


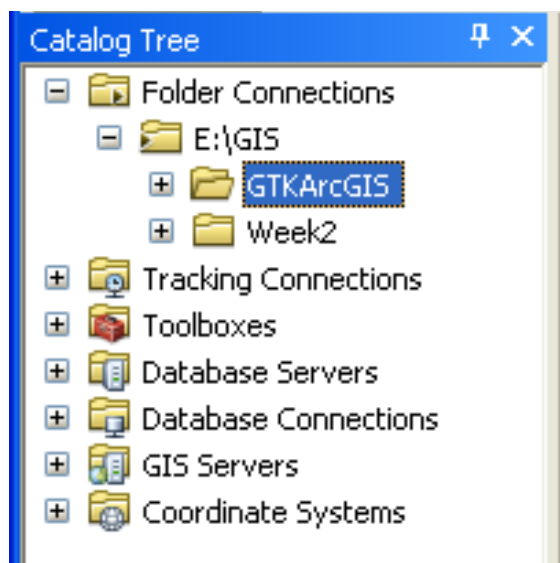
Name: _____

LAB EXERCISE #1 (25pts)

ArcGIS Map Projection on the Fly:

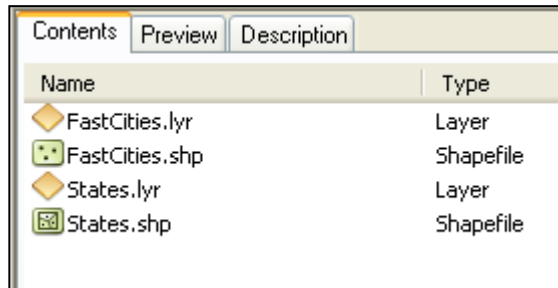
Working with: U.S. Map illustrating population change between 1990 and 2000. You will create a map that will have 3 **data frames** (lower 48 states, Alaska, Hawaii). One **shapefile** of “U.S. States” will be used to create all three maps. You will set a different projected coordinate system for each (Using Albers Equal-Area Conic Projection) and ArcMap will project the data for you.

1. In Windows Explorer, create a folder on your USB portable data storage device (hence forth referred to as “USB-drive”) called “GIS” (*note: never use spaces, special characters, or long names when naming folders or files that will be used in ArcGIS*).
2. Insert your ArcGIS Data CD into the computer.
3. In Windows Explorer, copy the “GTKArcGIS” data folder from the data CD and paste it into your “GIS” folder you created in step 1.
4. Start ArcCatalog
Go to: <Start>, <All Programs>, <ArcGIS>, <ArcCatalog>
5. In ArcCatalog, you need to create a “data link” to your GIS folder.
 - Click on the “connect to” button . Then, find the GIS folder, highlight it, and then click <OK>.
 - Once connected, your CD drive letter will appear on the left column in the “Catalog Tree” under “Folder Connections” (*see below*). You are now able to access all of the data in your GIS folder using ArcCatalog. Your data is in the “GTKArcGIS” folder within your “GIS” folder.



←Catalog Tree

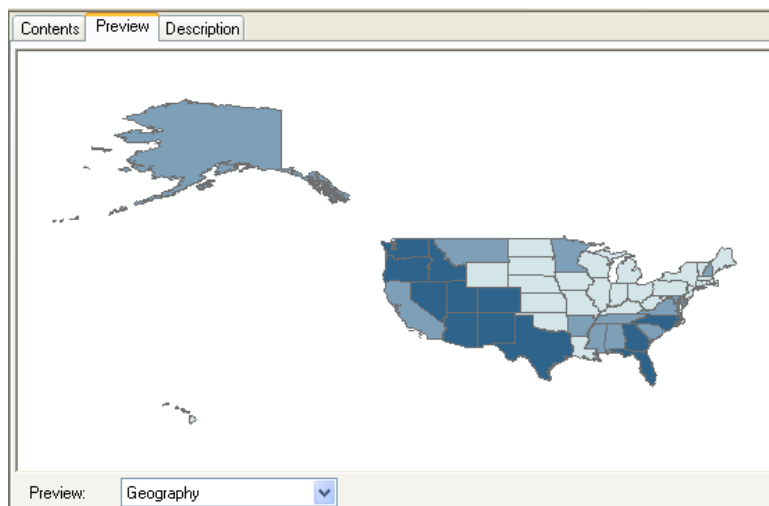
6. Open the data folder “GTKArcGIS” by double-clicking on it in the “Catalog Tree”. Then, double-click on the “Chapter 13” Folder and the “Data” folder. The contents of the “Data” folder are shown under the “Contents” tab of the Catalog Window(see below).



