Geographic Data Visualization Using ArcMap

Seungwon Kim

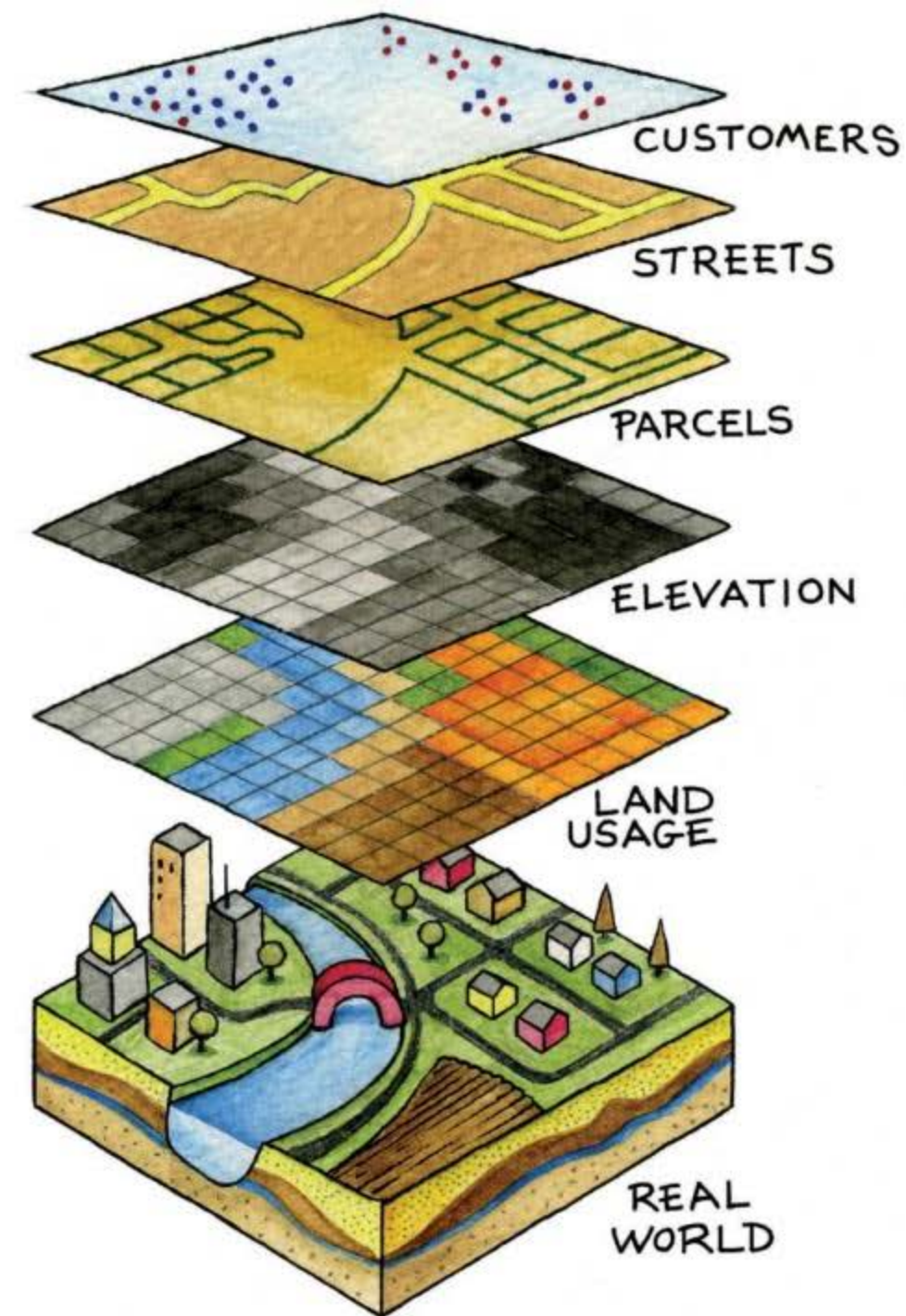Geographical and Sustainability Sciences

February 13, 2019

Why ArcMap?

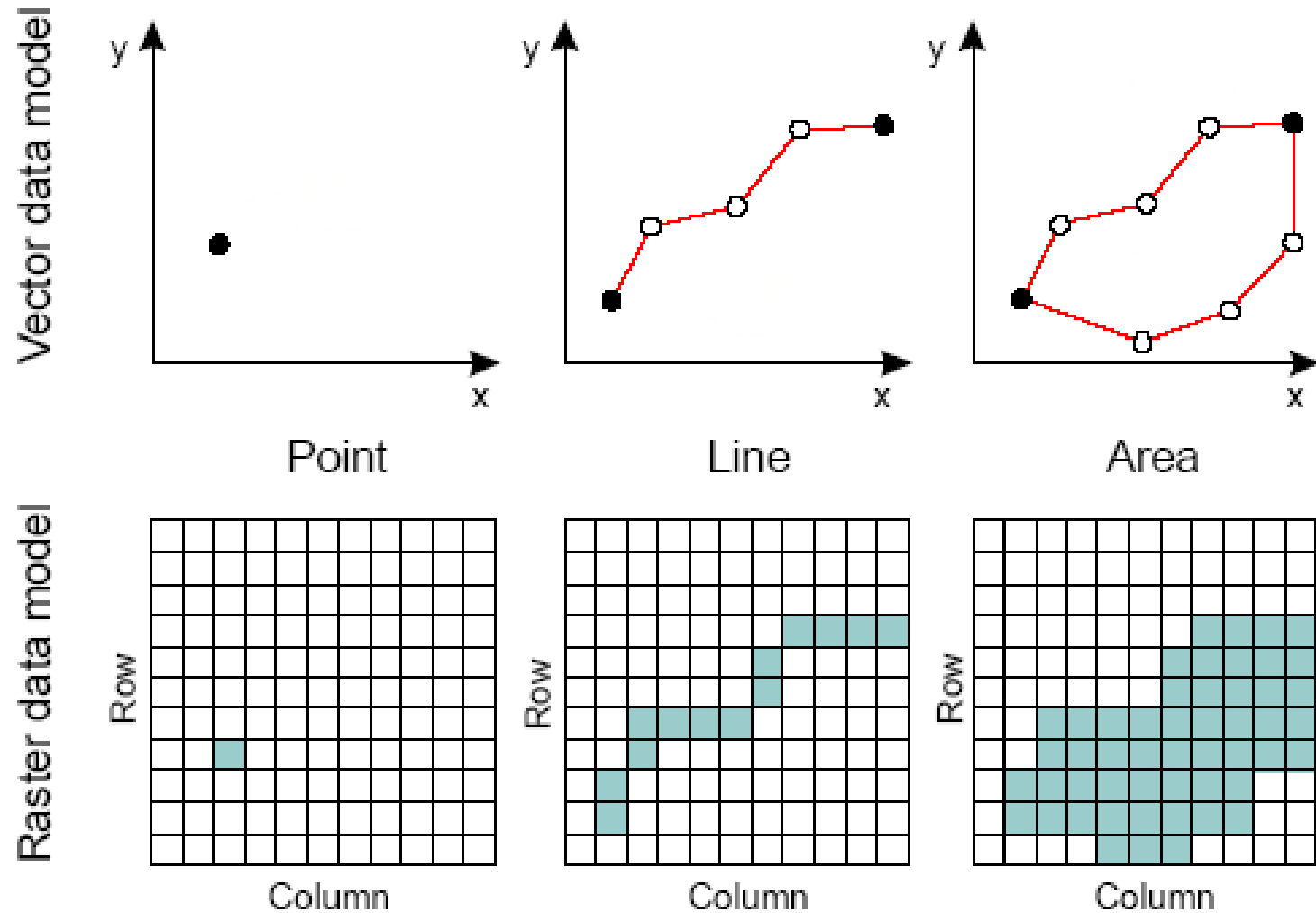- … is like SAS (or STATA) vs R
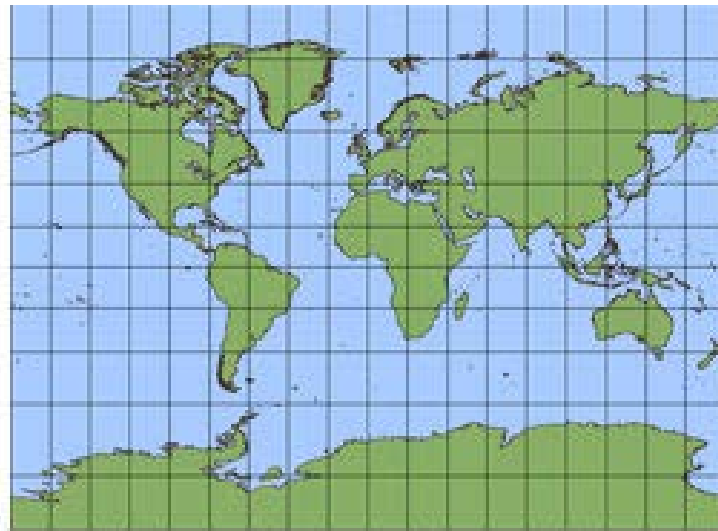
CUSTOMERS

