BIOL/ERSC 4421/5421 - Name _____

Lab 3- Common Coordinate Systems for AR

The purpose of this lab is to acquaint you with the common coordinate systems used for Arkansas. The first part of the lab is an internet search for information regarding which coordinate systems are applied to AR. The second part of the lab is the procedure for converting a dataset from Geographic Coordinates to projected coordinate systems. The third part of the lab is to illustrate why we use map projected coordinate systems, and not Geographic Coordinate systems in GIS, and cartography. The fourth part of the lab (to be handed out later) will be applying the local coordinate systems using GPS instruments.

What to hand in for lab 3: Sept. 30, 2009- beginning of class

- Answers to Questions from Part 1 (turn in on paper)
- The '.jpg's of map from Part 2 (upload to Lab 3 assignment dropbox)
- Answers to Questions from Part 3 and 4 (turn in on paper)

Part 1. Procuring Coordinate System information.

Use an online search engine to determine the Coordinate System parameters for central Arkansas (Pulaski County)

UTM -
Determine which UTM zone should you use for Pulaksi County?

Where did you find this information?

SPC -
Determine which SPC zone should you use?

Where did you find this information?

Part 2. Changing a Projection

TASK 1: in this section, we will project the shapefile *ca_interstate* into both the State Plane Coordinate system, and UTM (Universal Transverse Mercator) projection and compare the results.

A. Create your working folder
1. Create a Working folder for Lab 3 (if you need to, go back and read Lab 1 for a reminder – don't forget to set relative paths).
2. Paste a Copy of the following layers: *ca_interstate, ca_counties* from your Master folder to your Lab 3 working folder. (**USE ArcCatalog!!!!!!!)**

A. From inside of ArcCatalog, Open ArcToolbox

Under **Data Management Tools**, expand **Projections and Transformations** toolset, **Feature** toolset**,** and double click on **Project**

1. Project the shapefile *ca_interstate* into the State Plane Coordinate System,
   - name the output Dataset: *ca_interstate_spc*, (make sure the output will be placed in your Lab 3 working folder)
   - Use "Nad 1983" as your Datum
   - Use the SPC zone according to your online research from Part 1 of this lab.
   - Accept all other of the default values and finish the "Projection"

2. Now project the original shapefile again, this time into a UTM system.
   - name the output Dataset: *ca_interstate_utm*, (make sure the output will be placed in your Lab 3 working folder)
   - Use "Nad 1983" as your Datum
   - Use the UTM zone according to your online research from Part 1 of this lab.
   - Accept all other of the default values and finish the "Projection"

Task 2: View files in ArcCatalog

A. Navigate through the File Tree and **highlight** the file *ca_interstate*

click on the *Contents* tab at the top of this right hand window
click on the *Preview* tab
click on the *Metadata* tab

Under the Metadata tab, **click** on the *Spatial* tab. Click on the green text to see all information specific to each file. Observe the Horizontal Coordinate System and Bounding Coordinates information

B. Complete the steps in 'A' above for the files *ca_interstate*, *ca_interstate_spc* and *ca_interstate_utm* . Provide the information for each dataset in the Tables below.

1. ca_interstate

	Bounding Coordinates (non-projected)		Projected Coordinates
West		Left	
East		Right	
North		Top	
South		Bottom	
UNITS		**UNITS**	

2. ca_interstate_spc.

	Bounding Coordinates (non-projected)		Projected Coordinates
West		Left	
East		Right	
North		Top	
South		Bottom	
UNITS		**UNITS**	

3. ca_interstate_utm.

?

	Bounding Coordinates (non-projected)		Projected Coordinates
West		Left	
East		Right	
North		Top	
South		Bottom	
UNITS		**UNITS**	

Observe the “Metadata”, “Spatial”, “Details” for the UTM and SPC datasets
a.) Which projection uses a developable surface that intersects the Earth along two Secants? How did you determine this?

b). Which projection’s origin is along the equator? How did you determine this?