←Catalog Window with data

In the data folder, you will find 2 shapefiles (.shp) called *FastCities* and *States* along with two corresponding layer files (.lyr). The shapefiles contain information about the shape and location of features as points, lines, and polygons. The layer files contain additional display information(symbology information) such as the color of features, the symbols used to represent them, the size of the symbols, etc. Every layer file is associated with a spatial data file. In this case, the *FastCities* layer file defines the symbology of the *FastCities* shapefile. The *FastCities* shapefile contains information about the fastest growing cities in each state of the US. The *States* shapefile contains information about the location and shape of the states within the US. And, the *States* layer file contains the symbology information that is used to display the states.

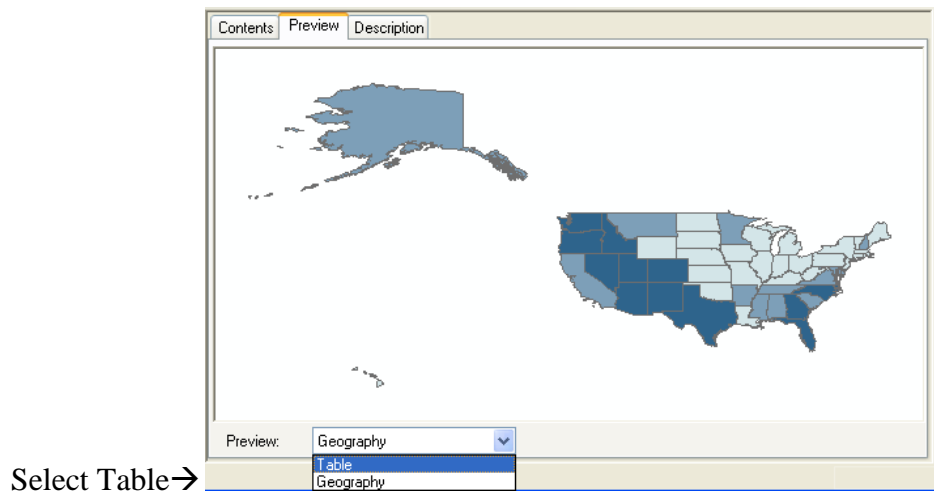
7. In the Catalog Window, click once on the *States* layer file. Then, in the same window at the top, click on the <Preview> tab. You should see a preview of the States layer file in the Catalog Window (see below).



←Preview of States Layer


This layer has been symbolized with a color ramp to illustrate population change. A color ramp is a set of colors displayed at different intensities. The lightest blue indicates the least population change while the darkest blue indicates the most population change (from 1990-2000). Every shade of blue in-between symbolizes in succession a unique level of population change. Take note that the states, displayed according to their geographic coordinates are distorted both in shape and area. (ex: N boundary of US, size of Montana vs. Texas, size of Alaska).

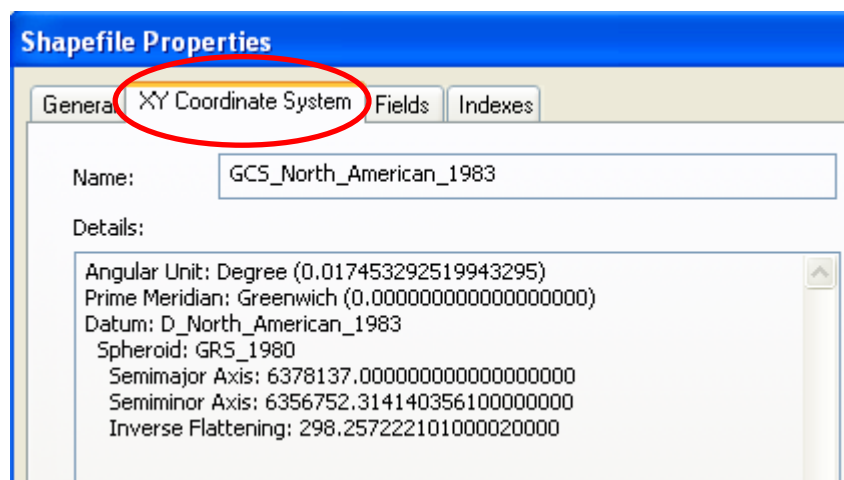
8. Let's take a look at the data (actual change in population numbers from 1990 to 2000 and percent change) in table format. At the bottom of the Catalog Window (with <Preview> tab still selected), click on the drop-down box and select "Table" (see below).





