

GEOG2017EL
Applied Cartography and Introduction to GIS
Lab 8 More Thematic Maps

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Purpose: The purpose of this lab is to expand your knowledge of Choropleth maps and introduce you to other kinds of thematic maps including graduated symbols and dot density maps.

Part 1 Downloading data

Refer to Lab 7 part 3 (and Lab 5 part 1) downloading from E-Stat. From the ***Provinces and Territories by Census Subdivision*** download the following:

- Population 2006
- Land Area

And from the **Housing** universe towards the end of the list

- Total number of private households by household type - 20% sample data
- One-family households, private households by household type
- Multiple-family households, private households by household type
- Non-family households, private households by household type

Remember, the small indent starting at “One-family...” tells you that it is a component of the “Total number of private...” Therefore, One, Multiple and Non-family household counts should equal Total. It’s ALWAYS a good idea to download the “Total” for your variables so that you can check your data.

Part 2 Creating a Choropleth Map (5 points)

1. Make a new map by adding your Ontario CSD file (spatial) and the data you just downloaded above. Add your economic regions (ER) spatial file as well (lab 7).
2. Refer to Lab 6 part 1 Changing Field Names to give meaningful Aliases to your downloaded E-Stat variables.

In Lab 6 you did this using the Field tab in the Layers Properties window. You can also create/change an Alias if you:

- Open the table (right click on the table name in the Table of Contents), then
- Right-click on the column header the scroll down to Properties.

Proper use of Choropleth maps

Choropleth maps should not be used to show raw counts (total population, number of single-detached homes, number of unemployed persons, number of moose, etc.). They should be used for ratios or proportions such as:

- proportion of total housing stock that is single-detached (# of single detached homes/Total by type of house,) or
- unemployment rate
- or density

Follow the link <http://en.wikipedia.org/wiki/Choropleth>

See specifically the last paragraph in the overview beginning with “Another common error in choropleths...” and the accompanying diagram on the bottom right comparing correct and incorrect use of choropleth map for population.

There are a few ways you can convert raw count data to ratios, percents, proportions (measures of intensity) in order to create appropriate choropleth maps. See Harvard University Graduate School of Design at <http://www.gsd.harvard.edu/gis/manual/normalize/>

Q.1 Why should summary statistics such as averages, medians, or percentages not be normalized? (1 point). (do a search on the Harvard page above)

You can convert your raw count data into a rate, ratio, proportion or percent, before mapping it using a program such as Excel, or you can use the Field Calculator to calculate an appropriate variable to map. We'll create a new variable called PopDensity (population density) using the **Field Calculator** in the data table we created from the download above. Dividing a raw count of objects or events by area (land/water, or combined) is referred to as Area(l) standardization or Normalization.

To calculate population density

1. Open your downloaded tabular data table (right-click on the table name in the Source tab of the Table of Contents – **IMPORTANT**: non-spatial data tables do NOT show in the Display tab, you must go to the Source tab to work with them).
2. From the Options button >Add Field
3. Create a new field called PopDensity
 - for Type select Double,
 - leave the Field Properties as default.
 - Click OK.

