GIS (geographic information system)

geospatial information system

For the complete encyclopedic entry with media resources, visit:
http://education.nationalgeographic.org/encyclopedia/geographic-information-system-gis/

A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships.

With GIS technology, people can compare the locations of different things in order to discover how they relate to each other. For example, using GIS, the same map could include sites that produce pollution, such as gas stations, and sites that are sensitive to pollution, such as wetlands. Such a map would help people determine which wetlands are most at risk.

GIS can use any information that includes location. The location can be expressed in many different ways, such as latitude and longitude, address, or ZIP code. Many different types of information can be compared and contrasted using GIS. The system can include data about people, such as population, income, or education level. It can include information about the land, such as the location of streams, different kinds of vegetation, and different kinds of soil. It can include information about the sites of factories, farms, and schools, or storm drains, roads, and electric power lines.

Data and GIS

Data in many different forms can be entered into GIS. Data that are already in map form can be included in GIS. This includes such information as the location of rivers and roads, hills and valleys. Digital, or computerized, data can also be entered into GIS. An example of this kind of information is data collected by satellites that show land use—the location of farms, towns, or forests. GIS can also include data in table form, such as population information. GIS technology allows all these different types of information, no matter their source or original format, to be overlaid on top of one another on a single map.

Putting information into GIS is called data capture. Data that are already in digital form, such as images taken by satellites and most tables, can simply be uploaded into GIS. Maps must be scanned, or converted into digital information.

GIS must make the information from all the various maps and sources align, so they fit together. One reason this is necessary is because maps have different scales. A scale is the relationship between the distance on a map and the actual distance on Earth. GIS combines the information from different

sources in such a way that it all has the same scale.

Often, GIS must also manipulate the data because different maps have different projections. A projection is the method of transferring information from Earth's curved surface to a flat piece of paper or computer screen. No projection can copy the reality of Earth's curved surface perfectly. Different types of projections accomplish this task in different ways, but all result in some distortion. To transfer a curved, three-dimensional shape onto a flat surface inevitably requires stretching some parts and squeezing other parts. A world map can show either the correct sizes of countries or their correct shapes, but it can't do both. GIS takes data from maps that were made using different projections and combines them so all the information can be displayed using one common projection.

GIS Maps

Once all of the desired data have been entered into a GIS system, they can be combined to produce a wide variety of individual maps, depending on which data layers are included. For instance, using GIS technology, many kinds of information can be shown about a single city. Maps can be produced that relate such information as average income, book sales, and voting patterns. Any GIS data layer can be added or subtracted to the same map.

GIS maps can be used to show information about number and density. For example, GIS can be used to show how many doctors there are in different areas compared with the population. They can also show what is near what, such as which homes and businesses are in areas prone to flooding.

With GIS technology, researchers can also look at change over time. They can use satellite data to study topics such as how much of the polar regions is covered in ice. A police department can study changes in crime data to help determine where to assign officers.

GIS often contains a large variety of data that do not appear in an onscreen or printed map. GIS technology sometimes allows users to access this information. A person can point to a spot on a computerized map to find other information stored in the GIS about that location. For example, a user might click on a school to find how many students are enrolled, how many students there are per teacher, or what sports facilities the school has.

GIS systems are often used to produce three-dimensional images. This is useful, for example, to geologists studying faults.

GIS technology makes updating maps much easier. Updated data can simply be added to the existing GIS program. A new map can then be printed or displayed on screen. This skips the traditional process of drawing a map, which can be time-consuming and expensive.

People working in many different fields use GIS technology. Many businesses use GIS to help them determine where to locate a new store. Biologists use GIS to track animal migration patterns. City

officials use GIS to help plan their response in the case of a <u>natural disaster</u> such as an earthquake or <u>hurricane</u>. GIS maps can show these officials what neighborhoods are most in danger, where to locate shelters, and what routes people should take to reach safety. Scientists use GIS to compare population growth to resources such as drinking water, or to try to determine a region's future needs for public services like parking, roads, and electricity. There is no limit to the kind of information that can be analyzed using GIS technology.