Select Table →

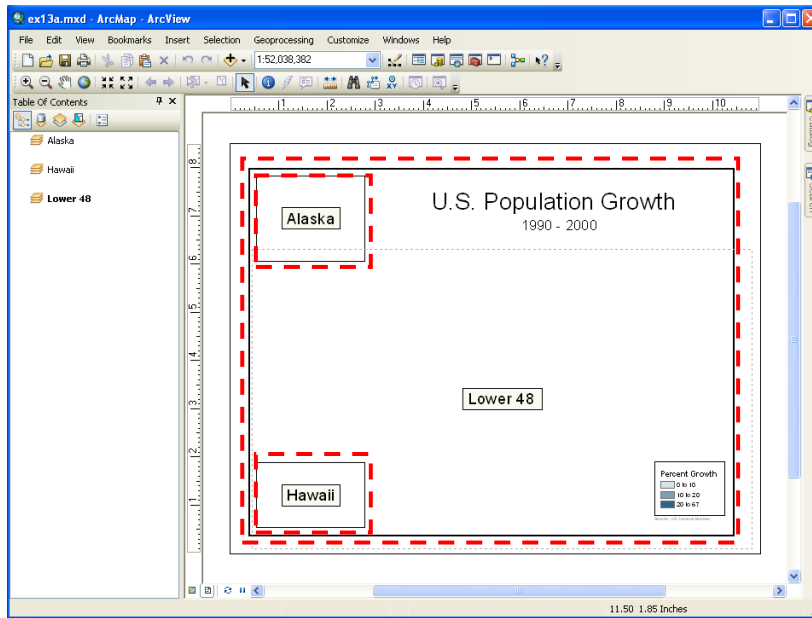
A table will open up in the Catalog Window. Note the actual population numbers for 1990 and 2000 for each state, as well as the population change in raw numbers as well as percent change.

9. Now, let's explore some metadata (data about the data). Shapefiles require that a geographic coordinate system be assigned to it. Let's confirm that the *States* shapefile has a geographic coordinate system assigned to it. In the "Catalog Tree", click once on the *States* shapefile <  *States.shp* >. Then, in the Catalog Window at the top, click on the <Description> tab. Some of the general metadata associated with the *States* shapefile are located here. Another way to view more detailed metadata, such as the coordinate system, is to right-click on the *States* shapefile in the catalog tree and select "Properties". A "Shapefile Properties" dialog box will open. Metadata about the geographic coordinate system is located under the <XY Coordinate System> tab. Click on this tab (see below).



Under the heading of "Name", a geographic coordinate system is displayed indicating that one exists. Specifically, it is the GCS North American Coordinate System of 1983. Notice, that under "Details", a datum is also listed.



10. Now that we have gained some needed information about the data using ArcCatalog, we can begin building our map using ArcMap. A pre-made [map document](#) (.mxd) has been prepared for your use. The map document contains information like where the map is displayed on a page, titles, legends, north arrows, and other supporting information. It is like a set of directions for the layout of the map. We will begin by starting ArcMap and adding the *States* layer file to the pre-made map document. First, find the pre-made map document in the Catalog Tree of ArcCatalog in the Chapter 13 folder, titled “ex13a” <  ex13a.mxd >. A shortcut to opening ArcMap and this map document would be to double-click directly on the map document file. Double-click on <  ex13a.mxd >. The ArcMap program initializes and the map document opens (see below).

