**Lesson 1. Geographic Techniques**

Specialists in geographic techniques study the ways in which geographic processes can be analyzed and represented using different methods and technologies. Mapmaking, or cartography, is perhaps the most basic of these. Cartography has been instrumental to geography throughout the ages.

As early as 1500 BCE, Polynesian navigators in the Pacific Ocean used complex maps made of tiny sticks and shells that represented islands and ocean currents they would encounter on their voyages. Today, satellites placed into orbit by the U.S. Department of Defense communicate with receivers on the ground called global positioning system (GPS) units to instantly identify exact locations on Earth.

Today, almost the entire surface of Earth has been mapped with remarkable accuracy, and much of this information is available instantly on the internet. One of the most remarkable of these websites is Google Earth, which “lets you fly anywhere on Earth to view satellite imagery, maps, terrain, 3D buildings, from galaxies in outer space to the canyons of the ocean.” In essence, anyone can be a virtual Christopher Columbus from the comfort of home.

Technological developments during the past 100 years have given rise to a number of other specialties for scientists studying geographic techniques. The airplane made it possible to photograph land from above. Now, there are many satellites and other above-Earth vehicles that help geographers figure out what the surface of the planet looks like and how it is changing.

Geographers looking at what above-Earth cameras and sensors reveal are specialists in remote sensing. Pictures taken from space can be used to make maps, monitor ice melt, assess flood damage, track oil spills, predict weather, or perform endless other functions. For example, by comparing satellite photos taken from 1955 to 2007, scientists from the U.S. Geological Survey (USGS) discovered that the rate of coastal erosion along Alaska’s Beaufort Sea had doubled. Every year from 2002 to 2007, about 45 feet per year of coast, mostly icy permafrost, vanished into the sea.

Computerized systems that allow for precise calculations of how things are distributed and relate to one another have made the study of geographic information systems (GIS) an increasingly important specialty within geography. Geographic information systems are powerful databases that collect all types of information (maps, reports, statistics, satellite images, surveys, demographic data, and more) and link each piece of data to a geographic reference point, such as geographic coordinates. This data, called geospatial information, can be stored, analyzed, modeled, and manipulated in ways not possible before GIS computer technology existed.

The popularity and importance of GIS has given rise to a new science known as geographic information science (GISci). Geographic information scientists study patterns in nature as well as human development. They might study natural hazards, such as a fire that struck Los Angeles, California, in 2008. A map posted on the internet showed the real-time spread of the fire, along with information to help people make decisions about how to evacuate quickly. GIS can also illustrate human struggles from a geographic perspective, such as the interactive online map published by the New York Times in May 2009 that showed building foreclosure rates in various regions around the New York City area.

The enormous possibilities for producing computerized maps and diagrams that can help us understand environmental and social problems have made geographic visualization an increasingly important specialty within geography. This geospatial information is in high demand by just about every institution, from government agencies monitoring water quality to entrepreneurs deciding where to locate new businesses.