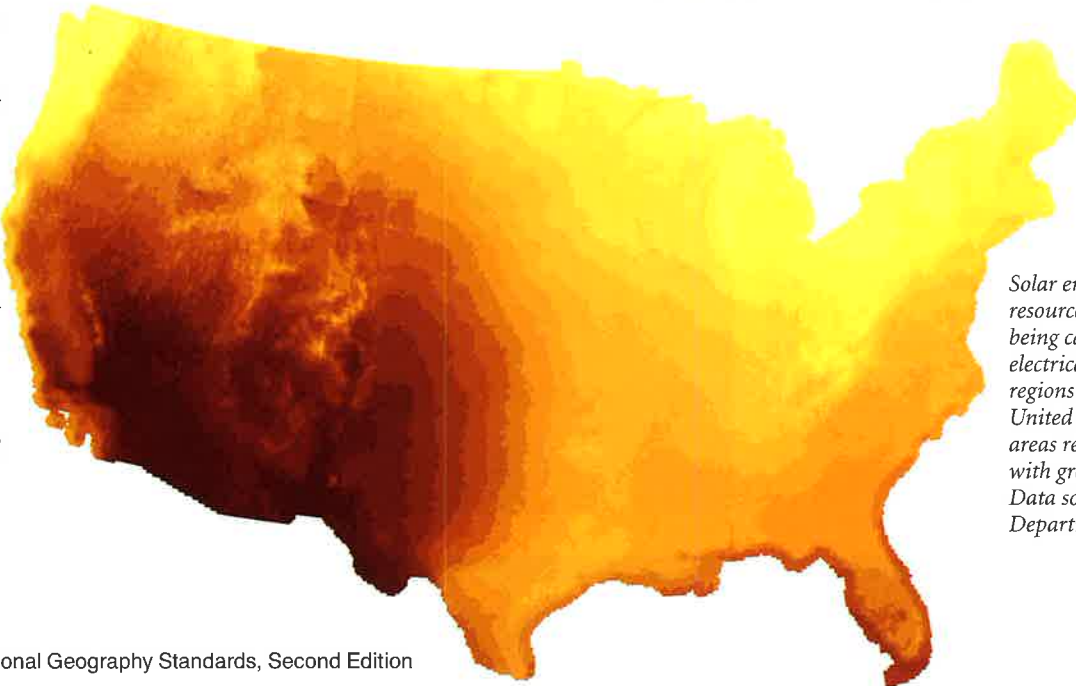
**Types and Meanings of Resources**

**1. The meaning and use of resources change over time**

*Therefore, the student is able to:*

- A. Explain the relationship between the quest for resources and the exploration, colonization, and settlement of different regions of the world, as exemplified by being able to
  - ▶ Describe the Columbian exchange of plant and animal resources and explain how this exchange changed patterns of food consumption around the world (e.g., the introduction of cattle and beef consumption throughout the Americas, the introduction of potatoes as a staple food across northern Europe and parts of Asia, the introduction of corn as a staple food across southern Africa).
  - ▶ Identify different types of resources (e.g., precious metals, spices, animal products) that drove the 15th- to 20th-century European process of exploration and colonization in North America, Africa, and Asia, and explain how this process influenced the spatial distribution of European colonies on those continents.
  - ▶ Describe and explain how the prospect of gaining access to resources in the Arctic and Antarctic regions creates competition among countries with territorial claims.
- B. Explain how globalization and higher standards of living affect the meaning and use of resources, as exemplified by being able to
  - ▶ Explain why mass consumption associated with globalization requires enormous amounts of resources worldwide (e.g., energy to ship raw materials and finished goods worldwide, emerging consumer markets increase in demand for energy due to increased ownership and use of electrical devices).
  - ▶ Explain fluctuations in world petroleum prices as a function of global changes in supply and demand (e.g., disruptions in supply due to political tensions, new suppliers such as Angola, environmental disasters such as oil leaks and spills).
  - ▶ Explain how and why per-capita consumption of resources (e.g., petroleum, coal, electricity, steel, water, food) differs between developed and developing countries now and in the past.

Map credit: University of North Alabama/Lisa Keys-Matthews



*Solar energy is a flow resource that is increasingly being captured and used for electrical power in certain regions of the contiguous United States. The darker areas represent locations with greater solar potential. Data source: NREL/US Department of Energy.*

## GEOGRAPHY STANDARD 16: The changes that occur in the meaning, use, distribution, and importance of resources

**4<sup>th</sup> GRADE**

the student knows and understands:

## Location and Distribution of Resources

**2. The spatial distribution of types of resources**

Therefore, the student is able to:

- A. Identify the locations of examples of each type of resource, as exemplified by being able to
- ▶ Identify the locations on a US map of various types of renewable, nonrenewable, and flow resources.
  - ▶ Identify the locations of examples of each of the three types of resources that are found in the student's state or region.
  - ▶ Identify which US states might be good locations for the production of hydroelectric, geothermal, solar, and wind energies.

**8<sup>th</sup> GRADE**

the student knows and understands:

## Location and Distribution of Resources

**2. The formation and spatial distribution of types of resources**

Therefore, the student is able to:

- A. Describe the physical processes that influence the formation and therefore spatial distribution of renewable, nonrenewable, and flow resources, as exemplified by being able to
- ▶ Explain how physical processes played a role in the formation and location of nonrenewable resources such as coal, petroleum, and diamonds.
  - ▶ Describe the physical conditions necessary to generate electricity from flow resources (e.g., water, geothermal, solar, wind) and then identify on a US map potential locations for the generation of electricity from these flow resources.
  - ▶ Describe the physical processes that support the quantity and quality of renewable resources and how the resulting distribution may make them more or less useful.
- B. Explain the location and uses of major resources in the world, as exemplified by being able to
- ▶ Construct a map that identifies the ten leading petroleum-producing countries and the ten leading petroleum-consuming countries and then identify where overlap occurs.
  - ▶ Identify countries in which resources (e.g., fossil fuels, minerals, agricultural products) are the primary source of export earnings and describe the advantages and disadvantages of this interdependency.
  - ▶ Describe different types of vegetation used in biofuel production (e.g., corn, sugarcane, switch grass) and identify countries that have or can have an abundance of vegetation that may be used for this type of fuel source.

**12<sup>th</sup> GRADE**

the student knows and understands:

## Location and Distribution of Resources

**2. The spatial distribution of resources affects patterns of human settlement and trade**

Therefore, the student is able to:

- A. Analyze and explain the relationships between the spatial patterns of settlement and resources, as exemplified by being able to
- ▶ Describe and analyze various thematic maps to understand the relationship between the distribution of resources (e.g., water, agricultural, mineral, and energy resources) and patterns of human settlement.
  - ▶ Analyze and explain the growth and/or decline of US towns that have relied on nonrenewable fossil fuel extraction (e.g., petroleum, coal, natural gas) or flow resource energy production (e.g., hydroelectric, geothermal, solar, wind).
  - ▶ Construct a map and explain how the spatial distribution of resources influences human migration patterns (e.g., guest workers in southwestern Asian petroleum-exporting countries, historic gold rushes and land grabs, hunters following animal migrations).
- B. Analyze and evaluate patterns of trade in resources, as exemplified by being able to
- ▶ Analyze the positive and negative economic, social, and environmental consequences of extracting and/or using specific resources to trade in foreign markets (e.g., timber, coal, petroleum, uranium).
  - ▶ Compare the per-capita incomes of countries that lead the world in the export of luxury crops (e.g., coffee, tea, tobacco, cacao) with countries that lead the world in the consumption of these crops and evaluate the positive and negative consequences of these trade relationships.
  - ▶ Identify countries that lead the world in petroleum production and explain how petroleum wealth influences international economic and political relationships.



Image credit: University of North Alabama/Lisa Keys-Matthews

Large reserves of natural gas are found under much of Wyoming. In this satellite image of Jonah Field, located in the Green River Basin in Sublette County, the sites of the gas wells are visible as dots connected by a road network. Data source: NASA Landsat, 2006.



**GEOGRAPHY STANDARD 16: The changes that occur in the meaning, use, distribution, and importance of resources**

**4<sup>th</sup> GRADE**

the student knows and understands:

**Sustainable Resource Use and Management**

**3. The sustainable use of resources in daily life**

Therefore, the student is able to:

- A. Identify the ways in which different types of resources can be conserved, reused, and recycled, as exemplified by being able to
  - ▶ Identify the advantages and disadvantages of recycling and reusing materials made from resources that people value.
  - ▶ Identify how much and what kinds of waste are or can be recycled in the school cafeteria.
  - ▶ Identify specific ways in which household water and electricity usage can be reduced.

**8<sup>th</sup> GRADE**

the student knows and understands:

**Sustainable Resource Use and Management**

**3. Humans can manage resources to sustain or prolong their use**

Therefore, the student is able to:

- A. Explain how renewable resources can be continuously replenished through sustainable use, as exemplified by being able to
  - ▶ Describe and explain how sustainable management techniques can be applied in farming, forestry, and fishing (e.g., soil banks and contour plowing, sustainable timber harvesting practices, aquaculture).
  - ▶ Describe and explain how international agreements or policies provide for limited and therefore sustainable fishing practices (e.g., whale harvesting, tuna harvesting, seasonal fishing limitations).
  - ▶ Explain how petroleum-based consumer products can be replaced by renewable resources (e.g., plastic bags, eating utensils, diapers replaced by corn- or bamboo-based materials).
- B. Explain how humans can use technology to prolong the supply of nonrenewable resources and utilize flow resources, as exemplified by being able to
  - ▶ Construct a world map showing energy consumption per capita and describe how the use of alternative energy technologies may change the spatial patterns of energy consumption.
  - ▶ Explain how the development and use of technological advances, such as hybrid engines in cars, can extend the supply of nonrenewable resources.
  - ▶ Explain how the development of new technologies can maintain or prolong the supply of nonrenewable resources (e.g., deep-water ocean drilling platforms, advanced oil recovery techniques for oil-shale deposits).

*Although this map is posted in Knoxville, Tennessee, communities across the country are using similar visuals to illustrate the importance of location in managing water resources since actions in upstream locations can affect water quality and quantity downstream.*

**12<sup>th</sup> GRADE**

the student knows and understands:

**Sustainable Resource Use and Management**

**3. Policies and programs that promote the sustainable use and management of resources impact people and the environment**

Therefore, the student is able to:

- A. Explain and compare the costs and benefits of using various types of renewable, nonrenewable, and flow resources, as exemplified by being able to
  - ▶ Compare the advantages and disadvantages of using alternative energy resources (e.g., electricity generated from coal fire, diesel turbines, hydroelectric dams, nuclear power, wind turbines, solar panels, geothermal heat, methane gas from landfills or animal waste) and then rank them based on criteria such as availability, sustainability, pollution, and expense.
  - ▶ Describe and explain the costs and benefits of Organization of Petroleum Exporting Countries (OPEC) policies on oil for both the producing and consuming countries.
  - ▶ Analyze the efforts of countries with emerging global economies (e.g., China, India, Brazil) to develop and use renewable and flow energy resources and evaluate the economic and environmental costs and benefits of these efforts.
- B. Evaluate policy decisions regarding the sustainable use of resources in different regions and at different spatial scales in the world, as exemplified by being able to
  - ▶ Evaluate the effect of efforts by the United Nations or other supranational organizations (e.g., World Bank, International Monetary Fund [IMF], Organization of American States [OAS], European Union [EU]) to promote sustainable development.
  - ▶ Compare government policies and programs to promote sustainability (e.g., reducing fossil-fuel dependency, recycling, conserving water) in developed and developing countries.
  - ▶ Compare the recycling programs of several local municipalities and evaluate the costs and benefits of each program.



Image credit: D. J. Zeigler

## GEOGRAPHY STANDARD 17: How to apply geography to interpret the past



Map credit: Library of Congress, Geography and Map Division

In 1803, the Lewis and Clark Expedition started up the Missouri River to explore the recently acquired Louisiana Territory which essentially doubled the land area of the United States at the time. This map published in 1814 by Samuel Lewis shows the track of the expedition.

**The geographically informed person** must understand the importance of bringing spatial and ecological perspectives of geography to bear on the events of history, and vice versa, and the value of learning about the geographies of the past. An understanding of geography informs an understanding of history. There is a significant inherent link between the two disciplines.

Therefore, Standard 17 contains these themes: Using Geography to Interpret the Past, Changes in Geographic Contexts, and Perceptions of Geographic Contexts.

The geographies of past times carry important messages for understanding the world of today. The events of human history have played out on a vast and complex geographic stage; countless generations have tried to adapt to what Earth has provided in the form of climate, land and water resources, plants and animals, and transportation routes. All of these things are shaped by the ongoing interactions and interdependence of physical and human systems and have created the contexts in which history has unfolded.

History is about changes over time set into the context of space and environment. The events of history are all place-based. Students need to understand the fundamental processes of change in geographic contexts. Events are influenced by people's perceptions of geographic contexts and by their perspectives on events.

Students must understand the spatial organization of the world in the past; consider the ways in which different people understood and assessed the physical and human geographical features of their spatial and environmental contexts; and pay attention to the beliefs and attitudes of people in the past regarding the environment, human migration, land use, and their own rights and privileges versus those of others.

Understanding these themes enables students to interpret and understand historical issues by knowing what the world was like in the past, how it changed, and how it was perceived by different people and groups at a given place at a given time.



Image credit: Phil Geramehl

Canals greatly increased the efficiency and lowered the costs of transportation in the eastern United States during the early 1800s. A restored canal boat passes through a lock in one of the historically preserved canal sections.

Essential Element: The Uses of Geography

**GEOGRAPHY STANDARD 17: How to apply geography to interpret the past**

**4<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Past**

**1. Geographic contexts (the human and physical characteristics of places and environments) are the settings for events in the past**

Therefore, the student is able to:

- A. Describe the geographic context in which a historical event occurred, as exemplified by being able to
  - ▶ Describe the geographic context of famous events in US history using maps and narrative accounts (e.g., read accounts of Paul Revere's ride and follow the route on a map, compare the overland and water routes to California during the 1849 gold rush).
  - ▶ Identify physical landforms that affected overland travel during the expansion of the United States (e.g., mountain ranges and passes, river crossings, deserts).
  - ▶ Identify and describe the differences between the geographic contexts of Native American original settlement areas and the current tribal reservations in the United States.