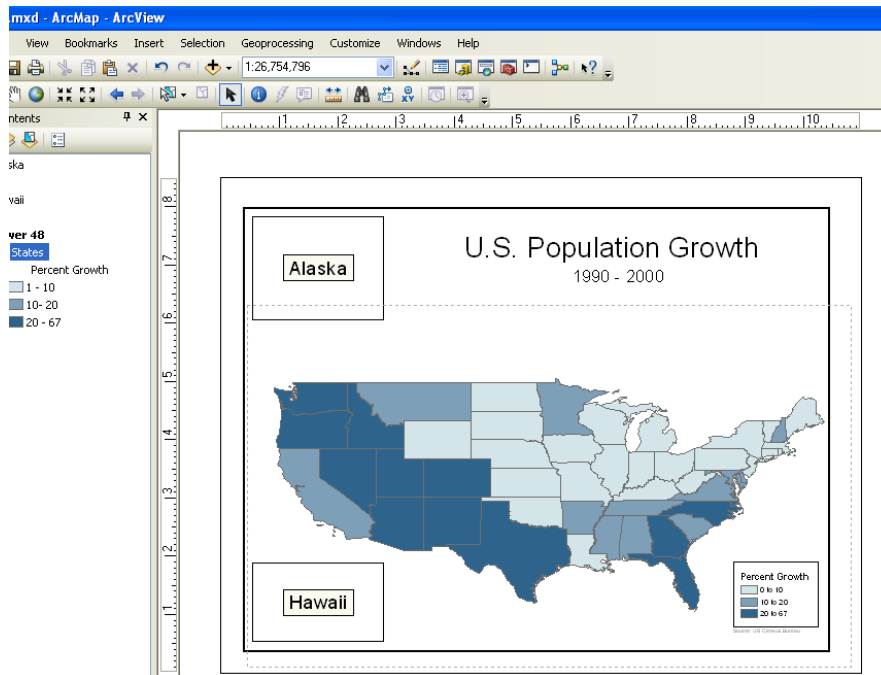



← ArcMap Interface

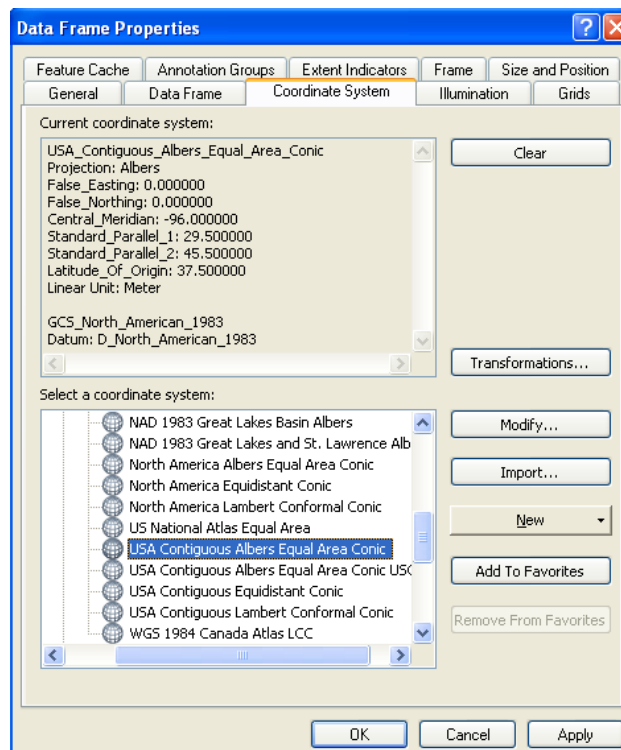
11. Note that this map document has 3 data frames (*I have highlighted them with broken-bordered frames in the example above*). Each frame will display an individual map. In this case, the large frame will display the lower 48 states and the smaller frames will display Alaska and Hawaii. Because of the large horizontal separation between Hawaii, Alaska, and the rest of the US, it would be ineffective to display all of these in the same map frame. For this project, we are not interested in all of the open ocean space between these features. So, we eliminate the extra space and focus in on the states by using 3 map frames. A title and legend have already been added to the map. In the next few steps, we will add the map [data](#) to the frames and apply appropriate map projections.

