



Mapping Census Data in QGIS

Instructional Documentation

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This instructional document will teach you how to download and work with Canadian Census data in QGIS. Census data is freely available for various census geographies across Canada- learning to work with these data is a valuable skill that can be applied across a variety of disciplines. This document will teach you **the basics of downloading geographic data and census data, working with data in GIS, and displaying geographic information in a final map.**

Objectives

- Learn to download census data from the Canadian Census Analyzer (CHASS).
- Learn to install plugins in QGIS.
- Download census geographic boundary data for Canada and extract Vancouver dissemination areas in QGIS.
- Use QGIS to map the percentage of population with postsecondary education in Vancouver by dissemination area.
- Create a final map with standard cartographic elements.

Workshop Overview

1. **Downloading census data from CHASS**
2. **Downloading census geographies from Statistics Canada**
3. **Preparing geographic data in QGIS**
4. **Base maps in QGIS using QuickMapServices**
5. **Join data by Geography**
6. **Part 5: Calculate percentage of population with postsecondary education**
7. **Change Map Symbology**
8. **Create Map Layout and Publishing a Final Map**

Part 1: Downloading Census data from CHASS

1. Visit the SFU Library website at www.lib.sfu.ca, from the **Top Links** on the top left corner of the homepage, click on **Article Databases**, and search for “Canadian Census Analyzer” in the search box. Or click on this direct link [Canadian Census Analyser](#) (link to CHASS SFU ID log-in)
 - a. CHASS is a platform developed by the University of Toronto that provides access to Canadian Census. To use CHASS, we first must login using our **SFU ID and password**.
 - b. After logging in, you will be redirected to the home page for CHASS.
 - c. Notice that we can select to download census data by either the geographic region or census year. Under **Census Geography**, we can specify the geographic scale at which we want to download the data, ranging from provinces and territories down to census tracts and dissemination areas (DA). Conversely, we can download our data based on the Census Year, ranging from 1961 to 2016. The census profile table you decide to download your data from will vary depending on your specific objectives.
 - d. For this demonstration, we will choose the Census year **2016**.

The screenshot shows the CHASS homepage with two columns of navigation links. The English column lists '1. Census Profiles Tables' with sub-links for 'by Census Geography' (Canada, Provinces and Territories, Federal Electoral District, Forward Sortation Areas (FSA), Census Division, Census Subdivision, Census Tract, Enumeration area / Dissemination area) and 'by Census Year' (2016, 2011 NHS, 2011, 2006, 2001, 1996, 1991, 1986, 1981, 1971, 1961). The French column lists '1. Tableaux de recensements (Profils)' with sub-links for 'par la géographie du recensement' (Canada, les provinces et les territoires, Circonscriptions électorales fédérales, Régions de tri d'acheminement (RTA), Divisions de recensement, Subdivisions de recensement, Secteurs de recensement, Secteurs de dénombrement / Aires de diffusion) and 'par année du recensement' (2016, 2011 ENM, 2011, 2006, 2001, 1996, 1991, 1986, 1981, 1971, 1961).

- e. Next, select **Profile of Dissemination Areas**.

Statistics Canada defines a dissemination area as a **small area consisting of one or more blocks and is the smallest geographic data for which census data is provided**. Canadian census data is freely available to download to the public but is aggregated to these different geographies to maintain anonymity of people living in the regions.

2. **Step 1** for downloading Census Data from CHASS is to specify the geographic region that you want to download census data for. We can select multiple geographies **by Name** or **by Province**. For this demonstration, we will download DA data for Greater Vancouver (B.C.).
 - a. Under the “**by Name**” tab, check “**G**” and find **Greater Vancouver (B.C.)**.

NOTE: You can download census data for multiple geographies by simply searching for and selecting other regions.

The screenshot shows the CHASS search interface. At the top, it says 'Step 1: Specify Census Geography for retrieval' and 'Census Geography: (1 selected)'. Below this, there is a search instruction: 'Locate census geography (Census Divisions) in the database using the following filtering criteria then select the items you would like to include in your search.' There are two tabs: 'by Name' and 'by Province'. Under 'by Name', there is a list of letters A through Y with checkboxes. The 'G' checkbox is checked. Below this, there is a list of 6 items found: Gatineau (Que.), Gloucester (N.B.), Greater Sudbury / Grand Sudbury (Ont.), Greater Vancouver (B.C.), Grey (Ont.), and Guysborough (N.S.). The 'Greater Vancouver (B.C.)' checkbox is checked. To the right, there is a 'Selected items:' box containing 'Greater Vancouver (B.C.)'.

3. **Step 2** for downloading Census Data from CHASS is selecting the data you want to download. You will notice there are multiple variable tabs such as “Age & Sex”, “Immigration”, “Education”, and “Labour”. Take a moment to explore the different variables tabs. Notice we can also split the census data by biological sex.

- Click on the **Education** tab.
- Under **Education – Total Sex** navigate to **Total- Highest certificate, diploma or degree for the population aged 15 and over in a private household- 25% sample data** and select **Postsecondary certificate, diploma, or degree**
- Next, click on the **Population** tab.
- Select **Population, 2016 (v1)**.
- We have specified that we want to download **population** and **postsecondary education** data for the **2016 census** by **DA**.

The screenshot shows the CHASS web interface with the 'Education' tab selected. Under 'Education - Total Sex', the following options are visible:

- Total - Highest certificate, diploma or degree for the population aged 15 years and over in private households - 25% sample data (v4920)
 - No certificate, diploma or degree (v4921)
 - Secondary (high) school diploma or equivalency certificate (v4922)
 - Postsecondary certificate, diploma or degree (v4923)
 - Apprenticeship or trades certificate or diploma (v4924)
 - Trades certificate or diploma other than Certificate of Apprenticeship or Certificate of Qualification (v4925)
 - Certificate of Apprenticeship or Certificate of Qualification (v4926)
 - College, CEGEP or other non-university certificate or diploma (v4927)
 - University certificate or diploma below bachelor level (v4928)
 - University certificate, diploma or degree at bachelor level or above (v4929)

4. Next scroll down and find the **Select the output format** window. This is where we specify how we want to download the census data. CHASS allows us to output the data to the screen or download to a file.

- Under **Download to a file** select **Comma-Separated Values (CSV) file for spreadsheet**.
- Click **Submit Query**.
- A new window will open with the heading **Data Request Summary**.
- Under **Download the files:** click on the **Data File** link.
- Save and rename the CSV file to a folder on your computer. **Do not** close the Data Request Summary window.
- Navigate to where you saved the file and open the CSV in Excel.

The screenshot shows the CHASS Data Centre Download Status page. The 'Data Request Summary' section includes the following information:

Job ran from 07/05/2022 18:41:10 to 07/05/2022 18:41:10
Job completed successfully!

3451 lines/observations retrieved.

Download the files:
Data file: http://datacentre.chass.utoronto.ca/grid3/2016/census/koJwrGvdace5R_data.csv
Header file: http://datacentre.chass.utoronto.ca/grid3/2016/census/koJwrGvdace5R_header.txt

Download instructions: Internet Explorer, Firefox and Chrome users... Right-click and select "Save Link As..."

Query parameters:

2016 Census Profiles Files / Profile of Census Disseminations Areas

Data Request ID	koJwrGvdace5R
Geography	5915
Variables	COL0 - GEO UID COL1 - Education - Total Sex / Total - Highest certificate, diploma or degree for the population aged 15 years and over in private households - 25% sample data COL2 - Education - Total Sex / Total - Highest certificate, diploma or degree for the population aged 15 years and over in private households - 25% sample data / Postsecondary certificate, diploma or degree COL3 - Population and dwelling counts / Population, 2016
Names ranges	

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5. Notice that the Data Request Summary page has a **Query parameters** table indicating which columns in the CSV corresponds to variables we selected for download. The column names in CHASS are by default COL0, COL1, COL2, COL3, etc. We need to rename the column names from the default to something more descriptive.

- Rename the columns in Excel. In this demonstration, we used the names **GEOUID**, **EducationTot**, **PostSec_edu**, and **Pop_2016**.

- b. CHASS also includes the totals for each variable we chose for the entire geographic area- in this case Vancouver. We do not need this information for mapping. Select row 2, right click, and delete the entire row.
- c. Save the Excel file with an appropriate name.

