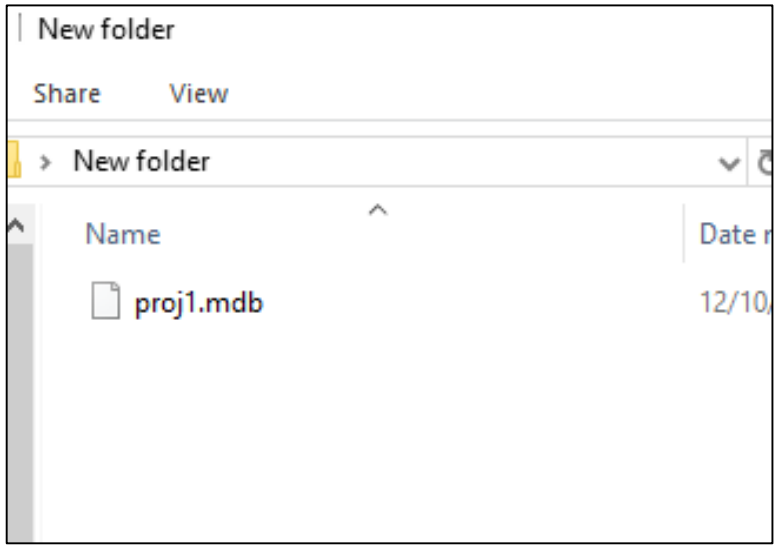
# GIS Data Management

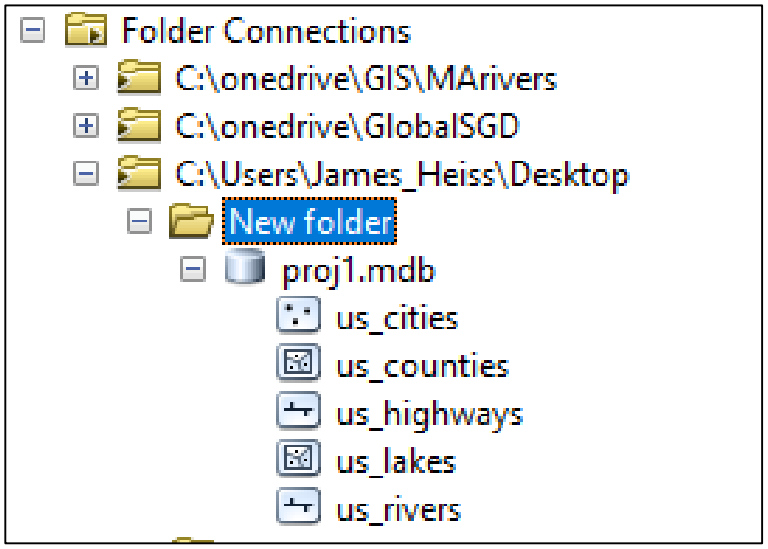
Today's Agenda

- Issues encountered last week
- GIS Data Management
- GitHub Website
- GIS Data types

# Do not use Windows Explorer to manage GIS data

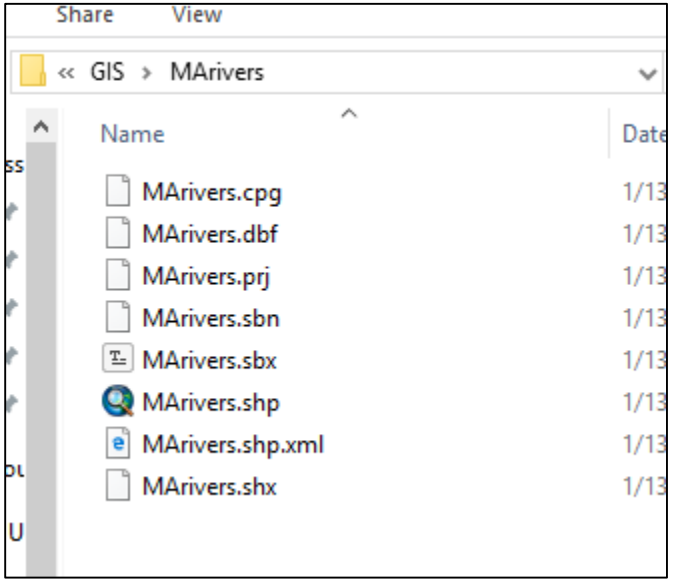


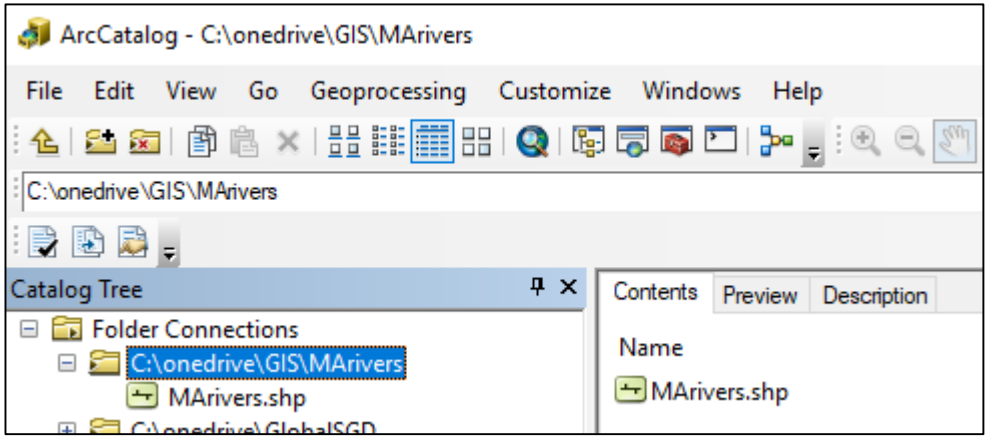

Wrong




Right

# Do not use Windows Explorer to manage GIS data

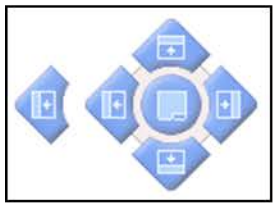


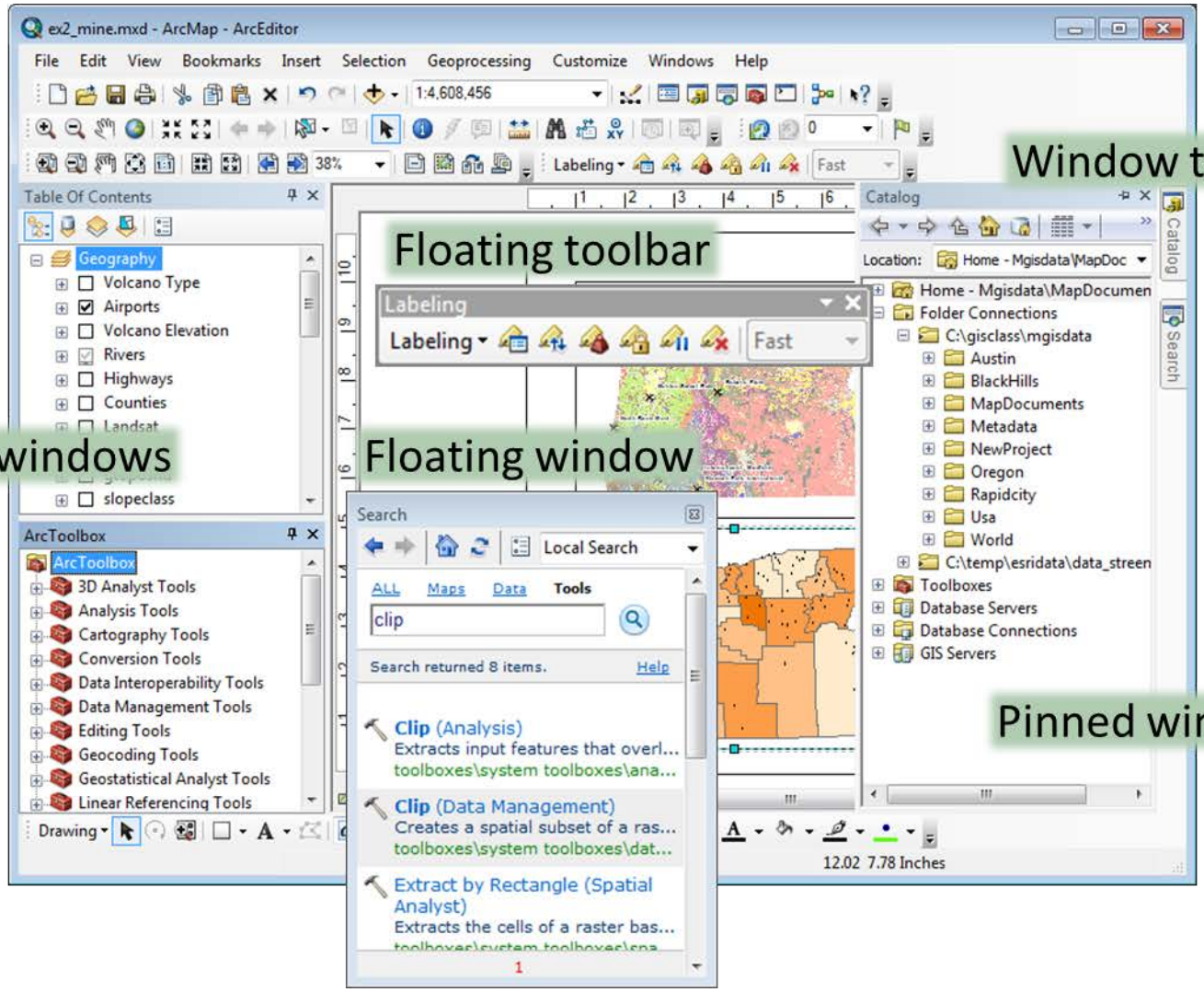




Wrong

Right

# Toolbars and windows





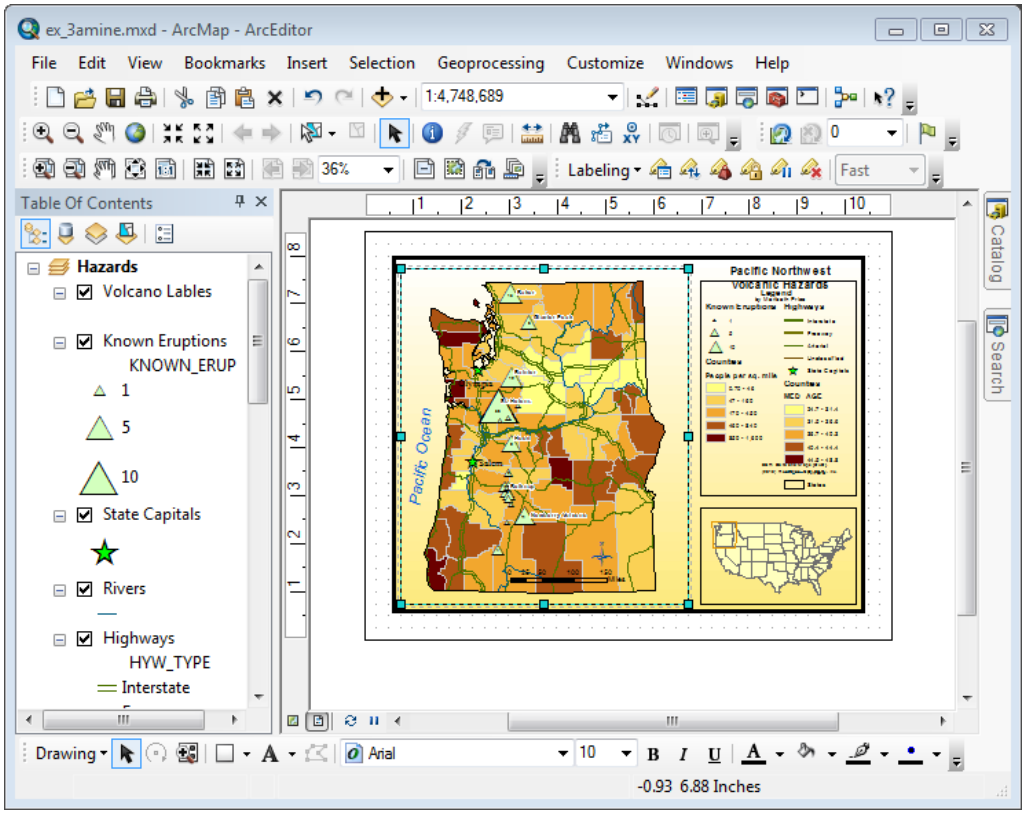
# The map document (.mxd)

Stores collections of data for viewing and analysis

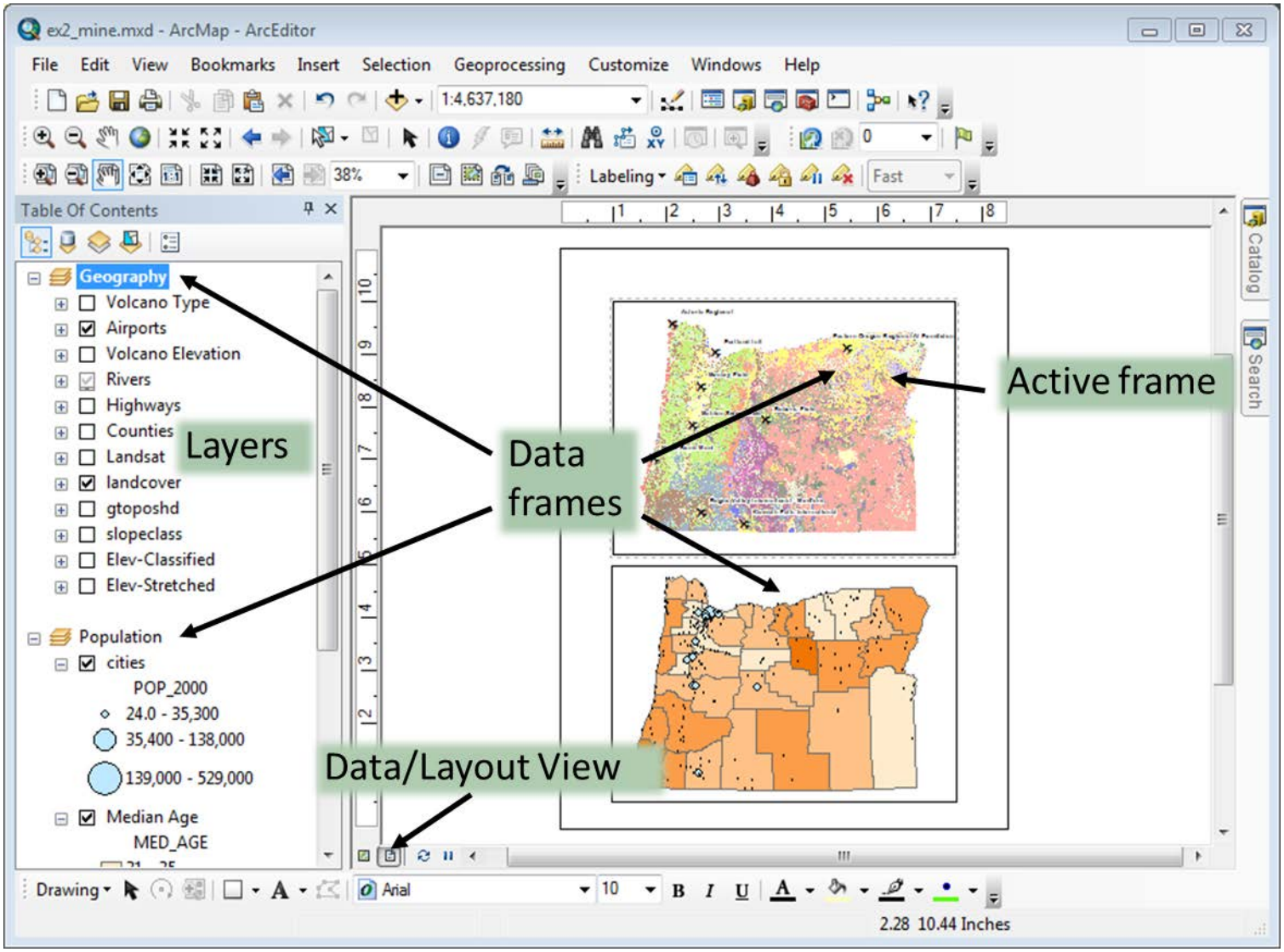
Contains one or more **data frames**

Stores visual properties for each **layer** in the Table of Contents

Stores a page **layout** for printing (Layout View)