12. To add data to the map document, first resize and align the ArcMap and ArcCatalog windows so that you can see both the ArcCatalog Tree and the ArcMap Table of Contents. In the ArcCatalog Tree, find the same Chapter 13 data folder and the “States.lyr” layer file. Click, hold, and drag the <States.lyr> from ArcCatalog to the bottom of the ArcMap Table of Contents (below the “Lower 48” data frame) and drop the file. The States data will be added to the largest data frame of the map document. In this largest frame, we ultimately want to present only the lower 48 states. Read on...


13. As you can see, the display of the map is not desirable. We need to zoom in and center the main frame over the lower 48 states. This could be accomplished by using the “zoom-in” tool  and the “pan-tool” . However, a previously zoomed and centered version was [bookmarked](#) (saved) so that it could be recalled. To recall this bookmark, click on <Bookmarks> at the top of the ArcMap window. Then select <lower 48>. After doing so, your ArcMap window should look like the following (on the next page)...

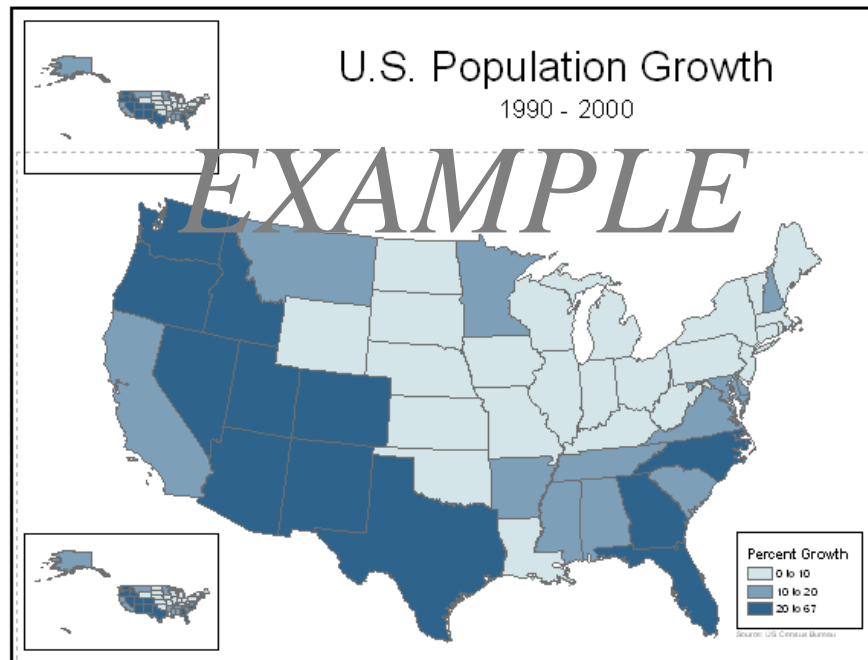


14. Now, let's project the data using a projection most appropriate for our purpose. To project the data, double-click on the "Lower 48" data frame <  **Lower 48** > within the Table of Contents in ArcMap. A "Data Frame Properties" box will open (see below). Click on the "Coordinate System" tab. By default, the data frame is set to the coordinate system of the first data layer that you added to this frame (GCS_North_American_1983). In the "Select a Coordinate System" box, click the <+> next to "Predefined". Then, click the <+> next to "Projected Coordinate Systems", the <+> next to "Continental", and the <+> next to "North America". Here, a variety of projected coordinate systems for North American data are listed. Click once on <USA Contiguous Albers Equal Area Conic>. The details of the projection appear in the "Current Coordinate System" box (see below). Click <OK>.





15. The States layer is projected “on the fly”. Let’s take a look at a previously saved bookmark of a zoomed in version of the Lower 48 after projection. As in step #13, click on <Bookmarks>, but this time select <Lower 48 after Projection>. As you now see it, the states are displayed in the Albers Equal Area Projection.

