Appendix

Workshop 1 Reading

Geography for Life Introductory Material

This material is from Chapters 2 and 3 of *Geography for Life: The National Geography Standards, 1994*. The Geography Education Standards Project. © 1994 National Geographic Society, Washington, D.C. Reprinted with the permission of the National Geographic Society.

The Components of Geography Education

Organization of Geography

Geography is composed of three interrelated and inseparable components: subject matter, skills, and perspectives. Subject matter is a distillation of essential knowledge and is the foundation for the geography standards. Subject matter is the basis on which geographic skills are brought to bear. These skills are:

1. asking geographic questions,
2. acquiring geographic information,
3. organizing geographic information,
4. analyzing geographic information, and
5. answering geographic questions.

Knowledge and skills must be considered from two perspectives: spatial and ecological.

Mastering any single component of geography is *not* equivalent to mastering geography. All three—subject matter, skills, and perspectives—are necessary to being geographically informed. None can stand alone.

There is a related chain of knowledge that the geographically informed person must appreciate and command. Knowing population growth rates is not sufficient unless that knowledge can be related to an understanding of the resource base—the distribution of arable land, climate patterns—and to the transportation system that moves food supplies to consumers, and so on. Likewise, knowing where to find information on the distribution of population is not sufficient unless you know how to evaluate the reliability of that information, can relate it to maps of arable land and transportation routes, and can then speculate on the impact of changing population policies, migration patterns, or new crops on the patterns of people and rates of food production. This process returns you to the subject of population growth rates, completing a chain of knowledge involving people, places, and environments.

Space and Place

Understanding the relationships between people, places, and environments depends upon an understanding of space. Space is the environmental stage upon which the drama of geography is played out, and places are particular points on the environmental stage where the action occurs. In this respect, there is a parallel with the approach of history. History is concerned with understanding the temporal dimension of human experience (time and chronology). Geography is concerned with understanding the spatial dimension of human experience (space and place).

Space in the world is identified in terms of location, distance, direction, pattern, shape, and arrangement. Place is identified in terms of the relationships between physical environmental characteristics, such as climate, topography, and vegetation, and such human characteristics as economic activity, settlement, and land use. Together, these characteristics make each particular place meaningful and special to people. Place, in fact, is space endowed with physical and human meaning. It is the fascination with and exploration of space and place that give geography its way of understanding the world.

Workshop 1 Reading, cont'd.

The Subject Matter

The roots of the word "geography" are found in two Greek words: *geo*, meaning Earth, and *graphia*, meaning description or depiction. The purpose of geography, therefore, is to describe or depict Earth. But there is no single way of doing that. Rather, Earth can be looked at in various ways.

As a physical object, it is an oblate spheroid with an equatorial circumference of approximately 24,902 miles; its surface is covered by water and land in a ratio of approximately 2.3:1; and that surface ranges from 29,028 feet above sea level to 35,840 feet below sea level (the top of Mount Everest to the bottom of the Mariana Trench).

As a physical environment, Earth is characterized by large-scale processes, such as the atmospheric jet streams that snake across its surface, and large-scale landforms, such as the Ring of Fire surrounding the Pacific Basin.

As a place in which humans can live, it offers such diverse habitats as the permafrost of Siberia, the tropical rain forest of the Congo River basin, and the Atacama Desert of Chile.

As a place in which humans *do* live, it displays intricate patterns of environmental modification (e.g., the polderlands of the Netherlands, or the terraced hills of the Philippines), as well as varied patterns of land use (e.g., the densely populated area of Hong Kong, the sparsely peopled central desert of Australia, and the automobile-based sprawl of southern California).

Geographers look at Earth in all of these ways—as a physical object, as a physical environment, and as a human place. Geographers also look at the world as a whole, to understand the connections between places, and to recognize that the local affects the global and vice versa. But in order to study Earth as the home of people, geographers must develop a framework that cuts into the connections between places.

Our framework consists of two levels. At the first level, the subject matter of geography is divided into six essential elements. By essential we mean that each piece is central and necessary; we must look at the world in this way. By element we mean that each piece is a building block for the whole. At the second level, each essential element contains a number of geography standards, and each geography standard contains a set of related ideas and approaches to the subject matter of geography.

The Six Essential Elements

The first element, **The World in Spatial Terms,** captures the essence of the geographic eye: the structuring of geographic information, the ordering of knowledge into mental maps, and the spatial analysis of that information. Given this essential grounding in the geographic way of approaching the world, the second element, **Places and Regions,** applies that 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. 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 interaction 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 us to understand the past, interpret the present, and plan for the future.

The Eighteen Standards

Physical and human phenomena are spatially distributed over Earth's surface. The outcome of *Geography for Life* is a geographically informed person who:

1. sees meaning in the arrangement of things in space;

Workshop 1 Reading, cont'd.

2. sees relations between people, places, and environments;
3. uses geographic skills; and
4. applies spatial and ecological perspectives to life situations.

The World in Spatial Terms

Geography studies the relationships between people, places, and environments by mapping information about them into a spatial context.

The geographically informed person knows and understands:

1. how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective
2. how to use mental maps to organize information about people, places, and environments in a spatial context
3. how to analyze the spatial organization of people, places, and environments on Earth's surface

Places and Regions

The identities and lives of individuals and peoples are rooted in particular places and in those human constructs called regions.

The geographically informed person knows and understands:

4. the physical and human characteristics of places
5. that people create regions to interpret Earth's complexity
6. how culture and experience influence people's perceptions of places and regions

Physical Systems

Physical processes shape Earth's surface and interact with plant and animal life to create, sustain, and modify ecosystems.

The geographically informed person knows and understands:

7. the physical processes that shape the patterns of Earth's surface
8. the characteristics and spatial distribution of ecosystems on Earth's surface

Human Systems

People are central to geography in that human activities help shape Earth's surface, human settlements and structures are part of Earth's surface, and humans compete for control of Earth's surface.

The geographically informed person knows and understands:

9. the characteristics, distribution, and migration of human populations on Earth's surface
10. the characteristics, distribution, and complexity of Earth's cultural mosaics
11. the patterns and networks of economic interdependence on Earth's surface
12. the processes, patterns, and functions of human settlement
13. how the forces of cooperation and conflict among people influence the division and control of Earth's surface

Environment and Society

The physical environment is modified by human activities, largely as a consequence of the ways in which human societies value and use Earth's natural resources, and human activities are also influenced by Earth's physical features and processes.

The geographically informed person knows and understands:

14. how human actions modify the physical environment
15. how physical systems affect human systems
16. the changes that occur in the meaning, use, distribution, and importance of resources

The Uses of Geography

Knowledge of geography enables people to develop an understanding of the relationships between people, places, and environments over time—that is, of Earth as it was, is, and might be.

The geographically informed person knows and understands:

17. how to apply geography to interpret the past
18. how to apply geography to interpret the present and plan for the future

Using the Eighteen Standards

While all of the National Geography Standards are applicable and relevant to all states and school districts, different emphases are possible and desirable. A state such as Alaska might emphasize the three Environment and Society standards, interpreting them prospectively by focusing on resources and the potential impacts of human activities on Alaska's physical environment. A state such as Pennsylvania might take the same three standards, interpreting them retrospectively by focusing on the environmental consequences of resource extraction and exhaustion in Pennsylvania. Similarly, an urban school in Detroit might implement National Geography Standard 10—the characteristics, distribution, and complexity of Earth's cultural mosaics—by emphasizing intraurban migration, neighborhood formation, and ethnic diversity; whereas a rural school in Montana might emphasize National Geography Standard 12—the processes, patterns, and functions of human settlement—and concentrate on the economic and social problems of low-density, dispersed settlements.

Illustrative examples can be tailored to local contexts. In discussing migration in National Geography Standard 9, a school district in California might examine migration from Southeast Asia, a school district in Florida might devote attention to migration from the Caribbean, and a school district in Texas might consider migration from Mexico and Central America. Similarly, a New England school district might discuss migration of French Canadians in the nineteenth century whereas a school district in Louisiana might look at the migration of Acadians in the early eighteenth century. School districts in Chicago and Baltimore might look at the flows of African Americans from Mississippi and Alabama in the early and middle twentieth century; whereas schools in Cincinnati and Cleveland might choose migration from Appalachia during the same period. In all cases, despite differences in specific place and time, the basic geographic concepts would be identical: push and pull factors, migration streams, migration fields, distances, the role of intervening opportunities.

Geographic Skills and Perspectives

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 physical and human patterns and processes on Earth. We use

geographic skills when we make decisions important to our well-being—where to buy or rent a home; where to get a job; how to get to work or to a friend's house; 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 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 us to make reasoned political decisions. Whether the issues involve the evaluation of foreign affairs and international economic policy or local zoning and land use, the skills enable us 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 for and against matters of public policy.

The Rationale for Geographic Skills

The geographic skills that a geographically informed person should have consist of five sets adapted from the *Guidelines for Geographic Education: Elementary and Secondary Schools*, prepared by the Joint Committee on Geographic Education and published in 1984 by the Association of American Geographers and the National Council for Geographic Education:

1. Asking geographic questions
2. Acquiring geographic information
3. Organizing geographic information
4. Analyzing geographic information
5. Answering geographic questions

Following is a brief discussion of the principles underlying the five skills sets, followed by the presentation of skills.

1. Asking Geographic Questions

Successful geographic inquiry involves the ability and willingness to ask, speculate on, and answer questions about why things are where they are and how they got there. Students need to be able to pose questions about their surroundings: Where is something located? Why is it there? With what is it associated? What are the consequences of its location and associations? What is this place like?

Students should be asked to speculate about possible answers to questions because 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 kinds of questions it asks—the "where" and "why there" of a problem. It is important that students develop and practice the skills of asking such questions for themselves. The task can be approached by giving students practice in distinguishing geographic from nongeographic questions and by presenting students with issues and asking them to develop geographic questions. At higher grade levels students can identify geographic problems and ways in which an application of geography can help solve problems or resolve issues.

2. Acquiring Geographic Information

Geographic information is information about locations, the physical and human characteristics of those locations, and the geographic activities and conditions of the people who live in those places. To answer geographic questions, students should start by gathering information from a variety of sources in a variety of ways. They 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 library research.

Workshop 1 Reading, cont'd.

The skills involved in acquiring geographic information include locating and collecting data, observing and systematically recording information, reading and interpreting maps and other graphic representations of spaces and places, interviewing, and using statistical methods.

Primary sources of information, especially the result 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 the students' curiosity and makes the study of geography more enjoyable and relevant. It fosters active learning by enabling students to observe, ask questions, identify problems, and hone their perceptions of physical features and human activities. Fieldwork connects the students' school activities with the world in which they live.

Secondary sources of information include texts, maps, statistics, photographs, multimedia, computer databases, newspapers, telephone directories, and government publications.

Tertiary sources such as encyclopedias report information compiled from secondary sources and are important in some research situations.