Data Request Summary

Job ran from 07/05/2022 18:47:00 to 07/05/2022 18:47:00
Job completed successfully!

3451 lines/observations retrieved.

Download the files:
Data file: http://datacentre.chass.utoronto.ca/grid3/2016/census/bE1DhJJ9vEaa_data.csv
Header file: http://datacentre.chass.utoronto.ca/grid3/2016/census/bE1DhJJ9vEaa_header.txt

Download instructions: Internet Explorer, Firefox and Chrome users... Right-click and select "Save"

Query parameters:

2016 Census Profiles Files / Profile of Census Disseminations Areas

Data Request ID	bE1DhJJ9vEaa
Geography	5915
Variables	COL0 - GEO UID COL1 - Education - Total Sex / Total - Highest certificate, diploma or degree for th COL2 - Education - Total Sex / Total - Highest certificate, diploma or degree for th COL3 - Population and dwelling counts / Population, 2016
Names ranges	

[CHASS Data Centre | CHASS H](#)
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We have successfully downloaded Canadian Census Data from CHASS! Next, we will learn to join this non-spatial data to geographic data for DA in QGIS.

Part 2: Downloading census geographies from Statistics Canada

Now that we have our 2016 census data from CHASS, we need to download geographic data for the DA geographies.

Conveniently, Statistics Canada also provides this geographic data for free. Note that because we downloaded 2016 census data, we also need to download 2016 geographic data. Be sure to download the geographic data corresponding to the same census year as your CHASS data. Census geographies change over time, and downloading the geographic data for the wrong year will cause problems in your analysis.

Click [here](#) to open the webpage for downloading the 2016 boundary files .

1. Choose a language (English or French).
2. Choose a format for your geographic data. In this demonstration, we will use ESRI's **ArcGIS shapefile (.shp)**.
3. Under **Boundary files** notice we can choose various geographic areas and water features. Scroll and select **Dissemination areas** under **Cartographic Boundary File**.
4. Scroll down and click **Continue**. This will open a new window for downloading the zipped document.
5. Give the download an appropriate name such as **DA_Canada**.
6. Extract the zipped folder.

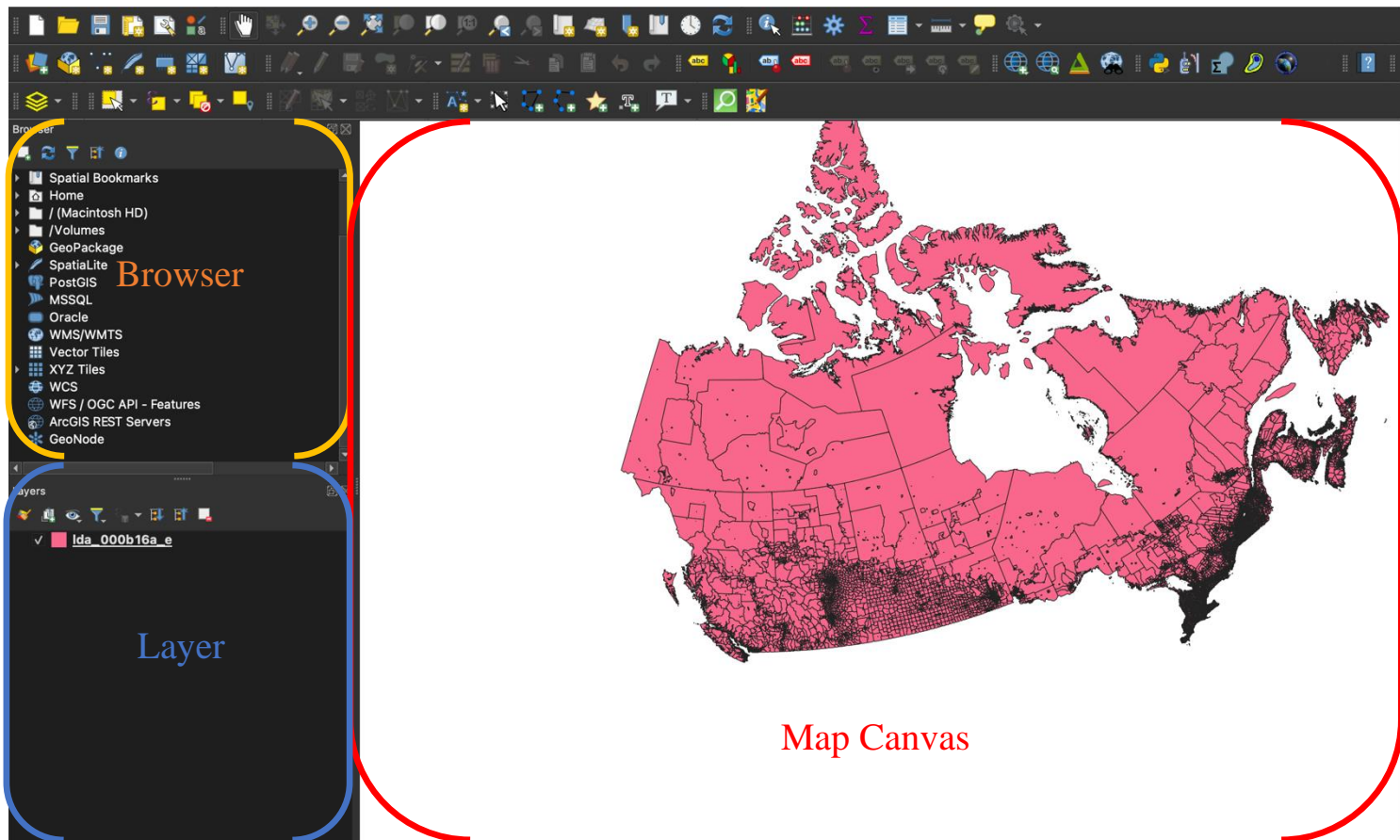
Boundary files			
Geographic area or water feature	Cartographic Boundary File	Digital Boundary File	Water File
Provinces/territories	<input type="radio"/>	<input type="radio"/>	...
Federal electoral districts (2013 Representation Order)	<input type="radio"/>	<input type="radio"/>	...
Economic regions	<input type="radio"/>	<input type="radio"/>	...
Census divisions	<input type="radio"/>	<input type="radio"/>	...
Aggregate dissemination areas	<input type="radio"/>	<input type="radio"/>	...
Census agricultural regions	<input type="radio"/>	<input type="radio"/>	...
Census consolidated subdivisions	<input type="radio"/>	<input type="radio"/>	...
Census subdivisions	<input type="radio"/>	<input type="radio"/>	...
Census metropolitan areas and census agglomerations	<input type="radio"/>	<input type="radio"/>	...
Census tracts	<input type="radio"/>	<input type="radio"/>	...
Dissemination areas	<input checked="" type="radio"/>	<input type="radio"/>	...
Dissemination blocks	<input type="radio"/>	<input type="radio"/>	...



