

Accessing and Linking Spatial and Non-Spatial Data (15 points)

Purpose:

The purpose of this lab is to learn to access non-spatial (tabular) data and join it to spatial data in order to create a thematic map.

You will learn to create a choropleth (area map) map in ArcView.

Part 1 Download the 2006 Census tabular attribute data from E-Stat

E-Stat is an educational product prepared by Statistics Canada (StatCan) that provides students with extensive population and agricultural census data. E-Stat is accessible through the Library as a web link

You can use Firefox to download the data; however, these instructions are for Internet Explorer.

1. Go to Laurentian library **Data, Statistics, GIS**
2. Under **Data and Statistics** (not GIS this time), click **Data**
3. Scroll down and click on **E-Stat**
4. You have to click on **Accept and Enter** at the end of the license agreement
5. At the "Welcome to E-Stat" page you can enter the **Table of Content - Data Tables** page and see the wide variety of data that are available here.
6. Scroll to the People section then click on **Population and demography** (2nd column)
7. At the "E-Stat" Themes page, scroll down to **Census databases**
8. Click on the **Population and demography** title next to the folder icon (not the icon, it doesn't link)
9. This takes you to a search results page with 67 matches, you want to scroll down (usually the third major group) to

2006 Census of Population (Provinces, Census Divisions, Municipalities)

10. Here, you want to select the fourth bullet

- **2006 Cumulative Profile**

This takes you to a "Selection page".

11. At the “Selection page,” follow the three steps to select and download the data with the following criteria:

Step 1. Select a geographic region

by clicking in the selection box or on the down arrow

2006 Cumulative Profile

Step 1: Select a geographic region:

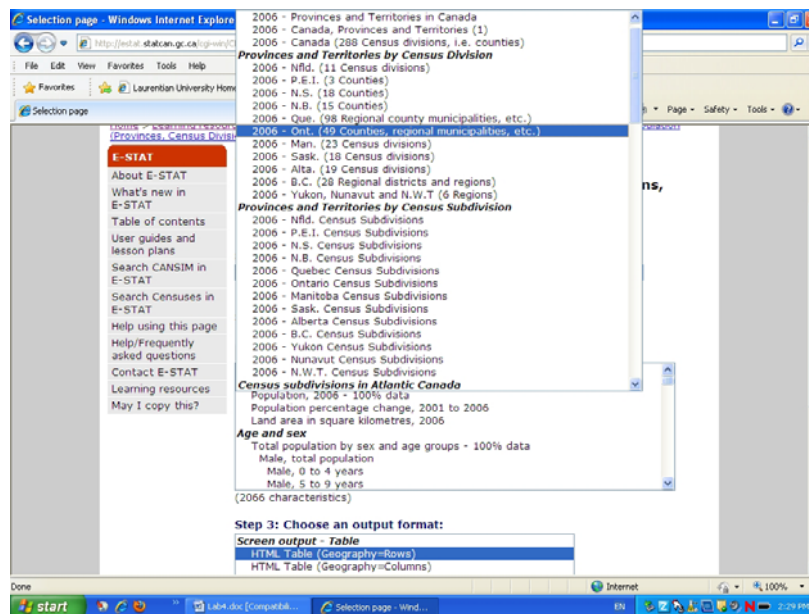
2006 - Provinces and Territories in Canada

Areas sorted by Geographic Code Areas sorted by Name

Select **Provinces and Territories by Census Division**

2006 – Ont. (49 counties....)

Pay attention that you did not select **Provinces and Territories by Census Subdivision** because this would give you 585 cases – You will be doing this for your term project however, so remember these steps and this page.



Step 2 Select one or more characteristics

Notice that there are two ways to select data:

1. You can click the checklist button and select variables simply by checking the box next to the variable of choice, or
2. You can select variables from the window on the Selection page. We're only selecting the first four variables for this lab, but with 2,000+ variables you can imagine that the checklist may work better to keep track of your selection.

