

Types of Geospatial Information

This tutorial is part of an educational series produced by members of the [Big Ten Academic Alliance Geospatial Information Network](#).



Prepared by: Nicole Kong, Associate Professor, GIS Specialist, Purdue University (kongn@purdue.edu).



These slides and the accompanying activities are licensed under a [Creative Commons Attribution 4.0 International](#) license.

Introduction

- There are many types of data that can be brought into GIS.
- The “type” introduced in this tutorial refers to the different data models that can usually be discovered from a geodata portal or other data portal sites. Or, the data models that GIS professionals usually use to collect and share information.
- It doesn’t refer to the topic, content, or the purpose of the information, the information source, or any other aspects.
- BTAA Geoportal Project Glossary of Terms <https://sites.google.com/umn.edu/btaa-gdp/about/project-documents/glossary>

Geospatial Information Types

- GIS data are usually stored in one of the following data models
 - Vector
 - Raster
 - Tabular
- Geospatial information can be found from scanned maps
- GIS data can be hosted online using web services

Vector

Web Services

Raster

Tabular

Scanned Map

Vector Data

Vector

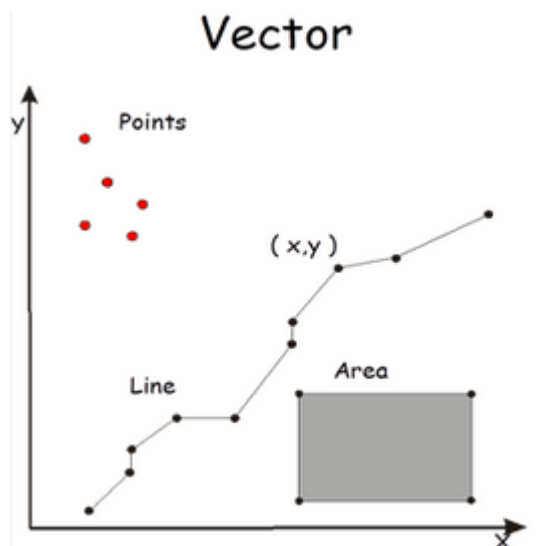
Web Services

Raster

Tabular

Scanned Map

- Vector data are comprised of vertices and lines (or arcs), represented explicitly in the form of XY coordinates.
- The 3 basic geometry types for vector data are:
 - Points - XY coordinates
 - Example: cities, schools, incident locations
 - Lines - connecting the points in a set order
 - Example: roads, streams
 - Polygons - a set of points in a particular order and close it (the 1st and last point are the same)
 - Example: a state, county, or census block
- Most GIS applications do not allow mixed geometry type In a single layer



*Vector Data Types *Used by permission of Paul Bolstad, GIS Fundamentals*

- Each vector feature has attribute data that describe it.

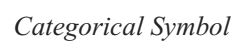
Ecology of our study area

Vegetation

Shape	Class	Description	Growth_index	Fire_hazard	Soil_type
Polygon	1	Woodland	22	Medium	Loam
Polygon	1	Woodland	22	Medium	Loam
Polygon	3	Scrub	17	Very high	Clay
Polygon	3	Scrub	17	Very high	Clay
Polygon	3	Scrub	17	Very high	Clay
Polygon	2	Grassland	25	High	Sandy
Polygon	2	Grassland	25	High	Sandy
Polygon	1	Woodland	22	Medium	Loam

Attribute Data

- Vector data are usually saved as a shapefile or a feature class in a geodatabase (In Arc/Info (1980-1999), it can also be saved in coverage format).
- Vector symbology:



Raster Data



- Raster data is made up of pixels with each pixel has its own Value.
- Raster data is usually used to represent surfaces.
- Raster data model is commonly used for digital elevation models (DEM), aerial and satellite imagery, and land use land cover maps.
- Raster data resolution: cell dimension, or the size of pixels.
- Raster images can consume a large amount of storage space.

Raster Data Types

*Raster Data Types *Used by permission of Paul Bolstad, GIS Fundamentals*

- Two types of raster data: **continuous** and **discrete**
- **Discrete** rasters have distinct themes or categories. Each class can be discretely defined, usually by integer values. Example, land cover/use map.
- **Continuous** rasters are grid cells with gradual changing data such as elevation and temperature.