Part 3: Preparing Geographic data in QGIS

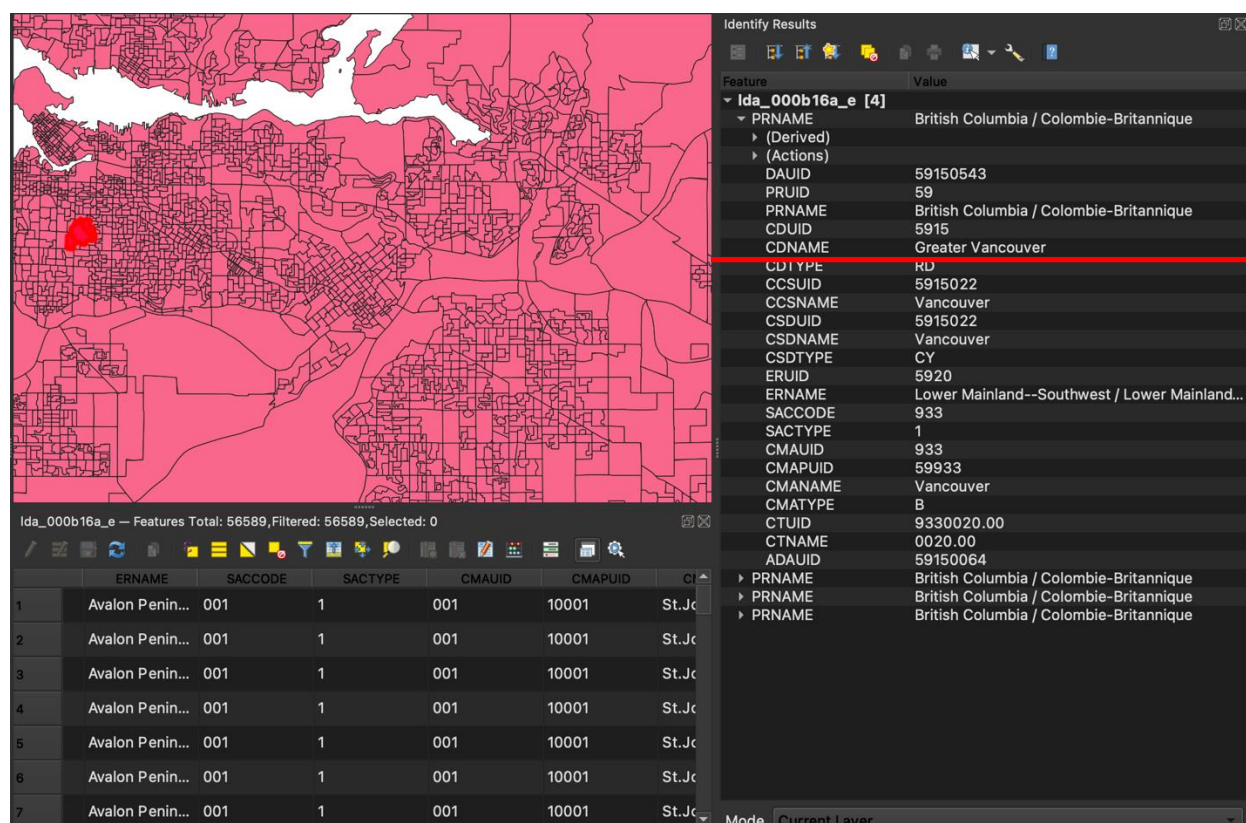
We now have all the census data we need to begin working in GIS. Next, we will learn to import our data into QGIS and extract the Greater Vancouver DA boundaries that we need for mapping.

1. Open QGIS and open a new project.
2. Navigate to the **Browser** window. This window allows you to access the files you have saved on your computer and drag them into the QGIS project.
3. Open the **DA_Canada** folder and add click and drag the **.shp** into the QGIS project. Also click and drag the CSV file containing the census data. Files can be added into QGIS by simply clicking and dragging them into the map canvas or layers area.
 - a. You have now added spatial and non-spatial data into QGIS (one shapefile and one csv file)
 - b. QGIS might ask you about the projection. Just accept what transformations it suggests.
4. Let us set our projection of this project to **NAD 83/ UTM zone 10N**.
 - a. Navigate to the Project tab → Properties → CRS and search “**NAD 83/ UTM zone 10N**.”
 - b. Select the projection from the list and click OK. Notice that the data in our map canvas
 - c. Now we have set the projection for our QGIS project. Make sure to save your project!


Notice that the DA boundary file we have downloaded contains every DA in Canada. Now we will learn to select and extract only DAs for Vancouver.



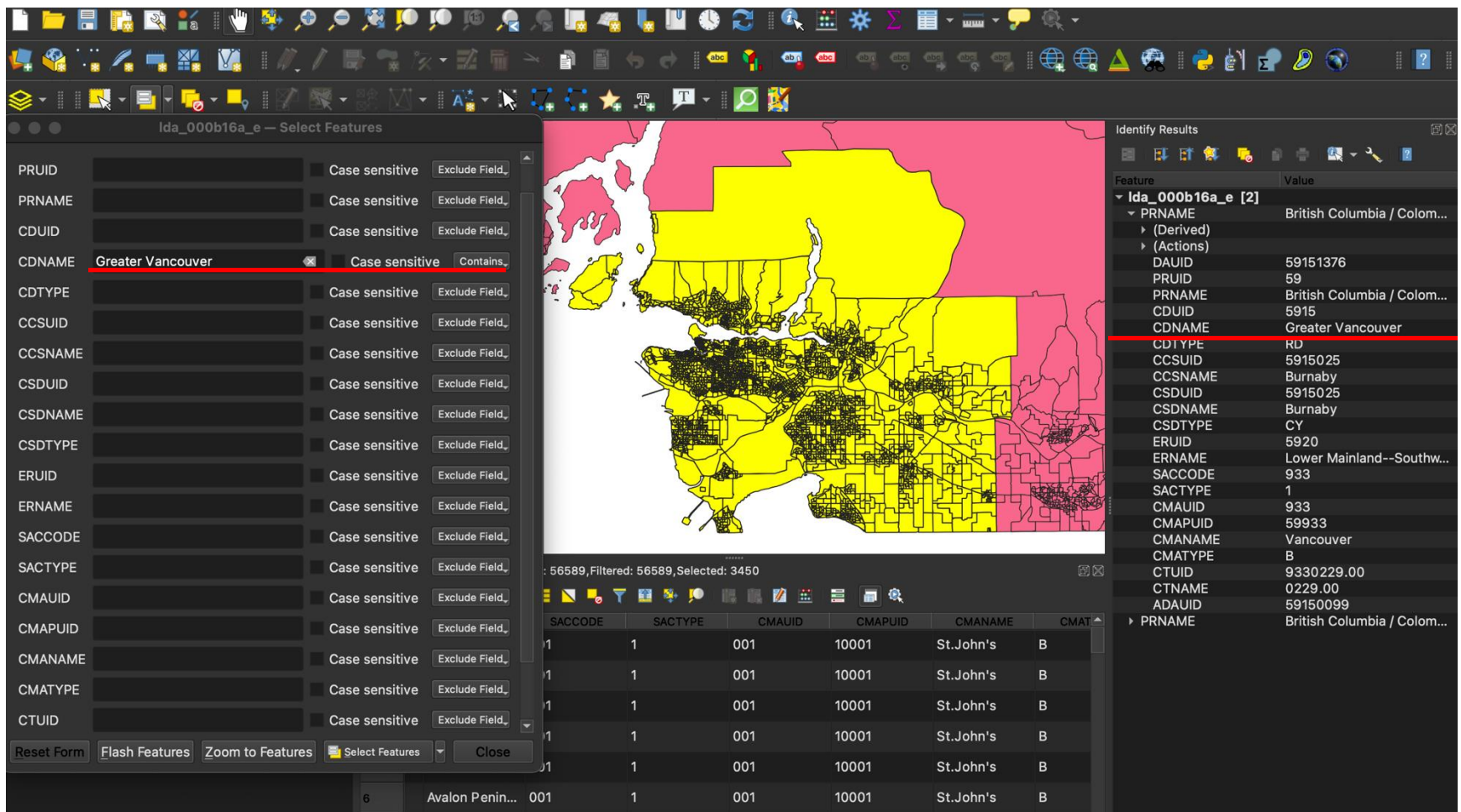
5. Right click on the Canada DA layer (in the demonstration figure above “**Ida_000b16a_e**”) and **Open Attribute Table**. Notice the different attributes contained in the data.
6. Select the Pan Map icon  and zoom your map into Vancouver.
7. Select the Identify Features icon  and click on any DA in the Vancouver area. This will open a new window that shows us the attribute information for this particular DA.
8. Remember in **Part 1. 2a** we indicated that wanted to download our census data for **Greater Vancouver (B.C)**. Notice that the attribute table of our DA shapefile has a column **CDNAME** (Census Division Name) that matches the census geography name. We will use this attribute field to select and extract only DA’s with **CDNAME** equal to **Greater Vancouver**.



We will start by selecting all DA’s in our geographic data with the **CDNAME Greater Vancouver**. There are multiple ways to do this in GIS, but for this demonstration we will use the **Select Features by Value** tool.