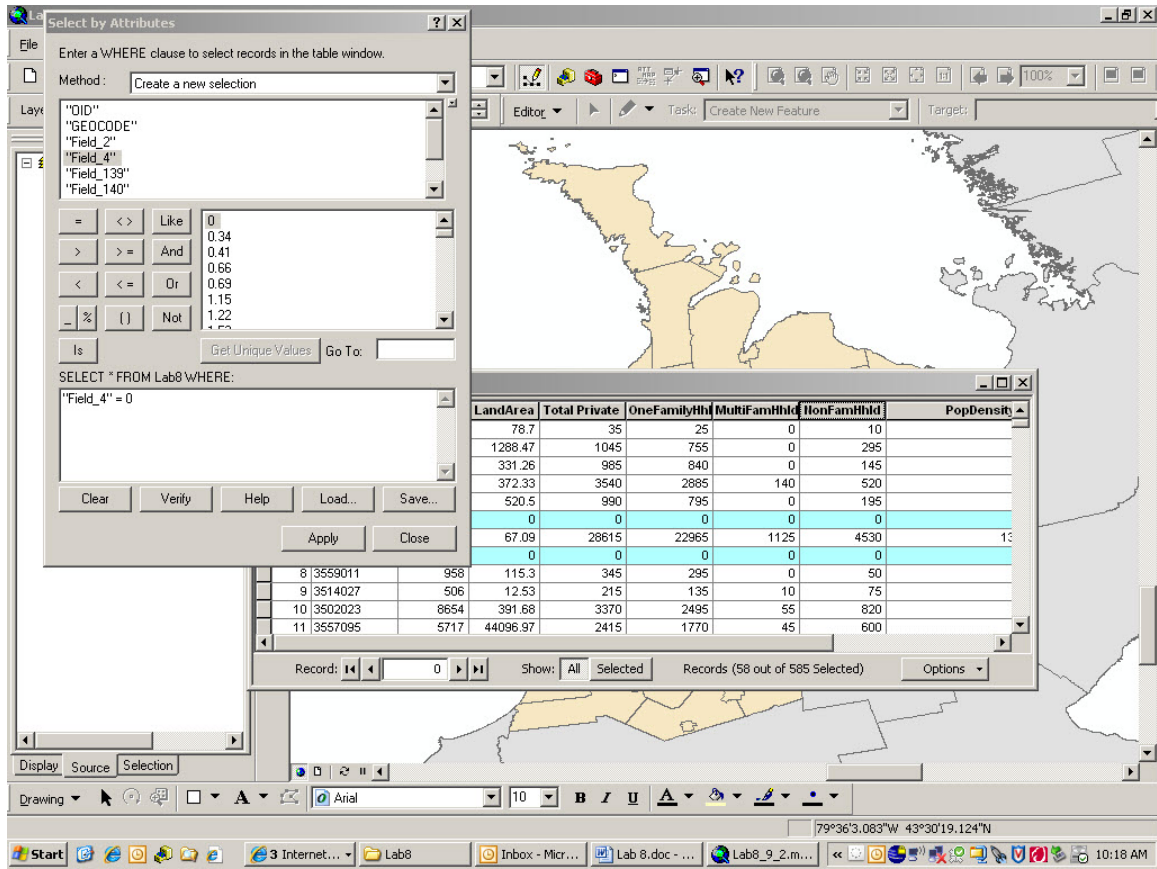
BEFORE YOU ACTUALLY CALCULATE POPDENSITY YOU WILL HAVE TO SELECT ONLY THOSE CSDs THAT HAVE AN AREA >0. If you don't do this, you will get an error because the software cannot resolve a division by zero or a null value. To select follow these steps:

4. With the attribute table opened, from the Options button, go to **Select by Attribute**

5. Make the selection criteria as follows (and screen capture below)

"Field_4" = 0

(Unfortunately, even if you change the Alias prior to this selection, the new name won't show – you have to have the old dependable pen and paper to keep yourself organized.)



Q.2 How many CSDs have a land area of 0? (1 point)

6. Now click on **Options>Switch Selection (fourth option from the top)**. We want to calculate density for CSDs that don't have 0 as land area. Switching Selection allows us to do this (it's pretty well the same as doing a NOT query, but it's good to know about this method).

Q.3 How many CSDs are now selected now that you have "Switch[ed] Selection"? (1 point)

7. Right-click on the PopDensity field header you created and
8. Use the Field Calculator to divide 2006 Population by Land Area.
 - Because you selected certain records, the calculation ONLY applies to those cases.
9. Now join the tabular data (including the new population density variable) with the CSD file.
10. Make a Choropleth graduated colour map of population density by CSD for the whole province.
11. **Save the map file and export to pdf format (Adobe). Send the pdf file to your TA and I (email addresses are at the top of this document). Include all appropriate cartographic elements and design (2 points)**

[You do not have to do the following method of Normalizing on this page, your lab continues on the next page— it is only given as an example] ArcGIS also gives you the opportunity to “Normalize” your data (create a rate or proportion) without having to create a new variable. This is done in the Symbology tab of the Layer Properties window. The problem with this method is that the legend may be difficult to interpret and you may have to re-label the legend. By clicking on the area highlighted by the red rectangle below, you can change the label as needed’. The advantage is that you do not run into problems with divisions by zero or null values.

