Introduction

The following workshop uses QGIS 3.4 (long-term release) for Mac, which was downloaded from here: https://qgis.org/en/site/forusers/download.html
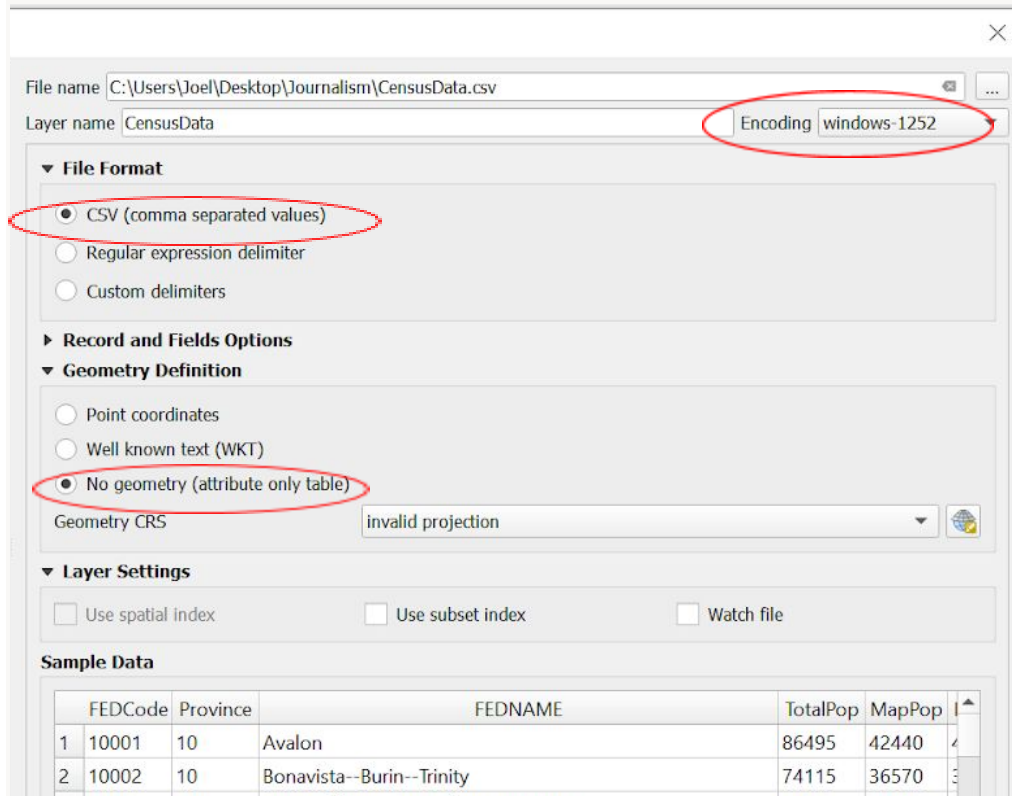
Adding Census Data and Census Boundary Layer

The data that we'll be using today can be found here - Workshop Data

The census data was downloaded from the 2016 Census webpage and includes statistical data as well as geospatial layers. The following steps will outline the steps to add the statistical data to QGIS as well as adding corresponding census geospatial boundary layer for the accompanying data. We'll be looking at the data at the Federal Electoral District (FED) level, which corresponds to a Federal riding for the federal elections.

Step 1: Add Census Tabular Data

1) In QGIS, go to **Layer** > **Add Layer** > **Add Delimited Text Layer…** to add the comma-separated values (.csv) to QGIS. The software will preview the corresponding data.
2) Fill in the following information then click **OK**
   a. File format: **CSV**
   b. Geometry definition: **No geometry (attribute only table)**
   c. Encoding: **windows-1252 IANA**

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3) This will add the census data table to the table of contents.

Step 2: Add Census Boundary Layer
1) In QGIS, add the census boundary layers by clicking on *Layer > Add Layer > Add Vector Layer…* Browse to the project's folder and find/add the **lfed000b16a_e.shp** by clicking on it and selecting **Ok.**
    a. You could also have the project folder open in Windows Explorer and just drag and drop the file in. Either way works!

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Joining Census Data to Census Boundary Layers

Our next step is to do an attribute join of the data. This can only be done when fields from our data and boundary layer are the same type and the values in each column correspond to one another.

