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MEMORANDUM

NEW ENGLAND PUBLIC POLICY CENTER

To: NEPPC Staff
From: David R. Agrawal
Date: August 16, 2006
Re: Using ArcGIS for Regional Data Analysis

This memo is intended to summarize how to produce geo-spatial maps based on Census data using GIS. GIS has many advanced capabilities such as enhancing decision analysis and calculating distances. By far, the most common and practical use of the software for the Center is the software's ability to create a visual and easy to understand image of Census data.

Even if not using maps in a finished product, GIS software can be easily used to quickly display data in a way that will allow you to see regional trends much more rapidly than a data table.

Census data can be uploaded into GIS using block data, tract data, town data, county data, or state data. Before proceeding, you will need to create maps for the unit of analysis you wish to utilize. I have already created tract level, county level, and town (county subdivision) level maps for the New England Region and its six states. All of these maps can be found on CD disks.

It is important to note that when saving a map, the GIS software only saves the file paths—thus, you must not move or change names of the directories storing these files. Furthermore, if you create a map template that will be useful for the Center's use, please be sure to store the original files used to make the map. Now, let us get started!

Note: Parts of the following memo are modified from internet resources that I found useful.

For a definition of GIS terminology, please see the GIS dictionary:
http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway

Types of GIS programs

ArcGIS comes with three programs, in addition to map CDs:

1. ArcMap
2. ArcCatalog
3. ArcReader.

ArcMap is the software you will use to generate maps, do data editing, and input data. ArcMap also allows you to open existing maps, work with layer files, and open data files.

ArcCatalog is the organizational toolbox for GIS. You can use the program to organize files, edit source code of files, change coordinate systems of files, and do micro level editing of layer and shapefiles.

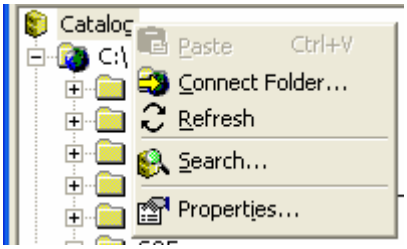
ArcReader is the program that is used to read GIS produced maps and data. While the other two programs only have one license, ArcReader can be installed on as many computers as desired.

The program also comes with several map CDs. The Map CDs that are most useful are United States 1 and United States 2, although the StreetMap CDs are also useful for transportation projects. Because these CDs come in two parts, in order to properly use them you will need to create a folder called "USA" on your hard drive and then will need to copy the two CDs into the folder. You can do this with any of the map CDs in order to make them run faster and to create a direct link for when you save map files (remember, if the CD is not in the drive, the maps you save will not display correctly—thus, working off the hard drive is a much better option.)

Creating a shortcut to data

In order to add data in ArcMap, you will need to have created a data folder link in ArcCatolog. To do this, be sure to do the following:

1. Open ArcCatalog
2. Right click the "Catalog" title in the folder list on the left
3. Click "Connect to folder"



4. Navigate to the folder you wish to connect, such as your personal folder on the G drive, the H drive, or a particular folder on your C drive.
5. This connection will now be visible in ArcMap until you manually remove it.

Saving files

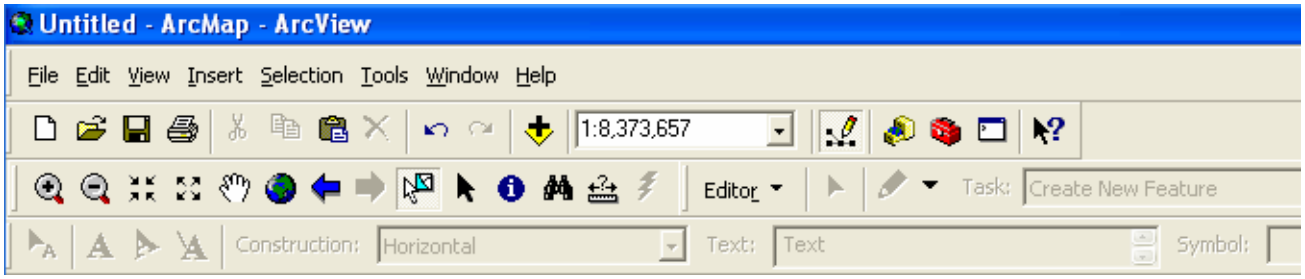
Perhaps, one of the hardest things to do in GIS is to adequately save files. Save every layer, shapefile, and map that you use and be sure to save it in an organized way as you start your project. The reason you can save everything is that GIS files are small—they only save the path to access the primary data (they don't actually save the image).

To reiterate, it is extremely important you save the data in folders that will not change names and will not get moved around. If you do move a folder or a file, any maps you have previously saved using that file will not work until you tell GIS where its new location is. I recommend that when you create a map template, you save *all* of its layers into *one* folder. Then, if you need to relocate file paths because a folder was moved, you will only need to point it to the folder rather than to every specific file (assuming the layer names were not changed). Also, before changing the names of layers in the map, be sure to save a template with the raw layer names.

As a precaution, save your files correctly before you use them. Save them with names you will recognize. Furthermore, don't be afraid to save extra maps.

Basic commands in ArcMap

The following toolbars should be displayed in ArcMap. If not, you can add them by selecting "View" and the "Toolbars" buttons and then selecting the toolbars you wish to add.



Definition of symbols:

- The plus symbol will add data or layer files to your map.
- The red toolbox will display shortcuts to handy editing tools.
- The magnifying glasses will allow you to zoom to the level you wish. The area you select will be what is formally displayed in your layout.
- The globe button will zoom out so that all of the data is in view.
- The pointer with blue and white box will allow you to select by certain attributes. Suppose you have a map of the U.S. and wish to select the New England states—use this tool to select Connecticut, then hold "Shift" and select Massachusetts, etc.
- The blue circle button will display information based on the unit you select.
- Last, use the Editor button to start and stop editing sessions. Be very careful about saving edits, as you may eliminate a source file from its original form—especially if the file you are using is part of an already saved map!

Sources of map files

The following sources can be used to obtain map files at the national level:

- Map CDs: Click on the folder named "Census"
- Bureau of the Census pre-made maps: http://www.census.gov/geo/www/cob/bdy_files.html
- Census Tiger Line files by county, including offshore Census jurisdictions: http://arcdata.esri.com/data/tiger2000/tiger_download.cfm

Furthermore, many New England states publish their own maps (in addition to maps with data displayed on them) at the following websites:

- Connecticut: http://www.dep.state.ct.us/gis/
- Maine: http://megis.maine.gov/
- Massachusetts: http://www.mass.gov/mgis/
- New Hampshire: http://www.granit.sr.unh.edu/
- Rhode Island: http://www.edc.uri.edu/rigis/
- Vermont: http://www.vcgi.org/

Creating maps

How you create a map depends on the jurisdiction you wish to analyze and the availability of the existing map templates. I will now explain how to create single county maps and multi-jurisdictional maps.