3. Organizing Geographic Information

Once collected, the geographic information should be organized and displayed in ways that help analysis and interpretation. Data should be arranged systematically. Different types of data should be separated and classified in visual, graphic forms: photographs, aerial photos, graphs, cross sections, climagraphs, diagrams, tables, cartograms, and maps. Written information from documents or interviews should be organized into pertinent quotes or tabular form.

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 form, such as by using graphs of all kinds, tables, spreadsheets, and time lines. Such visuals 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, and charts that best reflect 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 can mean using sketch maps to make a point in an essay or record field observations. It can mean using symbols to map data on the location of world resources or producing a county-level map of income in a state. It can even mean mapping the distribution of fire-ant mounds in a field or trash on a school playground. For students, making maps should become as common, natural, and easy as writing a paragraph. They should be skilled in interpreting and creating map symbols, finding locations on maps using a variety of reference systems, orienting maps and finding directions, using scales to determine distance, and thinking critically about information on 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. Students can then synthesize their observations into a coherent explanation. Students should note associations and similarities between areas, recognize patterns, and draw inferences from maps, graphs, diagrams, tables, and other sources. Using simple statistics students can identify trends, relationships, and sequences.

Geographic analysis involves a variety of activities. 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. Students should scrutinize maps to discover and compare spatial patterns and relationships; 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; examine texts and documents to interpret, explain, and synthesize characteristics. Together these analytic processes lead to answers

to the questions that first prompted an inquiry and to the development of geographic models and generalizations. These are the analytical skills that all students need to develop.

5. Answering Geographic Questions

Successful geographic inquiry culminates in the development of generalizations and conclusions based on the data collected, organized, and analyzed. Skills associated with answering geographic questions include the ability to make inferences based on information organized in graphic form (maps, tables, graphs) and in oral and written narratives. These skills involve the ability to distinguish generalizations that apply at the local level from those that apply at the global level (issues of scale are important in developing answers to geographic questions).

Generalizations are the culmination of the process of inquiry, and they help to codify understanding. Developing generalizations requires that students use the information they have collected, processed, and analyzed to make general statements about geography. At other times, however, students use the evidence they have acquired to make decisions, solve problems, or form judgments about a question, issue, or problem.

Geographic generalizations can be made using inductive reasoning or deductive reasoning. Inductive reasoning requires students to synthesize geographic information to answer questions and reach conclusions. Deductive reasoning requires students to identify relevant questions, collect and assess evidence, and decide whether the generalizations are appropriate by testing them against the real world. Students should have experience in both approaches to learning.

Students should also be able to communicate clearly and effectively, especially as they learn to answer geographic questions. It is a skill linked closely to good citizenship. Students can develop a sense of civic responsibility by disseminating the answers they have discovered in geographic inquiry. They can display geographic information in many engaging and effective ways—for example, by using multimedia, such as combinations of pictures, maps, graphs, and narratives, to present a story or illuminate a generalization. Geographic information can also be presented through the use of poems, collages, plays, journals, and essays. Every medium chosen to present geographic information to answer questions or address an issue or problem should stimulate inquiry and communicate clearly. Choosing the best means of presenting answers to geographic questions is an important skill.

Students should also understand that there are alternative ways to reach generalizations and conclusions. There are many types of knowledge, and many levels of reality and meaning. Teachers should encourage students to develop multiple points of view and to seek multiple outcomes to problems. This process should include collecting many kinds of data, including personal, subjective information, from a variety of sources.

The fifth skill set represents the last step in the process of geographic inquiry. But it is not really the end, because the process usually begins again with new questions suggested by the conclusions and generalizations that have been developed. These questions, often posed as hypotheses to be tested, provide a way to review generalizations. Each question answered, decision reached, or problem solved leads to new issues and new problems.

Geographic learning is a continuous process that is both empowering and fascinating.

Developing Geographic Skills

It is essential that students develop the skills that will enable them to observe patterns, associations, and spatial order. Many of the skills that students are expected to learn involve the use of tools and technologies that are part of the process of geographic inquiry. Maps are essential tools of geography because they assist in the visualization of space.

Other tools and technologies, such as 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 photographs. Large-scale land-use changes can be made clear by comparing images taken over a period of years.

A new and important tool in geographic analysis is the spatial database, or geographic information system (GIS) (see *Geography for Life* Appendix E). Geographic information systems make the process of presenting and analyzing geographic information easier, so they can accelerate geographic inquiry. Spatial databases also can be developed in the classroom using paper and pencil.

Workshop 1 Reading, cont'd.

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, and decision-making. These 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 the students' school years, and for each of the three successive grade levels discussed [K-4, 5-8, 9-12, *Geography for Life* pp. 46-56]. Teachers and other curriculum developers will need to recognize that the students' mastery of geographic skills must be sequenced effectively so that the students retain and build on their understanding.

Geographic Perspectives

A perspective is one point of view among many competing ways of interpreting 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. 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 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 perspective types regardless of their cultural experiences, ethnic backgrounds, age, gender, or any other characteristic. Geographically informed people know how to contemplate, understand, and apply two specific geographic perspectives, along with complementary disciplinary and personal perspectives.

The two specific geographic perspectives are the spatial perspective and the ecological perspective. Geographic perspectives bring societies and nature under the lens of geography for interpretation and explanation. Geographic perspectives encompass understanding spatial patterns and processes on Earth and comprehending that Earth is composed of living and nonliving elements interacting in complex webs of relationships within nature and between nature and societies. A fully developed set of geographic perspectives, therefore, requires the use of both spatial and ecological points of view.

Knowledge is one fabric woven from many distinctive fields of learning and is organized by different intellectual frameworks. Although each field of study represents distinctive areas of inquiry, specialization, and perspectives, diverse sets of questions are needed to reveal the complexities of nature and societies. Consequently, although spatial and ecological perspectives are hallmarks of the geographic way of looking at the world, additional perspectives are required for us to become fully informed.

The Spatial Perspective

As history is concerned with the temporal dimension of human experience (time and chronology), 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 to 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 which occur at multiple levels. Humans are part of the interacting 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.

Workshop 1 Reading, cont'd.

Understanding Earth as a complex set of interacting 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.

Complementing the Two Geographic Perspectives

Many perspectives supplement the two geographic perspectives and, when used appropriately, they can expand our understanding of spatial patterns and human-environment interactions. The geographic perspectives can be integrated with other disciplinary perspectives and with our own points of view to enrich and enlarge the understanding of people, places, and environments. Two other perspectives are of particular value to students of geography: the historical perspective and the economic perspective.

The Historical Perspective

All human events and activities have historic and geographic aspects. Central to historical inquiry are questions concerning chronology, the sequencing of events, relationships within and among societies over time, changes in cultures in various eras, and the changing relationships between civilizations and physical environments. A historical perspective enriches the geographic perspective by adding the essential questions of "When?""Why then?" and "Why is the event significant?" These questions complement the study of whereness and consequently promote a deepened understanding of past and contemporary events, how and why places and regions form and change, and variations in human use of environments in different cultures and eras.

Understanding temporal patterns is a vital dimension of comprehending human experiences on Earth. People who ask questions about when events occurred and how events are related to each other over time use a historical perspective.

The Economic Perspective

Economics focuses on how people produce and exchange goods and services to fulfill such needs as food, shelter, transportation, and recreation. Earning a living; developing and trading resources; and inventing, producing, and distributing products and services are central to economics. Previously isolated economies are incorporated into the global economy through difficult transitions from subsistence to commercial activities. Economic transformations promote an increasing interdependence among all societies and cultures on Earth. Technological changes in transportation and communications accelerate and expand economic exchange between the peoples of the world. Local economies may be drastically altered by decisions made in distant places.

Understanding the integration of local, regional, and national economies with the global economy is critical to knowing how people interact. People who ask how diverse peoples earn a living and how peoples are connected through trade in goods and services apply an economic perspective.

The Standards (Workshop Readings)

From *Geography for Life: The National Geography Standards,* 1994

This material is from *Geography for Life: The National Geography Standards, 1994*. The Geography Education Standards Project. © 1994 National Geographic Society, Washington, D.C. Reprinted with the permission of the National Geographic Society.

Please check the grid below and read the appropriate standards for your workshop.

Workshop	Standards
Workshop 1: Introduction	1, 2, 3, 4, 7, 8, 14, 15
Workshop 2: Latin America	4, 7, 9, 15
Workshop 3: North America	1, 4, 10, 12, 16
Workshop 4: North Africa/Southwest Asia	5, 6, 9, 13, 14
Workshop 5: Sub-Saharan Africa	9, 13, 15, 16
Workshop 6: Russia	2, 4, 10, 11, 12, 16
Workshop 7: Europe	6, 10, 11, 13, 17, 18
Workshop 8: Global Forces/Local Impact	3, 8, 11, 14, 16

Standard 1

How To Use Maps and Other Geographic Representations, Tools, and Technologies to Acquire, Process, and Report Information From a Spatial Perspective

Geographic information is compiled, organized, manipulated, stored, and made accessible in a great many ways. It is essential that students develop an understanding of those ways so they can make use of the information and learn the skills associated with developing and communicating information from a spatial perspective.

The study and practice of geography require the use of geographic representations, tools, and technologies. Geographic representations consist primarily of maps, and also include globes, graphs, diagrams, aerial and other photographs, and satellite-produced images. Tools and technologies consist primarily of reference works such as almanacs, gazetteers, geographic dictionaries, statistical abstracts, and other data compilations.

Maps are graphic representations of selected aspects of Earth's surface. They represent compilations of geographic information about selected physical and human features. Using point, line, and area symbols, as well as color, they show how those features are located, arranged, distributed, and related to one another. They range in appearance and purpose from a simple freehand line drawing of how to get to a friend's house to a complex multicolor depiction of atmospheric conditions used in weather forecasting. No single map can show everything, and the features depicted on each map are selected to fit a particular purpose. Maps can depict not only visible surface features such as rivers, seacoasts, roads, and towns but also underground features such as subway systems, tunnels, and geologic formations. They can depict abstract features such as political boundaries, population densities, and lines of latitude and longitude.

In the classroom, maps serve both as repositories of many kinds of geographic information and as an essential means of imparting that information to students. Maps constitute a critical element of geography education.

However, they do have limitations. One major limitation is that it is not possible to accurately represent the round Earth on a flat surface without distorting at least one Earth property, such as distance, direction, or size and shape of land and water bodies. Therefore, different map projections are used to depict different Earth properties (e.g., equal area projections show landmasses in correct areal proportion to one another but with distortions of shape). No single map can accurately depict all Earth's properties, so it is essential that students know how to look at a given map and know which properties are rendered correctly and which are distorted.

As scale models, globes constitute the most accurate representation of Earth in terms of the properties of Earth's surface features—area, relative size and shape, scale and distance, and compass direction are proportionately and therefore correctly represented on globes. Globes present an essential overview of Earth, and they can be very useful in the teaching of such concepts as location, spatial patterns, Earth-Sun relationships, and time. However, globes have limitations: They are cumbersome to handle and store, small scale, and only half of Earth can be observed at once.

