GIS Data

https://paititi.info/research-technology/geographic-information-systems/
GIS Data Models: Raster vs. Vector

1) Raster – Images consisting of pixels
   ❖ Shows “real world” surface features
     ➢ reflection & emission (wavelength)
     ➢ brightness, color, contrast

2) Vector – Points, lines, polygons
   ❖ Represents features symbolically
     ➢ outlines, line weight/symbol
     ➢ unique icon
     ➢ colors/patterns
Both data models are:

- Spatial – geographic shape and extent
- Georeferenced –
  - tied to a particular location in space
  - referenced by a coordinate system
    (location on surface)
Some ArcGIS terminology:

- **Node** (end node is red): beginning & end points
- **Vertex**: intermediate points along the path
- **Line segment** (vector)
- **Polygon** boundary
- **Centroid**: center point of the polygon
Summary of Vector model

- Small file sizes: stores coordinate pairs, and line length and direction
- Joined with attribute data (a table)
  - Tied to each feature (point, line, or polygon)
- Vector datasets
  - can be displayed by GIS (symbolically)
  - can be projected in GIS (mathematical representation)
  - can be edited (add, change, delete node coordinates)
ArcGIS Vector Formats

Geodatabase vs Shapefile
### ArcGIS Vector - Shapefiles

<table>
<thead>
<tr>
<th>ICON</th>
<th>FILE TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>🗺️</td>
<td>Shapefile, point</td>
<td>Vector dataset, contains only point features</td>
</tr>
<tr>
<td>📢</td>
<td>Shapefile, line</td>
<td>Vector dataset, contains only line features</td>
</tr>
<tr>
<td>🕯️</td>
<td>Shapefile, polygon</td>
<td>Vector dataset, contains only polygon features</td>
</tr>
</tbody>
</table>

**Files as seen in Catalog**

- GlobalMars_vectors_1atlon
- Crater_Catalogs_not_updated
- Barlow_crater_version1
  - barlow_craters_all.shp
- Geology_1802ABC
- Graticules
  - iatong.shp
  - WORLD30.shp
  - WORLD30_line.shp
  - world30_occ.shp
- Tectonic
  - AA_tectonic_readme.txt
  - GCS_Mars_Mola.prj
  - Mars-Tectonics.mxd
  - tectonics_Compression.shp
  - tectonics_Extension.shp

**One Shapefile in Windows**

- Database
- Projection
- Connection
- Geographic
- Metadata

- Early 1990s ArcView 2 format
- Mostly open format
- *.dbf & *.shp cannot exceed 2GB
ArcGIS Vector - Shapefiles

Advantages:

- Small file sizes (usually a few 100k to several MB)
- Non-proprietary – can be used in other GIS software

Disadvantages:

- File size limited to 2GB (but that is a lot of features)
- Uses old data file formats (dbase: 1980s format)
- Many file components (3-7) make up single shapefile
# ArcGIS Vector - Geodatabases

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="icon" /></td>
<td>Geodatabase</td>
<td>A proprietary database format, can contain vector, raster, and tabular information.</td>
</tr>
<tr>
<td><img src="image" alt="icon" /></td>
<td>Geodatabase, feature dataset</td>
<td>A container within a Geodatabase that holds vector datasets which share common properties (e.g., projection)</td>
</tr>
<tr>
<td><img src="image" alt="icon" /></td>
<td>Geodatabase, point</td>
<td>Vector dataset within a geodatabase that contains only points. Can reside within or outside feature dataset.</td>
</tr>
<tr>
<td><img src="image" alt="icon" /></td>
<td>Geodatabase, line</td>
<td>Vector dataset within a geodatabase that contains only lines. Can reside within or outside feature dataset.</td>
</tr>
<tr>
<td><img src="image" alt="icon" /></td>
<td>Geodatabase, polygon</td>
<td>Vector dataset within a geodatabase that contains only polygons. Can reside within or outside feature dataset.</td>
</tr>
</tbody>
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**Geodatabase viewed in Catalog**

**A Geodatabase viewed in Windows**

![Catalog View](image)  
![Windows View](image)
Advantages:

- Single container of diverse spatial data
  - Vector, raster (increases GDB size dramatically), and tables
- Easily transferable to colleagues (.zip, .tar, .7z)
- Easily organized and managed
- Stable
- Large size limit (attributes: 65.5k columns, 2.1G rows)

Disadvantages:

- Proprietary file format, owned by ESRI
- Only usable in ArcGIS – AND SPECIFIC VERSION!
## ArcGIS File Types – Other Files

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<tbody>
<tr>
<td><img src="image.png" alt="Raster" /></td>
<td>Raster, or Image file</td>
<td>Map or image information that is represented as an array of pixels, each of which has a numeric value. Can contain one or more bands.</td>
</tr>
<tr>
<td><img src="image.png" alt="Tables" /></td>
<td>Tables</td>
<td>Tabular dataset in a specific format (e.g., dbase)</td>
</tr>
<tr>
<td><img src="image.png" alt="XML" /></td>
<td>XML files</td>
<td>An XML formatted text file</td>
</tr>
<tr>
<td><img src="image.png" alt="Text" /></td>
<td>Text files</td>
<td>A general text file. Can be formatted as TAB or comma-separated values (*.csv) to be read in as spatial XY data.</td>
</tr>
<tr>
<td><img src="image.png" alt="Excel" /></td>
<td>Excel files</td>
<td>Microsoft Excel spreadsheet file.</td>
</tr>
<tr>
<td><img src="image.png" alt="Layer" /></td>
<td>Layer file</td>
<td>A file that contains information about how shapefile or geodatabase features should appear. Contains no geographic data.</td>
</tr>
<tr>
<td><img src="image.png" alt="Projection" /></td>
<td>Projection file</td>
<td>A text file (*.prj) that describes projection information. It contains no geographic data.</td>
</tr>
</tbody>
</table>
## ArcGIS – Database Connection Icons

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<tr>
<td>![Add Database Connection icon]</td>
<td>Add Database Connection</td>
<td>A method that allows users to connect/log in to a database management system to access geodatabase data.</td>
</tr>
<tr>
<td>![Add Database Server icon]</td>
<td>Add Database Server</td>
<td>Allows Internet connection to a remote server that contain databases</td>
</tr>
<tr>
<td>![Add ArcGIS Server icon]</td>
<td>Add ArcGIS Server</td>
<td>Allows Internet connection to a remote server that hosts ArcGIS data through ArcGIS Server software</td>
</tr>
<tr>
<td>![Add WMS Server icon]</td>
<td>Add WMS Server</td>
<td>Allows Internet connection to a remote server that hosts ArcGIS data through a Web Mapping Service.</td>
</tr>
</tbody>
</table>

Icons for Geodatabase Connections – Links to available data resources on the Internet