

Mapping Census Data with GIS

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This Tutorial provides step by step instructions for creating a map of population change in Fairfax County, VA. This tutorial is for those who could not access Geolytic Census Product and have to download Census data from online and make an own map using GIS Software.

The purpose of this tutorial is:

1. How to download boundary files for GIS mapping.
2. How to explore and download Census data from American Factfinder.
3. How to convert the data in a dbf file.
4. How to join the variables from two tables into one table.
5. How to derive new column for your analysis in GIS (ArcView or ArcGIS).
6. How to display the Census data with GIS software.
7. How to add critical information to your map layout.

What you will need: ArcView 3.x (or ArcGIS), an Internet Browser, Excel, Access, and WinZip (or any unzipping software).

STEP 1. Downloading Boundary Files for Fairfax County, VA

- Visit the ESRI website at www.esri.com
- At the search bar on the top right corner of the page, type 'Census 2000 Tiger/Line data'.
- Click on the second result which reads "[Download Census 2000 TIGER/Line Data](#)"
- Select **Virginia** (VA) State at the state selection either by clicking on the VA state in the map or by selecting Virginia from the drop down menu.
- Select **Fairfax County** from the Select by County drop down menu and click on submit selection.
- In the Available Data Layers section, check the boxes next to the following data layers:
 - Census Tracts 1990
 - Census Tracts 2000
- Then finally click on Proceed to Submit.
- Then click on Download File and save the data in your computer.
- Unzip the downloaded files using Winzip software (or any other unzip software) and store the data into a folder named 'fairfaxCT'.

NOTE: When you unzip each of the zipped files, they will in turn give you three files. One file with '.shp' extension, one with '.shx' extension and one with '.dbf' extension.

STEP 2. Downloading the Census Data

- Visit the **American Factfinder** website at www.factfinder.census.gov

- Click on **Data Sets** in the left hand side menu of this website.
- In the 2000 section, select *Census 2000 Summary File 1 (SF 1) 100-Percent Data* and click on the **Detailed Tables**. In the select geographic type section, scroll down to **Census Tracts** in the drop down menu.
- In the select a state section, drop down and select **Virginia**.
- In the select county section, drop down and select **Fairfax County**.

Choose a selection method

list name search address search map geo within geo

[Show all geography types](#) | [i Explain Census Geography](#)

Select a [geographic type](#)

..... Census Tract

Select a state

Virginia

Select a county

Fairfax County

Select one or more geographic areas and click 'Add'

All Census Tracts
 Census Tract 4151
 Census Tract 4152
 Census Tract 4153
 Census Tract 4154
 Census Tract 4155
 Census Tract 4156
 Census Tract 4157

Map It

Add

- In the Select one or more geographic areas and click 'Add', select **All Census Tracts** and click on Add.
- Then click on Next.
- Then select the P1. **Total Population** from the list of tables and click on add.
- Then finally click on show result. It gives you summary of the table selected.
- Now in the [print/download](#) menu to the top, click on **download** (as shown in the figure below). It would give you various format options to download in. **Uncheck the 'include descriptive data element names' box**. Select Microsoft **Excel** (.xls) and click ok. Then save the zipped file to your computer.

Detailed Tables

You are here: [Main](#) > [All Data Sets](#) > [Data Sets with Detailed Tables](#) > [Geography](#) > [Tables](#) > [Results](#)

Use the links above to change your results

Options | Print / Download | Related

Note: use download to retrieve all selected tables and geographies

Print
Download
Load Query
Save Query

Download

P1. TOTAL POPULATION [1] - Universe: Total population
Data Set: [Census 2000 Summary File 1 \(SF 1\) 100-Percent Data](#)

geographies 1-10 of 165 [Next](#)

NOTE: For information on confidentiality protection, nonsampling error, and definitions, see <http://factfinder.census.gov/home/en/datnotes/efpsf1u.htm>.

	Census Tract 4151, Fairfax County, Virginia	Census Tract 4152, Fairfax County, Virginia	Census Tract 4153, Fairfax County, Virginia	Census Tract 4154, Fairfax County, Virginia	Census Tract 4155, Fairfax County, Virginia	Census Tract 4156, Fairfax County, Virginia	Census Tract 4157, Fairfax County, Virginia	Census Tract 4158, Fairfax County, Virginia	Census Tract 4159, Fairfax County, Virginia
Total	3,237	3,032	3,783	7,744	5,744	2,478	3,622	4,434	3,034

U.S. Census Bureau
Census 2000

- Follow the above steps to also download 1990 data from *1990 Summary Tape File 1 (STF 1) - 100-Percent data* > P001, Total Population for Fairfax County Census Tract.

NOTE: Download each individual file separately, do not select both files during a single operation.

IMPORTANT

The census data that has been downloaded above gives us 2 Excel sheets each of information on the total population and median value with the names ending with 'geo' and 'data1'. For example, when we download the total population data set for the year 2000, it would give us 2 excel sheets. One would be named as *dt_dec_2000_sf1_u_geo* and the other excel sheet would be named as *dt_dec_2000_sf1_u_data*.

The file data1 contains the population information in it while the geo information contains the county geographic information such as tracts, etc. We will be joining the above data tables with the Fairfax county shape file on the basis of the geographic information in the form of Tracts. **In order to join the population information to the Fairfax county shape file, we need to join the above 2 excel sheets into one file which contains the population information as well as geographic information.**

To make things easier, we will also join all the above files into one census data file, which can then be imported into ArcView or ArcGIS for further analysis.

UNZIPPING THE DOWNLOADED FILES

Unzip all the downloaded census files using **Winzip** software (or any other unzipping software) and save them in a folder named accordingly. Rename all the excel sheets with the same name as the folder for easy reference.

Example: After unzipping the H85 file, save the contents in a folder named Fairfax.pop.