In addition to maps and globes, graphs, diagrams, aerial and other photographs, and satellite-produced images also provide valuable information about spatial patterns on Earth. They are very diversified in the kinds of information they present and, under certain circumstances, have classroom value as both supplements to and substitutes for globes and maps. However, they also have limitations: For instance, they may not be immediately understandable to students, who may need special instruction in their use.

The tools and technologies used in geography encompass a great variety of reference works, ranging from encyclopedias and other multivolume publications covering many topics to single reports on specialized subjects. Some of these works are in narrative form; some are primarily compilations of data represented in tabular form. Some are easy to understand and use; some are not. Students need to develop an understanding of the kinds of reference works that are available to them, as well as learn how to obtain information from the works, how to gauge the general reliability of that information, and how to convert information from one form to another (e.g., take data from a table and present it in a written narrative).

Traditionally, reference works have been available solely in printed form. Currently, however, more and more of them are also being made available in the form of computer-based databases and computer-based information systems. This development is a result of computer systems becoming an essential tool for storing, analyzing, and presenting spatial information. Because of their speed and flexibility, such systems enable the geographically informed person to explore, manipulate, and assess spatial data far more effectively than do conventional printed materials (see Appendix E of *Geography for Life*). Furthermore, current developments in multimedia techniques, such as animation, sound, and interactive learning procedures, promise an even more flexible and creative approach to geographic learning.

Throughout their K-12 schooling, students should continue to have direct experience with a wide variety of geographic representations, especially maps. Maps can become increasingly abstract with each succeeding grade level, reflecting the developmental changes in students' abilities to represent and manipulate spatial and symbolic information. In the early grades, students should come to see maps, like the written word, as a source of information about their world. They should be given opportunities to read and interpret different kinds of maps and to create maps of their classroom, school, and neighborhood using various media (e.g., pencils, cutouts). Subsequent experiences in map reading and mapmaking should become more sophisticated and abstract as students develop a more comprehensive understanding of the knowledge, skills, and perspectives involved in maps and mapping activities.

In addition, students should be given an opportunity to become familiar with computer systems and computer-based geographic information systems. As such systems become increasingly common in the home, school, and workplace, for many different purposes, people will learn to use them as comfortably and as effectively as they have traditionally used printed materials. Therefore, it is essential that students of geography be exposed to as many forms of geographic data processing as possible and come to understand the role of computer systems in both the study and practice of geography.

Knowing how to identify, access, evaluate, and use all of these geographic resources will ensure students a rich school experience in geography and the prospect of having an effective array of problem-solving and decision-making skills for use in both their other educational pursuits and their adult years.

Standard 2

How To Use Mental Maps To Organize Information About People, Places, and Environments in a Spatial Context

To be geographically informed, a person must keep in mind a lot of information about people, places, and environments, and must be able to organize this information in the appropriate spatial contexts. A very effective way of doing this is to create and use what can be called "mental maps." Such a map is an individual's internalized representation of some aspect or aspects of Earth's surface. It represents what the person knows about the locations and characteristics of places at a variety of scales (local to global), from the layout of the student's bedroom to the distribution of oceans and continents on the surface of the Earth. These maps in the mind provide students with an essential means of making sense of the world, and of storing and recalling information about the shapes and patterns of the physical and human features of Earth. Learning how to create and use mental maps, therefore, is a fundamental part of the process of becoming geographically informed.

Mental maps have several distinguishing characteristics:

- Mental maps are personal and idiosyncratic and are usually a mixture of both objective knowledge and subjective perceptions. They contain objective and precise knowledge about the location of geographic features such as continents, countries, cities, mountain ranges, and oceans. They also contain more subjective and less precise information, such as impressions of places, rough estimates of relative size, shape, and location, and a general sense of certain connections between places, as well as priorities that reflect the mapmaker's own predilections.
- Mental maps are used in some form by all people throughout their lives. Such maps enable people to know what routes to take when traveling, comprehend what others say or write about various places, and develop an understanding of the world.
- Mental maps represent ever-changing summaries of spatial knowledge and serve as indicators of how well people know the spatial characteristics of places. People develop and refine their mental maps both through personal experience and through learning from teachers and the media. They refine at least some of their maps to ever higher levels of completeness and accuracy, and they continue to add information so that the maps reflect a growing understanding of a changing world. Critical geographic observation is essential to this development and refinement process, because mental maps reflect people's skill in observing and thinking about the world in spatial terms (and have nothing to do with their ability to draw).

As students read, hear, observe, and think more about the world around them, they can add more detail and structure to their maps. As students get older, their mental maps accumulate multiple layers of useful information and this growth in complexity and utility can provide them with a sense of satisfaction as more places and events in the world can be placed into meaningful spatial contexts.

If geography is to be useful in creating a framework for understanding the world—past, present, and future—then coherent mental maps must take shape and become increasingly refined as students progress through their school years. Students should be encouraged to develop and update their mental maps to ensure that they continue to have essential knowledge of place location, place characteristics, and other information that will assist them in personal decision-making and in establishing a broad-based perception of Earth from a local to a global perspective. In addition, they need to understand that developing mental maps is a basic skill for everyone who wants to engage in a lifetime of geographic understanding.

Standard 3

How To Analyze the Spatial Organization of People, Places, and Environments on the Earth's Surface

Thinking in spatial terms is essential to knowing and applying geography. It enables students to take an active, questioning approach to the world around them, and to ask what, where, when, and why questions about people, places, and environments. Thinking spatially enables students to formulate answers to critical questions about past, present, and future patterns of spatial organization, to anticipate the results of events in different locations, and to predict what might happen given specific conditions. Spatial concepts and generalizations are powerful tools for explaining the world at all scales, local to global. They are the building blocks on which geographic understanding develops.

Thinking in spatial terms means having the ability to describe and analyze the spatial organization of people, places, and environments on Earth's surface. It is an ability that is central to a person being geographically literate.

Geographers refer to both the features of Earth's surface and activities that take place on Earth's surface as phenomena. The phenomena may be physical (topography, streams and rivers, climates, vegetation types, soils), human (towns and cities, population, highways, trade flows, the spread of a disease, national parks), or physical and human taken together (beach resorts in relation to climate, topography, or major population centers). The location and arrangement of both physical and human phenomena form regular and recurring patterns.

The description of a pattern of spatial organization begins by breaking it into its simplest components: points, lines, areas, and volumes. These four elements describe the spatial properties of objects: a school can be thought of as a point connected by roads (which are lines) leading to nearby parks and neighborhoods (which are areas), whereas a lake in a park can be thought of as a volume. The next step in the descriptive process is to use such concepts as location, distance, direction, density, and arrangement (linear, grid-like, random) to capture the relationships between the elements of the pattern. Thus the U.S. interstate highway system can be described as lines connecting points over an area—the arrangement is partly grid-like (with north-south and east-west routes as in the central United States) and partly radial or star-shaped (as in the highways centered on Atlanta)—and the pattern of interstates is denser in the East than it is in the West.

The analysis of a pattern of spatial organization proceeds with the use of such concepts as movement and flow, diffusion, cost of distance, hierarchy, linkage, and accessibility to explain the reasons for patterns and the functioning of the world. In the case of a physical pattern, such as a river system, there is a complex hierarchical arrangement linking small streams with small drainage basins and large rivers with drainage basins that are the sum total of all of the smaller drainage basins. There are proportional spatial relationships between stream and river length, width, volume, speed, and drainage basin area. The gradual changes that can occur in these properties of a river system are related to climate, topography, and geology.

Central to geography is the belief that there is pattern, regularity, and reason to the locations of physical and human phenomena on Earth's surface and that there are spatial structure and spatial processes that give rise to them. Students must be encouraged to think about all aspects of the spatial organization of their world. Understanding the distribution and arrangement of the Earth's physical and human features depends on analyzing data gathered from observation and field study, working with maps and other geographic representations, and posing geographic questions and deriving geographic answers.

Spatial relationships, spatial structure, and spatial processes are simple to understand, despite their apparent unfamiliarity. For example, the spatial organization of human settlement on Earth's surface is generally a pattern of a few large cities, which are widely spaced and many smaller towns, which are closer together. A comparative analysis of those cities and towns shows that cities offer a wide range of goods and services whereas small towns offer fewer goods and services. Taken together, the description and the analysis explain why consumers shop where they do, why they often buy different products at different locations, and also why changes occur in this spatial pattern.

Understanding patterns of spatial organization enables the geographically informed person to answer three fundamental geographic questions: Why are these phenomena located in these places? How did they get there? Why is this pattern significant? Description and analysis of patterns of spatial organization must occur at scales ranging from local to global.

Students confront a world that is increasingly interdependent. Widely separated places are interconnected as a consequence of improved transportation and communication networks. Human decisions at one location have physical impacts at another location. (For example, the decision to burn coal rather than oil in a power plant may result in acid rain damaging vegetation hundreds of miles away.)

Understanding such spatial linkages requires that students become familiar with a range of spatial concepts and models that can be used to describe and analyze patterns of spatial organization. This knowledge can be grounded in the students' own immediate experiences, and yet it will give the students the power to understand the arrangement of physical and human geographic phenomena anywhere on Earth.

Standard 4

The Physical and Human Characteristics of Places

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. Our sense of self is intimately entwined with that of place. Who we are is often inseparable from where we are. Places are human creations and the geographically informed person must understand the genesis, evolution, and meaning of places.

Places are parts of Earth's space, large or small, that have been endowed with meaning by humans. They include continents, islands, countries, regions, states, cities, neighborhoods, villages, rural areas, and uninhabited areas. They usually have names and boundaries. Each place possesses a distinctive set of tangible and intangible characteristics that helps to distinguish it from other places. Places are characterized by their physical and human properties. Their physical characteristics include climate, landforms, soils, hydrology, vegetation, and animal life. Their human characteristics include language, religion, political systems, economic systems, population distribution, and quality of life.

Places change over time as both physical and human processes operate to modify Earth's surface. Few places remain unchanged for long and these changes have a wide range of consequences. As knowledge, ideologies, values, resources, and technologies change, people make place-altering decisions about how to use land, how to organize society, and ways in which to relate (such as economically or politically) to nearby and distant places. Out of these processes emerge new places, with existing places being reorganized and expanded, other places declining, and some places disappearing. Places change in size and complexity and in economic, political, and cultural importance as networks of relationships between places are altered through population expansion, the rise and fall of empires, changes in climate and other physical systems, and changes in transportation and communication technologies. A place can be dramatically altered by events both near and far.

Knowing how and why places change enables people to understand the need for knowledgeable and collaborative decision-making about where to locate schools, factories, and other things and how to make wise use of features of the physical environment such as soil, air, water, and vegetation. Knowing the physical and human characteristics of their own places influences how people think about who they are, because their identity is inextricably bound up with their place in life and the world. Personal identity, community identity, and national identity are rooted in place and attachment to place. Knowing about other places influences how people understand other peoples, cultures, and regions of the world. Knowledge of places at all scales, local to global, is incorporated into people's mental maps of the world.

Students need an understanding of why places are the way they are, because it can enrich their own sense of identity with a particular place and enable them to comprehend and appreciate both the similarities and differences of places around their own community, state, country, and planet.