Select

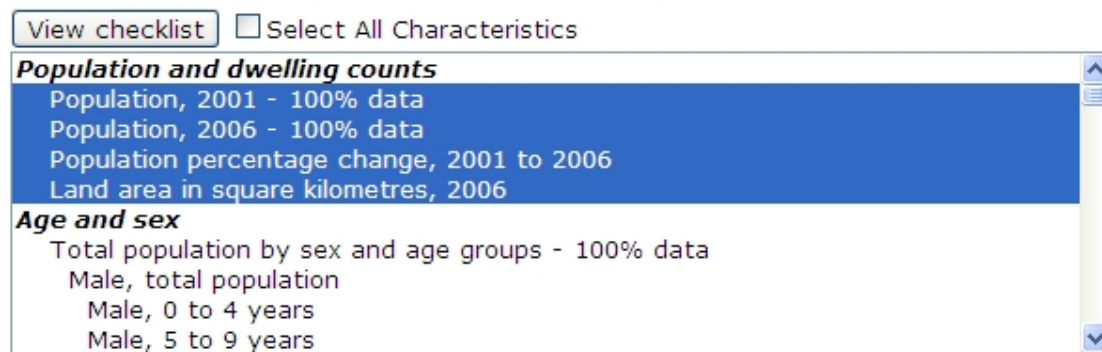
- ✓ Population 2001,
- ✓ Population 2006,
- ✓ Population change and
- ✓ Land Area

Choose them in this order and make note of the names.

If you use the selection window instead of the checklist, to select more than one variable, hold down the **Ctrl** key and make your selection. If your variables are sequential, you can click the first variable, hold the **Shift** key and click on the last variable of choice, this will select a range of variables. Be careful. If after making a multiple selection with the Ctrl or Shift keys, you click on a single variable (without holding Ctrl or Shift), you will cancel your previous selection.

Step 2: Select one or more characteristics:

(See "[Help with this page](#)" for tips on selecting multiple characteristics)



(2066 characteristics)

After you've downloaded the data in the next step, you should come back to this list to scan some of the data that is available here.

Step 3 Choose an output format

Go to the **Download to a file** section

Select **dBase (dbf) file**

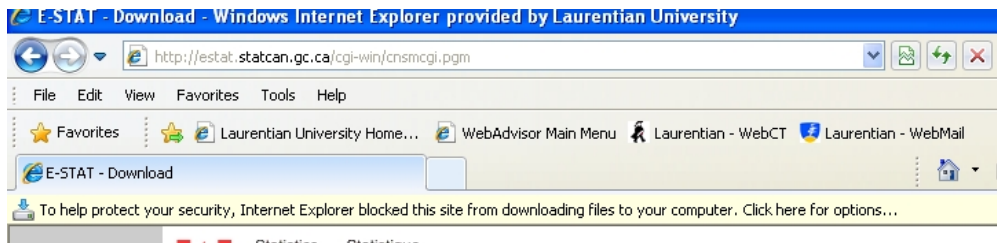
Other formats (cvs, tab delimited, WK1[geography as rows]) will work well, but you will have to manage these with Excel in order to "Add" them to ArcView. If you're comfortable with importing with Excel, go ahead, but dbf files are very easy to incorporate into ArcGIS.

Click on the "Retrieve Now" button to bring you to a Download page

IMPORTANT

Don't worry that the file does not download immediately. You should not have to click on the [click here to fetch the results](#) of your retrieval (2.9KB)

At the Download page, you will likely see a warning message near the top of your web browser (see below). You will need to click on the message to download the file..



At the download file window, you will be asked to save the OM...dbf file. Save it to a meaningful place on your flashdrive. Be careful about how you name this file. DBF files work best (especially in ArcGIC) if you stick to 8character limit before the dbf extension, e.g. OnCDdata.dbf

Q1. Name 5 other variables (characteristics) available in the list of 2006 Provinces and Census Divisions Cumulative Profiles (not including the first four we selected). (5 points)

Part 2. Joining tabular data to spatial data

Start ArcMap and to create a Census division map of Ontario. You will need at least the Ontario provincial and the Ontario (only) Census Division shapefiles.

You should have saved your Ontario CD map in the last lab, but if you did not, simply add the necessary data (Ontario, Ontario CD, and if you want Canadian Provinces).

Add Tabular Data

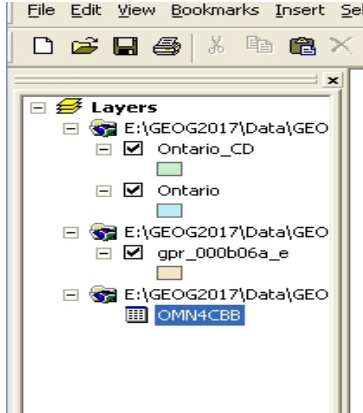
Make sure you are in Data View to start this work.