# Data frames


ex2_mine.mxd - ArcMap - ArcEditor
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:4,637,180
Table Of Contents
Geography
Volcano Type
Airports
Volcano Elevation
Rivers
Highways
Counties
Landsat
landcover
gtoposhd
slopeclass
Elev-Classified
Elev-Stretched
Population
cities
POP_2000
24.0 - 35,300
35,400 - 138,000
139,000 - 529,000
Median Age
MED_AGE
Layers
Data frames
Active frame
Data/Layout View
Catalog
Search
Drawing
Arial
10
2.28 10.44 Inches

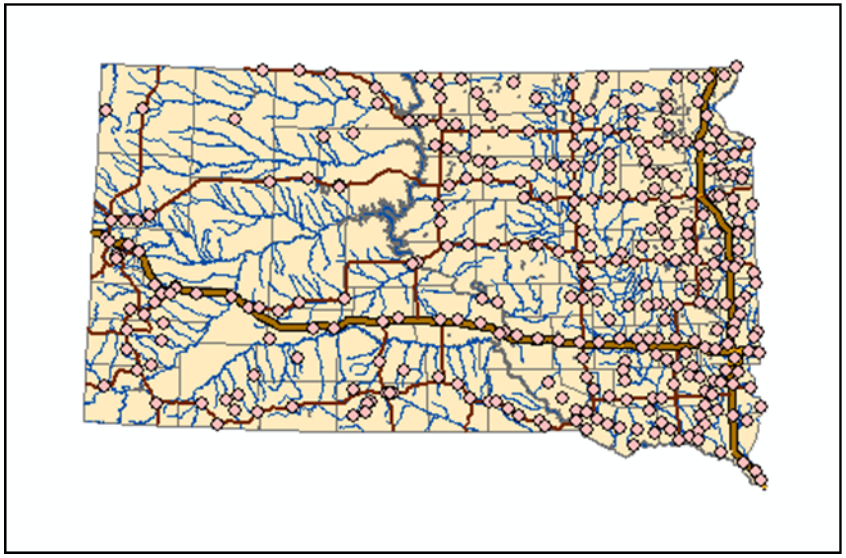
# View Mode

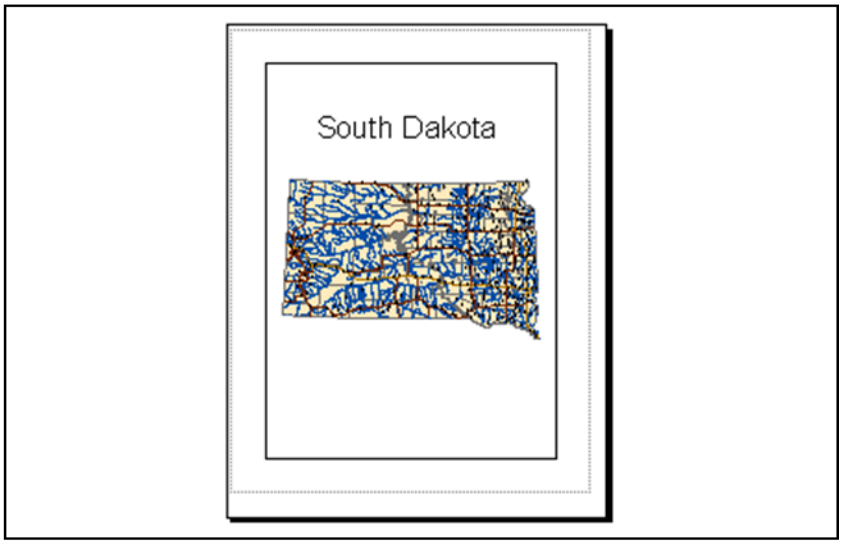
Pause

Refresh

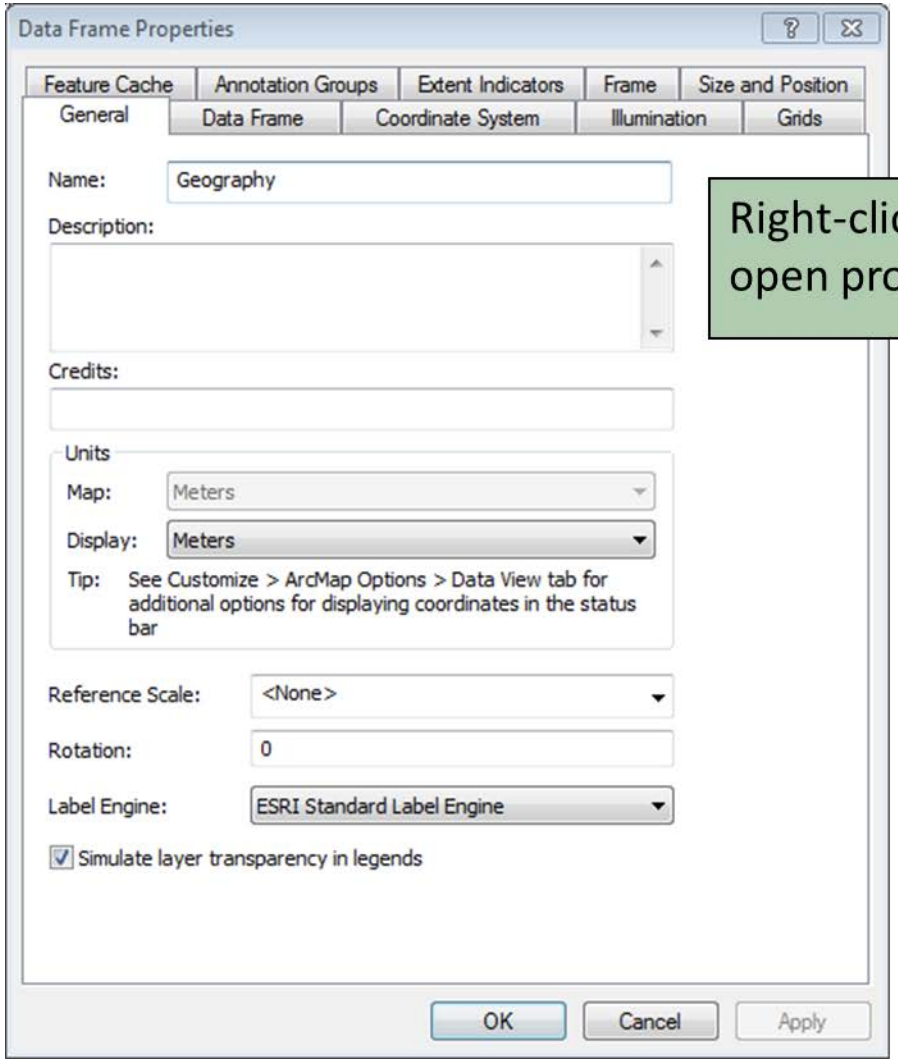
Data view

Layout view

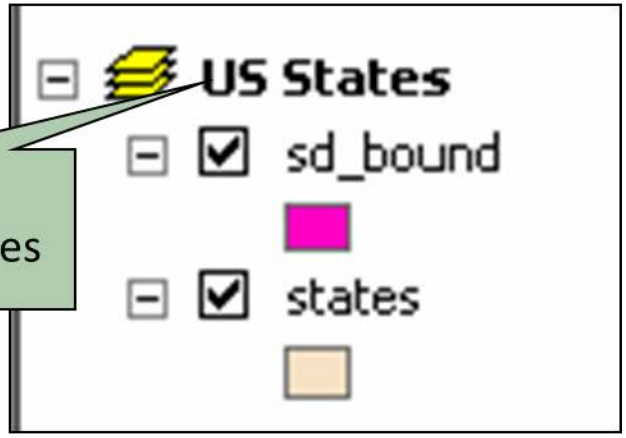



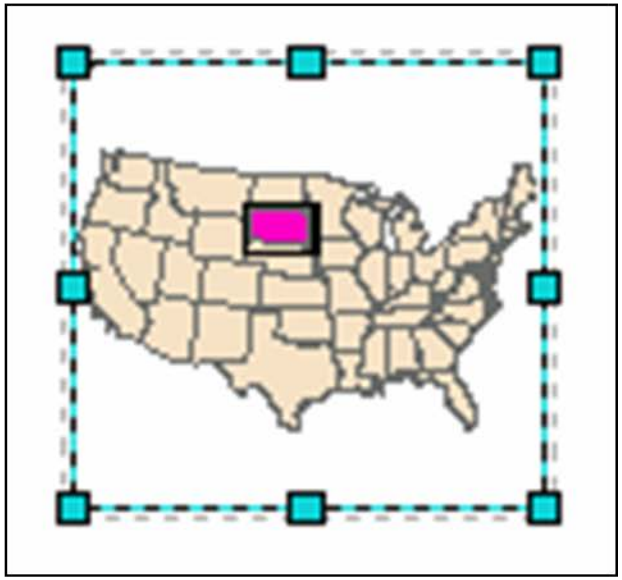


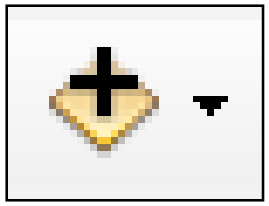
# Data frame properties




Right-click to open properties

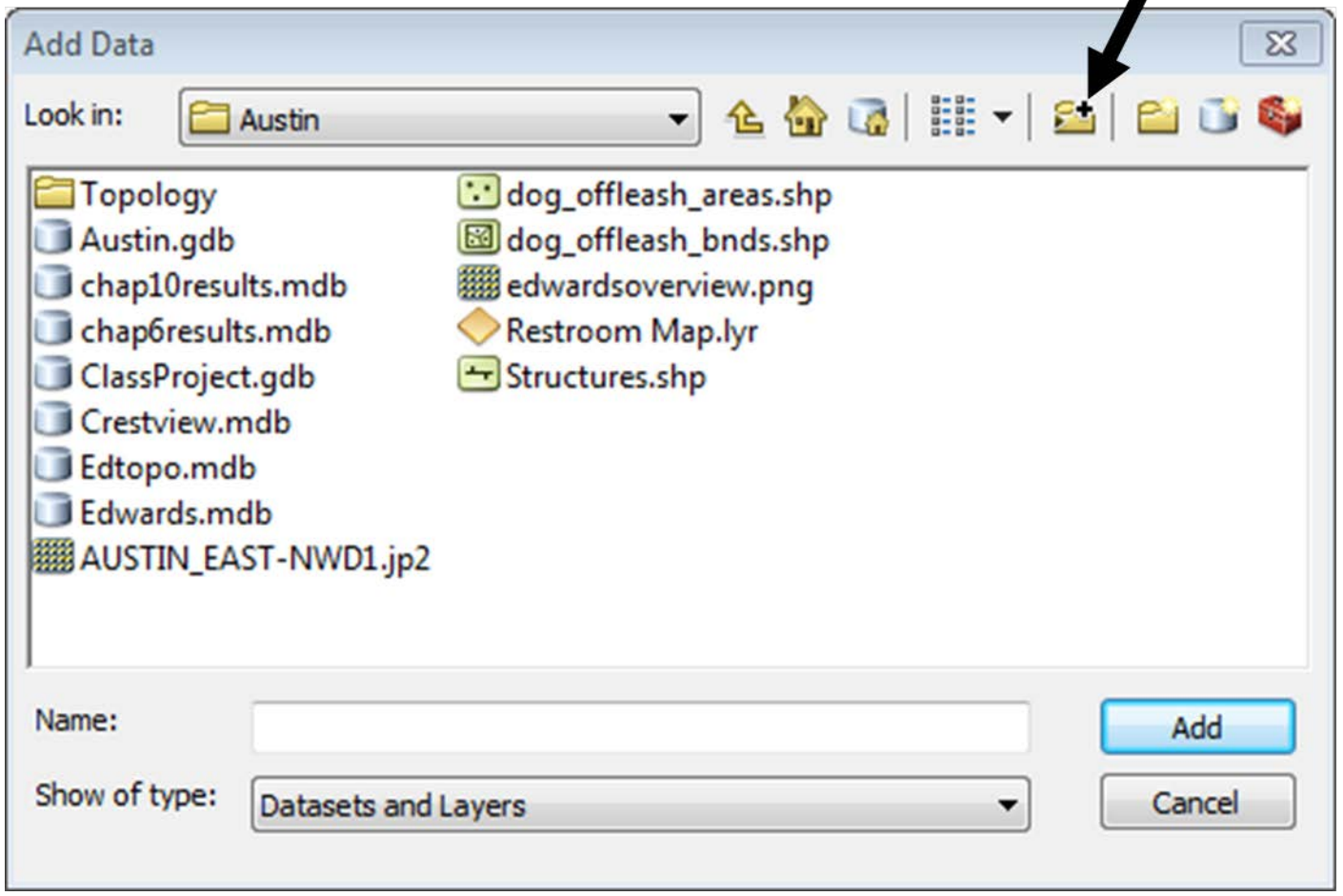




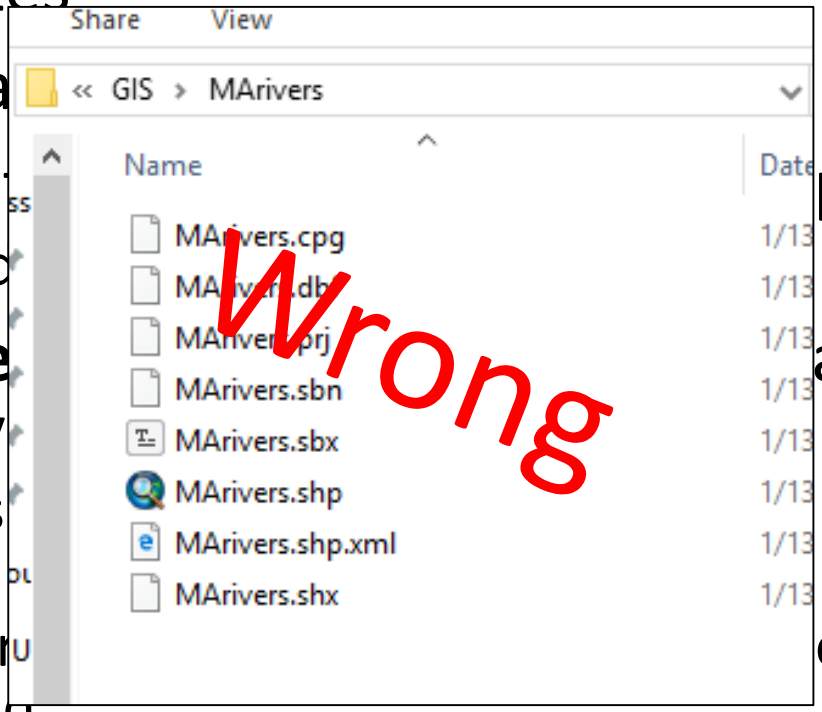
# Import data to data frames

Connect to Folder



# GIS data are different

- Large sizes
- Shared a
- Derived
  - Metac
- **Multiple**
  properly
  - This is
    files
  - Use Ar
    instead