Layer Properties

Labels XCallout Joins & Relates

General Source Selection Display Symbology Fields Visibility Fields Definition Query

Show:

Features
Categories
Quantities
 Graduated colors
 Graduated symbols
 Proportional symbols
 Dot density
Charts
Multiple Attributes

Draw quantities using color to show values. Import...

Fields: Value: Pop2006 Normalization: LandArea Classification: Equal Interval Classes: 5 Classify...

Color Ramp:

Symbol	Range	Label
	0.017573840 - 794.479450	0.01757 - 794.5
	794.479451 - 1588.94133	794.6 - 1588
	1588.94134 - 2383.40320	1590 - 2383
	2383.40321 - 3177.86508	2384 - 3178
	3177.86509 - 3972.32695	3179 - 3972

Show class ranges using feature values Advanced

OK Cancel Apply

Part 3 Mapping raw count data (this part you have to do!) (10 points)

You may want to map raw count data and there are in fact a number of techniques available at your disposal including Graduated Symbols, Proportional Symbols, and Dot Density maps to name a few.

Graduated Symbol

One mapping technique often used with raw counts such as population is Graduated symbols. This avoids the problem discussed in the Wikipedia example above where the physical size of the area mapped “giving undue prominence to larger polygons”

1. To create a Graduated symbol map, make sure your tabular and spatial files are added to your map and properly joined.
2. Simply double click (or right click > Properties>Symbology) on your Ontario CSD layer
3. Quantities >Graduated symbols
4. Select population 2006 for Value, and classify the data as you wish (natural breaks, quantiles, with as many or few classes as you like)
5. Zoom in to an area of your own choice, preferably but not necessarily an Economic Region. Don't worry about the fact that CSDs from other ERs also have proportional symbols.
6. **Save your map, export to pdf and send the pdf to your TA and I. Use appropriate cartographic elements and design principles. (3 points)**

Proportional Symbols

You can also map interval-ratio data, including raw counts, using Proportional Symbols.

Do a help search for “About symbolizing data to represent quantity” and answer the following:

Q.4 How is a graduated symbol map different than a proportional symbol map? (1 point)

Q.5 What would be the greatest challenge in mapping raw population counts for CSDs in Ontario? (1 point)

Dot Density

Another popular way to map raw count data is through dot density maps. To do this:

1. Select Quantities again, but this time >Dot Density

ArcMap allows you to map several raw counts at the same time (e.g. if you had a count or estimate of prey and predator, you could map them together), but this should be done with extreme caution. You must be able to distinguish the dots that represent your populations or events. We will only map one variable for the sake of simplicity and clarity.

2. Select Population 2006 from the Fields Selection list (double click or click once to highlight and use the “>” button to add it to the list.
3. You may have to change the colour of your symbol. To do this

- a) Double-click on the symbol (it's sometimes hard to see if the dot is very small) this will bring up the usual Symbols Selector window.
 - b) Pick a colour that is easy to see (dark or black if you have a light background)
4. You control the size of each dot and how many people (in this case) each dot represents using the **Density** options. You will need to play around with combinations to give the best results. The help file explains this well: " In general, you should choose values that ensure the dots are not so close as to form solid areas that obscure the patterns or so far apart as to make the variations in density hard to see."

Tip. You can always preview how a map will look by clicking Apply in the Properties window when you've made a change. I strongly suggest you use the Apply button when experimenting with changing dot size or dot value, otherwise your last change may not activated (sort of a glitch in ArcMap).

Q.6 What happens if you click on the "Mean" box in the Densities section of this window? (1 point)

Q.7 What is the purpose of the "Maintain Density" check-box? Hint -use help file and try zooming- in after you've created a dot-density make. (1 points)

5. Zoom in to an area of your own choice, again, preferably, but not necessarily an Economic Region. Don't worry about the fact that CSDs from other ERs also have dot density values (we will learn to hide these in another lab)
6. **Save your map, export to pdf and send the pdf to your TA and I. Use appropriate cartographic elements and design principles. (3 points)**