Raster Two Types

*Continuous and Categorical Data *Used by permission of Paul Bolstad, GIS Fundamentals*

- Raster data are usually saved in the format of raster dataset, GeoTIFF, or many other formats.

Vector vs. Raster

	Vector	Raster
Positional Precision	Can be precise	Defined by cell size
Attribute Precision	Poor for continuous data	Good for continuous data
Output Quality	Very good, map like	Fair to poor, depending on resolution
Data Structure	Often complex	Often quite simple
Storage Requirement	Relatively small	Often quite large
Spatial Analysis	Good topology relationship	Good for modeling

Tabular Data

Vector	Web Services
Raster	
Tabular	
Scanned Map	

- Tables with geospatial information can be used for mapping purpose in GIS.
- Tables with information that can be joined with an existing map Reference: Tutorial about table join
- Tables with XY coordinate information
- Tables with address information
 - Geocoding

Scanned Maps

Vector	Web Services
Raster	

Tabular

Scanned Map

- A scanned map stored as an image file.
- Georeferenced scanned map: has a linked file that stores spatial information so that it can be overlaid with other digital maps in GIS. Usually stored as GeoTIFF.
- Un-georeferenced scanned map: The presence of coordinates in the record's metadata does not make the map georeferenced. Can be saved as TIFF or JPG, etc.

Scanned Map

A Scanned Map

Web Services - GIS

Vector

Web Services

Raster

Tabular

Scanned Map

- A streaming GIS layer that can be viewed and queried in a browser or GIS application.
- Types of GIS web services - they are often provided using either Esri format or open standard defined by Open Geospatial Consortium (OGC)

Esri	ArcGIS Dynamic Map Layer Service	Vector data. Map image layers are dynamically rendered.
	ArcGIS Feature Layer Service	Displays vector data as individual or collected features.
	ArcGIS Image Map Layer Service	Displays raster data (a grid of cells used to store imagery).

	ArcGIS Tiled Map Layer Service	Displays set of web-accessible tiles that reside on a server.
OGC	Web Mapping Service (WMS)	Renders a geospatial dataset as map images.
	Web Feature Service (WFS)	Serves queryable geographic features.
IIIF	International Image Interoperability Framework (IIIF)	Displays an image from a server. This image can be panned and zoomed.

How to Find These Data in the BTAA Geoportal

The [Big Ten Academic Alliance Geoportal](#) connects users to digital geospatial resources, including **GIS datasets**, **web services**, and **digitized historical maps** from multiple data clearinghouses and library catalogs. The site is solely a search tool and does not host any data.

Search by Resource Class

Once you are at the search results page of BTAA Geoportal, you have filter options on the left of the screen. You can filter your search by **Resource Class**.

- **Datasets:** vector or raster data
- **Maps:** scanned maps and photographs
- **Web Services:** for items with a web service, such as an ArcGIS REST service, an OGC web service, or IIIF.
- **Imagery** Aerial photography and satellite imagery
- **Collections:** describe a group of records, typically as a description of and website link to the group's original geoportal or library.
- **Websites:** interactive web resource, such as dashboard.

Related Resources

- [BTAA Geoportal Project Glossary of Terms](#)
- [Finding Geospatial Data \(Tutorial\)](#)
- [Linking tabular data to geospatial data \(Tutorial\)](#)
- [Using GIS web services \(Tutorial\)](#)

Exercise

- Find an example for each of following type of data from BTAA geoportal. Discuss the use cases of each data type, as well as pros/cons of the particular data type.
- Vector data
- Raster data
- Scanned map
- Web service

Wrapping Up

This tutorial is part of an educational series produced by members of the [Big Ten Academic Alliance Geoportal](#). The BTAA Geoportal connects users to digital geospatial resources, including GIS datasets, web services, and digitized historical maps from multiple data clearinghouses and library catalogs. The site is solely a search tool and does not host any data.

To access additional tutorials in this series that cover various other topics, visit: <https://sites.google.com/umn.edu/btaa-gdp/tutorials>.

License statement: Except where otherwise noted, content in this tutorial is licensed under a [Creative Commons Attribution 4.0 International license](#).

Providing attribution for this work: “Types of Geospatial Information” by [Nicole Kong](#) is licensed under a [Creative Commons Attribution 4.0 International license](#).