Step 1: Ensure Proper Field Type

1) Right click on the **lfed000b16a_e** and **Open Attribute Table**. Right click on the **CensusData** and **Open Attribute Table.** Look at the data and try to determine which field from both files could be used for a join.
2) Right click on **lfed000b16a_e** again, but this time, select **Properties**. On the left tabs, select **Source Fields**. This should tell you the field type for every field in your data. Looking here, the field type for **FEDUID** is **String**.
3) Right click on **CensusData** again and select **Properties**. On the left tabs, select **Source Fields**. This should tell you the field type for every field in your data. Looking here, the field type for **FEDCODE** is **Integer.**

   As you can see, the field types don't match. We'll be changing the field type for **CensusData.**

4) Right click on **CensusData** and select **Open Attribute Table**
5) Select the **Open Field Calculator Icon**
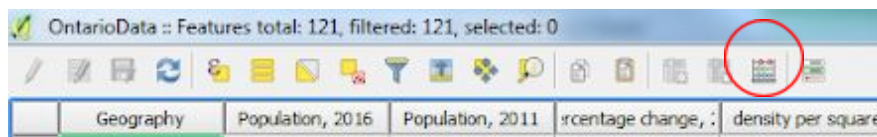
6) In the field calculator, do the following calculation and click **Ok**.
   a. Output field name: **FEDid**
   b. Output field type: **Text, unlimited length (text)**
   c. Expression: **"FEDCode"**

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☐ Only update 0 selected features

Create a new field   ☐ **Update existing field**

☑ Create virtual field

Output field name   FEDid

Output field type   Text (string)   ▼

Output field length 0   ⬍   Precision 3 ⬍

[Expression] [Function Editor]

[=] [+] [-] [/] [*] [^] [||] [( ] [ )] ['\n']   🔍 Search...   Show Values

"FEDCode"

Color
Conditionals
Conversions
Date and Time
Fields and Values
  123 FEDCode
  NULL
  123 Province
  abc FEDNAME
  123 TotalPop
  123 MapPop
  123 FemalePop
  123 Income

group field

Double-click to add field name
to expression string.
Right-Click on field name to

Values   🔍 Search...

[All Unique] [10 Samples]

Output preview: 10001

This layer does not support adding new provider fields. You can only add virtual fields.

[Help]   [Cancel] [OK]

7) This will create a new text field with the data from the FEDCode field. We'll then be able to do our join with this newly created field since it's the same field type as the boundary layer.

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Step 2: Attribute Join

1) To do our attribute join, right click on **lfed000b16a_e** and select **Properties**. From the **Properties window**, select **Joins** and click on the **green + button** at the bottom left of the screen.
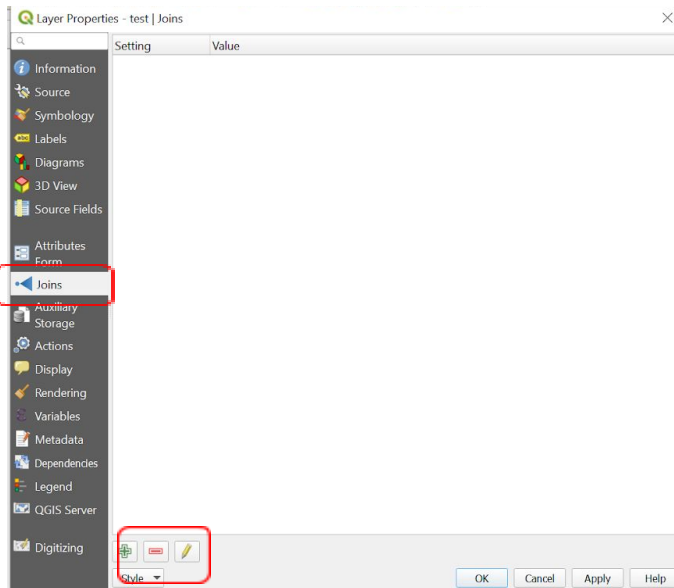
Fill in the corresponding information to perform the join. Ensure you select **Custom Field Name Prefix** and remove the text in that box. This will keep the original field names from the CensusData.