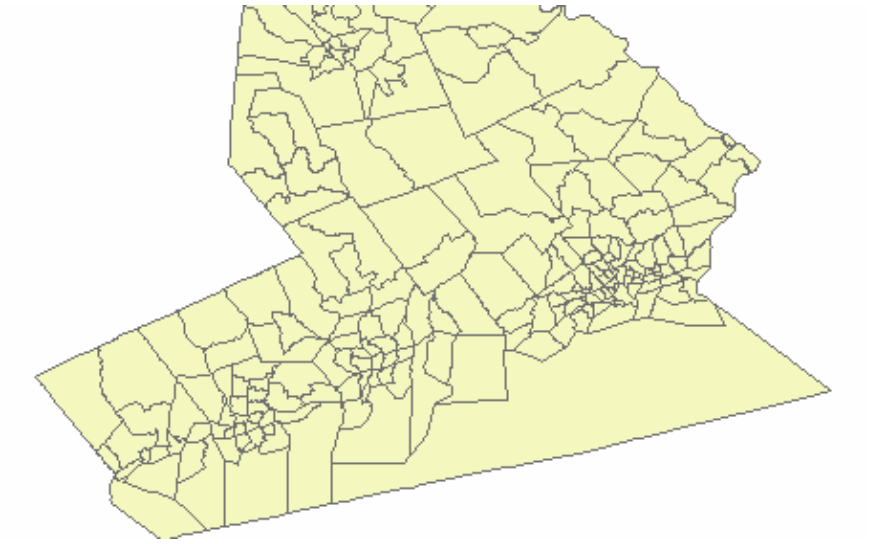
Single county creation / creating a shapefile from scratch

The method below creates files that are not clipped to the shoreline. As an (easier) alternative to this method below, you can use the select feature to create a county file that is already clipped to the water from a larger map. This will be explained later on in more detail.

Go to http://arcdata.esri.com/data/tiger2000/tiger_download.cfm and download the appropriate data in the following manner:

1. From the above website, select the state and counties you wish to download.
2. Select the jurisdiction level of analysis (tract, state, etc.).
3. Download the files.
4. Unzip the folders and the unzipped folders inside of the main folder.
5. Appropriately name the folders so that you know the jurisdiction and the unit of analysis.

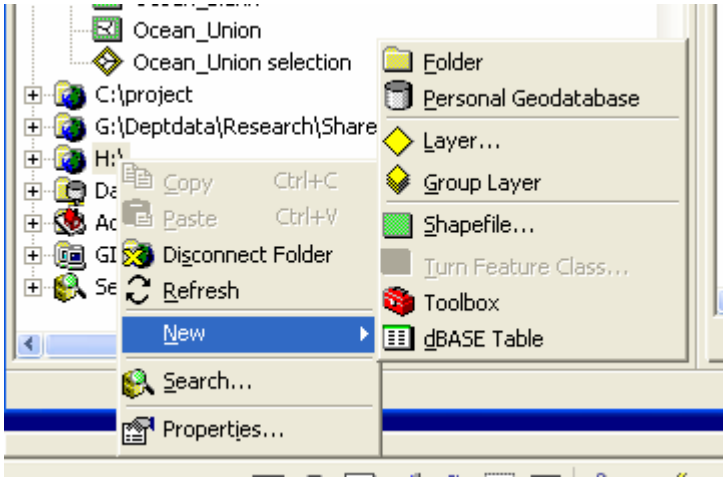
Unfortunately, these data files only work well for landlocked jurisdictions. For jurisdictions along the water, the Census divisions extend into the water and you will need to clip the files to the shoreline (unless you wish to display water Census divisions).



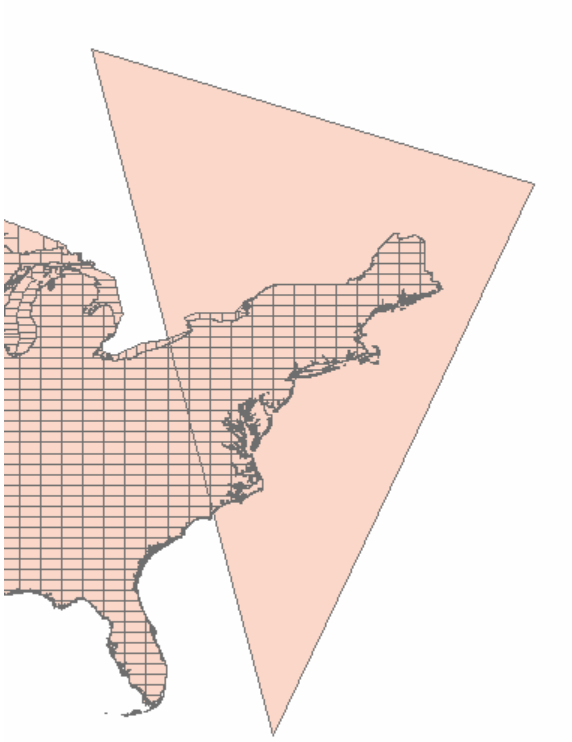
This can be done by creating an ocean shapefile and placing it over the county file you just downloaded. Depending on how large your map is, you may want to create a detailed ocean file with all the nooks of the shoreline or you may want a less detailed shoreline. However, if you need to create your own shapefile, do it in the following manner:

1. First decide if you want the shoreline to be clipped with a detailed coastal boundary or a more general outline of the coastal areas.
2. Select a United States map with the appropriate coastal boundary from the USA CD.
3. Open ArcCatalog.
4. Create a Geodatabase in ArcCatalog to store your files.

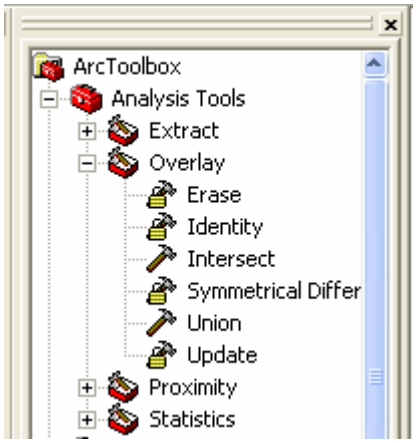
5. Place the USA map you wish to use into the Geodatabase.
6. Right click the folder you wish to store the new ocean file in.
7. Click “New” and then “Shapefile” and label it appropriately.



8. As the feature type, select “Polygon.”
9. Click Edit and then select Import and then select the USA file you are using. This will import the US file’s coordinate system so that they overlay correctly.
10. Now, open ArcMap and Import the USA File from the Geodatabase and then open the new Ocean file.
11. Right click the US map and select “Zoom to Layer.”
12. Select “Start Editing Session” from the editing toolbar.
13. Select the pencil and draw a large shape around the area that you wish to create the ocean file in the vicinity of—be sure to overextend the ocean file well beyond view.
14. You can make the topmost layer more transparent by double clicking the layer; select “Display” and then set transparency to “30%.”



15. Click “Editor” and then “Save Edits” and then “Stop Editing.”
16. Click ArcToolBox. Then click “Analysis Tools” and “Overlay” followed by “Union.”



17. Select the two layers as the inputs and create a new union.
18. Turn off the other layers, except the united area.
19. Use the select features tool to select the ocean area.
20. Click “Selection / Create Layer” from the selected features and name the layer.
21. Right click the layer in the contents and select “Export” in order to save the file.