Standard 5

That People Create Regions To Interpret Earth's Complexity

Region is a concept that is used to identify and organize areas of Earth's surface for various purposes. A region has certain characteristics that give it a measure of cohesiveness and distinctiveness and that set it apart from other regions. As worlds within worlds, regions can be used to simplify the whole by organizing Earth's surface on the basis of the presence or absence of selected physical and human characteristics. As a result, regions are human constructs whose boundaries and characteristics are derived from sets of specific criteria. They can vary in scale from local to global; overlap or be mutually exclusive; exhaustively partition the entire world or capture only selected portions of it. They can nest within one another, forming a multilevel mosaic. Understanding the idea of region and the process of regionalization is fundamental to being geographically informed.

Understanding the nature of regions requires a flexible approach to the world. The criteria used to define and delimit regions can be as spatially precise as coastlines and political boundaries, or as spatially amorphous as suggesting the general location of people with allegiances to a particular professional athletic team or identifying a market area for distributing the recordings of a specific genre of music. Regions can be as small as a neighborhood or as vast as a territorial expanse covering thousands of square miles in which the inhabitants speak the same language. They can be areas joining people in common causes or they can becomes areas for conflict, both internal and external. Geographers define regions in three basic ways:

The first type is the formal region. It is characterized by a common human property, such as the presence of people who share a particular language, religion, nationality, political identity or culture, or by a common physical property, such as the presence of a particular type of climate, landform, or vegetation. Political entities such as counties, states, countries, and provinces are formal regions (e.g., areas with a Mediterranean climate), landform regions (e.g., the Ridge and Valley and Piedmont regions of Pennsylvania), and economic regions (e.g., the wheat belt of Kansas, the citrus-growing areas of south Texas, and the irrigated farmlands of the Central Valley of California). Formal regions can be defined by measures of population, per capita income, ethnic background, crop production, population density and distribution, or industrial production, or by mapping physical characteristics such as temperature, rainfall, growing season, and average date of first and last frost.

The second type of region is the functional region. It is organized around a node or focal point, with the surrounding areas linked to that node by the transportation systems, communication systems, or other economic association involving such activities as manufacturing and retail trading. A typical functional region is a metropolitan area (MA) as defined by the Bureau of the Census. For example, the New York MA is a functional region that covers parts of several states. It is linked by commuting patterns, trade flows, television and radio broadcasts, newspapers, travel for recreation and entertainment. Other functional regions include shopping areas centered on malls or supermarkets, areas served by branch banks, and ports and their hinterlands.

The third type of region is the perceptual region. It is a construct that reflects human feelings and attitudes about areas and is therefore defined by people's shared subjective images of those areas. It tends to reflect the elements of people's mental maps, and, although it may help to impose a personal sense of order and structure on the world, it often does so on the basis of stereotypes that may be inappropriate or incorrect. Thus southern California, Dixie, and the upper Midwest are perceptual regions that are thought of as being spatial units, although they do not have precise borders or even commonly accepted regional characteristics and names.

Some regions, especially formal regions, tend to be stable in spatial definition, but may undergo change in character. Others, especially functional regions, may retain certain basic characteristics, but may undergo spatial redefinition over time. Yet other regions, particularly perceptual regions, are likely to vary over time in both spatial extent and character.

Regional change, in the context of the human spatial organization of Earth's surface, is an area of study that provides students with opportunities to examine and learn about the complex web of demographic and economic changes that occur.

Regions serve as a valuable organizing technique for framing detailed knowledge of the world and for asking geographic questions. Because regions are examples of geographic generalization, students can learn about the char-

acteristics of other regions of the world by knowing about one region. Knowing about the physical processes that create the Mediterranean climate and vegetation of southern California, for example, can serve as an analogue for learning about other regions with Mediterranean climates and vegetation in Australia, Europe, South America, and Africa. Regions provide a context for discussing similarities and differences between parts of the world.

Through understanding the idea of region, students can apply geographic knowledge, skills, and perspectives to solving problems as immediate as making an informed decision about a neighborhood zoning issue, or as long-range as predicting the reconfiguration of political and economic alliances owing to resource shortages or changes in the global ecosystem. Most importantly, studying regions enables students to synthesize their understanding of the physical and human properties of Earth's surface at scales that range from local to global.

Standard 6

How Culture and Experience Influence People's Perceptions of Places and Regions

People's perception of places and regions is not uniform. Rather, their view of a particular place or region is their interpretation of its location, extent, characteristics, and significance as influenced by their own culture and experience. It is sometimes said that there is no reality, only perception. In geography there is always a mixture of both the objective and the subjective realms, and that is why the geographically informed person needs to understand both realms and needs to see how they relate to each other.

Individuals have singular life histories and experiences, which are reflected in their having singular mental maps of the world that may change from day to day and from experience to experience. As a consequence, individuals endow places and regions with rich, diverse, and varying meanings. In explaining their beliefs and actions, individuals routinely refer to age, sex, class, language, ethnicity, race, and religion as part of their cultural identity, although some of their actions may be at least partly a result of sharing values with others. Those shared beliefs and values reflect the fact that individuals live in social and cultural groups or sets of groups. The values of these groups are usually complex and cover such subjects as ideology, religion, politics, social structure, and economic structure. They influence how the people in a particular group perceive both themselves and other groups.

The significance that an individual or group attaches to a specific 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. People's perception of Earth's surface is strongly linked to the concept of place utility—the significance that a place has to a particular function or people. For example, a wilderness area may be seen as a haven by a backpacker or as an economic threat by a farming family trying to hold back forest growth at the edges of its fields. The physical reality of the wilderness area is the same in both cases, but the perceptual frameworks that assign meaning to it are powerfully distinct. A place or region can be exciting and dynamic, or boring and dull depending on an individual's experience, expectations, frame of mind, or need to interact with that particular landscape. The range, therefore, of perceptual responses to a place or region is not only vast, but is also continually changing.

Some places and regions are imbued with great significance by certain groups of people, but not by others. For example, for Muslims the city of Mecca is the most holy of religious places, whereas for non-Muslims it has only historical significance. For foreign tourists Rio de Janeiro is a city of historical richness that evokes images of grandness, energy, and festiveness, but for many local street youths it is a harsh environment where they have to struggle for daily survival. Around the world the names of such places as Hiroshima, Auschwitz, Bhopal, and Chernobyl convey profoundly sad and horrific collective images, but for the people who live there, the reality of life tends to be how best to earn a living, raise a family, educate children, and enjoy one's leisure time. At another level, Disneyland or "my hometown" may evoke equally strong but positive and idiosyncratic images among local inhabitants. People's group perceptions of places and regions may change over time. For instance, as settlement and knowledge spread westward during the nineteenth century, parts of what are now Oklahoma, Kansas, and Nebraska went from being labeled as within the Great American Desert to being likened to the Garden of Eden. Then during the drought years of the 1930s, these same areas changed character yet again, becoming the heart of what was known as the Dust Bowl.

Culture and experience shape belief systems, which in turn influence people's perceptions of places and regions throughout their lives. So it is essential that students understand the factors that influence their own perception of places and regions, paying special attention to the effects that personal and group points of view can have on their understanding of other groups and cultures. Accordingly, it may be possible for students to avoid the dangers of egocentric and ethnocentric stereotyping, to appreciate the diverse values of others in a multicultural world, and to engage in accurate and sensitive analysis of people, places, and environments.

Standard 7

The Physical Processes That Shape the Patterns of Earth's Surface

Physical processes create, maintain, and modify Earth's physical features and environments. Because the physical environment is the essential background for all human activity on Earth, the geographically informed person must understand the processes that produce those features.

Physical processes can be grouped into four categories: those operating in the atmosphere (i.e., climate and meteorology), those operating in the lithosphere (e.g., plate tectonics, erosion, and soil formation), those operating in the hydrosphere (e.g., the circulation of the oceans and the hydrologic cycle), and those operating in the biosphere (e.g., plant and animal communities and ecosystems).

By understanding the interaction within and between these categories of physical processes, the geographically informed person can pose and answer certain fundamental questions: What does the surface of Earth look like? How have its features been formed? What is the nature of these features and how do they interact? How and why are they changing? What are the spatially distinct combinations of environmental features? How are these environmental features related to past, present, and prospective human uses of Earth? The answers to these questions lead to an understanding of how Earth serves as the home of all plants and animals, including humans.

Processes shape and maintain the physical environment. Therefore it is vital that students appreciate the complex relationships between processes and resultant features, and how these relationships give rise to patterns of spatial organization. For example, in a region such as southern California, the physical landscape is constantly reshaped by a complex set of interacting physical processes: earthquakes, coastal erosion, land subsidence owing to subsurface oil and water extraction, flash floods and landslides caused by heavy rainfall in the spring, and drought and the loss of chaparral vegetation from fire in the dry summer weeks. In turn, these processes show chains of interaction: the chaparral vegetation is the biosphere's response to the climate and soil. Given the expected variations in rainfall in this Mediterranean climate regime, the chaparral becomes dormant and is prone to fire; however, clearance of the chaparral vegetation, especially in the canyons of steep hills, exposes the surface to flash flooding and soil erosion.

Five basic ideas help to explain the interactions and effects of physical processes. These are known as system, boundary, force, state of equilibrium, and threshold. A system is a collection of elements that are mutually connected and therefore influence one another to form a unified whole (e.g., the hydrologic cycle). Each system has boundaries, either real or arbitrary, within which it operates. Some forces, such as gravity and weather, activate and drive processes; other forces, such as friction, resist change and act to maintain the status quo. Systems exist in different states. When a system is in equilibrium, driving forces such as gravity and resisting forces such as friction are in balance. However, when a threshold—the point at which change may occur—is reached adjustment takes place. For example, an avalanche occurs when gravity, acting on deep layers of snow, overcomes the friction that was holding the snow mass in place (i.e., a state of equilibrium gives way when a threshold is reached). After the avalanche a new state of equilibrium is established.

It is essential that students understand the physical processes that act upon Earth and that such processes affect the choices made by people in different regions of the United States. Knowledge of these processes is required for dealing with such commonplace issues as evaluating locations of relative safety in an earthquake-prone region; purchasing a home in a floodplain; coping with the threat of sinkholes and subsidence in a landscape underlain by limestone deposits; building a house in an area that has shrink-swell clay soils.

It is also essential that students learn to make intelligent predictions about future events and evaluate the short- and long-term effects of physical events on places and regions. Evaluating reports of world climate change requires knowing the factors that affect climate and weather in general and how the natural environment functions in particular regions. Climate and weather affect more than just personal decision-making on a daily basis. They are major factors in understanding world economic conditions over longer periods. Many important natural resources are formed by physical processes that occur in relatively few places on Earth. Understanding physical processes and the patterns of resources they produce is vital to understanding not only the physical geography of Earth's surface but also the strategic relationships between nations and world trade patterns.

Understanding physical processes enables the geographically informed person to link the personal with the societal, the short term with the long term, and the local with the global dimensions of Earth.