people

atafile to work

be used to manage

e in ArcMap

# Tips!

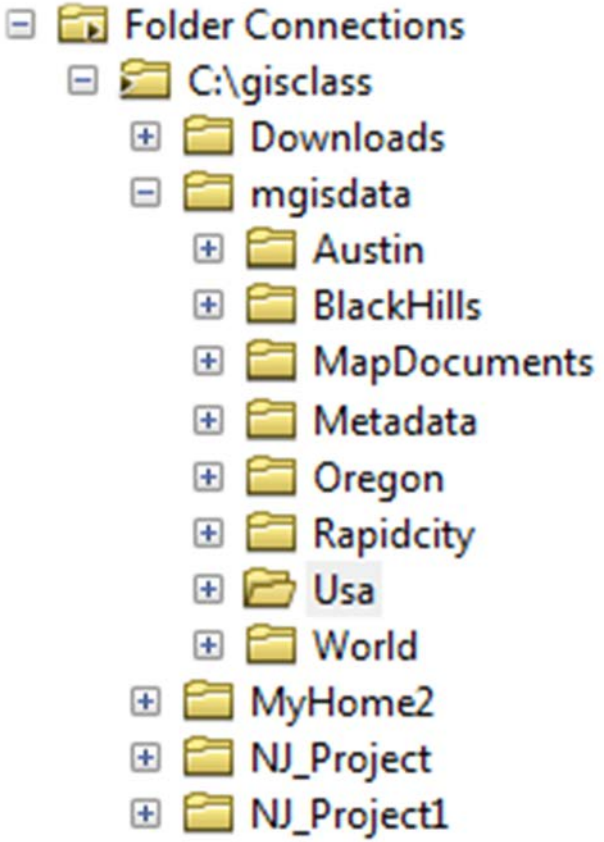
- Name your files with a clear description
  - Example: Snailhabitat, not rastercalc1
- Use a system of folders (project name, data type, source, vector, raster, etc)
  - Should make logical sense
  - Must be understandable to others
- Keep folder and file names short
  - Use only letters, numbers, and underscore
  - **No spaces** or special characters #$&@!
    - Spaces are a terrible idea

# Tips!

- Note file extensions
  - Disable “Hide extensions for known file types” in Windows Explorer – Do this now
- Create and name a folder called **GIS** in the root folder of your flash drive. Store all your files in it.
  - Not the desktop, not your user folder. It will be erased
- Separate working folders from permanent data
- Be aware of where you are saving and downloading data do (don’t click download without knowing where it is downloading to)
  - Default location is not a good place

# Tips!

- Never use Windows Explorer to save or manage files inside a geodatabase
- Files with .gz, .zip, .tar, .tgz, and .tar.gz are zipped folders and must be extracted

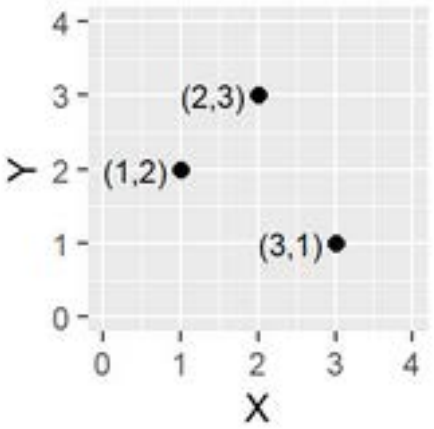


# GitHub Pages

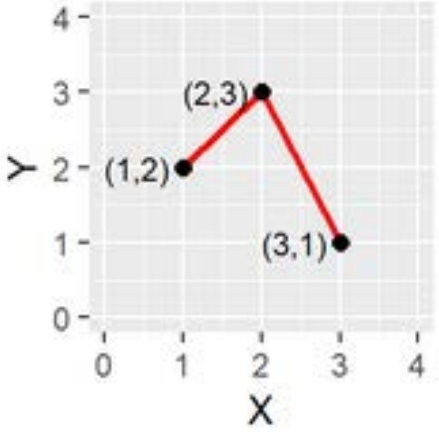
# Geospatial Data Types

# Vectors

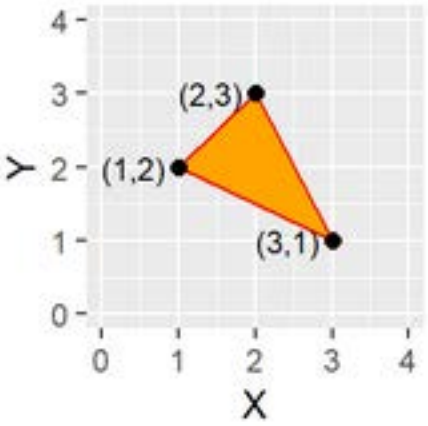
- Used for discrete data
- Points, lines, polygons




Points

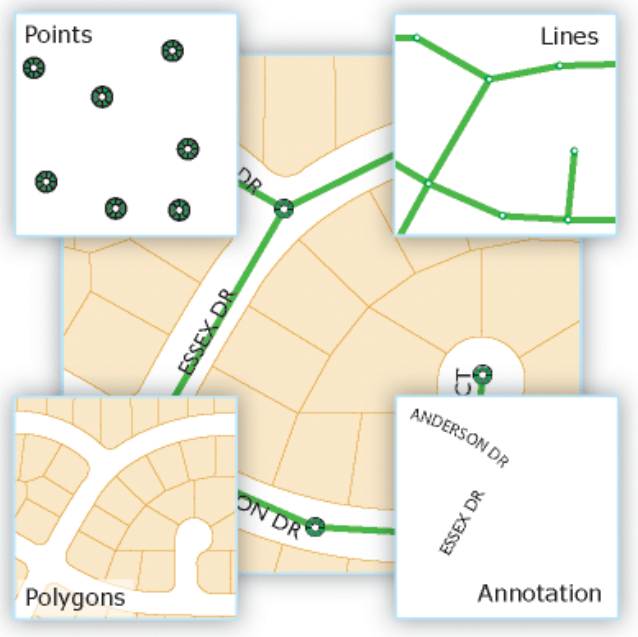



Lines



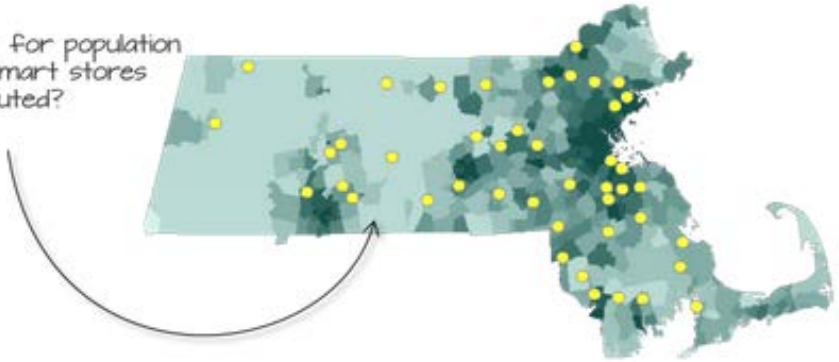

Polygons

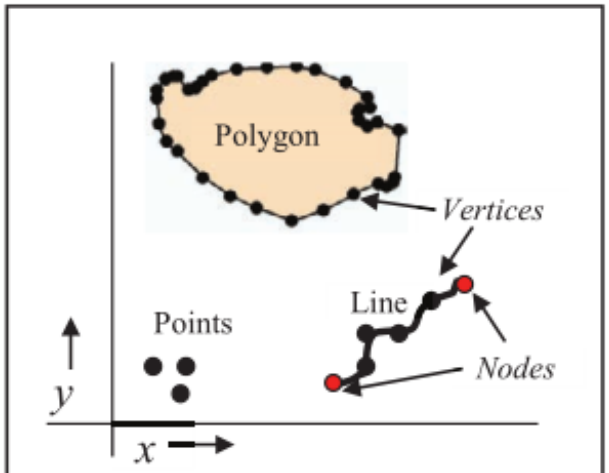
# Vectors




Walmart stores in MA

When controlled for population density, are Walmart stores randomly distributed?



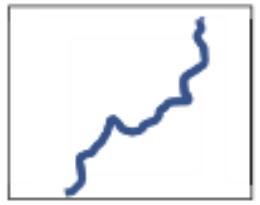


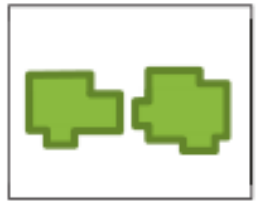
# Vectors

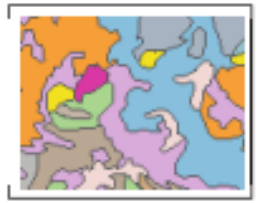
**Geographic View**


**Tables View**

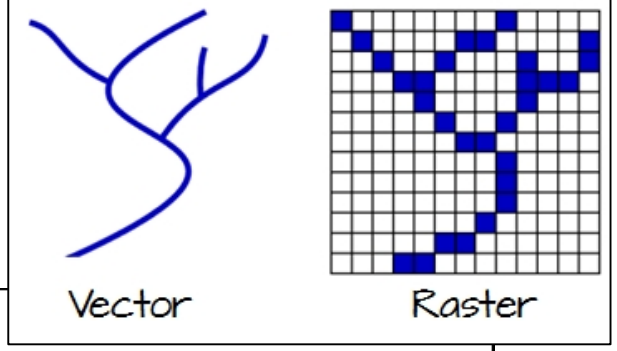
| Object ID | Shape | Name | LV Code | Management Agency |
|---|---|---|---|---|
| 1 | | Shady Pines | 20 | Private |
| 2 | | Pinewood Village | 30 | Pinewood Village Association |
| 3 | | Sarah Park | 80 | City Park Board |
| 4 | | Town Park | 99 | City Park Poard |