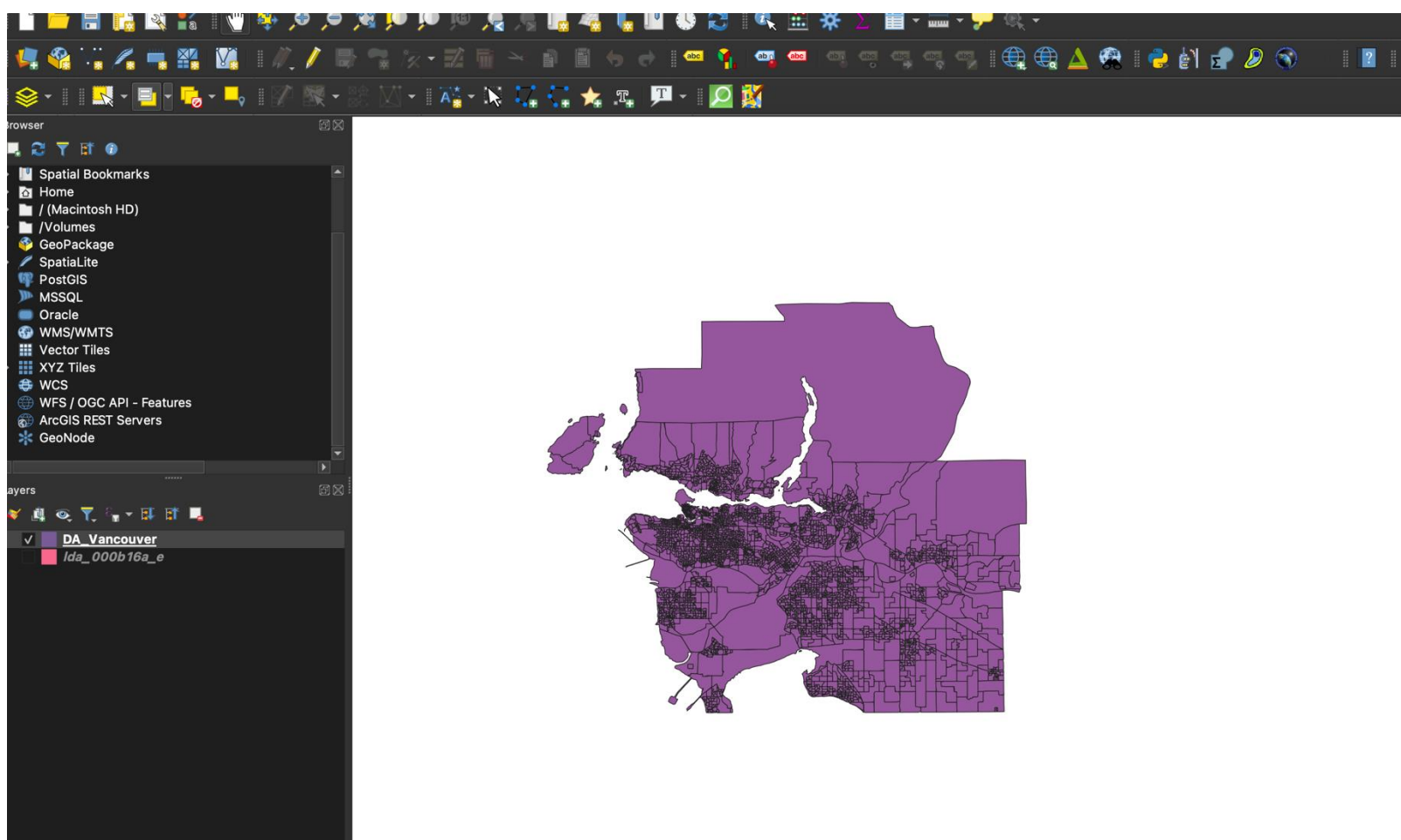
1. Select the DA boundary layer in the **Layers** windows by simply clicking on it. Next, navigate to the **Select Features by Value** icon  and click **Select Features by Value** from the dropdown.
2. A new window will open with a list of all the attributes in our DA boundary layer. Find **CDNAME** and type **Greater Vancouver**.

3. Click the **Select Features** button at the bottom right of the window. Running this tool will select all DA's with **CDNAME** equal to **Greater Vancouver**.
4. Notice that the tool has selected all DA's in Greater Vancouver and highlighted them yellow.



Now that we have selected DA's in Vancouver, we will extract this data to a new shapefile that we will use for mapping our census data.

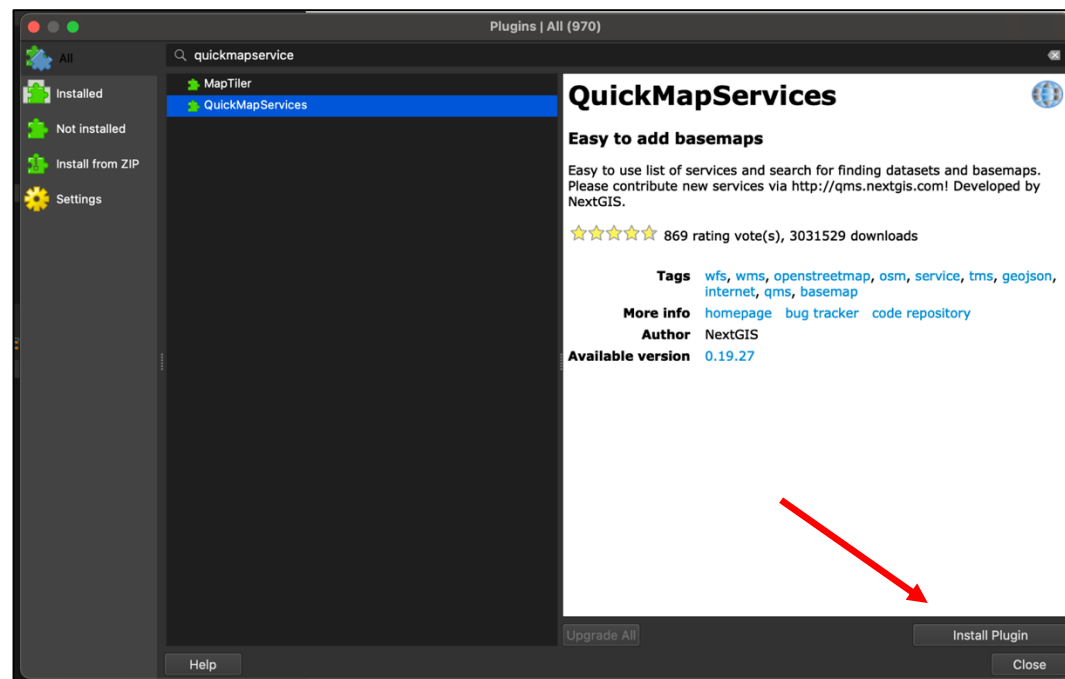
1. With the Greater Vancouver DA's selected, right click on the layer and click **Export → Save Selected Features As...**
2. Format: **ESRI Shapefile**.
3. File name: name and save the new shapefile to your computer. For the demonstration, we will name the file **DA_Vancouver**.
4. CRS: **NAD83/ UTM Zone 10N**.
5. Click OK. Now we have a new layer **DA_Vancouver** added to our project. Unselect the Canada DA boundaries file.



