

MAP SCALE AND PROJECTIONS

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Unaided, our human senses provide a limited view of our surroundings. To overcome those limitations, humankind has developed powerful vehicles of thought and communication, such as language, mathematics, and graphics. Each of those tools is based on elaborate rules; each has an information bias, and each may distort its message, often in subtle ways. Consequently, to use those aids effectively, we must understand their rules, biases, and distortions. The same is true for the special form of graphics we call maps: we must master the logic behind the mapping process before we can use maps effectively.

A fundamental issue in cartography, the science and art of making maps, is the vast difference between the size and geometry of what is being mapped—the real world, we will call it—and that of the map itself. Scale and projection are the basic cartographic concepts that help us understand that difference and its effects.

Map Scale

Our senses are dwarfed by the immensity of our planet; we can sense directly only our local surroundings. Thus, we cannot possibly look at our whole state or country at one time, even though we may be able to see the entire street where we live. Cartography helps us expand what we can see at one time by letting us view the scene from some distant vantage point. The greater the imaginary distance between that position and the object of our observation, the larger the area the map can cover, but the smaller the features will appear on the map. That reduction is defined by the *map scale*, the ratio of the distance on the map to the distance on Earth. Map users need to know about map scale for two reasons: so that they can convert measurements on a map into meaningful real-world measures and so that they can know how abstract the cartographic representation is.

REAL-WORLD MEASURES. A map can provide a useful substitute for the real world for many analytical purposes. With the scale of a map, for instance, we can compute the actual size of its features (length, area, and volume). Such calculations are helped by three expressions of a map scale: a word statement, a graphic scale, and a representative fraction.

A *word statement* of a map scale compares X units on the map to Y units on Earth, often abbreviated “X unit to Y units.” For example, the expression “1 inch to 10 miles” means that 1 inch on the map represents 10 miles on Earth

(Figure A-1). Because the map is always smaller than the area that has been mapped, the ground unit is always the larger number. Both units are expressed in meaningful terms, such as inches or centimeters and miles or kilometers. Word statements are not intended for precise calculations but give the map user a rough idea of size and distance.

A *graphic scale*, such as a bar graph, is concrete and therefore overcomes the need to visualize inches and miles that is associated with a word statement of scale (see Figure A-1). A graphic scale permits direct visual comparison of feature sizes and the distances between features. No ruler is required; any measuring aid will do. It needs only be compared with the scaled bar; if the length of 1 toothpick is equal to 2 miles on the ground and the map distance equals the length of 4 toothpicks, then the ground distance is 4 times 2, or 8 miles. Graphic scales are especially convenient in this age of copying machines, when we are more likely to be working with a copy than with the original map. If a map is reduced or enlarged as it is copied, the graphic scale will change in proportion to the change in the size of the map and thus will remain accurate.

The third form of a map scale is the *representative fraction* (RF). An RF defines the ratio between the distance on the map and the distance on Earth in fractional terms, such as 1/633,600 (also written 1:633,600). The numerator of the fraction always refers to the distance on the map, and the denominator always refers to the distance on Earth. No units of measurement are given, but both numbers must be expressed in the same units. Because map distances are extremely small relative to the size of Earth, it makes sense to use small units, such as inches or centimeters. Thus the RF 1:633,600 might be read as “1 inch on the map to 633,600 inches on Earth.”

Herein lies a problem with the RF. Meaningful map-distance units imply a denominator so large that it is impossible to visualize. Thus, in practice, reading the map scale involves an additional step of converting the denominator to a meaningful ground measure, such as miles or kilometers. The unwieldy 633,600 becomes the more manageable 10 miles when divided by the number of inches in a mile (63,360).

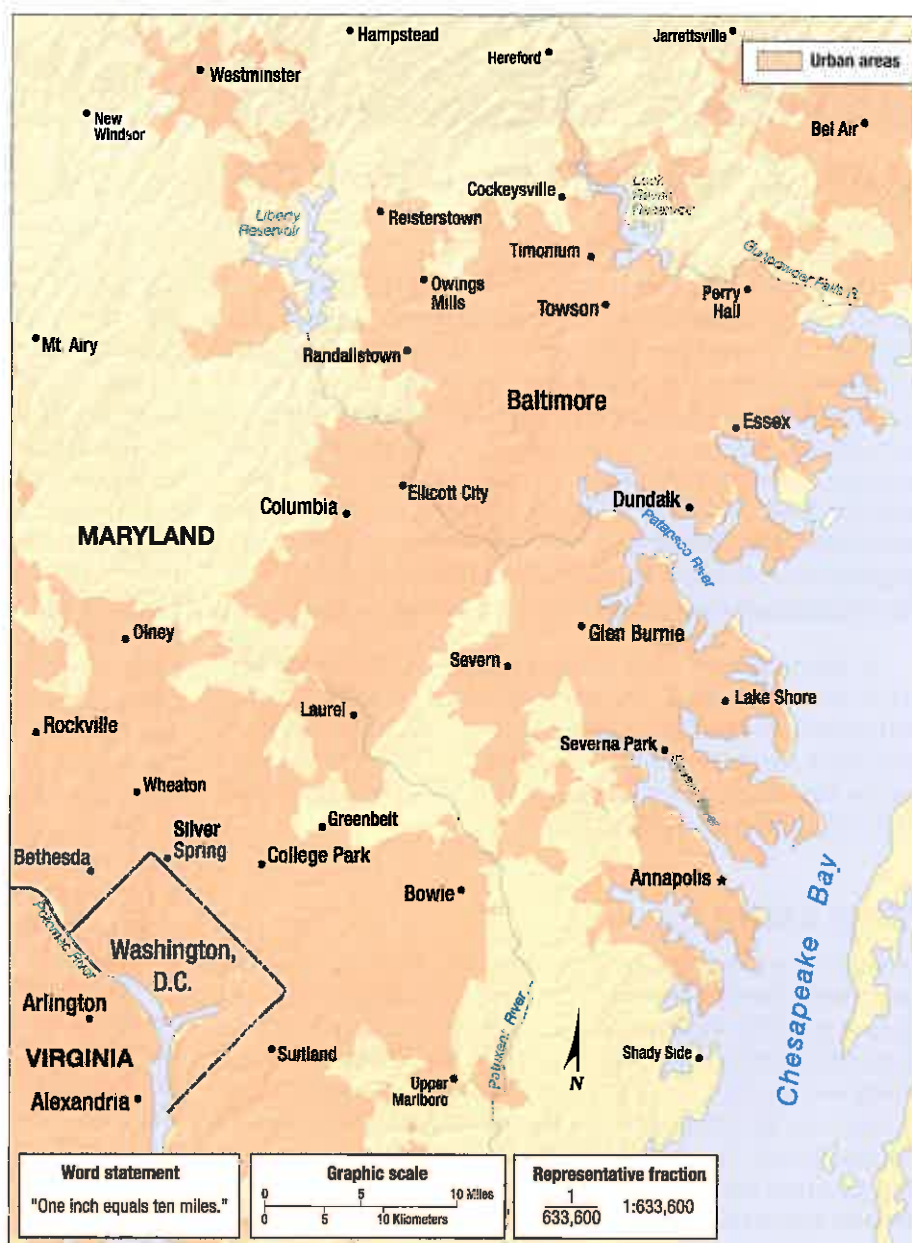
On the plus side, the RF is good for calculations. In particular, the ground distance between points can be easily determined from a map with an RF. One simply multiplies the distance between the points on the map by the denominator of the RF. Thus a distance of 5 inches on a map with an RF of 1/126,720 would signify a ground distance of

5 X 126,720, which equals 633,600. Because all units are inches and there are 63,360 inches in a mile, the ground distance is $633,600 / 63,360$, or 10 miles. Computation of area is equally straightforward with an RF. Computer manipulation and analysis of maps is based on the RF form of map scale.

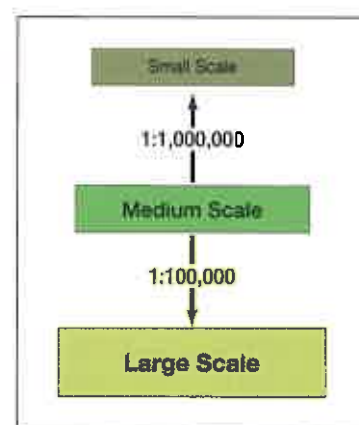
GUIDES TO GENERALIZATION. Scales also help map users visualize the nature of the symbolic relation between the map and the real world. It is convenient here to think of maps as falling into three broad scale categories (Figure A-2). (Do not be confused by the use of the words large AND small in this context; just remember that the larger the denominator, the smaller the scale ratio and the larger the area that is shown on the map.) Scale ratios greater than 1:100,000, such as the 1:24,000 scale of U.S. Geological Survey topographic quadrangles, are large-scale maps. Although those maps can cover only a local area, they can be drawn to rather rigid standards of accuracy. Thus they are useful for a wide range of applications that require detailed and accurate maps, including zoning, navigation, and construction.

At the other extreme are maps with scale ratios of less than 1:1,000,000, such as maps of the world that are found in atlases. Those are small-scale maps. Because they cover large areas, the symbols on them must be highly abstract. They are therefore best suited to general reference or planning, when detail is not important. Medium- or intermediate-scale maps have scales between 1:100,000 and 1:1,000,000. They are good for regional reference and planning purposes.