Creating a map from a larger existing map

Now suppose you wish to create a map of New England or of an entire New England state, but you only have a United States map. To do this, you will need to use the “Select by Attribute” feature tool. (Not only

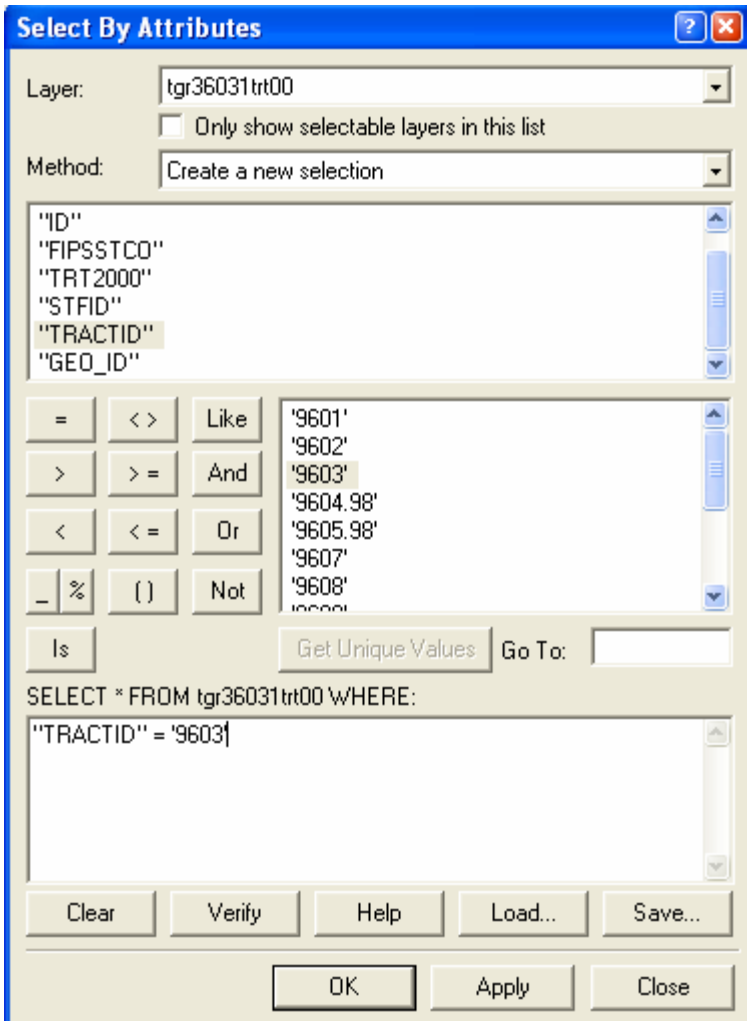
can you select by state but if you use the appropriate map on the CDs you can also select by county, town, etc.)

You can find out the codes for the attributes by right clicking the existing map you will use and selecting "Open Attribute Table." The state codes for New England are as follows:

- CT = 09
- ME = 23
- MA = 25
- NH = 33
- RI = 44
- VT = 50.

To create a map:

1. Open ArcMap.
2. Open the Shapefile of the United States in the program with the appropriate jurisdictions for your data.
3. Click "Selection" and then "Select by Attributes."
4. Select "Create New Selection."
5. Now use the columns such as state names and codes along with the equal signs to select the appropriate states. If doing multiple states, after clicking ok for one state, repeat the same procedure only by clicking "Add to Current Selection." In the example below, I am selecting a particular tract:



6. Verify that the states you wish to select are outlined in blue on your shapefile.
7. Right click on the file you are working with under the layers display.
8. Select "Data" and then "Export Data." Be sure to save the file in the correct folder and name it appropriately.

Note: You can also merge several states or counties together using the "Union" tool. Once you do this, you will need to manipulate the attribute table by creating some new fields.

Creating map templates

Once you have your map layers, you are ready to begin creating a template. When doing this, you can add layer files (.lyr) or shapefiles (.shp). The difference between the two is minor—and they basically only differ based on the amount of editing you can do with them.

To begin creating a map template:

1. Add the necessary shapefiles into ArcMap using the plus sign symbol (for example, to create a template of CT and RI, you will need to add a CT layer and a RI layer, unless you created them as one).

2. Adjust the layers in the column on the left such that the layer you want on top is highest on the list and the layer you want on the bottom is lowest.
3. When doing this, I recommend using the jurisdiction map and adding on top of it a layer with the state line jurisdictions in a darker color—you can do this by double clicking on the color symbol such that the top layer is set to "No Color" and the outline is set to a dark color.

Suppose you wish to add other layers such as transportation networks to the map. Further, suppose this layer extends beyond the region you want to analyze and you cannot use the editor to delete portions of it. It is easy to fix this by covering the layer with another shapefile. For example, if working with a New England map, adding a layer for NY will cover the highways extending beyond New England.

1. Add the transportation layer (or whatever layer you wish) to your map
2. Create a shapefile of states surrounding the region (you can do this by selecting all but a certain state or states and creating a shapefile)
3. Add this shapefile to your map and place it above the transportation network
4. Adjust the colors such that the border is white and the fill is white
5. Move an outline layer of your state map (with the fill set to transparent) above this layer so that the border of your state remains

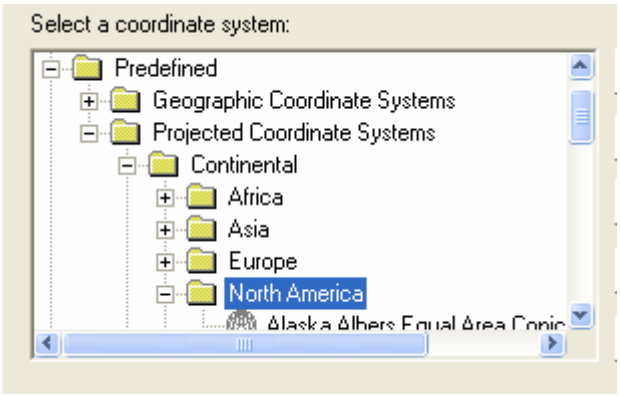
In cases where you need to cover over items that extend into the ocean, use the ESRI files found at: http://arcdata.esri.com/data/tiger2000/tiger_download.cfm .

Adjusting the coordinate system of the map

If you were to create a regional map of New England or a United States map, you will notice that the unadjusted map distorts horizontal distances. This is a result of projecting a spherical image onto a flat surface. Thus, you will need to change the coordinate system of your map to correct this problem—which coordinates you use depends upon the size of your map. Every state in the country has its own coordinate system. If creating a state map (or a subdivision of the state), use the system appropriate for that state. If creating a regional map, there are a number of accurate systems that you can use—choose the one that best fits the purposes of your map. Once again, if using a national map, there are different systems, but be sure to select a USA coordinate system.

To change the coordinate system, do the following:

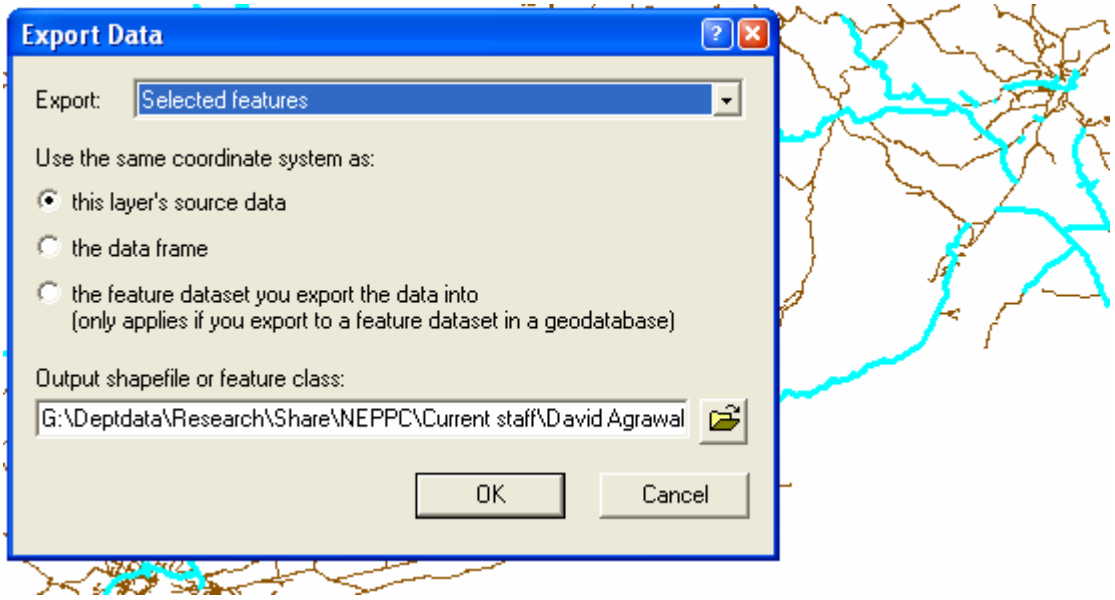
1. In ArcMap, view your map from the data view.
2. Right click the map, select "Properties" and then "Coordinate System."
3. Select the "Predefined" folder and then select "Projected Coordinate Systems."
4. If creating a U.S. map, select "Continental" and then "North America" and then the appropriate system you wish.
   If creating a state map select "State Plane" and then select the appropriate systems and states. If your map uses recent data, use the NAD 1983 system.
   If creating a regional map, there are a number of folders you can find systems in.
5. Select "OK" and your map will now be drawn to scale.



