

## 2.0 Introduction to GIS

**GIS or geographic information system** refers to a computerized data management system used to capture, store, manage, retrieve, analyze, and display information using spatial properties. The spatially related data in a GIS are commonly called themes or data layers.

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### GIS data

In order for data be used in a GIS, it must be in digital or electronic format. Data can be entered into GIS similar to any other database. The data should be similar to a table with columns, identifiers, and parameter values. The language used in ArcGIS for tables refers to columns as ‘fields’ and rows as ‘records’. This is illustrated below:

Field1	Field2	Field3
Record1	Record1	Record1
Record2	Record2	Record2

Maps, drawings, photographs, and other pictures can be input into a GIS if they are available in an electronic format. For example, aerial photographs can be scanned and saved in an electronic file on your computer. It is important to remember that these ‘scanned’ or imported images have no spatial value until they are georeferenced. Georeferencing refers to the process of assigning coordinate values to locations on an image.

Data can also be integrated into GIS by using GPS techniques. GPS equipment is used to identify specific spatial information (x, y, and z) for a particular location. Most GPS equipment come with software for transferring the GPS collected points. When acquiring a position with GPS, other attributes can be saved with the location. These attributes might be land use, soil type, geology, sampling site, water chemistry, etc.

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### Spatial objects

Information can be entered into GIS and associated with different types of spatial objects. There are two main types of spatial objects: raster and vector. Generally, all data entered into a GIS database are linked to some spatial object. This linkage is what separates GIS from other database applications.

### Raster

Raster representation consists of a surface area that has been divided into grid cells. Each cell is assigned a specific value and is of equal dimensions. Raster cells are most often square but may also be rectangular (Longley et al., 2001). Raster data is used to express some value that can be measured for any location and varies spatially, such as elevation, land use, and geology.

Using raster data can be very challenging because the files tend to be large. If you plan to use and manipulate large raster datasets, be sure to use an adequate computer. You may experience many computer crashes if you use a computer that is not appropriate for GIS raster evaluations.

### **Vector**

Vector objects are data that do not cover the entire spatial surface but are better represented by points, lines, or polygons. Points may be used to identify specific locations (e.g., sampling locations, site where a particular insect or invasive was located, orientation point for map viewer). Lines are used to link to points by a specific path (e.g., roads, streams). Polygons are selected to represent enclosed area boundaries (e.g., city boundary, forest boundary, field boundary, political boundaries).

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Knowledge of the different spatial objects is important so that you can determine the type of data you need for a particular application. The most frequent 'new' type of object that is created by the GIS user (non-developer) is to create a point layer. A point layer might be created if you had a selection of locations (latitude and longitude coordinates) and wanted to map them with other GIS layers.

### **Reference**

Longley, P.A., M.F. Goodchild, D.J. Maguire, and D.W. Rhind. 2001. Geographic information systems and science. John Wiley & Sons, LTD: England.