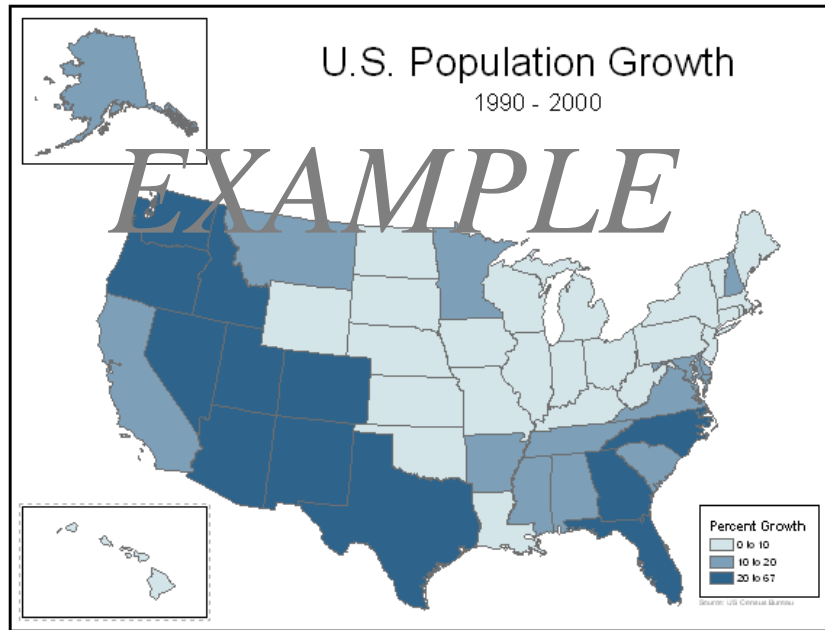
16. Now, let’s copy the *States* data layer, paste it into the other two data frames, and set their coordinate system properties. To do this, first right-click the *States* layer < States > in the Table of Contents and click <Copy>. Then, in the Table of Contents, right-click on the Hawaii data frame <  Hawaii > and click <Paste Layers>. Repeat the paste function for the Alaska data frame. The States data layer should now appear in all three data frames (see below).



17. In the next few steps, you will set an Albers Projection that is developed specifically for Alaska (Alaska Albers Equal Area Conic) to the Alaska frame and set the “Hawaii Albers Equal Area Conic” projection to the Hawaii frame to minimize distortion for each of these states.

18. In the ArcMap Table of Contents, right-click the Alaska data frame <  Alaska > and click <Activate>. This activates the Alaska frame so that any actions you do will affect only that map. Now, double-click the Alaska data frame (again, in the Table of Contents). A “Data Frame Properties” box will open. Click the <Coordinate System> tab. Using the same procedures as in step #14, select the <Alaska Albers Equal Area Conic> projection and click <OK>. In the Alaska data frame, note the results. The US is distorted severely, but Alaska is now projected with minimal distortion. Compare the size and shape of Alaska in the new projection with that of the previous projection as seen in the other small “Hawaii” data frame. We can zoom in and center this frame over Alaska. A previously saved bookmark of a zoomed and centered version is available so that you don’t have to for now. Select the <Alaska> bookmark in the same manner that you selected the other bookmarks.

19. Now, repeat step #18 for the Hawaii data frame to project Hawaii with minimal distortion. ****Don’t forget to activate the Hawaii data frame before applying a projection****. A bookmark is available for the Hawaii data frame as well. But, before applying it, try to zoom in manually to a desirable scale using the “Zoom In” tool <  > found in the Toolbar. Finally, apply the <Hawaii> bookmark to the Hawaii data frame. Your final map should look like the following (See Next Page).



20. Finally, it is time to label the map with your name and save it as a PDF. First, in ArcMap, click on <Insert>, then <Text>. A very small text box will appear within your map. Type your name in it and move it off the map contents, but still within the large data frame. Second, to save your map as a PDF, click on <File>, then <Export Map>. Navigate to your “GIS” folder on your USB-Drive. Name the file “***Lastname***MapEx1”. Under the “Save as Type” dropdown menu, choose <PDF>. Then, click <Save>. By saving the map as a PDF, it can be viewed outside of ArcGIS on most any computer.

21. Another process that you will use throughout the semester is the creation of an image of your work. Before you finish and close ArcMap, make a “screen shot” of your map and save it as a .jpg image file. To do this, hold down the <control key> (“Ctrl”) and press the <print screen> key (“Prnt Scrn”) while your map is displayed on the screen. By doing so, you will have copied the image to the clipboard. Then, open Microsoft Paint (Start, All Programs, Accessories, Paint) and paste the image (Edit, Paste). Save the file in jpeg format with the filename “***Lastname***MapEx1.jpg”. Send your final saved map image **and** your PDF map as email attachments to your instructor before the due date. Email: judd.curran@gccd.edu

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