INTRO TO GIS & GEOSPATIAL DATA

Michael Shensky
GIS & Geospatial Data Coordinator
We have 6 informative workshops planned for you this spring

All focused on geospatial techniques this semester

Regular Data & Donuts workshops resume in the spring

Grab a donut – sign in – learn – let us know what you think!
Workshop Goals

- Develop familiarity with important geospatial data terms and concepts
- Get to know what GIS software is and what options you have to choose from
- Learn about the key distinguishing characteristics of raster and vector geospatial data
- Develop basic familiarity with the major uses of GIS software for working with geospatial data
Geographic information systems are specialized systems of software for...

- Storing
- Managing
- Visualizing
- Sharing
- Creating/Editing
- Analyzing

...geospatial data
The “System” in GIS

Enterprise GIS Conceptual Framework

Desktop GIS

Geospatial Data

GIS Based Web/Mobile Apps

Server GIS
The 3 Major GIS Software options

QGIS
- Free
- Open Source
- Extensible with Plugins
- Windows, MacOS, & Linux
- Widely used in Europe
- Growing popularity in the US

ArcMap
- Developed by Esri
- Expensive to purchase
- Free UT student/staff licensing available
- Windows only
- Integrates with ArcGIS Online
- Widely used but being phased out

ArcGIS Pro
- Developed by Esri
- Expensive to purchase
- Free UT student/staff licensing available
- Windows only
- Integrates with ArcGIS Online
- Growing adoption, replacing ArcMap
Desktop GIS software is used for:

- Visualizing data
- Producing digital maps
- Managing data storage
- Creating/editing data
- Analyzing data
- Publishing data for sharing
What is Geospatial Data?

Geospatial data is data that contains both location and attribute information.
Data must be gathered with sensors or human observation.

The world is infinitely complex while computers, sensors, & humans have limited abilities.

Thus we are only able to work with limited information about real features.

We must decide what attributes are important and how they will be measured.

We then need to determine how to digitally associate those attributes with a location.
### Important Geospatial Data Terminology

These 2 models are the most common way to store geospatial data in digital formats.

<table>
<thead>
<tr>
<th>Vector</th>
<th>Raster</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Best for:</strong></td>
<td><strong>Best for:</strong></td>
</tr>
<tr>
<td>Discrete objects</td>
<td>Continuous Data</td>
</tr>
<tr>
<td><strong>Location Modeling:</strong></td>
<td><strong>Location Modeling:</strong></td>
</tr>
<tr>
<td>Coordinates pairs define points, lines, and polygons</td>
<td>Georeferenced grid cells</td>
</tr>
<tr>
<td><strong>Attribute Storage:</strong></td>
<td><strong>Attribute Storage:</strong></td>
</tr>
<tr>
<td>Multiple attributes</td>
<td>Single attribute</td>
</tr>
</tbody>
</table>
Points are associated with a single set of coordinates \((X, Y)\).

Points are infinitely small, they have no area.

Typically used to represent small features or events, but can represent large features at small scales.
- A line is a connected sequence of coordinate pair nodes and vertices.
- Lines have length but no width.
- Typically used to represent long narrow features.
A sequence of interconnected lines whose first & last coordinate points are the same

Polygons are two dimensional and have area
Location coordinates by themselves are not that valuable.

Example: -97.7403, 30.2746

What can we do with this information?

- Geographic data becomes valuable when we have attributes associated with the geometry that is defined by our coordinates.

- Attribute information makes it possible to develop useful maps and to conduct analysis for aiding in spatial decision making.
Data is stored in a matrix of

The location of each cell is saved using only the following information:

1. A georeferenced corner of the raster grid
2. Cell size
3. Column and row numbers

Each cell has a single value as its attribute
Key GIS Terminology

Geoid & Reference Ellipsoid
A geoid is a gravitational model of the Earth and a reference ellipsoid is a mathematically smoothed approximation of the geoid.

Coordinate System
The grid system applied on top of a reference ellipsoid that makes it possible to assign coordinates to locations.

Map Projection
A mathematical formula for transforming 3D geospatial coordinates onto a 2D surface (paper, computer screen, etc.).

These choices affect the display of both raster and vector data.
What do you see when you first open GIS software?

- Table of contents / Layers panel
- Catalog / Browser panel
- Tool bar
- Empty map frame

What don’t you see?
Loading Data into GIS Software

**Common Geospatial File Types**
- Shapefile
- GeoJSON
- File Geodatabase
- CSV with point coordinates
- Georeferenced raster image files

**Free Geospatial Data Often Provided By**
- Federal agencies
- State agencies
- Counties
- Cities
- Non-profit organizations
- Companies
### Key GIS Terminology

**Spatial Feature**
A unique object or region with a defined location
Represented by a row in a data table

**Map Layer**
A raster or vector dataset added to a map document

**Map Document / Project**
The desktop GIS file that stores references to your map data and stores symbology and other map configurations

**Attribute Table**
Holds non-spatial qualities of a feature (type, color, etc.)
Each type of attribute is stored in a column ("field")

**Symbology**
The style (color, size, symbol, etc.) assigned to vector feature geometry based on attribute values
Desktop GIS Software Demonstrations

- Desktop GIS software is used for:
  - Visualizing data
  - Producing digital maps
  - Managing data storage
  - Creating/editing data
  - Analyzing data
  - Publishing data for sharing
THANK YOU!

Questions?     Comments?

FIND THIS WORKSHOP INFORMATIVE? CONTINUE BUILDING YOUR GIS SKILLS AT NEXT WEEK’S DATA & DONUTS WORKSHOP

WORKSHOP SLIDES WILL BE POSTED ONLINE AT:
HTTP://GUIDES.LIB.UTEXAS.EDU/DATA-AND-DONUTS/

Finding Geospatial Data Online

- Instructor: Michael Shensky
- Date: 2/8/2019 (Fri.)
- Time: 3:00 p.m.
- Location: PCL Learning Lab 1
- Event Type: Workshop
- Event Series: Data & Donuts

This workshop will provide instruction on browsing for geospatial data, cover how to search for specific datasets to download, and will discuss how to process downloaded data using GIS software to enhance its usability.