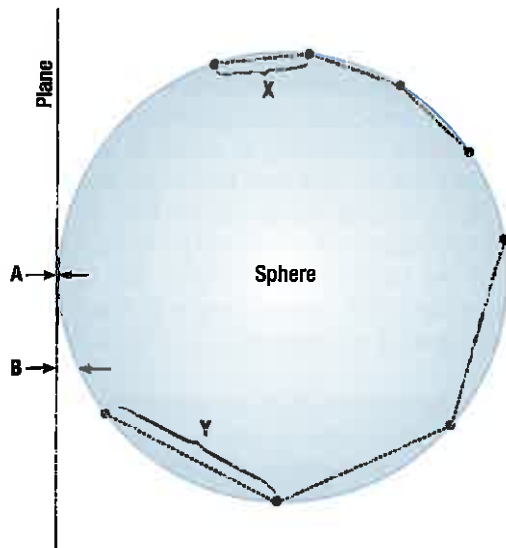
Another important aspect of map scale is to give us some notion of geometric accuracy; the greater the expanse of the real world shown on a map, the less accurate the geometry of that map is. Figure A-3 shows why. If a curve is represented by straight line segments, short segments (X) are more similar to the curve than are long segments (Y). Similarly, if a plane is placed in contact with a sphere, the difference between the two surfaces is slight where they touch (A) but grows rapidly with increasing distance from the point of contact (B). In view of the large diameter and slight local curvature of Earth, distances will be well represented on large-scale maps (those with small denominators) but will be increasingly poorly represented at smaller scales. This close relationship between map scale and map geometry brings us to the topic of map projections.



▲ FIGURE A-1 Common expressions of map scale.



▲ FIGURE A-2 The scale gradient can be divided into three broad categories.



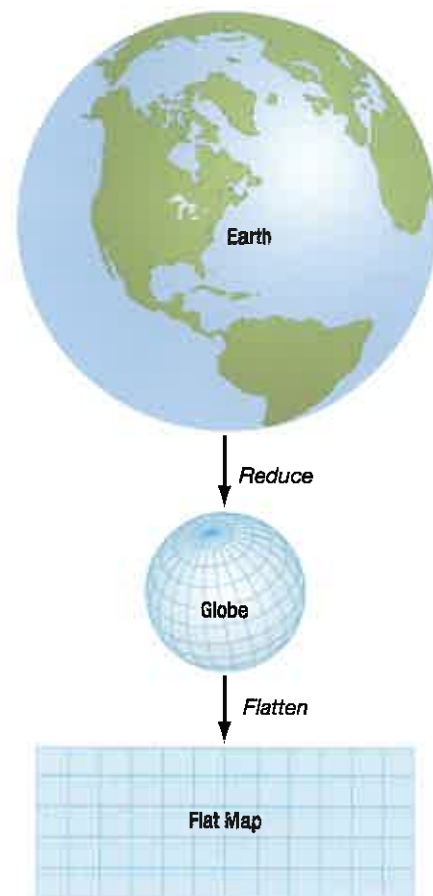
▲ FIGURE A-3 Relationships between surfaces on the round Earth and a flat map.

Map Projections

The spherical surface of Earth is shown on flat maps by means of map projections. The process of “flattening” Earth is essentially a problem in geometry that has captured the attention of the best mathematical minds for centuries. Yet no one has ever found a perfect solution; there is no known way to avoid spatial distortion of one kind or another. Many map projections have been devised, but only a few have become standard. Because a single flat map cannot preserve all aspects of Earth’s surface geometry, a mapmaker must be careful to match the projection with the task at hand. To map something that involves distance, for example, a projection should be used in which distance is not distorted. In addition, a map user should be able to recognize which aspects of a map’s geometry are accurate and which are distortions caused by a particular projection process. Fortunately, that objective is not too difficult to achieve.

It is helpful to think of the creation of a projection as a twostep process (Figure A-4). First, the immense Earth is reduced to a small globe with a scale equal to that of the desired flat map. All spatial properties on the globe are true to those on Earth. Second, the globe is flattened. Since that cannot be done without distortion, it is accomplished in such a way that the resulting map exhibits certain desirable spatial properties.

PERSPECTIVE MODELS. Early map projections were sometimes created with the aid of perspective methods, but that has changed. In the modern electronic age, projections are normally developed by strictly mathematical means and are plotted out or displayed on computer-driven graphics devices. The concept of perspective is still useful in visualizing what map projections do, however. Thus projection methods are often illustrated by using strategically located light sources to cast shadows on a projection

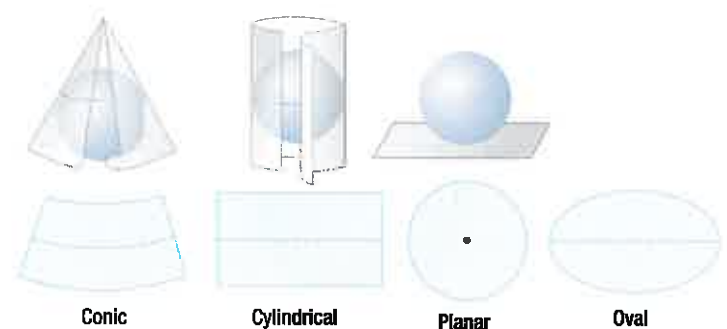


▲ FIGURE A-4 The two-step process of creating a projection.

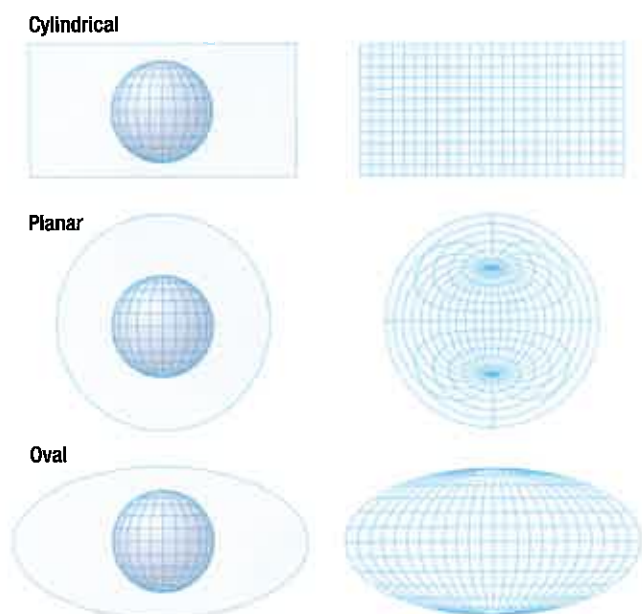
surface from a latitude/longitude net inscribed on a transparent globe.

The success of the perspective approach depends on finding a projection surface that is flat or that can be flattened without distortion. The cone, cylinder, and plane possess those attributes and serve as models for three general classes of map projections: *conic*, *cylindrical*, and *planar* (or *azimuthal*). Figure A-5 shows those three classes, as well as a fourth, a false cylindrical class with an oval shape. Although the oval class is not of perspective origin, it appears to combine properties of the cylindrical and planar classes (Figure A-6).

The relationship between the projection surface and the model at the point or line of contact is critical because



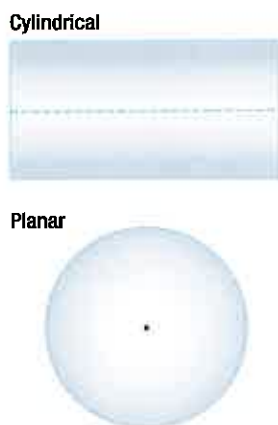
▲ FIGURE A-5 General classes of map projections.



▲ **FIGURE A-6** The visual properties of cylindrical and planar projections combined in oval projections.

distortion of spatial properties on the projection is symmetrical about, and increases with distance from, that point or line. That condition is illustrated for the cylindrical and planar classes of projections in Figure A-7. If the point or line of contact is changed to some other position on the globe, the distortion pattern will be recentered on the new position but will retain the same symmetrical form. Thus centering a projection on the area of interest on Earth's surface can minimize the effects of projection distortion. And recognizing the general projection shape, associating it with a perspective model, and recalling the characteristic distortion pattern will provide the information necessary to compensate for projection distortion.

PRESERVED PROPERTIES. For a map projection to truthfully depict the geometry of Earth's surface, it would have to preserve the spatial attributes of *distance*, *direction*, *area*, *shape*, and *proximity*. That task can be readily accomplished



▲ **FIGURE A-7** Characteristic patterns of distortion for two projection classes. Here, darker shading implies greater distortion.

on a globe, but it is not possible on a flat map. To preserve area, for example, a mapmaker must stretch or shear shapes; thus area and shape cannot be preserved on the same map. To depict both direction and distance from a point, area must be distorted. Similarly, to preserve area as well as direction from a point, distance has to be distorted. Because Earth's surface is continuous in all directions from every point, discontinuities that violate proximity relationships must occur on all map projections. The trick is to place those discontinuities where they will have the least impact on the spatial relationships in which the map user is interested.

We must be careful when we use spatial terms, because the properties they refer to can be confusing. The geometry of the familiar plane is very different from that of a sphere; yet when we refer to a flat map, we are in fact making reference to the spherical Earth that was mapped. A shape-preserving projection, for example, is truthful to local shapes—such as the rightangle crossing of latitude and longitude lines—but does not preserve shapes at continental or global levels. A distance-preserving projection can preserve that property from one point on the map in all directions or from a number of points in several directions, but distance cannot be preserved in the general sense that area can be preserved. Direction can also be generally preserved from a single point or in several directions from a number of points but not from all points simultaneously. Thus a shape-, distance-, or direction-preserving projection is truthful to those properties only in part.

