

Introduction to Geographic Information Systems (GIS)

What is GIS?

A **Geographic Information System (GIS)** is a computer system of mapping tools and resources that collectively are capable of managing, analyzing, and displaying **geographic information**.

What is Geographic Information?

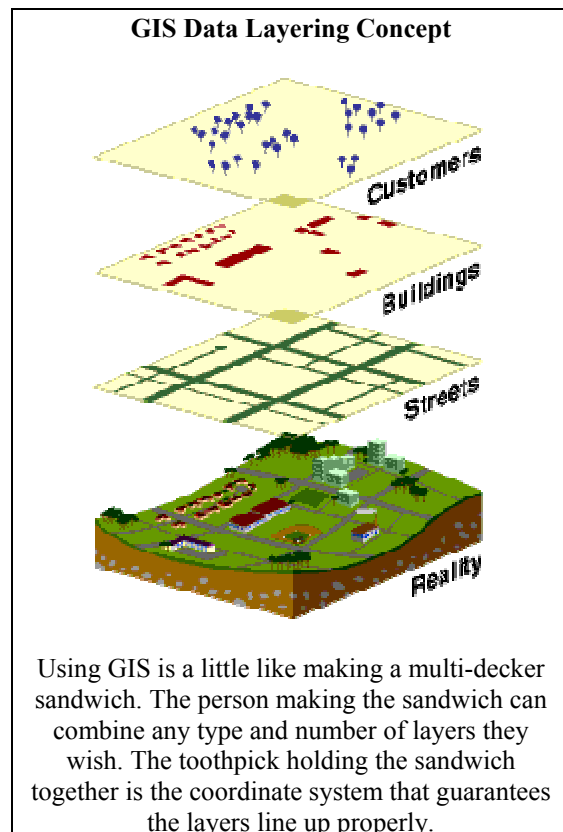
Geographic information refers to geographically referenced data or information, i.e. data identified according to their locations, also referred to as spatial data.

What Can GIS Do?

When information, in digital form, is geographically referenced (meaning that the information is linked to specific places on the earth, using a system such as Latitude/Longitude) it can then be used as a **map layer** in GIS. Each **map layer**, or **theme**, thus consists of geographic, or spatial, data linked to descriptive, or tabular, information.

GIS uses known earth coordinates (such as Latitude/Longitude) to make sure each layer lines up correctly with the others (see the example to the right).

The strength of GIS lies in its ability to create and organize these distinct map layers for different types of information, and then to overlay and combine layers as necessary to create maps and perform analyses.



Using Geographic information and GIS in Decision Making

GIS and **geographic information** are key components to better decision-making since just about everything a community, business, or public agency does, whether in day-to-day operations or long-term planning, is related to its geography. In fact, many routine operations of business and government are tied to a location and rely on the use of geographic information to accomplish their goal. GIS has been used by the defense, natural resources, and planning communities for many years, and is now being used by many more sectors including transportation, marketing, utilities, emergency management, sales, and education, to name just a few. Examples include:

Land-use planning

Where is growth happening?

Marketing

Where are our customers?

Subdivision review

Where is the wetland?

Permit tracking

Whose property is the permit attached to?

Parcel/tax mapping

Who are Jane Doe's abutters?

Natural resource management

Where are the invasive species spreading?

Road and utility maintenance

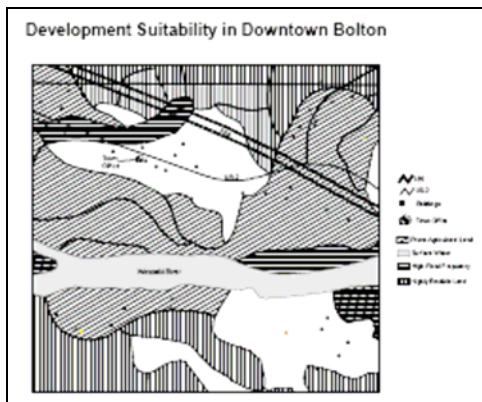
Where is the downed power line blocking the road?

Crime, fire, accident events & reporting

Where do the most accidents take place?

Emergency dispatching

Where is the E-9-1-1 call originating from?



For example, a community involved in municipal planning might want to know how suitable different areas of the town are for development. GIS can be used to generate maps showing where various conditions exist: prime agricultural land, surface water, high flood frequency, and highly erodible land (see map example). Planners can use this information to make decisions about zoning designations and building permits.

Computer Mapping: Moving Beyond Traditional Maps

For many years, personnel involved in these routine operations described above have had to rely on reams of printed material, hand-drawn maps and their own imaginations to consider alternatives and make choices. Traditional paper maps exist in many different map scales (the relationship between distance on the map and distance on the ground, e.g. 1 inch = 1 mile) and projections (scheme used to represent the sphere of the earth as a flat picture), making it next to impossible to superimpose or overlay them the way GIS can.

GIS can mathematically transform map features from one scale or projection to another to allow map layers from different sources to be used together. Traditional maps are also less efficient because changes require starting from scratch with a brand-new map. Once information is entered into a GIS system, it is a simple matter to change the data on the computer and produce an updated product. GIS can produce maps at any size, depicting an entire community or only a selected area.

Different types of Mapping Applications and GIS Software

Online mapping applications are becoming increasingly common on the web. Example mapping applications include those available from MapQuest (<http://www.mapquest.com/>) and GoogleMaps (<http://maps.google.com/>) that are designed to show locations and provide directions.

Other applications are created to serve as online atlases that feature geographic information with satellite imagery, maps, and terrain models to explore areas throughout the world. Examples include GoogleEarth (<http://earth.google.com/>) and MapMachine from National Geographic (<http://plasma.nationalgeographic.com/mapmachine/>).

There are also many different GIS software products; some cater to particular sectors and uses (search for “GIS software” on the internet to explore your options).

Products created by ESRI (<http://www.esri.com>) are the state standard in Vermont (most state agencies use them), and they include a suite of products called ArcGIS (ArcInfo, ArcEditor, ArcView as well as others).

ESRI also provides software called **ArcExplorer**, which is free and available for download from the web. ArcExplorer includes much of the same functionality found in more sophisticated packages but is a simpler way to view and manipulate geographic data. In addition, ArcExplorer – Java Edition for Education works with both the Windows and the Macintosh OS X platforms.

Summary: What can GIS do?

- Assemble, Organize and Manage Geographic Data
- Perform Queries & Analyses using Geographic Data as Layers or Themes
- Create New Data and Information to Assist Decision Making
- Allow for the Visualization of Data
- Generate Maps and Export Tabular Data

Visit the Following Sites to Learn More about GIS:

Vermont Center for Geographic Information, Inc. (VCGI)

What is GIS?

http://www.vcgi.org/commres/about_gis/

GIS.com (ESRI)

The Guide to Geographic Information Systems (GIS)

<http://www.gis.com/>