STREETS

PARCELS

ELEVATION

LAND USAGE

REAL WORLD

GIS

geographic information system

Vector & Raster

Vector data model — Point, Line, Area

Raster data model — Column, Row
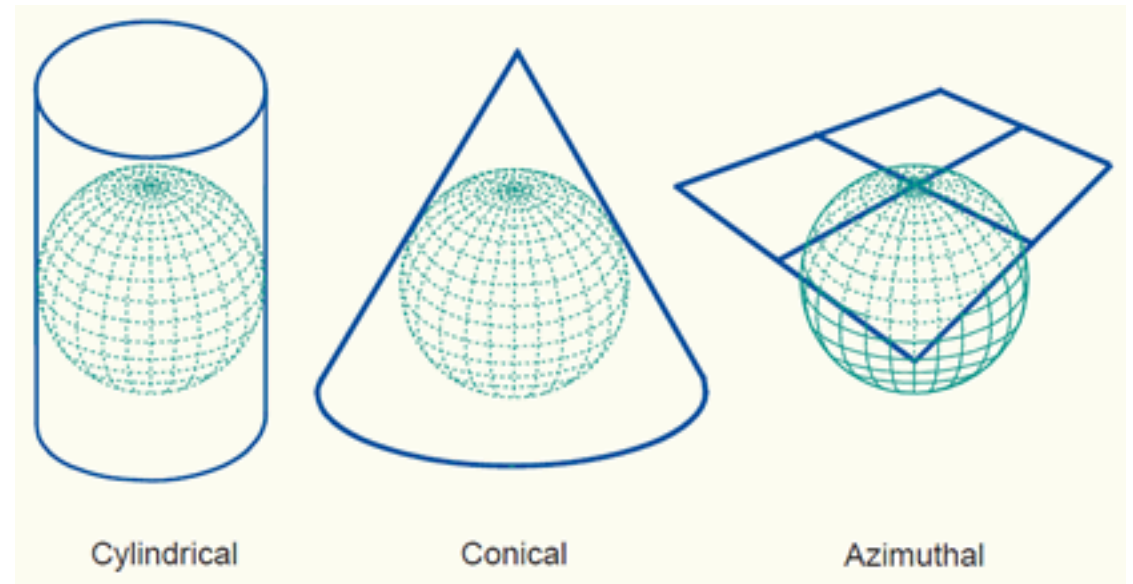
Projection

- A map projection
  - A systematic transformation of the latitudes and longitudes of locations from the surface of a sphere or an ellipsoid into locations on a plane
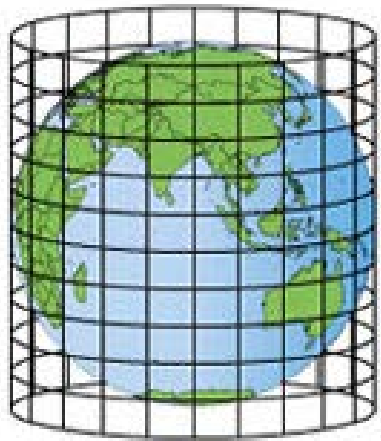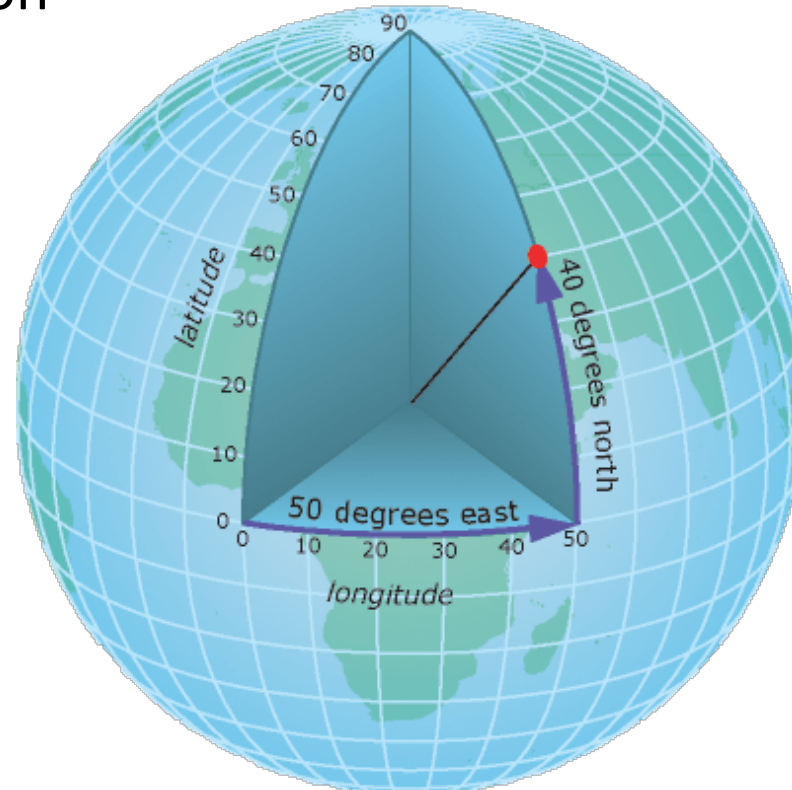

Cylindrical Projection

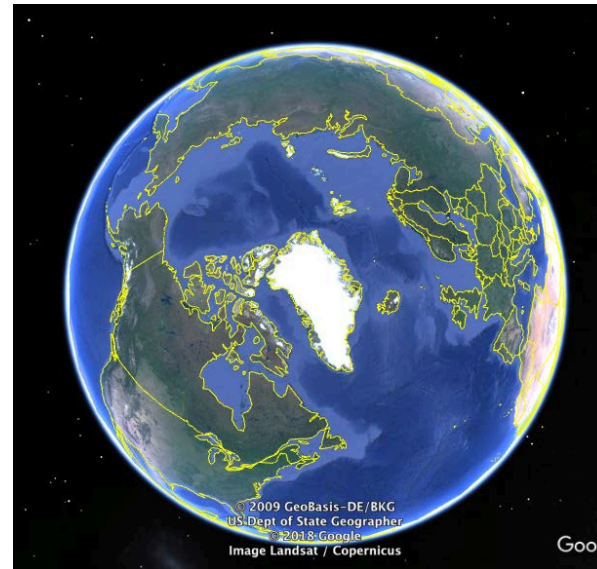Cylindrical   Conical   Azimuthal

Projection

- Geographic Coordinate System (GCS)
  - Without projection
  - Decimal degree

Projection

- Projected Coordinate System (PCS)
  - Should be set to minimize distortion for target areas
  - Meter, miles, and etc

Mercator projection: Distortion will be minimized around the equator line

Projection

- Which projection is the most appropriate for your research area?
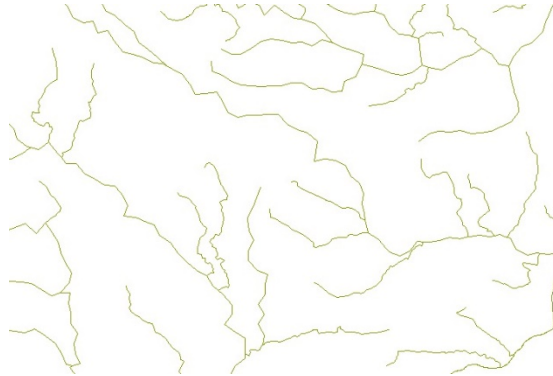 - http://projectionwizard.org/

What is a shapefile?