STEP 3. Creating a DBF File

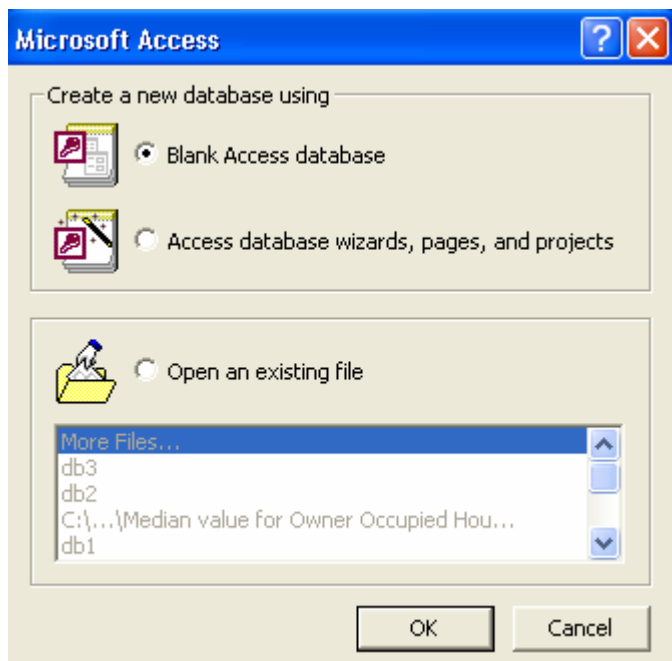
MS Access database is required to continue with this exercise!!

Before starting this exercise, make sure that you give appropriate names to the columns containing housing, year and population information in the downloaded Excel sheets.

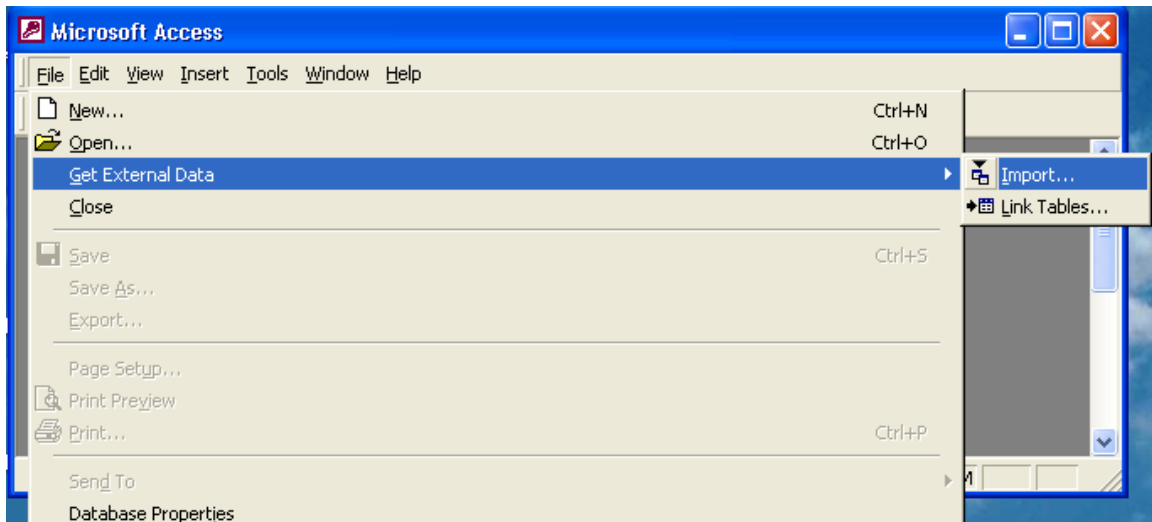
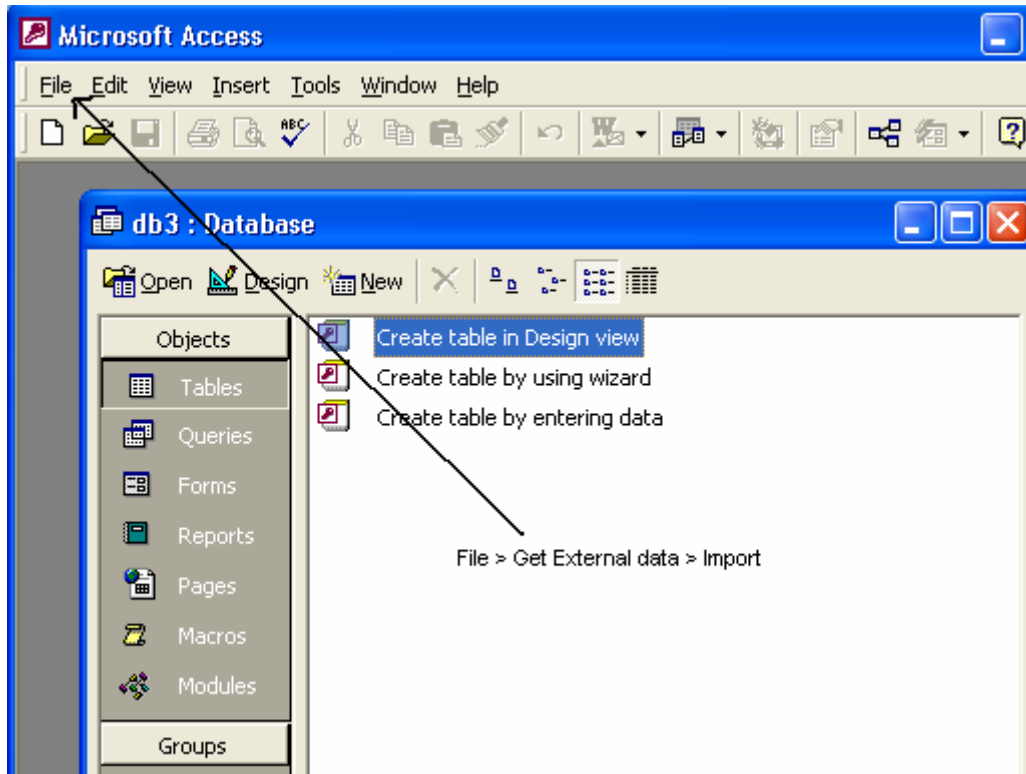
We have to import all the excel files into the MS Access database in order to join them. We need a relational database (like Access) for us to join the tables relationally keeping a column as reference.