Standard 8

The Characteristics and Spatial Distribution of Ecosystems on Earth's Surface

Ecosystems are a key element in the viability of planet Earth as human home. Populations of different plants and animals that live and interact together are called a community. When such a community interacts with the other three components of the physical environment—atmosphere, hydrosphere, and lithosphere—the result is an ecosystem. The cycles of flows and interconnections—physical, chemical, and biological—between the parts of ecosystems form the mosaic of Earth's environments. The geographically informed person needs to understand the spatial distribution, origins, functioning, and maintenance of different ecosystems and to comprehend how humans have intentionally or inadvertently modified these ecosystems.

Ecosystems form distinct regions on Earth's surface, which vary in size, shape, and complexity. They exist at a variety of scales, from small and very localized areas (e.g., a single stand of oak trees or a clump of xerophytic grasses) to larger areas with precise geographic boundaries (e.g., a pond, desert biome, island, or beach). Larger scale ecosystems can form continent-wide belts, such as the tundra, taiga, and steppe of northern Asia. The largest ecosystem is the planet itself.

All elements of the environment, physical and human, are part of several different but nested ecosystems. Ecosystems, powered by solar energy, are dynamic and ever-changing. Changes in one ecosystem ripple through others with varying degrees of impact. As self-regulating open systems that maintain flows of energy and matter, they naturally move toward maturity, stability, and balance in the absence of major disturbances. In ecological terms, the physical environment can be seen as an interdependent web of production and consumption cycles. The atmosphere keeps plants and animals alive through solar energy, chemical exchanges (e.g., nitrogen-fixing and photosynthesis), and the provision of water. Through evapotranspiration the atmosphere and plants help to purify water. Plants provide the energy to keep animals alive either directly through consumption or indirectly through their death and decay into the soil, where the resultant chemicals are taken up by new plants. Soils keep plants and animals alive and work to cleanse water. The root systems of plants and the mechanical and chemical effects of water percolating through bedrock create new soil layers.

Ecosystems therefore help to recycle chemicals needed by living things to survive, redistribute waste products, control many of the pests that cause disease in both humans and plants, and offer a huge pool of resources for humans and other living creatures.

However, the stability and balance of ecosystems can be altered by large-scale natural events such as El Niño, volcanic eruptions, fire, or drought. But ecosystems are more drastically transformed by human activities. The web of ecological interdependency is fragile. Human intervention can shatter the balance of energy production and consumption. For example, the overgrazing of pasturelands, coupled with a period of drought, can lead to vegetation loss, the exposure of topsoil layers, and massive soil erosion (as occurred in the 1930s Dust Bowl); tropical forest clear-cutting can lead to soil erosion and ecological breakdown, as is currently occurring in Amazonia; the construction of oil pipelines in tundra environments can threaten the movements of the caribou herds on which indigenous Inuit populations depend.

By knowing how ecosystems operate and change, students are able to understand the basic principles that should guide programs for environmental management. Students can understand the ways in which they are dependent on the living and nonliving systems of Earth for their survival. Knowing about ecosystems will enable them to learn how to make reasoned decisions, anticipate the consequences of their choices, and assume responsibility for the outcomes of their choices about the use of the physical environment. It is important that students become well-informed regarding ecosystem issues so they can evaluate conflicting points of view on the use of natural resources. The degree to which present and future generations understand their critical role in the natural functioning of ecosystems will determine in large measure the quality of human life on Earth.

Standard 9

The Characteristics, Distribution, and Migration of Human Populations on Earth's Surface

Human population has increased dramatically over the last few centuries. In 1830, more than 900 million people inhabited Earth. As the twenty-first century approached, Earth's population was nearly six billion. At the same time, extraordinarily large and dense clusters of people are growing: Tokyo has already reached a population in excess of 25 million. The geographically informed person must understand that the growth, distribution, and movements of people on Earth's surface are the driving forces behind not only human events—social, cultural, political, and economic—but also certain physical events—large-scale flooding, resource depletion, and ecological breakdown.

Students need to develop an understanding of the interaction of the human and environmental factors that help to explain the characteristics of human populations, as well as their distribution and movements. The distribution and density of Earth's population reflect the planet's topography, soils, vegetation, and climate types (ecosystems); available resources; and level of economic development. Population growth rates are influenced by such factors as education (especially of women), religion, telecommunications, urbanization, and employment opportunities. Mortality rates are influenced by the availability of medical services, food, shelter, health services, and the overall age and sex distribution of the population.

Another key population characteristic is growth, which may be described in terms of fertility and mortality, crude birth- and death rates, natural increase and doubling time, and population structure (age and sex distribution). These basic demographic concepts help bring focus to the human factors that explain population distributions and densities, growth patterns, and population projections. Population pyramids, for example, indicate the differential effects of past events, such as wars, disease, famine, improved sanitation, and vaccination programs, on birth- and death rates and gender. An analysis of specific age cohorts enables predictions to be made. For example, a large proportion zero to 15 years old suggests rapid population, which will soon require significant resources to support the elderly. Both predictions could have significant geographic implications for a community; for example, a young population could create a need for more housing and schools, whereas an older population could create a need for more retirement and medical facilities. Such demographic analyses can be performed at all scales.

Almost every country is experiencing increased urbanization. Across Earth peasant and pastoral life is giving way to the more economically promising lure of life in cities, as people seeking better jobs or more income move to areas where opportunities are better. The majority of the world's people are moving toward a way of life that only a minority of people experienced less than a century ago. Population geographers predict that Tokyo, Sao Paulo, Bombay, Shanghai, Lagos, and Mexico City will be the twenty-first century's massive population centers. However, people in some developed countries are giving up the economic advantages of city life for the ease and attractions of suburbs and small towns, especially those with access to employment in metropolitan areas.

Migration is one of the most distinctive and visible characteristics of human populations, and it leads to significant reshaping of population distribution and character. It is a dynamic process that is constantly changing Earth's landscapes and modifying its cultures. It takes place at a variety of scales and in different contexts. At international scales geographers track the flows of immigrants and emigrants. At national scales they consider net regional balances of in- and out-migrants or the flows from rural to urban areas, which are a principal cause of urbanization.

At a local scale they consider the continuous mobility of college students, retirees, and tourists or the changes of address that occur without necessarily resulting in a job change or change in friendship patterns.

The context of migration varies from voluntary and discretionary (the search for a better place to live), to voluntary but unavoidable (the search for a place to live), to involuntary and unavoidable (the denial of the right to choose a place to live).

In the two voluntary contexts, migration often results from the weighing of factors at the point of origin and at potential destinations against the costs (financial and emotional) of moving. "Pull" factors may make another place seem more attractive and therefore influence the decision to move. Other factors are unpleasant enough to "push" the migrant out of the local setting and toward another area. These factors reflect people's objective knowledge of places and also their secondhand impressions. As a consequence, many countries have experienced waves of people going from settled areas to new lands in the interior (e.g., the westward movement in the United States in the nineteenth century and the move from the southeast coast to the interior of Brazil starting in the 1960s, when the new capital city of Brasilia was built).

Voluntary and unavoidable migration occurs when much of a region's or country's population is impelled into migration streams, such as the millions of Irish who fled to the United States in the 1840s because of the potato famine or the millions of Somalis, Sudanese, and Rwandans who moved in the 1990s because of drought, famine, and civil war. However, some migrations are forced and involuntary. Such was the case with African Americans who were taken to North and South America in the seventeenth, eighteenth, and nineteenth centuries to work as slave laborers on sugar, cotton, and tobacco plantations.

Demographic shifts rearrange patterns of population and create new human landscapes. Natural increase, war, famine, and disease play decisive roles in influencing why many people live where they do. Migration sets people in motion as they leave one place, strike out for a second, and possibly settle in a third. Intervening obstacles influence the patterns of migration. Physical barriers such as deserts, mountains, rivers, and seas or cultural barriers such as political boundaries, languages, economic conditions, and cultural traditions determine how people move and where they settle.

It is essential that students develop an understanding of the dynamics of population characteristics, distributions, and migration, and in particular of how population distribution (in terms of size and characteristics) is linked to the components of fertility, mortality, and mobility.

Standard 10

The Characteristics, Distribution, and Complexity of Earth's Cultural Mosaics

Culture is a complex, multifaceted concept. It is a term used to cover the social structure, languages, belief systems, institutions, technology, art, foods, and traditions of particular groups of humans. The term is used to define each group's way of life and its own view of itself and of other groups, as well as to define the material goods it creates and uses, the skills it has developed, and the behaviors it transmits to each successive generation.

The human world is composed of culture groups, each of which has its distinctive way of life as reflected in the group's land-use practices, economic activities, organization and layout of settlements, attitudes toward the role of women in society, education system, and observance of traditional customs and holidays. These ways of life result in landscapes and regions with a distinctive appearance. Landscapes often overlap, thus forming elaborate mosaics of peoples and places.

These cultural mosaics can be approached from a variety of spatial scales. At one scale, for example, Western Europe's inhabitants can be seen as a single culture group; at another scale they consist of distinctive national culture groups (e.g., the French and the Spanish); and at yet another scale each national culture group can be subdivided into smaller, regionally clustered culture groups (e.g., the Flemings and Walloons in Belgium).

As Earth evolves into an increasingly interdependent world in which different culture groups come into contact more than ever before, it becomes more important that people have an understanding of the nature, complexity, and spatial distribution of cultural mosaics.

Given the complexity of culture, it is often useful—especially when studying the subject from a geographic point of view—to focus on the languages, beliefs, institutions, and technologies that are characteristic of a culture. The geographically informed person, therefore, is an individual who has a thorough grasp of the nature and distribution of culture groups.

Language both represents and reflects many aspects of a culture. It stands as an important symbol of culture. It is seen as a sign of the unity of a particular culture group. It can be analyzed—in terms of vocabulary and structure—for clues about the values and beliefs of a culture group. Language is also a visible marker that provides a way of tracing the history of a culture. The complex and often tense relations between French-speaking and English-speaking people in Quebec illustrate and reflect the importance of language to culture groups and also the value of studying the geography of language.

Beliefs include religion, customs, values, attitudes, ideals, and world views. A person's point of view on issues is influenced by cultural beliefs, which in turn influence decisions about resources, land use, settlement patterns, and a host of other geographically important concerns. The complicated and often difficult relations of Hindus and Muslims in India demonstrate how the spatial organization of a country can be shaped by the geography of the region.

Institutions shape the ways in which people organize the world around them; for example, sets of laws, educational systems, political arrangements, and the structure of the family shape a culture region. The Mormon culture region of the western United States shows how institutions are embodied in a distinctive place, demarcating it and influencing practically every aspect of daily life.

Technology includes the tools and skills a group of people use to satisfy their needs and wants. Levels of technology range from the simple tools used by hunters and gatherers to the most complex machines and information systems used in modern industrial societies. Technologies can be usefully understood as either hardware—the tools themselves—or software—the skilled ways in which a society uses tools. The Amish of south-central Pennsylvania have created a distinctive landscape that is simultaneously an expression of technology, institutions, beliefs, and language.