Once you've added the Ontario Census Division layer you need to add the tabular data.

1. Click on the **Add Data** Button
2. Navigate to where you saved your dbf file.
3. Click on it to add it to your map document

Naturally, the data will not appear on the Data View because they (data is plural) are not spatial.

4. Click on the **Source Tab** in the Table of Contents (ToC) if it did not come up automatically when you added the tabular data (it should have). You should now see your added data table in the ToC.



Manage the tabular data.

1. Right click on the table name of the file you added.
2. Click on Open

Notice that most columns do not have useful names. We'll change that shortly. First we need to create a useful key variable on which we can join the spatial data to the tabular data. Recall that the Census Division Unique identifier CDUID in the CD shapefile meets the SGC coding structure of 2 digits province + 2 digits CD. You can right click on the shapefile and check this by Open Attribute Table.

However the GEOCODE identifier in E-STAT is 7 characters long (it has trailing zeros). We need to get rid of these so that we can join the tabular to the spatial file (if unique ids don't match exactly between files, then they won't join)

3. With the tabular file opened, click on the "Options" button on the bottom right.
4. Scroll up to and click Add Field
5. In the Add Field Window, fill in the following:

Name: **ShortGeo**

The name of the joining variables do not need to be the same. It's good practice to name them the same; we could have called it CDUID, but I want to show you that this is not strictly necessary.

Type: **Text**

THIS IS VERY IMPORTANT. YOU CANNOT JOIN A NUMERIC VARIABLE TO A TEXT VARIABLE (OR VICE VERSA). If both are numeric or both are text the join will work

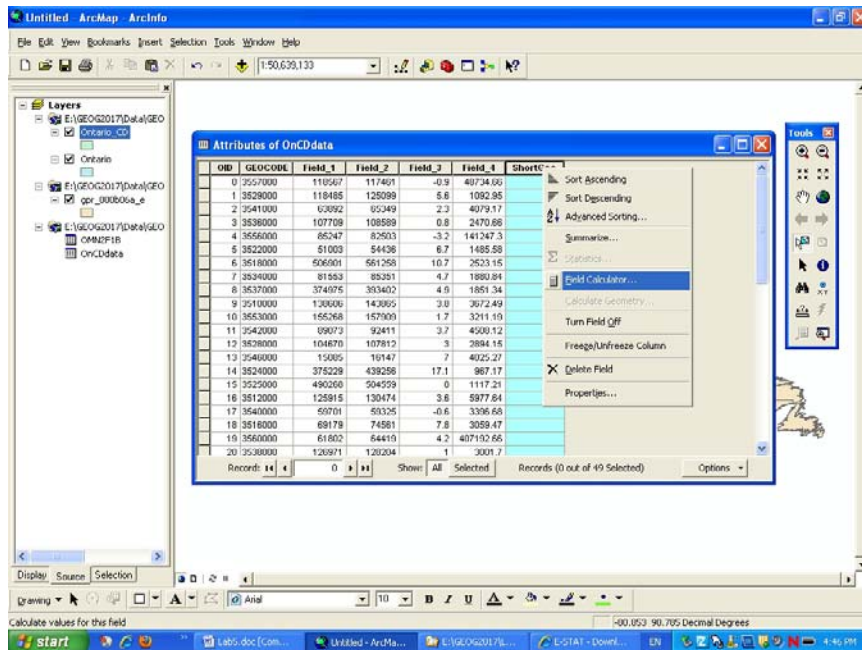
Length **4**

This too doesn't matter very much but, it's good practice to make joining variables the same length.

- A new blank field called ShortGeo will appear at the end of the table

6. Right click on the title of the field, or column header.

7. Select Field Calculator



8. Click **Yes** on the Field Calculator warning – we want this calculation to be permanent.

9. In the field calculator window (see below) fill in the following to populate the new variable ShortGeo:

Skip **Fields** (the first box on the upper left), we'll come back to it in a second

Type: Click on the radial button (computer tech talk for the circle) next to **String**

Functions: Scroll down till you find **Left()** and double click on it. It should appear in the **ShortGeo=** window below