Part 3: Base maps in QGIS using QuickMapServices

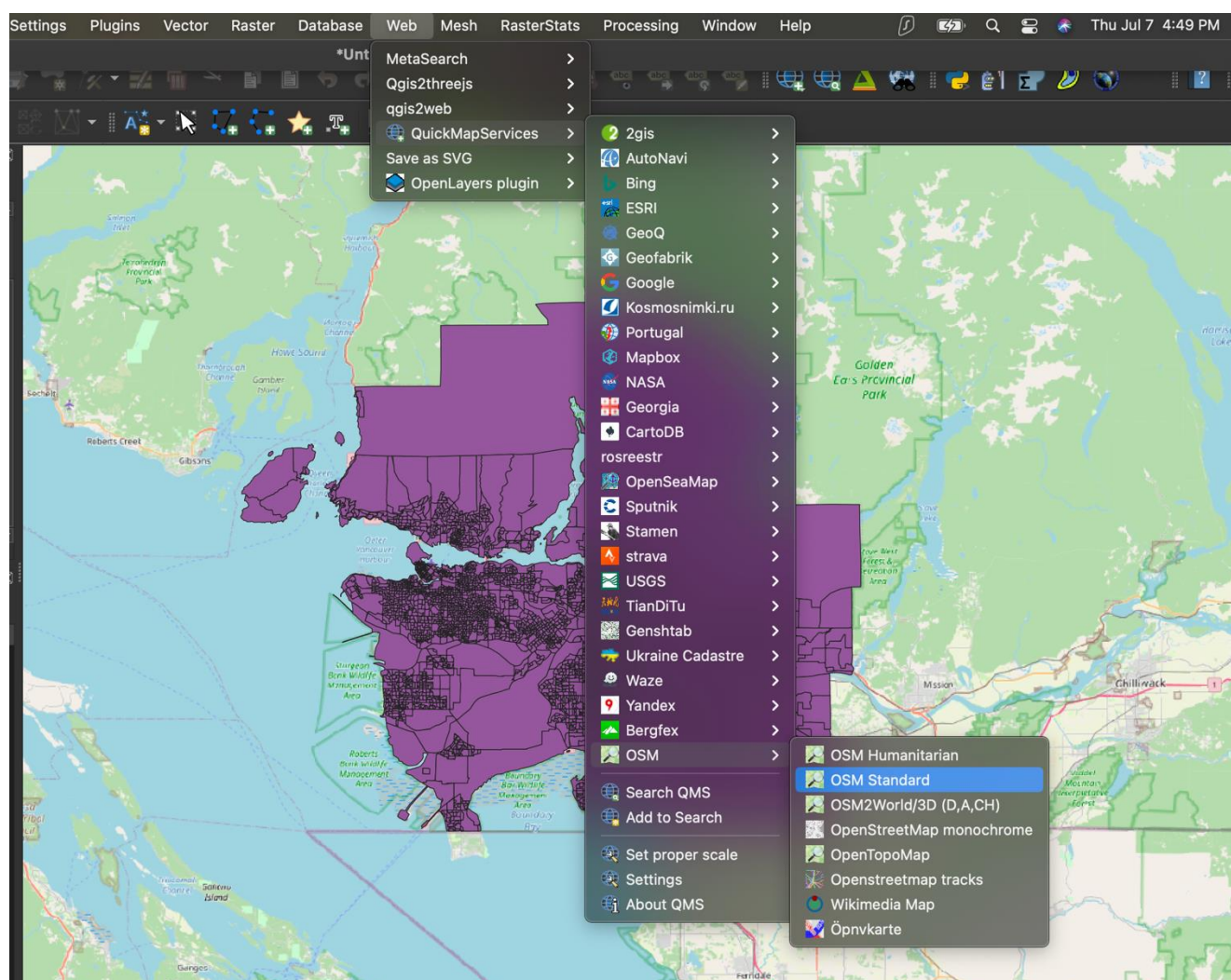
A basemap is a layer with geographic information that serves as the background and context for your map. Adding basemaps to your project helps to provide geographic reference.

1. QGIS has multiple plugins we can use to add basemaps to our project. For this demonstration we will use **QuickMapServices**.
 - a. Navigate to the Plugins tab → Manage and Install Plugins...
 - b. Search for **QuickMapServices** and click Install Plugin on the bottom right
 - c. A popup window might tell you to restart the program to access QuickMapServices. If so, save your project and restart QGIS



2. Access the plugin by going to the **Web** tab → **QuickMapServices**.
 - a. Explore the different base maps by simply clicking on the name. The map will then appear as a layer in your “Layers” window. For the demonstration, we will use the OSM (Standard) base map. OSM → OSM (Standard).

NOTE: If you do not have a full list of base maps go to **Web** → **QuickMapServices** → **Settings** → **More services** → **Get contributed pack** → **Save**

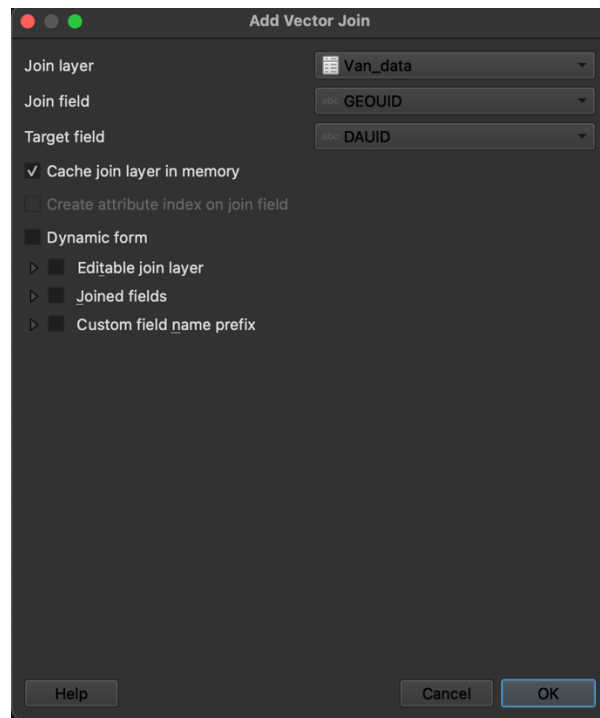


- Now we have a DA layer for Vancouver and a simple base map that will serve as a background for our final map.

Part 4: Join Data by Geography

Next, we will learn how to join our non-spatial census data to our census geography data.

- Right click the **DA_Vancouver** shapefile and select “Properties”.
 - Select the ‘Joins’ tab.
 - Click the ‘+’ at the bottom.
 - For Join layer, select the name of your census data layer (in this case Van_data)
 - Join Field → GEOUID
 - Target Field → DAUID
 - Click OK again to exit the properties window.



- Open the attribute table for **DA_Vancouver**. Notice that our DA census data has been joined to that attribute table of our DA boundaries layer. Now every individual DA polygon in our census geography layer has three additional attributes.

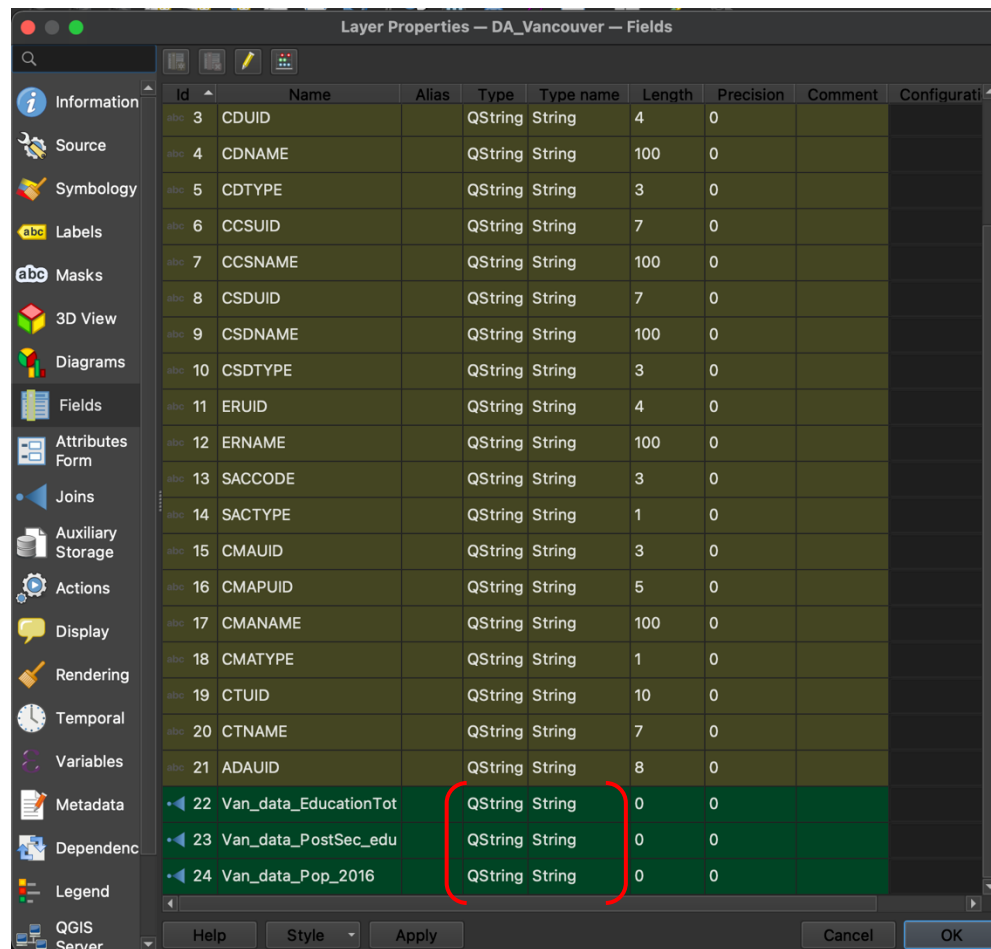
	CMAUID	CMAPUID	CMANAME	CMATYPE	CTUID	CTNAME	ADAUID	n_data_Education	n_data_PostSec_e	n_data_Pop_20
	933	59933	Vancouver	B	9330186.07	0186.07	59150215	725	270	999
	933	59933	Vancouver	B	9330410.02	0410.02	59150198	845	460	999
	933	59933	Vancouver	B	9330161.06	0161.06	59150313	870	510	998
	933	59933	Vancouver	B	9330191.04	0191.04	59150209	870	525	997
	933	59933	Vancouver	B	9330066.00	0066.00	59150035	990	795	996
	933	59933	Vancouver	B	9330260.05	0260.05	59150118	860	510	996
	933	59933	Vancouver	B	9330224.01	0224.01	59150168	785	400	995
	933	59933	Vancouver	B	9330506.01	0506.01	59150308	760	325	995
	933	59933	Vancouver	B	9330147.01	0147.01	59150161	860	535	995
0	933	59933	Vancouver	B	9330501.01	0501.01	59150289	975	470	995
1	933	59933	Vancouver	B	9330292.04	0292.04	59150179	850	570	995
2	933	59933	Vancouver	B	9330101.04	0101.04	59150333	955	615	994
3	933	59933	Vancouver	B	9330147.08	0147.08	59150153	880	485	991
4	933	59933	Vancouver	B	9330184.11	0184.11	59150257	825	340	989
5	933	59933	Vancouver	B	9330404.02	0404.02	59150173	715	440	989