Importing Excel files into Access:

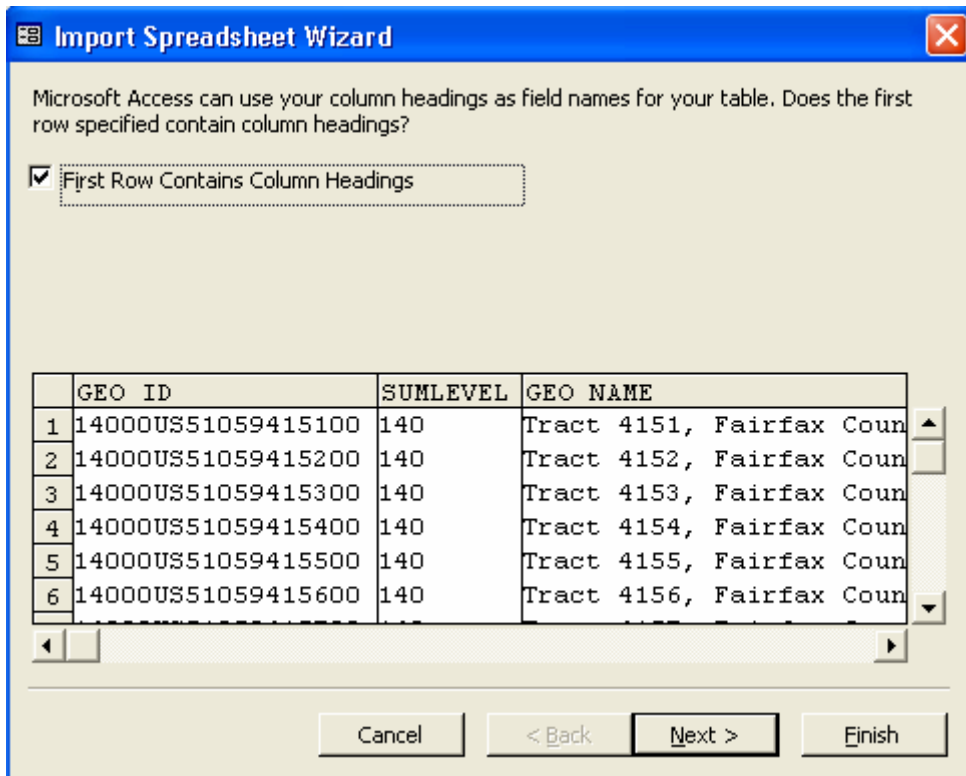
- To import the excel files into MS Access, open the Access database.



- Click on Blank Access database and click on OK.
- Save 'db1' database in a temporary folder and click on create.
- Then go to File>Get External Data>Import as shown in the figure below.



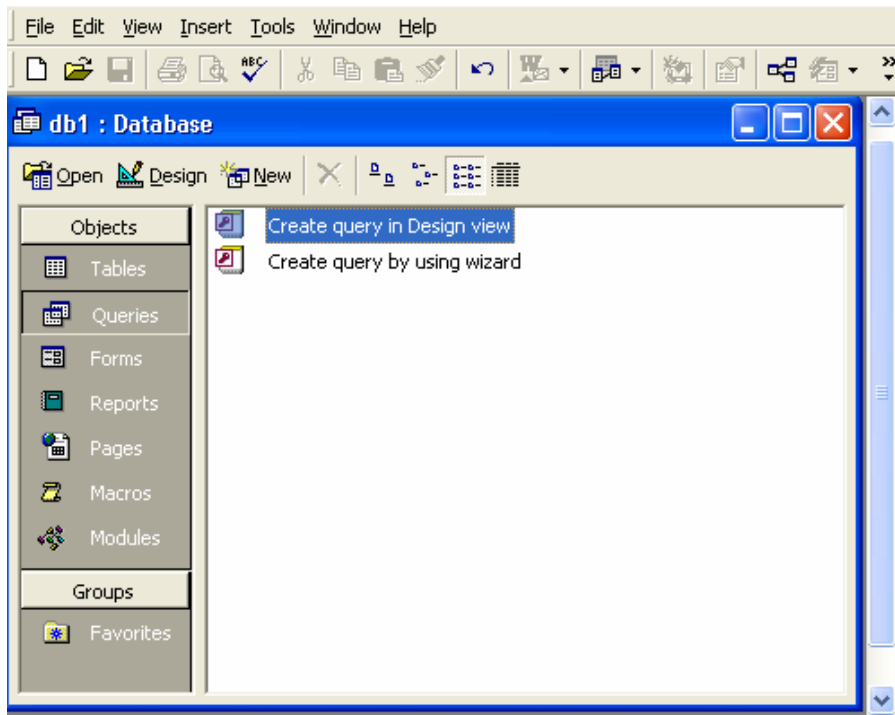
- Scroll to the folder where you stored the excel files and open the excel file.
- Access opens up a wizard to import excel files. In the first screen make sure you have the *First row contains column headings* box checked. Then click next.