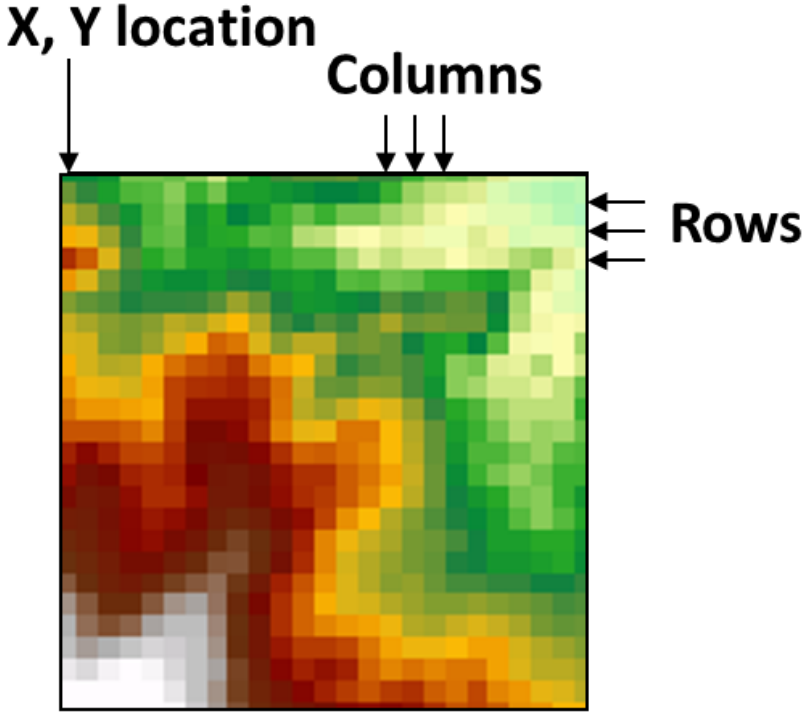




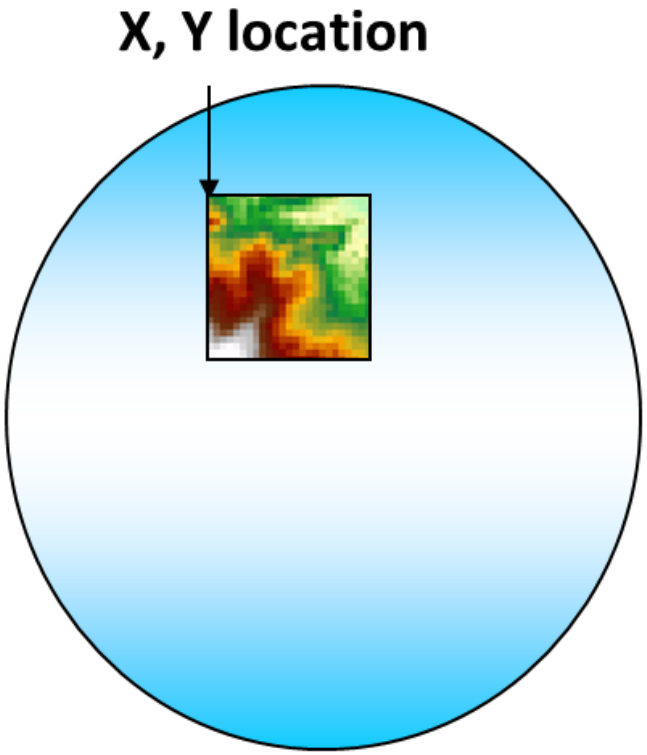


# Rasters



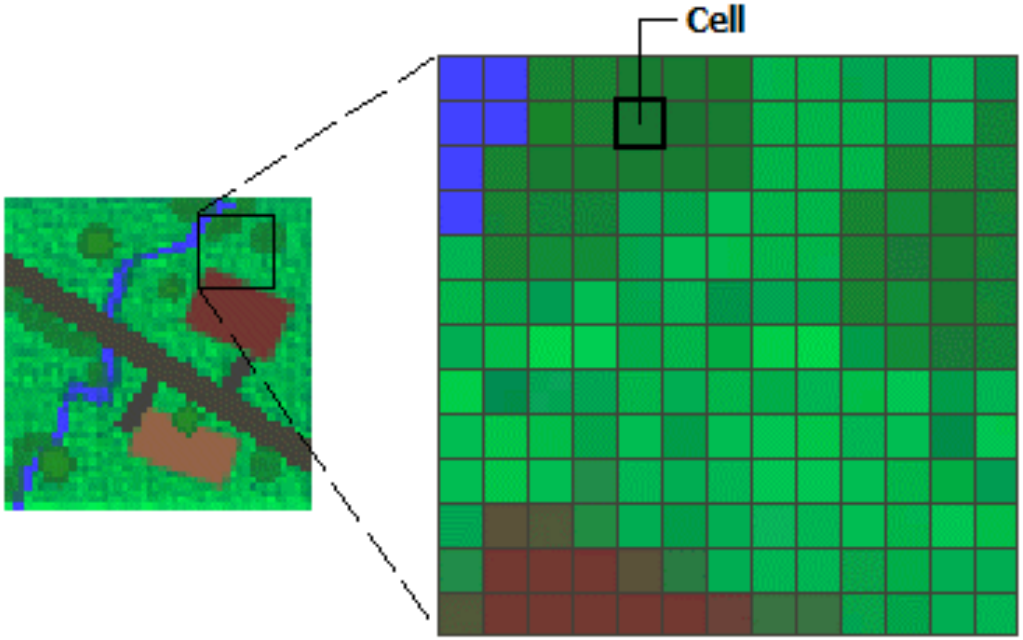



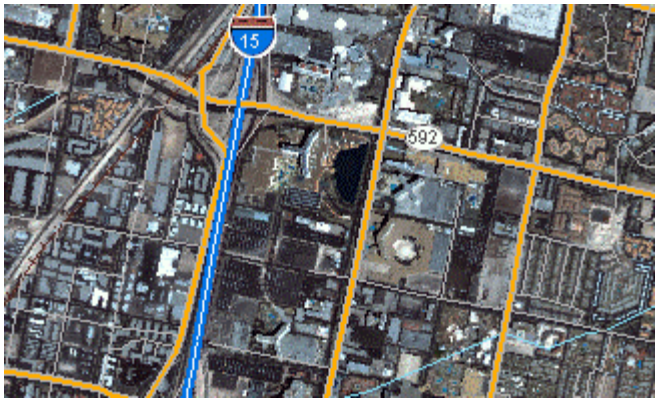

Raster data file
N rows by M columns




Georeferenced to earth's surface

# Rasters



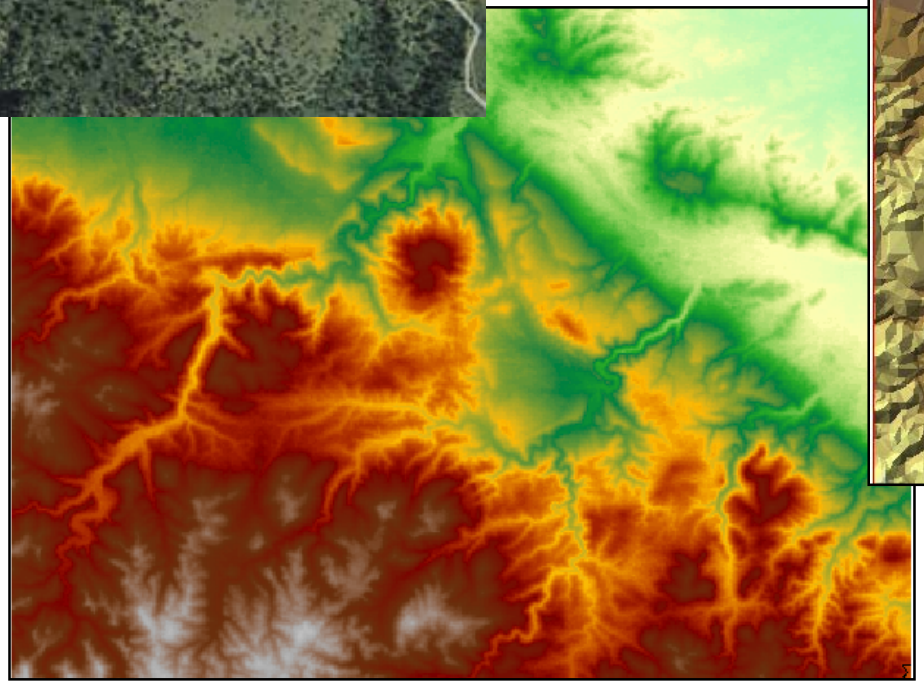



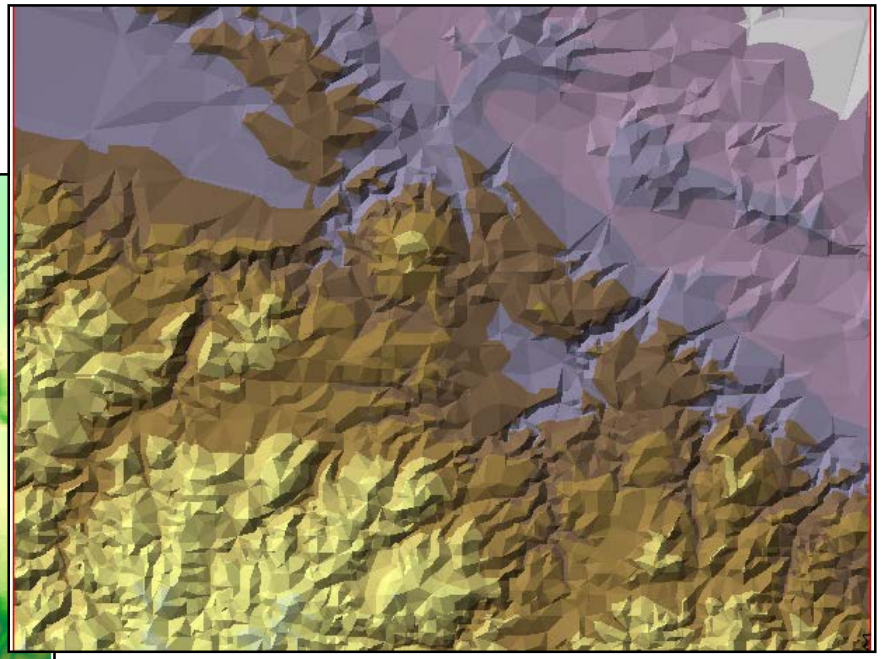

Rasters are commonly used as basemaps

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 80 | 74 | 62 | 45 | 45 | 34 | 39 | 56 |
| 80 | 74 | 74 | 62 | 45 | 34 | 39 | 56 |
| 74 | 74 | 62 | 62 | 45 | 34 | 39 | 39 |
| 62 | 62 | 45 | 45 | 34 | 34 | 34 | 39 |
| 45 | 45 | 45 | 34 | 34 | 30 | 34 | 39 |

Images from ESRI

# Rasters



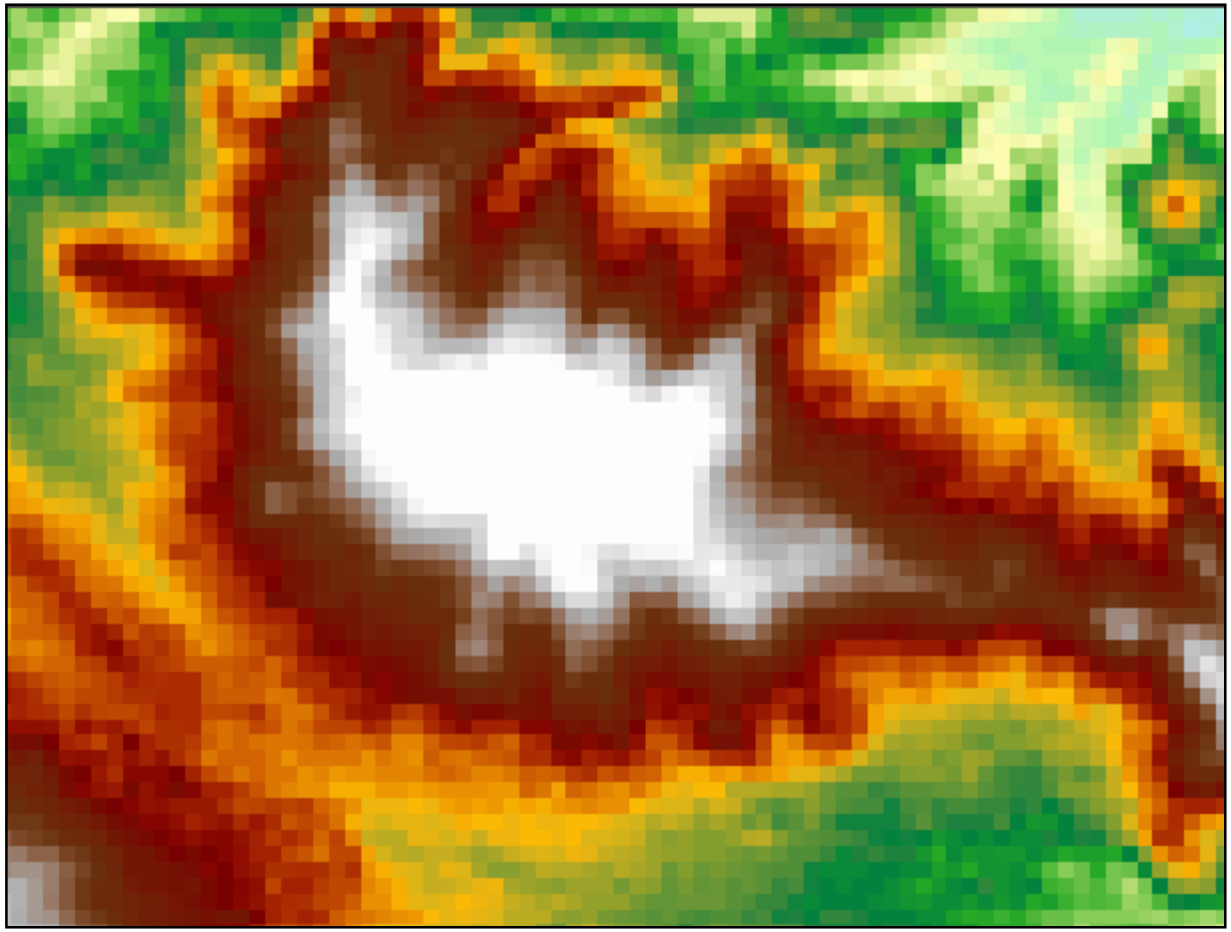


Raster

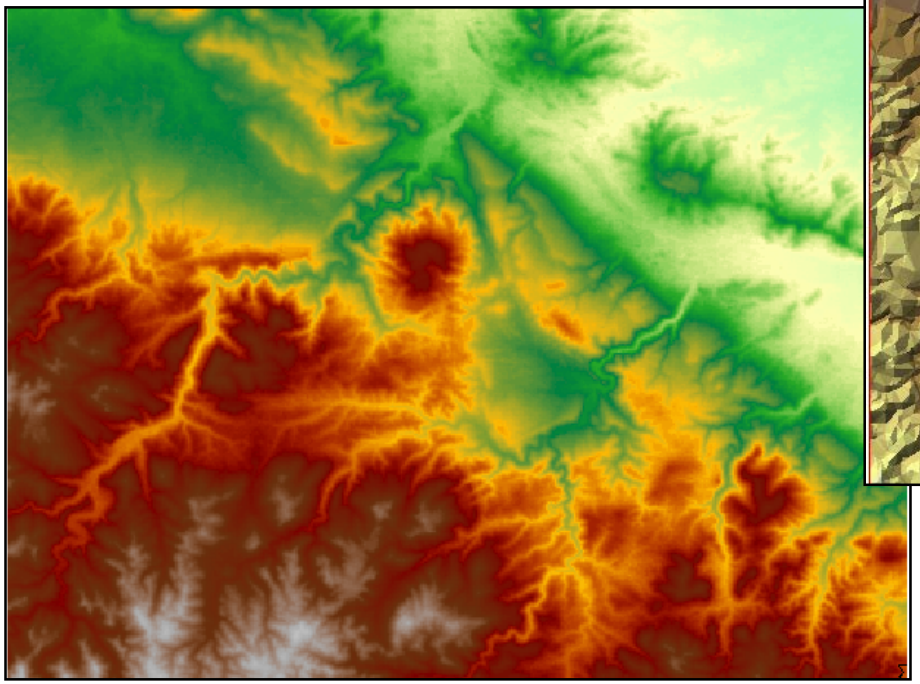
# Digital Elevation Model

A DEM has cells or pixels, each of which contains a single elevation.

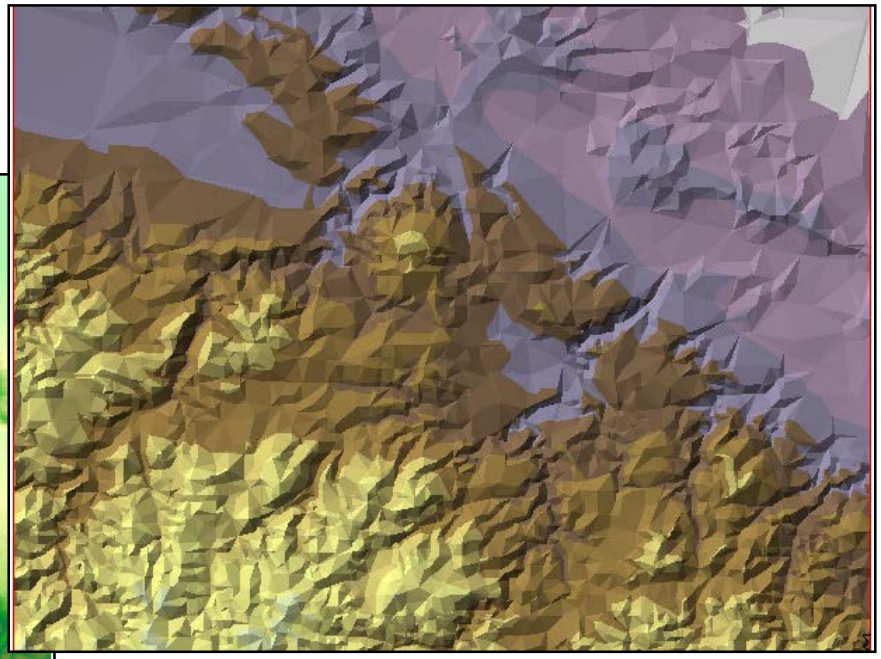
Regularly spaced array of elevation values.