Partial truths are not the only consequence of transforming a sphere into a flat surface. Some projections exploit that transformation by expressing traits that are of considerable value for specific applications. One of those is the famous shape-preserving *Mercator projection* (Figure A-8). That cylindrical projection was derived



▲ **FIGURE A-8** The useful Mercator projection, showing extreme area distortion in the higher latitudes.

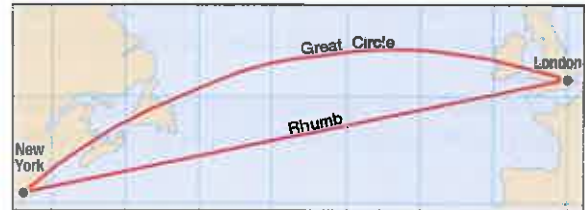
mathematically in the 1500s so that a compass bearing (called *rhumb lines*) between any two points on Earth would plot as straight lines on the map. That trait let navigators plan, plot, and follow courses between origin and destination, but it was achieved at the expense of extreme areal distortion toward the margins of the projection (see Antarctica in Figure A-8). Although the Mercator projection is admirably suited for its intended purpose, its widespread but inappropriate use for nonnavigational purposes has drawn a great deal of criticism.

The *gnomonic projection* is also useful for navigation. It is a planar projection with the valuable characteristic of showing the shortest (or great circle) route between any two points on Earth as straight lines. Long-distance navigators first plot the great circle course between origin and destination on a gnomonic projection (Figure A-9A). Next they transfer the straight line to a Mercator projection, where it normally appears as a curve (Figure A-9B). Finally, using straight-line segments, they construct an approximation of that course on the Mercator projection. Navigating the shortest course between origin and destination then involves following the straight segments of the course and making directional corrections between segments. Like the Mercator projection, the specialized gnomonic projection distorts other spatial properties so severely that it should not be used for any purpose other than navigation or communications.

(A) Gnomonic

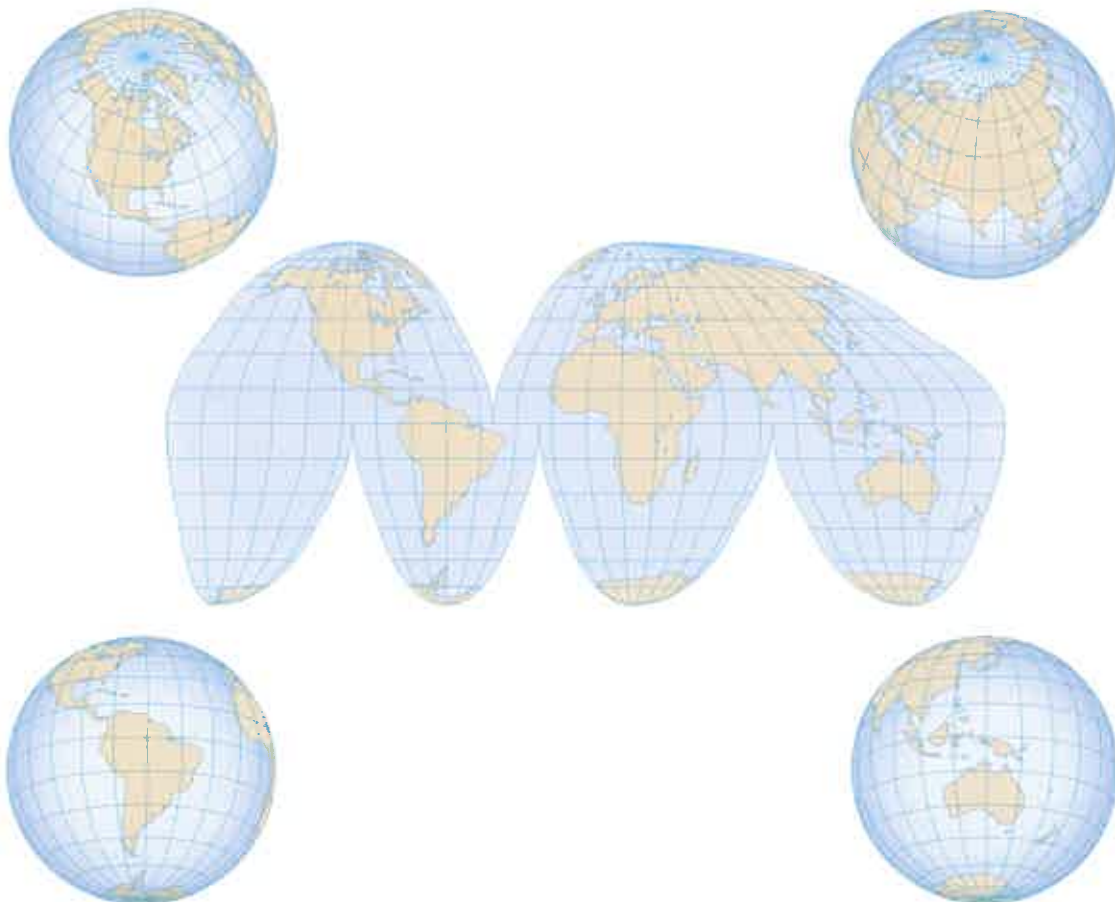


(B) Mercator



▲ **FIGURE A-9** (a) A gnomonic projection and (b) a Mercator projection, both of value to long-distance navigators.

PROJECTIONS USED IN TEXTBOOKS. Although a map projection cannot be free of distortion, it can represent one or several spatial properties of Earth's surface accurately if other properties are sacrificed. The two projections used for world maps throughout this textbook illustrate that point well. *Goode's homolosine projection*, shown in Figure A-10, belongs to the oval category and shows area



▲ **FIGURE A-10** An interrupted Goode's homolosine, an equal-area projection.

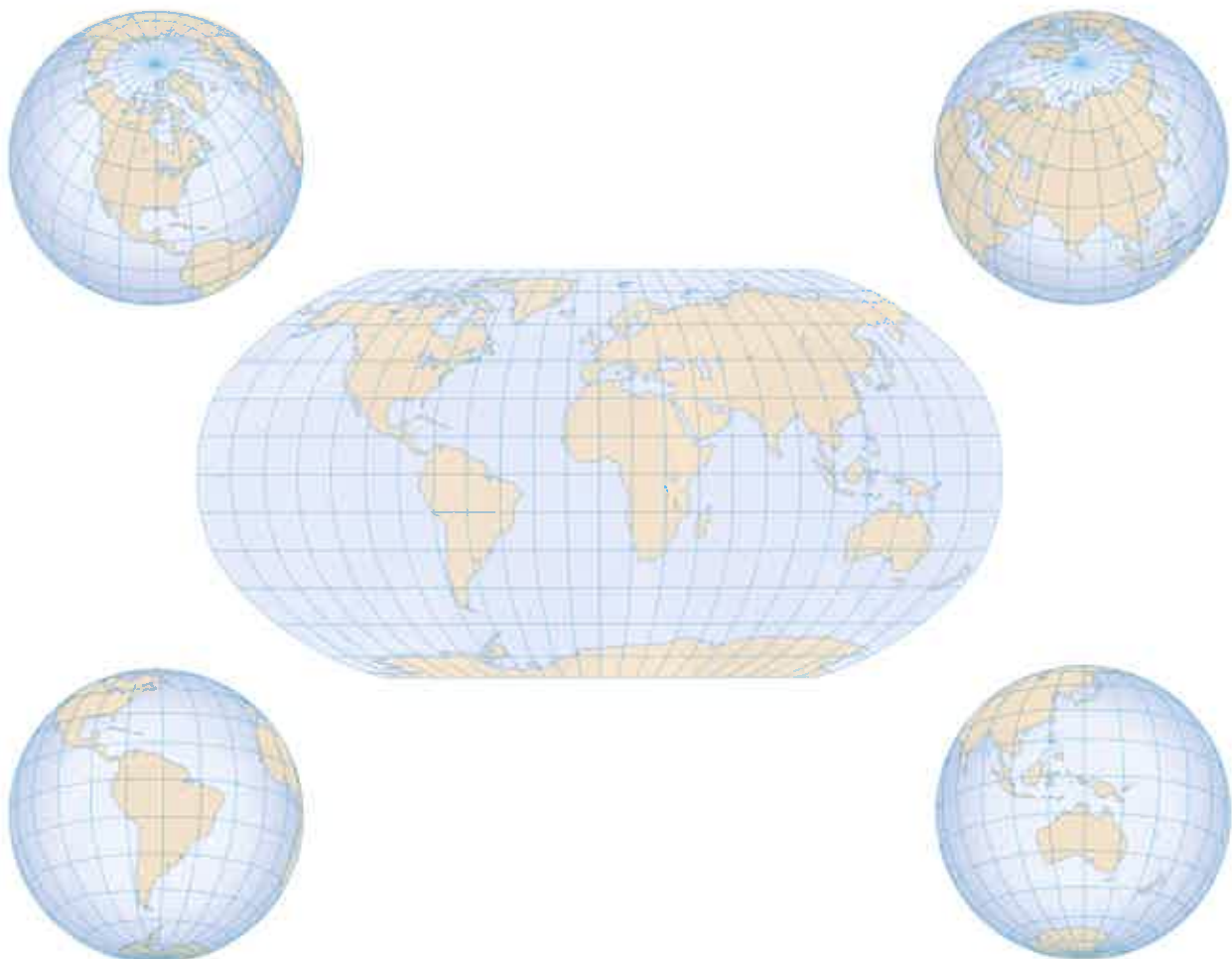
accurately, although it gives the impression that Earth's surface has been torn, peeled, and flattened. The interruptions in Figure A-10 have been placed in the major oceans, giving continuity to the land masses. Ocean areas could be featured instead by placing the interruptions in the continents. Obviously, that type of interrupted projection severely distorts proximity relationships. Consequently, in different locations the properties of distance, direction, and shape are also distorted to varying degrees. The distortion pattern mimics that of cylindrical projections, with the equatorial zone the most faithfully represented (Figure A-11).