TASK 3: Displaying, changing, measuring map units.

A. Launch ArcMap, add the *ca_counties,* and *ca_interstate* dataset to an empty map.

B. Make sure the **Tools** toolbar is on (to check, click on ***View*** in the main menu, then on **Toolbars**, and make sure there is a checkmark to the left of the word Tools). Click on the *black arrow* (*Select Elements* tool).

C. Observe the units - Move the curser around in the map view window and observe what happens on the lower bar of the ArcMap window.

D. Observe the bounding coordinates of the *ca_counties* shapefile by using the *Select Elements* tool and cursor (i.e move the cursor over the corners and observe the readings at the lower left -these should be in DMS – Degrees, Minutes, Seconds or in DD – Decimal Degrees).

This method is not as accurate as looking at the extent in ArcCatalog or the Extent in ArcMap.

E. View extent of bounding coordinates in ArcMap - Right click on the *ca_counties* in the Table of Contents, click on Properties, then on the Source Tab. Record the extent below in DD (dd) or in DMS whichever your default values are. Next, convert those values to the other DD to DMS or DMS to DD - (SHOW your calculations!!!)

	DD	DMS
Left		
Right		
Top		
Bottom		

Part 3. Why we use Map Projections!!

Re-read the section 5.6 of your Longley et al., textbook "***Measuring the Earth: latitude and longitude".***

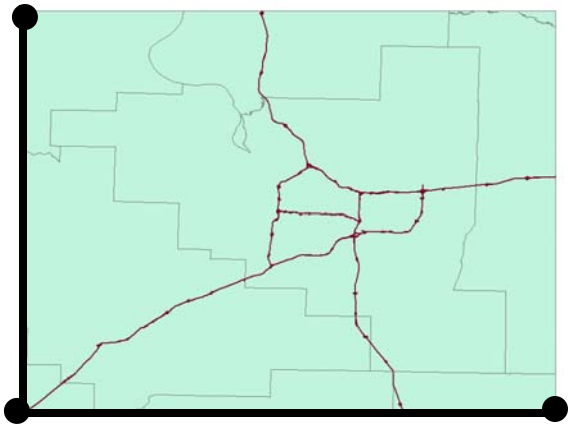
1) Ignoring flattening, what is the surface distance between two points on the globe separated by one degree in the N-S direction?

2) What is the surface distance between two points on the globe separated by one degree E-W at the Equator?

3) What is the surface distance between two points separated by one degree E-W at 45 degrees N or S?

Let's say you are all gung-ho to use only Latitude Longitude units of measure for the rest of your life. It is so much simpler than dealing with those pesky projections - much simpler to think of the Earth as a 3D spheroid. So, you've been out in the field collecting locational data in Central Arkansas on a couple of transects. You have the Lat/Long coordinates of the NW corner, the SW corner, and the SE corners of your study area. Your boss comes in and tells you that you will be paid based on the length in kilometers of these two transects. You give it to him/her in terms of Decimal Degrees. But of course, he/she does not typically think in terms of DD. So, you've got to convert to kilometers.

Use the mathematical relationship between degrees and distance on the surface of the earth to calculate the distance on the Earth of transects from your study area (use the extent of the rectangular boundary of the *ca_counties* shapefile). Start by writing in the coordinates (in DD) for the three corners from your study area.



SHOW YOUR CALCULATIONS.

4) How long is your N-S transect in DD?

5). How long is your E-W transect in DD?

6). How long is your N-S transect in kilometers?

7). How long is your E-W transect in kilometers?

8) If you completed a transect on the Eastern border of the study area, would it be longer, shorter, or the same length as the Western transect?

9) If you completed a transect on the Northern border of the study area, would it be longer, shorter, or the same length as the Western transect?

10. What is the main advantage of the UTM or SPC coordinate systems vs. the Geographic Coordinate system?