**8<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Past**

**1. A historical event is influenced by the geographic context (the human and physical characteristics of places and environments) in which it occurred**

Therefore, the student is able to:

- A. Analyze and explain the influence of the geographic context on historical events, as exemplified by being able to
  - ▶ Analyze the significance of physical features that have influenced historical events (e.g., the role of hydrologic features such as the fall line, Cumberland Gap, the Ohio River, the Ogallala Aquifer, or artesian wells of the Great Plains in the settlement of the United States, the role of ocean currents and prevailing winds in exploration by Columbus, the forced transport of Africans to North and South America).
  - ▶ Explain how physical geographic features and levels of technology influence the course and outcome of battles and wars (e.g., weather conditions at Valley Forge and the outcome of the American Revolution, weather and beach features on D-Day during World War II, the role of the typhoon winds in the defeat of the Mongols invading Japan in the 1200s).
  - ▶ Describe and explain how access to the open range of the Great Plains provided the context for the expansion of the cattle industry (e.g., free grasslands for grazing, trails across open areas to railroad trailheads).

*During the 19th century, cattle replaced bison on the grasslands of the Great Plains. An open range and free grass encouraged grazing, and unrestricted trails facilitated the movement of cattle to railroad towns where they could be shipped to eastern markets. Today, Wind Cave National Park has reestablished the American bison on South Dakota's prairie.*

*The Wilderness Road channeled westward-bound pioneers through the Cumberland Gap into the trans-Appalachian west. Today, the road is a hiking trail that passes over the crest of the Appalachians offering the opportunity to experience a part of historical geography.*

**12<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Past**

**1. Geographic contexts (the human and physical characteristics of places and environments) can explain the connections between sequences of historical events**

Therefore, the student is able to:

- A. Analyze and explain the connections between sequences of historical events and the geographic contexts in which they occurred, as exemplified by being able to
  - ▶ Analyze and explain how the vast size and physical geographic characteristics of Russia helped it to survive multiple military invasions (e.g., scorched-earth policy and continuous retreat, severe winter weather, length of logistical support lines for armies, distances to travel during short summer seasons).
  - ▶ Analyze the long-term development of the connections between Europe and the Americas in terms of trade of products and resources, migrations (forced and voluntary), disease diffusion, cultural diffusion, and colonization.
  - ▶ Analyze the restructuring of Africa by explaining how colonial-era boundaries were imposed on preexisting cultural geographies (e.g., race, ethnicity, language, religions) and have resulted in current boundary tensions.



Image credit: D.J. Zeigler



Image credit: Mary Claire May

## GEOGRAPHY STANDARD 17: How to apply geography to interpret the past

**4<sup>th</sup> GRADE**

the student knows and understands:

## Changes in Geographic Contexts

**2. Places, regions, and environments change over time**

Therefore, the student is able to:

- A. Analyze how places, regions, and environments change over time, as exemplified by being able to
- ▶ Construct a time line illustrating changes in land use, settlement, housing, and economic activities in the local community or region (e.g., the effects of migration, demographic changes, economic conditions).
  - ▶ Describe and analyze the change in the number of states in the United States and their boundaries.
  - ▶ Describe how the physical environment of a county or state was changed by processes of forest clearing, damming of rivers, cultivation of fields, or land leveling.

**8<sup>th</sup> GRADE**

the student knows and understands:

## Changes in Geographic Contexts

**2. Change occurs in the geographic characteristics and spatial organization of places, regions, and environments**

Therefore, the student is able to:

- A. Describe and explain changes in the geographic characteristics and spatial organizations of places, regions, and environments in the past, as exemplified by being able to
- ▶ Describe and compare population settlement patterns during different historical periods (e.g., discuss regional differences in colonial settlement patterns in North America, trace the westward expansion of the United States through land acquisitions and government incentives for land ownership).
  - ▶ Analyze the changing patterns of spatial organization in an area that has been occupied by different cultures (e.g., the settlement of the Mexico City area by Aztecs, Spanish, and the modern Mexican State).
  - ▶ Describe the changes in the spatial organization of cities over the past 100 years (e.g., the effects of suburbanization, freeway systems, public transit, skyscrapers, shopping malls).

**12<sup>th</sup> GRADE**

the student knows and understands:

## Changes in Geographic Contexts

**2. The causes and processes of change in the geographic characteristics and spatial organization of places, regions, and environments over time**

Therefore, the student is able to:

- A. Identify and explain the causes and processes of change in the geographic characteristics and spatial organization of places, regions, and environments over time, as exemplified by being able to
- ▶ Explain the diffusion of a phenomenon and the effects it had on regions of contact (e.g., the spread of diseases such as bubonic plague or species such as the African honey bee, diffusion of cell phone technology, the migration of urban dwellers to the suburbs in 20th-century United States, the spread of religious faiths).
  - ▶ Explain the causes of and short- and long-term effects of migrations on the receiving and sending regions (e.g., the Great Migration of African Americans to the cities of the North, the move to “El Norte” of Mexicans and other Central Americans in 1900 to the present, the population shift out of the Dust Bowl in the 1930s).
  - ▶ Analyze how technological changes in infrastructure have affected human activities in places, regions, and environments over time (e.g., the effects of processes of technological change, particularly suburbanization, through creation of an interstate highway system, development of the railroad spurring migration and influencing changes in land-use patterns with access to markets).



Image credit: D.J. Zeigler

High in Peru's Andes Mountains, Machu Picchu was built by the Incas, possibly as a retreat for the emperor. It survived the Spanish decimation of the Inca Empire in the 1500s and then disappeared into the rainforest for over three centuries. It has since reemerged to become one of the most valuable indigenous archaeological and historical sites in South America.

Essential Element: The Uses of Geography  
**GEOGRAPHY STANDARD 17: How to apply geography to interpret the past**

**4<sup>th</sup> GRADE**

the student knows and understands:

Perceptions of Geographic Contexts

**3. People’s perceptions of the world—places, regions, and environments—changed over time**

Therefore, the student is able to:

- A. Describe examples of people’s changing perceptions of the world, as exemplified by being able to
  - ▶ Describe how people might have perceived a place 50 or 100 miles away before the invention of the automobile, buses, or trains.
  - ▶ Describe how the reports and maps of early nautical explorers changed people’s perceptions of the world (e.g., the world was not flat, the sea did not drop off into nothingness, the world could be circumnavigated).
  - ▶ Describe how people’s perception of the environment changed over time from limitless exploitation to sustainability (e.g., pollution of rivers during industrialization, pollution of air or scarring of land from mining, depletion of American bison from overhunting).

**8<sup>th</sup> GRADE**

the student knows and understands:

Perceptions of Geographic Contexts

**3. Historical events were influenced by people’s perceptions of places, regions, and environments**

Therefore, the student is able to:

- A. Explain how historical events were influenced by people’s perceptions of people, places, regions, and environments, as exemplified by being able to
  - ▶ Explain how geographic perceptions impacted decisions of and actions by an individual, a group, or a nation (e.g., the perception of land uses and its values leading to the creation and later dissolution of the Indian Territory in the United States, views held resulting in Australia initially being used as a penal colony, perceptions of desert regions as resource-poor changed when oil was discovered).
  - ▶ Analyze and explain how letters, promotional literature, advertisements, and newspapers in the 19th century shaped public perceptions of the American West and led to its settlement.
  - ▶ Explain how the perception of oceans as buffers on both coasts contributed to US isolationist foreign policy until 1898.

**12<sup>th</sup> GRADE**

the student knows and understands:

Perceptions of Geographic Contexts

**3. Historical events must be interpreted in the contexts of people’s past perceptions of places, regions, and environments**

Therefore, the student is able to:

- A. Analyze and evaluate the role that people’s past perceptions of places, regions, and environments played as historical events unfolded, as exemplified as being able to
  - ▶ Describe the changes in perceptions about a group, place, or geographic feature and analyze the effects of those changes (e.g., opinions about the role of fires in national forests and parks, attitudes towards and therefore treatment of wetlands in the United States from 1700 to today, changes in attitudes about the characteristics of the Great Plains from the idea of the Great American Desert to the Dustbowl to the Breadbasket).
  - ▶ Analyze the effects of changes in environmental perception on the decision-making processes (e.g., Jamestown, Virginia, settlers perceived Virginia to be laden with gold and a continental climate conducive for settlement, African Americans migrating to the “Promised Land” of northern industrial centers to escape Jim Crow laws, Nevada’s cities changing from desert outposts or silver mining boom towns to entertainment and golf resort destinations).
  - ▶ Analyze and compare the changing perceptions of the tropical Latin American rainforests on the development policies towards their use (e.g., as a source of rubber and timber, as a barrier to transcontinental travel, as a home to indigenous populations, as a source of raw materials, as areas rich in biodiversity and in need of preservation, as a carbon sink).

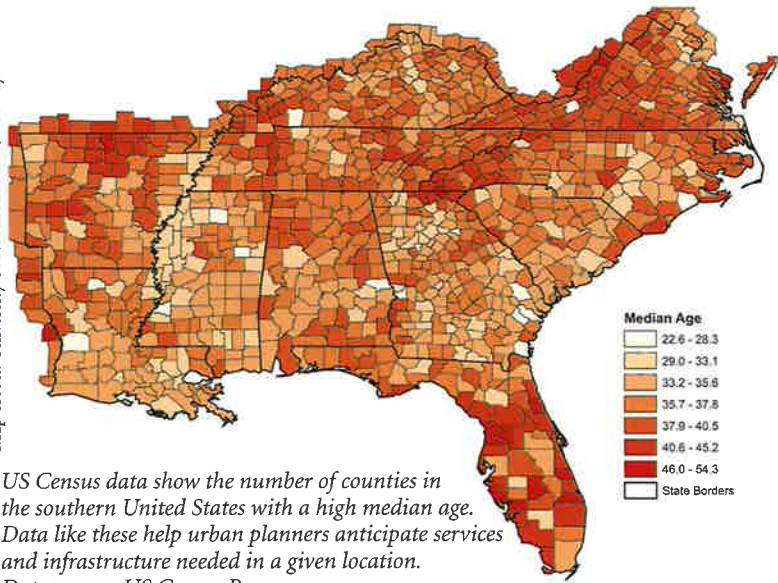
Map credit: Library of Congress, Geography and Map Division



*This 1851 “Map Of The Upper Great Plains And Rocky Mountains Region” by Pierre Jean De Smet shows the territories of various North American Indian nations and early boundaries for some US states. A growing US population and desire for a transcontinental railroad to the Pacific would contribute to changes in future boundaries.*

**GEOGRAPHY STANDARD 18: How to apply geography to interpret the present and plan for the future**

Map credit: University of North Alabama/Lisa Keys-Mathews



US Census data show the number of counties in the southern United States with a high median age. Data like these help urban planners anticipate services and infrastructure needed in a given location. Data source: US Census Bureau.

**The geographically informed person**

must understand that the study of geography is critical to understanding the world, now and in the future, and is not simply an exercise for its own sake. As the world becomes more complex and interconnected—as a result of globalization, improvements in transportation and communication technologies, changes in physical systems, and increased cooperation and conflict—the need for geographic knowledge, skills, and perspectives increases among the world’s people. While Standard 17 focuses on the importance of geography to understanding the events of the past, Standard 18 emphasizes the value and power of geography in comprehending current events and planning for the future in geographically-appropriate and sustainable ways.

Therefore, Standard 18 contains these themes: Using Geography to Interpret the Present and Plan for the Future, Changes in Geographic Contexts, and Perceptions of Geographic Contexts.

Knowing geography is a key to nations, peoples, and individuals being able to develop a coherent understanding of the causes, meanings, and effects of the physical and human events that occur—and are likely to occur in the future—on Earth. Consequently, the practical application of geography empowers students to participate as responsible citizens and leaders of tomorrow. Creating effective, ethical, and lasting solutions to the world’s problems requires that today’s students mature into adults who can make skilled and informed use of geographic knowledge, skills, and perspectives to identify possible solutions, predict their consequences, and implement the appropriate solutions.

Students must understand that the world in which they live is dynamic and that actions they take, both as individuals and collectively, can help to shape the future in both positive and negative ways. They also should understand that their perceptions of geographic contexts influence their decisions. Students must continually pose and answer geographic questions about the world in which they live and the world in which they wish to live.

Geographic context plays an integral role in creating the world of the future. Understanding these themes enables students to solve significant problems, make informed decisions, and take positive action on a variety of issues.



Pointing the way to London’s future, a high-rise dormitory in “The City” contrasts sharply with the low-rise structures characterizing traditional neighborhoods.

Image credit: D.J. Zeigler

Essential Element: The Uses of Geography

**GEOGRAPHY STANDARD 18: How to apply geography to interpret the present and plan for the future**

**4<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Present and Plan for the Future**

**1. Geographic contexts (the human and physical characteristics of places and environments) are the settings for current events**

Therefore, the student is able to:

- A. Analyze geographic contexts in which current events and issues occur, as exemplified by being able to
  - ▶ Describe the geographic factors that would influence the decision on where to locate a new school in the local community (available land, proximity to student populations, proximity to dangerous roads or industries).
  - ▶ Describe the services a city government needs to provide due to the specific geographic characteristics of the community (e.g., big snow removal equipment in lake-effect locations, frequent brake replacement for San Francisco streetcars, wind screens for tennis courts in Great Plains locations, evacuation plans in flood-prone areas).
  - ▶ Analyze a current environmental issue in the region (e.g., building or demolishing a dam, building or expansion of freeway system, creation of parks and open spaces, regulatory legislation on industry to prevent further air, water, and land pollution) and describe ways in which people and the environment interact to affect the issue positively and negatively.



Image credit: D.J. Zeigler

**8<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Present and Plan for the Future**

**1. Geographic contexts (the human and physical characteristics of places and environments) provide the basis for problem solving and planning**

Therefore, the student is able to:

- A. Describe and analyze the influences of geographic contexts on current events and issues, as exemplified by being able to
  - ▶ Explain the role of the geographic context in a current global conflict (e.g., boundary dispute, resource allocation, land-use issues) and identify strategies that might be used to settle the conflict.
  - ▶ Describe and analyze the challenges a region's physical geography offers in making policy decisions about present and future needs (e.g., planning military operations in remote or rugged areas of the world, determining the advisability of extracting natural resources from environmentally fragile areas).
  - ▶ Describe the geographic context and resulting challenges in monitoring and maintaining a secure southern US border.
- B. Describe and analyze the influences of geographic contexts on the process of planning for the future, as exemplified by being able to
  - ▶ Identify areas in a community with potential for growth and describe the geographic considerations for planning for future transportation and city services (e.g., schools, parks, sewage treatment plants, water and energy services).
  - ▶ Analyze areas of a community most prone to potential flooding from rivers, thunderstorms, and storm surges and suggest possible mitigation strategies.
  - ▶ Analyze the current pattern of interstate highways and based on projections of population growth suggest where new highways might be needed.