Vocabulary

Term	Part of Speech	Definition
accomplish	verb	to succeed or complete a goal.
align	verb	to put in a straight line.
assign	noun	to give or distribute.
biologist	noun	scientist who studies living organisms.
crime	noun	unlawful activity.
data	plural noun	(singular: datum) information collected during a scientific study.
data capture	noun	process of putting information into a geographic information system (GIS).
density	noun	number of things of one kind in a given area.
digital	adjective	having to do with numbers (or digits), often in a format used by computers.
distortion	noun	representation that is twisted, mistaken, or false.
enable	verb	to empower or allow.
expensive	adjective	very costly.
facility	noun	a building or room that serves a specific function.
factory	noun	one or more buildings used for the manufacture of a product.
farm	noun	land cultivated for crops, livestock, or both.
fault	noun	a crack in the Earth's crust where there has been movement.
flood	noun	overflow of a body of water onto land.
forest	noun	ecosystem filled with trees and underbrush.

Term	Part of Speech	Definition
geographic information system (GIS)	*noun*	any system for capturing, storing, checking, and displaying data related to positions on the Earth's surface.
geologist	*noun*	person who studies the physical formations of the Earth.
hill	*noun*	land that rises above its surroundings and has a rounded summit, usually less than 300 meters (1,000 feet).
hurricane	*noun*	tropical storm with wind speeds of at least 119 kilometers (74 miles) per hour. Hurricanes are the same thing as typhoons, but usually located in the Atlantic Ocean region.
income	*noun*	wages, salary, or amount of money earned.
land use	*noun*	range of purposes people put to the earth.
latitude	*noun*	distance north or south of the Equator, measured in degrees.
location	*noun*	position of a particular point on the surface of the Earth.
longitude	*noun*	distance east or west of the prime meridian, measured in degrees.
manipulate	*verb*	to manage a complex device or situation with great skill.
map	*noun*	symbolic representation of selected characteristics of a place, usually drawn on a flat surface.
map projection	*noun*	method by which shapes on a globe are transferred to a flat surface.
migration	*noun*	movement of a group of people or animals from one place to another.
natural disaster	*noun*	an event occurring naturally that has large-scale effects on the environment and people, such as a volcano, earthquake, or hurricane.
polar	*adjective*	having to do with the North and/or South Pole.
pollution	*noun*	introduction of harmful materials into the environment.
power line	*noun*	cable or cord used to transfer electricity from a power plant to a population center. Also called a transmission line.
projection	*noun*	flat representation of a sphere.
prone	*adjective*	vulnerable or tending to act in a certain way.

Term	Part of Speech	Definition
river	noun	large stream of flowing fresh water.
road	noun	path, usually paved, for vehicles to travel.
satellite	noun	object that orbits around something else. Satellites can be natural, like moons, or made by people.
scale	noun	relationship between distances shown on a map and actual distances.
scan	verb	to transfer data, usually visual, on to a computer.
soil	noun	top layer of the Earth's surface where plants can grow.
storm drain	noun	system to empty streets of excess rainwater. Storm drains flow into local creeks, rivers, or seas.
technology	noun	the science of using tools and complex machines to make human life easier or more profitable.
three-dimensional	adjective	having the appearance of width, height, and depth.
town	noun	human settlement larger than a village and smaller than a city.
upload	verb	to transfer electronic information from a smaller computer to a larger computer.
valley	noun	depression in the Earth between hills.
vegetation	noun	all the plant life of a specific place.
voting pattern	noun	general way a specific population votes in political elections.
wetland	noun	area of land covered by shallow water or saturated by water.
ZIP code	noun	(zone improvement plan) series of numbers used to help locate an address for mail delivery.

Articles & Profiles
- National Geographic News: Police Use GIS in DC-Area Sniper Case

Interactives
- National Geographic Education: MapMaker Interactive

Websites
- USGS: Geographic Information Systems