Whatever characteristic of culture is considered, it is clear that the mosaics of Earth's cultural landscapes are not static. Culture changes as a result of a variety of human processes, migration, and the spread (diffusion) of new cultural traits—language, music, and technology—to existing culture groups. The processes of cultural change accelerate with improvements in transportation and communication. Each culture in the world has borrowed attributes from other cultures whether knowingly or not, willingly or not.

Students should be exposed to a rich appreciation of the nature of culture so they can understand the ways in which people choose to live in different regions of the world. Such an understanding will enable them to appreciate the role culture plays in the spatial organization of modern society. Rivalry and tension between cultures contribute much to world conflict. As members of a multicultural society in a multicultural world, students must understand the diverse spatial expressions of culture.

Standard 11

The Patterns and Networks of Economic Interdependence on Earth's Surface

Resources are unevenly scattered across the surface of Earth, and no country has all of the resources it needs to survive and grow. Thus each country must trade with others, and Earth is a world of increasing global economic interdependence. Accordingly, the geographically informed person understands the spatial organization of economic, transportation, and communication systems, which produce and exchange the great variety of commodities—raw materials, manufactured goods, capital, and services—which constitute the global economy.

The spatial dimensions of economic activity and global interdependence are visible everywhere. Trucks haul frozen vegetables to markets hundreds of miles from growing areas and processing plants. Airplanes move large numbers of business passengers or vacationers. Highways, especially in developed countries, carry the cars of many commuters, tourists, and other travelers. The labels on products sold in American supermarkets typically identify the products as coming from other U.S. states and from other countries.

The spatial dimensions of economic activity are more and more complex. For example, petroleum is shipped from Southwest Asia, Africa, and Latin America to major energy-importing regions such as the United States, Japan, and Western Europe. Raw materials and food from tropical areas are exchanged for the processed or fabricated products of the mid-latitude developed countries. Components for vehicles and electronics equipment are made in Japan and the United States, shipped to South Korea and Mexico for partial assembly, returned to Japan and the United States for final assembly intro finished products, then shipped all over the world.

Economic activities depend upon capital, resources, power supplies, labor, information, and land. The spatial patterns of industrial labor systems have changed over time. In much of Western Europe, for example, small-scale and spatially dispersed cottage industry was displaced by large-scale and concentrated factory industry after 1760. This change caused rural emigration, the growth of cities, and changes in gender and age roles. The factory has now been replaced by the office as the principal workplace in developed countries. In turn, telecommunications are diminishing the need for a person's physical presence in an office. Economic, social, and therefore spatial relationships change continuously.

The world economy has core areas where the availability of advanced technology and investment capital are central to economic development. In addition, it has semi-peripheries where lesser amounts of value are added to industry or agriculture, and peripheries where resource extraction or basic export agriculture are dominant. Local and world economies intermesh to create networks, movement patterns, transportation routes, market areas, and hinterlands.

In the developed countries of the world's core areas, business leaders are concerned with such issues as accessibility, connectivity, location, networks, functional regions, and spatial efficiency—factors that play an essential role in economic development and also reflect the spatial and economic interdependence of places on Earth.

In developing countries, such as Bangladesh and Guatemala, economic activities tend to be at a more basic level, with a substantial proportion of the population being engaged in the production of food and raw materials. Nonetheless, systems of interdependence have developed at the local, regional, and national levels. Subsistence farming often exists side by side with commercial agriculture. In China, for example, a government-regulated farming system provides for structured production and tight economic links of the rural population to nearby cities. In Latin America and Africa, rural people are leaving the land and migrating to large cities, in part to search for jobs and economic prosperity and in part as a response to overpopulation in marginal agricultural regions. Another important trend is industrialized countries continuing to export their labor-intensive processing and fabrication to developing countries. The recipient countries also profit from the arrangement financially but at a social price. The arrangement can put great strains on centuries-old societal structures in the recipient countries.

As world population grows, as energy costs increase, as time becomes more valuable, and as resources become depleted or discovered, societies need economic systems that are more efficient and responsive. It is particularly important, therefore, for students to understand world patterns and networks of economic interdependence and to realize that traditional patterns of trade, human migration, and cultural and political alliances are being altered as a consequence of global interdependence.

Standard 12

The Processes, Patterns, and Functions of Human Settlement

People seldom live in isolation. Most reside in settlements, which vary greatly in size, composition, location, arrangement, and function. These organized groupings of human habitation are the focus of most aspects of human life: economic activities, transportation systems, communications media, political and administrative systems, culture and entertainment. Therefore, to be geographically competent—to appreciate the significance of geography's central theme that Earth is the home of people—a person must understand settlement processes and functions and the patterns of settlements across Earth's surface.

Settlements exercise a powerful influence in shaping the world's different cultural, political, and economic systems. They reflect the values of cultural groups and the kinds of political structure and economic activity engaged in by a society. Accordingly, the patterns of settlement across Earth's surface differ markedly from region to region

and place to place. Of great importance to human existence, therefore, are the spatial relationships between settlements of different sizes: their spacing, their arrangement, their functional differences, and their economic specialties. These spatial relationships are shaped by trade and the movements of raw materials, finished products, people, and ideas.

Cities, the largest and densest human settlements, are the nodes of human society. Almost half of the world's people now live in cities, and the proportion is even higher in the developed regions of the world. In the United States, more than three-quarters of the people live in urban areas. More than two-thirds of the people of Europe, Russia, Japan, and Australia live in such areas.

Cities throughout the world are growing rapidly, but none so rapidly as those in developing regions. For example, the ten largest cities in the world in the year 2000 will include such Latin American cities as Sao Paulo and Mexico City. In some regions of the world there are concentrations of interconnected cities and urban areas, which are known as megalopoli. In Japan, the three adjacent and continuous cities of Tokyo-Kawasaki-Yokohama make up such a megalopolis. In Germany there is another, consisting of the Rhine River Valley and the cities of Essen, Düsseldorf, Dortmund, and Wuppertal. The corridor from Boston to Washington, D.C., is also a megalopolis (sometimes called Megalopolis because it was the first one to be designated).

Cities are not the same all over the world. North American cities, for example, differ from European cities in shape and size, density of population, transportation networks, and the patterns in which people live and work within the city. The same contrast is true of cities in Africa, Latin America, and Asia. For example, in North American cities wealthy people tend to live in the outskirts or suburban areas, whereas lower-income residents tend to live in inner-city areas. In Latin America the spatial pattern is reversed: wealthy people live close to the city centers and poor people live in slums or barrios found at the edges of urban areas.

In North America, Europe, and Japan urban areas are linked to one another by well-integrated, efficient, and reliable transportation and communications systems. In these regions, even the smallest villages are linked in a web of trade, transportation, and communication networks. In contrast, in developing regions such as Latin America and Southeast Asia, a single primate city often dominates the life of the country. A primate city such as Buenos Aires or Manila is preeminent in its influence on the culture, politics, and economic activities of its country. Nevertheless, in terms of transportation and communications links it may be better connected to the outside world than it is to other regions of the country it serves.

Settlements and the patterns they etch on Earth's surface provide not only data on current economic and social aspects of human existence but also a historical record. Today's settlement patterns, evident on a map, provide information about past settlement patterns and processes, and the boundaries of counties and other political entities indicate how people organized the land as they settled it. In all such cases, the surviving evidence of past settlements can and should be amplified by the students' use of research materials to develop a fuller understanding of how settlements relate to their physical setting over time. It is valuable, for example, to know about life in a German medieval town and the town's relationship to the surrounding countryside; life in a typical North Dakota settlement along a railroad line in the 1890s; and life in the walled city of Xian and the city's importance in north China in the second century B.C.

Students must develop an understanding of the fundamental processes, patterns, and functions of human settlement across Earth's surface, and thereby come to appreciate the spatially ordered ways in which Earth has become the home of people. They need to acquire a working knowledge of such topics as: the nature and functions of cities, the processes that cause cities to grow and decline, how cities are related to their market areas or hinterlands; the patterns of land use and value, population density, housing type, ethnicity, socioeconomic status, and age distribution in urban areas; the patterns of change, growth, and decline within urban areas; the process of suburbanization; and how new types of urban nodes develop. Geographers ask these questions to make sense of the distribution and concentration of human populations.

Standard 13

How the Forces of Cooperation and Conflict Among People Influence the Division and Control of Earth's Surface

Competing for control of large and small areas of Earth's surface is a universal trait among societies and has resulted in both productive cooperation and destructive conflict between groups over time. The geographically informed person has a general understanding of the nature and history of the forces of cooperation and conflict on Earth and the spatial manifestation of these forces in political and other kinds of divisions of Earth's surface. This understanding enables the individual to perceive how and why different groups have divided, organized, and unified areas of Earth's surface.

Divisions are regions of Earth's surface over which groups of people establish control for purposes of politics, administration, religion, and economics. Each such region usually has an area, a name, and a boundary. In the past even small groups inhabiting vast territories divided space in accordance with their cultural values and life-sustaining activities. For them some spaces were sacred, others were devoted to hunting or gathering, and still others were intended for shelter and socializing. In present-day urban, industrial societies, earning a livelihood, owning or renting a home in a safe neighborhood, getting a drink of clean water, buying food, being able to travel safely within one's own community—all of these activities are linked to how Earth is divided by different groups for different purposes.

Often, conflicts over how to divide and organize parts of Earth's space have involved control of resources (e.g., Antarctica or the ocean floor), control of strategic routes (e.g., the Panama or Suez Canals or the Dardanelles), or the domination of other peoples (e.g., European colonialism in Africa). Language, religion, political ideologies, national origins, and race motivate conflicts over how territory and resources will be developed, used, and distributed. Conflicts over trade, human migration and settlement, and exploitation of marine and land environments reflect how Earth's surface is divided into fragments controlled by different political and economic interest groups.

The primary political division of Earth is by state sovereignty—a particular government is recognized by others as having supreme authority over a carefully delimited territory and the population and resources within that space. With the exception of Antarctica, Earth's surface is exhaustively partitioned by state sovereignty. These political divisions are recognized by the United Nations and its member states, which discuss and act on issues of mutual interest, especially international peace and security. However, the partitioning is not mutually exclusive. Some nations exert competing claims to certain areas (e.g., the islands in the South Atlantic Ocean, which are claimed by Great Britain as the Falkland Islands and by Argentina as the Malvinas).

Regional alliances among nations for military, political, cultural, or economic reasons constitute another form of the division of Earth's surface. Among these many alliances are the North Atlantic Treaty Organization, the Caribbean Community and Common Market, the Council of Arab Economic Unity, and the European Union. In addition, numerous multinational corporations divide Earth's space and compete with each other for resource development, manufacturing, and the distribution of goods and services. And non-governmental organizations such as the International Red Cross and various worldwide religious groups divide space to administer their programs.

Events of the twentieth century illustrate that the division of Earth's surface among different groups pursuing diverse goals continues unabated at all scales of human activity. World wars, regional wars, civil wars, and urban riots often are manifestations of the intensity of feeling humans hold for the right to divide Earth according to their particular perceptions and values. Traditionally, most territorial disputes have been over the land surface, but with the increasing value of resources in the oceans and even outer space, political division of these spaces has become a topic of international debate. Cooperation and conflict will occur in all of these spatial contexts.