If making a map of the United States, I recommend the following system: "USA Contiguous Lambert Conformal Conic." If making a New England map, I recommend using a state system rather than the regional system. The regional system splits New England down the middle and slightly tilts the map. For New England, I think "NAD 1983 StatePlane Massachusetts Mainland FIPS 2001" works best.

Editing files that are not land masses

Suppose you have a layer file of railroad networks in the United States, but you wish to only display Class I and Class II railroads, but not Class III railroads. Use the "Select by Attribute" feature (explained above) to select Class I and Class II, which will now be highlighted in blue. Next, right click on the rail file and select "Data" and "Export Data." Be sure you are only exporting the selected features and then appropriately name the file.



Suppose you wish to create a layer of all the highways except for interstate I-91. You can use the selection arrow tool to select a region of highways. Then, you can use the "Select by Attributes Tool" and then "Remove from Current Selection" to select out I-91. Then you can export the selected data as mentioned above. You can also use the editor tool to delete particular highways, etc. depending on the file type.

Downloading Census data

You are all familiar with how to use the download tool with the Census, so I will not explain how to do this. Nonetheless, there are a few quirks about this that you should know. When using the download center at http://factfinder.census.gov/servlet/DownloadDatasetServlet?_lang=en you will receive two files.

- _data1
- _geo

You will want to work with the _data1 file. However, in some circumstances, your map may not have codes for county numbers and state numbers. These codes are found in _geo. In cases where your map files do not contain this data, you will want to correctly copy and paste the _geo columns in the _data1 file.

Now, we will need to prepare the data such that it can be imported into GIS from an Excel spreadsheet.

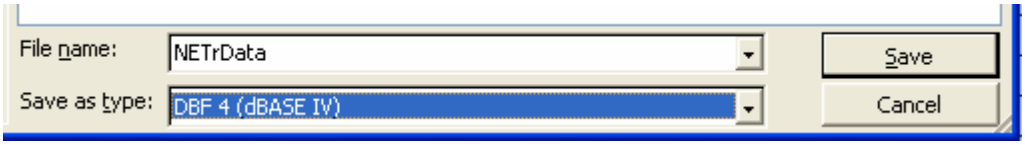
Converting the format of Excel files

Before importing Excel files, the files need to be saved in particular formats:

1. Open the Excel file you wish to import into GIS.
2. Select and highlight all of the cells you will import (be sure to select them all).
3. Right click and select "Format Cells."
4. Select "Number"—all data must be in this format and not text.
5. Select the number of decimal places you wish to import into GIS (more is better since the GIS software will allow you to restrict this later on).
6. Change the top line of the column labels. Ideally, you will want something you will recognize. However, you can keep the letter and number format if you have notes on what they represent. When converting field names, they must obey the following rules—no longer than 10 characters, no spaces or commas.
7. Delete the second line of the Excel file with the long descriptions of the data. However, you may wish to keep a backup spreadsheet such that you can refer to what the variables mean in case you forget.

Now, you will need to convert the .xls file to a .dbf file.

1. Highlight all of the data in your spreadsheet including the column headers.
2. With the cells highlighted, select "Save As."
3. Choose "Save As Type" and select dBaseIV, *.dbf.



4. Name your file something short because it will appear in GIS and we do not wish to drop the variable names.
5. When you get a warning message, select "Yes."
6. Exit Excel and you must choose "No" when prompted to save again.

Importing and joining DBF files in GIS

The next step is to join the data files and the GIS shapefiles so that they know which data goes with which map. In order to do this, you will need to create a common column that both files recognize. You will need to do this by creating a data column in the shapefile that matches the "GEO_ID" column in your DBF file. Look at your Excel file—specifically at the column GEO_ID. You will see it is numbers followed by US followed by more numbers. You will now need to create this number in GIS.

1	GEO_ID
167	06000US09009130
168	06000US09009135
169	06000US09005130
170	06000US09015075
171	06000US23021005
172	06000US23031005
173	06000US23029005
174	06000US23011005
175	06000US23029010
176	06000US23031010

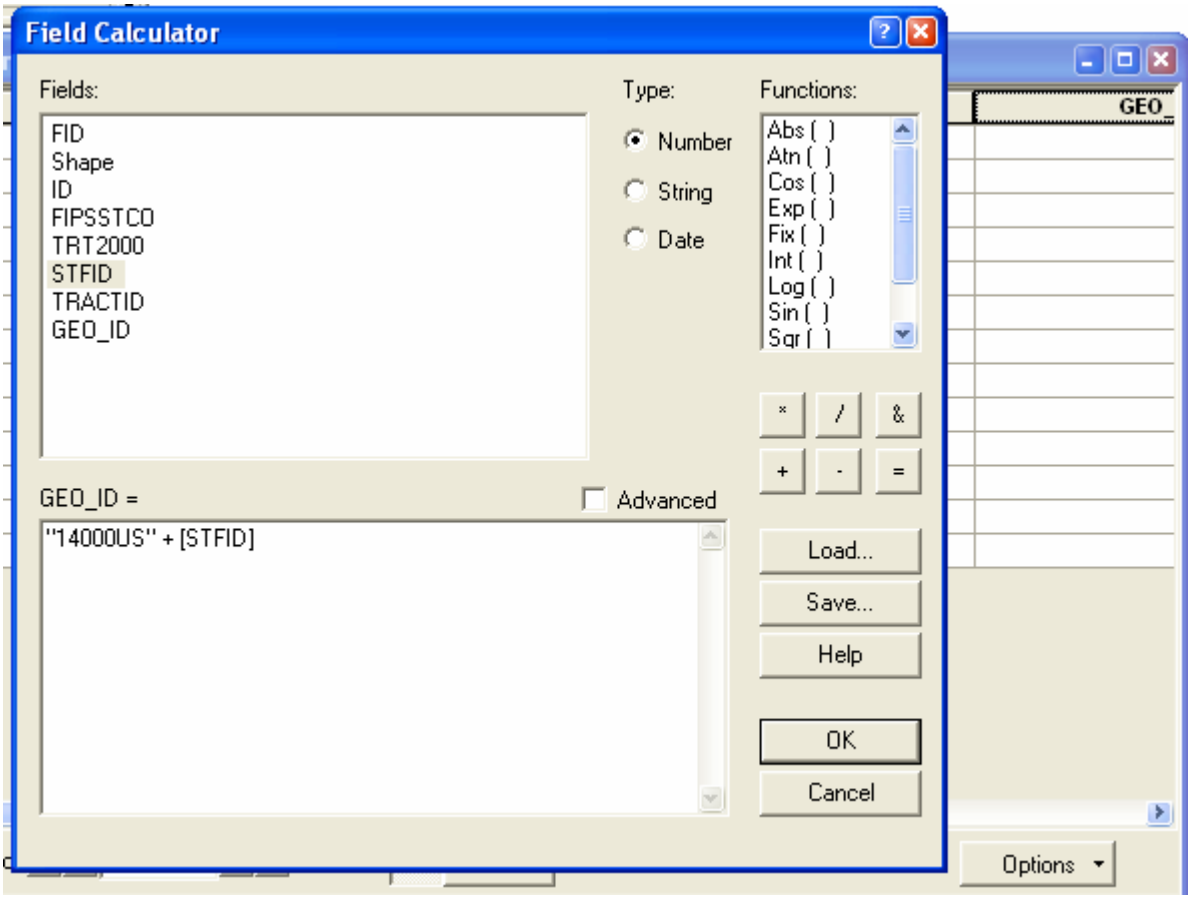
As you can see, the first numbers tell you the jurisdiction of analysis for the United States. Here "06000US" stands for town level census data. Then the following two numbers, here "09" and "23" stand for the states CT and ME. The next three digits are the county code followed by the three digits representing the "county subdivision / town" code.