Part 5: Calculate percentage of population with postsecondary education

We now have population and post-secondary education data for each DA joined to our polygon shapefile. Before displaying our data on a map, we need to standardize the data for each DA. For this demonstration, we will calculate the percentage of the population within each DA with a post-secondary education.

Before calculating percentages for Vancouver DA's, we first need to check the "field types" of our census data. Sometimes the data we are working with will be in a format that will prevent us from doing certain analysis. So, let us check the field type of PostSec_edu and Pop_2016 since these are fields we will be using to calculate our percentages.

1. Right click on the **DA_Vancouver** shapefile and select **Properties** → **Fields**
2. Scroll to find **PostSec_edu** and **Pop_2016**. Notice that QGIS has classified these fields as strings. In other words, QGIS thinks the attributes we joined to our census geographies contain text. We need to convert these to numeric fields.
3. Click **OK** to close the window.



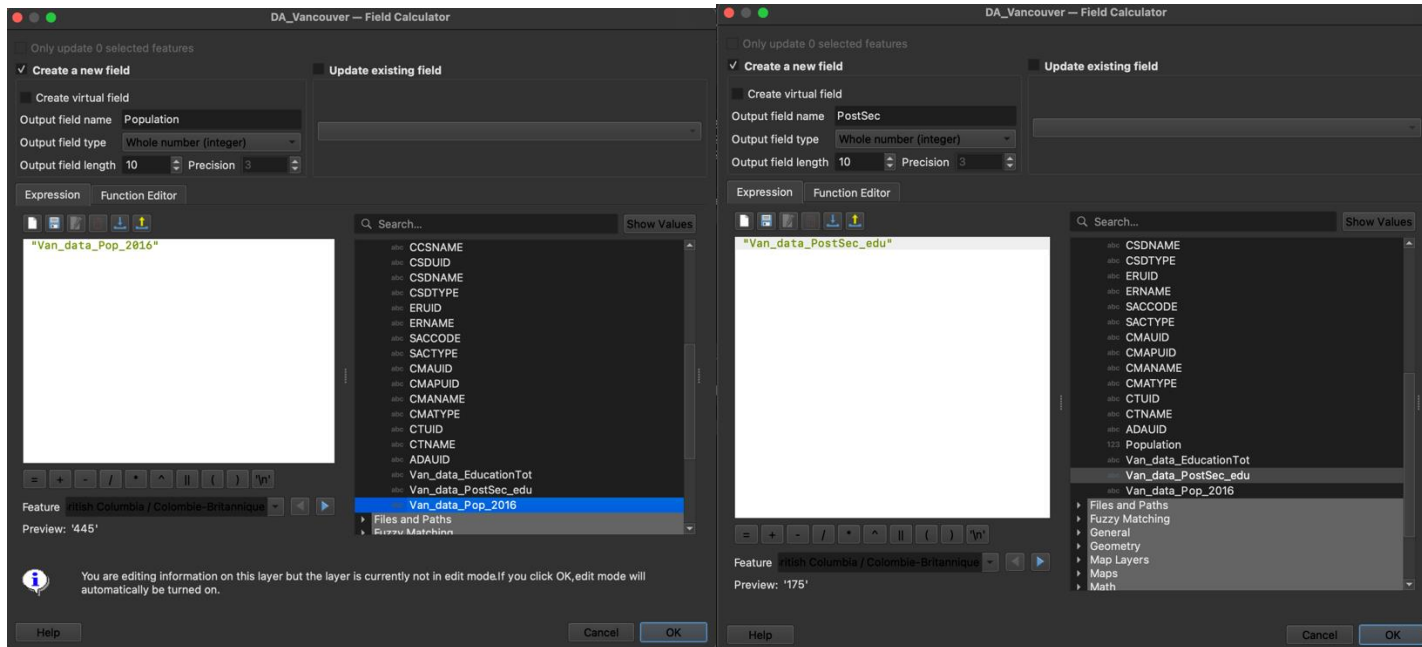
There are many ways to change the field type of an attribute in GIS. For this demonstration, we will use the **Field Calculator** to copy the contents from **PostSec_edu** and **Pop_2016** to new fields.

1. Right click **DA_Vancouver** and select **Open Attribute Table**.
2. Notice that the shapefile has both the post-secondary education (**Van_data_PostSec_edu**) counts and the total population for each DA in 2016 (**Van_Data_Pop_2016**).
3. Next, open the field calculator within the attribute table window.
 - a. The field calculator allows us to perform calculations with the existing attribute values in our **DA_Vancouver** shapefile. The output of the calculations can be written into a new column, or field.

	CMAUID	CMAUID	CMANAME	CMATYPE	CTUID	CTNAME	ADAUID	n_data_Education	n_data_PostSec_e	n_data_Pop_20
933	59933	59933	Vancouver	B	9330186.07	0186.07	59150215	725	270	999
933	59933	59933	Vancouver	B	9330410.02	0410.02	59150198	845	460	999
933	59933	59933	Vancouver	B	9330161.06	0161.06	59150313	870	510	998
933	59933	59933	Vancouver	B	9330191.04	0191.04	59150209	870	525	997
933	59933	59933	Vancouver	B	9330066.00	0066.00	59150035	990	795	996
933	59933	59933	Vancouver	B	9330260.05	0260.05	59150118	860	510	996
933	59933	59933	Vancouver	B	9330224.01	0224.01	59150168	785	400	995
933	59933	59933	Vancouver	B	9330506.01	0506.01	59150308	760	325	995
933	59933	59933	Vancouver	B	9330147.01	0147.01	59150161	860	535	995
933	59933	59933	Vancouver	B	9330501.01	0501.01	59150289	975	470	995
933	59933	59933	Vancouver	B	9330292.04	0292.04	59150179	850	570	995
933	59933	59933	Vancouver	B	9330101.04	0101.04	59150333	955	615	994
933	59933	59933	Vancouver	B	9330147.08	0147.08	59150153	880	485	991
933	59933	59933	Vancouver	B	9330184.11	0184.11	59150257	825	340	989
933	59933	59933	Vancouver	B	9330404.02	0404.02	59150173	715	440	989

4. Output Field Name: **Population**
5. Output Field Type: **Whole number (integer)**

- Navigate to the middle of window and find the drop-down for “**Fields and Values**”. Double click the field name (**Van_data_Pop_2016**) to input the name into the expression box.
- Click **OK**
- Repeat steps 3-7 to create a new field named “**PostSec**” for the contents of **PostSec_edu**.