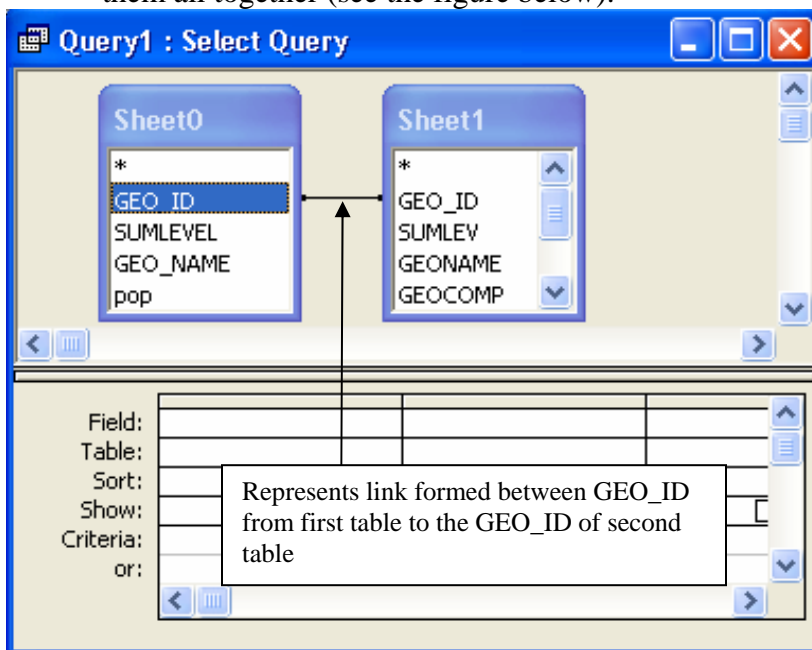
- In the 'where would you like to store data', Check the 'in a new table'. Then click next.
- Then in the current screen click on next.
- Then click on *No primary key* and click next.
- Name the table with the same name as the current excel sheet you are dealing with.
- The wizard finally displays that it has finished importing the excel sheet. Simply click on OK.
- In total, we should have 8 excel sheets imported into Access. Make sure that you import all the excel files which were downloaded.

JOINING THE IMPORTED FILES USING THE ACCESS QUERY BUILDER

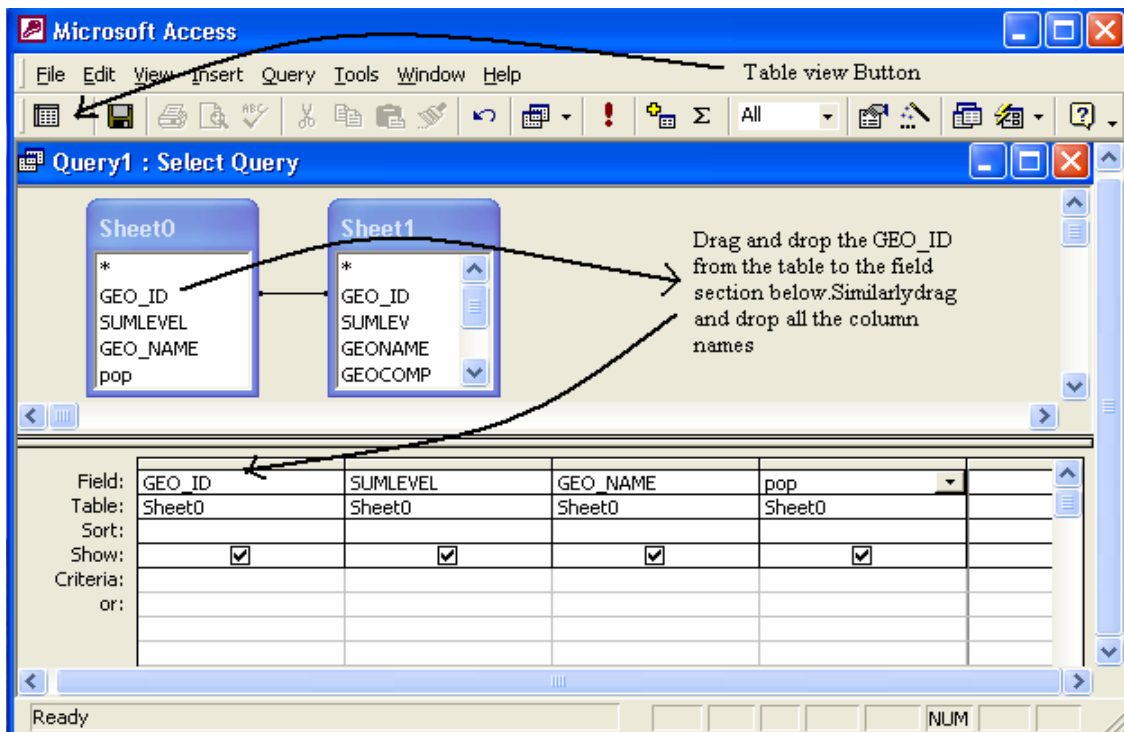
- To join the excel files we use the Access queries. Under the Objects section, click on queries.



- Then double click on *Create query in Design View*.
- The wizard comes up with a *Show Table* window with all the imported excel files named in it. **Double click on each of those excel sheets** to add them to the *Select query* window. Then click on close in the Show table window.
- The select query window now has 8 windows, each for one excel sheet. Now we have to link a common column in every table to a reference table in order to join them all together (see the figure below).



- The figure above shows an example of a link between GEO_ID of first and second table.
- When all the links are formed, we need to add the required columns to the field by dragging and dropping the column names. Each column name goes into a separate section as shown below.



- After adding all the columns, we can view the newly formed table by clicking on the table VIEW bottom at the top left hand corner.
- Now we have to store the newly formed table as a DBF file to enable us to open it in ArcView and ArcGIS. Firstly, save the table (as a query) in your computer using File>Save. Then go to File>Export and save the table as a DBF format. For convenience, we can name the file as “*Census_Data.dbf*”

NOTE: Make sure that you save it as DBF IV format, which is ArcView and ArcGIS compatible.