- ESRI standard for vectorial format
- May contain spatial and non-spatial data
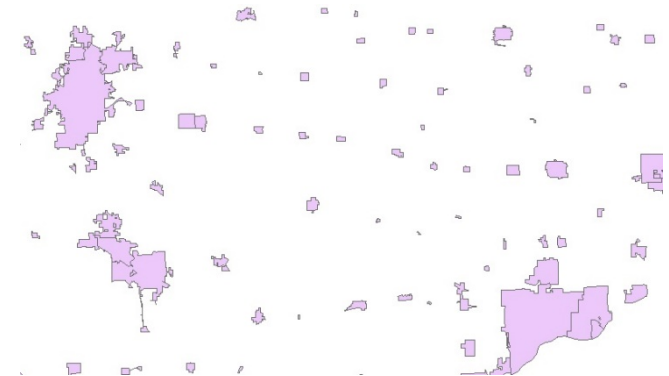- Only one type of geometry for a shapefile:

Point	Line – Polyline	Polygon

What is a shapefile?

- A shapefile is actually an archive of files with the same name and different format
- But in ArcGIS they look like a single file
- .shp .dbf .shx must be present
- .prj specifies the coordinate system

Name	Date Modified	Size	Kind
iowa_border.CPG	Mar 21, 2018 at 12:42 PM	5 bytes	Document
iowa_border.dbf	Mar 21, 2018 at 12:42 PM	73 bytes	Document
iowa_border.prj	Mar 21, 2018 at 12:42 PM	424 bytes	Document
iowa_border.sbn	Mar 21, 2018 at 12:42 PM	132 bytes	Document
iowa_border.sbx	Mar 21, 2018 at 12:42 PM	116 bytes	Adobe...ume File
iowa_border.shp	Mar 21, 2018 at 12:42 PM	212 KB	Document
iowa_border.shp.xml	Mar 23, 2018 at 2:29 PM	18 KB	TextWr...cument
iowa_border.shx	Mar 21, 2018 at 12:42 PM	108 bytes	Document

You can get shapefiles from…

- Go to: https://geodata.iowa.gov/
- Datasets > Boundaries > County Boundaries of Iowa

You can get shapefiles from…
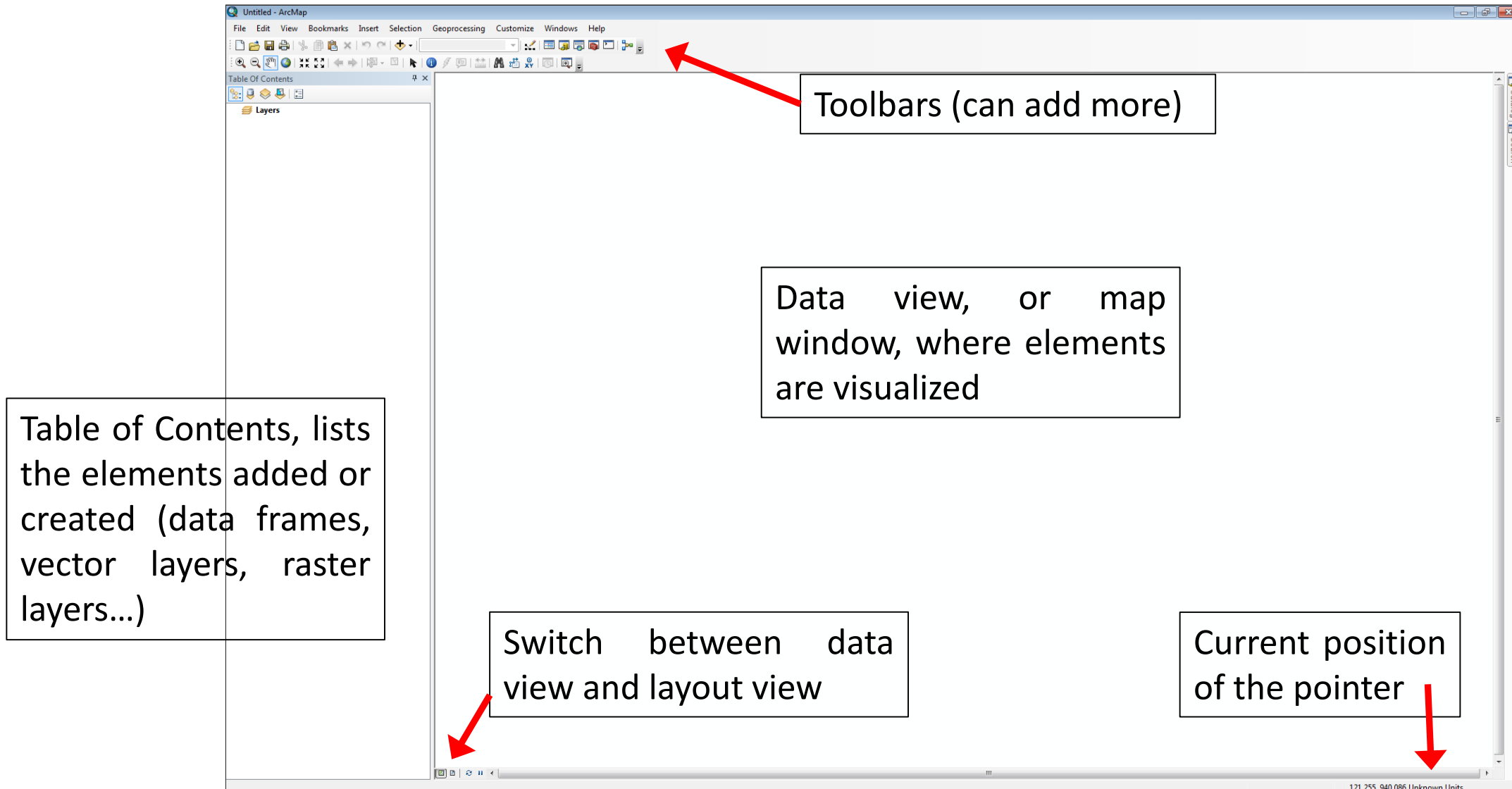
- Other sources
  - Shared Drive (U) (\\iowa.uiowa.edu\GIS-Data\Base_Data)
  - catalog.data.gov
  - census.gov
  - data.usgs.gov (look for geospatial/geographical data)

What is an MXD file?

- Map file format to save the map description, layout, and embedded objects saved in the map

- Working as a shortcut on Windows system

Elements of the workspace

Toolbars (can add more)

Data view, or map window, where elements are visualized

Table of Contents, lists the elements added or created (data frames, vector layers, raster layers...)

Switch between data view and layout view

Current position of the pointer
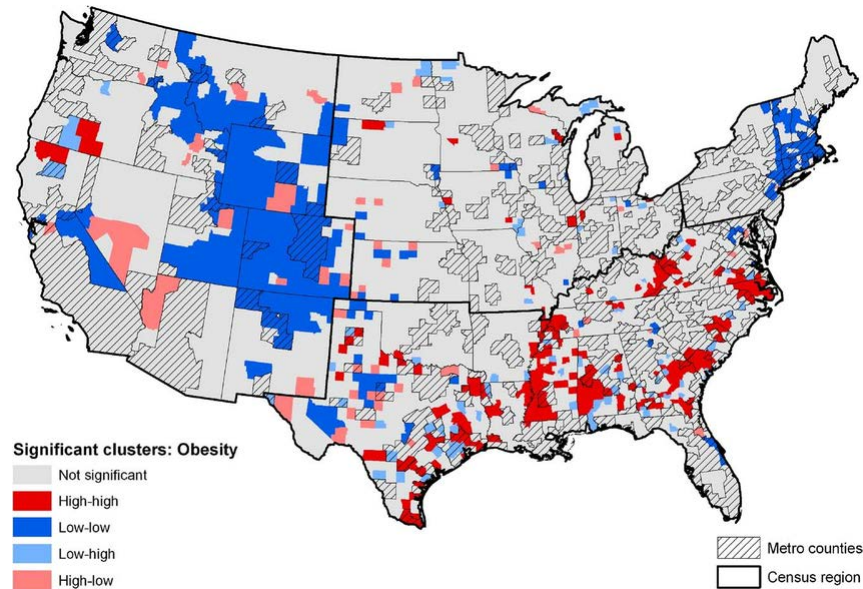
Clustering analysis

- Moran's I
  - A measure of spatial autocorrelation

- Local Moran's I
  - To identify spatial clusters of features with high or low values

Significant clusters: Obesity

- Not significant
- High-high
- Low-low
- Low-high
- High-low

- Metro counties
- Census region

Let's play with ArcMap!