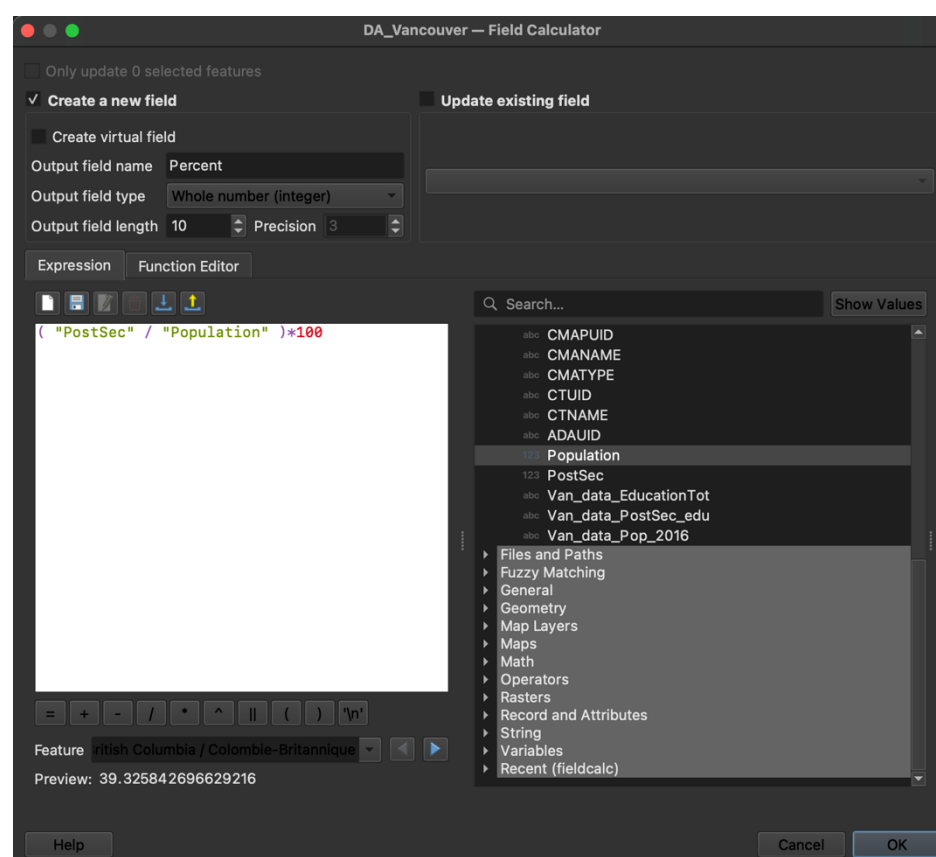


Now we have two new whole number fields in our data named **Population** and **PostSec**. We can now use these fields to calculate the percentage of population with postsecondary education in Vancouver DA's.

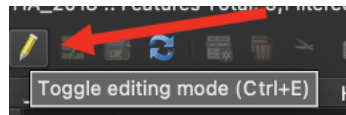
- Open the field calculator within the attribute table window.
- Name the output field “**Percent**”.
- Navigate to the middle of window and find the drop-down for “**Fields and Values**”. Double click the field names to input the names into the expression box.
- Input the following calculation in the expression box.

NOTE: your field names may be different from the names used in the expression below...

("PostSec" / "Population") *100



- Click **OK**.
- Click the pencil tab in the top left of the attribute table to save the edits you have done to the attribute table.

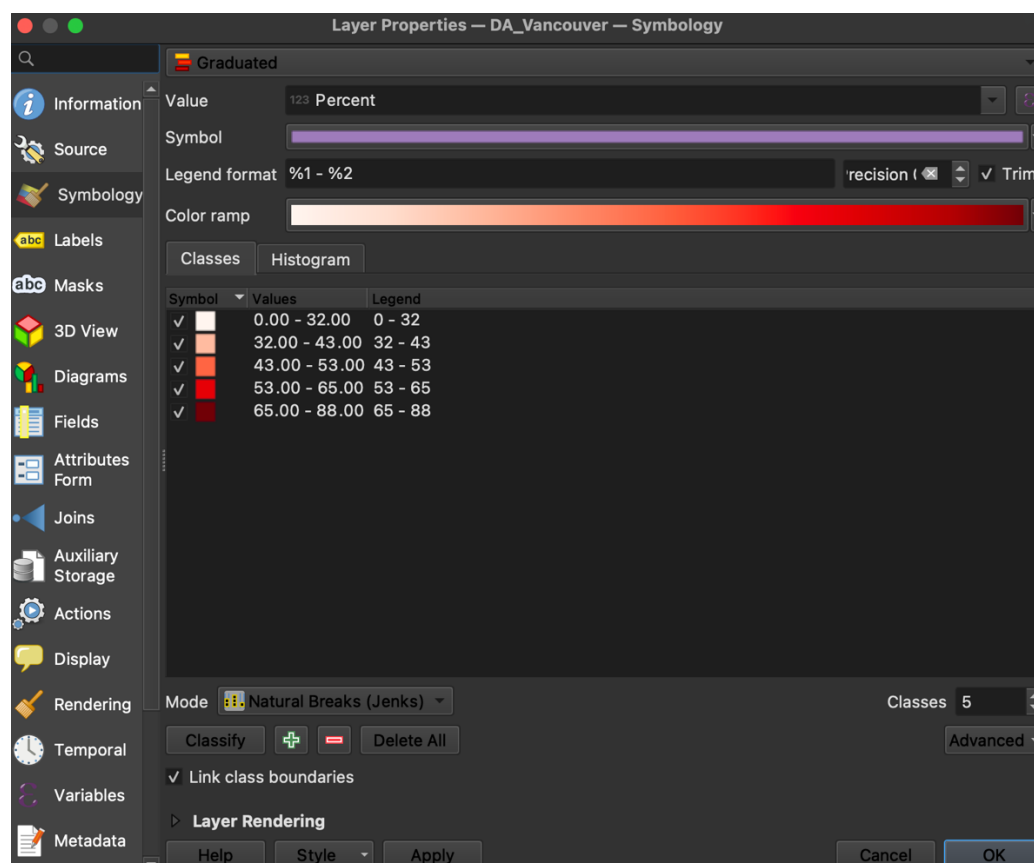


- Notice that we now have an additional field called “Percent”. The values in this new field are the percent of people living in each DA that have a post-secondary education.

Part 6: Change Map Symbology

Now that we have our census data joined to our geography file and have standardized the data, we can begin putting together our final map!

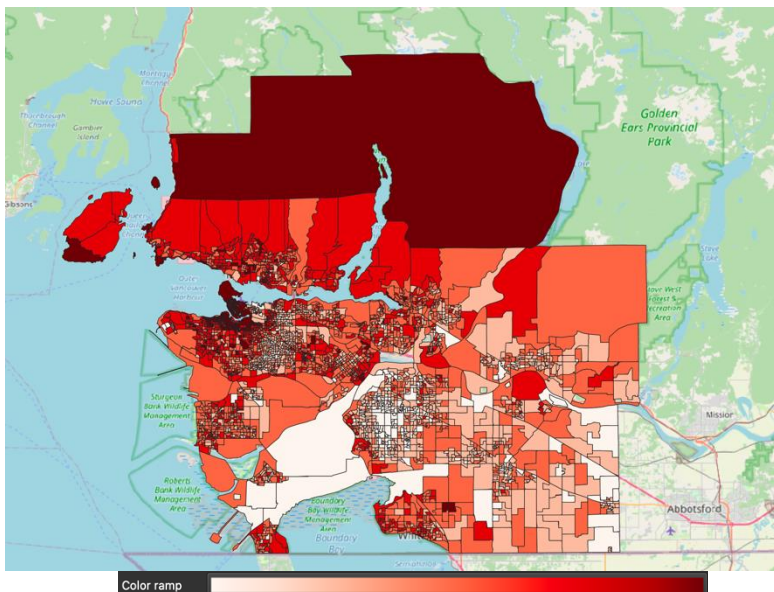
- Right click the **DA_Vancouver** and open Properties → Symbology
- Select **Graduated Colors** at the top drop-down menu.