STEP 4. Joining the Tables in ArcView

This exercise helps you learn how to analyze the census data and create thematic maps on the basis of the census data. The exercise involves importing the DBF file and joining it to the Fairfax county data and also plotting the changes in population.

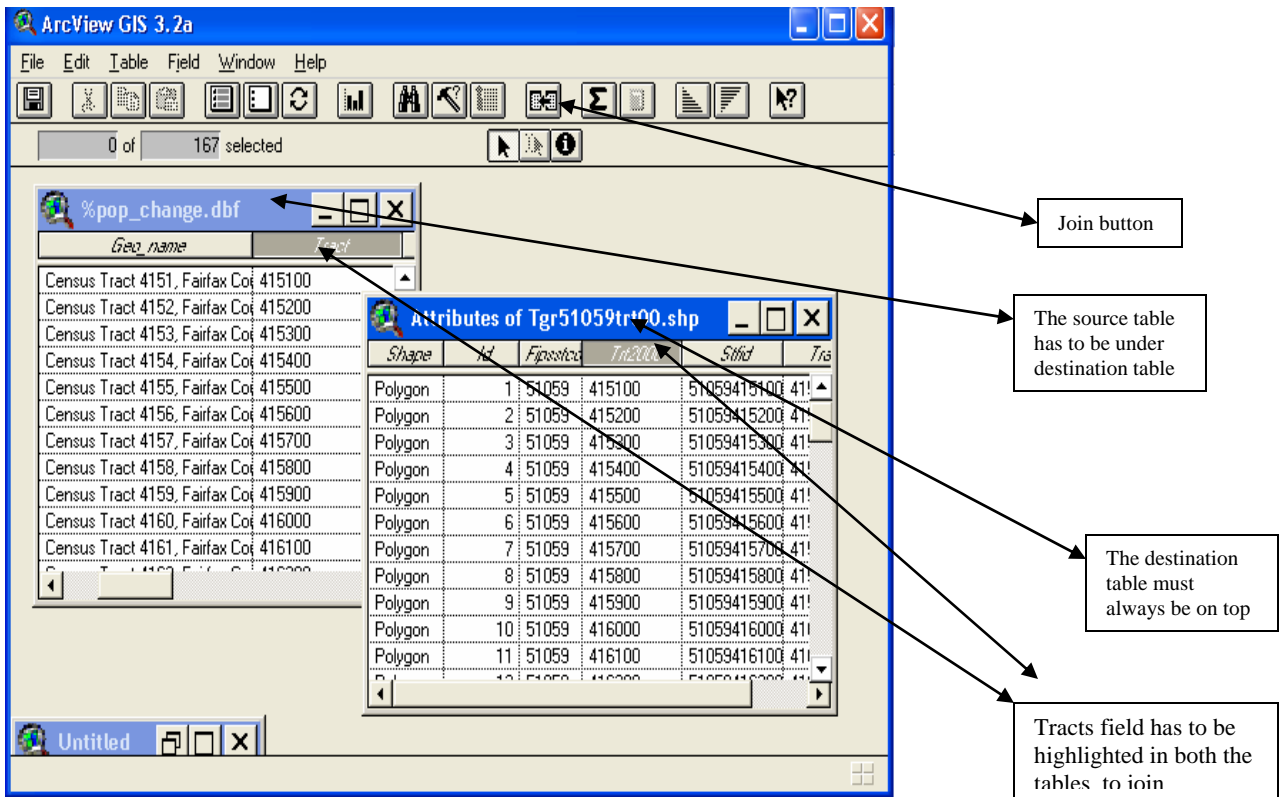
- To begin the exercise, open **ArcView** and “select with a new View” option.
- Say yes to “would you like to add data now?” and scroll to the folder where you have stored the Fairfax county shape files. Open the census tracts folder (which is


inside the 'fairfaxCT' folder) and select the *tgr51059trt.shp* file, which is the Fairfax county shape file. We have a new view named *View1* with the Fairfax County theme added to it.

- Now open the attribute table for this shape file by clicking on the *open theme table* button.
- Next go to the project window and click on Tables icon on the left hand side. Then click on Add button to open a table.




- Browse and open the *Census_Data.dbf* file. Now we will join the dbf file and the Fairfax county attribute table.
- To **join the two tables** we will first determine the **common field** (column) for the join. If you look at the two tables, the *Tract* column is common to both the tables. For the join, **the attribute table for Fairfax County is the destination table and the dbf file is the source table**. The figure illustrates the table join settings.



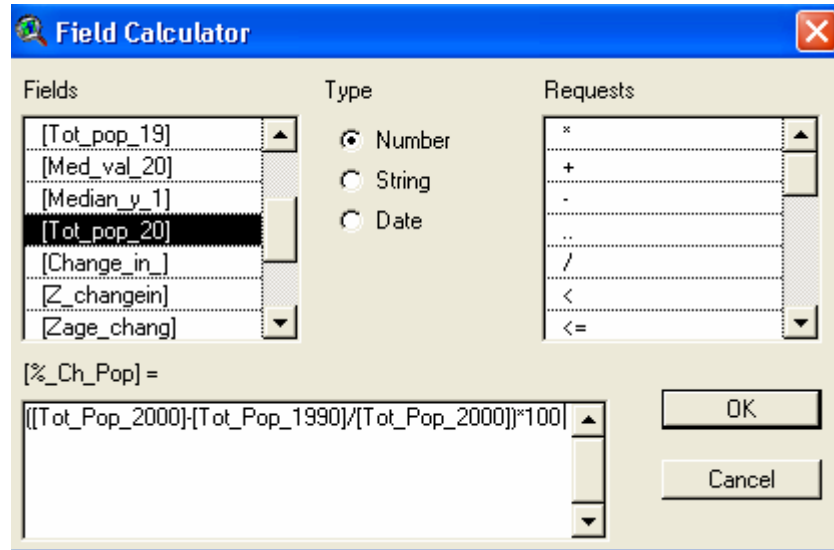
- First, open the dbf table and click the Tract column name. Then click on the Tract column name of the attribute table to highlight it. Make sure the attribute table is on top and click on the JOIN button . The dbf file table will automatically close after the join indicating that the join was successful.

