Working With Census Data Tables and Shapefiles in ArcMap 10

This tutorial will demonstrate how to work with Census data tables from the Census Bureau's Factfinder and Census Tiger Line shapefiles. Formatting both the tabular and geographic data, joining the tabular data to the features, and displaying the data on a map are covered. This document covers only a small bit of the information available from the Census Bureau, but the workflow should be modifiable for other metrics collected by the Census.

Census data is a great resource that is reliable, well documented (always helpful for research), and updated regularly. It is collected and identified by geography and includes a wide range of geographic detail, from states to neighborhoods. This is ideal for GIS but the formatting of the data upon downloading is not 'GIS-ready' and there are a multitude of steps necessary to turn your the raw downloaded data into a map.

In this tutorial you will learn to find and download Census and GIS data, and then format the two to work together and create a thematic map. We'll use poverty levels in Houghton County, Michigan, USA as our example for this guide.

Steps
1. Find and download the census data

    a.   Go to http://factfinder2.census.gov and start by clicking 'Geographies' on the left

    b.   In the 'Select Geographies' window, select 'Census Tract' as your Geographic Type. You will then be given options to narrow down your tracts. Choose 'Michigan' under Select a State then select 'Houghton' under Select a county. Next, choose 'All Census Tracts within Houghton County, Michigan'. Click Add to your selections.

    c.   Close the 'Select Geographies' box.

    d.   Now it's time to select your variables. Click 'Topics' on the left and then choose 'People', then 'Poverty', and click 'Poverty', at which point it will be added to 'Your Selections' at the top left and you can close the 'Select Topics' box.

    e.   Since you have now made your geographic and variable selections, you can check 'Poverty Status in the Past 12 Months' in the 'Search Results' box. Click the View button at the top of the window to preview your data.

    f.   Click the 'Download' button at the top of the window and select the first option to download a comma delimited (csv) file for your data. Click OK followed by Download once your file is created.

2. Format your data for use with GIS

After downloading your chosen Census variables you must open your data in Excel and properly format the worksheet before adding it to ArcMap and joining it to a GIS layer. Factfinder datasets often come with more information that is necessary for your interests. A natural first step is to eliminate unnecessary data.

    a.   Double click the downloaded 'ACS_10_5yr_S1701.zip' file and open the csv file in Excel.

    b.   Make a copy of your dataset in case you accidentally erase something you later realize you need (File→Save As, and save as 'HoCoTractsPoverty')

    c.   For this project, we are only concerned with percent below poverty and we will discard the other data as well as the margins of error. The 2nd row in the worksheet shows the 'universe' or total dataset from which the numbers are pulled, and the rows below give more detail about the data in any given column. We want

to keep column H which shows the Percent below poverty level from the population from whom poverty status is determined.

      d.   Select the columns D, E, F, and G using the top row, then right click and delete those columns. Then select all of the populated columns after the percent below poverty column (now column D) and delete them as well (there should be columns E through JO). You should now only have 4 columns left including the GEO ID's.

FactFinder datasets come with at least two header rows, and often several more, but ArcMap only accepts one header row. For the sake of consistency, we'll use the same header format in this exercise, but there is also a list of suggestions below for when you are working on your own projects.

      a.   Select cell D8 which should read 'Estimate' and rename it 'PctBelowPov' for 'Percent Below Poverty.

      b.   Select rows 1-7 using the far left column, and right click and delete those rows. Now row 1 should be your column headers, and everything below that is your data.

      c.   Click File→save to save the changes you've made in your worksheet. Click Continue past the Excel formatting warning

The following suggestions will help you get rid of the excess header rows and end up with a GIS-ready dataset in the future.

- Keep the row that starts with 'Id' and 'Id2' as the first two cells – the join will rely on the data in the ID2 Column
- You will need to rename the headers so that they make sense to you, but be sure to keep the following rules in mind when naming your headers:
  - They cannot start with a number
  - They cannot include figures other than text, numbers, or underscores o
  - They cannot include spaces
- ArcGIS will allow you to use longer field names in a join from Excel, however if you choose to save a shapefile to include your new data it will truncate the field names to 10 characters, therefore you may wish to limit your header rows to 10 characters now
- Make sure you do not have any empty header cells, or multiple cells with the same name
- You may wish to create a codebook for decoding your new headers in the future
- Once you are satisfied with your header row, select the unused header rows using the column on the left (1,2,3,4) and right click Delete

3. Download your spatial (GIS) Data

      a.   Go to http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html in a web browser.

      b.   Click 'Download Shapefiles' in the box on the left.

      c.   Select 'Census Tracts' in the pull down menu, and click 'Submit'.

      d.   In the '2010' menu, select Michigan, click submit, then select 'Houghton County' and click 'Download'.

      e.   Save the file to your machine – make sure you know where you are saving it!

      f.   Once it's saved, navigate to the file, right click it and extract the files from the Zip Folder. This will create a new folder named tl_2010_26061_tract10 that contains your shapefile.