How you create this number depends on whether you are working with tract data, town data, or state data, etc. The example I will use below joins the data at the tract level. You can follow some permutation of it for other jurisdiction levels—based on looking at the Excel file and seeing how you can get a match in the shapefile data. In some cases you may need to add multiple columns to get the number after the US, such as by adding state codes to county codes to jurisdiction codes. In other cases, the numbers will already be in the GIS file. At the least, you will need to do the following.

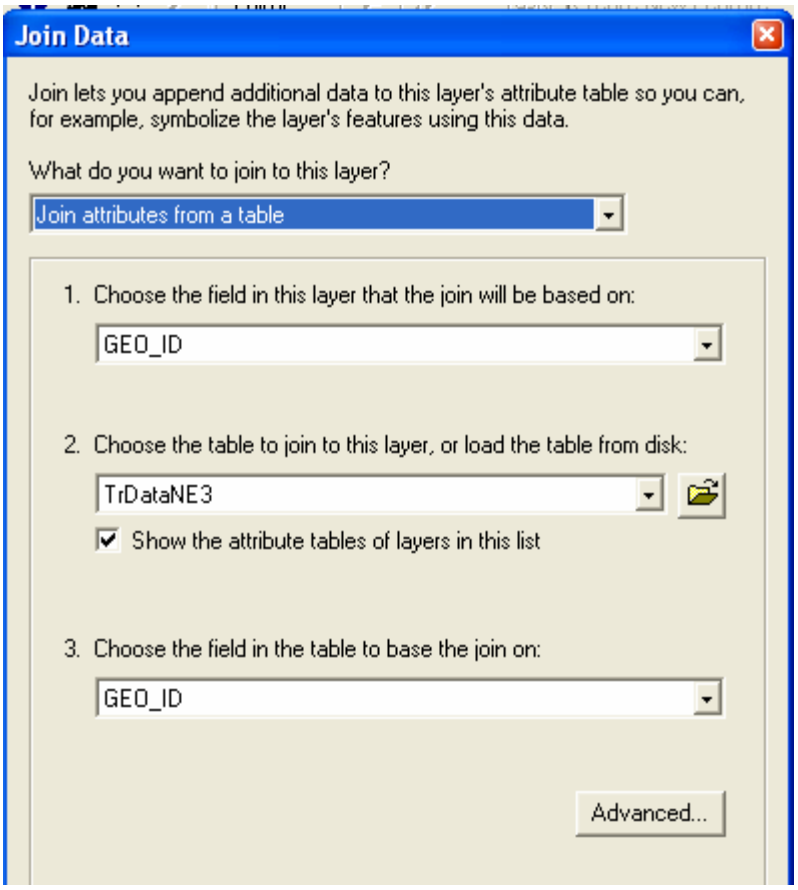
In order to join data, complete the following steps—this example is for joining tract level data, but slightly modify the code for other jurisdictions of analysis.

1. Right click the shapefile you will import the data into. Then select "Open Attribute Table."
2. Look at the columns and compare them to the DBF file. You will see the STFID column is the number after the US in the GEO_ID from the DBF file. All that is missing is a common number and the US.
3. In the attributes table select "Options" and then select "Add Field"
4. Create a field named "Geo_ID" and make it a text field with the length set at 25. The new field will appear to the right of your table.
5. Right click on the field name "Geo_ID" and then select "Calculate Values" from the drop down.
6. Select "Yes" to the warning, acknowledging that you wish to continue.
7. Now, the field calculator dialog box will appear. Type "14000US" and be sure to use quotation marks. Then, click the plus sign and then click STFID. The quotation marks indicate to put that

value directly in front of the STFID code rather than add. Press "OK" and the GEO_ID columns should now match the one in Excel.
NOTE: If using something other than tract level data the number 14000 will change and instead of using the single STFID, you may need to select the state code + county code + jurisdiction code.



8. Return to the map and use the Plus button in GIS to add your DBF file to the map.
9. Right click on the shapefile you wish to join the data to and then click "Join and Relates" followed by "Join."
10. Select "Join Attributes" from a table. Be sure lines one and three are set to GEO_ID and line two has the name of the data file.



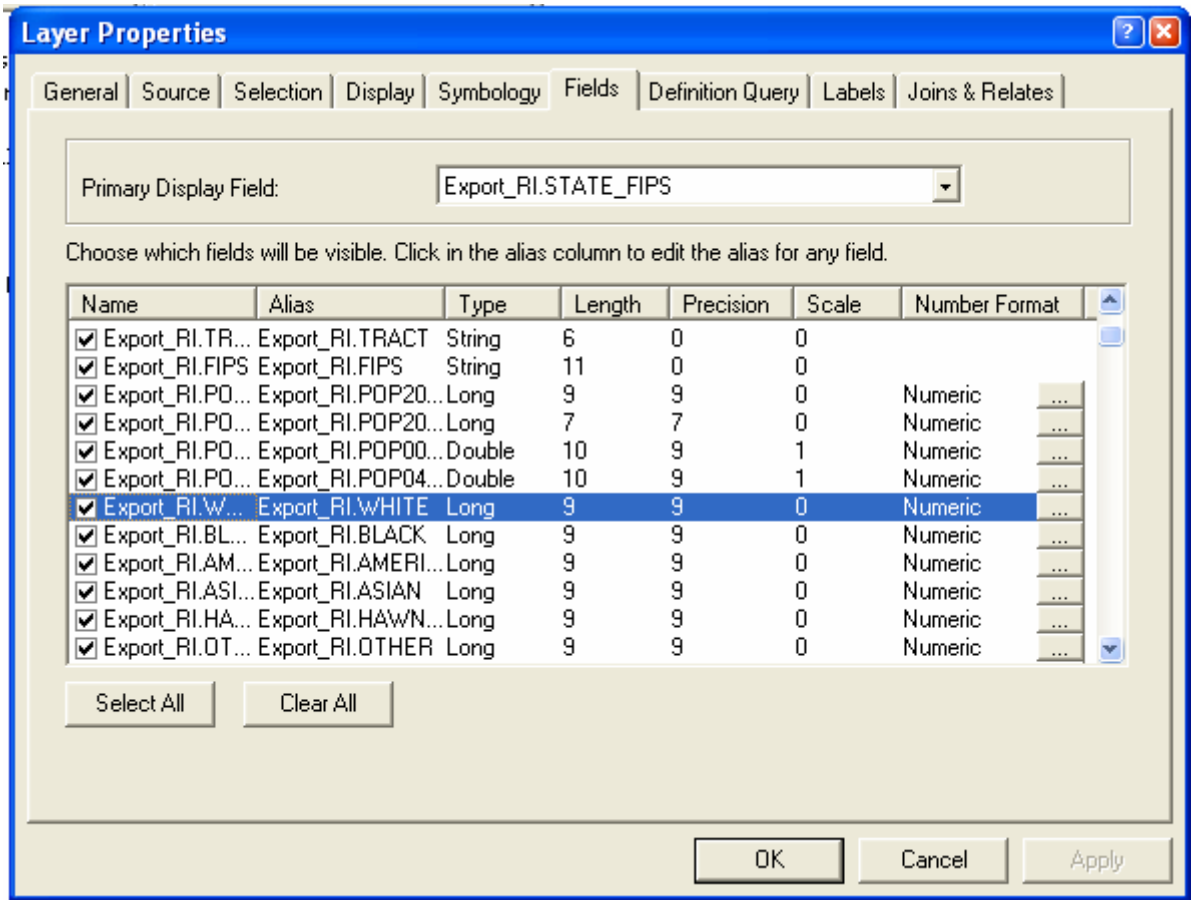
11. Be sure to check your attributes table and make sure there are no problems with the merge.