*In Virginia Beach, Virginia, and cities everywhere, geography can be used by coastal populations in planning for evacuation and disaster preparedness.*

**12<sup>th</sup> GRADE**

the student knows and understands:

**Using Geography to Interpret the Present and Plan for the Future**

**1. Geographic contexts (the human and physical characteristics of places and environments) provide the basis for analyzing current events and making predictions about future issues**

Therefore, the student is able to:

- A. Explain and evaluate the influences of the geographic context on current events and issues to make informed decisions and predictions about the future, as exemplified by being able to
  - ▶ Identify different views regarding contemporary social and environmental challenges and analyze the geographic factors influencing the stakeholders and their preferred policies (e.g., visions from local citizens about the relative importance of privacy versus security, opinions from residents of multiple states about a shared resource and about mechanisms for seeking resolution, viewpoints from around the world about relationships between economic development, resource consumption, population, and environmental alteration).
  - ▶ Evaluate the current zoning policies for high-crime areas in a metropolitan area and predict changes in zoning and land use that may positively affect the community.
  - ▶ Analyze the geographic consequences on different continents of strategies for responding to a global health pandemic (e.g., effects of closing international airports, quarantine of ships or cargoes, implementation of immunization plans for susceptible populations).
- B. Analyze and evaluate the connections between the geographic contexts of current events and possible future issues, as exemplified by being able to
  - ▶ Evaluate the feasibility and long-range impacts in a series of scenarios for dealing with social and environmental issues (e.g., absorbing and dispersing refugees, responding to threats from global warming, managing the future of Antarctica).
  - ▶ Analyze the geographic implications of storing low-level nuclear material in a given state or region (e.g., suitability of sites, distribution of population, transportation network and routes).
  - ▶ Analyze the effects of current rates of population growth on long-term sustainability in different regions of the world.

## GEOGRAPHY STANDARD 18: How to apply geography to interpret the present and plan for the future

**4<sup>th</sup> GRADE***the student knows and understands:***Changes in Geographic Contexts****2. Places, regions, and environments will continue to change***Therefore, the student is able to:*

- A. Describe current changes in places, regions, and environments and predict how these locations may be different in the future, as exemplified by being able to
- ▶ Describe how to plan for the environmental future of a place by completing the following statements: “I will keep...” “I will change...” and “I will remove...”
  - ▶ Describe the effects that building a new subdivision might have on the local environment (e.g., loss of farms or green space, increased traffic, more run off from additional paved surfaces).
  - ▶ Describe the effects of opening or closing schools (e.g., gain or loss of playgrounds, fewer or more students needing buses to get to school).

**Perceptions of Geographic Contexts****3. People’s perceptions of the world—places, regions, and environments—are constantly changing***Therefore, the student is able to:*

- A. Explain how people’s perceptions of the world can change with new information and new experiences, as exemplified by being able to
- ▶ Describe a recent trip and explain what preconceived thoughts were about the place compared with how it turned out to be in reality.
  - ▶ Explain how the depiction of a place in movies or on television can affect how people perceive that place.
  - ▶ Describe and explain how a student’s view of his or her home community can be different from someone who is only visiting the community.

**8<sup>th</sup> GRADE***the student knows and understands:***Changes in Geographic Contexts****2. Change occurs in the geographic characteristics and spatial organization of places, regions, and environments***Therefore, the student is able to:*

- A. Describe and explain current changes in the geographic characteristics and spatial organizations of places, regions, and environments and predict how they may be different in the future, as exemplified by being able to
- ▶ Identify environmental issues in a region and describe the consequences of these issues on the region and the appearance of the environment in the next 30 years if no action is taken, limited action is taken, or with considerable intervention.
  - ▶ Describe how the increasing demand for water resources will affect the physical environment and suggest ways to replenish and conserve water resources.
  - ▶ Explain why the majority of emerging megacities will continue to be located in South and East Asia.

**Perceptions of Geographic Contexts****3. People’s perceptions of the world affect their views of the present, and expectations about the future***Therefore, the student is able to:*

- A. Explain the role perception plays in planning for the present and the future, as exemplified by being able to
- ▶ Identify the top five states a student would choose and not choose to live in and explain the reasons for the choices.
  - ▶ Explain how the views of different stakeholder groups would need to be considered in the development of a new local facility (e.g., school, park, hospital, reservoir).
  - ▶ Describe how changes in the economy of a community may affect personal perceptions of that place and people’s plans for their futures.

**12<sup>th</sup> GRADE***the student knows and understands:***Changes in Geographic Contexts****2. The current and possible future causes and processes of change in the geographic characteristics and spatial organization of places, regions, and environments***Therefore, the student is able to:*

- A. Identify and explain the causes and processes of current and possible future changes in the geographic characteristics and spatial organization of places, regions, and environments, as exemplified by being able to
- ▶ Identify areas where people are engaged in nationalistic movements and analyze the potential of these groups to change the current political geographies of their nation states.
  - ▶ Describe and explain the possible effects of new electronic communication technologies on everyday life (e.g., location-based services on purchasing, telecommuting on the demand for commercial real estate and traffic volume and patterns, outsourcing of technological services).
  - ▶ Describe and explain the possible effects of new routes and technologies on world trade patterns (e.g., the effects of increasing the size of the Panama Canal, opening the route through the Arctic Ocean, the development of increasingly larger supertankers and cargo ships).

**Perceptions of Geographic Contexts****3. Multiple and diverse perceptions of the world must be taken into account to understand contemporary and future issues***Therefore, the student is able to:*

- A. Evaluate how perceptions vary and affect people’s views of contemporary issues and strategies for addressing them, as exemplified by being able to
- ▶ Explain how and why residents of different regions of the country might evaluate energy policy proposals differently (e.g., Alaska and Arctic National Wildlife Refuge [ANWR] oil drilling, California and off-shore oil production, mid-Atlantic states and the Marcellus Oil Shale Field).
  - ▶ Explain how perceptions of immigration differ among people depending on their location, socioeconomic status, or occupation.
  - ▶ Identify and compare different perspectives about international climate change agreements regarding carbon emissions from the points of view of the developed countries and the less-developed countries.





# Asking and Answering Questions about the World: Geographic Skills

## The Importance of Geographic Skills

Geographic skills provide the necessary tools and techniques for us to think geographically. They are central to geography's distinctive approach to understanding Earth's physical and human patterns and processes. Geographic skills are used in making decisions important to everyday life—where to buy or rent a home; where to get a job; how to get to work or to a friend's house; and where to shop, vacation, or go to school. All of these decisions involve the ability to acquire, arrange, and use geographic information. Daily decisions and community activities are linked to thinking systematically and spatially about environmental and societal issues.

Community decisions relating to problems of air, water, and land pollution or locational issues, such as where to place industries, schools, and residential areas, also require the skillful use of geographic information. Business and government decisions—from the best site for a supermarket or a regional airport to issues of resource use or international trade—involve the analysis of geographic data.

Geographic skills help people make reasoned political decisions. Whether the issues involve the evaluation of foreign affairs and international economic policy or local zoning and land use, geographic skills enable people to collect and analyze information, come to an informed conclusion, and make reasoned decisions on a course of action. Geographic skills also aid in the development and presentation of effective, persuasive arguments regarding matters of public policy.

## Developing Geographic Skills

It is essential that students develop skills that will enable them to observe patterns, associations, and spatial order. Many of the skills that students are expected to learn involve using tools and geospatial technologies that are part of the process of geographic inquiry. Geographic representations, such as maps and globes, as well as their digital versions, are essential tools of geography because they assist in visualizing spatial arrangements and patterns.

Other tools and geospatial technologies, including satellite-produced images, graphs, sketches, diagrams, and photographs are also integral parts of geographic analysis. The rate of growth of an urban area, for example, can be observed by comparing old and new satellite images. Large-scale land-use changes or changes in sea surface temperatures can be observed by comparing a series of satellite images. An important tool in geographic analysis is the geographic information system (GIS). Geographic information systems make the process of organizing, analyzing, and presenting geographic infor-

mation easier, thus accelerating geographic inquiry. Remotely sensed data provide both archived and real-time images that can be studied independently or as a part of a GIS analysis. Digital globes and interactive online maps can display human and physical data sets to assist in systematic analysis of spatial phenomena. A global positioning system (GPS) aids in accurately identifying the location of collected data; GPS technologies are currently used in a wide range of digital mobile devices.

Many of the capabilities that students need to develop geographic skills are termed “critical thinking skills.” Such skills are not unique to geography and involve a number of generic thinking processes, such as knowing, inferring, analyzing, judging, hypothesizing, generalizing, predicting, problem-solving, and decision-making. These skills have applications to all levels of geographic inquiry and constitute the bases on which students can build competencies in applying geographic skills to geographic inquiry.

Geographic skills develop over the entire course of students' school years. For each of the three successive grade levels discussed, teachers and other curriculum developers must recognize that students' mastery of geographic skills should be sequenced effectively so that students retain and build on their understanding. The skills cannot be taught or applied in isolation. They are interconnected and complementary, and together they form a process of investigation that makes the complexity of place more intelligible and more understandable.

## The Rationale for Geographic Skills

The geographic skills required of a geographically informed person consists of five sets of skills adapted from the Guidelines for Geographic Education: Elementary and Secondary Schools, prepared by the Joint Committee on Geographic Education by the Association of American Geographers and the National Council for Geographic Education. The five skill sets are as follows:

1. Asking Geographic Questions
2. Acquiring Geographic Information
3. Organizing Geographic Information
4. Analyzing Geographic Information
5. Answering Geographic Questions

For each of the five skills sets, there is a discussion of the principles underlying the set of skills and then a presentation of what the student is expected to know, understand, and be able to do at grades 4, 8, and 12.

# Asking and Answering Questions about the World: Geographic Skills

## 1. Asking Geographic Questions

Geographic inquiry involves the ability and willingness to ask and answer questions about geospatial phenomena. The key geographic questions ask Where is it located? Why is it there? What is the significance of the location? As students pose additional questions, they seek responses that help to organize spatial understandings: What is this place like? With what is it associated? What are the consequences of its location and associations? As geospatial technologies advance, students will still need to be able to ask these basic questions to select and apply the appropriate technology to conduct geographical research, thereby gaining geospatial understanding.

Students should be asked to speculate about possible answers to questions. Speculation leads to the development of hypotheses that link the asking and answering stages of the process. Hypotheses guide the search for information.

Geography is distinguished by the types of questions it asks—the “where” and “why there” of an issue or problem. It is important that

students develop and practice the skills of asking such questions for themselves. Practice in asking geographic questions begins with distinguishing between geographic and nongeographic questions (e.g., space-based versus time-based inquiry). Students should then develop geographic questions related to issues. At higher grade levels, students can identify geographic problems and ways in which geographic inquiry can help solve problems, resolve issues, inform decisions, and lead to actions.

Being able to ask geographic questions enables students to engage in doing geography by posing geographic questions to guide a geographic inquiry, realizing that questions can be refined as a part of the inquiry process. Geographic questions help increase spatial reasoning skills, identify geographic issues and problems, and develop new or additional geographic research questions and hypotheses for further investigation.

### 4<sup>th</sup> GRADE

*the student knows and understands:*

#### Asking Geographic Questions

##### 1. The characteristics of a geographic question

*Therefore, the student:*

- A. Identifies and describes differences between geographic and nongeographic questions, as exemplified by
  - ▶ Identifying examples of geographic questions from a list of both geographic and nongeographic questions (e.g., does the question ask Where is it located? Why is it there? What is the significance of the location?).
  - ▶ Identifying questions that help explain the importance of the features or location of places (e.g., Why are good harbor facilities an important part of New York City’s location? How does Chicago’s mid-continent location influence its accessibility to the rest of the United States? How does the climate of Florida’s cities affect the movement of vacationing winter visitors?).
  - ▶ Describing how geographic questions seek information about the organization of human or physical features in space (e.g., Where do most people live in the world? Why are mountain ranges located where they are?).

### 8<sup>th</sup> GRADE

*the student knows and understands:*

#### Asking Geographic Questions

##### 1. The sources of geographic questions

*Therefore, the student:*

- A. Identifies geographic issues and constructs a question from a geographic perspective, as exemplified by
  - ▶ Identifying geographic issues and problems in news articles and constructing geographic questions that would address the issue from a geographic perspective (e.g., spatial or ecological perspectives).
  - ▶ Identifying a local environmental issue and constructing geographic questions appropriate to study the issue (e.g., What are the pros and cons of building a community water park in the desert southwest region of the United States?).
  - ▶ Identifying a global human population issue and constructing geographic questions to investigate the issue from multiple perspectives (e.g., What are some of the reasons why people move from rural areas in a developing country to its largest and most crowded city? What are some of the economic and environmental consequences of such migrations?).

### 12<sup>th</sup> GRADE

*the student knows and understands:*

#### Asking Geographic Questions

##### 1. The role of developing geographic questions in a research project that answers geographic questions

*Therefore, the student:*

- A. Analyzes an issue and constructs geographic questions that inform a geographic investigation, as exemplified by
  - ▶ Analyzing digital and paper maps of a place or thematic topic and constructing geographic questions to investigate the issue.
  - ▶ Analyzing current trends in population and constructing geographic questions to investigate the sources and future projections of the trends.
  - ▶ Analyzing a current news report and constructing geographic questions that would provide a geographic focus to the study or resolution of the topic or issue.

## 2. Acquiring Geographic Information

Geographic information is any information connected to a location that includes data about physical and human characteristics or phenomena at any place on the planet. To answer geographic questions, students should start by gathering data from diverse sources in various ways to develop information that will inform their responses.