At smaller spatial scales, land-use zones in municipalities, administrative districts for airports and other essential services such as water supply and garbage disposal, and school districting within counties, states, and provinces are all examples of the local division of space. Franchise areas, regional divisions of national and multinational corporations, and free-trade zones indicate the economic division of space. City neighborhood associations,

suburban homeowners' associations, civic and volunteer organization districts, and the divisions of neighborhood space by youth gangs on the basis of socioeconomic status, race, or national origin illustrate the power of social and cultural divisions of space.

The interlocking systems for dividing and controlling Earth's space influence all dimensions of people's lives, including trade, culture, citizenship and voting, travel, and self-identity. Students must understand the genesis, structure, power, and pervasiveness of these divisions to appreciate their role within a world that is both globally interdependent and locally controlled.

Standard 14

How Human Actions Modify the Physical Environment

Many of the important issues facing modern society are the consequences—intended and unintended, positive and negative—of human modifications of the physical environment. So it is that the daily news media chronicle such things as the building of dams and aqueducts to bring water to semiarid areas, the loss of wildlife habitat, the reforestation of denuded hills, the depletion of the ozone layer, the ecological effects of acid rain, the reduction of air pollution in certain urban areas, and the intensification of agricultural production through irrigation.

Environmental modifications have economic, social, and political implications for most of the world's people. Therefore, the geographically informed person must understand the reasons for and consequences of human modifications of the environment in different parts of the world.

Human adaptation to and modification of physical systems are influenced by the geographic context in which people live, their understanding of that context, and their technological ability and inclination to modify it to suit their changing need for things such as food, clothing, water, shelter, energy, and recreational facilities. In meeting their needs, they bring knowledge and technology to bear on physical systems.

Consequently, humans have altered the balance of nature in ways that have brought economic prosperity to some areas and created environmental dilemmas and crises in others. Clearing land for settlement, mining, and agriculture provides homes and livelihoods for some but alters physical systems and transforms human populations, wildlife, and vegetation. The inevitable by-products—garbage, air and water pollution, hazardous waste, the overburden from strip mining—place enormous demands on the capacity of physical systems to absorb and accommodate them.

The intended and unintended impacts on physical systems vary in scope and scale. They can be local and small-scale (e.g., the terracing of hillsides for rice growing in the Philippines and acid stream pollution from strip mining in eastern Pennsylvania), regional and medium scale (e.g., the creation of agricultural polderlands in the Netherlands and of an urban heat island with its microclimatic effects in Chicago), or global and large-scale (e.g., the clearing of the forests of North America for agriculture or the depletion of the ozone layer by chlorofluorocarbons).

Students must understand both the potential of a physical environment to meet human needs and the limitations of that same environment. They must be aware of and understand the causes and implications of different kinds of pollution, resource depletion, and land degradation and the effects of agriculture and manufacturing on the environment. They must know the locations of regions vulnerable to desertification, deforestation, and salinization, and be aware of the spatial impacts of technological hazards such as photochemical smog and acid rain. Students must be aware that current distribution patterns for many plant and animal species are a result of relocation diffusion by humans.

In addition, students must learn to pay careful attention to the relationships between population growth, urbanization, and the resultant stress on physical systems. The process of urbanization affects wildlife habitats, natural vegetation, and drainage patterns. Cities create their own microclimates and produce large amounts of solid waste, photochemical smog, and sewage. A growing world population stimulates increases in agriculture, urbanization, and industrialization. These processes expand demands on water resources, resulting in unintended environmental consequences that can alter water quality and quantity.

Understanding global interdependence begins with an understanding of global dependence—the modification of Earth's surface to meet human needs. When successful the relationship between people and the physical environment is adaptive; when the modifications are excessive the relationship is maladaptive. Increasingly, students will be required to make decisions about relationships between human needs and the physical environment. They will need to be able to understand the opportunities and limitations presented by the geographical context and to set those contexts within the local to global continuum.

Standard 15

How Physical Systems Affect Human Systems

No matter what the spatial scale, Earth's surface presents a picture of physical diversity in terms of soils, climates, vegetation, and topography. That diversity offers a range of environmental contexts for people. The geographically informed person must understand how humans are able to live in various kinds of physical environments—not only those of the familiar mid-latitudes but also those that seem less conducive to intensive settlement such as the Arctic tundra and the Equatorial rain forest—and the role physical features of those environments play in shaping human activities.

To live in any given physical environment humans must develop patterns of spatial organization, which take advantage of opportunities offered and avoid or minimize the effects of limitations. Physical systems and environmental characteristics do not, by themselves, determine the pattern of human activity. If the incentives are great enough settlement is possible, although at great cost and risk. The trans-Alaska oil pipeline and construction techniques used in tundra-area settlements are evidence of the extent of human ingenuity. However, the environment does place limitations on human societies (e.g., a glaciated region with its complex of features—thin, rocky water-logged soils and unique landforms—offers few opportunities for commercial agriculture).

A central concept is the idea of carrying capacity—the maximum, sustained level of use of an environment that is possible without incurring significant environmental destruction. Environments vary in their carrying capacity, and people's failure to understand it—or their inability to live within it—can lead to environmental disaster. Cyclical environmental change, especially in semiarid environments, can pose particular problems for human use of that environment and can lead to desertification, famine, and mass migration, as has occurred in the Sahel of north-central Africa. The relationship between any environment and its inhabitants is mediated by decisions about how much to consume and in what ways to consume. Energy conservation, water conservation, and recycling can have significant effects on patterns of environmental use.

In modern times human have used technology as a means of reducing the potential effect of physical systems on human activity. In the United States, for example, the wide-spread introduction of air-conditioning has allowed people to relocate to the South and Southwest, regions previously considered less suited to settlement. And in various regions of Earth, use of the airplane has made it possible to establish settlements and industries in hitherto inaccessible places. However, the use of technology to overcome physical impediments to human activity can also have wide-ranging and sometimes unexpected consequences. For instance, the attempt to control rivers by building dams and dredging waterways to prevent destructive and life-threatening floods can also lead to diminished soil replenishment, increased water salinity, reduced flow of sediment to oceans, and increased riverbank erosion.

In addition to carrying-capacity limitations, the physical environment often imposes significant costs on human society. Natural hazards are defined as processes or events in the physical environment that are not caused by humans but whose consequences can be harmful. They cost the United States billions of dollars each year. Hurricanes, earthquakes, tornadoes, volcanoes, storms, floods, forest fires, and insect infestations are events that are not preventable and whose precise location, timing, and magnitude are not predictable. Their negative consequences can be reduced by understanding the potential vulnerability of different groups of people and by implementing a variety of strategies such as improved building design, land-use regulation, warning systems, and public education.

Whether the issue is the mitigation of a natural hazard or recognition of carrying capacity, students need to understand the characteristics and spatial properties of the physical environment. It is essential that they be able to translate an understanding of the physical processes and patterns that shape Earth's surface into a picture of that surface as a potential home for people. That home can hold only so many people or be used only in certain ways without incurring costs. Judgment as to the acceptability of those costs requires an understanding of environmental opportunities and constraints.

Standard 16

The Changes That Occur in the Meaning, Use, Distribution, and Importance of Resources

A resource is any physical material that constitutes part of Earth and which people need and value. There are three basic resources—land, water, and air—that are essential to human survival. However, any other natural material also becomes a resource if and when it becomes available to humans. The geographically informed person must develop an understanding of this concept and of the changes in the spatial distribution, quantity, and quality of resources on Earth's surface.

Those changes occur because a resource is a cultural concept, with the value attached to any given resource varying from culture to culture and period to period. Value can be expressed in economic or monetary terms, in legal terms (as in the Clean Air Act), in terms of risk assessment, or in terms of ethics (the responsibility to preserve our National Parks for future generations). The value of a resource depends on human needs and the technology available for its extraction and use. Rock oil seeping from rocks in northwestern Pennsylvania was of only minor value as a medicine until a technology was developed in the mid-nineteenth century that enabled it to be refined into a lamp illuminant. Some resources that were once valuable are no longer important. For example, it was the availability of pine tar and tall timber—strategic materials valued by the English navy—that in the seventeenth century helped spur settlement in northern New England, but that region now uses its vegetative cover (and natural beauty) as a different type of resource—for recreation and tourism. Resources, therefore, are the result of people seeing a need and perceiving an opportunity to meet that need.

The quantity and quality of a resource is determined by whether it is a renewable, nonrenewable, or a flow resource. Renewable resources, such as plants and animals, can replenish themselves after they have been used if their physical environment has not been destroyed. If trees are harvested carefully, a new forest will grow to replace the one that was cut. If animals eat grass in a pasture to a certain level, grass will grow again and provide food for animals in the future, as long as the carrying capacity of the land if not exceeded by the pressure of too many animals. Nonrenewable resources, such as minerals and fossil fuels (coal, oil, and natural gas), can be extracted and used only once. Flow resources, such as water, wind, and sunlight, are neither renewable nor nonrenewable because they must be used as, when, and where they occur. The energy in a river can be used to generate electricity, which can be transmitted over great distances. However, that energy must be captured by turbines as the water flows past or it will be lost.

The location of resources influences the distribution of people and their activities on the Earth. People live where they can earn a living. Human migration and settlement are linked to the availability of resources, ranging from fertile soils and supplies of freshwater to deposits of metals or pools of natural gas. The patterns of population distribution that result from the relationship between resources and employment change as needs and technologies change. In Colorado, for example, abandoned mining towns reflect the exhaustion of nonrenewable resources (silver and lead deposits), whereas ski resorts reflect the exploitation of renewable resources (snow and scenery).

Technology changes the ways in which humans appraise resources, and it may modify economic systems and population distributions. Changes in technology bring into play new ranges of resources from Earth's stock. Since the industrial revolution, for example, technology has shifted from waterpower to coal-generated steam to petroleum-powered engines, and different resources and their source locations have become important. The population of the Ruhr Valley in Germany, for example, grew rapidly in response to the new importance of coal and minerals in industrial ventures. Similarly, each innovation in the manufacture of steel brought a new resource to prominence in the United States, and resulted in locational shifts in steel production and population growth.

Demands for resources vary spatially. More resources are used by economically developed countries than by developing countries. For example, the United States uses petroleum at a rate that is five times the world average. As countries develop economically, their demand for resources increases faster than their population grows. The wealth that accompanies economic development enables people to consume more. The consumption of a resource does not necessarily occur where the resource is produced or where the largest reserves of the resource are located. Most of the petroleum produced in Southwest Asia, for example, is consumed in the United States, Europe, and Japan.

Sometimes, users of resources feel insecure when they have to depend on other places to supply them with materials that are so important to their economy and standard of living. This feeling of insecurity can become especially strong if two interdependent countries do not have good political relations, share the same values, or understand each other. In some situations, conflict over resources breaks out into warfare. One factor in Japan's involvement in World War II, for example, was that Japan lacked petroleum resources of its own and coveted oil fields elsewhere in Asia, especially after the United States threatened to cut off its petroleum exports to Japan.