NOTE: If you have an attribute table that was created by the "Union" tool, you will need to be more creative in creating the GEO_ID. This can be done by using the select feature to calculate values only for selected parts and then follow the same pattern again by selecting the next union, etc.

Creating new variables in GIS

Suppose you have data on the percent of commuters who drive alone and the percent who carpool, but you wish to plot the percent of people who get to work in a car.

1. Double click the shapefile with the given data in it.
2. Select "Fields" and analyze the properties of the field(s) you will be using to create the new variable from.
3. Write down the type, length, precision, and scale.



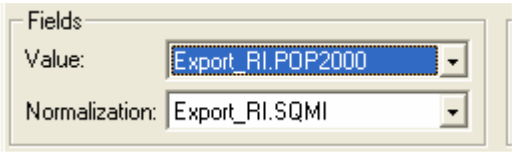
4. Right click the shapefile and select "Open Attribute Table."
5. Select "Add Field" from options.
6. Type the variable name and input the correct characteristics of the variable that you figured out above in step 3.
7. Then right click the field and select "Calculate."
8. You can now use the field editor to perform mathematical applications on your existing columns.
9. In this case, select your variables and use the plus sign to add and hit "OK."

NOTE: If using your own numbers, such as dividing by 100, do not use quotation marks around the numbers.

10. Double click on the shapefile with the data in it and then select "Field."
11. Scroll down to the variable you created and click on the "…" and adjust the variable to the correct number of decimal places you wish to have.

Plotting data in GIS

First, I will outline a common mistake. One common mistake of using GIS is a failure to normalize most data. Plotting simple counts is not as useful as normalizing the data. For example, suppose you wish to analyze unemployment. Plotting data based on a count of the number of unemployed is arbitrary because you expect census divisions with larger populations to have larger counts. Thus, be sure to convert data into percentages, densities, or an alternative normalized value. GIS data contains an area variable if you wish to normalize by area.

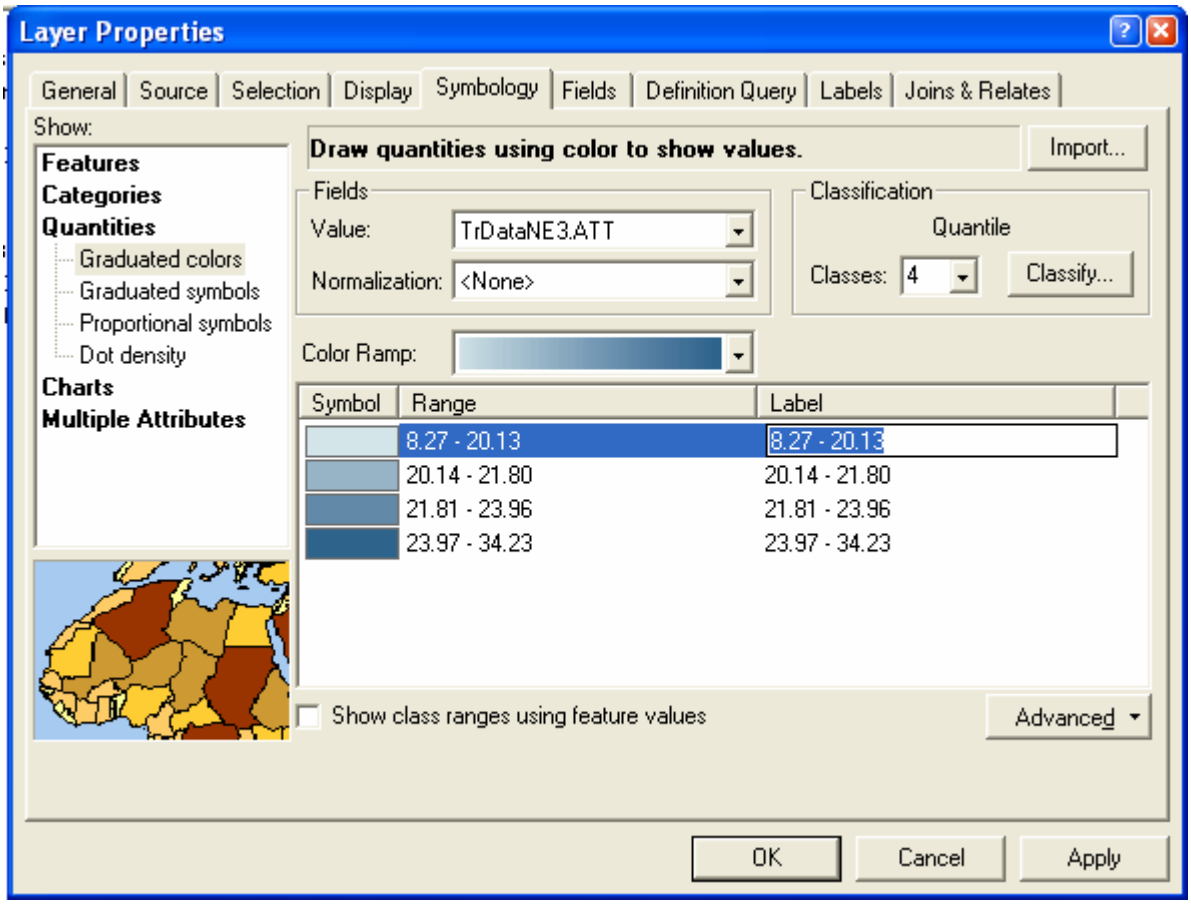


Now, there are several types of ways you can plot Census data in GIS

- Graduated Colors
- Graduated Symbols
- Dot Densities
- Proportional Symbols.