# Rasters



Raster

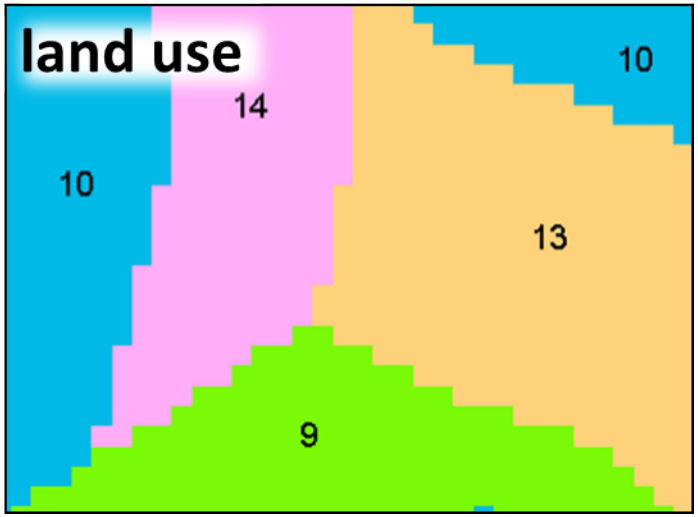


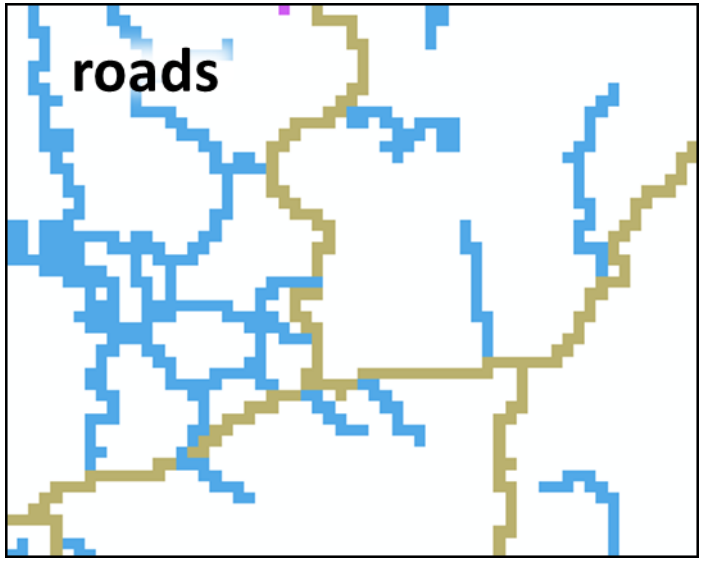
Raster

# Discrete rasters

Discrete rasters essentially store features—but in raster format

Few values that change abruptly from one category to another



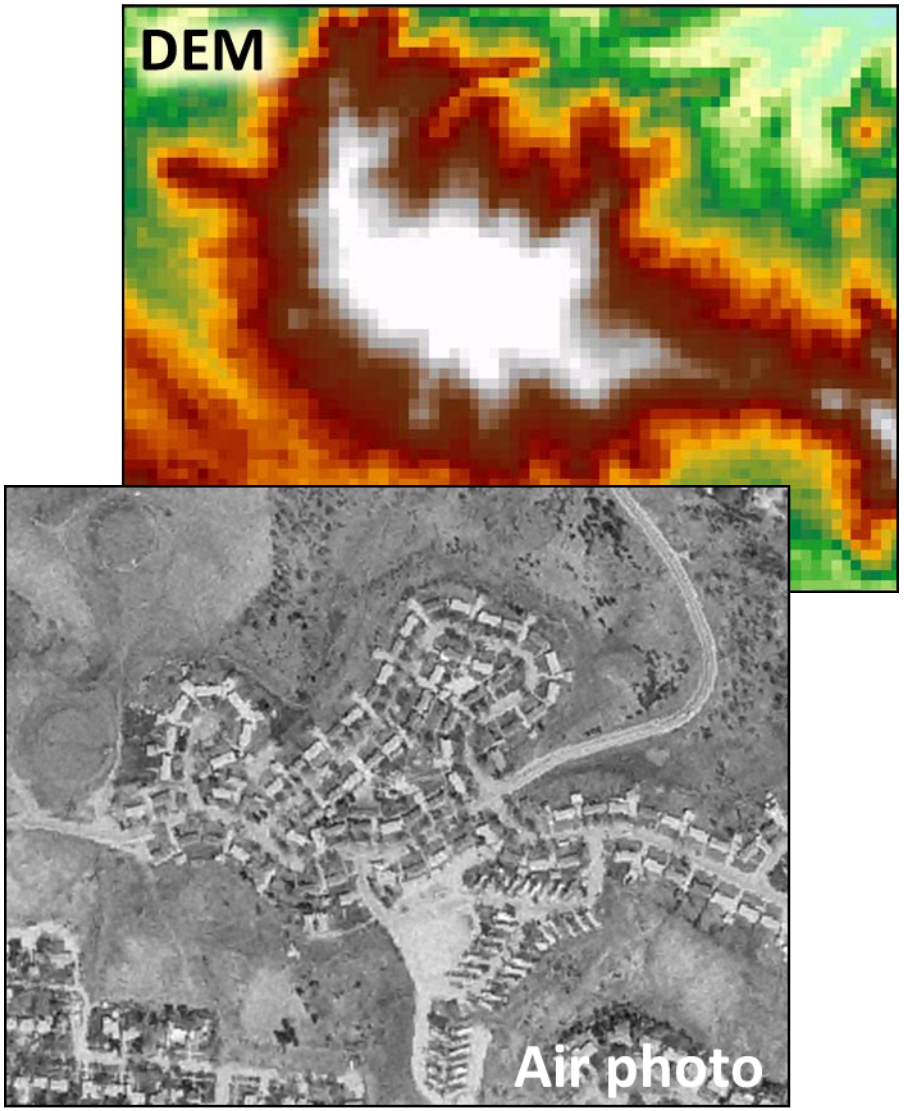



Return to Outline

# Continuous rasters

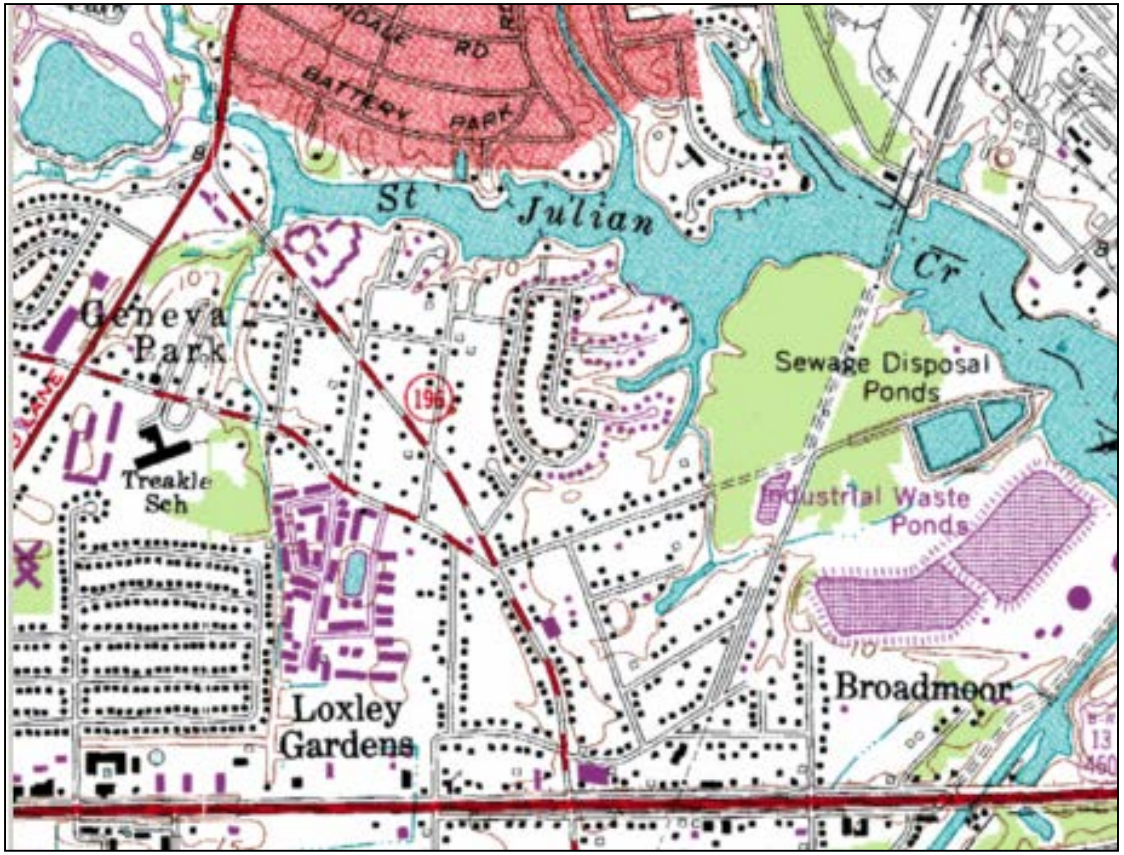
Continuous rasters store surfaces or fields of variables that change continuously over space

Many potential values. Adjacent cells rarely share the same value.



# Scanned images are also rasters!

This is a scanned USGS topo map

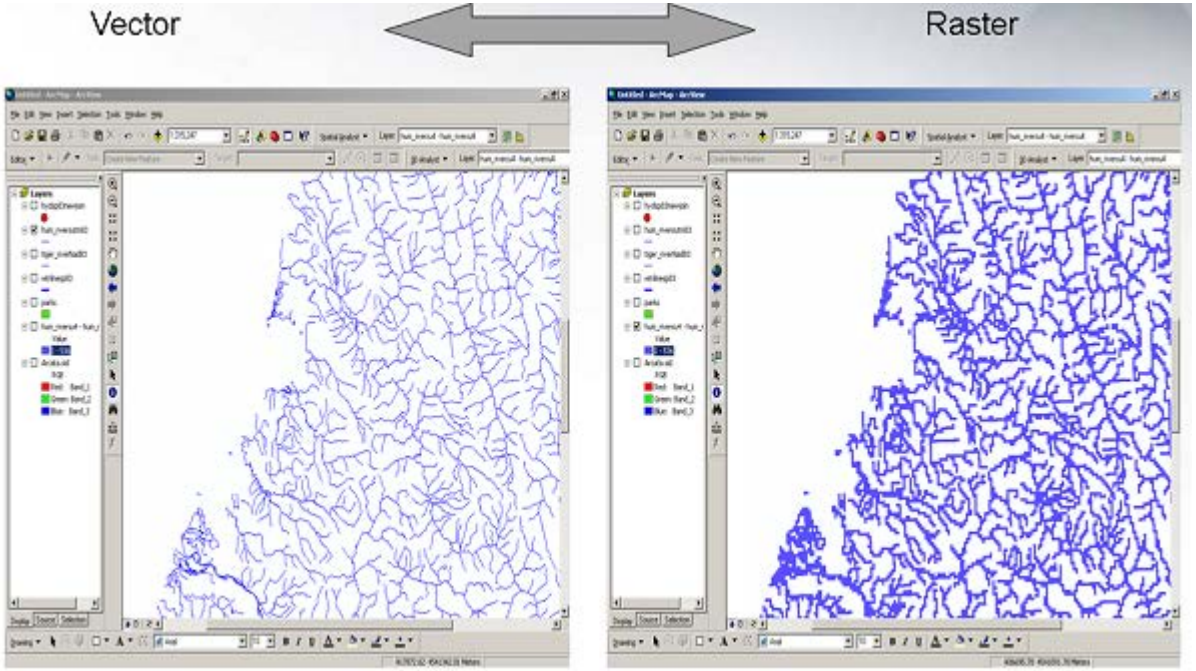



Discrete or continuous?

# Pictures are also rasters!

# Conversion between vector and raster

"Feature To Raster" tool

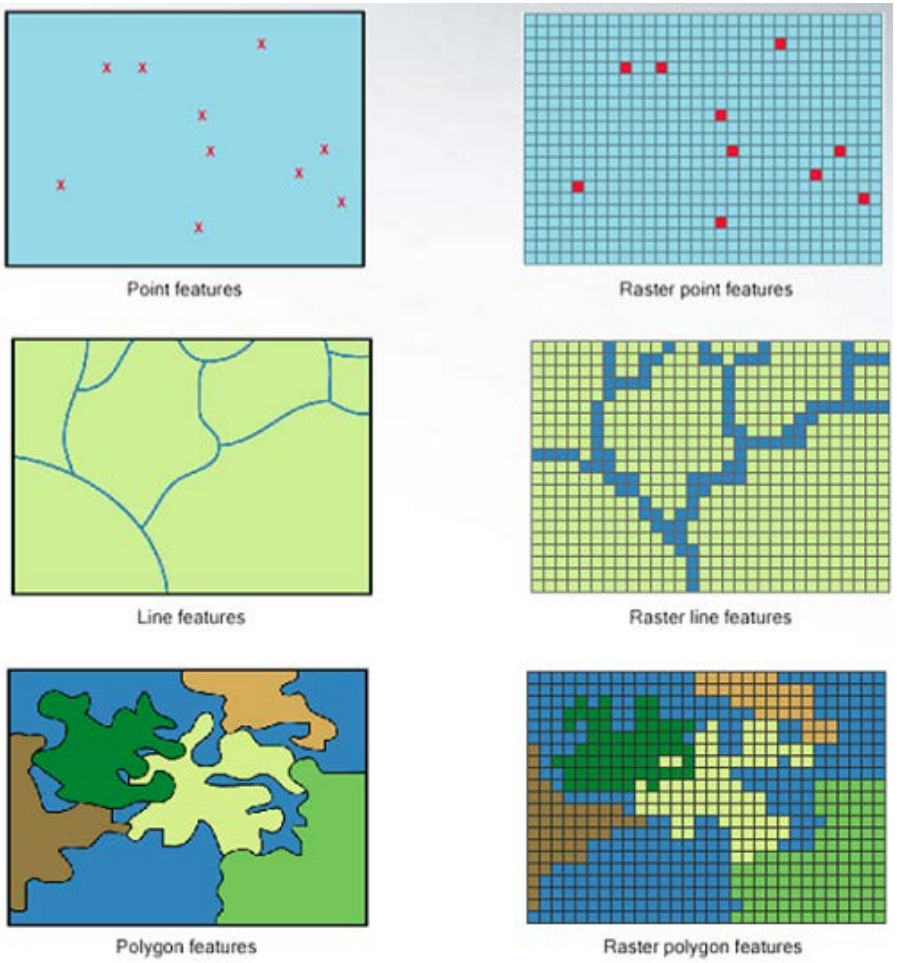



You can convert data between rasters and vectors but the nature of the data will be very different.