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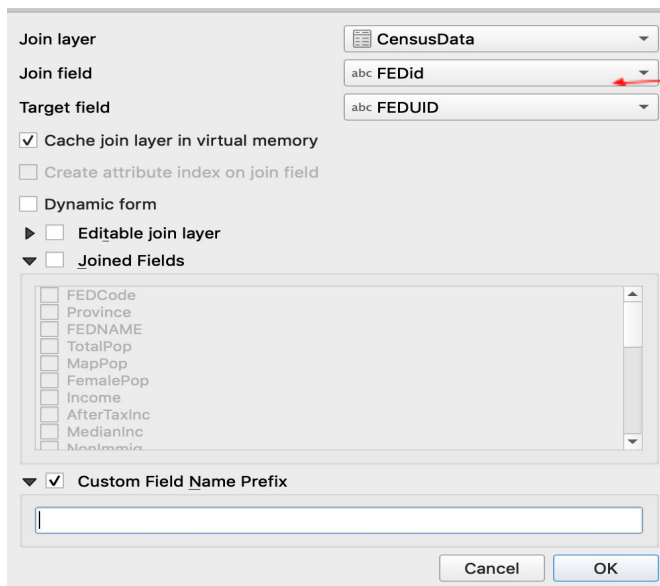
2) Click **Ok.**

3) Right click on **lfed000b16a_e** > **Export** > **Save Features as…** Change format to **Esri Shapefile** and click on the three dots next to the **File name** box and navigate to a folder to save the file as **FED_Census_Data.shp**. The join is now permanent.

Step 3: Explore the Joined Data
1) In the table of contents, right click on **FED_Census_Data** and select **Open Attribute Table**. You should now see the additional census data in your layer file.
2) Remove the **lfed000b16a_e** and the **CensusData** from the table of contents. You should have only the **FED_Census_Data** in the table of contents.

Now that our attribute data is joined to our geospatial file, we are now ready to begin mapping!

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Style and Labels Your Map

To better visualize our census data, we'll use different colours and labels for our map. Before doing so, we'll adjust how our column headers look, since the column names aren't clearly labelled.

Step 1: Create Field Alias
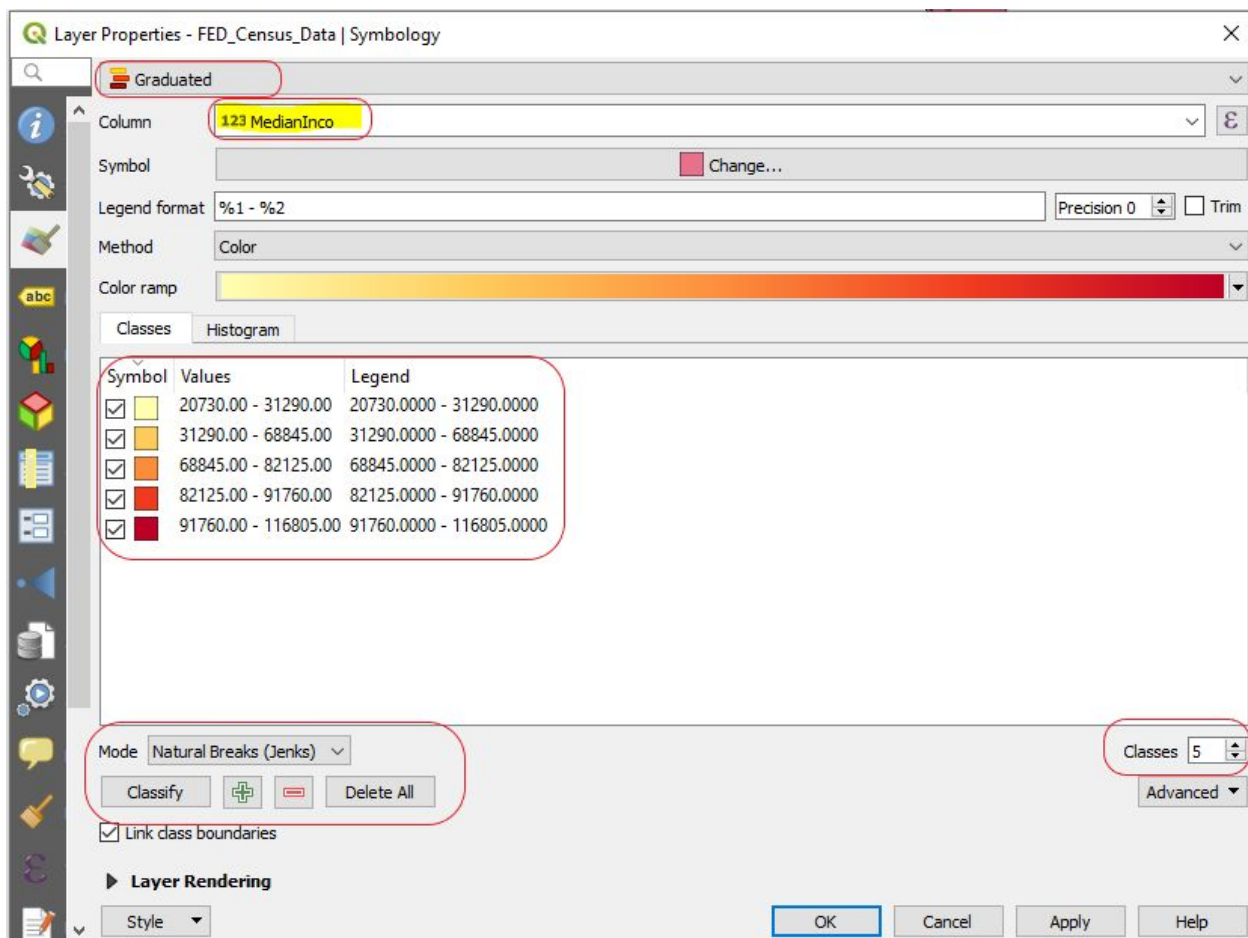
1) Right click on the **FED_Census_Data** polygon file and select **Properties**…
2) Click on the ***Attributes Form*** tab
3) You will see a list of all the fields. Click on a field and input text in the ***Alias*** field to something helpful for each field. Feel free to use the table that explains the census data variables to set a proper alias. Click **Ok** when done.