STEP 5. Making a New Column in ArcView

After joining the two tables we have to start analyzing the data in order to come up with meaningful maps based on the census data. The next step would be to calculate the difference in the median values, median years and the changes in population in 1990 & 2000. We have to create new fields for the difference values so that we can plot them in the map.

- To add a field to the table, go to **Table>Start Editing**. You will notice that the column names that were initially italic are now straight. Then go to **Edit>Add Field**. Give an appropriate name for the field. For the decimal places field, make sure that you enter the value 5 for it to calculate up to **five decimal places**.
- Now with the new field name highlighted, click on the calculate  button. This comes up with a window to calculate the values for the newly formed field.
- In the window, form the following equations:
NOTE: We need to calculate the percentage changes in population from 1990 to 2000.
 - For the percentage changes in population from 1990 to 2000

$$([Tot_Pop_2000]-[Tot_Pop_1990])/ [Tot_Pop_2000])*100$$

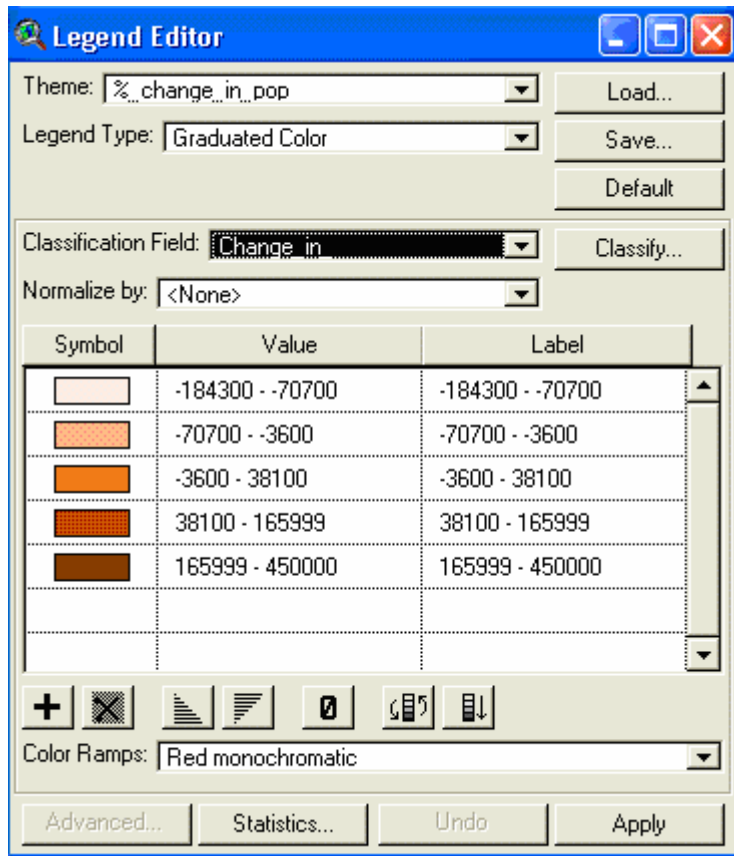


In the above example, we have formed an equation to calculate the percent change in population (%_Ch_Pop).

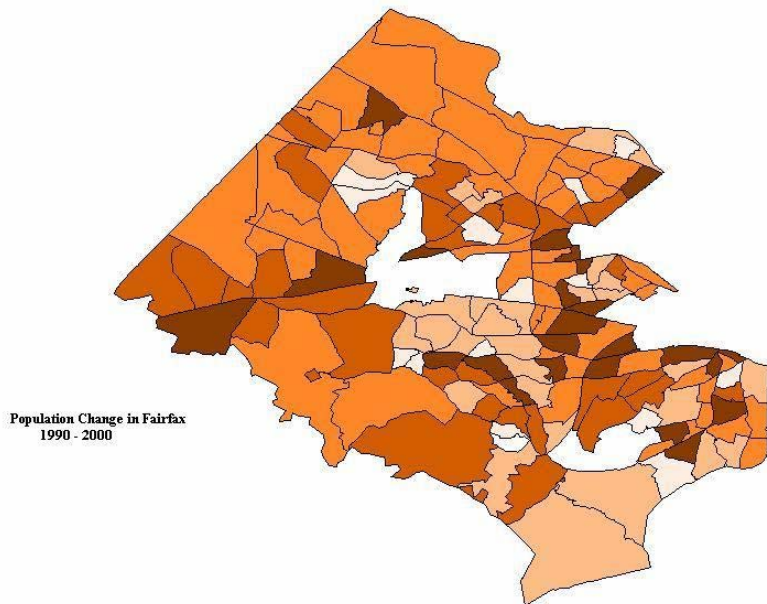
- After calculating, make sure that you stop editing by going to **File>Stop Editing**. When it prompts you to save edits click yes.

STEP 6. Display Themes in ArcView

- To plot the calculated fields as maps, go to the project window and double click on view1.
- In order to be able to view all the 2 changes, we will make copies of the theme. Highlight the current theme *tgr51059trt.shp* (the selected theme is slightly raised to indicate that it is highlighted). Go to **Edit>Copy Themes** to copy the theme. Then paste the theme twice by selecting **Edit>Paste themes**.
- Now highlight the first of the 2 themes and select **Theme>Properties**. In the theme name section, rename it as **%_change_in_pop**. Then click on OK.
- Then **double click on this theme** to view the legend editor. In the legend editor, select **graduated color** from the Legend Type field.
- Then in the classification field, scroll down and select the %_Ch_Pop field.
- You could then choose a suitable color ramp from the color ramps section and then click on Apply.