An alternative to special-property projections such as the equal-area Goode's homolosine is the compromise

projection. In that case no special property is achieved at the expense of others, and distortion is rather evenly distributed among the various properties, instead of being focused on one or several properties. The *Robinson projection*, which is also used in this textbook, falls into that category (Figure A-12). Its oval projection has a global feel, somewhat like that of Goode's homolosine. But the Robinson projection shows the North Pole and the South Pole as lines that are slightly more than half the length of the equator, thus exaggerating distances and areas near the poles. Areas look larger than they really are in the high latitudes (near the poles) and smaller than they really are in the low latitudes (near the equator). In addition, not all latitude and longitude lines intersect at right angles, as they do on Earth so we know that the Robinson projection does not preserve direction or shape either. However, it has fewer interruptions than the Goode's homolosine does, so it preserves proximity better. Overall, the Robinson projection does a good job of representing spatial relationships, especially in the low to middle latitudes and along the central meridian.



▲ FIGURE A-11 The distortion pattern of the interrupted Goode's homolosine projection, which mimics that of cylindrical projections.



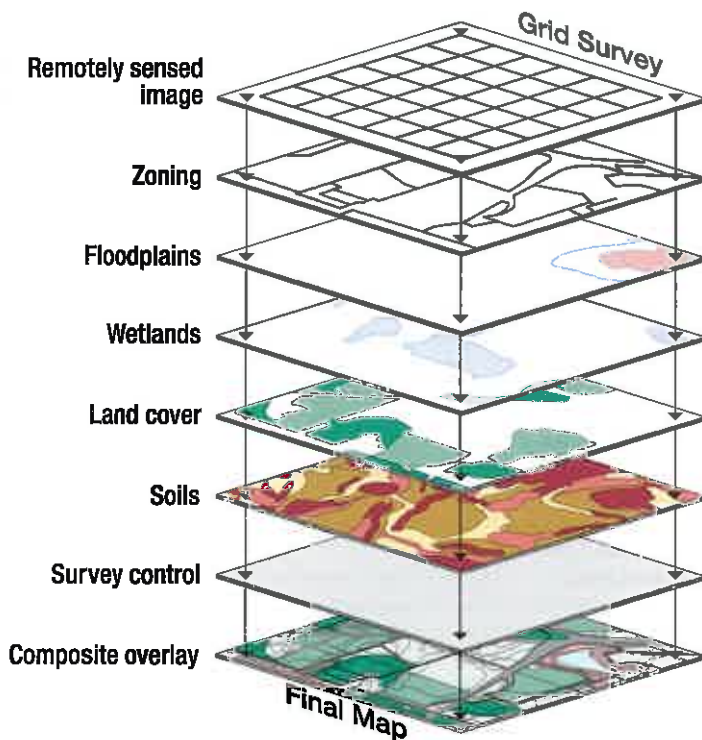
▲ FIGURE A-12 The compromise Robinson projection, which avoids the interruptions of Goode's homolosine but preserves no special properties. (Courtesy of ACSM)

Geospatial Technologies and GIS

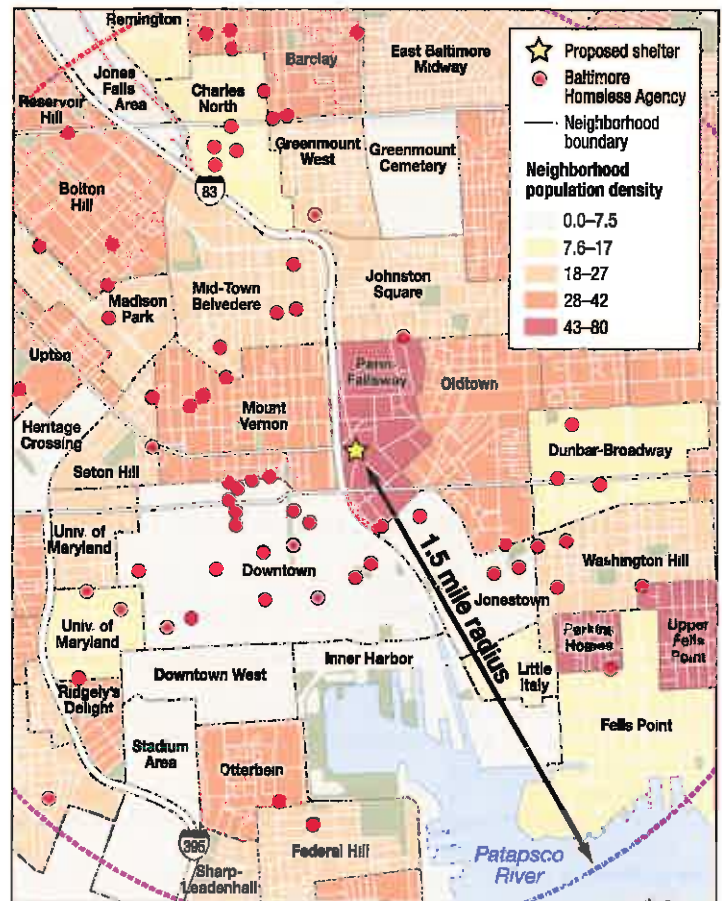
Today, user-friendly mapping software enables anyone with a computer to produce maps at a range of scales using a variety of projections. But a challenge remains to geographers and other users of spatial information: how to organize and present in map form the vast amounts of spatial data that are now available.

From data gathered by orbiting satellites or GPS devices to statistical data linked to spatial coordinates, these data provide a more detailed view of Earth's physical and human systems than has ever before been possible. To manage these data, geographers have developed a powerful tool—geographic information systems (GIS), which enable users to manipulate and display spatial data in map form. GIS maps contribute to problem solving in diverse fields such as science and engineering, industry, health care, retail sales, urban planning, environmental protection, law enforcement, and many others.

The power of GIS lies in its ability to map different data sets—called data layers—against each other, revealing relationships that might otherwise be difficult to detect. Figure A-13 shows examples of environmental data organized as GIS data layers.



▲ **FIGURE A-13** Within a GIS, environmental data attached to a common terrestrial reference system, such as latitude/longitude, can be stacked in layers for spatial comparison and analysis.



▲ **FIGURE A-14** This GIS map shows that Baltimore's proposed homeless shelter would be near a cluster of service providers. The map's data layers include: neighborhood borders, population density (by neighborhood), and locations of homeless agencies.

GIS can help answer almost any question involving spatial or locational analysis. In one application of GIS, The city of Baltimore, Maryland, wanted to determine the best location for an emergency shelter for homeless people. Among many other factors considered, one main criterion for the shelter was that it be accessible from other facilities providing services to the homeless. As shown in the map in Figure A-14, the site selected was in a densely populated part of the city and at the center of a 1.5-mile-radius circle containing more than 60 percent of the city's providers of homeless services.

GLOSSARY

A

- Abiotic** (p. 34) Composed of nonliving or inorganic matter.
- Active solar energy** (p. 412) Solar radiation captured with photovoltaic cells that convert light energy to electrical energy.
- Acculturation** (pp. 28, 138) The process of changes in culture that result from the meeting of two groups, each of which retains distinct culture features.
- Acid deposition** (p. 415) The accumulation of acids on Earth's surface.
- Acid precipitation** (p. 415) Conversion of sulfur oxides and nitrogen oxides to acids that return to Earth as rain, snow, or fog.
- Adolescent fertility rate** (p. 364) The number of births per 1,000 women ages 15 to 19.
- Agnosticism** (p. 185) The belief that the existence of God can't be proven empirically.
- Agribusiness** (p. 326) Commercial agriculture characterized by the integration of different steps in the food-processing industry, usually through ownership by large corporations.
- Agricultural density** (p. 50) The ratio of the number of farmers to the total amount of land suitable for agriculture.
- Agricultural revolution** (p. 308) The time when human beings first domesticated plants and animals and no longer relied entirely on hunting and gathering.
- Agriculture** (p. 308) The deliberate effort to modify a portion of Earth's surface through the cultivation of crops and the raising of livestock for sustenance or economic gain.
- Air pollution** (p. 414) Concentration of trace substances, such as carbon monoxide, sulfur dioxide, nitrogen oxides, hydrocarbons, and solid particulates, at a greater level than occurs in average air.
- Animate power** (p. 385) Power supplied by animals or by people.
- Animism** (p. 193) The belief that objects, such as plants and stones, or natural events, like thunderstorms and earthquakes, have a discrete spirit and conscious life.
- Annexation** (p. 478) Legally adding land area to a city in the United States.
- Anocracy** (p. 228) A country that is not fully democratic or fully autocratic but rather displays a mix of the two types.
- Apartheid** (p. 245) Laws (no longer in effect) in South Africa that physically separated different races into different geographic areas.
- Aquaculture (or aquafarming)** (p. 324) The cultivation of seafood under controlled conditions.
- Arithmetic density** (p. 50) The total number of people divided by the total land area.
- Assimilation** (pp. 28, 138) The process by which a group's cultural features are altered to resemble those of another more dominant group.
- Asylum seeker** (p. 29) Someone who has migrated to another country in the hope of being recognized as a refugee.
- Atheism** (p. 185) The belief that God does not exist.
- Atmosphere** (p. 34) The thin layer of gases surrounding Earth.
- Autocracy** (p. 288) A country that is run according to the interests of the ruler rather than the people.
- Autonomous religion** (p. 211) A religion that does not have a central authority but shares ideas and cooperates informally.