4. Format your GIS Data

Your Tiger Line shapefile also requires a small amount of formatting. We will base the join on the data in the'GEOID' field in the shapefile, but it is not the proper field type for joining to excel data (The GEOID field is a text field and it needs to be a 'double' field to be able to join the ID field in the excel data, which is also 'double'). These steps will help you load your data and create a new field that is properly formatted.

    a.   Open ArcMap and click 'Add Data'

    b.   Navigate to your downloaded (and extracted) Tiger Line Shapefile (you may have to use the 'connect to folder' button if you saved these files in a location that has not previously been accessed from ArcMap)

    c.   Select the tl_2010_26061_tract10 layer and click 'Add'

    d.   Right click the Layer name in the 'Table Of Contents' and click 'Open Attribute Table'

    e.   Click the white 'Table Options' button at the top left corner of the table and select 'Add Field'

    f.   Name the field 'ID2', set the type as 'Double', and click 'OK'

    g.   Scroll to the right of the table and find the new 'ID2' column

    h.   Right click the 'ID2' column header and select 'Field Calculator'

    i.   In the 'fields' box, find and double click the 'GEOID10' field so that the bottom of the window reads ID2= [GEOID10]

    j.   Click 'OK' and the Contents of the GEOID10 field will be calculated into the 'ID2' field, which is in the proper format for joining to your worksheet

5. Join the Census Data to the GIS layer

Once all of your data is formatted properly you can add your excel file and join it to your Shapefile layer.

    a.   Click 'Add Data'

    b.   Navigate to your edited 'HoCoTractsPoverty.csv' file (again, you may have to use the 'connect to folder' button if you saved these files in a location that has not previously been accessed from ArcMap)

    c.   Select the file in the 'Add data' window and click 'Add'

    d.   You will now see your worksheet in the Table Of Contents under your shapefile layer

**Note: When you add a worksheet, the Table of Contents view switches from 'Drawing Order' to 'Source'. You can change the view using the icons directly below the words 'Table of Contents'. 'Drawing Order' is a nicer and more functional view, but will not show your worksheet.

    e.   Right click the shapefile layer name (tl_2010_26061_tract10)and select 'Joins and Relates→ Join'

    f.   In the 'Join Data' dialogue box, choose'ID2' (the ID Field you created) in field 1, the name of your worksheet (HoCoTractsPoverty) in field 2, and 'ID2' in field 3

    g.   Click 'OK' to complete the Join

    h.   To ensure that the Join worked properly, right click the name of the shapefile layer in the Table of Contents (tl_2010_26061_tract10)and select 'Open Attribute Table'

    i.   Scroll to the right in the table and you should see your data after the first 'ID2' field. The last filed should be 'PctBelowPov'

    j.   If the cells contain values (as opposed to reading <null>) your join was successful

    k.   Close the table when finished

6. View your data

Now for the fun part. Once you have joined your data to the GIS Layer, it is time to create a map!

      a.   Right click the Shapefile Layer name in the Table of Contents (tl_2010_26061_tract10) and select 'Properties'

      b.   Select the 'Symbology' tab

      c.   Select the 'Quantities' option under 'Show:'

      d.   Select the 'PctBelowPov' variable in the 'Value' field

      e.   Select a color in the 'Color Ramp' pull down menu

      f.   Click 'OK'

      g.   Your data will now be displayed on the map

      h.   Go wild with your GIS and Cartography skills to add a legend, title, all the things a proper map should have. The census tracts you downloaded are in unprojected (geographic) coordinates, so you may want to apply a projection to the data frame to make your map appear less 'squashed'.

7. Save your data

You may wish to save a copy of the shapefile that includes your census variables. This will make your data easier to share or use in multiple map projects without relying on an excel sheet and a join.

      a.   With your data still joined, right click 'tl_2010_26061_tract10' in the Table of Contents and click 'Data→Export Data'

      b.   Choose a name and location for your new dataset under 'Output Feature Class'

      c.   Click OK and ArcMap will export a copy of your shapefile that includes the census variables that you joined.