- Check the box right next to the theme to display the percentage changes in population from 1990 and 2000 (See the figure below)



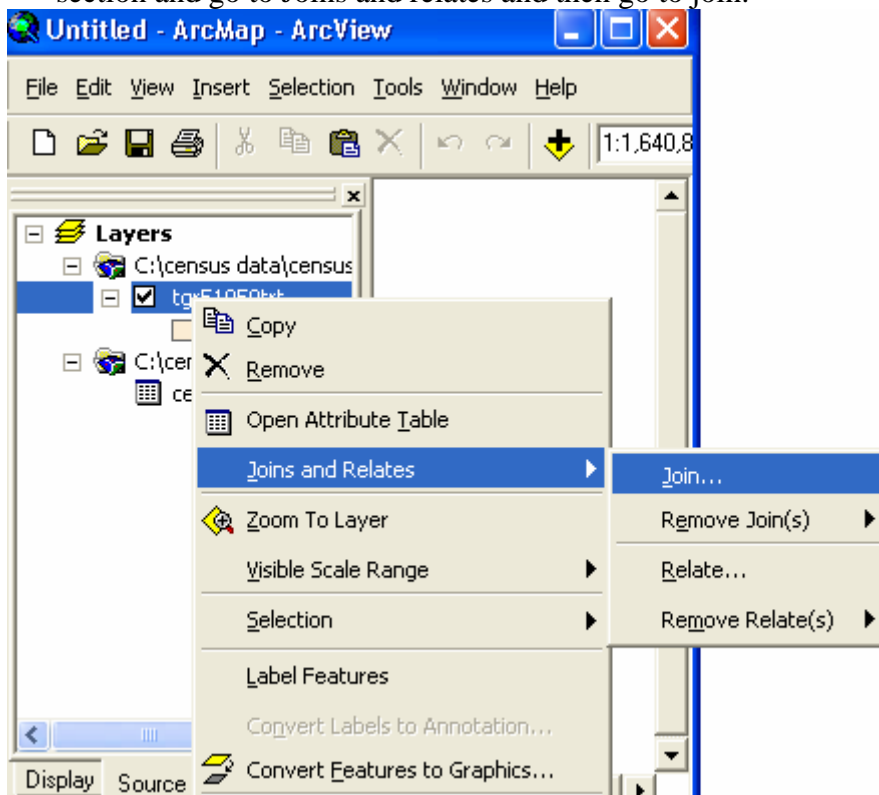
Population Change in Fairfax County, 1990 - 2000

- You can save this project by going to File>Save as “.apr” extension and you can open the file in ArcView. You can save this figure by going to File>Export and choose bitmap option to open the figure in any window environment.

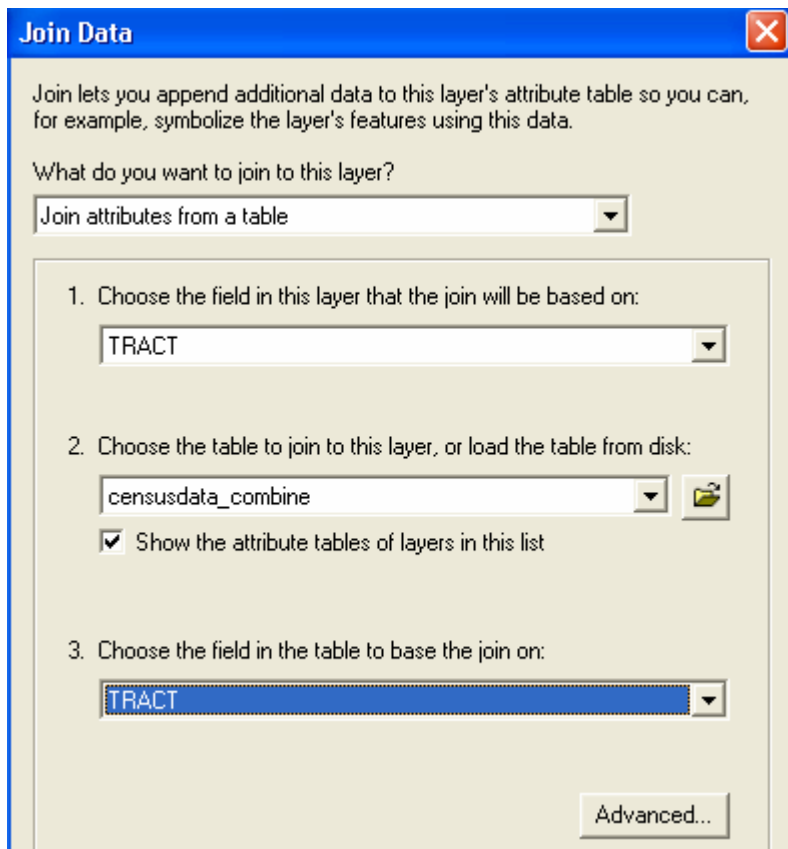
Using ArcGIS

The above exercise can also be performed using ArcGIS. The steps to be followed are basically similar. First you have to join the two tables, then build new fields and finally plot the new fields. Let’s look at each part stepwise.