B

- Balance of power** (p. 295) A condition of roughly equal strength between opposing countries or alliances of countries.
- Balkanization** (p. 256) A process by which a state breaks down through conflicts among its ethnicities.
- Balkanized** (p. 256) A small geographic area that cannot successfully be organized into stable countries because it is inhabited by many ethnicities with complex, long-standing antagonisms toward each other.

- Basic business** (p. 446) A business that sells its products or services primarily to consumers outside the settlement.
- Behavioral geography** (p. 26) The study of the psychological basis for individual human actions in space.
- Biochemical oxygen demand (BOD)** (p. 416) The amount of oxygen required by aquatic bacteria to decompose a given load of organic waste; a measure of water pollution.
- Biomass fuel** (p. 385) Fuel derived from wood, plant material, or animal waste.
- Biosphere** (p. 34) All living organisms on Earth, including plants and animals, as well as microorganisms.
- Biotic** (p. 34) Composed of living organisms.
- Blockbusting** (p. 243) A process by which real estate agents convince white property owners to sell their houses at low prices because of fear that persons of color will soon move into the neighborhood.
- Boundary** (p. 280) An invisible line that marks the extent of a state's territory.
- Brain drain** (p. 103) Large-scale emigration by talented people.
- Branch (of a religion)** (p. 188) A large and fundamental division within a religion.
- Break-of-bulk point** (p. 395) A location where transfer is possible from one mode of transportation to another.
- Bulk-gaining industry** (p. 390) An industry in which the final product weighs more or comprises a greater volume than the inputs.
- Bulk-reducing industry** (p. 389) An industry in which the final product weighs less or comprises a lower volume than the inputs.
- Business service** (p. 432) A service that primarily meets the needs of other businesses, including professional, financial, and transportation services.

C

- Carbon capture and storage (CCS)** (p. 494) The process of capturing waste CO₂, transporting it to a storage site, and depositing it where it will not enter the atmosphere, normally underground.
- Cartography** (p. 6) The science of making maps.
- Caste** (p. 218) The class or distinct hereditary order into which a Hindu is assigned, according to religious law.
- Census** (p. 46) A complete enumeration of a population.
- Census tract** (p. 468) An area delineated by the U.S. Bureau of the Census for which statistics are published; in urban areas, census tracts correspond roughly to neighborhoods.
- Central business district (CBD)** (p. 462) The area of a city where retail and office activities are clustered.
- Central city (city)** (p. 460) An urban settlement that has been legally incorporated into an independent, self-governing unit known as a municipality.
- Central place** (p. 434) A market center for the exchange of services by people attracted from the surrounding area.
- Central place theory** (p. 434) A theory that explains the distribution of services based on the fact that settlements serve as centers of market areas for services; larger settlements are fewer and farther apart than smaller settlements and provide services for a larger number of people who are willing to travel farther.
- Centripetal force** (p. 247) An attitude that tends to unify people and enhance support for a state.
- Cereal grain** (p. 312) A grass that yields grain for food.
- Chain migration** (p. 103) Migration of people to a specific location because relatives or members of the same nationality previously migrated there.
- Chlorofluorocarbon (CFC)** (p. 414) A gas used as a solvent, a propellant in aerosols, a refrigerant, and in plastic foams and fire extinguishers.
- Circular migration** (p. 106) The temporary movement of a migrant worker between home and host countries to seek employment.

Circulation (p. 78) Short-term, repetitive, or cyclical movements that recur on a regular basis.

Citizen science (p. 9) Scientific research by amateur scientists.

City-state (p. 451) A sovereign state comprising a city and its immediate hinterland.

Climate (p. 34) The long-term average weather condition at a particular location.

Clustered rural settlement (p. 448) A rural settlement in which the houses and farm buildings of each family are situated close to each other, with fields surrounding the settlement.

Colonialism (p. 278) An attempt by one country to establish settlements and to impose its political, economic, and cultural principles in another territory.

Colony (p. 278) A territory that is legally tied to a sovereign state rather than completely independent.

Combined statistical area (CSA) (p. 461) In the United States, two or more contiguous CBSAs tied together by commuting patterns.

Commercial agriculture (p. 310) Agriculture undertaken primarily to generate products for sale off the farm.

Compact state (p. 286) A state in which the distance from the center to any boundary does not vary significantly.

Concentration (p. 22) The spread of something over a given area.

Concentric zone model (p. 466) A model of the internal structure of cities in which social groups are spatially arranged in a series of rings.

Congregation (p. 188) A local assembly of persons brought together for common religious worship.

Connection (p. 32) Refers to the relationships among people and objects across the barrier of space.

Conservation (p. 32) The sustainable management of a natural resource.

Consumer service (p. 432) A service that primarily meets the needs of individual consumers, including retail, education, health, and leisure services.

Consumptive water usage (p. 416) The use of water that evaporates rather than being returned to nature as a liquid.

Contagious diffusion (p. 29) The rapid, widespread diffusion of a feature or trend throughout a population.

Cooperative store (p. 350) A member-owned, member-governed business that operates for the benefit of its members according to common principles agreed upon by the international cooperative community.

Core-based statistical area (CBSA) (p. 461) In the United States, any MSA or pSA.

Cosmogony (p. 214) A set of religious beliefs concerning the origin of the universe.

Cottage industry (p. 384) Manufacturing based in homes rather than in factories, most common prior to the Industrial Revolution.

Counterurbanization (p. 90) Net migration from urban to rural areas in more developed countries.

Creole (or creolized) language (p. 167) A language that results from the mixing of a colonizer's language with the indigenous language of the people being dominated.

Crop (p. 308) Any plant gathered from a field as a harvest during a particular season.

Crop rotation (p. 323) The practice of rotating use of different fields from crop to crop each year to avoid exhausting the soil.

Crude birth rate (CBR) (p. 54) The total number of live births in a year for every 1,000 people alive in the society.

Crude death rate (CDR) (p. 54) The total number of deaths in a year for every 1,000 people alive in the society.

Cultural ecology (p. 36) A geographic approach that emphasizes human—environment relationships.

Cultural landscape (p. 36) An approach to geography that emphasizes the relationships among social and physical phenomena in a particular study area.

Culture (p. 18) The body of customary beliefs, social forms, and material traits that together constitute a group's distinct tradition.

Custom (p. 112) The frequent repetition of an act, to the extent that it becomes characteristic of the group of people performing the act.

D

Dairy farm (p. 330) A form of commercial agriculture that specializes in the production of milk and other dairy products.

Democracy (p. 288) A country in which citizens elect leaders and can run for office.

Demographic transition (p. 56) The process of change in a society's population from a condition of high crude birth and death rates and low rate of natural increase to a condition of low crude birth and death rates, low rate of natural increase, and higher total population.

Demography (p. 55) The scientific study of population characteristics.

Denglish (p. 159) A combination of *Deutsch* (the German word for German) and *English*.

Denomination (p. 188) A division of a branch that unites a number of local congregations into a single legal and administrative body.

Density (p. 22) The frequency with which something exists within a given unit of area.

Density gradient (p. 480) The change in density in an urban area from the center to the periphery.

Dependency ratio (p. 60) The number of people under age 15 and over age 64 compared to the number of people active in the labor force.

Desertification (pp. 94, 333) Degradation of land, especially in semiarid areas, primarily because of human actions such as excessive crop planting, animal grazing, and tree cutting. Also known as semiarid land degradation.

Developed country (p. 350) A country that has progressed relatively far along a continuum of development.

Developing country (p. 350) A country that is at a relatively early stage in the process of development.

Developing language (p. 147) A language spoken in daily use with a literary tradition that is not widely distributed.

Development (p. 350) A process of improvement in the conditions of people through diffusion of knowledge and technology.

Dialect (p. 164) A regional variety of a language distinguished by vocabulary, spelling, and pronunciation.

Dietary energy consumption (p. 312) The amount of food that an individual consumes, measured in kilocalories (Calories in the United States).

Diffusion (p. 28) The process of spread of a feature or trend from one place to another over time.

Dispersed rural settlement (p. 448) A rural settlement pattern characterized by isolated farms rather than clustered villages.

Distance decay (p. 30) The diminished importance and eventual disappearance of a phenomenon with increasing distance from its origin.

Distribution (p. 22) The arrangement of something across Earth's surface.

Double cropping (p. 322) Harvesting twice a year from the same field.

Doubling time (p. 52) The number of years needed to double a population, assuming a constant rate of natural increase.

E

Ebonics (p. 167) A dialect spoken by some African Americans.

Ecology (p. 36) The scientific study of ecosystems.

Economic base (p. 446) A community's collection of basic businesses.

Ecosystem (p. 36) A group of living organisms and the abiotic spheres with which they interact.

Ecumene (p. 49) The portion of Earth's surface occupied by permanent human settlement.

Edge city (p. 467) A large node of office and retail activities on the edge of an urban area.

Elderly support ratio (p. 61) The number of working-age people (ages 15 to 64) divided by the number of persons 65 and older.