Go back to **Fields** and double click on **GEOCODE**

- Now the **ShortGeo= Left ([GEOCODE])**

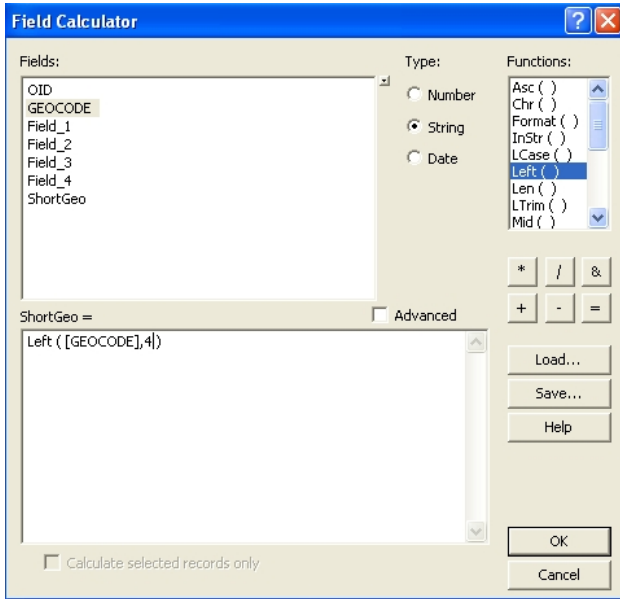
Finally, add a comma after **[GEOCODE]**, but before the parenthesis.

- Now it looks like **Left ([GEOCODE],)**

Add a 4 between the comma and the round parenthesis.

- Now ShortGeo= Left ([GEOCODE],4)

This means you've asked the software to return the 4 left characters of the existing GEOCODE variable to make a ShortGeo (to match the spatial file CDUID)



10. Click OK

You should have the following

OID	GEOCODE	Field_1	Field_2	Field_3	Field_4	ShortGeo
0	3557000	118567	117461	-0.9	48734.66	3557
1	3529000	118485	125099	5.6	1092.95	3529
2	3541000	63892	65349	2.3	4079.17	3541
3	3536000	107709	108589	0.8	2470.66	3536
4	3556000	85247	82503	-3.2	141247.3	3556
5	3522000	51003	54436	6.7	1485.58	3522
6	3518000	506901	561258	10.7	2523.15	3518
7	3534000	81553	85351	4.7	1880.84	3534
8	3537000	374975	393402	4.9	1851.34	3537
9	3510000	138606	143865	3.8	3672.49	3510
10	3553000	155268	157909	1.7	3211.19	3553
11	3542000	89073	92411	3.7	4508.12	3542
12	3528000	104670	107812	3	2894.15	3528
13	3546000	15085	16147	7	4025.27	3546
14	3524000	375229	439256	17.1	967.17	3524
15	3525000	490268	504559	0	1117.21	3525
16	3512000	125915	130474	3.6	5977.64	3512
17	3540000	59701	59325	-0.6	3396.68	3540
18	3516000	69179	74561	7.8	3059.47	3516
19	3560000	61802	64419	4.2	407192.66	3560
20	3538000	126971	128204	1	3001.7	3538

- Notice the ShortGeo now follows the PR+CD StatCan naming convention
- You will also notice that some columns have Field_1, Field_2, etc. as headers. These are the variables or “Characteristics” we imported from E-Stat. Unfortunately, exporting to dbf causes this automatic cryptic naming of variables. You will learn to change the field names in another lab.

Joining the Spatial and Tabular data tables

You can do the following step from the **Source or Display** tabs in the ToC

1. Right click on the Ontario CD layer name
2. Scroll down to and click Joins and Relates > Join
3. In the Join Data window
4. Select “Join Attributes from a Table” (not other option of spatial join in this case)
5. Follow the steps

Step 1 Select CDIUD from drop-down

Step 2 Select the tabular/non-spatial file you want to join to. This should be **OnCDdata**. **It should show up automatically; if it doesn't, you simply need to select it from the drop-down list. There should be no need to navigate using the folder icon**

Step 3 Select **ShortGeo** or whatever you named your CD unique Id in the tabular file (the names don't have to be the same, just the field types, i.e., text or numeric. If the field you intended to join to does not appear in the drop down list, it's because the field types are not the same. Make sure you don't select GEOCODE here; that's got trailing zeros and will not work.

If you get a Create Index window, click yes.

Now check if the data joined successfully by opening the OntarioCD shapefile attribute table (right-click>Open Attribute Table).

If you see “null” in all the joined fields you may have accidentally tried to join CDUID to the GEOCODE field instead of the **ShortGeo** field.