The skills involved in acquiring geographic information include activities such as locating and collecting data, observing and systematically recording information, reading and interpreting maps and other graphic representations of spaces and places, interviewing people who can provide both information and perspectives about places and issues, and using statistical methods. Students should read and interpret all kinds of maps. They should compile and use primary and secondary information to prepare quantitative and qualitative descriptions. They should collect data from interviews, fieldwork, reference material, and digital resources. Internet-based sources for geographic information are increasingly accessible but must always be evaluated for reliability and validity.

Primary sources of geographic information, especially the results of fieldwork performed by the students, are important in geographic inquiry. Fieldwork involves students conducting research in the community by distributing questionnaires, taking photographs, recording

observations, interviewing citizens, and collecting samples. Fieldwork helps arouse students' curiosity and makes the study of geography more enjoyable and relevant. Fieldwork fosters active learning by enabling students to observe, ask questions, identify problems, and hone their perceptions of physical features and human activities. Fieldwork connects students' school activities with the world in which they live. Data collected using GPS technology in the field can be mapped onto digital maps and globes or viewed and analyzed in a GIS.

Typical secondary sources of information include texts, maps, statistics, photographs or imagery, video or multimedia, databases, newspapers, telephone directories, and government publications. Digital data may be highly specialized such as real-time data, physical and human statistical data, and remotely sensed data and images. These sources aid in the acquisition of geographic information, especially from or about remote locations. Encyclopedias report information compiled from secondary sources and are important in some research situations.

Being able to acquire geographic information enables students to engage in doing geography by mastering the techniques and skills necessary to gather and record geographic information and data from primary and secondary sources.

### 4<sup>th</sup> GRADE

*the student knows and understands:*

#### Acquiring Geographic Information

##### 1. The characteristics of geographic information

*Therefore, the student:*

- A. Describes and analyzes the characteristics of geographic information, as exemplified by
  - ▶ Describing the characteristics of a place using observed and collected data (e.g., weather, climate, elevation, population density, availability of fresh water).
  - ▶ Analyzing data examples to determine whether or not it is geographic (e.g., Does it provide information about a location or place, connections between and among places, or the spatial organization of human or physical features on Earth's surface?).
  - ▶ Identifying and describing the characteristic information required for a map to be accurate and helpful (e.g., title, orientation, date, author, legend, scale, index, grid, source).

### 8<sup>th</sup> GRADE

*the student knows and understands:*

#### Acquiring Geographic Information

##### 1. The process of collecting geographic information

*Therefore, the student:*

- A. Explains which sources of geographic information will be needed for a geographic investigation, as exemplified by
  - ▶ Describing and explaining how observations and collected geographic information can be used in a geographic investigation.
  - ▶ Identifying and describing sources of reliable geographic data (e.g., US Census Bureau data, Population Reference Bureau data, CIA: The World Factbook).
  - ▶ Explaining how digital globes and maps can provide base map information to provide a context for additional data layers or themes (e.g., tectonic plate boundaries and the occurrence of earthquakes, identification of climate and vegetation characteristics that may contribute to increased wildfire risk, identification of human or physical features that may affect the development of an emergency situation evacuation route).

### 12<sup>th</sup> GRADE

*the student knows and understands:*

#### Acquiring Geographic Information

##### 1. The criteria for evaluating the value and reliability of geographic information

*Therefore, the student:*

- A. Evaluates sources of geographic information for reliability, as exemplified by
  - ▶ Evaluating the metadata for geospatial database files (e.g., data that might be used in a GIS, US census data on the Census Bureau's website).
  - ▶ Evaluating the reliability of Internet-based data sources to ensure validity and accuracy (e.g., information on a blogger site versus the United Nations website or political advertisement websites versus National Institute of Health Research Bulletins).
  - ▶ Evaluating the date, sources, authors, and designs of geographic visualizations or representations for accuracy (e.g., dates for data displayed, construction of x- and y-axis values on charts displaying information, misuse of map symbols on cartograms).

# Asking and Answering Questions about the World: Geographic Skills

## 4<sup>th</sup> GRADE

the student knows and understands:

### Acquiring Geographic Information

#### 2. The sources of geographic information

Therefore, the student:

A. Identifies observations, maps, globes, and other geographic representations as sources of geographic information, as exemplified by

▶ Identifying how satellite images provide geographic information (e.g., display patterns of population growth or decline by observing images detailing land use taken at different times, portrays contrasting shorelines of lakes in images taken at normal and drought times).

▶ Identifying ZIP codes as a source of geographic information that is helpful at a larger scale but less so at the neighborhood or school and classroom scale.

▶ Identifying digital globes and maps as sources of different types of geographic information (e.g., terrain data or road and transportation data).

## 8<sup>th</sup> GRADE

the student knows and understands:

### Acquiring Geographic Information

#### 2. The distinction between primary and secondary sources of geographic information

Therefore, the student:

A. Explains the differences between primary and secondary sources of geographic information, as exemplified by

▶ Explaining why using digital globe and mapped projects are secondary sources of geographic information.

▶ Explaining why mapping student-observed or -collected data points on a digital globe or map is a primary source of geographic information.

▶ Explaining the difference between using a map created by someone else versus a map created by the student as secondary and primary sources of geographic information.



Image credit: Joseph Kerski

*A GPS or other mobile device can be used to determine the location of data points when acquiring geographic information.*

## 3. Organizing Geographic Information

Once collected, the geographic information should be organized and displayed in ways that assist with analysis and interpretation. Data need to be arranged systematically. Different types of data may be separated and classified in visual, graphic forms: paper and computer-generated maps, various geospatial images (e.g., photographs, aerial photos, remotely sensed images), graphs, cross sections, climographs, diagrams, tables, and cartograms. Written information from documents or interviews may be organized into pertinent quotes or tabular form. Geographic information may also be organized in a GIS. These approaches allow students a wide range of options in displaying and organizing information.

Computer-based technologies and the Internet enhance not only students' access to geographic information but also the ability to organize it. Students may need guidance in selecting appropriate applications for organizing and displaying geographic information. There is an increasing number of free, web-based, mobile device, or desktop client applications that may be used for educational projects and instruction.

There are many ways to organize geographic information. Maps play a central role in geographic inquiry, but there are other ways to translate data into visual forms, such as graphs of all kinds, tables, spreadsheets, and time lines. Such visual aids are especially useful when accompanied by clear oral or written summaries. Creativity and skill are needed to arrange geographic information effectively. Decisions about

design, color, graphics, scale, and clarity are important in developing the kinds of maps, graphs, charts, and other visualizations that best represent the data.

Geography has been called “the art of the mappable.” Making maps should be a common activity for all students. They should read (decode) maps to collect information and analyze geographic patterns and make (encode) maps to organize information. Making maps may mean using sketch maps to make a point in an essay or record field observations, using symbols to map data showing the location of world resources, or producing a county-level map of income by state using a GIS. Students may also use Internet-based mapping resources to develop their own maps.

For students, making maps should become as common and natural as writing a paragraph. They should be skilled in interpreting and creating map symbols, finding locations on maps using various reference systems, orienting maps, finding directions, and using scales to determine distance. Using these map skills helps students think critically about the purposes and uses of maps.

Being able to organize geographic information enables students to engage in doing geography by applying methods to organize geographic and geospatial information so that it can be displayed to facilitate analysis and effectively communicate geographic information.

### 4<sup>th</sup> GRADE

the student knows and understands:

#### Organizing Geographic Information

##### 1. The different forms for displaying geographic information

Therefore, the student:

- A. Constructs digital and paper maps, graphs, tables, and charts to display geographic information, as exemplified by
  - ▶ Constructing a map using points to represent the locations of student-collected data.
  - ▶ Constructing a graph to display the changes in student enrollment at the school.
  - ▶ Constructing a data table with represented values and a map to display the values represented by colors (e.g., list of schools in the community with more than 100, 200, and 300 students; different types of businesses in the community; number of each, low-, medium-, and high-population states).

### 8<sup>th</sup> GRADE

the student knows and understands:

#### Organizing Geographic Information

##### 1. The advantages and disadvantages of the different forms for displaying geographic information

Therefore, the student:

- A. Describes and constructs appropriate forms of visualizations to represent different types of geographic data, as exemplified by
  - ▶ Constructing a choropleth map representing demographic values and explaining why this type of map is an effective way to display this type of data.
  - ▶ Describing and explaining how isopleth lines effectively represent increasing or decreasing values between locations (e.g., rainfall amounts, elevation, growing-season zones).
  - ▶ Describing and constructing both point and polygon maps to represent different types of geographic data.

### 12<sup>th</sup> GRADE

the student knows and understands:

#### Organizing Geographic Information

##### 1. The selection and design of appropriate forms for organizing and displaying geographic information

Therefore, the student:

- A. Evaluates the alternatives for organizing and displaying geographic information, as exemplified by
  - ▶ Constructing different types of graphs representing data that describes a place (e.g., population changes, levels of personal income per state, population pyramids).
  - ▶ Evaluating the use of a GIS to display and organize geographic information (e.g., Would additional data layers be helpful? Are there important relationships among data layers used? Is an appropriate scale selected to display the data?).
  - ▶ Evaluating the appropriateness of using a digital globe to display point data or area data (e.g., ZIP codes, counties, states).

# Asking and Answering Questions about the World: Geographic Skills

## 8<sup>th</sup> GRADE the student knows and understands:

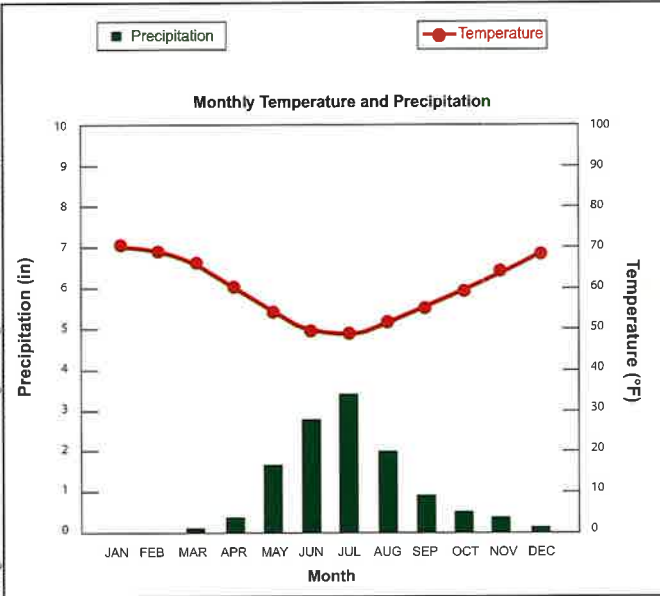
### Organizing Geographic Information

#### 1. The advantages and disadvantages of the different forms for displaying geographic information

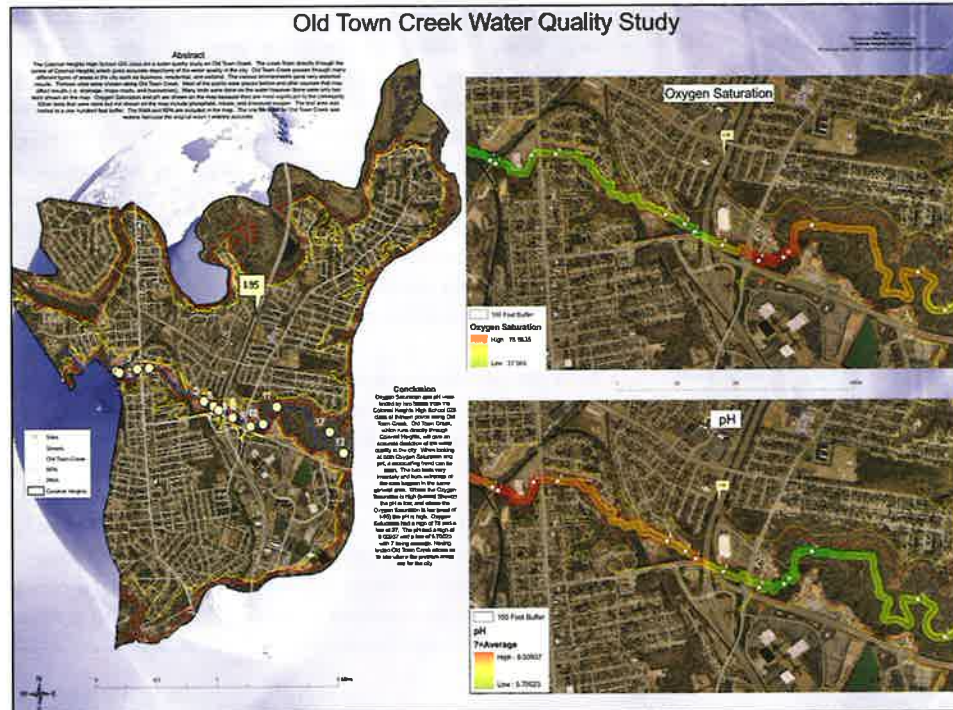
B. Explains the advantages of using different forms of geographic representations for data, as exemplified by

- ▶ Explaining why a GIS-generated map might be the best type of map to display the overlap or relational aspects of multiple data sets.
- ▶ Explaining why one map projection may be more appropriate to use than other projections (e.g., amount of distortion, degree of accuracy in represented shapes of continents, focus on a hemisphere or pole).
- ▶ Explaining the advantages of using graphs or maps for different types of data at different scales (e.g., climographs to represent climate data, population pyramids to represent population data, US national maps to represent state-level data, state maps to represent ZIP-code-level data).

Image credit: National Drought Mitigation Center, University of Nebraska-Lincoln



A climograph for Santiago, Chile displays data for the average seasonal variation in precipitation and temperature over the course of a year.



A GIS can be used to display student-collected data with other data sets and base maps.

## 4. Analyzing Geographic Information

Analyzing geographic information involves seeking patterns, relationships, and connections. As students analyze and interpret information, meaningful patterns or processes emerge. They can then synthesize their observations into coherent explanations. Students should note associations and similarities between areas, recognize patterns, and draw inferences from maps, graphs, diagrams, tables, and other sources. Using basic statistics, students are able to look for trends, relationships, and sequences.

Geographic analysis involves various thinking processes. It is sometimes difficult to separate the processes involved in organizing geographic information from the procedures used in analyzing it; the two processes go on simultaneously in many cases. But in other instances, analysis follows the manipulation of raw data into an easily understood and usable form. Both activities involve the use and development of students' spatial skills.