Create Choropleth map!

A thematic map in which areas are shaded in proportion to the measurement of the statistical variable
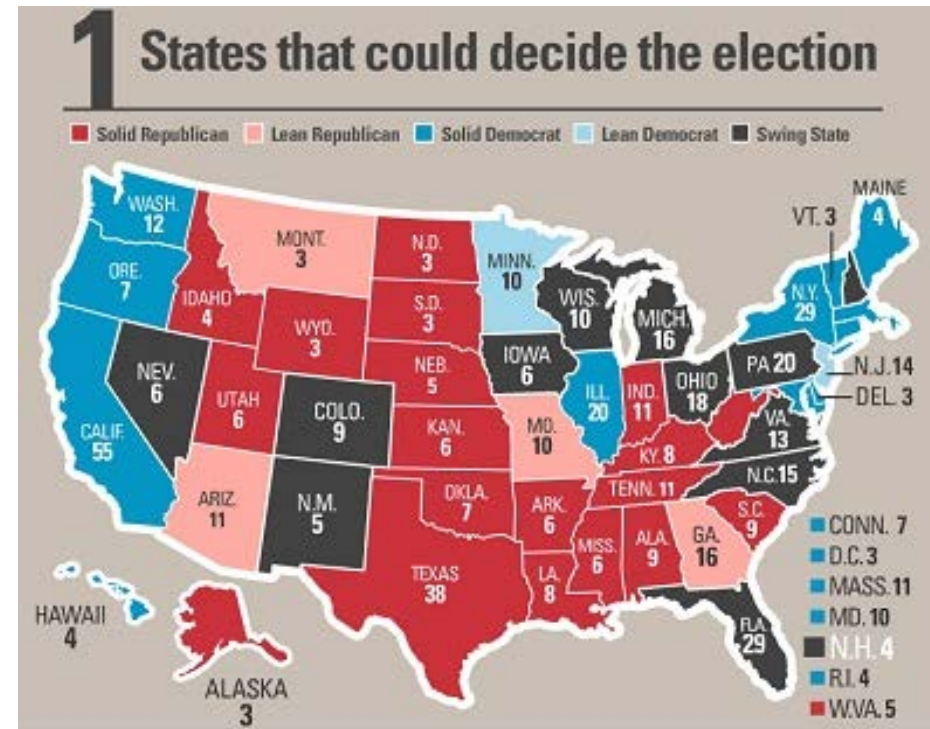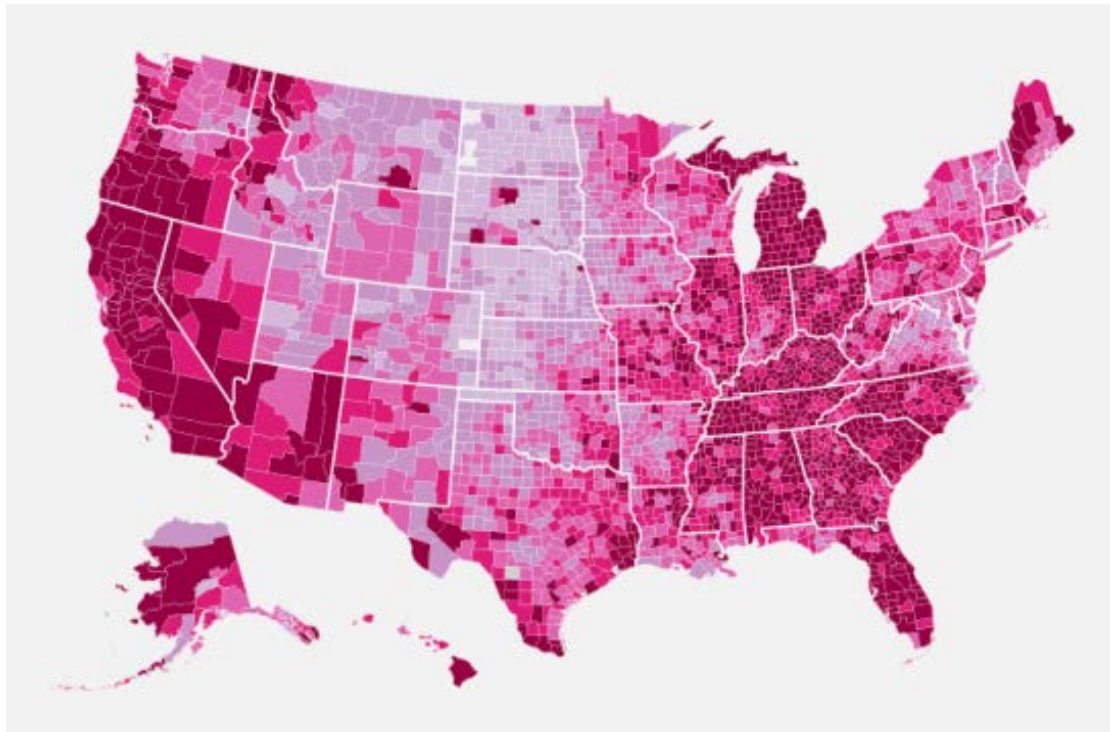
Create Choropleth map!

- **Use Add Data button in ArcMap**
- Add the 'US_COUNTY' layer and 'census_by_county.csv'
- Right-click on 'US_COUNTY' > Joins and Relates > Join
  - 1. FIPS_num
  - 2. census_by_county.csv
  - 3. FIPS

Create Choropleth map!

- Right-click on 'US_COUNTY' > Data > Export data

- Save your new shapefile in your personal folder

- Click OK to add the exported data to the map as a layer
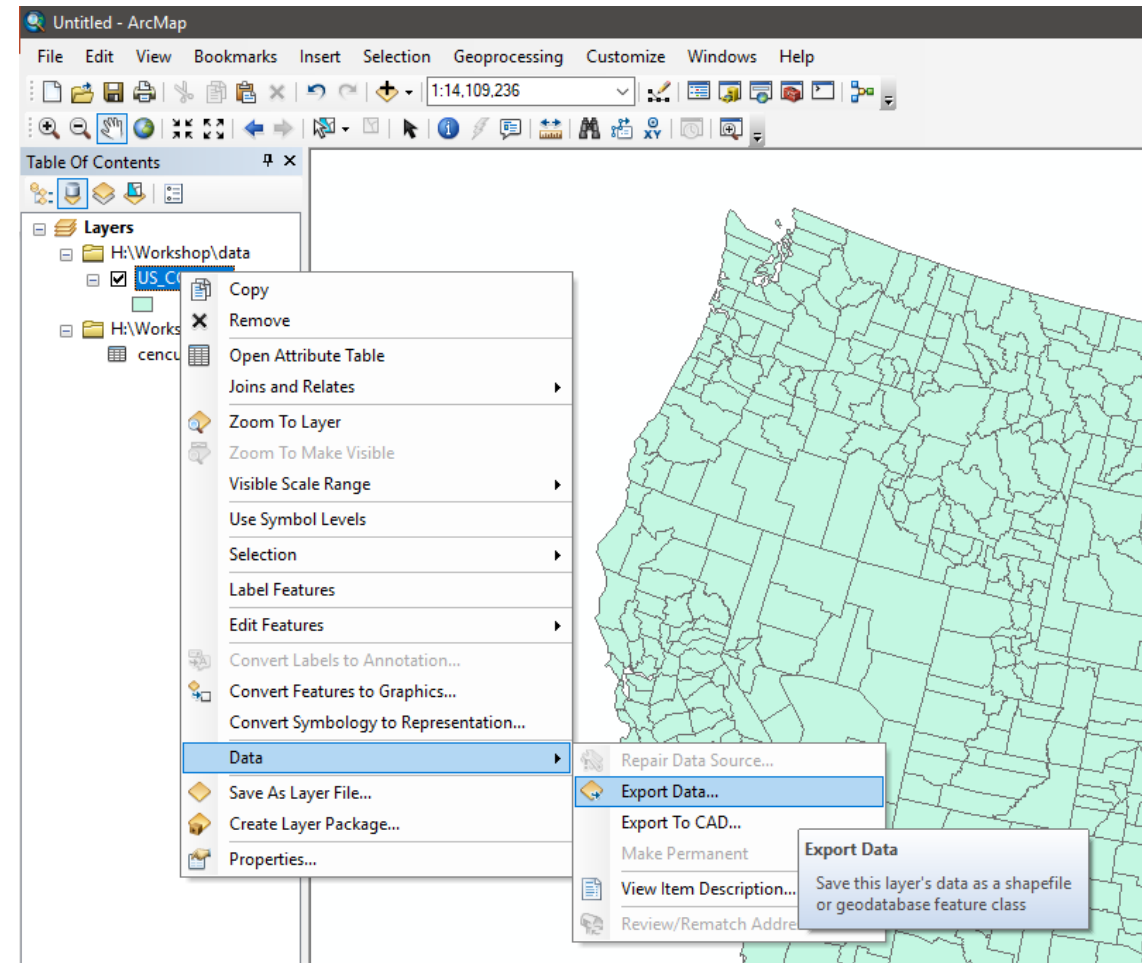
Create Choropleth map!