If you joined the files successfully, you should see new column headings some OntarioCD.xxx and others OnCD.xxxx. Notice the dot between the file name and the variable name. This is to let you know from which table each variable comes, e.g. Ontario.CDUID tells you that CDUID comes from the OntarioCD shapefiles, while OnCD.ShortGeo tells you that ShortGeo comes from the OnCD table

There's a quirk in ArcGIS whereby sometimes blank fields will appear in the joined file even if your join was correctly done. IF this happens, you can rectify by simply Exporting the joined shapefile (You should NOT have to do this in this exercise) and adding it to your map. (Right-click on layer > Data> Export Data...[do this ONLY if the Join failed and you're sure you followed all the steps above])

Creating a Choropleth Map

1. Right click on the OntarioCD shapefile (the one with the joined tabular data)
2. Scroll down to Properties

Tip: You can also bring up the Properties window by double-clicking on the layer name.

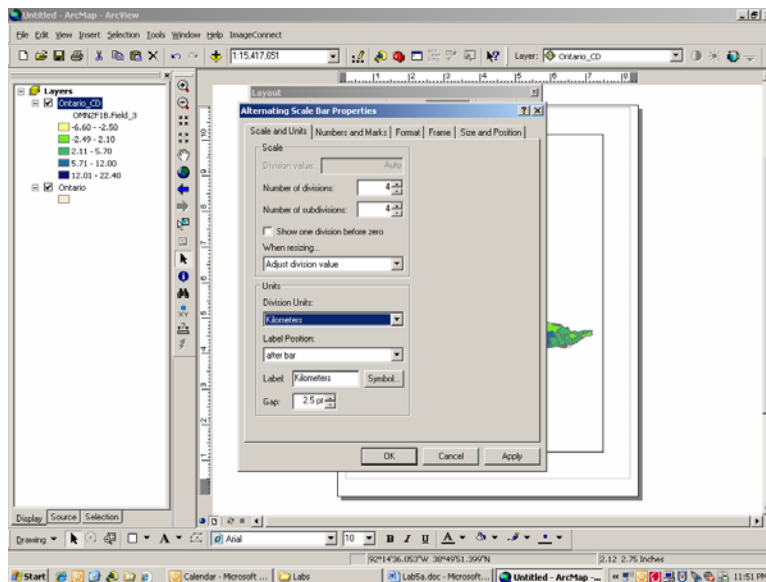
3. In Properties window, click on the Symbology tab
4. On the left hand side under the Show: box select **Quantities>Graduated Colors**
5. In the Field Value: box select Field_3 (this is percent growth)
Typically you should suddenly see 5 class breaks
6. In the Classification box (on the right) you should see Natural Breaks (Jenks) with 5 classes. You can change these if you like but for this lab, the defaults will do.
7. You can change the Colour ramp: as you like.


Create the final Layout

Add necessary cartographic elements

When you add a scale bar, the units will likely be Decimal Degrees. You can change this when you first add the scale bar, but you can also set the scale to Kilometre after it's inserted.

1. Right-click on the scale bar itself
2. Select Properties
3. Go to Units box towards the bottom
4. In Division Units, select Kilometers (note the American spelling).
5. You can change the name of the measure to Kilometres, km, whatever you like by typing what you want next to Label:.



6. When you add the Legend, make sure you remove Ontario in the Legend Items list on the right. You only want the OntarioCD layer in the Legend Items.
7. As you progress in the labs, I expect improved cartographic design.
 - Make sure the subject of your map takes up a significant portion of your layout using the zoom tools.
 - Also, the shape of the province may not lend itself to a portrait or landscape page layout. Remember from the Lab 2 tutorial that while in Layout View, you can manipulate the size and location of your data frame (the mapped area from the data view) with the Select Elements arrow  to give more balance to your map layout.

SAVE your map document (mxd file) on your FLASH DRIVE – this is very important for future labs and your term project.

Q2. Fill in the following table (5 points)

Census Division	2006 Population	Land Area (Square Km)	Population Density (per sq km)	Population Change
Greater Sudbury				
Parry Sound				
Simcoe				
York				
Toronto				

Final map (5 points)

1. Make sure only your new Ontario Census Division layer is in the legend.
2. Send Holly (TA) and I a pfd (Adobe) version of your **layout**.
GEOG2017E_Lab5_Fname_Lname.pdf