http://gsp.humboldt.edu/olm/Lessons/GIS/08%20Rasters/RasterToVector.html

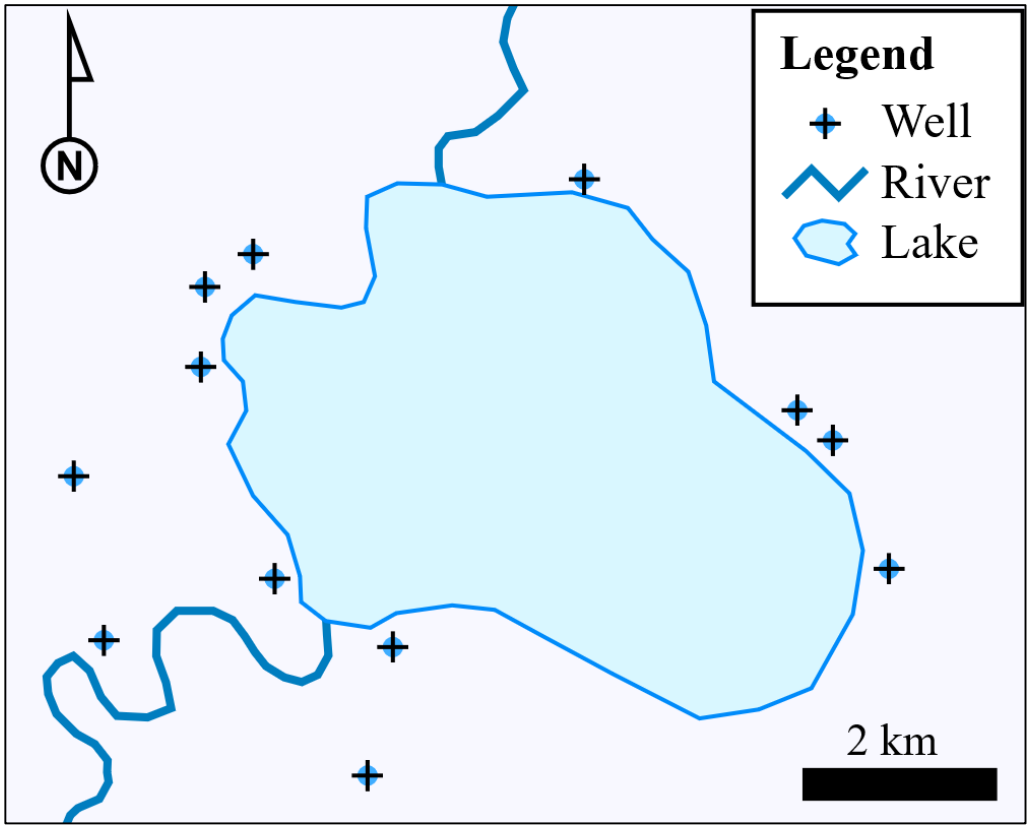
# Conversion between vector and raster

"Feature To Raster" tool



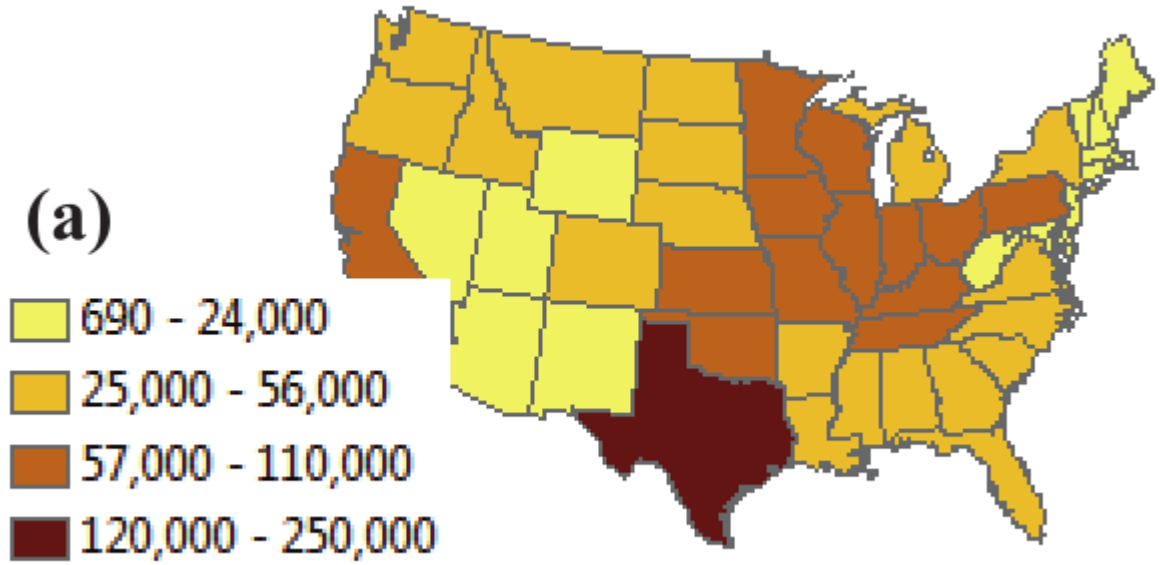

http://gsp.humboldt.edu/olm/Lessons/GIS/08%20Rasters/RasterToVector.html

# Vector or raster?

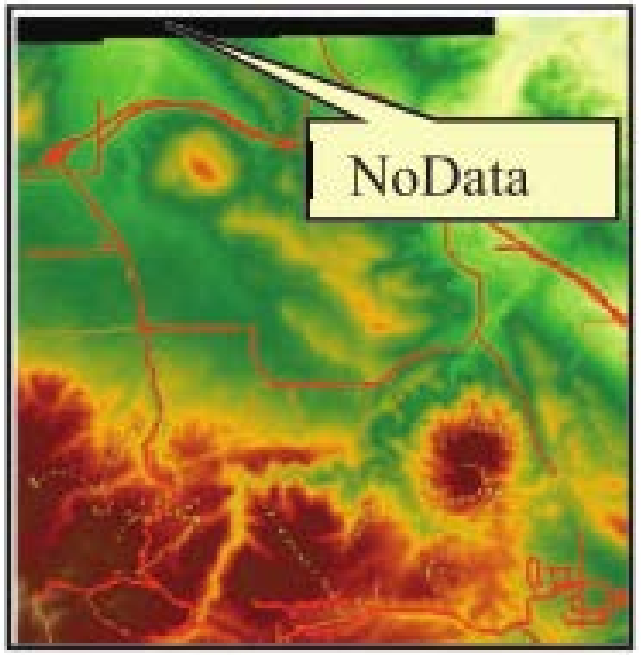



# Vector or raster?

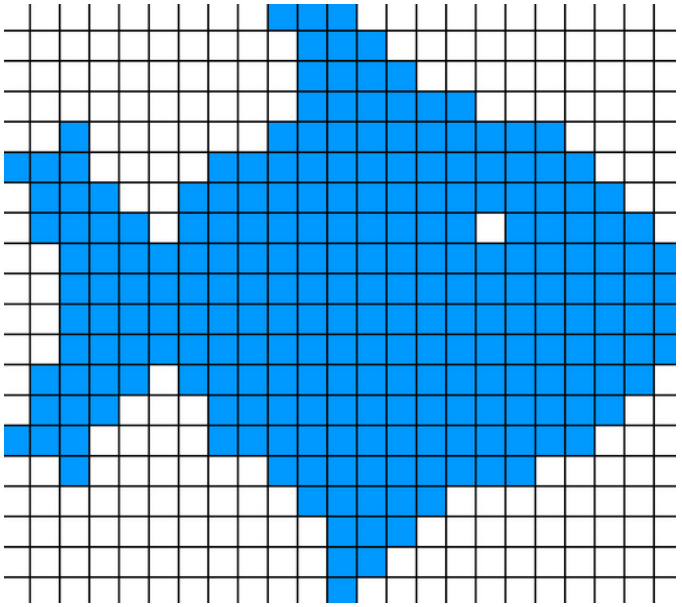
# Vector or raster?




# Vector or raster?



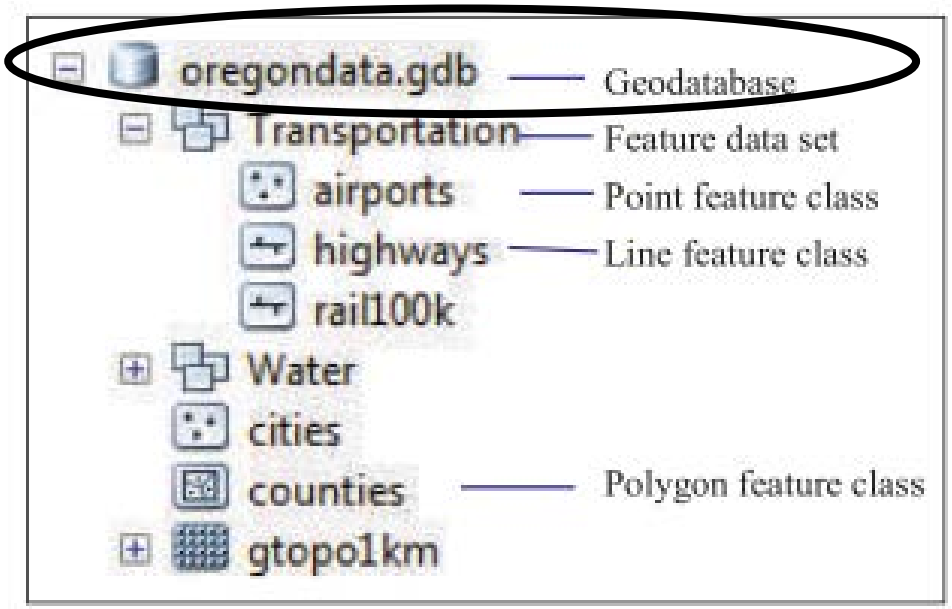

# Vector or raster?



# Vector or raster?

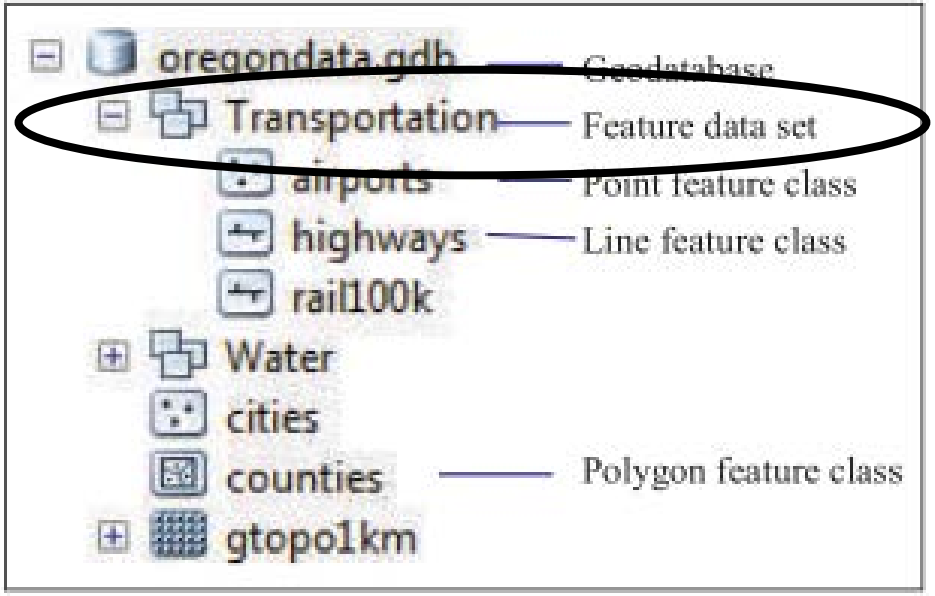
# Geodatabase

A container for **all possible** types of GIS data



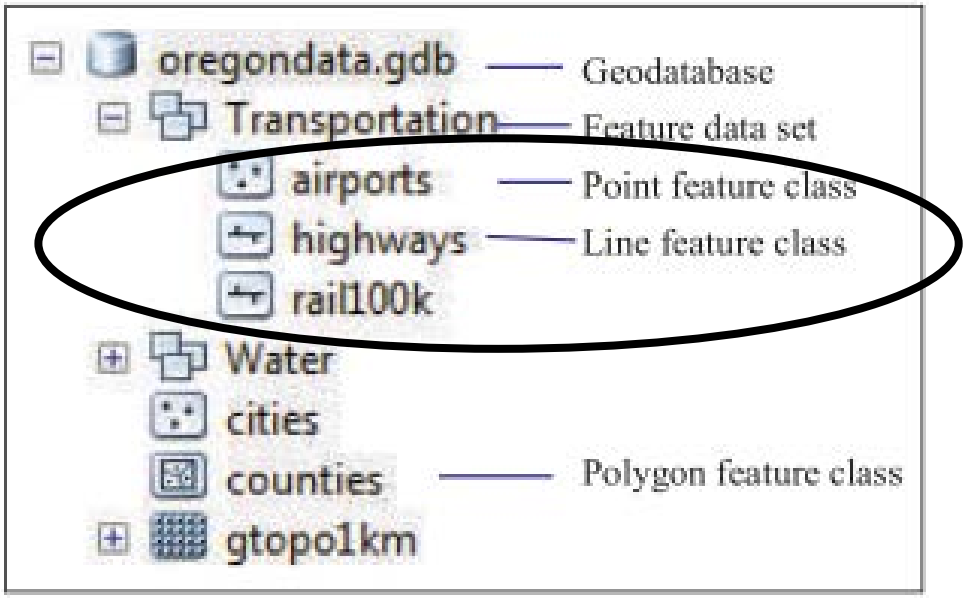
# Feature Dataset

A container for GIS data with similar features

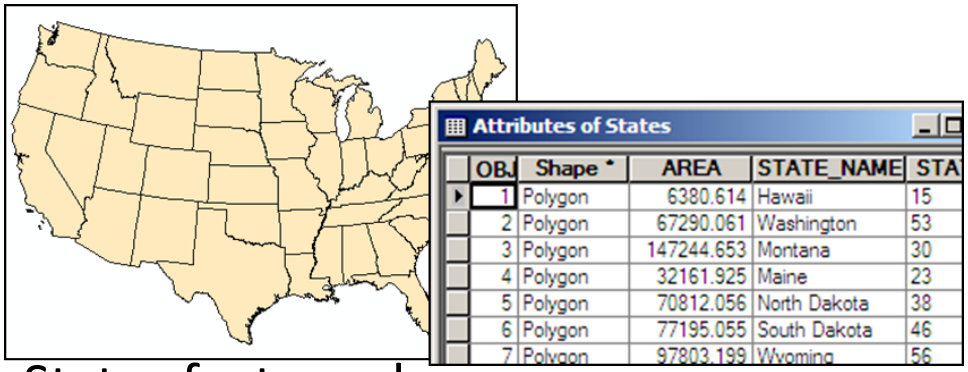


# Feature Class

A shapefile that contains points, lines, OR polygons



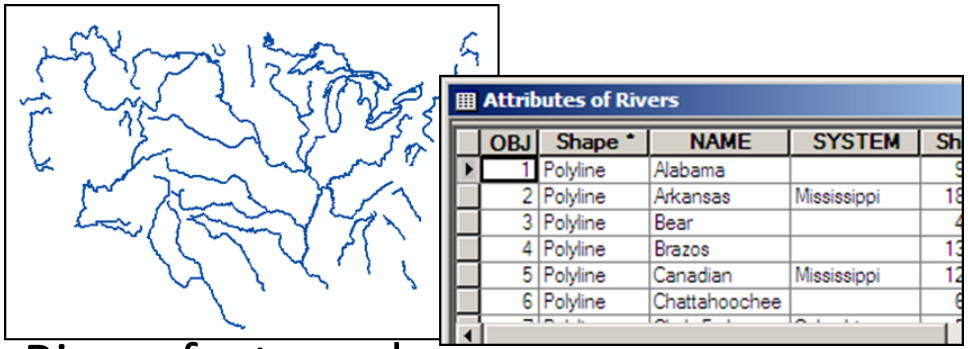
# Feature Classes



Attributes of States

| OBJ | Shape * | AREA | STATE_NAME | STA |
|---|---|---|---|---|
| 1 | Polygon | 6380.614 | Hawaii | 15 |
| 2 | Polygon | 67290.061 | Washington | 53 |
| 3 | Polygon | 147244.653 | Montana | 30 |
| 4 | Polygon | 32161.925 | Maine | 23 |
| 5 | Polygon | 70812.056 | North Dakota | 38 |
| 6 | Polygon | 77195.055 | South Dakota | 46 |
| 7 | Polygon | 97803.199 | Wyoming | 56 |

