## HW#3 – 33 Points

Due: 4/22/2019, 5:00 pm. Submitted electronically to CANVAS. Format must be Adobe PDF.

Use HW format and headings described on CANVAS. All problems are worth 1 point unless otherwise specified.

This lab will orient you to some of the basic fundamentals of map projection and the influence that it can have on your data. The dataset you will be using for this lab are permanent GPS stations throughout Oregon. Some of them are special stations called Continuously Operating Reference Stations (CORS), others are part of the Oregon Real-Time Network, and others are used by the Pacific Boundary Observatory.

In order to answer the questions, you will need to do the following:

1. Obtain the 2002coords.csv file from our public_html folder and copy it to your own directory.
2. Add the 2002coords.csv file to your ArcMap Table of Contents (use "Add data")
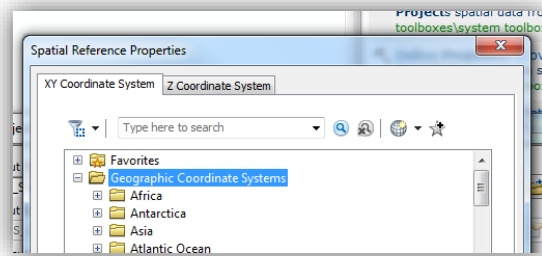3. Right click the table in the "List by Source View"
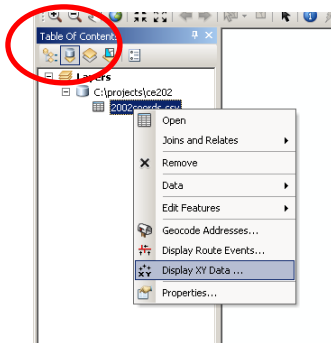
4. Select Display XY data
5. In the dialog box that opens up, make sure that the X,Y,&Z fields are matched up appropriately.
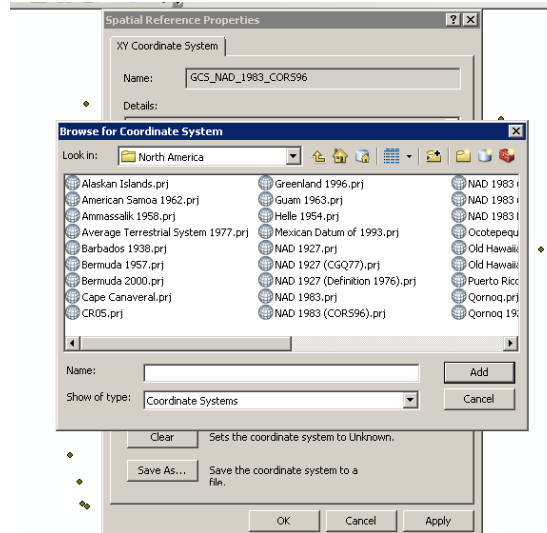   **If Z does not show up – manually select Z field**.
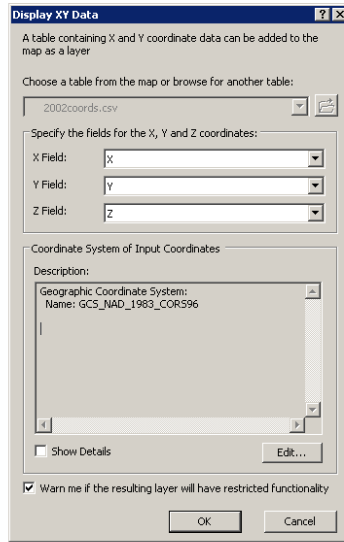
6. Click "Edit" to edit the spatial reference. A new dialog box will appear.
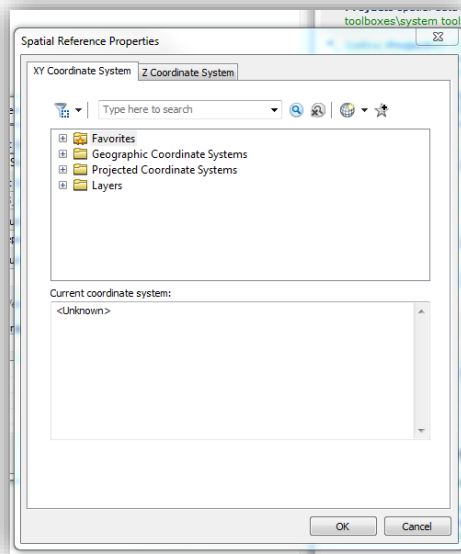
7. Select your spatial reference. A file browser will open.

8. Choose the appropriate folder for when you are working with latitude longitude coordinates (geographic folder because it is not Projected).

9. You will then see multiple folders with options for datums. Our data is in NAD83 (CORS96). Using your knowledge of what "NAD" means, select the appropriate folder

10. Then select the appropriate projection file

11. Select OK to the open dialog boxes.

12. Once you have defined the spatial reference, you should see the points displayed in the view

13. Right Click the file and select "Data" then "Export Data". Export the points to a shapefile named "S2002coords.shp"

14. Remove the 2002coords.csv Events layer.

15. We now want to label features. Right click the S2002coords.shp and select "Label Features" from the dropdown list.

16. Find an Oregon State Boundary shape file from The Oregon Spatial Data Library, http://spatialdata.oregonexplorer.info/geoportal/catalog/main/home.page

    then download it to your own directory.

   (Note: You will need to think about which category will have the data you are looking for – "Oregon State Boundary 2001").