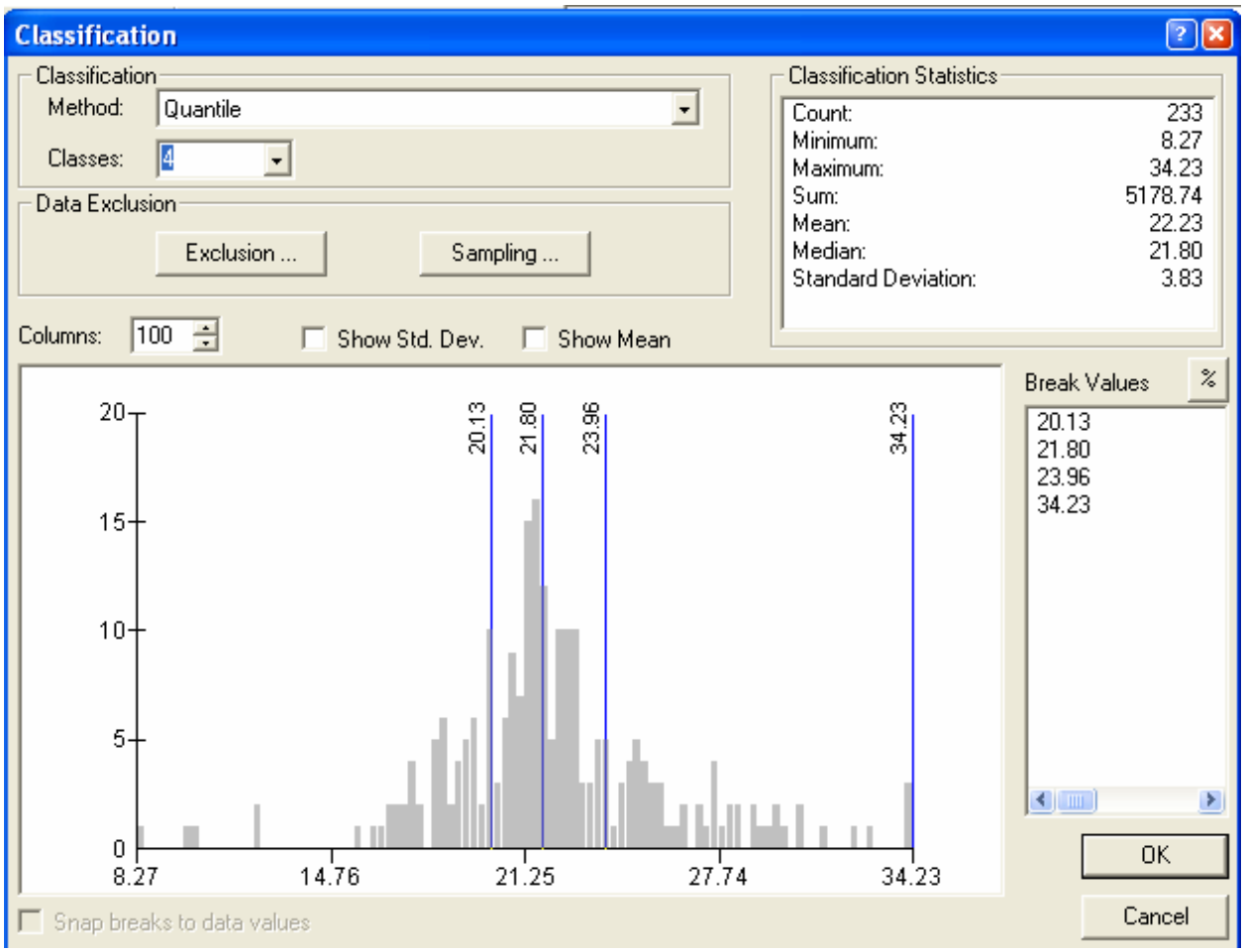
I will demonstrate how to use the graduated color scheme, but each of the other options follows a similar course of action. To plot data:

1. Double click the shapefile you are working with.
2. Select "Symbology" in the top menu.
3. Then click "Quantities" on the left followed by graduated colors.



4. In the value drop down, select the data variable you wish to plot from the list of variables you joined earlier.

5. Select the normalization variable (area, etc.) if necessary. In the example above, I am plotting average travel time and thus no normalization is needed.
6. Select the color scheme gradation you wish to use. The colors closest to the Policy Center colors (and easiest on your eyes) are the blue gradation shown above. To select this color scheme click the fourth choice from the top in the drop down menu.
7. Decide how you wish to break the data (natural breaks in the data, quantiles, equal intervals or manually decided breaks that are logical) and determine the number of breaks you wish to use. I recommend four, but no more than five, unless you have negative and positive values (where you can use two different color grades for each side of zero).
   NOTE: You can use the data statistics and distribution to determine how to break the data. There are advantages and disadvantages to each, for example:
   - Quantiles are useful for depicting certain types of statistics where having breaks with the same number of observations makes sense—but they will give you un-rounded intervals.
   - Natural breaks may be better if there are natural gaps in the data and if the data is not normally distributed.
   - Manual breaks may useful if you want to illustrate something in intervals that people may most readily think in (such as 20-30 minutes etc.).
   - Additionally, you can combine these methods by using the quantiles to find approximate break points and than rounding them to the nearest manual interval you find suitable.



8. Next, if you do wish to adjust the range, return back to the layer properties menu and adjust the range by clicking the values.
9. Also, adjust the labels to the appropriate decimal places.
   NOTE: If your data break is out to two decimal places, you should keep your labels out to two decimals so you do not deceive the reader. If you wish to have fewer decimals in the label, be sure to adjust the data using the "Fields" tab and then selecting the "…" option.
10. Also, adjust the labels to the appropriate decimal places.
11. Display the map; you may wish to double-click the color boxes and remove the black outlines by adjusting outline width to "0" if no one is interested in the jurisdiction boundaries. However, you may wish to darken the boundaries if the town, tract, etc. lines are of interest to policymakers.

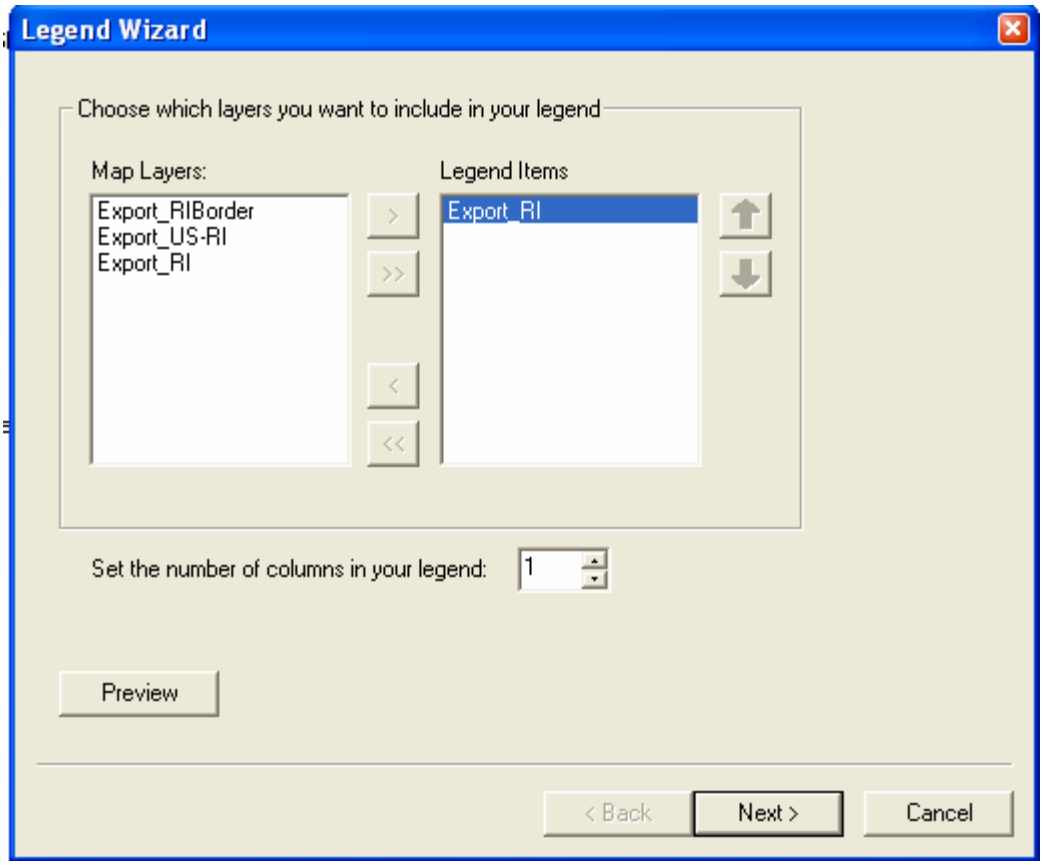
You can follow the same type of steps for other types of data maps—with some minor modifications.