- Right-click on your new shapefile > Properties > Symbology
- You will be displaying the data as <u>'Quantities' > Graduated colors</u>
  - Set the Value field to 'POP10_SQMI'. This stands for population density per square mile in 2010.
- Next, you need to choose the number of classes and classification method. Here, you will use a manual method to set your class breaks.
  - Click on the Classify… button.
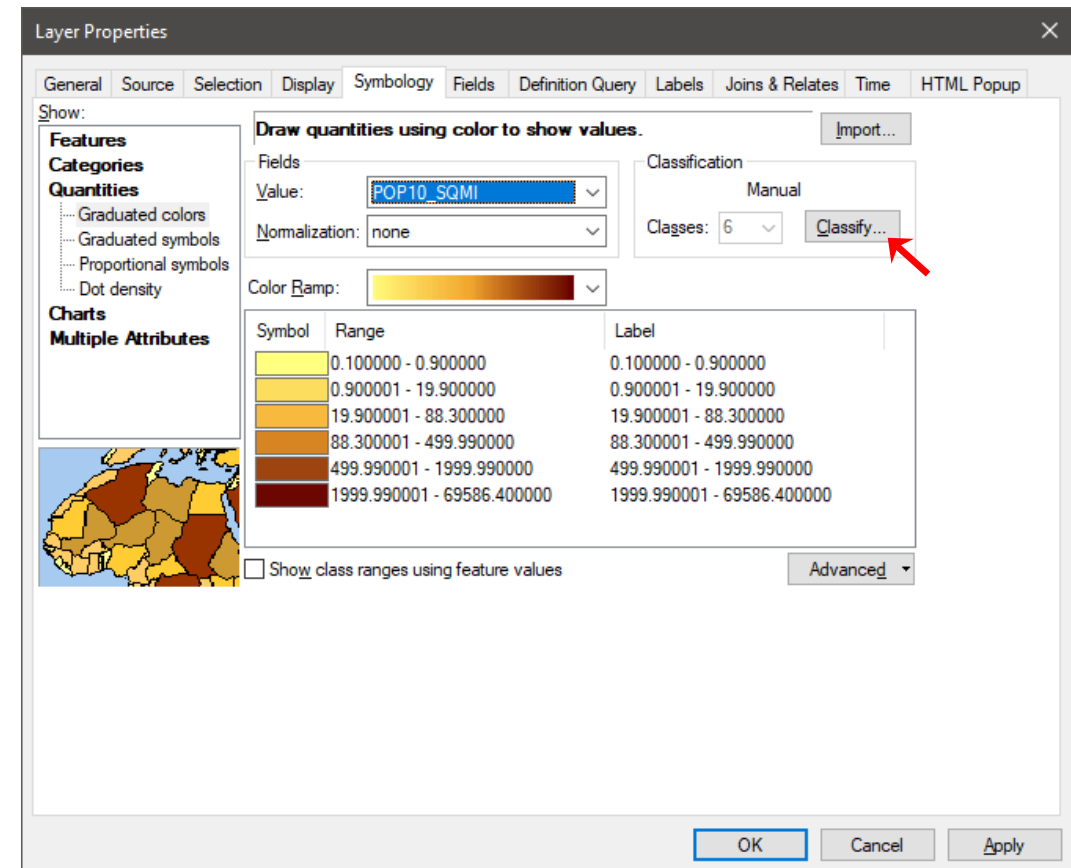
Create Choropleth map!

- Select the number of classes to 6 first and then set Manual as the classification method.

- Set Break Values as shown below. For your information, overall population density of the US is 88.4.
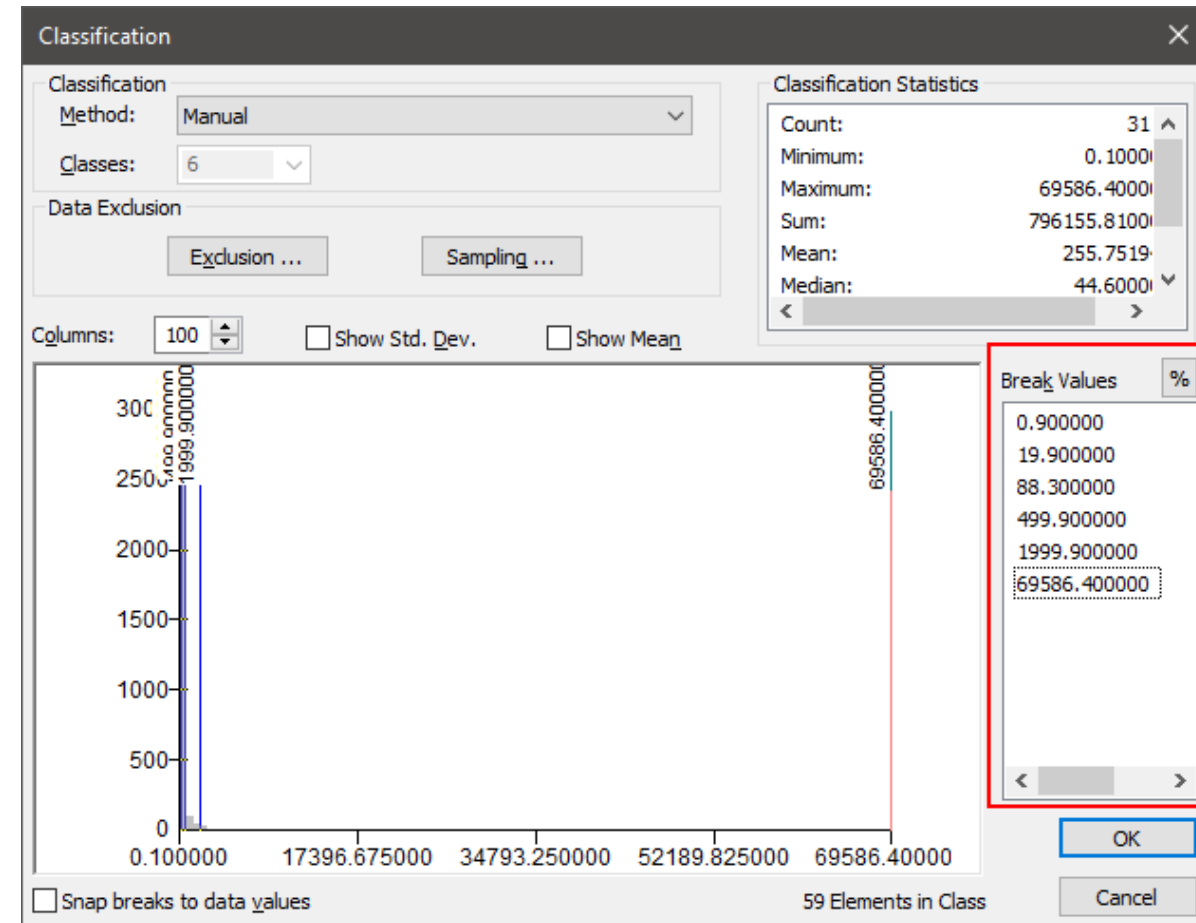
Create Choropleth map!