Students should scrutinize paper and digital maps to discover

and compare spatial patterns and relationships. In addition, they can study tables and graphs to determine trends and relationships between and among items; probe data through statistical methods to identify trends, sequences, correlations, and relationships; and examine texts and documents to interpret, explain, and synthesize characteristics. All students need to develop these analytical skills.

Digital tools provide additional ways to analyze spatial data. For example, a GIS spatial display can be used to analyze georeferenced data. Multiple data layers may reveal relationships or trends as a part of the analysis. These analytic processes then may lead to answers to the questions that first prompted an inquiry and to the development of geographic models and generalizations.

Being able to analyze geographic information enables students to engage in doing geography by using analytical methods to interpret and evaluate geographic information. Employing accurate analysis techniques and methodologies is essential in geographic inquiry.

### 4<sup>th</sup> GRADE

the student knows and understands:

#### Analyzing Geographic Information

##### 1. The process of analyzing data to identify geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes simple graphs, tables, and maps using geographic data to identify relationships, patterns, and trends, as exemplified by
  - ▶ Constructing a graph representing geographic information from a data table to identify trends (e.g., comparing social or economic indicators between two or more countries).
  - ▶ Analyzing various maps to identify relationships or similarities between countries or regions based on the data represented (e.g., variations in climate related to latitude, population densities related to climate, railway networks in relation to elevation or topographies).
  - ▶ Analyzing the relationships and patterns between political boundary lines and features on maps to describe possible trends (e.g., boundaries aligned to rivers, mountain ranges, or other physical features, boundaries aligned to lines of latitude or longitude or other mathematical formulations).

### 8<sup>th</sup> GRADE

the student knows and understands:

#### Analyzing Geographic Information

##### 1. The process of analyzing data to describe geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes graphs, tables, and maps using geographic data to describe relationships, patterns, and trends, as exemplified by
  - ▶ Analyzing two or more maps or satellite images to describe changes or identifying trends that may be evident based on the data (e.g., satellite images of a city or region before and after a tsunami, earthquake, or flood, satellite images of forests where logging is taking place, maps of census data showing changes in population).
  - ▶ Analyzing map legends to better understand the nature of the representation of data on the map (e.g., classification values and break points of a choropleth map, methods for determining different classification values, review the histogram of the data to see how data are represented in another form in addition to the mapped version).
  - ▶ Analyzing a GIS to describe the relationships and patterns resulting from the overlay of multiple data sets (e.g., describe the relationship of tornado occurrences with population density and state boundaries).

### 12<sup>th</sup> GRADE

the student knows and understands:

#### Analyzing Geographic Information

##### 1. The process of analyzing data to explain geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes and explains geographic relationships, patterns, and trends using models and theories, as exemplified by
  - ▶ Constructing a GIS model to analyze data from multiple locations and comparing the model results to identify patterns or relationships in those locations.
  - ▶ Analyzing population data as represented in the demographic transition model to explain the changes through time in populations of countries.
  - ▶ Analyzing a US city using a concentric zone model to explain the historical evolution of the commercial downtown.
- B. Analyzes data using statistics and other quantitative techniques, as exemplified by
  - ▶ Constructing a scatter plot of data to identify possible relationships or trends in the data.
  - ▶ Analyzing a histogram for data to determine the best method for displaying the values on a map.
  - ▶ Analyzing data using descriptive statistics such as average, median, mode, and range to determine the characteristics of the distribution in the data set.



## Asking and Answering Questions about the World: Geographic Skills

### 5. Answering Geographic Questions

In any academic discipline, good questions encourage good answers. Geography is no exception. The skills needed to build such answers require a structure that is both multifaceted and complex. Students must learn not only to manage data but also to assemble it so that it is clear and concise. The answers that derive from such a process can be organized in graphic form (maps, tables, graphs, and other geovisualizations) as well as oral and written narratives. Whatever the format, responses must be based on provable and relevant facts that inspire interpretation, analysis, reasoning, and, when appropriate, the subtleties of inference.

Generalizations and new understandings are the expected results of the inquiry process. Developing generalizations requires that students use the information they have collected, processed, and analyzed to make informed statements about geographic issues. Teachers should encourage students to explore multiple points of view and to seek multiple solutions to problems. Students may also use the evidence they have acquired to make decisions, solve problems, or form judgments about a question, issue, or problem.

Developing geographic generalizations may require inductive reasoning (i.e., inferring a generalization from particular instances or facts) or deductive reasoning (i.e., inferring particular instances and fact from a generalization). Inductive reasoning enables students to synthesize geographic information to answer questions and reach

conclusions. Deductive reasoning enables students to identify relevant questions, collect and assess evidence, and decide whether the generalizations are appropriate by testing them. Students should have experience in both approaches to reasoning.

Students should be able to communicate clearly and effectively when answering geographic questions. They can display geographic information in many engaging and effective ways. These include combinations of digital images, maps, graphs, video, and narratives in multimedia or web-based presentations. Geographic information may also be presented through the use of poems, collages, plays, journals, debates, and essays. It is important to know how to select the best means of presenting answers to geographic questions.

Answering geographic questions is not always the last step in the process of geographic inquiry, because the process usually begins again with new questions suggested by the conclusions and generalizations. Geographic learning is a continuous process that is both empowering and fascinating.

Being able to answer geographic questions enables students to engage in doing geography by presenting the results of their geographic inquiry to inform decision-making and offer potential solutions to problems.

#### 4<sup>th</sup> GRADE

the student knows and understands:

##### Answering Geographic Questions

#### 1. The process of making generalizations and drawing conclusions to answer geographic questions

Therefore, the student:

- A. Constructs answers to geographic questions using data, as exemplified by
  - ▶ Constructing a flowchart, map, and narrative summarizing the steps used in answering a geographic question.
  - ▶ Constructing a digital or paper map that answers a geographic question and describing the data used to inform the answer.
  - ▶ Constructing a photographic display to summarize key geographic observations based on viewing a collection of images of a place or region.

#### 8<sup>th</sup> GRADE

the student knows and understands:

##### Answering Geographic Questions

#### 1. The process of explaining generalizations and conclusions that answer geographic questions

Therefore, the student:

- A. Describes and explains the data and processes used to answer geographic questions, as exemplified by
  - ▶ Constructing an answer to a geographic question by describing the characteristics and relevance of the data used to inform the answer.
  - ▶ Describing how a GIS was developed and explaining why specific data layers were selected to answer a geographic question.
  - ▶ Explaining the steps used in answering a geographic question including how geographic information was collected, organized, and analyzed to arrive at the answer.

#### 12<sup>th</sup> GRADE

the student knows and understands:

##### Answering Geographic Questions

#### 1. The process for evaluating and defending the answers to geographic questions

Therefore, the student:

- A. Evaluates the data sources and processes used to answer geographic questions, as exemplified by
  - ▶ Constructing a narrative report that evaluates the validity and reliability of the data used and the processes used to formulate answers to geographic questions.
  - ▶ Explaining how and why the data used in an investigation supports the defense of the generalizations made in answering geographic questions.
  - ▶ Constructing a test of a geographic answer by applying it to a new study area or era to see if the same process yields a defensible answer.

## 4<sup>th</sup> GRADE

the student knows and understands:

### Answering Geographic Questions

#### 2. The methods for presenting answers to geographic questions

Therefore, the student:

- A. Describes various options for presenting answers to a geographic question, as exemplified by
  - ▶ Describing how maps can display geographic information to help answer geographic questions.
  - ▶ Describing how multimedia tools can be used to present answers to geographic questions.
  - ▶ Identifying and describing an example of a presentation of geographic information that may answer geographic questions (e.g., map displaying an analysis from a news article, a graph displaying data used to compare two locations).

## 8<sup>th</sup> GRADE

the student knows and understands:

### Answering Geographic Questions

#### 2. The construction of presentations to answer geographic questions

Therefore, the student:

- A. Constructs a presentation to answer a geographic question, as exemplified by
  - ▶ Constructing a map using a GIS that displays possible answers to geographic questions (e.g., preferred site location for business or schools, possible sources and paths of pollution plumes, areas for greatest or least crime risk in an urban area).
  - ▶ Constructing a multimedia presentation including maps, images, and video to describe the steps and data used to answer a geographic question (e.g., show how a geographic question was chosen, present where and how data were collected or acquired, use different visual methods for organizing, displaying, and analyzing geographic information).
  - ▶ Constructing an oral presentation that presents and defends the answers to a geographic question.

## 12<sup>th</sup> GRADE

the student knows and understands:

### Answering Geographic Questions

#### 2. The process of using valid generalizations and conclusions to inform reasoned decisions

Therefore, the student:

- A. Explains and evaluates the data and processes used to inform answers to geographic questions, as exemplified by
  - ▶ Explaining the limits of the generalizations that may be made as a result of the data used in a geographic inquiry.
  - ▶ Evaluating a news article that defends a possible answer to a geographic question and explaining how the data used does or does not support the proposed answer and what additional data might be considered.
  - ▶ Evaluating the feasibility of an answer presented by identifying additional geographic questions or concerns that may influence the proposed answer.

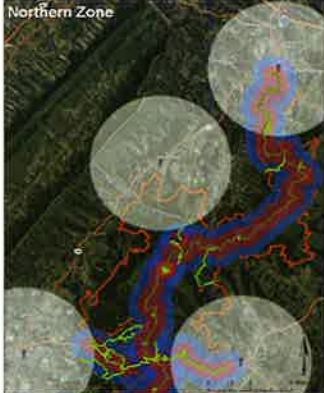
# Asking and Answering Questions about the World: Geographic Skills

Image credit: Geospatial Semester, James Madison University/Robert Kalvoord and Lurray High School/T. Meadows, C. Fox and T. Racey

## Bearly Relocated


**Introduction**

Where are the ideal locations within the Shenandoah National Park that bears can be safely relocated away from tourists and homes? This is the question that we are trying to answer. We will use GIS to help us find the best locations for bears to be relocated. We will use GIS to help us find the best locations for bears to be relocated. We will use GIS to help us find the best locations for bears to be relocated.

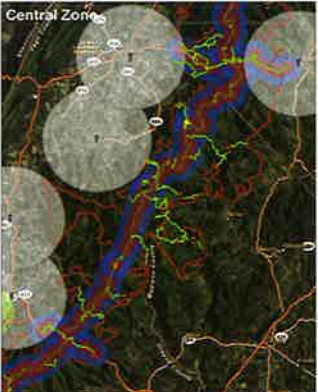


**Northern Zone**


**Anahsin**




**Shenandoah National Park**



**Central Zones**




**Sources**



**Southern Zone**

**Hypothesis/Experiment**

When we begin our search for the best locations for bear relocation we started off with the idea of using GIS to find the best locations for bear relocation. We used GIS to find the best locations for bear relocation. We used GIS to find the best locations for bear relocation.



**Conclusion**

At the conclusion of our project we were able to find the best locations for bear relocation. We were able to find the best locations for bear relocation. We were able to find the best locations for bear relocation.

Using a GIS, a student presentation answers the question, “Where are the ideal locations within the Shenandoah National Park that bears can be safely relocated away from tourists and homes?”

# Glossary **A**

**absolute location**—the location of a point on Earth’s surface that can be expressed by a grid reference (e.g., latitude and longitude)

**accessibility**—the relative ease with which a place can be reached from other places

**acculturation**—the process of adopting the traits of a cultural group

**acid precipitation (rain or snow)**—precipitation with a pH value of 5.6 or lower (7 is neutral, less than 7 increasing in acidity, and greater than 7 increasing in alkalinity). Precipitation becomes excessively acidic when oxides of sulfur and nitrogen released by combustion of fossil fuels combine with moisture in the atmosphere to form acids.

**aerial photograph**—a photograph of part of Earth’s surface usually taken from an airplane

**African Union (AU)**—an association of African countries promoting economic, social, and political integration and a commitment to democratic principles among the member states

**agribusiness**—the strategy of applying business practices to the operation of specialized commercial farms to achieve efficiency of operation and increased profit margins

**alluvial fan**—a semiconical landform that occurs where a canyon exits a mountain range. It is composed of stream and debris flow materials that are deposited as flow spreads out and slows down once it exits the canyon.

**Antarctic Circle**—latitude 66.5° south that encircles the continent of Antarctica. From this latitude to the South Pole, daylight lasts for 24 hours on the southern summer solstice, usually December 22, whereas on the southern winter solstice, usually June 22, nighttime lasts for 24 hours.

**aquifer**—an underground permeable rock layer within which water is stored and can flow, and from which water can be extracted for use at the surface

**arable land**—an area suitable for growing crops

**archipelago**—a chain or group of islands

**Arctic National Wildlife Refuge (ANWR)**—an area in northeast Alaska. It is managed by the US Fish and Wildlife Service to conserve wildlife, wilderness, and recreational assets and to ensure the nation’s compliance with international treaty obligations affecting mineral resources, water quality, and water quantity in the region.

**artifacts**—the material manifestations of a culture such as tools, clothing, and foods

**assimilation**—the acceptance, by one culture group or community, of cultural traits normally associated with another

**astrolabe**—primarily a historical term identifying an instrument once used to make astronomical measurements to calculate latitude; before the development of the sextant

**atmosphere**—the envelope of gases, aerosols, and other materials that surrounds Earth and is held close by gravity. The gases are dominated by nitrogen (78.1 percent), oxygen (20.9 percent), argon (0.93 percent), and carbon dioxide (0.03 percent) and include much smaller percentages of helium, methane, and hydrogen. Water vapor, clouds, dust, meteor debris, salt crystals, and pollutants also contribute to the atmosphere’s mass, which is concentrated within a layer that extends about twelve miles from Earth’s surface.

**atmospheric pressure cells**—areas of the atmosphere with relatively high or low barometric pressure referred to simply as “highs” and “lows.” Winds on Earth are caused by air movement from areas of high pressure to areas of low pressure. Large areas of permanent high or low pressure existing in bands or belts around Earth influence world climate patterns and ocean currents (e.g., the Siberian High and the Icelandic Low).