Elongated state (p. 286) A state with a long, narrow shape.

Emigration (p. 78) Migration from a location.

Enclosure movement (p. 449) The process of consolidating small landholdings into a smaller number of larger farms in England during the eighteenth century.

Environmental determinism (p. 37) A nineteenth- and early twentieth-century approach to the study of geography which argued that the general laws sought by human geographers could be found in the physical sciences. Geography was therefore the study of how the physical environment caused human activities.

Epidemiologic transition (p. 64) The process of change in the distinctive causes of death in each stage of the demographic transition.

Epidemiology (p. 64) The branch of medical science concerned with the incidence, distribution, and control of diseases that are prevalent among a population at a special time and are produced by some special causes not generally present in the affected locality.

Ethnic cleansing (p. 252) A purposeful policy designed by one ethnic or religious group to remove by violent and terror-inspiring means the civilian population of another ethnic or religious group from certain geographic areas.

Ethnic enclave (p. 236) A place with a high concentration of an ethnic group that is distinct from those in the surrounding area.

Ethnic religion (p. 185) A religion with a relatively concentrated spatial distribution whose principles are likely to be based on the physical characteristics of the particular location in which its adherents are concentrated.

Ethnicity (p. 230) Identity with a group of people who share the cultural traditions of a particular homeland or hearth.

Ethnoburb (p. 327) A suburban area with a cluster of a particular ethnic population.

Expansion diffusion (p. 29) The spread of a feature or trend among people from one area to another in an additive process.

Extinct language (p. 177) A language that was once used by people in daily activities but is no longer used.

F

Fair trade (p. 376) An alternative to international trade that provides greater equity to workers, small businesses, and consumers, focusing primarily on products exported from developing countries to developed countries.

Federal state (p. 289) An internal organization of a state that allocates most powers to units of local government.

Female labor force participation rate (p. 393) The percentage of women holding full-time jobs outside the home.

Filtering (p. 489) A process of change in the use of a house, from single-family owner occupancy to abandonment.

Fishing (p. 304) The capture of wild fish and other seafood living in the waters.

Fission (p. 408) The splitting of an atomic nucleus to release energy.

Floodplain (p. 94) An area subject to flooding during a given number of years, according to historical trends.

Folk culture (p. 112) Culture traditionally practiced by a small, homogeneous, rural group living in relative isolation from other groups.

Food desert (p. 439) An area that has a substantial amount of low-income residents and has poor access to a grocery store, defined in most cases as further than 1 mile.

Food security (p. 314) Physical, social, and economic access at all times to safe and nutritious food sufficient to meet dietary needs and food preferences for an active and healthy life.

Forced migration (p. 82) Permanent movement, usually compelled by cultural factors.

Fordist production (p. 424) A form of mass production in which each worker is assigned one specific task to perform repeatedly.

Foreign direct investment (FDI) (p. 372) Investment made by a foreign company in the economy of another country.

Formal region (or uniform region) (p. 16) An area in which everyone shares in common one or more distinctive characteristics.

Fossil fuel (p. 385) An energy source formed from the residue of plants and animals buried millions of years ago.

Fragmented state (p. 287) A state that includes several discontinuous pieces of territory.

Franglais (p. 159) A combination of *français* and *anglais* (the French words for French and English, respectively).

Frontier (p. 280) A zone separating two states in which neither state exercises political control.

Functional region (or nodal region) (p. 16) An area organized around a node or focal point.

Fundamentalism (p. 220) Literal interpretation and strict adherence to basic principles of a religion (or a religious branch, denomination, or congregation).

Fusion (p. 409) Creation of energy by joining the nuclei of two hydrogen atoms to form helium.

G

Gender Inequality Index (GII) (p. 360) An indicator constructed by the U.N. to measure the extent of each country's gender inequality in terms of reproductive health, empowerment, and the labor market.

Gender-related Development Index (GDI) (p. 360) An indicator constructed by the U.N. to measure the gender gap in the level of achievement in terms of income, education, and life expectancy.

Genetically modified organism (GMO) (p. 338) A living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology.

Genocide (p. 258) The mass killing of a group of people in an attempt to eliminate the entire group from existence.

Gentrification (p. 490) A process of converting an urban neighborhood from a predominantly low-income, renter-occupied area to a predominantly middle-class, owner-occupied area.

Geographic information science (GIScience) (p. 9) The development and analysis of data about Earth acquired through satellite and other electronic information technologies.

Geographic information system (GIS) (p. 9) A computer system that stores, organizes, analyzes, and displays geographic data.

Geotagging (p. 9) Identification and storage of a piece of information by its precise latitude and longitude coordinates.

Geothermal energy (p. 411) Energy from steam or hot water produced from hot or molten underground rocks.

Gerrymandering (p. 290) The process of redrawing legislative boundaries for the purpose of benefiting the party in power.

Ghetto (p. 205) During the Middle Ages, a neighborhood in a city set up by law to be inhabited only by Jews; now used to denote a section of a city in which members of any minority group live because of social, legal, or economic pressure.

Global Positioning System (GPS) (p. 8) A system that determines the precise position of something on Earth through a series of satellites, tracking stations, and receivers.

Globalization (p. 20) Actions or processes that involve the entire world and result in making something worldwide in scope.

Grain (p. 312) Seed of a cereal grass.

Gravity model (p. 438) A model which holds that the potential use of a service at a particular location is directly related to the number of people in a location and inversely related to the distance people must travel to reach the service.

Green revolution (p. 324) Rapid diffusion of new agricultural technology, especially new high-yield seeds and fertilizers.

Greenhouse effect (p. 414) The anticipated increase in Earth's temperature caused by carbon dioxide (emitted by burning fossil fuels) trapping some of the radiation emitted by the surface.

Greenwich Mean Time (GMT) (p. 12) The time in the zone encompassing the prime meridian, or 0° longitude.

Gross domestic product (GDP) (p. 352) The value of the total output of goods and services produced in a country in a year, not accounting for money that leaves and enters the country.

Gross national income (GNI) (p. 352) The value of the output of goods and services produced in a country in a year, including money that leaves and enters the country.

Guest worker (p. 106) A term once used for a worker who migrated to the developed countries of Northern and Western Europe, usually from Southern and Eastern Europe or from North Africa, in search of a higher-paying job.

H

- Habit** (p. 112) A repetitive act performed by a particular individual.
- Hearth** (p. 28) The region from which innovative ideas originate.
- Hierarchical diffusion** (p. 29) The spread of a feature or trend from one key person or node of authority or power to other persons or places.
- Hierarchical religion** (p. 210) A religion in which a central authority exercises a high degree of control.
- Hinterland** (p. 434) The area surrounding a central place from which people are attracted to use the place's goods and services (also known as market area).
- Horticulture** (p. 322) The growing of fruits, vegetables, and flowers.
- Human Development Index (HDI)** (p. 350) An indicator constructed by the U.N. to measure the level of development for a country through a combination of income, education, and life expectancy.
- Humanistic geography** (p. 26) The study of different ways that individuals form ideas about place and give those places symbolic meanings.
- Hydrosphere** (p. 34) All of the water on and near Earth's surface.

- Immigration** (p. 78) Migration to a new location.
- Industrial Revolution** (p. 56) A series of improvements in industrial technology that transformed the process of manufacturing goods.
- Inequality-adjusted Human Development Index (IHDI)** (p. 358) A modification of the HDI to account for inequality.
- Infant mortality rate (IMR)** (p. 61) The total number of deaths in a year among infants under 1 year of age for every 1,000 live births in a society.
- Informal settlement** (p. 474) An area within a city in a less developed country in which people illegally establish residences on land they do not own or rent and erect homemade structures.
- Institutional language** (p. 147) A language used in education, work, mass media, and government.
- Intensive subsistence agriculture** (p. 322) A form of subsistence agriculture characteristics of Asia's major population concentrations in which farmers must expend a relatively large amount of effort to produce the maximum feasible yield from a parcel of land.
- Internal migration** (p. 82) Permanent movement within a particular country.
- Internally displaced person (IDP)** (p. 92) Someone who has been forced to migrate for similar political reasons as a refugee but has not migrated across an international border.
- International Date Line** (p. 13) An arc that for the most part follows 180° longitude, although it deviates in several places to avoid dividing land areas. When the International Date Line is crossed heading east (toward America), the clock moves back 24 hours, or one entire day. When it is crossed heading west (toward Asia), the calendar moves ahead one day.
- International migration** (p. 80) Permanent movement from one country to another.
- Interregional migration** (p. 82) Permanent movement from one region of a country to another.
- Intervening obstacle** (p. 94) An environmental or cultural feature of the landscape that hinders migration.
- Intraregional migration** (p. 82) Permanent movement within one region of a country.
- Isogloss** (p. 166) A boundary that separates regions in which different language usages predominate.
- Isolated language** (p. 176) A language that is unrelated to any other languages and therefore not attached to any language family.

Just-in-time delivery (p. 395) Shipment of parts and materials to arrive at a factory moments before they are needed.

Labor-intensive industry (p. 396) An industry for which labor costs comprise a high percentage of total expenses.