- To edit the number of decimal places displayed, from within the layer properties window you need to right click on the Label tab and select Format Labels.
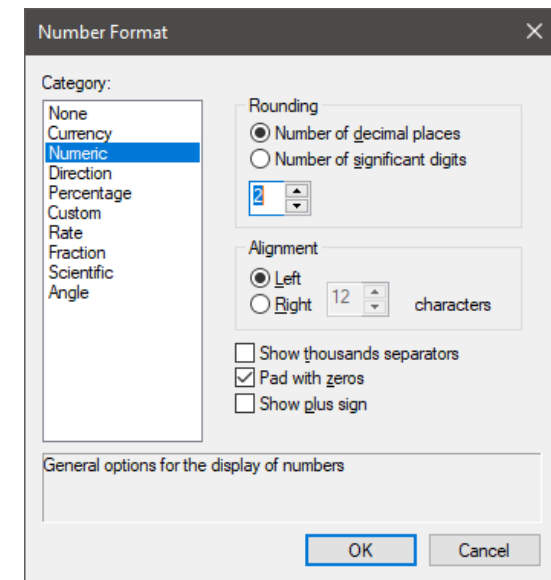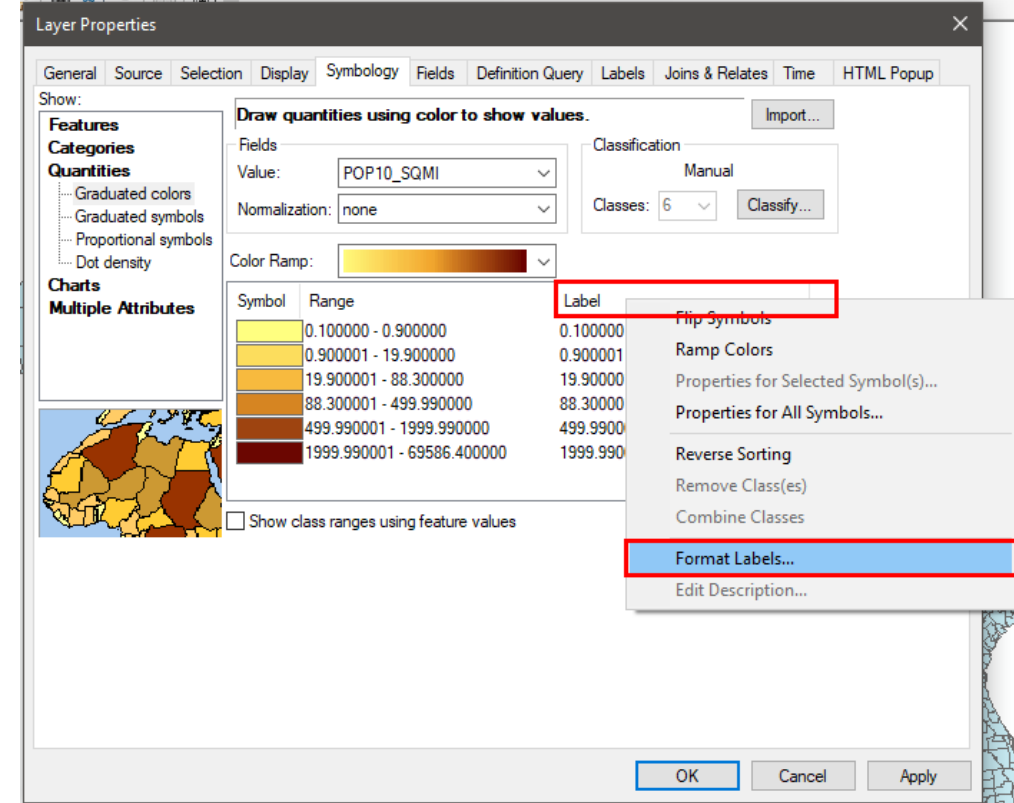
Create Choropleth map!

- Change to layout view (from Data view)

- Add North Arrow

- Scale

- Legend

- Title

- File > Export map > save as jpg or png

Switch between data view and layout view
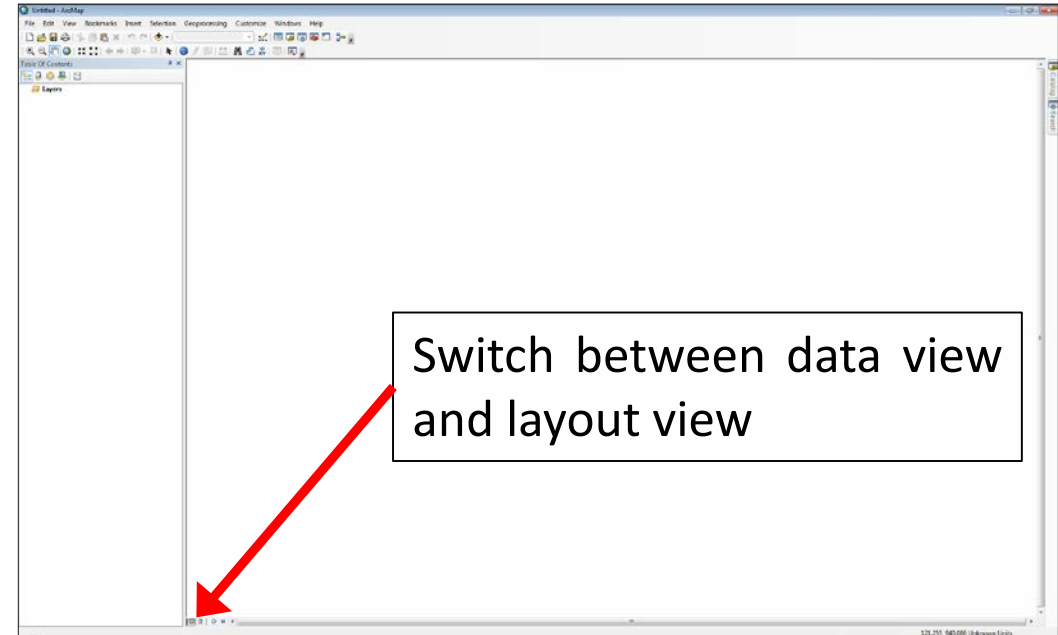
Cluster analysis

- Right-click on US_COUNTY > Open Attribute table

- Add Field > Set name and type as "Float" > OK

- Right-click on your new field > Field calculator

- Type this in the box > OK
  - [ASIAN] / [POPULATION] * 1000

- Normalization. Why?

Normalization

Is it fair to compare Iowa and California economy by count of unemployed people? California has more unemployed people than Iowa. But also more employed people!

Is it fair to compare Iowa and California university system by number of college graduates? California has more college graduates. But also more college dropouts!

You cannot fairly compare California and Iowa, because California is just bigger and has more of everything: people, working-age people, students, tourists, hospitals, areas for recreation, polluted sites, agricultural output, etc.

For a fair comparison you have to normalize counts, i.e. divide counts by respective whole/total. Then you compare densities, ratios: unemployment rate, GDP per capita, college dropout rate, crop output per hectare of arable land, number of hospital beds per 1,000 people, etc.