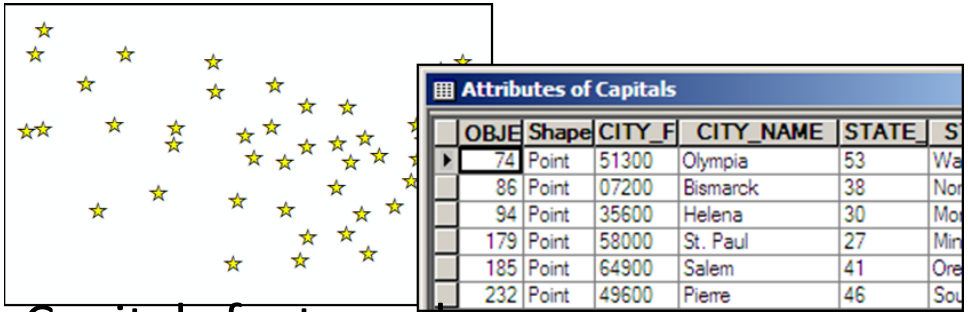
States feature class



Attributes of Rivers

| OBJ | Shape * | NAME | SYSTEM | Sh |
|---|---|---|---|---|
| 1 | Polyline | Alabama | | |
| 2 | Polyline | Arkansas | Mississippi | 18 |
| 3 | Polyline | Bear | | 4 |
| 4 | Polyline | Brazos | | 13 |
| 5 | Polyline | Canadian | Mississippi | 12 |
| 6 | Polyline | Chattahoochee | | 6 |

Rivers feature class



Attributes of Capitals

| OBJE | Shape | CITY_F | CITY_NAME | STATE_ | S |
|---|---|---|---|---|---|
| 74 | Point | 51300 | Olympia | 53 | Wa |
| 86 | Point | 07200 | Bismarck | 38 | Nor |
| 94 | Point | 35600 | Helena | 30 | Mo |
| 179 | Point | 58000 | St. Paul | 27 | Min |
| 185 | Point | 64900 | Salem | 41 | Ore |
| 232 | Point | 49600 | Pierre | 46 | Sou |

Capitals feature class

A **feature class** is a collection of similar objects with the same attributes, stored as a single unit.

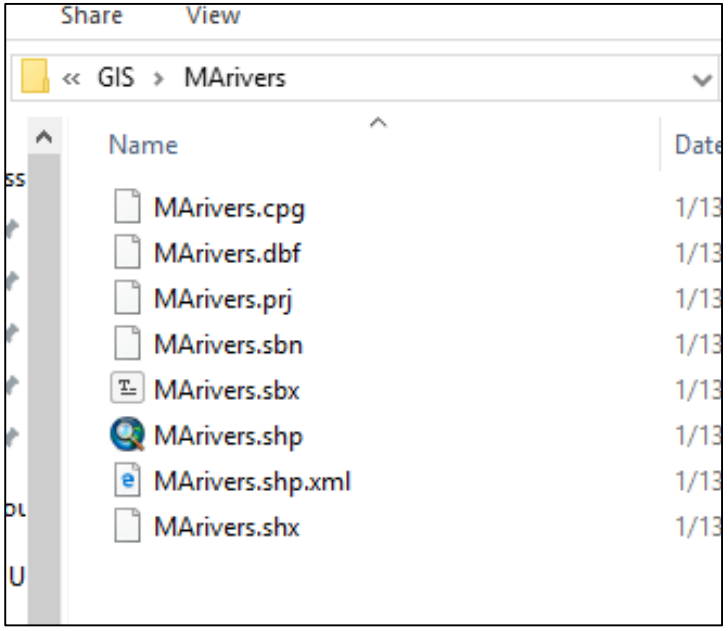
Stored as spatial features with a table of associated attributes for each feature.

Feature classes may contain only one type of geometry (points or lines or polygons).

# Shapefile Files

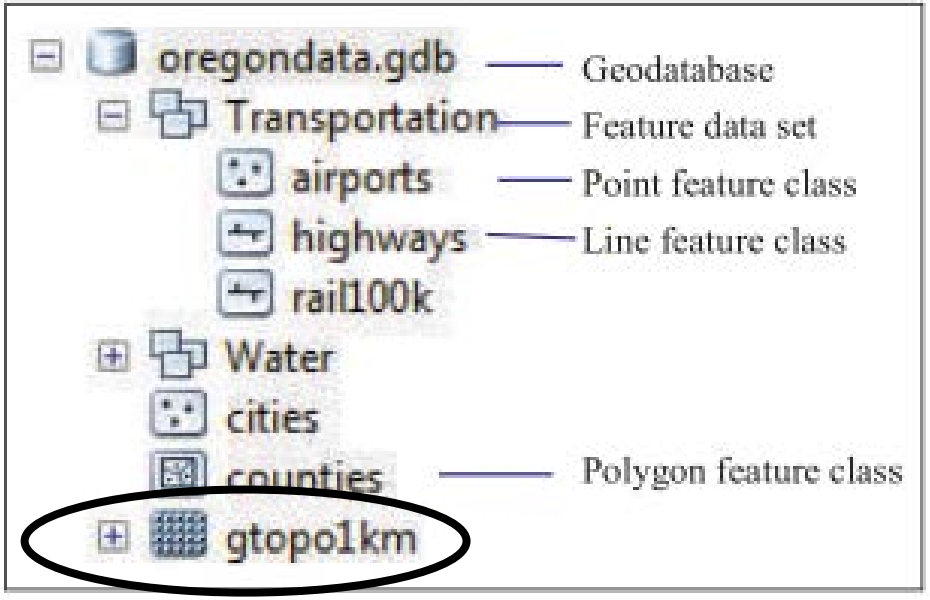
A single shapefile contains multiple imbedded file types

**.shp** is a *mandatory* Esri file that gives features their geometry.
**.shx** is a *mandatory* Esri that gives a shape its index position.
**.dbf** is a *mandatory* standard database file used to store attribute data and object IDs.
**.prj** is an *optional* file that contains the metadata associated with the shapefiles coordinate and projection system.
**.xml** file types contains the metadata associated with the shapefile.



# Rasters

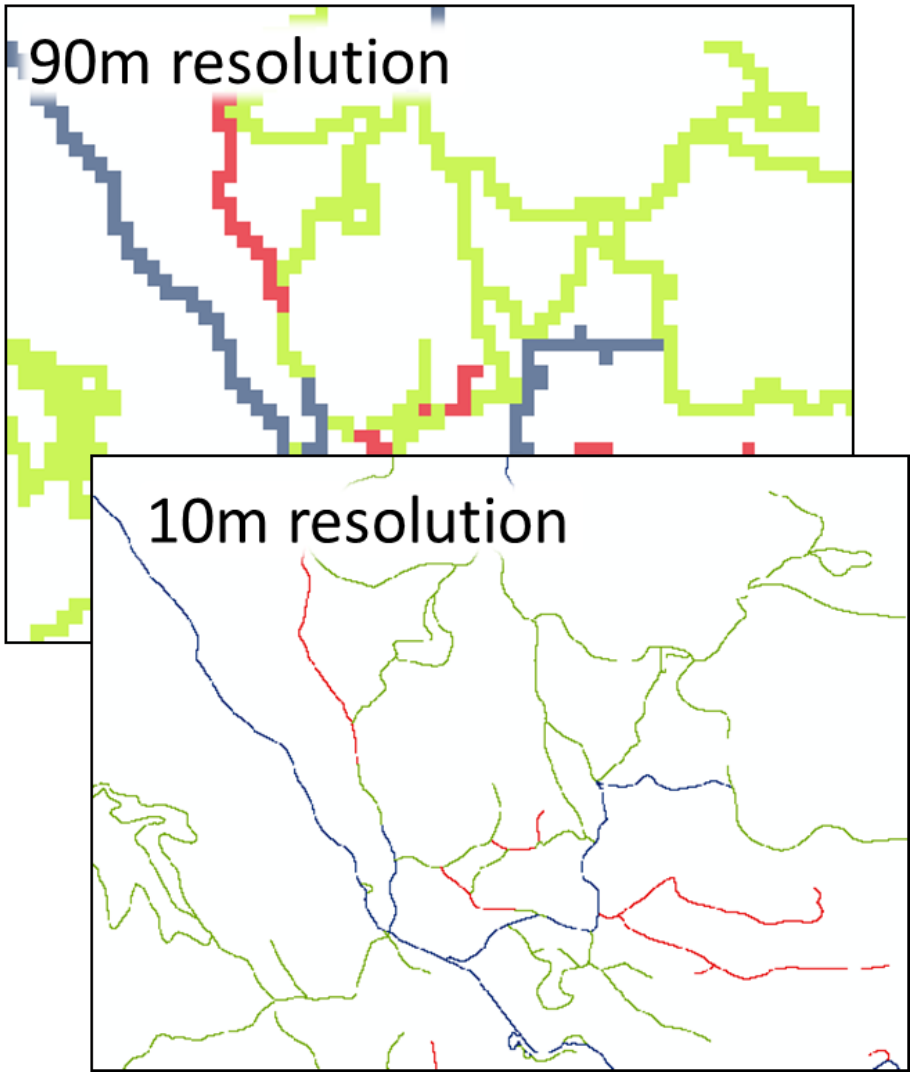
A grid of x and y coordinates on a display space.



# Rasters: Impact of resolution

Storage space increases with resolution

Portraying large areas at high precision is problematic

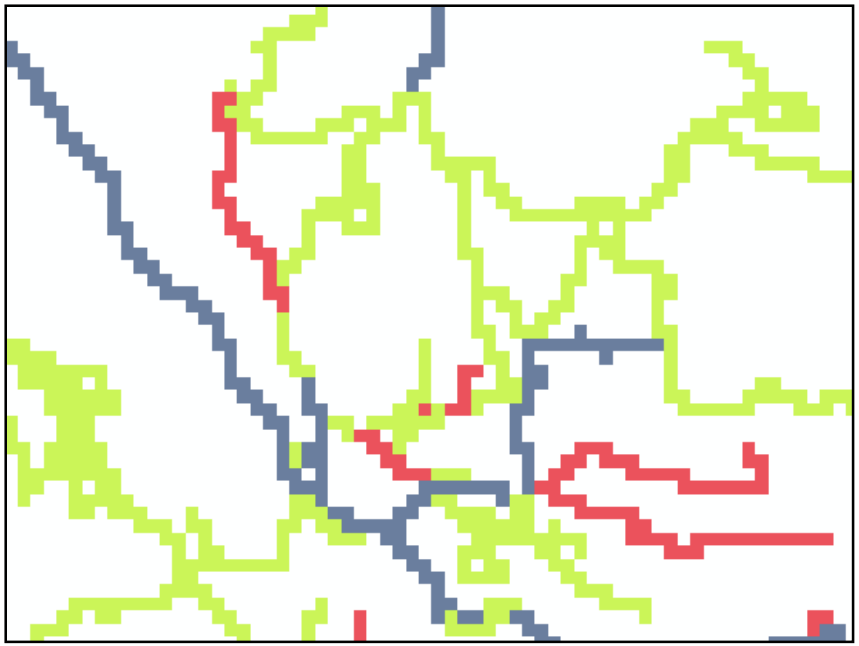


# Rasters: Storage of attributes

Roads may have other attributes: ownership, speed limit, number of lanes, etc.

Would need a new raster for each attribute

Only numeric attributes may be stored



Raster contains 1 value indicating a single attribute such as road type

# Finding data

# Lots of data out there

- ArcGIS Online (not all downloadable)
- State and federal government sites
- GIS Clearinghouses (store metadata)
- University/research organizations
- Some is great, some is worthless

Try some of the clearinghouse sites

http://nationalmap.gov

http://geo.data.gov

https://www.census.gov/ - homepage has a lot of GIS examples

https://factfinder.census.gov/faces/nav/jsf/pages/guided_search.xhtml

http://www.cdc.gov/gis/data.htm

http://data.geocomm.com/

http://openstreetmapdata.com/data

https://www.mass.gov/orgs/massgis-bureau-of-geographic-information

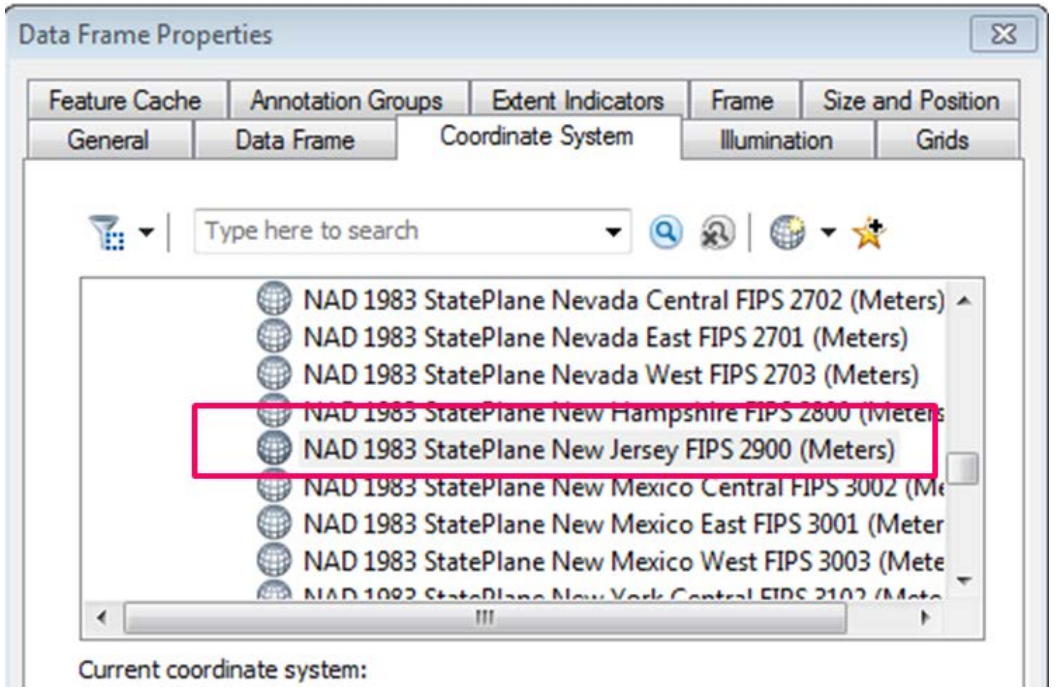
http://freegisdata.rtwilson.com/ - lists over 300 sites with GIS data by topic – elevation, weather/climate, hydrology, natural disaster, ecology, human geography, crime, natural disasters

- Keep notes when you find a good site
- Many downloaded datasets will need to be unzipped