- Landlocked state** (p. 289) A state that does not have a direct outlet to the sea.
- Language** (p. 146) A system of communication through the use of speech, a collection of sounds understood by a group of people to have the same meaning.
- Language branch** (p. 147) A collection of languages related through a common ancestor that can be confirmed through archaeological evidence.
- Language family** (p. 147) A collection of languages related to each other through a common ancestor long before recorded history.
- Language group** (p. 147) A collection of languages within a branch that share a common origin in the relatively recent past and display relatively few differences in grammar and vocabulary.
- Latitude** (p. 12) The numbering system used to indicate the location of parallels drawn on a globe and measuring distance north and south of the equator (0°).
- Life expectancy** (p. 52) The average number of years an individual can be expected to live, given current social, economic, and medical conditions. Life expectancy at birth is the average number of years a newborn infant can expect to live.
- Lingua franca** (p. 160) A language mutually understood and commonly used in trade by people who have different native languages.
- Literacy rate** (p. 355) The percentage of a country's people who can read and write.
- Literary tradition** (p. 147) A language that is written as well as spoken.
- Lithosphere** (p. 34) Earth's crust and a portion of upper mantle directly below the crust.
- Location** (p. 14) The position of anything on Earth's surface.
- Logogram** (p. 161) A symbol that represents a word rather than a sound.
- Longitude** (p. 12) The numbering system used to indicate the location of meridians drawn on a globe and measuring distance east and west of the prime meridian (0°).

M

- Map** (p. 6) A two-dimensional, or flat, representation of Earth's surface or a portion of it.
- Map scale** (p. 10) The relationship between the size of an object on a map and the size of the actual feature on Earth's surface.
- Maquiladora** (p. 421) A factory built by a U.S. company in Mexico near the U.S. border, to take advantage of the much lower labor costs in Mexico.
- Market area** (p. 434) The area surrounding a central place from which people are attracted to use the place's goods and services (also known as hinterland).
- Mashup** (p. 9) A map that overlays data from one source on top of a map provided by a mapping service.
- Maternal mortality rate** (pp. 59, 364) The annual number of female deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes).
- Medical revolution** (p. 56) Medical technology invented in Europe and North America that has diffused to the poorer countries in Latin America, Asia, and Africa. Improved medical practices have eliminated many of the traditional causes of death in poorer countries and enabled more people to live longer and healthier lives.
- Megalopolis** (p. 481) A continuous urban complex in the northeastern United States.
- Mental map** (p. 8) A representation of a portion of Earth's surface based on what an individual knows about a place that contains personal impressions of what is in the place and where the place is located.
- Meridian** (p. 12) An arc drawn on a map between the North and South poles.
- Metropolitan statistical area (MSA)** (p. 460) In the United States, an urbanized area of at least 50,000 population, the county within which the city is located, and adjacent counties meeting one of several tests indicating a functional connection to the central city.

- Microfinance** (p. 375) Provision of small loans and financial services to individuals and small businesses in developing countries.
- Micropolitan statistical area (μSA)** (p. 461) An urbanized area of between 10,000 and 50,000 inhabitants, the county in which it is located, and adjacent counties tied to the city.
- Microstate** (p. 266) A state that encompasses a very small land area.
- Migration** (p. 78) A permanent move to a new location.
- Migration transition** (p. 81) A change in the migration pattern in a society that results from industrialization, population growth, and other social and economic changes that also produces the demographic transition.
- Milkshed** (p. 330) The area surrounding a city from which milk is supplied.
- Millennium Development Goals** (p. 379) Eight goals adopted by the U.N. in 2002 to reduce disparities between developed and developing countries by 2015.
- Missionary** (p. 200) An individual who helps to diffuse a universalizing religion.
- Mixed crop and livestock farming** (p. 328) Commercial farming characterized by integration of crops and livestock; most of the crops are fed to animals rather than consumed directly by humans.
- Mobility** (p. 78) All types of movements between locations.
- Monotheism** (p. 194) The doctrine of or belief in the existence of only one God.
- Multiethnic state** (p. 272) A state that contains more than one ethnicity.
- Multinational state** (p. 272) A state that contains two or more ethnic groups with traditions of self-determination that agree to coexist peacefully by recognizing each other as distinct nationalities.
- Multiple nuclei model** (p. 467) A model of the internal structure of cities in which social groups are arranged around a collection of nodes of activities.

N

- Nation-state** (p. 220) A state whose territory corresponds to that occupied by a particular ethnicity.
- Nationalism** (p. 247) Loyalty and devotion to a particular nationality.
- Nationality** (p. 230) Identity with a group of people who share legal attachment to a particular country.
- Natural increase rate (NIR)** (p. 52) The percentage growth of a population in a year, computed as the crude birth rate minus the crude death rate.
- Net migration** (p. 78) The difference between the level of immigration and the level of emigration.
- Network** (p. 30) A chain of communication that connects places.
- New international division of labor** (p. 420) Transfer of some types of jobs, especially those requiring low-paid, less-skilled workers, from more developed to less developed countries.
- No tillage** (p. 377) A farming practice that leaves all of the soil undisturbed and the entire residue of the previous year's harvest left untouched on the fields.
- Nonbasic business** (p. 446) A business that sells its products primarily to consumers in the same settlement.
- Nonconsumptive water usage** (p. 416) The use of water that is returned to nature as a liquid.
- Nonpoint source pollution** (p. 417) Pollution that originates from a large, diffuse area.
- Nonrenewable energy** (p. 10) A source of energy that has a finite supply capable of being exhausted.
- Nonrenewable resource** (p. 32) Something produced in nature more slowly than it is consumed by humans.
- Overpopulation** (p. 46) A situation in which the number of people in an area exceeds the capacity of the environment to support life at a decent standard of living.
- Ozone** (p. 414) A gas that absorbs ultraviolet solar radiation and is found in the stratosphere, a zone 15 to 50 kilometers (9 to 30 miles) above Earth's surface.

P

- Paddy** (p. 323) The Malay word for wet rice, increasingly used to describe a flooded field.
- Pandemic** (p. 64) Disease that occurs over a wide geographic area and affects a very high proportion of the population.
- Parallel** (p. 12) A circle drawn around the globe parallel to the equator and at right angles to the meridians.
- Participatory GIS (PGIS)** (p. 9) Community-based mapping, representing local knowledge and information.
- Passive solar energy systems** (p. 412) Solar energy systems that collect energy without the use of mechanical devices.
- Pastoral nomadism** (p. 318) A form of subsistence agriculture based on herding domesticated animals.
- Pattern** (p. 23) The geometric or regular arrangement of something in a particular area.
- Perforated state** (p. 286) A state that completely surrounds another one.
- Peripheral model** (p. 480) A model of North American urban areas consisting of an inner city surrounded by large suburban residential and business areas tied together by a beltway or ring road.
- Photochemical smog** (p. 451) An atmospheric condition formed through a combination of weather conditions and pollution, especially from motor vehicle emissions.
- Physiological density** (p. 50) The number of people per unit area of arable land, which is land suitable for agriculture.
- Pidgin language** (p. 160) A form of speech that adopts a simplified grammar and limited vocabulary of a lingua franca; used for communications among speakers of two different languages.
- Pilgrimage** (p. 212) A journey to a place considered sacred for religious purposes.
- Place** (p. 4) A specific point on Earth, distinguished by a particular characteristic.
- Plantation** (p. 318) A large farm in tropical and subtropical climates that specializes in the production of one or two crops for sale, usually to a more developed country.
- Point source pollution** (p. 417) Pollution that enters a body of water from a specific source.
- Polder** (p. 38) Land that the Dutch have created by draining water from an area.
- Pollution** (p. 414) Concentration of waste added to air, water, or land at a greater level than occurs in average air, water, or land.
- Polytheism** (p. 194) Belief in or worship of more than one god.
- Popular culture** (p. 112) Culture found in a large, heterogeneous society that shares certain habits despite differences in other personal characteristics.
- Population pyramid** (p. 60) A bar graph that represents the distribution of population by age and sex.
- Possibilism** (p. 37) The theory that the physical environment may set limits on human actions, but people have the ability to adjust to the physical environment and choose a course of action from many alternatives.
- Post-Fordist production** (p. 424) Adoption by companies of flexible work rules, such as the allocation of workers to teams that perform a variety of tasks.
- Poststructuralist geography** (p. 26) The study of space as the product of ideologies or value systems of ruling elites.
- Potential reserve** (p. 404) The amount of a resource in deposits not yet identified but thought to exist.
- Preservation** (p. 32) The maintenance of resources in their present condition, with as little human impact as possible.
- Primary census area (PSA)** (p. 461) In the United States, any CSA, any MSA not included in a CSA, or any μSA not included in a CSA.

O

Primary sector (p. 352) The portion of the economy concerned with the direct extraction of materials from Earth, generally through agriculture.

Primate city (p. 437) A city that is the largest settlement in a country and has more than twice as many people as the second-ranking settlement.

Primate city rule (p. 437) A pattern of settlements in a country such that the largest settlement has more than twice as many people as the second-ranking settlement.

Prime agricultural land (p. 332) The most productive farmland.

Prime meridian (p. 12) The meridian, designated as 0° longitude, that passes through the Royal Observatory at Greenwich, England.

Productivity (p. 353) The value of a particular product compared to the amount of labor needed to make it.

Projection (p. 11) A system used to transfer locations from Earth's surface to a flat map.

Prorupted state (p. 286) An otherwise compact state with a large projecting extension.

Proven reserve (p. 404) The amount of a resource remaining in discovered deposits.

Public housing (p. 490) Government-owned housing rented to low-income individual, with rents set at 30 percent of the tenant's income.

Public service (p. 432) A service offered by the government to provide security and protection for citizens and businesses.

Pull factor (p. 92) A factor that induces people to move to a new location.

Pupil/teacher ratio (p. 355) The number of enrolled students divided by the number of teachers.