Cluster analysis

- CTRL + F
- Type cluster in search bar
- Open Cluster and Outlier Analysis > Set as below > See the result and interpret!
- Change colors
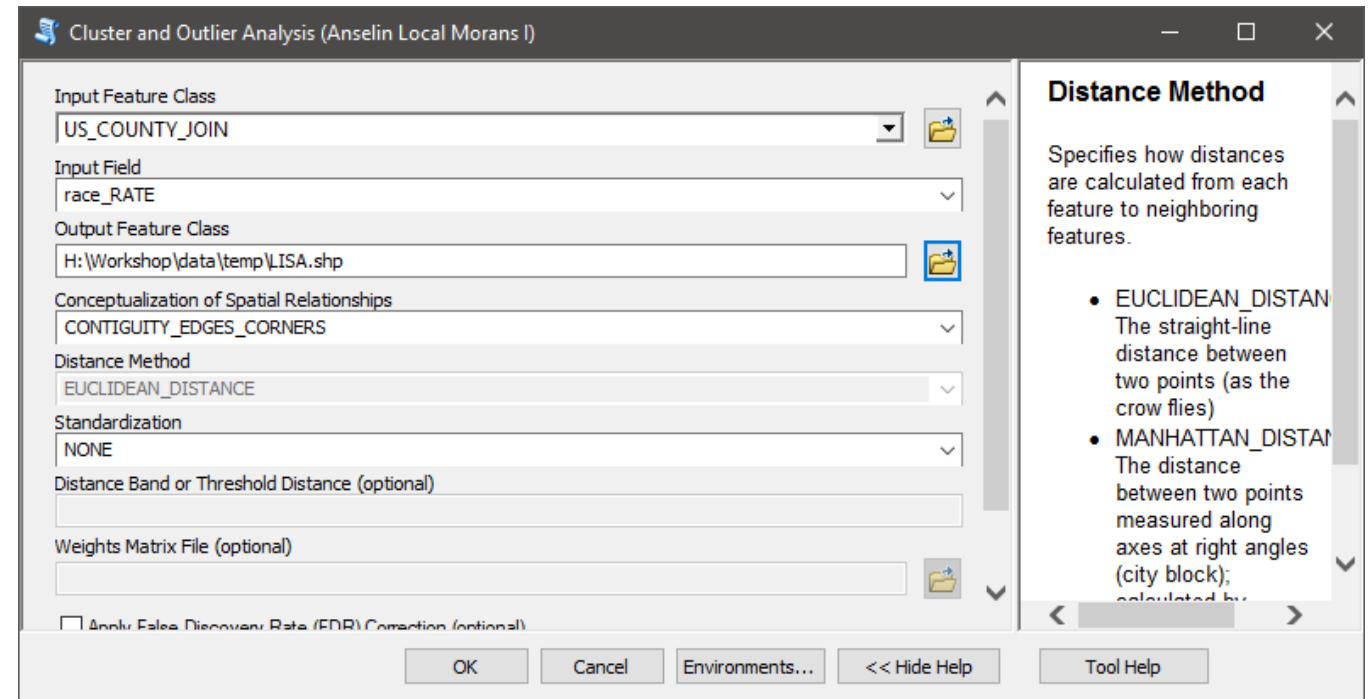
Play with Tweet data

Create a shapefile of counties in Iowa (Method 1)

- Open ArcMap
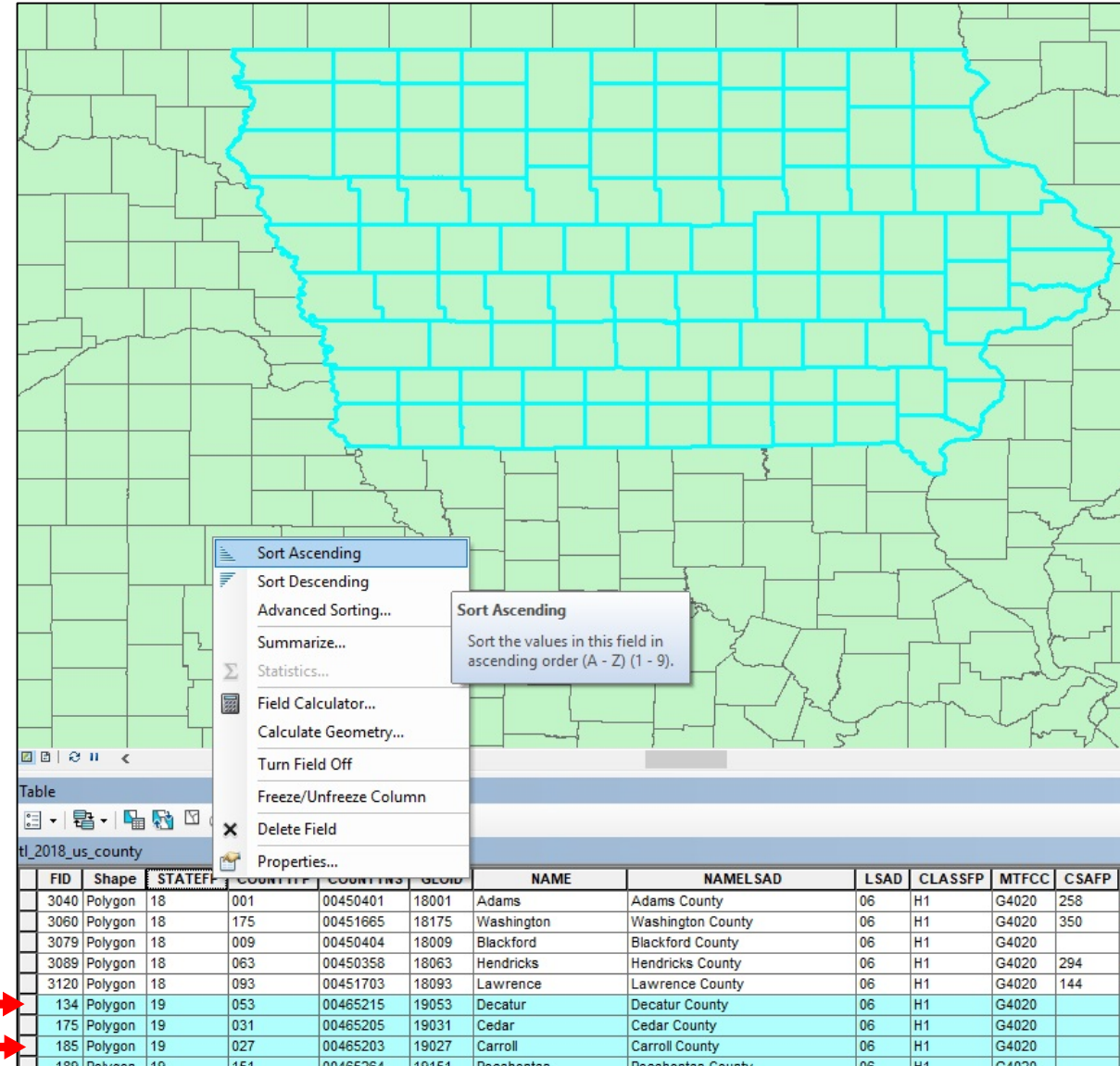- Add the shapefile with the US counties
- Right-click on layer -> **Open Attribute Table**
- Right-click on the column name STATEFP -> Sort Ascending
- Each US administrative subdivision (State, county, etc.) has a unique ID, named FIPS. Iowa FIPS is 19.
- Scroll down and select all the rows/counties where STATE_FIPS = 19
- To select, click at the very beginning of a row
- You can select the first, scroll down to the last occurrence, hold Shift and select it.
- Check you have the same selection as in the figure here. **There are 99 counties in Iowa.**

# Create a shapefile of counties in Iowa (alternative method)
(Skip if you have selected already)

- Open ArcMap
- Add the shapefile with the US counties
- Go Selection > Select by Attributes..
- Double-click on "STATE_FIPS" and click '=' once
- Click '**Get Unique Values**' then the numbers will show up in the box from '01' to '78'
- Find '19' and double-click
- The box at the bottom should be exactly the same as the one on the right
- You can type manually but won't work if any typos or (single for numbers/double for characters) quotation marks are missing
- Click Okay
- If you want to reselect the features in the layer, go Selection > Clear Selected Features
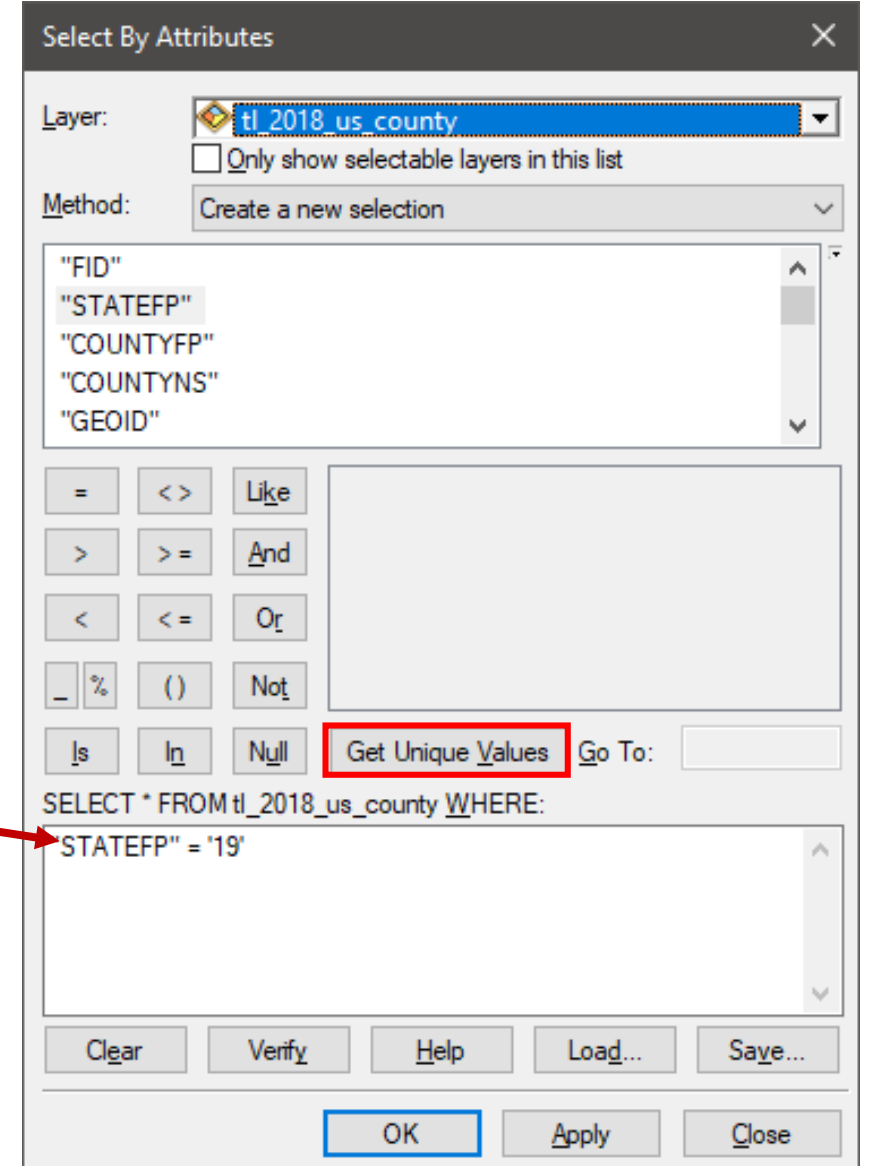
Create a shapefile of counties in Iowa