Conflicts over resources are likely to increase as demand increases. Globally, the increase in demand tends to keep pace with the increase in population. More people on Earth means more need for fertilizers, building materials, food, energy, and everything else produced from resources. Accordingly, if the people of the world are to coexist, Earth's resources must be managed to guarantee adequate supplies for everyone. That means reserves of renewable resources need to be sustained at a productive level, new reserves of nonrenewable resources need to be found and exploited, new applications for flow resources need to be developed, and, wherever possible, cost-effective substitutes—especially for nonrenewable resources—need to be developed.

It is essential that students have a solid grasp of the different kinds of resources, of the ways in which humans value and use (and compete over) resources, and of the distribution of resources across Earth's surface.

Standard 17

How To Apply Geography To Interpret the Past

Geographers and historians agree that the human story must be told within the context of three intertwined points of view—space, environment, and chronology. The geographically informed person understands the importance of bringing the spatial and environmental focus 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 can inform an understanding of history in two important ways. First, the events of history take place within geographic contexts. Second, those events are motivated by people's perceptions, correct or otherwise, of geographic contexts. By exploring what the world was like and how it was perceived at a given place at a given time, the geographically informed person is able to interpret major historical issues. For example, why did the land invasions of Russia by Sweden under Charles XII, France under Napoleon, and Germany under Hitler all fail? And why did people want to build the Panama and Suez Canals?

Answering such questions requires a geographic approach to the spatial organization of the world as it existed then and as that world was seen by the people of those times. In the case of the land invasions of Russia, the failure of the invaders can be linked to the dimensions, conditions, and constraints of the physical and human environments involved: the harsh weather conditions to be endured, the prevalence of rivers and marshes to be crossed, the vehicle-impeding mud to be overcome, the vast distances to be traversed, the shortages of food and other supplies, and the hostility, determination, and home-ground advantage of the defenders. As all three invasions demonstrated, space and environment form a context within which people make choices.

The geographic approach to the past also requires looking at the ways in which different people understood and assessed the physical and human geographical features of their spatial and environmental contexts. In the case of the Panama and Suez Canals, the geographic approach involves an assessment of how people and governments perceived and valued transportation costs in terms of both money and time, the topography and geology of the area, the available technology and labor force, the political forces operating in Central America, Europe, and Southwest Asia, and the economic returns that would ensue. Such an assessment leads to understanding that the

canals were constructed because it was determined that the efforts and costs would be worthwhile in terms of the resulting economic and political gains.

Looking at the past geographically requires that attention be given to the beliefs and attitudes of the peoples of bygone times regarding the environment, human migration, land use, and especially their own rights and privileges versus those of others. Such information can be obtained through the use of contemporary newspapers and other firsthand accounts. It also can be obtained through the study of visible remains of buildings and other facilities, which offer clues to what occurred and why. A careful geographical analysis of today's cultural and physical landscapes is a valuable resource for learning about the past.

The geographies of past times carry important messages for today's people. The events of human history have been played out on a vast and complex geographic stage, and countless generations have had to make the best of 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 of physical and human systems and have created the contexts in which history has unfolded. The study of history, without these rich contexts, is one-dimensional. Understanding the geographies of past times, therefore, is as important as understanding the geography of the present. Students must appreciate that viewing the past from both spatial and chronological points of view can lead to a greater awareness and depth of understanding of physical and human events, and is an essential ingredient in the interpretation of the world of today. Students must also understand that the geographic approach helps to explain why events did happen in a particular way but not necessarily why they must have happened in that way.

Standard 18

How To Apply Geography To Interpret the Present and Plan for the Future

Geography is for life and not simply an exercise for its own sake. As the world becomes both more complex and more interconnected—as a result of economic development, population growth, technological advancement, and increased cooperation (and, to some extent, conflict)—the need for geographic knowledge, skills, and perspectives increases among the world's peoples. Geography is the 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—on Earth's surface.

Consequently, the practical applications of geography (along with other aspects of geographic literacy) need to be fostered in all students in preparation for life as the responsible citizens and leaders of tomorrow.

Through its spatial emphasis, geography enables students to comprehend spatial patterns and spatial contexts; connections and movements between places; the integration of local, regional, national, and global scales; diversity; and systems. Through its ecological emphasis, geography enables students to comprehend physical processes and patterns; ecosystems; the physical interconnections between local and global environments; and the impact of people on the physical environment.

Taken together, these sets of understandings enable students to pose and answer geographic questions about the spatial organization of the world in which they live. At a local and personal level students need to understand the reasons for and implications of decisions about such issues as community recycling programs, the loss of agricultural land to new housing, the choice between spending tax dollars on a sewage treatment plant or housing for senior citizens, the expansion of the runways of a local airport, or the introduction of air quality standards. They also need to be aware of the impact of such decision-making on their own lives and the lives of others, and that eventually, as community members and voting citizens, they will be asked to participate in the decision-making process. Such participation demands the knowledge and judgment of geographically informed people who know where to find relevant information, how to evaluate it, how to analyze it, and how to represent it.

Geographic literacy also has great significance at a more global and less personally immediate level. With a solid foundation in the interlinked knowledge, skills, and perspectives of geography, students will be better able to analyze and reach informed opinions about a variety of issues—ranging from the implications of resource depletion and the economic and social tensions caused by exponential population growth to what will happen within the

The Standards (Workshop Readings), cont'd.

family of nations as old political structures change, new alliances are formed, and realignments cause mass migration of refugees seeking asylum, security, and economic opportunity.

With a solid understanding of geography, people are better able to decide where to live and work, how and where to travel, and how to assess the world in spatial terms. In a world where people are competing for territory, resources, markets, and economic positions, knowing too little about geography is a liability, which compromises the capacity of people to function successfully at home or abroad. Creating effective and lasting solutions to the world's pressing 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 best solutions. That is why it is imperative that all students in the United States achieve geographic literacy.

Video Credits

Produced and Directed by:
Bob Burns

Lance Wisniewski

Eilish McCormick

Narrator
E. Deborah Dorsey

Editors
Jesse Gebryel

Tom Miller

Andrew Sayre

Production Assistant
Melanie Lewis

Music
Tom Phillips

Randy Roos

Digital Cartography
Carter Irvine

Graphics and Animation
Bob Burns

Lance Wisniewski

Melanie Lewis

Case Studies from *The Power of Place:*

El Paso

Producer
Lance Wisniewski

Director
Rebecca Marvil

NASA

Producer
Lance Wisniewski

Guatemala

Producer/Director
Lance Wisniewski

Associate Producer
Nancy Caulfield

Additional Directing
Pat Goudvis

Ecuador

Producers/Directors
Peter Frumkin

Lance Wisniewski

Boston

Producer/Director
Lance Wisniewski

Chicago

Producer/Director
Bob Burns

Jerusalem

Producer/Director
Joop van Reede

Teleac, Netherlands

Update Producer
Lance Wisniewski

Video Credits, cont'd.

Egypt

Producer/Director
Roger Samsioe

UR, Sweden

Update Producer
Bill Wheatley

South Africa

Producer/Director
Roger Samsioe

UR, Sweden

Update Producer
Terry Rockefeller

Kenya

Producer/Director
Roger Samsioe

UR, Sweden

Update Producer
Terry Rockefeller

St. Petersburg

Producer/Director
Joop van Reede

Teleac, Netherlands

Update Producer
Bill Wheatley

Dagestan

Producer/Director
Joop van Reede

Teleac, Netherlands

Update Producer
Lance Wisniewski

Berlin

Producer
Jean-Louis Cros

CNDP, France

Director
Micheline Paintault

Update Producer
Bill Wheatley

Strasbourg

Producer
Colette Weibel

CNDP, France

Director
Georges Combes

Update Producer
Bill Wheatley

Guangdong

Producer/Director
Hardy Stow

ABC/Open Learning Australia

Update Producer
Bob Burns

Oregon

Producers
Nancy Caulfield

Lance Wisniewski

Senior Project Officer for
The Power of Place
Hilda Moskowitz Goodman

Annenberg/CPB

Video Credits, cont'd.

Academic Production Consultants
James Binko, Towson University

Susan Hardwick, University of Oregon

Gil Latz, Portland State University

Academic Advisors
Sarah Bednarz, Texas A&M University

Osa Brand, Association of American Geographers

Barbara Moses, The Mennonite School

Ruth Shirey, National Council for Geographic Education

Fred Walk, Normal Community High School

Special Thanks to:
NASA, Johnson Space Center, Houston

ESRI, Redlands, California for its GIS software and staff support

Charlie Fitzpatrick, ESRI

Lockheed Martin Space Operations

Kamlesh Lulla, NASA

El Paso Border Patrol,
U.S. Immigration and Naturalization Service

Patty Mothes and Peter Hall,
Instituto Geofisico, Ecuador

Aral Sea Animation Provided by:
Deutschen Zentrum für Luft- und Raumfahrt

Footage Provided by:
Instituto Geofisico, Quito, Ecuador

Johns Hopkins University Center for Communication Programs

AIDS Campaign Team (ACT) for Africa – The World Bank

Rare Earth Films

Steps for Mankind Productions

United Visions Entertainment, Germany

Confederated Tribes

Stills Provided by:
Michel Monzier

The White House

United State Embassy, Israel

Hyde Flippo Photography

Guntram Herb

Susan Hardwick

Senior Project Officer
Karen Sensenig Gallagher

Annenberg/CPB

Series Producer
Eilish McCormick

A Production of
Cambridge Studios, Inc., Boston

Executive Producers
Lance Wisniewski

Bob Burns

Video Credits, cont'd.

Teaching Geography is a production of Cambridge Studios for Annenberg/CPB.

Senior Producer
Eilish McCormick

Curriculum Developers
Eilish McCormick

James Binko

Designers
Westford Design: Dave Ebert, Scott Wilder

Michael Mahoney

Additional Developers
Melanie Lewis

Lance Wisniewski

Terry Rockefeller

Bob Burns

Teacher Contributors
Andy Aiken
Boulder High School, CO

Marlene Brubaker
Philadelphia Mennonite School, PA

Craig Cogswell
Westminster High School, CO

Mary Pat Evans
The Londonderry School, PA

Rick Gindele
Smoky Hill High School, CO

Sharon Goralewski
Oxford Middle School, MI

Ungennette Brantley Harris
West Point High School, MS

Randy Hoover
Dover-Sherborn Middle School, MA

Connie Hudgeons
Cibola High School, NM

Shirley Hutchins
West Point Middle School, MS

Carole Mayrose
Northview High School, IN

Phil Rodriguez
Holmes High School, TX

Cynthia Ryan
Barrington Middle School, RI

Herschel Sarnoff
Jordan High School, CA

Maureen Spaight
East Providence High School, RI

Fred Walk
Normal Community High School, IL

Judy Ware
Crossroads School, MO

Artis West
North Cobb High School, GA