GEOL 452/552
- GIS for Geoscientists I

Lecture 3
Today:

- Some chapter 1 main concepts:
  - GIS data
  - Data files
  - Layer properties (follow along ex.)
- No new homework today
- Lab: finish Ch. 1 tutorial and HW I

- Problems?
Chapter I: GIS Data

- What is a feature?
- a (single) entity: a point, a line or a polygon
- features => “vector data”
- Line: 2+ points (polyline)
- Polygon: line of 3+ points (always closed!)
- Each point (within a line or polygon) has a X,Y location
Coordinate systems found on a USGS topo map:

Origin in degrees

$\begin{align*}
x &= 103° \, 52' \, 32'' \\
y &= 44° \, 15' \, 01''
\end{align*}$

What is the star’s x/y coordinate?

X-Y Coordinate systems/units:
Longitude-latitude (degrees)
State Plane (feet)
UTM (meters)
• Each feature is linked to a single entry (record, row) in a data table.

• Each column (field) holds a single attribute for all features.
A feature class is a collection of similar objects with the same attributes, stored as a single unit.

Stored as spatial features with a table of associated attributes for each feature.

Because all features must share the same table, all must have the same attributes.

Feature classes may contain only one type of geometry (points or lines or polygons).
Let's annotate this layer (draw on paper)

- What are attributes? What are features?
- Which are records in a table?
- How do table rows relate to the GIS map?

<table>
<thead>
<tr>
<th>#</th>
<th>x/y Location</th>
<th>Name</th>
<th>Pop2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>213232.5/34243.6</td>
<td>A</td>
<td>1200</td>
</tr>
<tr>
<td>2</td>
<td>276343.5/32930.5</td>
<td>B</td>
<td>34200</td>
</tr>
</tbody>
</table>

PS: see Glossary pp. 559
Map of 30 states, 500 cities - how many total features, tables, records?

- # of feature classes (layers) ?  2 (states, cities,)
- # of features ?                       30 + 500 = 530
- # of attribute tables ?             Don't know
- # of total records ?                30 + 500 = 530
**Raster data**

- Collection of points (pixels, cells) on a 2D matrix
- Each cell (center) has a X,Y location on Earth
- Size: rows x columns
- Data “table”: each cell contains (one or more) numbers
- Elevation => Digital Elevation Model (DEM)
- Image: Air/Satellite photo
- Geol552: 80% vector data, 20% raster data (ch. 8)
- Geol588 (Spring 2011): Raster GIS
ArcInfo vs. ArcView vs. ArcGIS

- Historic development of ESRI’s GIS System:
  - ArcINFO (DB format, originally UNIX)
  - ArcView (Map making)
  - ArcGIS Desktop (Unified approach)

- **ArcMap**: visualization & analysis application
- **ArcCatalog**: Data browser
- **ArcToolbox**: tools for conversion, projection, analysis, etc.
• Confusion Alert: Sometime the term Arc-View or Arc-Info functionality is used!

• This functionality level has nothing to do with the old ArcView/Arc-Info software:

• ESRI sell ArcGIS in 3 different versions of complexity

• (think: light - advanced - professional)

• ISU GIS lab: ArgGIS - **ArcEditor** functionality

![ArcView](image1)

![ArcEditor](image2)

![ArcInfo](image3)
Arc GIS Data formats

- 3 types of vector data files (ArcINFO, ArcView, ArcGIS)

- Coverages
- Shapefiles
- Geodatabases
- **Coverages (beige):** older format - skip for now

- **Shapefiles (green):** vector files
  - contains only 1 feature class (many features of **same** type)
  - in ArcCatalog: **looks** like a single file
  - in Windows: many different files for each “single” shape file
  - => always use ArcCatalog to **copy/move/delete** shape files!
  - table kept inside its .dbf file in dBase format (MS Excel 2003)
• Geo data base or GeoDB: (grey)
• *feature dataset* (= folder for feature classes)
  • feature class (many features)
    • features (single point, line, ...)
• .mdb is a single file in windows but we need Arc to look inside
• GeoDB keeps automatically track of a feature’s length/area
• Can also store tables, rasters, topology, networks
layer files (.lyr)

- Yellow “stack” icon
- .lyr files store only the appearance (line thickness, symbol type, color of features, etc.)
- They don’t contain any actual spatial data - just a how to **draw** them
- Confusion alert: don’t mix up with the GIS layer- (feature class) concept
- More about it later - for now: keep in mind: no data!
ArcMap document file (.mxd)

• Another “container” file format

• .mxd files do NOT contain any data, only links to data files

• map document files store “appearances” only:
  • symbol type, color of features, etc. per layer
  • (think: many .lyr files)
  • layout (printing), more

• If you remember only one thing about today’s lecture: mxd files do NOT contain any real data!
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>yellowstone</td>
<td>Personal Geodatabase</td>
</tr>
<tr>
<td>states</td>
<td>Coverage</td>
</tr>
<tr>
<td>vegetation</td>
<td>Coverage</td>
</tr>
<tr>
<td>boundary</td>
<td>Shapefile</td>
</tr>
<tr>
<td>dem30</td>
<td>Raster Dataset</td>
</tr>
<tr>
<td>elevation</td>
<td>Layer</td>
</tr>
<tr>
<td>hillshade</td>
<td>Raster Dataset</td>
</tr>
<tr>
<td>hydrology</td>
<td>Layer</td>
</tr>
<tr>
<td>mask</td>
<td>Shapefile</td>
</tr>
<tr>
<td>study_area</td>
<td>Shapefile</td>
</tr>
<tr>
<td>tin_study</td>
<td>TIN Dataset</td>
</tr>
<tr>
<td>vegtype</td>
<td>dBASE File</td>
</tr>
<tr>
<td>yellowstone</td>
<td>Map Document</td>
</tr>
</tbody>
</table>
• Questions?
Ch 1 follow-along exercise

- Copy `//delphi/GEOL552/data/follow along data/ch1_class_ex` to your student folder (Tip: Press F5 to force a folder content refresh)

- Open this folder in ArcCatalog - what types of files? How many feature classes (their geometry?), how many features in each class?

- 2 x click on `ch1_class-ex.mxd` to start ArcMap

- Red exclamation mark besides the counties layer (?)

- 2 x click on countries (layer properties)
Layer properties - Source

Layers reference the original feature class data — they do NOT store it!

Changing properties affects only the layer, not the original feature class.

If the original source is moved or deleted, the layer file won’t work (red ! - counties.shp does not exist)

Repair red !: Press Set Data Source and set to countries_short.shp
Save mxd file as ch1_class_ex_fixed.mxd
Exit Arcmap
Open ch1_class_ex_fixed.mxd
After the break:

- Finish Chapter 1 tutorial and HW1
- last step in ch 1 tutorial 33 -> may not work (?), use USAgroup_sample.lyr file (USA folder) instead
- Other tutorial snafus to report?
- GoogleEarth place markers from HW0: data/Geol-552-2009.kml