17. Add the state boundaries shapefile to ArcMap.

18. Move the state boundaries layer so it draws below the S2002coords.shp data layer.

19. Change the symbology (color and shape) for the S2002coords.shp dataset and the state boundary shapefile.

20. Your map should appear similar to the following map:

Questions

1. Explain the difference between a geographic coordinate system and a projected coordinate system. (1pt)
2. Discuss what CORS stations are (see class notes and link above). (1pt)
3. Several of these stations are part of the ORGN. What is that? Who manages it? (Hint: Web search for ORGN CORS). (1pt)
4. How many of the GPS stations (S2002coords.shp) are within Oregon State Boundaries? Describe how you determined this number. (1pt)
5. List the types of measurements available in the measurement tool and discuss the differences between each type (Hint – look at ArcGIS desktop help: http://resources.arcgis.com/en/help/main/10.1/index.html#//00s500000022000000) (1pt)

You will want to work on questions 6-8 simultaneously. **To complete these, you will need to change the coordinate system of the data frame frequently.** To do this,

A. Right-click data frame->Properties
B. Expand the "Predefined" Coordinate systems folder to select a new map projection for the data frame.
C. Note that this does not modify the existing data, but merely re-projects all data to be in the same coordinates system.
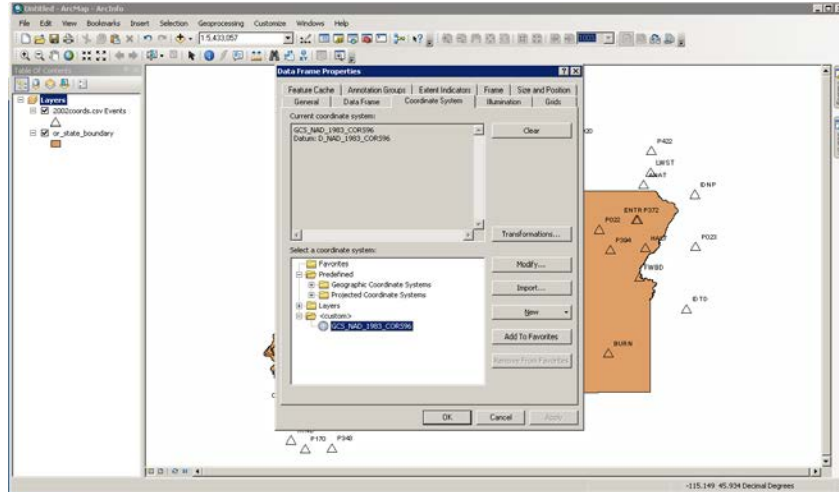
When measuring using the measurement tool, **BE SURE TO SNAP TO THECOORDINATES!!** You will see a circle appear when you are within the snapping tolerances. Double click on last point to preserve measurement, since otherwise it will continue to measure as you move the mouse. Then use the escape key to terminate.

6. Measure distances and areas between the following stations using the listed projections for the data frame. Present distances in meters, rounded to the nearest mm. Present areas to the nearest square meter. (11 points) – Hint: you will change the map projection of the data frame and then measure distances between CORS Stations. The objective is to demonstrate how different map projections/coordinate systems can change distances, angles, and areas.

Projection	Distance (CORV to BEND)	Distance (BURN to REED)	Area (TILL-REED-BURN - PDTN)
Geographic coordinates (NAD83 (CORS96))			
Oregon State Plane North (NAD83 (CORS96))			
Oregon Lambert (Statewide system, NAD83 CORS96)			
UTM Z10 N (NAD83)			
OCRS – Salem Zone (State Systems)			
Azimuthal Equidistant (World)			
Craster Parabolic (World)			

7. Capture a screenshot of the entire dataset (i.e. all of the CORS and the state boundaries) for each projection listed in the table.   Use captions to clearly distinguish each screenshot and specifically identify its associated projection. (3 pts)

8. Comment on the differences you observed between the projections. Why do the numbers not agree? (1pt)

9. List and discuss the key parameters necessary to describe a spatial reference. (1pt)

10. Define the geoid and discuss its purpose. What is the most recent geoid model (hint web search NGS geoid). (1pt)

11. Convert the following coordinates from degree minutes seconds to decimal degrees. Hint: See posted slides on Canvas under Week 3 Modules. (1pt)

    50°14'11.75"N,   120°15'25.1"W

12. Convert the following coordinates from decimal degrees to degree minutes seconds. (1pt)

    11.268956325N,   -130.256458958E

13. What can you do if you do not know what coordinate system your data are in? (Hint: See the ArcGIS help under map projections) (1pt)

14. What were the primary motivations for developing and common usages for the following coordinate systems: (3 pts)
    a. UTM   b. State Plane c. Oregon Coordinate Reference System (OCRS)
    – hint see lecture notes and:
    http://www.oregon.gov/ODOT/hwy/geometronics/Pages/ocrs.aspx

15. Which of the following coordinate systems has the lowest topographic distortion? (1pt)

    a. OCRS   b. State Plane c. UTM d. Oregon Stateside Lambert

16. What is the length of a 3.5 degree increment along a (A) meridian and (B) parallel at 55N and 120W? Assume the radius of Earth is 6,370 km. (2 pts)

17. Which State Plane Zone is appropriate for (a) Corvallis, Oregon? (b) Salem, Oregon (1pt)

18. Which UTM Zone is appropriate for (a) Newport, Oregon? (b) Pendleton, Or (1pt)

What to Submit

Turn in the completed Lab with all questions answered. Remember, you are not limited by the amount of lines provided for each question, so answer your questions accurately with correct information. Follow homework submission guidelines as indicated on Syllabus.

Be sure to include your name, date, and section number for your Lab time.

NOTE: If you are planning on performing some of this work both here and at home, you will need to take an additional step to ensure ArcMap will open your work reliably.

- Navigate to *File > Map and Document Properties >* and make sure the *Store relative pathnames to data sources option* is checked *On*. *Ok* out accordingly