

assessment of terrestrial species and habitat, land stewardship, and management status that began in 2004. The Northwest GAP is part of a nationwide GAP environmental quality assessment by the USGS for species conservation; critical data layers are vegetation type, species range, and land ownership, among other environmental variables. (See <http://gapanalysis.usgs.gov/> or <http://gap.uidaho.edu> to read a project overview and to access interactive maps.)

Geographic information science (GISci) is the field that develops the capabilities of GIS technology for use within geography and other disciplines. GISci analyzes Earth and human phenomena over time. This can include the study and forecasting of diseases, the population displacement caused by Hurricane Sandy, the destruction from the Japan earthquake and tsunami in 2011, and the status of endangered species and ecosystems, to name a few examples.

GIS technology is widely used in the creation of maps with a three-dimensional perspective. These maps are produced by combining *digital elevation models* (DEMs), which provide the base elevation data, with satellite-image overlays (see examples in Chapter 10). Through GIS technology, these data are available for multiple displays, animations, and other scientific analyses.

Visualization Technologies Google Earth™ and similar programs that can be downloaded from the Internet provide three-dimensional viewing of the globe and

related geographic information. Google Earth™ allows the user to zoom in on landscapes and features of interest, using satellite imagery and aerial photography at varying resolutions. Users can select layers, as in a GIS model, depending on the task at hand and the composite overlay displayed. NASA's World Wind software is another open-source browser with access to high-resolution satellite images and multiple data layers suitable for scientific applications.

Geovisualization is a set of technologies for adjusting geospatial data sets in real time, so that users can instantly make changes to maps and other visual models. Geovisual tools are important for translating scientific knowledge into resources that nonscientists can use for decision making and planning. For example, scientists at East Carolina University, in partnership with state, local, and nonprofit organizations, are developing geovisual tools to assess the effects of sea-level rise along the North Carolina coast (see <http://www.ecu.edu/renci/Technology/GIS.html>).

Access to GIS technology, geovisualization tools, and large scientific data sets is expanding and becoming more user-friendly. Numerous open-source GIS software packages are now available. These are usually free, have online support systems, and are updated frequently (see <http://opensourcegis.org/>). In addition, public access to large remote-sensing data sets for analysis and display is now available, without the need to download large amounts of data (see examples of research applications at <http://disc.sci.gsfc.nasa.gov/>).

KEYLEARNINGconceptsreview

Here is a handy summary designed to help you review the Key Learning Concepts listed on this chapter's title page. The recap of each concept concludes with a list of the key terms from that portion of the chapter, their page numbers, and review questions pertaining to the concept. Similar summary and review sections follow each chapter in the book.

Define geography in general and physical geography in particular.

Geography combines disciplines from the physical and life sciences with disciplines from the human and cultural sciences to attain a holistic view of Earth. Geography's **spatial** viewpoint examines the nature and character of physical space and the distribution of phenomena within it. Geographic science integrates a wide range of subject matter traditionally categorized into five major themes: **location**, **region**, **human–Earth relationships**, **movement**, and **place**. Methods of **spatial analysis** unify this diverse field, focusing on the interdependence among geographic areas, natural systems, society, and cultural activities over space. The analysis of **process**—a set of actions or mechanisms that operate in some special order—is also central to geographic understanding.

Physical geography applies spatial analysis to all the physical components and process systems that make up the environment: energy, air, water, weather, climate, landforms, soils, animals, plants, microorganisms, and Earth itself. Physical geography is an essential aspect of **Earth systems science**. The science of physical geography is uniquely qualified to synthesize the spatial, environmental, and human aspects of our increasingly complex relationship with our home planet—Earth.

geography (p. 2)	place (p. 2)
spatial (p. 2)	spatial analysis (p. 4)
location (p. 2)	process (p. 4)
region (p. 2)	physical geography (p. 4)
human–Earth relationships (p. 2)	Earth systems science (p. 4)
movement (p. 2)	

1. On the basis of information in this chapter, define physical geography and review the approach that characterizes the geographic sciences.
2. Suggest a representative example for each of the five geographic themes; for instance, an example of the movement theme might be oceanic circulation spreading debris from the Japan tsunami.