## **B**

**balance of power**—a geopolitical term identifying efforts on the part of nations to maintain an equilibrium of economic and military power as a means of checking the predominance of one nation or coalition of nations

**balance of trade**—an economic term identifying the difference in value over a period of time between a country’s imports and exports of goods and services; a favorable balance of trade results in a trade surplus while an unfavorable one results in a trade deficit

**barrier island**—a long, narrow off-shore island built by deposits from wave action and separated from a low-lying coastal mainland by a body of water

**biomes**—very large ecosystems made up of specific plant and animal communities interacting with the physical environment (climate and soil); usually identified with the climate and climax vegetation of large areas of Earth’s surface (e.g., the Equatorial and Tropical Rain Forest Biomes)

## Glossary

**biofuel**—fuel derived directly from organic matter (e.g., a fuel blend made partially from corn or sugarcane)

**biosphere**—the realm of Earth that includes all plant and animal life forms

**birthrate**—see “crude birthrate”

**bitmap**—see “raster image”

**border**—a line separating two political or geographic areas, especially countries (e.g., Germany’s western border with France) or states (e.g., Indiana’s northern border with Illinois)

**boundary**—a line marking the limit or extent within which a system exists or functions, including a social group, a neighborhood, a state, or physical feature

**butte**—an isolated and detached hill with steep sides and a flat top rising from a plain

## C

**capital**—one of the factors of production of goods and services. Capital can be goods (e.g., factories, equipment, highways, information, and communications systems) and/or funds (investment and available money for operating expenses) used to increase production and wealth. Other factors are land, water, and labor.

**carbon cycle**—a complex natural process by which carbon is exchanged among Earth’s physical systems, resulting in carbon’s recycling and reuse throughout the biosphere and all its organisms

**carbon footprint**—the scale and measurable totality of the impact of carbon use by people on the environment

**cardinal directions**—the four main points of the compass: north, east, south, and west

**carrying capacity**—the maximum number of animals and/or people a given area can support at a given time under specified levels of consumption without impairing relevant ecosystems

**cartographer**—a person who designs and creates maps and other geographic representations

**cartography**—the study of making maps

**census**—an official count of a population conducted by a government at set intervals; typically records details and trends among individuals and groups in the population

**Central Business District (CBD)**—the traditional core of a city typically consisting of office buildings, hotels, retail shops, entertainment facilities, and a transportation hub; often called “downtown”

**central place**—a village, town, or city that provides services to a surrounding region functionally tied to it

**central place theory**—the conceptual framework that explains the size, spacing, and distribution of settlements and their economic relationships with their hinterlands

**choropleth map**—shows differences between areas by using colors or shading to represent distinct categories of qualities (such as vegetation type) or quantities (such as the percentage graduating from high school, population density, or birthrate)

**cirque**—a half-open steep-sided hollow excavations at the head of a valley or on a mountainside resulting from glacial erosion; often amphitheater-shaped

**civilization**—a complex and well-organized political and social order whose status is measured in terms of material, scientific, and artistic advancement

**climate**—long-term trends in weather elements and atmospheric conditions

**climate change**—long-term significant modifications in the average weather conditions of the world’s regions caused either by natural or human-induced processes (e.g., alterations in the physical dynamics of Earth’s atmosphere or human practices such as burning fossil fuels)

**climate graph**—see climograph

**climate variability**—changes in the patterns of weather and climate at both temporal (beyond individual weather events) and spatial scales (globally or in a specific world region)

**climax vegetation**—a stable community of plants established over time and at a point where it can sustain itself

**climograph**—a graphical depiction of average monthly temperatures and precipitation amounts for a particular location

**cognitive map**—see mental map

**colony**—an area of the world under the full or partial political control of another country, typically occupied by settlers from the occupying country

**command economy**—an economy where production, investment, prices, and incomes are determined centrally by the national government (e.g., economies in communist countries—former Soviet Union, People’s Republic of China, Socialist Republic of Vietnam)

**commercial agriculture**—a form of agriculture in which crops are cultivated for sale rather than for personal consumption or subsistence

**commercial economy**—a system promoting profits through efficient methods of production and distribution to ensure the maximum utilization of resources for the benefit of all

**Common Market**—see European Union (EU)

**comparative advantage**—the circumstances (e.g., relative location, access to resources and markets, skilled labor force, quality infrastructure) in which a country, area, or group can produce goods or services at a lower cost than other competitors

**complementarity**—the mutually satisfactory exchange of raw materials, manufactured products, or information between two regions to fill the needs and wants of each

**concentric growth**—refers to the zonal model of urban social or economic growth, which states that a city grows outward from a central area in a series of concentric rings or zones that are occupied by distinctive social groups or land uses

**connectivity**—a geographic concept explaining how physical and cultural features are linked to one another functionally and spatially (e.g., communication networks and transportation systems that join people and places locally, regionally, or globally)

**continental drift**—see plate tectonics

**contour map**—a representation of some part of Earth’s surface using lines along which all points are of equal elevation above or below a fixed datum, usually sea level

**conurbation**—see megalopolis

**cost-distance**—the amount of money necessary for people, objects, or information to travel between two places

**country**—unit of political space, sometimes referred to as a state

**crude birthrate**—the total number of live births in a year for every 1,000 people in a population

**crude death rate**—the total number of deaths in a year for every 1,000 people in a population

## Glossary

**cryosphere**—the frozen area of Earth's surface (e.g., glaciers, ice caps, sea ice) that is an integral part of the planet's climate system

**culture**—learned behavior of people, which includes their belief systems and languages, their social relationships, their institutions and organizations, and their material goods (e.g., food, clothing, buildings, tools, machines)

**cultural characteristics**—specific behavioral features showing how people within a specific social group think and act (e.g., the celebration of religious or national holidays, the methods of child rearing, clothing styles, food preferences)

**cultural convergence**—the tendency of certain societies to become more similar with time (e.g., an immigrant group gradually loses its traditional identity as it adapts to the culture of the place where it has settled; people across the world gradually disconnect from the traditions of their groups because of the influence of films, television, the Internet, digital phones)

**cultural diffusion**—the spread of cultural elements from one culture to another

**cultural divergence**—the tendencies of certain societies to become less similar with time (e.g., nomadic herders rejecting new grazing practices for their cattle introduced by neighboring groups)

**culture hearth**—the place of origin of a culture group or of a series of material and nonmaterial innovations

**cultural landscape**—the human imprint on the physical environment; the humanized landscape as created or modified by people

## D

**data**—facts and statistics about geographic phenomena gathered for analysis

**database**—a compilation, structuring, and categorization of information (print or electronic) for analysis and interpretation

**data table**—a tool providing a system in tabular form for arranging data for analysis and research purposes (usually on a computer screen)

**deforestation**—the destruction and removal of a forest and its undergrowth by natural or human forces

**delta**—area of marshland formed by deposits of silt at the mouth of some rivers (e.g., Mississippi, Nile, Ganges). Various shapes are associated with the deposition of silt, most commonly triangular (e.g., Nile River) and a bird's foot (e.g., Mississippi River).

**demographic**—relating to the structure of populations (e.g., a census report identifying a trend toward a longer life expectancy in a country or a declining birthrate in an agricultural region)

**demographic change**—change in population size, composition, rates of growth, density, fertility and mortality rates, and patterns of migration

**demographic transition**—a model showing changes over time in a country's birth and death rates. The early stages of the model illustrate the high birth and death rates (slow population growth) of a predominately agricultural society; middle stages show declines in both rates (death rate initially and birthrate later, thus causing rapid population growth) as economies change from agriculture to industry; and advanced stages indicate low birth and death rates (slow population growth) typical of industrialized urban societies.

**demography**—the study of population statistics, changes, and trends based on various measures of fertility (adding to a population), mortality (subtracting from a population), and migration (redistribution of a population)

**density**—the population or number of objects per unit area (e.g., per square kilometer or mile)

**dependency ratio**—the ratio consisting (a) of a population under 15 years old and over 64 years old to (b) the percentage of a population between 16 to 64 years of age; typically used to determine how many people are in their most productive years

**depopulation**—a substantial reduction of the numbers of people in a population resulting from a variety of causes (e.g., death from disease, war casualties, emigration)

**deposition**—the final stage in the process of erosion that results in the placement of sediment on a land surface that has been transported by wind, water, or ice

**desalination**—process of converting salty seawater to fresh water

**desertification**—the spread of desert conditions in arid and semi-arid regions resulting from a combination of climatic changes and increasing human pressures (e.g., overgrazing, removal of vegetation, cultivation of marginal land)

**developed country**—an area of the world that is technologically advanced, highly urbanized, wealthy, and has generally evolved through both economic and demographic transitions

**developing country**—an area of the world that is changing from uneven growth to more constant economic conditions and that is generally characterized by low rates of urbanization, relatively high rates of infant mortality and illiteracy, and relatively low rates of life expectancy and energy use

**devolution**—the transfer of some powers from the central government to regional and local authorities; often a contentious political process

**diaspora**—the scattering of people from their homeland to distant places in the world

**diffusion**—the spread of people, ideas, technology, and products among places

**digital globe**—a digital model of Earth using advancements in technology for representing the planet more accurately with images that keep changing to meet the user's requirements

**digital image**—an electronically processed image displayed in an electronic format including photos, maps, graphics, aerial photos, and satellite data

**digital map**—an electronically processed representation of a geographic area or feature rendered from digital data

**distribution**—the arrangement of items over a specified area

**domesticate**—taming animals and cultivating crops for farm production and human use

**doubling time**—the number of years needed to double a population based on its current annual growth rate and a constant rate of natural increase

## E

**earthquake**—vibrations and shock waves caused by the sudden movement of tectonic plates along fracture zones, called faults, in Earth's crust

**ecology**—the study of the interactions of living organisms between themselves, their habitats, and the physical environment

## Glossary

**economic dependence**—a situation resulting from one country's economic subordination to another more developed country (e.g., a developing country exports raw material to a developed country in exchange for capital, manufactures, and technology from a developed country)

**ecosystem (ecological system)**—a set of connected living parts formed by the interaction of all living organisms (plants, animals, humans) with each other and with the physical and chemical factors of the environment in which they live

**edge city**—a well-developed suburb connected to the central city but with a large business, commercial, entertainment, and transportation base independent of the central city; located in close proximity to the interstate highway system and a major airport

**egocentric stereotype**—tendency to interpret and evaluate people and cultures in terms of oneself and in the exclusive context of one's own experience and culture

**El Niño**—an irregularly occurring and complex series of climate changes (usually in 7-year intervals, with some 3–4 year sub-oscillations) characterized by the appearance of unusually warm, nutrient-poor water affecting ocean currents in the equatorial Pacific region; typically in late December and affecting climate patterns in North America and the Atlantic Ocean (the opposite of La Niña)

**elevation**—height of a point or place above sea level (e.g., Mount Everest has an elevation of 29,028 feet above sea level)

**emigration**—leaving one's own country to settle permanently in another

**empire**—a group of nations, territories, or peoples controlled by a single powerful authority

**environment**—everything in and on Earth's surface and its atmosphere within which organisms, communities, or objects exist

**environmental determinism**—the theory that the physical environment controls various aspects of human behavior and cultural development

**environmental footprint**—see carbon footprint

**environmental hazard**—an extreme and often disastrous natural event that can lead to significant damage in the physical world and likely affect human activity (e.g., severe and prolonged flooding resulting in changes in a river's course and the subsequent dislocation of populations or an extended drought period due to altered weather patterns causing serious food shortages)

**environmental justice**—initiatives seeking to establish equity for groups bearing heavy environmental burdens through no fault of their own (e.g., impoverished communities living without access to clean air, clean water, sanitary conditions, and nutritious food)

**epidemic**—outbreak of a rapidly spreading infectious disease

**equator or latitude 0°**—an imaginary line running east–west around the globe and dividing it into two equal parts known as the Northern and Southern Hemispheres; the places on Earth that always have approximately twelve hours of daylight and twelve hours of darkness

**equilibrium**—the point in the operation of a system when driving forces and resisting forces are in balance

**equinox**—the two days during the calendar year (usually September 23 and March 21) when all latitudes have twelve hours of both daylight and darkness and the sun is directly overhead at the equator

**ethnic enclaves**—areas or neighborhoods within cities that are homogeneous in their ethnic makeup and are usually surrounded by groups of a different ethnic character (e.g., Little Italy, Chinatown)

**ethnocentric stereotype**—process of evaluating other peoples and cultures according to the standards of one's own culture resulting in an exaggeration or misrepresentation of the other culture

**ethnocentrism**—the belief in the inherent superiority of one's own group and culture; a tendency to view all other groups or cultures in terms of one's own

**European Union (EU)**—an association of a number of European countries promoting free trade, cultural and political linkage, and relatively easy access among its nations. Formed in 1957, the European Union was formerly called the European Community.

**eutrophication**—the process in lakes and water bodies characterized by increased amounts of sediments, nutrients, and organic material

**expansionism**—a government's policy to increase its territory or its economic influence

## F

**fauna**—the animal life of an area, region, or time

**fertility rate**—the average number of children a woman will have during her childbearing years (15 to 49 years of age)

**flood plain**—a generally flat valley area bordering a stream or river that is subject to inundation; the most common land area for human settlement

**flora**—the plant life of an area, region, or time

**flowchart**—a chart or diagram showing a series of interconnected events, actions, or items that indicate the progressive development of a theme, product, or other objective

**flow map**—a map with arrows and lines showing how something moves (e.g., migration or raw materials to industrial sites)

**flow pattern**—the regular movement of materials, products, people, and/or ideas along a consistent route or path

**flow resources**—resources that are neither renewable nor nonrenewable but must be used as, when, and where they occur else they are lost (e.g., running water, wind, sunlight)

**force**—the power or energy in a process, such as weather, that results in both movement and friction

**formal region**—a region defined by the uniformity or homogeneity of certain characteristics (e.g., precipitation, landforms, subculture, type of economic production)

**fossil fuel**—energy source formed in past geologic times from organic materials (e.g., coal, petroleum, natural gas)

**free trade**—international exchange of goods exempted from protective regulations, quotas, and tariffs intended to restrain trade with other nations

**friction of distance**—the force that inhibits the interaction of people and places on Earth. The frequency of interaction between people and places depends on the cost of overcoming this force (e.g., moving commodities over land).

**frontier**—part of a territory with expanding settlement that is being opened up in advance of full settlement for agricultural and urban development; an area marking the limit of settled land beyond which lies wilderness

**functional region**—the functional unity of a region is often provided by a strong node or center of human population and activity. Regions that are defined by their ties to a central node are classified as nodal or functional regions (e.g., banking linkages between large nodal cities and smaller cities and towns).