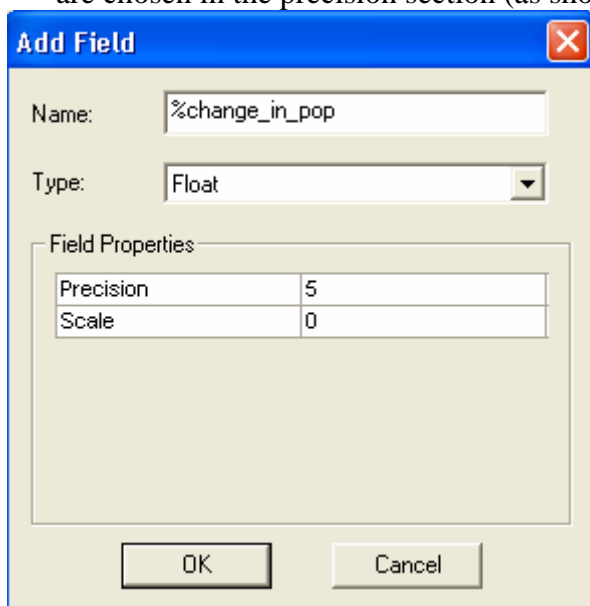
- Open ArcMap and select the new empty map option. Then go to **File>Add Data** and browse to ‘fairfaxCT’ shape file folder and add the *tgr51059trt.shp* file. Then similarly also **add the dbf file** formed by the MS Access database.
- Now we have to join the attribute table of the Fairfax County shape file and the dbf file table. To do so, right click on the *tgr51059trt.shp* theme under *Layers* section and go to Joins and relates and then go to join.



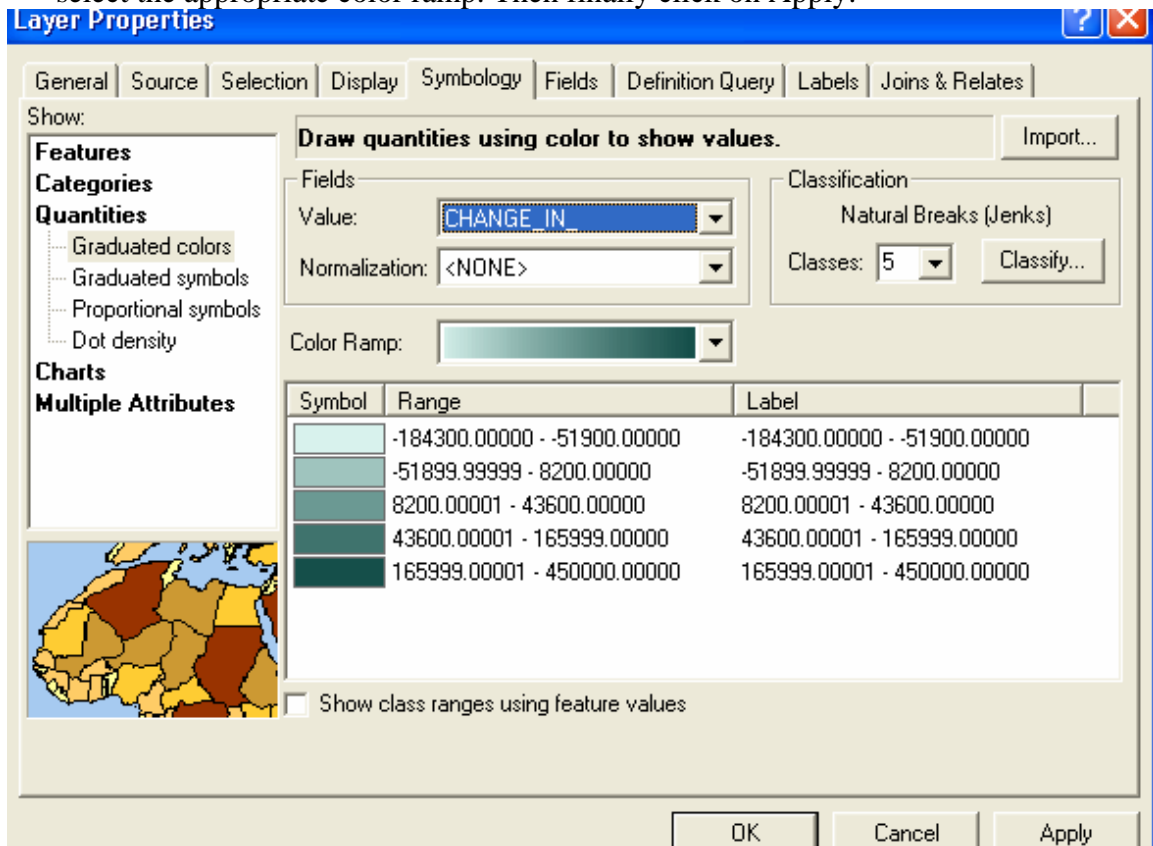
- This will give you a join data window. In the *what do you want to join to this layer?* Section scroll down to Join attributes from a table.
- In the *choose the field in this layer that the join will be based on* section scroll down and select the Tracts field.
- The next section automatically gives you the name of the dbf file. In the next section scroll down to choose the Tracts field.



- This will join the two tables.
- Now to create new fields in the newly formed table, right click on the theme and click on open attribute table. This opens the attribute table. Now click on the options button at the bottom of the table and select add field. Name the field appropriately and make sure the type is selected as float and that 5 decimal places are chosen in the precision section (as shown in the figure below).



- Now right click on the field name and select calculate values.
- This lets you calculate the values of the field like you did in ArcView. Use the same equations as before to calculate the 3 differences in population, median value and median year.
- Once you are done calculating the fields close the attribute table.
- Now when you double click on the theme file, it gives you the legend editor for that particular theme file. Click on the general tab and rename it appropriately in the Layer name field. Then click on the Symbology tab. In the Show section click on Quantities and then Graduated colors. Then in the Value field, scroll down to the respective field (percentage population change) and in the color ramp section select the appropriate color ramp. Then finally click on Apply.



- You can save the projects in ArcMap as ArcMap documents with '.mxd' extension.

If you have any question on this tutorial, please contact Joy Suh, hsuh1@gmu.edu.

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