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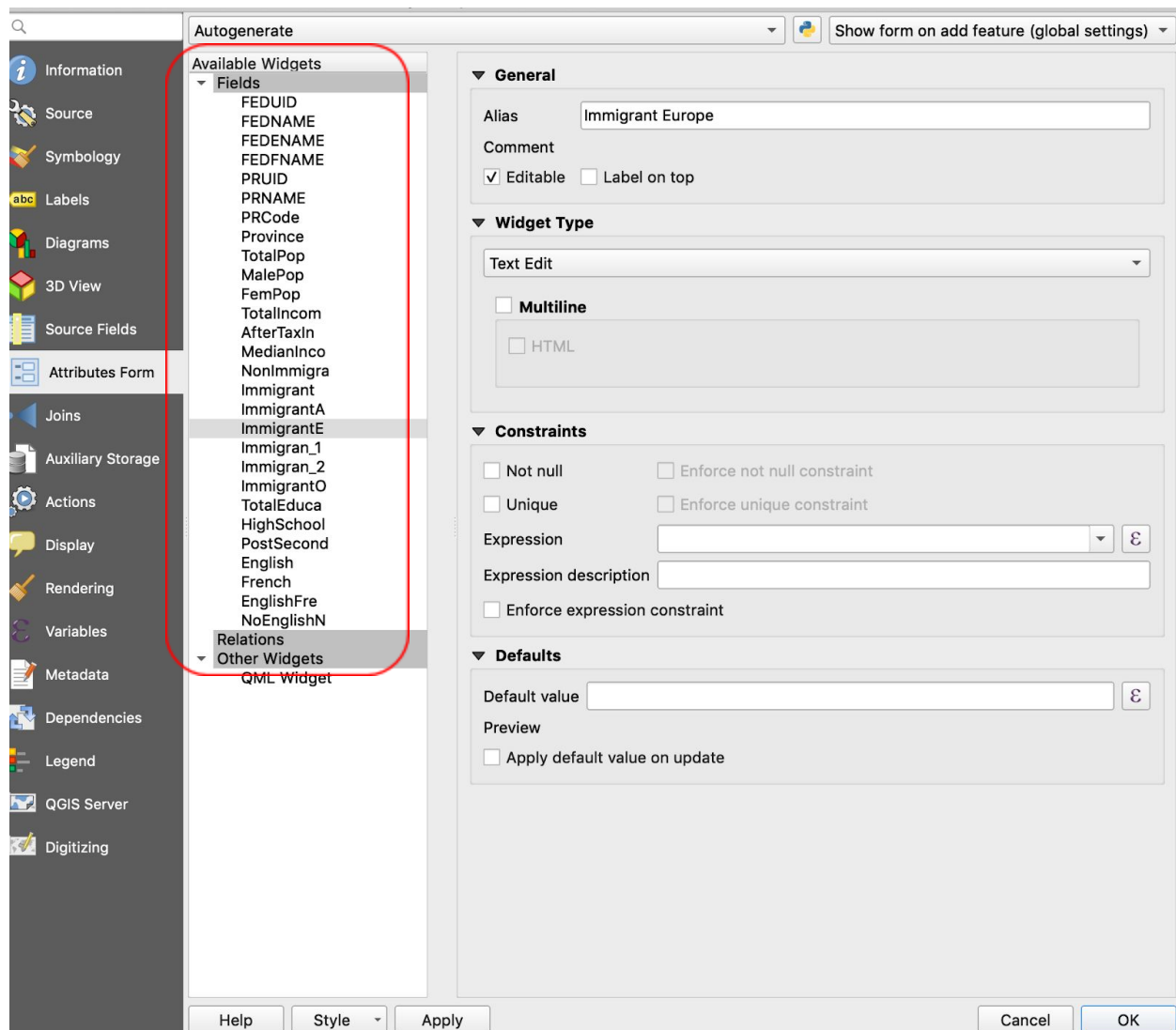
Step 2: Change the Style of the Map

