

## ***Exercise 2 – Working with Projections and Grid Systems in ArcGIS*** **33 Points**

### **Introduction**

The primary objective of this exercise is for you to gain some familiarity with the use of map projections and grid systems in ArcGIS and to explore map projection characteristics.

### **Part 1 – Identifying map projection and coordinate information for existing maps**

You will be using the “Colleges” shapefile, which is contained within the Lab2 Winzip archive, for this question. This map shows the point locations of colleges and universities throughout New York.

1. Using one of the techniques for identifying coordinate systems described in the tutorial, what are the geographic and projected coordinate systems for the Colleges map? Describe technique you used to gather this information. Also, explain what “False Easting 500000” means **(2 Points)**
2. What are the three closest colleges to Colgate according to these data? **(1 point)**
3. How many colleges are present in Erie County? **(1 point)**
4. After you have added the counties shapefile to the map, click on the full extent button. Why is the western edge of the country chopped off? **(2 points - it is important that you add the colleges map first, followed by the counties map layer)**

### **Part 2 – Projection selection and modification**

Imagine that you are working for a consulting company that works on issues of global food security and you have been asked to develop an agriculture map of China. You need to select an appropriate projection and modify it so that China is the visual focus.

1. What projection property/properties do you want to maintain with such a map? Justify your answer. **(4 points)**
2. Open a new map view (data frame) in ArcMap and add the Country shapefile from the C:\ESRI\ESRIDATA folder. Reproject this map into the appropriate projection for the agriculture map and modify it in such a way that China is the visual center of the map (i.e., adjusting central lines). Explain the modifications (or reasons for not making modifications) that you performed. (Hint: refer back to the image you saved in the tutorial if you are not familiar with the geography of China.) **(4 Points)**
3. Would it be appropriate to place a north arrow on your particular China map? Please explain. **(2 Points)**

### Part 3 – Map Distortion

This section of the exercise will use a shapefile called “Circles” which is also contained in the Lab2 data archive. This map contains a series of circles that have radii of 5 degrees on the spherical earth.

1. Open a new window in ArcMap, add the Country shapefile, and reproject it in a Mercator projection. Next, add the circles shapefile on top of the Mercator map. Note that the circles are automatically projected into a Mercator. Given that each of these circles has the same radius, they would appear the same size if mapped on a globe. However, this is not the case on the Mercator projection. Explain what happens to the appearance of these on the Mercator and why. Is it appropriate to place a scale bar on this world map? Why or why not? **(4 Points)**
2. Change the projection to Sinusoidal, which is an equal-area world projection. How do the circles look now? Is this what you would expect and why? **(3 Points)**
3. Finally, change the projection to a Robinson, which is a compromise world projection. What happens to the circle appearance and is it what you would expect? Explain. **(3 Points)**

### Part 4: Defining and changing coordinate systems

You will be using the “dow\_dams” shapefile for this part of the exercise. This map shows the location of all dams in New York State in NAD83 UTM 18N coordinates. Unfortunately, ArcMap does not know this because the correct projection information has not been defined in the shapefile.

Open a new window in ArcMap , add dow\_dams.shp. Next, add the counties shapefile from ESRIDATA. Once you’ve done so click the full extent button.

1. How do you know that ‘project on the fly’ has failed? What do you see that provides a clue to this failure. **(4 points)**

Next, follow the procedures from the in-class tutorial to **define** the projection of dow\_dams as a NAD1983 UTM 18N. Remember that you are not creating a new map, but simply adding this new information to the previously undefined map layer.

The next task is to create a new stand-alone map of dams in NAD1927 UTM18N by **changing** the projection of this map.

As was the case in the tutorial:

- Launch ArcTools if they are not already open.

- Select Data Management -> Projections and Transformations -> Feature -> Project. Note that this tool is under the “Feature” menu. The term “feature” refers to vector data, which is the case with the dow\_dam data.
- Work through the various options (as you did in the tutorial) making sure to give the new map a clear name that identifies it as NAD27. You may also need to use the NAD\_1927\_to\_NAD\_1983\_NADCON option under geographic transformation

You will now explore the Projections-on-the-Fly capabilities of ArcMap. In the old days, if you attempted to overlay two maps with differently defined coordinate systems you would get a mismatch on the map. Projection on the fly solves this problem.

You should now have two separate maps of dow\_dam with different projections. One should have the UTM18N NAD27 and the other should have UTM 18N NAD83. Let's see if ArcMap can project these on the fly so that they line up.

2. Open a new data frame and add one map, followed by the other (make mental note of which one is added first). Change the scale in order to look closely at the points. Do the features appear to match? What is the projected coordinate system of the data frame? **(2 points)**

### **Part 5: Exploring the Help Menu**

1. What kind of information is stored in a shapefile's \*.prj file? **(1 Point)**

(possible question) 2. What is a geodatabase? What kind of data can be stored in a geodatabase?