## G

**gentrification**—the process in urban areas of upper- or middle-class families moving back into a zone in transition; often surrounds the central business district of a city

**geographic context**—the spatial aspects of human existence (i.e., sensitivity to location, place, scale, patterns of movement, and the use of maps and other graphics) including the locational circumstances of historical and contemporary events

**geographic information system (GIS)**—a geographic database that contains computer hardware and software for creating, storing, retrieving, and analyzing information about the physical and human characteristics of places or areas; a technology-based mapping system

**geographic model**—an idealized and simplified representation of reality representing a spatial concept; a tool for predicting outcomes in geography

**geography**—the study of the physical and human systems across Earth's surface

**geomatics**—the discipline of gathering, storing, processing, and delivering geographic information about Earth's physical and human systems using satellite imagery and other computer-based technologies

**geomorphology**—the science of the processes that develop landforms and the history of landform development

**geopolitics**—the study of the influence of geographic factors (i.e., spatial factors) on a country's politics and foreign policy, especially with respect to disputes over borders and territorial claims

**georeferenced data**—information connected to the location of the physical and human features of a specific place on Earth's surface; often involves computer applications, geographic information systems, and global positioning systems

**geospatial data**—information that identifies the geographic location and characteristics of natural or constructed features and boundaries on Earth; information that describes the distribution of physical and human phenomena on Earth's surface

**geospatial technologies**—computer hardware and software with which users analyze and represent geographic data at infinitely varied levels; includes technologies related to mapping and interpreting physical and human features on Earth's surface (i.e., global positioning systems (GPS), geographic information systems (GIS), remote sensing (RS), and geospatial visualization)

**geospatial visualization**—the process of viewing data that are associated with a particular location as tagged information on maps or satellite imagery (or both) enabling users to discover relationships and correlations between data sets (e.g., the ability to overlay multiple data sets on top of a geospatial map)

**geosphere**—all of solid Earth's dynamic layers including the continental and oceanic crust as well as the various layers of Earth's interior; includes the lithosphere as the outermost layer

**global city**—a world-class city that serves as a strategic command point in the organization of the world's economic system (i.e., finance, banking, trade, markets, and innovation) that has a direct effect on international affairs; provides specialized financial services and information about market conditions and trade flows across the globe; sometimes called an alpha city or a world city

**global economy**—the interdependence of the economies of the world's nations creating an international economic system for the exchange of goods and services

**global positioning system (GPS)**—a satellite-based navigation system that allows land, sea, and airborne users to determine their exact location on Earth's surface

**global warming**—increase in Earth's average temperature in recent decades due to the buildup of certain gases, including carbon dioxide and methane, that are released by human activities

**globalization**—the increasing interconnectedness of different parts of the world resulting in the expansion of cultural, economic, and political activities so that they become worldwide in scope and influence due to technological advances in communication and transportation

**globe**—a scale model of Earth that correctly represents area, relative size and shape of physical features, distance between points, and true compass direction

**greenhouse effect**—the ability of certain gases in the atmosphere to absorb and thus trap heat energy released from Earth's surface

**grid**—a pattern of lines on a chart or map, such as those representing latitude and longitude, that helps determine absolute location and assists in the analysis of distribution patterns

**Gross Domestic Product (GDP)**—the total monetary value of goods and services produced in a country during one year

**Gross National Product (GNP)**—gross domestic product adjusted to include the value of goods and services from other countries subsequently used in producing goods and services in the home country

**ground water**—subsurface water that saturates the soil and bedrock; constitutes most of the world's fresh water

## H

**hemisphere**—half a sphere. Cartographers and geographers, by convention, divide Earth into the Northern and Southern Hemispheres at the equator and the Eastern and Western Hemispheres at the prime meridian (longitude 0°) and 180° meridian.

**hierarchy of settlements**—a division and ranking of places usually according to their size and function (e.g., hamlets, villages, towns, cities, megalopolises)

**hills**—landform features that may have steep slopes but lower elevations and less local relief than mountains (e.g., the Black Hills of South Dakota)

**hinterland**—service area surrounding an urban center that supplies the goods, services, and labor needed in that area

**homogeneous society**—a human community sharing the same customs, values, laws, and organizational structure

**human capital**—the skills and knowledge acquired by an individual through training and experience; viewed in terms of the individual's value to an institution, organization, or country

**human process**—a course or method of operation that produces, maintains, and alters human systems on Earth (e.g., migration or diffusion)



## Glossary

**hurricane**—severe tropical storm or low-pressure cell of limited area or extent in the Atlantic and eastern Pacific with accompanying torrential rains and high-velocity winds usually in excess of 80 miles per hour. These storms are known as typhoons in the western Pacific and cyclones in southern Asia.

**hydroelectric power**—electrical energy generated by the force of falling water that rotates turbines housed in power plants in dams on rivers

**hydrologic cycle**—the continuous circulation of water from the oceans, through the air, to the land, and back to the sea. Water evaporates from oceans, lakes, rivers, and land surfaces and transpires from vegetation. It condenses into clouds in the atmosphere, which may result in precipitation returning water to the land. Water then seeps into the soil or flows out to sea, completing the cycle.

**hydrology**—the study of the movement, distribution, and conservation of water on Earth's surface and in the atmosphere

**hydrosphere**—the water realm of Earth, which includes water contained in the oceans, lakes, rivers, ground, glaciers, and water vapor in the atmosphere

## I

**icon**—a symbolic or graphic representation of a place or physical feature

**immigration**—the process of people entering a new country to establish permanent residence

**imperialism**—a government's policy of imposing its rule and influence over other countries or territories through military force, economic dominance, or diplomacy

**import**—the purchase of goods and services produced and developed in another country

**indigenous**—that which is native to a place (e.g., Native Americans in the Western Hemisphere before the arrival of Europeans or herbs such as oregano and coriander common to southern Europe)

**industrialization**—the growth of machine production and the factory system; the process of introducing manufacturing into countries or regions where most of the people are engaged in primary economic activities

**infant mortality rate**—the annual number of deaths among infants under one year of age for every 1,000 live births; usually provides an indication of the quality of available health care

**infrastructure**—the basic physical and organizational structures and facilities (e.g., bridges, roads, sewage systems, power sources, transportation networks) necessary for the operation and maintenance of a society

**interdependence**—people relying on each other in different places or in the same place for ideas, goods, and services

**intermediate directions**—the points of the compass that fall between north and east, north and west, south and east, south and west (e.g., NE, NW, SE, SW)

**International Date Line**—an imaginary line that roughly follows the 180° meridian in the Pacific Ocean. West of this line the calendar date is one day ahead of the calendar date east of the line. People crossing the date line in a westward direction lose a calendar day, while those crossing eastward gain a calendar day.

**International Monetary Fund (IMF)**—an international association established by the United Nations and based in Washington, DC, to help stabilize world currencies, lower trade barriers, and assist developing nations in paying their debts

**intervening opportunity**—the availability of an opportunity closer at hand that reduces the attractiveness of a similar opportunity at locations farther away, (e.g., shoppers may purchase bread at a local bakery rather than travel to a supermarket in a mall)

**isolationism**—a government's policy officially avoiding economic and political contact with other countries

**isopleth map**—a map using lines joining points of equal value to show variations in that value (e.g., contour lines showing areas with the same elevation or isobars on a weather map connecting points having the same atmospheric conditions)

## L

**La Niña**—a periodic and complex series of climate changes complementary to those of El Niño and characterized by the appearance of cooler-than-usual ocean temperatures occurring at irregular time intervals along the equator between the west coast of South America and the International Date Line (the opposite of El Niño)

**lake desiccation**—the reduction in water level (drying out) of an inland water body

**land degradation**—the physical process that wears down and levels landforms and carries away the loosened debris. This term is also used to define human misuse of the land or the environment (e.g., farming on steep slopes increases erosion).

**land use**—the range of uses of Earth's surface made by humans. Uses are classified as urban, rural, agricultural, forested, etc., with more specific subclassifications useful for specific purposes (e.g., low-density residential, light industrial, nursery crops).

**landform**—the shape, form, or nature of a specific physical feature of Earth's surface (e.g., plain, hill, plateau, mountain)

**landlocked country**—a country that is completely surrounded by the territory of one or more other countries, thus denying direct access to the sea or ocean

**latitude**—assuming that the Earth is a sphere, the angular distance in degrees measured north and south from the equator

**Leadership in Energy and Environmental Design (LEED)**—a “green” certification system developed in the United States providing voluntary guidelines for constructing environmentally sustainable buildings

**legend**—an explanatory description or key to features on a map or chart

**life expectancy**—the average number of years a person can expect to live under current mortality levels in a society. Life expectancy at birth is the most common use of this measure.

**limits to growth**—a geographic model examining the consequences of a rapidly increasing world population and finite supplies of resources to support that population

**linkage**—contact and resulting flow of ideas, information, people, or products between places

**literacy rate**—the percentage of a country's population able to read and write at a competent level

**lithosphere**—the uppermost portion of the solid Earth including soil, land, and geologic formations

**lithospheric plates**—see tectonic plates

**local relief**—in landforms, the difference in elevation between the highest and lowest points in a specified area

**location**—the position of a point on Earth’s surface expressed by means of a grid (absolute) or in relation (relative) to the position of other places

**locational**—understanding the positioning of a place in terms of such features as site characteristics, accessibility, connectivity, etc.

**longitude**—the position of a point on Earth’s surface expressed as its angular distance, east or west, from the prime meridian to 180°

## M

**map**—a graphic representation of a portion of Earth that is usually drawn to scale on a flat surface

**map projection**—a mathematical formula by which the lines of a global grid and the shapes of land and water bodies are transferred from a globe to a flat surface

**maquiladora**—an assembly plant in Mexico run by a foreign company using special duty and tariff privileges for the export of products to other areas of the world

**megacity**—a super-city with a population of more than 10 million people; characterized by its rapid growth, erratic patterns of population distribution, formal and informal economies, and high levels of social fragmentation

**megapolis**—the coalescence of two or more large metropolitan areas into a continuous or almost continuous built-up urban complex, sometimes referred to as conurbation

**mental map**—an individual’s internalized representation of aspects of Earth’s surface; a map that represents the mental image a person has of an area, including knowledge of features and spatial relationships, as well as the individual’s perceptions and attitudes regarding the place; also known as a cognitive map

**meridian**—a north–south line of longitude used to measure both time and distance east and west of the prime meridian or longitude 0° (see prime meridian)

**metadata**—data about data; structured information explaining or describing an information resource; provides facts about the data being documented (i.e., who? what? when? where? why? how?)

**metes and bounds**—a survey system of precisely measuring parcels of land using distances, angles, and directions that result in a legal definition of the property that is typically recorded in county land records

**metropolitan area**—the US Office of Management and Budget’s designation for the functional area surrounding and including a central city; has a minimum population of 50,000; is contained in the same county as the central city; and includes adjacent counties having at least 15 percent of their residents working in the central city’s county

**microclimate**—a small, localized climate area within a larger climate region that has significantly different atmospheric elements. Microclimates can be caused by human intervention or by local landform configurations (e.g., “heat islands” in a central city’s areas of high skyscrapers or sheltered south-facing slopes of hills).

**migration**—the act or process of people moving from one place to another with the intent of staying at the destination permanently or for a relatively long period of time

**mitigation**—the process of reducing the severity of an extreme physical or human condition in a stressed environment (e.g., building levees along a river bank to diminish flooding, developing public policy on urban land-use issues in congested neighborhoods to discourage gang activity)

**model**—see geographic model

**monoculture**—the practice of growing one or more cash crops for export to one or more countries

**monsoon**—a wind system that changes direction seasonally, producing distinct wet and dry seasons; used especially to describe the low-sun and high-sun seasonal wind systems of South, Southeast, and East Asia

**moraine**—ridge composed of an unsorted mixture of boulders, sand, silt, and clay that is deposited in contact with a glacier; usually reflect a period when the glacier has remained stationary as opposed to advancing or retreating

**mortality rate**—see crude death rate

**mountains**—high elevation landform features composed mostly of steep slopes and large amounts of local relief within a specified area (e.g., the Alps of Europe)

**multiculturalism**—a pluralistic society in which there are a number of subcultures

**multinational corporation (MNC)**—corporation or enterprise that manages the production of goods or delivers services in several countries in various world locations; often with budgets that exceed those of many countries

**multinational organizations**—organizations of nations aligned around a common economic or political cause (e.g., Organization of Petroleum Exporting Countries (OPEC) or the Organization of American States (OAS))

## N

**nation**—a cultural concept for a group of people bound together by a strong sense of shared values and cultural characteristics including language, religion, and common history

**natural hazard**—an event in the physical environment, such as a hurricane or earthquake, that is destructive to human life and property

**natural increase**—see natural population increase

**natural population increase**—the changes in population size, expressed as a percentage, attributable solely to fertility (addition by births) and mortality (subtraction by deaths) excluding migration

**natural vegetation**—plants originally found together in an area. Little of the world’s vegetation is entirely unmodified by human activities.

**network**—a pattern of links between points along which movement can take place (e.g., streams, roads, or communication modes)

**nitrogen cycle**—a complex and continuous natural process by which nitrogen is recycled in the ecosystem (i.e., nitrates from the soil are absorbed by plants that are eaten by animals that die and decay, returning the nitrogen back to the soil)

**node**—a central point, such as a neighborhood, a market area, or a temple or parish church, where cultural and economic functions are coordinated; a strategic point in a built-up area around which the movement of people and goods occurs (e.g., a transportation complex, an agricultural service area, an industrial park)

**nomads**—a group of people without permanent residence who move from place to place usually on a seasonal basis in search of grasslands and water for their animals (e.g., cattle, horses, sheep, camels)

**nongovernmental organizations (NGOs)**—independent organizations that pursue activities to promote the interests of underserved populations, protect the environment, provide basic social services, relieve suffering, or undertake community development; not part of the local, state, or federal government; often international in scope

**nonrenewable resource**—a finite resource that cannot be replaced once it is used (e.g., petroleum, minerals)

## Glossary

**North America Free Trade Agreement (NAFTA)**—an agreement made by the United States, Canada, and Mexico to remove barriers to free trade through the gradual elimination of tariffs, various fees, and import quotas among the three participants

**North Pole**—the geographic point farthest north on Earth; the northern end of Earth's axis. On globes and most maps, it is that place in the Northern Hemisphere where meridians converge.