Now, we'll change the style of **FED_Census_Data** to visualize and represent the population change from 2011 to 2016

1) Right click on **FED_Census_Data** and click on **Properties** select the **Symbology** tab from the left.
2) At the top, change the symbol **single symbol** to **Graduated**.
3) Under **column,** select **MedianIncome...or MedianInco**
4) Click on the **colour ramp** and select **YlOrRd.**
5) Change the Mode to **Natural Breaks (Jenks)** and click on **Classify**.
6) Click **Ok**

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Step 3: Add Labels to the Map

In this section, we'll learn how to add labels to our map.

1) Now let's label each FED with the name of the FED.
2) In *Properties*, select the *Labels* tab.
3) In the top bar change No labels to *Single labels*
4) In *Label with* and set the label field to **FEDENAME**
5) Choose your label font. In the example it's Arial, size 12, bold, black.
6) Click *OK*.

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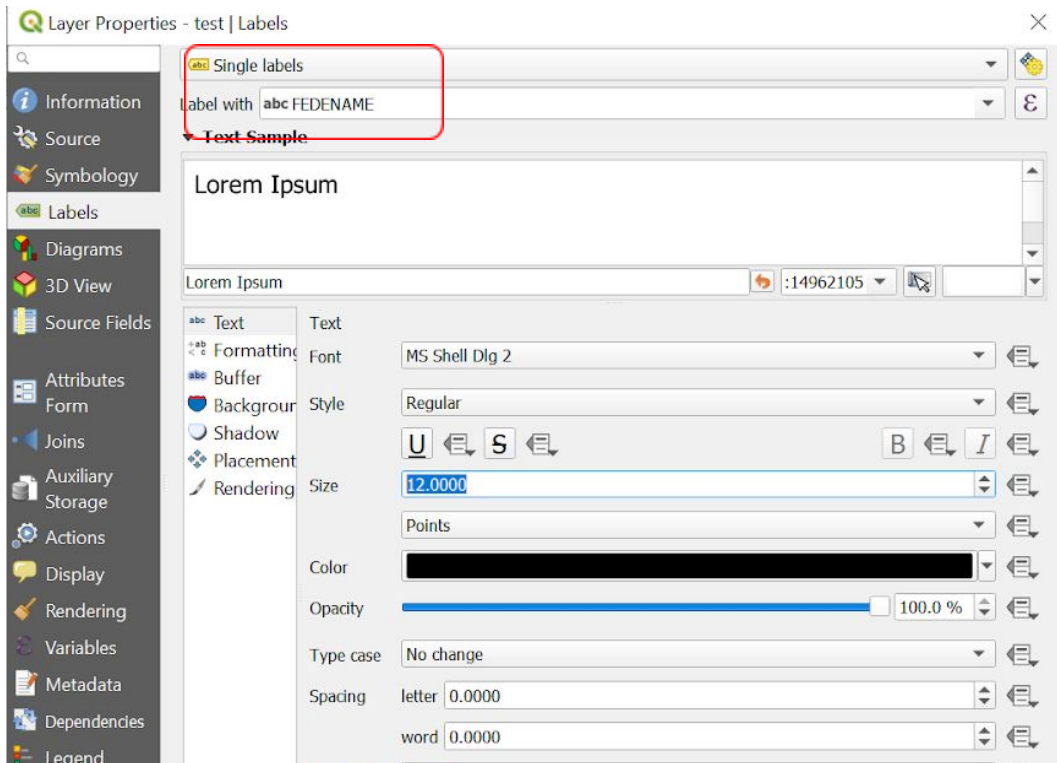
7) Your map should now look something like this. You're visualizing the after-tax median income and have the Federal Electoral Districts labelled. Give yourself a pat on the back!