Layout for map for production

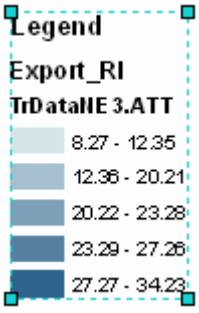
Now, you are ready to layout the map such that it fits on appropriately sized paper, has a title, and a legend to describe the dataset.

1. Use the zoom tool to zoom to the appropriate area of the map that you wish to print.

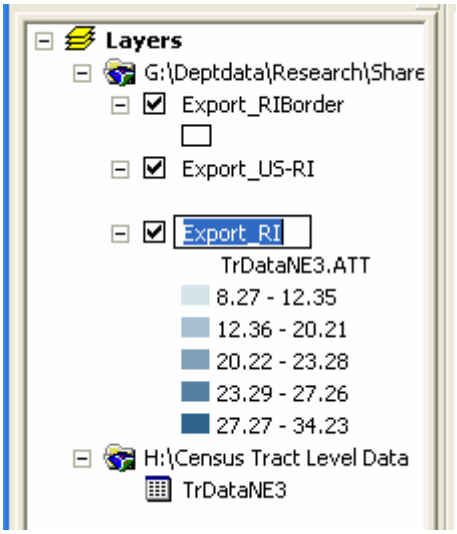
2. Click “Print and Print Setup” under “File” and then select portrait or landscape depending on how you wish to display the map.
3. Click “View” and then “Layout View.”
4. If the map does not display correctly, click “View” and then “Data View” and use the zoom tools again to adjust the image—returning to the layout view once complete.
5. Extend the outline box to determine the size of the border you wish to have.
6. Select “Insert” and the “Title.”
7. Type the appropriate title and hit enter. Then, if you wish to adjust its size, double click the title box.
8. Click “Insert” and then “Scale Bar.” Adjust the properties of the scale bar such that it is displayed in miles.
9. Insert a north arrow if necessary.
10. If you need to add a formula or a description, insert a text box and double click it to format it. Formulas can be written in a math program and then pasted into the map as an image.
11. If you wish to add town names or county names to the image, right click the shapefile you are using and select “Label Features.” If some labels do not fit inside the jurisdiction, you can annotate the labels.
12. To annotate labels, go to the data view of the map, zoom to the appropriate size, then select “Convert Labels to Annotation.” In the prompt that arises, select “In the Map” and “All Features.” Once this is done, you will be able to double click labels and move them and manually edit them so they can fit. If necessary, you can use the “Draw” toolbox to insert lines pointing from the label to the jurisdiction.
13. To add a legend, select “Insert Legend.” In the box that comes up, add the shapefile layer you plotted data for into the legend items. If you have other layers (such as a highway network) that you wish to include in the legend, also select that layer.



14. Select "Next," type the title of the legend and then continue hitting "Next" until you reach the finish (unless you wish to change font sizes, etc.).
15. When the legend is made, it will still contain the name of the shapefiles, which you will need to remove or convert to appropriate text.



16. To remove these names or replace them, go to the layers list on the left and click once and then moments later, once again on the layer you wish to rename.



17. Replace the name of the layer file (or delete it and hit "Enter" if you wish it to be blank). Do the same for the sub-layer below.
18. Save your finished product as a map file and then also save it as an image file. Illustrator files are particularly useful for graphics and EPS files are useful for merging maps into documents. (Remember, map files only save sources and not images). Furthermore, graphics will need an image file to make the maps even more pretty and colorful.
19. In order to save a file as something other than a map file, click "File" and then "Export Map" and then select the appropriate file extension.
20. Admire the finished product! (see last page).

CD templates

The following data template CDs are available in the NEPPC:

- Tract level maps (New England, CT, ME, MA, NH, RI, VT)
- Town level maps / county sub-division (New England, CT, ME, MA, NH, RI, VT)
- County maps (New England, CT, ME, MA, NH, RI, VT)
- State maps (Unites States).

In order to use the CD and save data to a profile, you should work off of the C, H, or G drive. Thus, once you know which master map you want, do the following:

1. Insert the correct master CD.
2. On the CD you will see a folder named "Master maps" along with one folder of background data for each map.
3. Copy the background data you wish to use to a hard-drive folder in which you will save your new map to. Also copy the appropriate map from master map.
4. Remove the CD.
5. When you open the base map, each layer will have an "!" next to it because it can no longer locate the CD.
6. Simply click one "!" and then locate that file in the background data folder that you just copied. This will restore the entire map because all the data is located in one folder.

Burning a template on CD

Once you create map templates, it is in everyone's advantage to take the extra time to burn a public CD with the maps. To do this, use the "Sonic" program. But, you will need to do this in two steps. First, add the folders with all of the layers and shapefiles to the CD. Once you burn this CD, copy your map template files on your hard-drive (do this so you do not change the file links to other maps you may have saved). Using these copies, right click one of the layers and select "Set Data Source" and then select the folder on the CD drive. You must then save this new updated files and then burn it to the CD.

Note: Be very careful when doing this. You should not change the data source in the original files as it may disrupt your entire map.

Concluding thoughts

ArcGIS can do many other things that I have not explained. If you think something can be done geospatially, search for appropriate instructions. There are a lot of resources on the internet and the GIS software comes with several hundred pages of digital tutorial.

As an example of something else that can be done in GIS—a Brown economist used the program to calculate the geographic center of every Census tract in the country. Then he used the program to calculate an "as the crow flies" distance to the nearest interstate highway system. This is an example of the power of the program.

I hope this guide is a useful starting point for the Center's most valuable use—geo-spatially analyzing Census data. As you continue to learn new things, I am sure it will help others in the Center if you maintain template maps (for example, if you create maps with Census blocks for New England). Save them as it may save another person in the Center a day's work of making them in the future. Also save instructions on how to do things—it will be very helpful especially if the Center gets more than one program.

I have tried to limit omissions of steps, but if you see it necessary add steps to this document as you are following it—feel free to add them if they are needed.

Best of luck! Enjoy mapping. If you have questions –send me an email at Berkeley: agrawal@calmail.berkeley.edu.

Map 4: Net domestic migration outside of New England 2003-2004