Purchasing power parity (PPP) (p. 352) The amount of money needed in one country to purchase the same goods and services in another country.

Push factor (p. 92) A factor that induces people to move out of their present location.

Quota (p. 102) In reference to migration, a law that places a maximum limit on the number of people who can immigrate to a country each year.

Race (p. 230) Identity with a group of people who are perceived to share a physiological trait, such as skin color.

Racism (p. 232) The belief that race is the primary determinant of human traits and capacities and that racial differences produce an inherent superiority of a particular race.

Racist (p. 232) A person who subscribes to the beliefs of racism.

Ranching (p. 331) A form of commercial agriculture in which livestock graze over an extensive area.

Range (of a service) (p. 435) The maximum distance people are willing to travel to use a service.

Rank-size rule (p. 436) A pattern of settlements in a country such that the n th largest settlement is $1/n$ the population of the largest settlement.

Received Pronunciation (RP) (p. 165) The dialect of English associated with upper-class Britons living in London and now considered standard in the United Kingdom.

Recycling (p. 426) The separation, collection, processing, marketing, and reuse of unwanted material.

Redlining (p. 489) A process by which financial institutions draw red-colored lines on a map and refuse to lend money for people to purchase or improve property within the lines.

Refugee (p. 92) Someone who is forced to migrate from his or her home country and cannot return for fear of persecution because of his or her race, religion, nationality, membership in a social group, or political opinion.

Region (p. 4) An area distinguished by a unique combination of trends or features.

Relocation diffusion (p. 28) The spread of a feature or trend through bodily movement of people from one place to another.

Remittance (p. 97) Transfer of money by workers to people in the country from which they emigrated.

Remote sensing (p. 9) The acquisition of data about Earth's surface from a satellite orbiting the planet or from other long-distance methods.

Renewable energy (p. 410) A resource that has a theoretically unlimited supply and is not depleted when used by people.

Renewable resource (p. 32) Something produced in nature more rapidly than it is consumed by humans.

Resource (p. 32) A substance in the environment that is useful to people, is economically and technologically feasible to access, and is socially acceptable to use.

Ridge tillage (p. 337) A system of planting crops on ridge tops in order to reduce farm production costs and promote greater soil conservation.

Right-to-work law (p. 422) A U.S. law that prevents a union and a company from negotiating a contract that requires workers to join the union as a condition of employment.

Rush hour (p. 484) The four consecutive 15-minute periods in the morning and evening with the heaviest volumes of traffic.

Sanitary landfill (p. 418) A place to deposit solid waste, where a layer of earth is bulldozed over garbage each day to reduce emissions of gases and odors from the decaying trash, to minimize fires, and to discourage vermin.

Sawah (p. 322) A flooded field for growing rice.

Scale (p. 4) Generally, the relationship between the portion of Earth being studied and Earth as a whole.

Secondary sector (p. 352) The portion of the economy concerned with manufacturing useful products through processing, transforming, and assembling raw materials.

Sector model (p. 466) A model of the internal structure of cities in which social groups are arranged around a series of sectors, or wedges, radiating out from the central business district.

Self-determination (p. 272) The concept that ethnicities have the right to govern themselves.

Service (p. 432) Any activity that fulfills a human want or need and returns money to those who provide it.

Settlement (p. 432) A permanent collection of buildings and inhabitants.

Sex ratio (p. 58) The number of males per 100 females in the population.

Sharecropper (p. 242) A person who works fields rented from a landowner and pays the rent and repays loans by turning over to the landowner a share of the crops.

Shifting cultivation (p. 318) A form of subsistence agriculture in which people shift activity from one field to another; each field is used for crops for a relatively few years and left fallow for a relatively long period.

Site (p. 15) The physical character of a place.

Site factors (p. 388) Location factors related to the costs of factors of production inside a plant, such as land, labor, and capital.

Situation (p. 15) The location of a place relative to another place.

Situation factors (p. 388) Location factors related to the transportation of materials into and from a factory.

Slash-and-burn agriculture (p. 320) Another name for shifting cultivation, so named because fields are cleared by slashing the vegetation and burning the debris.

Smart growth (p. 479) Legislation and regulations to limit suburban sprawl and preserve farmland.

Social area analysis (p. 468) Statistical analysis used to identify where people of similar living standards, ethnic background, and lifestyle live within an urban area.

Solstice (p. 217) An astronomical event that happens twice each year, when the tilt of Earth's axis is most inclined toward or away from the Sun, causing the Sun's apparent position in the sky to reach its most northernmost or southernmost extreme, and resulting in the shortest and longest days of the year.

Sovereignty (p. 268) Ability of a state to govern its territory free from control of its internal affairs by other states.

Space (p. 5) The physical gap or interval between two objects.

Space—time compression (p. 30) The reduction in the time it takes to diffuse something to a distant place as a result of improved communications and transportation systems.

Spanglish (p. 159) A combination of Spanish and English spoken by Hispanic Americans.

Spatial association (p. 18) The relationship between the distribution of one feature and the distribution of another feature.

Sprawl (p. 480) Development of new housing sites at relatively low density and at locations that are not contiguous to the existing built-up area.

Standard language (p. 165) The form of a language used for official government business, education, and mass communications.

State (p. 266) An area organized into a political unit and ruled by an established government that has control over its internal and foreign affairs.

Stimulus diffusion (p. 29) The spread of an underlying principle even though a specific characteristic is rejected.

Structural adjustment program (p. 374) Economic policies imposed on less developed countries by international agencies to create conditions that encourage international trade.

Subdialect (p. 164) A subdivision of a dialect.

Subsistence agriculture (p. 310) Agriculture designed primarily to provide food for direct consumption by the farmer and the farmer's family.

Suburb (p. 478) A residential or commercial area situated within an urban area but outside the central city.

Sustainability (p. 32) The use of Earth's renewable and nonrenewable natural resources in ways that do not constrain resource use in the future.

Sustainable development (p. 494) Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable Development Goals (p. 379) Seventeen goals adopted by the U.N. in 2015 to reduce disparities between developed and developing countries by 2030.

Swidden (p. 320) A patch of land cleared for planting through slashing and burning.

Syncretism (p. 28) The combining of elements of two groups into a new cultural feature.

T

Taboo (p. 127) A restriction on behavior imposed by social custom.

Terroir (p. 126) The contribution of a location's distinctive physical features to the way food tastes.

Terrorism (p. 298) The systematic use of violence by a group calculated to create an atmosphere of fear and alarm among a population or to coerce a government into actions it would not otherwise undertake or refrain from actions it wants to take.

Tertiary sector (p. 352) The portion of the economy concerned with transportation, communications, and utilities, sometimes extended to the provision of all goods and services to people in exchange for payment.

Threshold (p. 435) The minimum number of people needed to support a service.

Toponym (p. 14) The name given to a portion of Earth's surface.

Total fertility rate (TFR) (p. 55) The average number of children a woman will have throughout her childbearing years.

Transhumance (p. 319) The seasonal migration of livestock between mountains and lowland pastures.

Transnational corporation (p. 20) A company that conducts research, operates factories, and sells products in many countries, not just where its headquarters or shareholders are located.

Triangular slave trade (p. 240) A practice, primarily during the eighteenth century, in which European ships transported slaves from Africa to Caribbean islands, molasses from the Caribbean to Europe, and trade goods from Europe to Africa.

Truck farming (p. 327) Commercial gardening and fruit farming, so named for the Middle English word *truck*, meaning "barter" or "exchange of commodities."

U

Unauthorized immigrant (p. 100) A person who enters a country without proper documents to do so.

Underclass (p. 488) A group in society prevented from participating in the material benefits of a more developed society because of a variety of social and economic characteristics.

Undernourishment (p. 343) Dietary energy consumption that is continuously below the minimum requirement for maintaining a healthy life and carrying out light physical activity.

Uneven development (p. 27) The increasing gap in economic conditions between core and peripheral regions as a result of the globalization of the economy.

Unitary state (p. 289) An internal organization of a state that places most power in the hands of central government officials.

Universalizing religion (p. 185) A religion that attempts to appeal to all people, not just those living in a particular location.

Urban area (p. 460) A central city and its surrounding built-up suburbs.

Urban cluster (p. 460) In the United States, an urban area with between 2,500 and 50,000 inhabitants.

Urbanization (p. 452) An increase in the percentage of and the number of people living in urban settlements.

Urbanized area (p. 460) In the United States, an urban area with at least 50,000 inhabitants.

V

Value added (p. 353) The gross value of a product minus the costs of raw materials and energy.

Vernacular region (or perceptual region) (p. 17) An area that people believe exists as part of their cultural identity.

Vertical integration (p. 420) An approach typical of traditional mass production in which a company controls all phases of a highly complex production process.

Vigorous language (p. 147) A language that is spoken in daily use but that lacks a literary tradition.

Voluntary migration (p. 82) Permanent movement undertaken by choice.

Volunteered geographic information (VGI) (p. 9) Creation and dissemination of geographic data contributed voluntarily and for free by individuals.

Vulgar Latin (p. 156) A form of Latin used in daily conversation by ancient Romans, as opposed to the standard dialect, which was used for official documents.

W

Wet rice (p. 322) Rice planted on dry land in a nursery and then moved to a deliberately flooded field to promote growth.

Z

Zero population growth (ZPG) (p. 56) A decline of the total fertility rate to the point where the natural increase rate equals zero.

Zoning ordinance (p. 482) A law that limits the permitted uses of land and maximum density of development in a community.