- Right-click on layer -> **Data** -> **Export Data…**
- Specify the output filename. Click on the folder icon and save the output in your folder as a shapefile. Save as 'COUNTY_IA.shp' and OK.
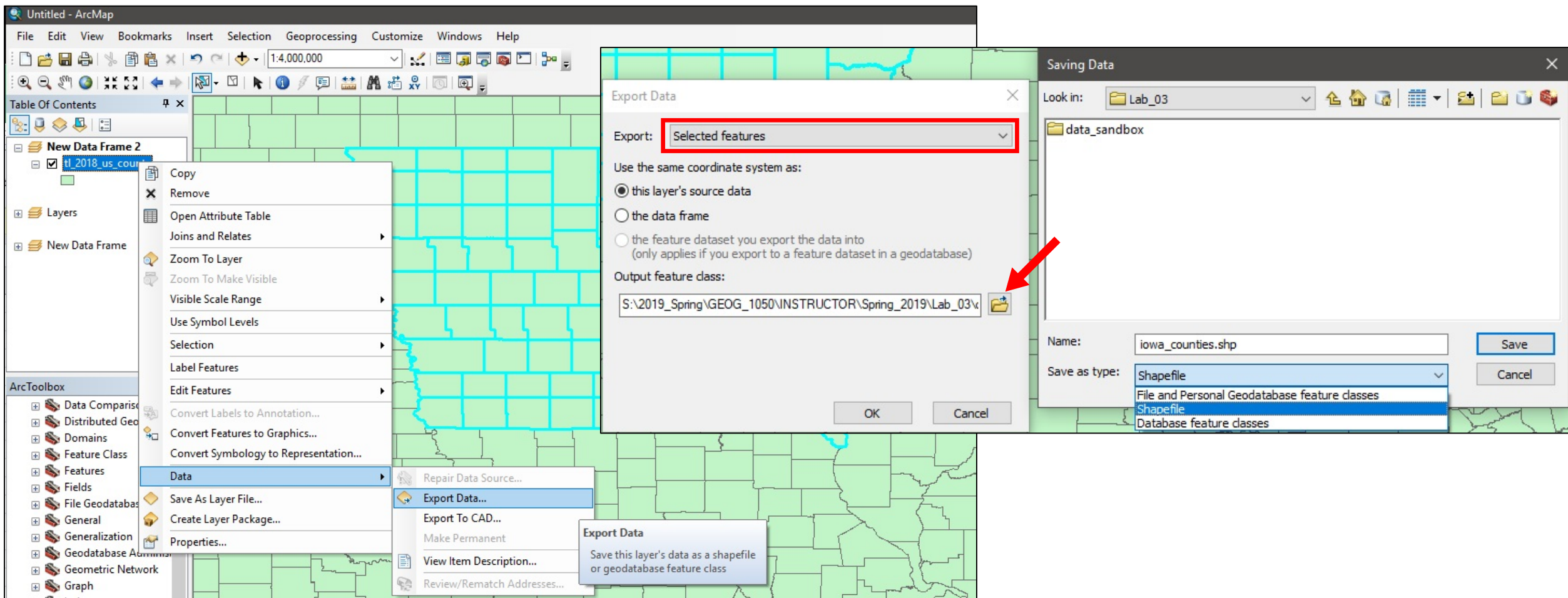
Halloween Tweets in Iowa

- File > New.. And save your work

- Add tweet.csv in ArcMap > Right-click > Display XY data...

- Edit > Geographic Coordinate System > North America > USA and territories > NAD 1983 > OK

- Right-click on tweet.csv Event > Data > Export data

- Add COUNTY_IA.shp in ArcMap
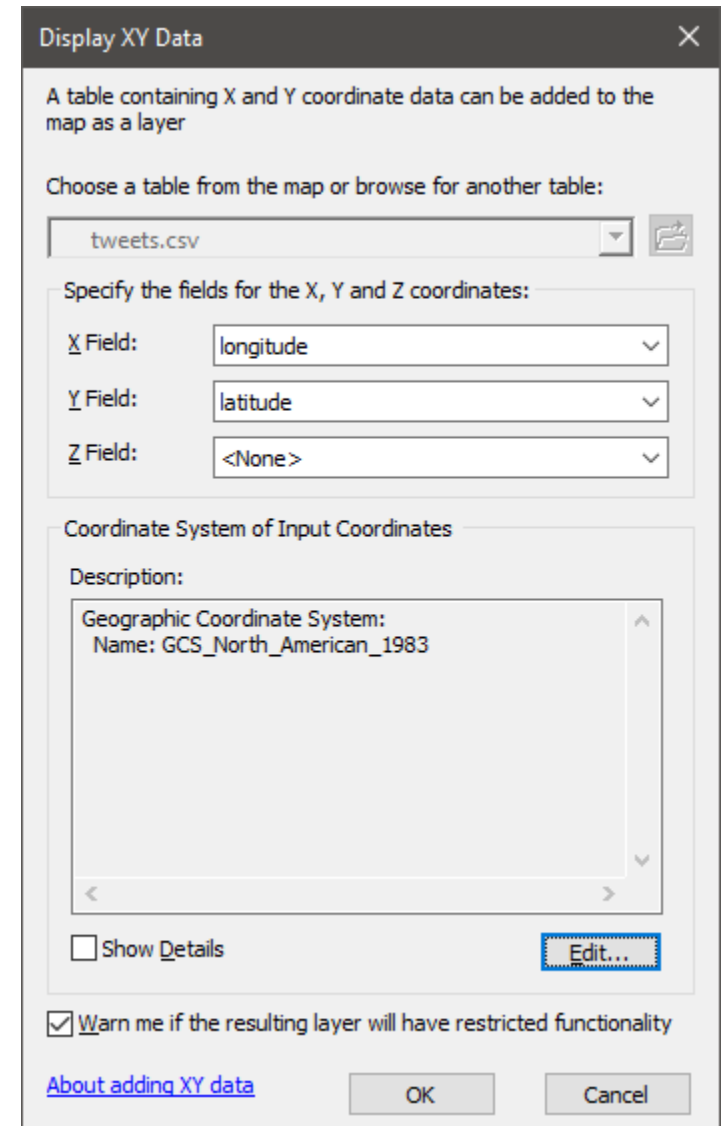
Halloween Tweets in Iowa

- CTRL+F and type Spatial Join
  - Target Feature : Polygon layer
  - Join Feature : Points features
  - Join Operation: JOIN_ONE_TO_ONE and check the Keep All Target Features
  - Match Option: COMPLETELY_CONTAINS

- See the Attribute table in your new shapefile
  - Join_Counts: The number of count of tweets during Halloween!

- Make choropleth map and conduct clustering analysis!