**no-till farming**—a method of farming using methods where the soil is unplowed or unturned before planting crops, thus reducing erosion of both soil and nutrients while increasing organic matter in the soil; also called zero tillage

## O

**oasis**—a fertile place in the desert where underground water rises to ground level

**oblate spheroid**—the shape of Earth, which is larger in circumference around the Equator than the poles

**ocean currents**—the regular and consistent horizontal flow of water in the oceans, usually in response to persistent patterns of circulation in the atmosphere

**Organization of African Unity (OAU)**—promotes harmony and solidarity among the African states and acts as a collective voice for the African continent on such issues as human rights

**Organization of American States (OAS)**—promotes social and economic development in the Western Hemisphere through cooperation among member nations

**Organization of Petroleum Exporting Countries (OPEC)**—an international cartel of twelve nations designed to promote collective pricing of petroleum, unified marketing policies, and regulation of petroleum extraction; controls most of the world's oil reserves

**orographic**—the study of the physical geography of mountains and mountain ranges

**outsourcing**—procuring services or products, such as the parts used in manufacturing a motor vehicle, from an outside supplier or manufacturer to cut costs; often a corporate practice in the developed world to have work done in developing countries where labor costs are lower

**overpopulation**—a situation in which the existing population is too large to be adequately supported by available resources at current levels of consumption. This should not be confused with dense population.

**ozone layer**—a layer in the stratosphere at an altitude of 12–21 miles that has a high concentration of ozone and protects the lower atmosphere and Earth's surface by absorbing much of the ultraviolet radiation that reaches Earth from the sun

## P

**Pacific Rim**—countries bordering the Pacific Ocean

**pandemic**—a disease that spreads throughout an entire population and in many different countries; can extend worldwide

**parallel**—an east–west line of latitude used to measure angular distance north and south of the equator or latitude 0°

**perceptual region**—an area of Earth, such as the Middle West, identified by expressions of feelings, attitudes and images

**photosynthesis**—a chemical process by which green plants and some other organisms use sunlight, water, and carbon dioxide and turn these natural elements into food and oxygen

**physical feature**—an aspect of a place or area that derives from Earth's processes and the natural environment

**physical process**—a course or method of operation that produces, maintains, or alters Earth's physical systems, such as glacial processes eroding and depositing landforms

**physiography**—the study of Earth's surface and its physical features, including relationships between air, land, and water

**physiological population density**—the relationship between the total population of a country and the quantity of land classified as arable or permanent pasture

**places**—locations having distinctive characteristics that give them meaning and character and distinguish them from other locations

**plains**—landform features characterized by a maximum of gentle slopes and minimum local relief within a specified area (e.g., the pampas of Argentina)

**plantation agriculture**—a type of agriculture involving large landholdings that produce cash crops such as tea, rubber, coffee, sugarcane, or cocoa

**plateaus**—landform features characterized by high elevation and gentle upland slopes

**plate tectonics**—the theory that Earth's surface is composed of rigid slabs or plates (see tectonic plates). The divergence, convergence, and side-by-side slipping of the different plates are thought to be responsible for present-day configurations of continents, ocean basins, and major mountain ranges and valley systems.

**pollution**—the direct or indirect process resulting from human action by which any part of the environment is made potentially or actually unhealthy, unsafe, or hazardous to the welfare of the organisms that live in it

**population density**—the number of individuals occupying an area derived from dividing the number of people by the area they occupy (e.g., 2,000 people divided by ten square miles = 200 people per square mile)

**population pyramid**—a bar graph showing the distribution by gender and age of a country's population

**population structure**—the age and gender makeup of a population, usually depicted on population pyramids

**prevailing winds**—the direction from which the wind usually blows at a particular location (e.g., the westerlies in the middle latitudes of North America)

**primary economic activity**—the production of naturally existing or culturally improved resources (e.g., agriculture, ranching, forestry, fishing, extraction of minerals and ores)

**primate city**—the most important city in a country that often has a population three or four times the size of the second-ranked city

**prime meridian (Greenwich meridian)**—0°; the standard meridian from which longitude is measured. The prime meridian crosses Greenwich in London, England, the site of the Royal Naval Observatory.

**principal meridians**—the prime meridian (Greenwich meridian) and the International Date Line

## Glossary

**principal parallels**—the Equator, the Tropics of Cancer and Capricorn, and the Arctic and Antarctic Circles

**pull factors**—in migration theory, the social, political, economic, and environmental attractions of new areas that draw people away from their previous locations

**push factors**—in migration theory, the social, political, economic, and environmental forces that drive people from their previous locations to search for new ones

## R

**rain shadow**—areas on leeward sides of mountain ranges characterized by much lower precipitation and humidity than the windward (rainy) side

**raster image**—(also called a bitmap) a way to represent digital images using bits of information that translate into a rectangular array of pixels when displayed

**rectangular land survey system**—method used in the United States to identify land parcels for deeds for land usually in rural and undeveloped areas by dividing a district into 24-square-mile quadrangles and then subdividing each into six-mile square parts called townships

**region**—an area with one or more common physical or cultural characteristics or features that give it a measure of homogeneity and make it different from surrounding areas

**regionalization**—the partitioning of areas on Earth using a variety of criteria for the purpose of organizing elements in a complex space

**relative humidity**—the amount of moisture actually in the air compared to the amount the air can hold at a given time at the same temperature (e.g., 85 percent)

**relative location**—the location of a place or region in relation to other places or regions (e.g., northwest or downstream)

**remote sensing**—information gathering about Earth's surface from a distance (usually referring to the use of aerial photography or satellite images)

**renewable resource**—a resource that can be regenerated if used carefully (e.g., fish or timber)

**resource**—an aspect of the physical environment that people value and use to meet a need for fuel, food, industrial product, or something else of value

**resource base**—the available resources in a given area at a given time

**rural**—relating to or characteristic of the countryside rather than cities

## S

**salinization**—the process by which high salt content in soils is formed in arid areas where evaporation rates are high

**satellite image**—an image produced by a variety of sensors (e.g., radar, microwave detectors, scanners) that measure and record electromagnetic radiation. The collected data are turned into digital form for transmission to ground receiving stations. The data can be reconverted into imagery in a form resembling a photograph.

**scale**—on maps, the relationship or ratio between a linear measurement on a map and the corresponding distance on Earth's surface (e.g., the scale 1:1,000,000 means one unit [mile or kilometer] on the map represents 1,000,000 similar units on Earth's surface); also refers to the size of places or regions being studied

**scientific method**—a technique of advancing knowledge through the use of a question using systematic observation, measurement, experiment resulting in the formulation, testing, and modification of hypotheses

**secondary economic activity**—the conversion of raw materials from the primary economic sector into finished industrial products (e.g., manufactured goods, oil refining, construction, ship building)

**sequent occupance**—the settlement of an area by successive groups, each creating a distinctive cultural landscape

**service industry**—a business that provides assistance to a customer rather than manufactured goods (e.g., medical services in hospitals, teaching activities in schools, selling such items as clothing and books in stores, an attorney representing a client in court, driving a truck, delivering mail)

**settlement pattern**—the spatial distribution and arrangement of human habitations, including rural and urban centers

**shifting cultivation**—a system of agriculture in which a field or plot is cleared, cropped, and harvested and after a few years, with initial fertility exhausted, abandoned in favor of a new field; also known as slash-and-burn, milpa, or swidden

**silting**—the buildup of sediments at points along the course of a river where the flow velocity decreases (e.g., upstream of a dam)

**site**—the specific place where something is located, including its physical setting (e.g., on a floodplain)

**situation**—the general location of something in relation to other places or features of a larger region (e.g., in the center of a group of cities or New York City's situation as a port of entry on the Atlantic coast, adjacent to heavy and light industries, transportation networks, productive agricultural lands, and major market areas)

**smog**—a mixture of chemical pollutants and particulate matter in the lower atmosphere, usually found in highest concentrations in urban-industrial areas

**soil**—unconsolidated material found at the surface of Earth that is divided into layers (or horizons) characterized by the accumulation or loss of organic and inorganic compounds. Soil types and depths vary greatly over Earth's surface and are influenced by climate, organisms, rock type, local relief, time, and human activity.

**soil creep**—the slow and gradual down-slope movement of masses of soil due to gravity in combination with freeze-thaw and wet-dry cycles

**solar radiation**—energy received from the sun upon which all life on Earth depends

**South Pole**—the geographical point farthest south on Earth; the southern end of Earth's axis. On globes and most maps, that place in the Southern Hemisphere where meridians converge.

**Southern Cone Common Market**—a regional trade association involving several Latin American countries working together to reduce tariffs and increase economic cooperation among its members; often called the Common Market of the South

**sovereignty**—the power and authority a state has governing a carefully defined territory and the population and resources within that space

**spatial**—pertains to space on Earth's surface

## Glossary

**spatial change**—modifications occurring in physical and human arrangements on Earth's surface

**spatial data**—information used to pose, analyze, and resolve problems about patterns on Earth's surface that reflect physical and human processes

**spatial distribution**—the spread and placement of physical and human phenomena on Earth's surface

**spatial organization**—the arrangement and positioning of various physical and human phenomena on Earth's surface

**spatial patterns**—the systematic arrangement of various physical and human phenomena on Earth's surface

**spatial processes**—a systematic and sequential series of changes affecting physical and human activity on Earth's surface

**spatial scale**—the absolute or relative size and extent of various phenomena on Earth's surface

**stereotype**—an oversimplified and generally inaccurate image of a place or a region (e.g., "All deserts are hot." or "Asian capitals are dirty and overcrowded."); see egocentric stereotype and ethnocentric stereotype

**subsistence agriculture**—a form of farming with an emphasis on self-support in which crops or livestock are cultivated for personal consumption rather than for sale

**supranational organizations**—corporations and international agencies that have power or influence transcending national boundaries or governments

**sustainability**—the integration of physical systems with human patterns of activity to assure continuity

**sustainable development**—the capacity of a country to balance economic, social, and institutional needs as population and societal needs change

**sustainable environment**—human use of resources designed to reduce stress on the physical environment

**system**—a collection of entities that are linked and interrelated (e.g., hydrologic cycle, cities, and transportation modes)

**systemic**—of or pertaining to a system as a whole

## T

**tariff**—an official schedule of taxes imposed by a government on imports or exports

**technological hazards**—disastrous events attributed to a failure of technology or a technological product (e.g., radioactive materials released from a nuclear power plant explosion or soil contamination from a chemical dump)

**technology**—application of scientific knowledge to meet the goals, goods, and services needed and desired by people

**tectonic plates**—sections of Earth's rigid crust that move as distinct units on a plastic-like mantle on which they rest. As many as twenty different plates have been identified, but only seven are considered to be major (e.g., Eurasian Plate and the South American Plate).

**tectonic process**—a physical process within Earth (e.g., volcanic activity, folding, faulting) that creates physical features, such as mountains, on the surface

**terraces**—the step-like flat surfaces created on steep hill slopes for the purpose of farming land that would be subject to erosion under normal cultivation practices

**tertiary economic activity**—the provision of services to the general population (e.g., banking, retailing, education)

**thematic map**—a map representing a specific spatial distribution, theme, or topic (e.g., population density, cattle production, climates of the world)

**threshold**—in physical and environmental processes, the point in the operation of a system when a jump or relatively great change occurs in response to a minor input (e.g., massive flooding in a region resulting from a brief but intense summer storm); in an economic context, the minimum population needed for a service (e.g., auto dealer) to locate in a central place

**time zone**—a division of Earth, usually of longitude 15°, within which the time at the central meridian of the division represents the whole division; a range of longitudes where a common standard time is used

**time–distance**—the amount of time necessary to travel between two places

**time–distance decay**—diminishing acceptance of an idea or innovation as time and distance increase from its point of origin

**topographic map**—a detailed map on a large scale (e.g., 1:25,000 or 1:50,000) illustrating selected physical and human features of a place (see also contour map)

**topography**—the examination of the arrangement of the physical and human features of an area at any scale

**tornado**—a small but intense funnel-shaped low-pressure cell with very low barometric pressure, strong and violent updrafts, and high-velocity converging winds

**transregional alliances**—political and economic alliances between or among nation states that transcend traditional cultural regions (e.g., Organization of African Unity)

**travel effort**—the difficulty involved in people moving from one place to another as measured in time, monetary cost, or physical distance

**Tropic of Cancer**—latitude 23.5° north; the farthest north the sun is directly overhead during the year, usually June 22

**Tropic of Capricorn**—latitude 23.5° south; the farthest south the sun is directly over head during the year, usually December 22

## U

**urban heat island**—a phenomenon of urban settlements where relatively warmer atmospheric temperatures prevail in the most heavily built-up areas and decrease outward toward the fringes

**urbanization**—a process by which there is an increase in the percentage of people living and working in urban places as compared to rural places

## V

**vector image**—type of remotely sensed or digitally drawn imagery resulting in either a point, line, or area (polygon) of information that is based on and stored as a mathematical formula (e.g., a mountain top or building [point], a river or a street [line], a lake or recreational park [area])

**volcanism**—a process resulting in the upward movement and expulsion of molten (melted) material from within Earth onto the surface where it cools and hardens (e.g., this process created the Hawaiian Islands)

## W

**watershed**—the drainage area of a river and its tributaries

**weathering**—the breaking down, disintegration, or dissolving of Earth's surface and subsurface rocks and minerals by physical, chemical, and organic processes

**Weber's Least Cost Theory**—a model developed by Alfred Weber, a 19th-century German theoretician, establishing that a site chosen for an industry should be located in a place that will reduce costs and maximize profits (i.e., a site that provides the combined lowest cost, accessibility to materials, availability of supplies, a competent workforce, cost-effective transportation, and markets)

**World Bank**—an international organization supported by the world's developed countries with the mission to aid developing countries in the process of economic emergence with loans, advice, and research

## Z

**zonation**—the division of a large area into smaller areas based on certain predetermined characteristics (e.g., areas of a country where large numbers of tornadoes occur; sections of a state with high unemployment rates; parts of a city with heavy concentrations of high-rise apartment buildings and condominiums)

**zoning**—a system of sectioning areas within cities, towns, and villages for specific land-use purposes through local ordinances (e.g., residential, light manufacturing, commercial uses)

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