# First steps when starting a GIS project

# 1. Decide on appropriate coordinate system (Global or Projected)

Set the coordinate system in the Data Frame Properties



# 2. Find and download data to your working folder

Try some of the clearinghouse sites

http://nationalmap.gov

http://geo.data.gov

https://www.census.gov/ - homepage has a lot of GIS examples

https://factfinder.census.gov/faces/nav/jsf/pages/guided_search.xhtml

http://www.cdc.gov/gis/data.htm

http://data.geocomm.com/

http://openstreetmapdata.com/data

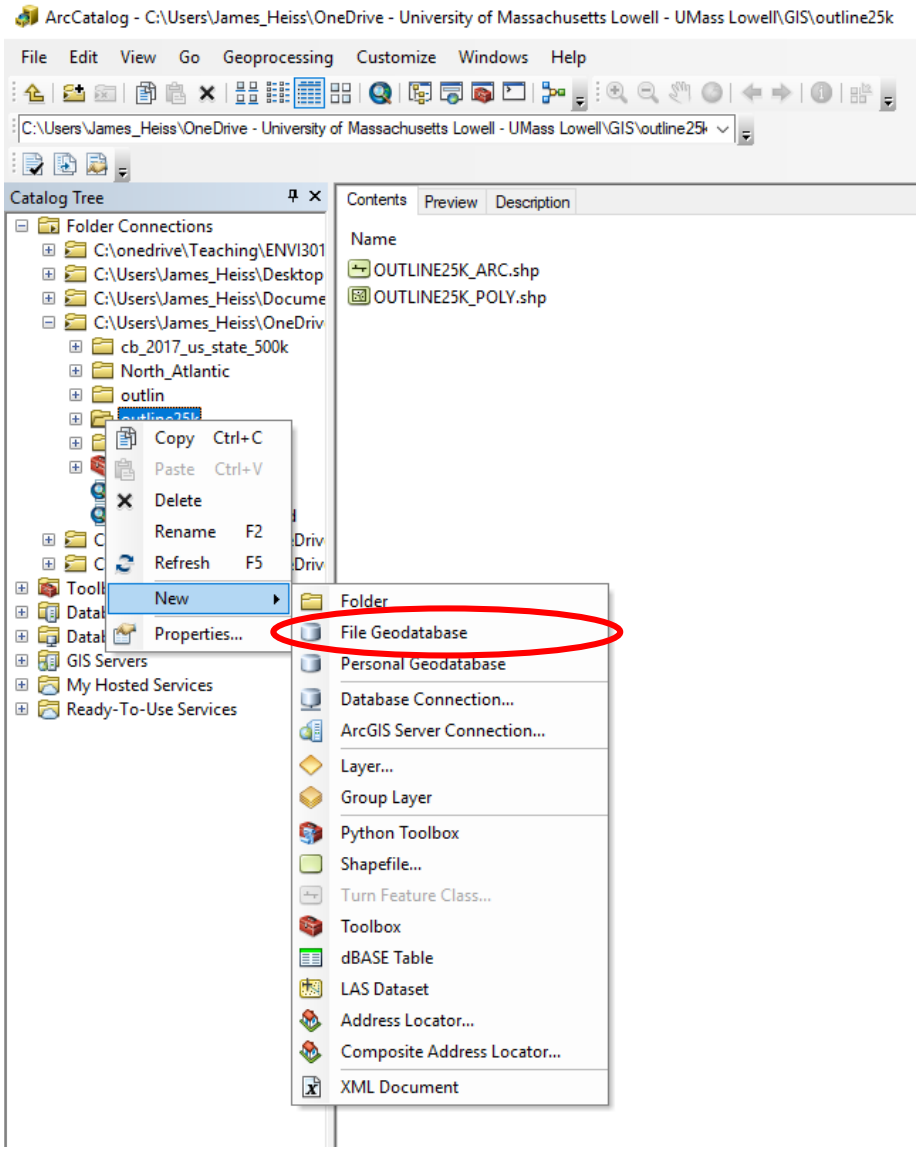
https://www.mass.gov/orgs/massgis-bureau-of-geographic-information

http://freegisdata.rtwilson.com/ - lists over 300 sites with GIS data by topic – elevation, weather/climate, hydrology, natural disaster, ecology, human geography, crime, natural disasters

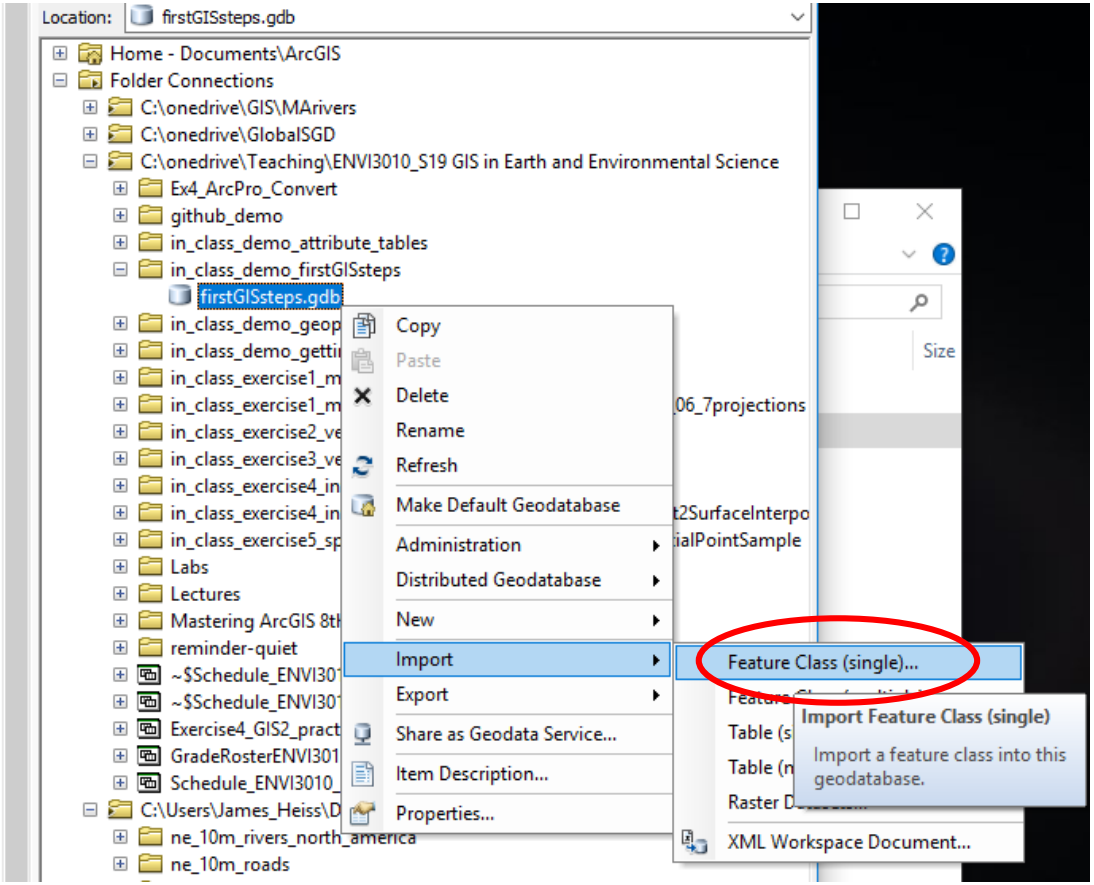
- Keep notes when you find a good site
- Many downloaded datasets will need to be unzipped

# 3. Create a geodatabase in your working folder

Right click folder ->New->
**File** Geodatabase

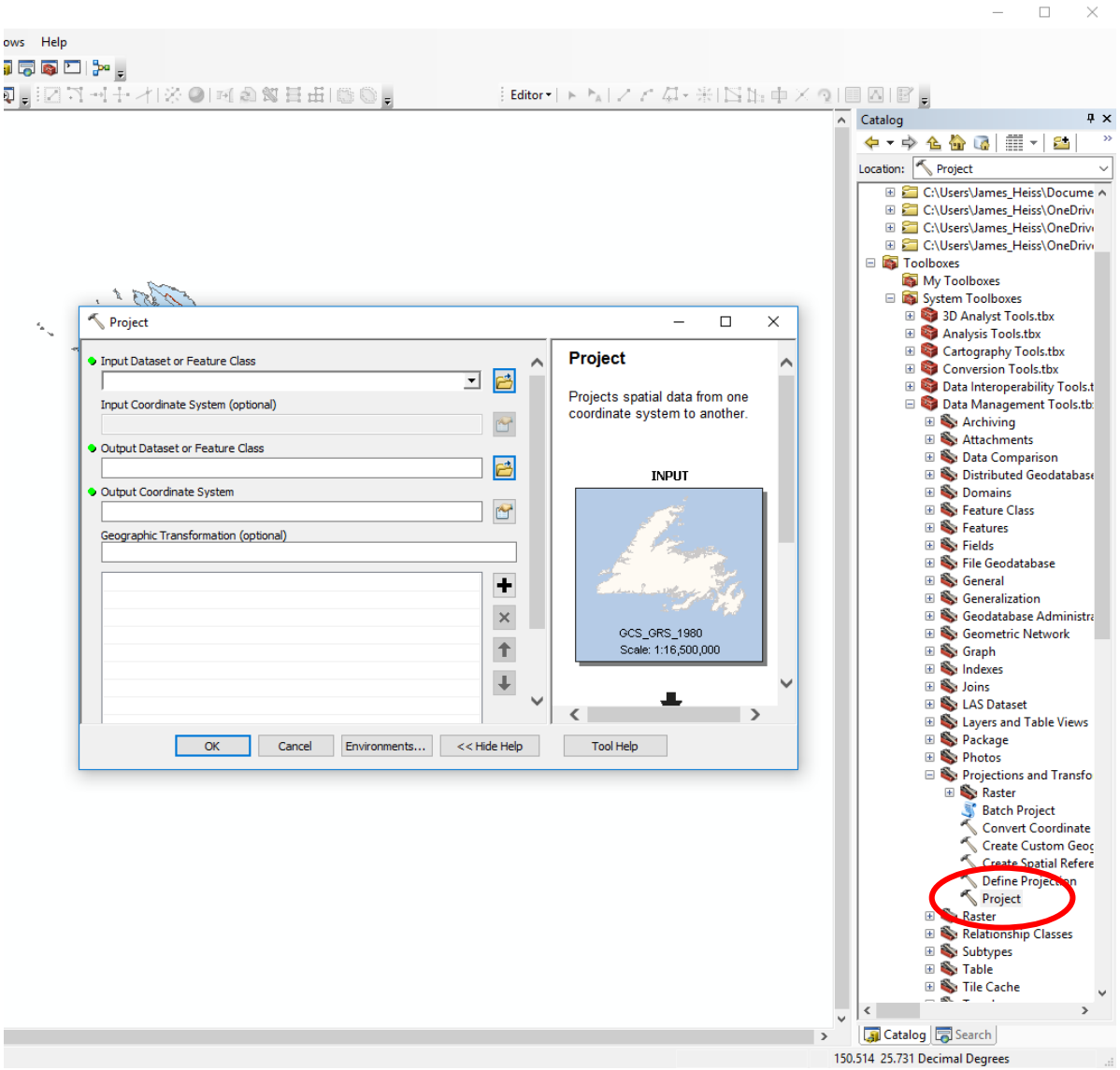


# 4. Import downloaded datasets into new geodatabase (ArcCatalog or ArcCatalog Pane in ArcMap

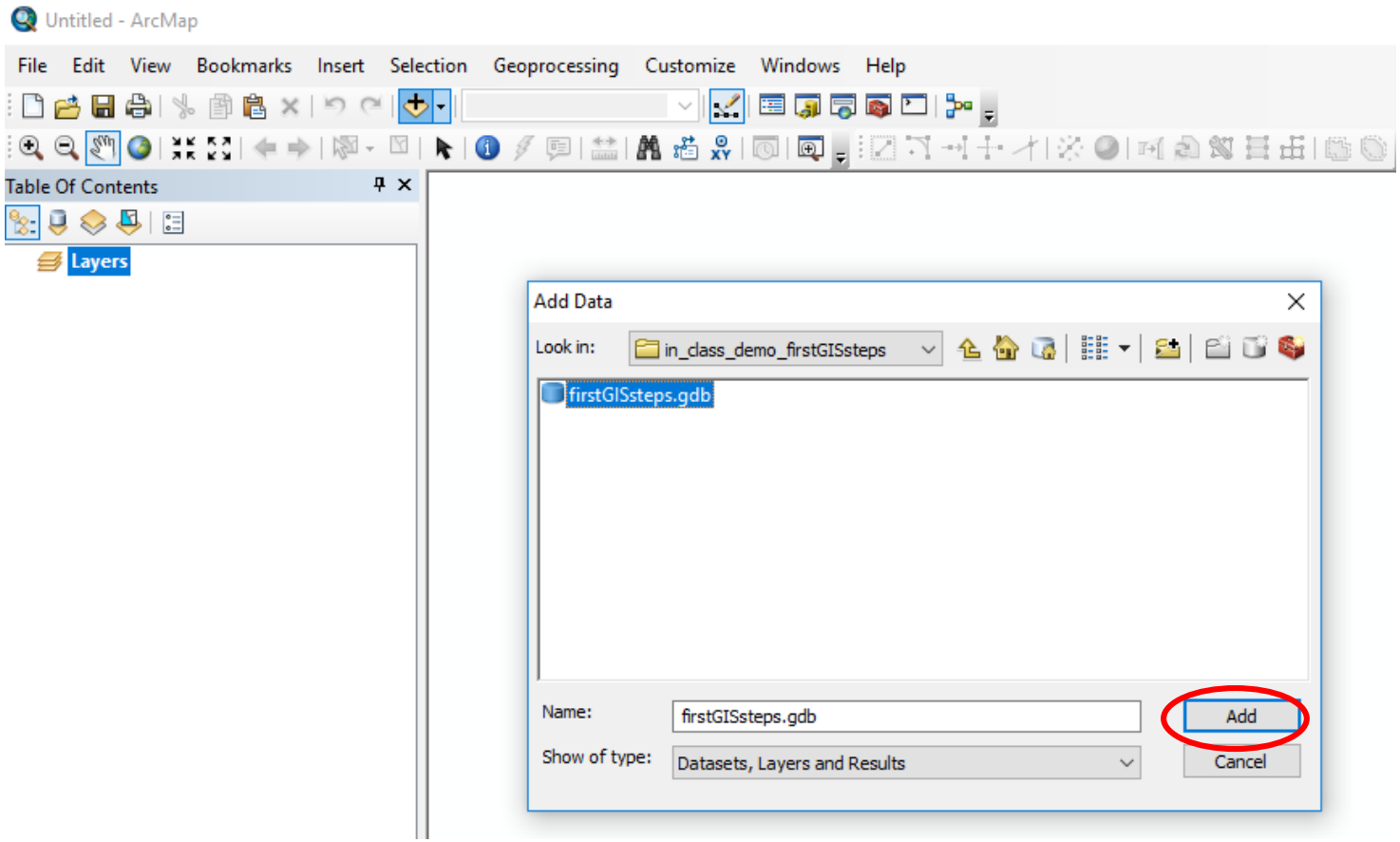


# 6. Project to desired coordinate system if needed

Use the **Project Tool** in the Data Management Toolbox



# 7. Connect to geodatabase (if needed) and add data to ArcMap



Everyone!