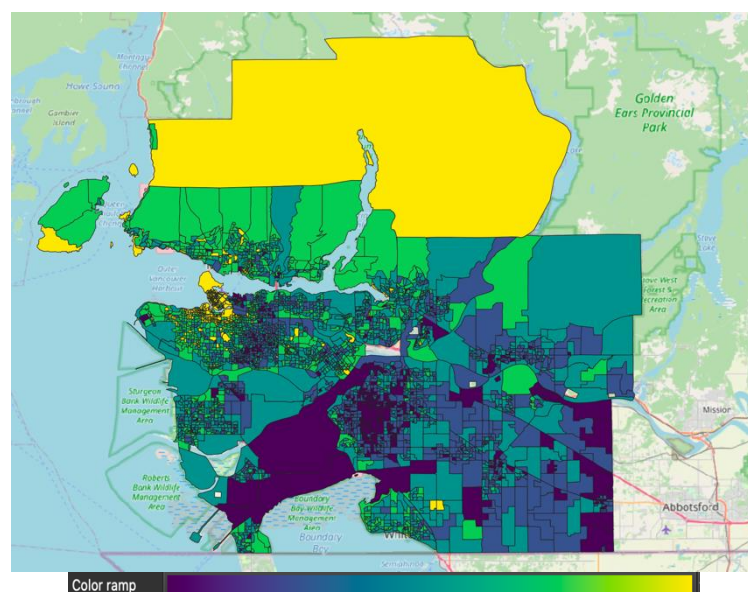
- Select the **Percent** field column as the **Value**.
- click '**Classify**'.
- Select a colour ramp from the drop-down menu.

Cartography Tip: Choose a colour ramp that is intuitive for our education percentage variable. It is best to choose a “high to low” colour ramp as opposed to an “above and below” colour ramp. The “above and below” colour ramps should be used to display variables such as temperature or above or below a certain value (i.e., averages). Notice that the Above and Below colour ramp is not intuitive for displaying our education percentage variable.

“High to Low”



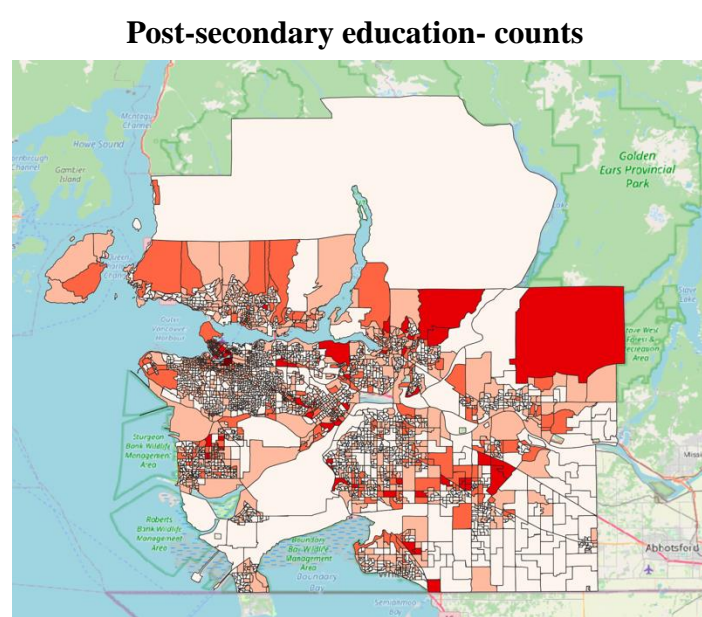
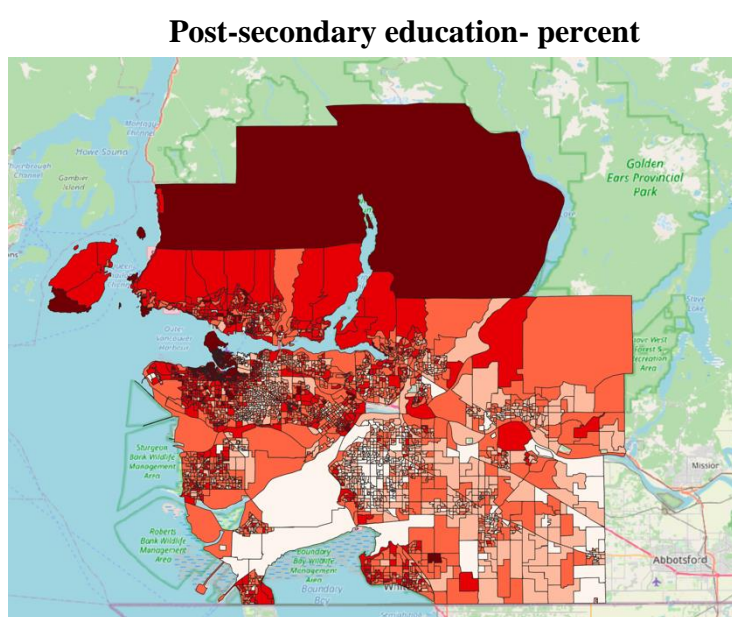
“Above and Below”



- d. Inspect the symbols and associated values.
 - i. Each range of values shown is associated with the adjacent color.
 - ii. You can change the specific colors as well as the range of values and the legend entries in this area.
- e. Try different **Modes** of displaying the Percent variable.
 - i. **Equal count** will adjust the categories so that an equal number of observations are shown by each color.
 - ii. **Natural Breaks** finds the most natural values at which to break each category.
 - iii. Explore the modes and see how they each differ with respect to the value categories.
 - iv. Also notice the 'Classes' option. This allows you to choose the number of breaks in the data.

Sidenote: How to lie with maps!

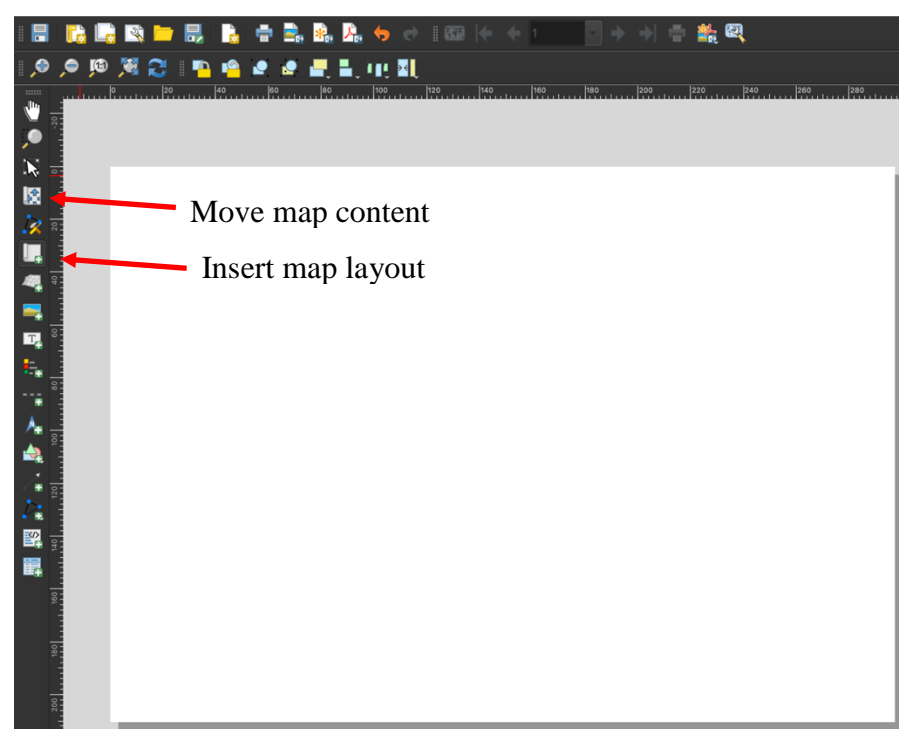
Suppose we had decided to map the education counts without standardizing the values by the DA's population. Notice that our final map would have told quite a different and misleading story! In this case, it was essential to account for the population differences between Vancouver's DA.



Part 7: Create Map Layout and Publishing a Final Map

We are now ready to create a final map.

1. Under **Project** select **New Print Layout**. Give it a name and click OK to open a new print layout.
2. Inspect the tools on the sidebar. Select the **Insert map layout** icon. Click and drag the area that you want your map to occupy.
3. Adjust the scale by clicking **Move map content**. With this tool selected, you can click and drag the map scene, and zoom in or out.



4. Navigate to the **Add Item** tab.
5. Add a legend by clicking and dragging.
 - a. Right click on the legend and open **Item Properties...**
 - b. Adjust the entries on the side by turning off auto update and manually filling in the necessary entries
 - c. Double click on the legend item to change the name
 - d. Scroll down to adjust the legend, background, and size of the legend
6. Add a **title**, a **north arrow**, and a **scale bar** by repeating the above steps. You can adjust the properties of each by right clicking on selecting **Item Properties**.
7. To export your final map, navigate to Layout → Export as image...