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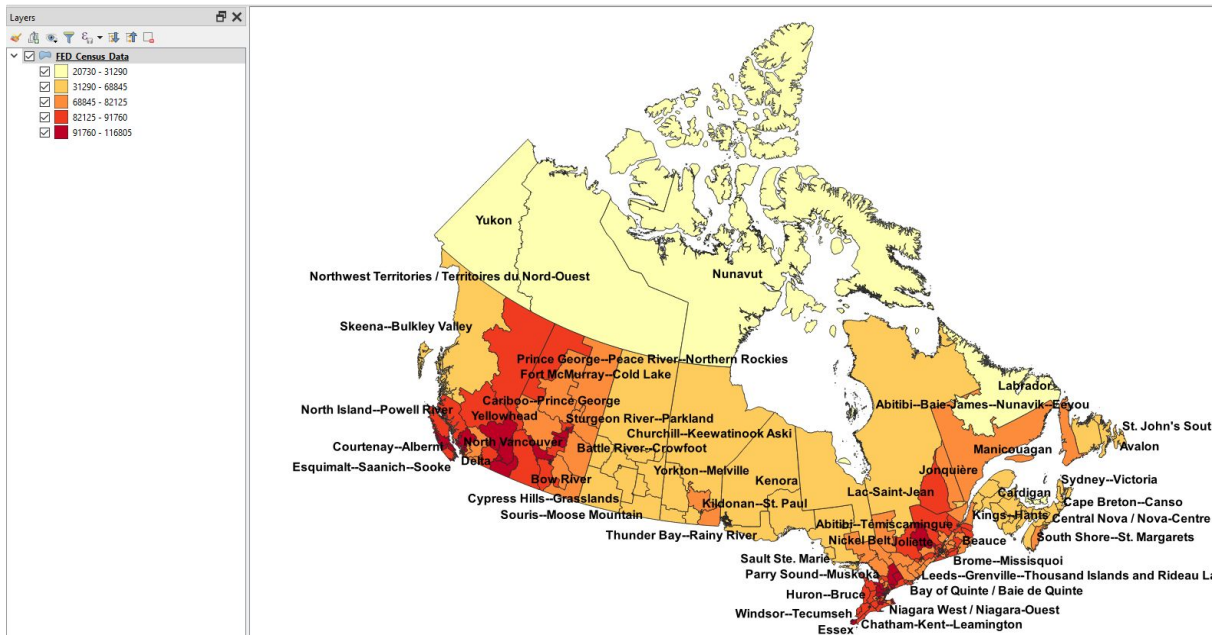
Select by Attribute

Next, we just want to select the Federal Electoral Districts for both Alberta and British Columbia. We will do this by selecting particular attributes

1) In the table of contents, right click on FED_Census_Data, click on **Open Attribute Table**.
2) Once the table open, select the **Select Features using an Expression** button
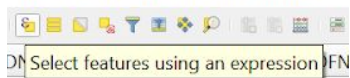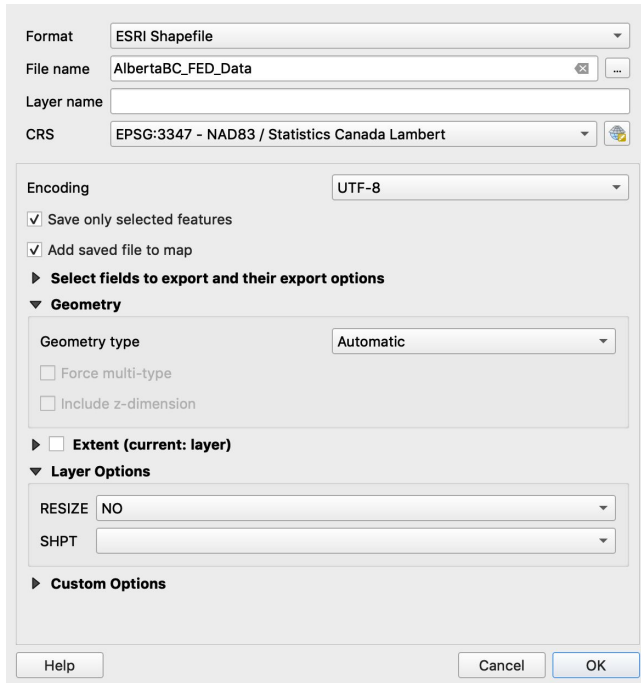
3) Type in the following formula: "PRUID" LIKE '48' OR "PRUID" LIKE '59'
4) Click Select Features in the bottom right corner
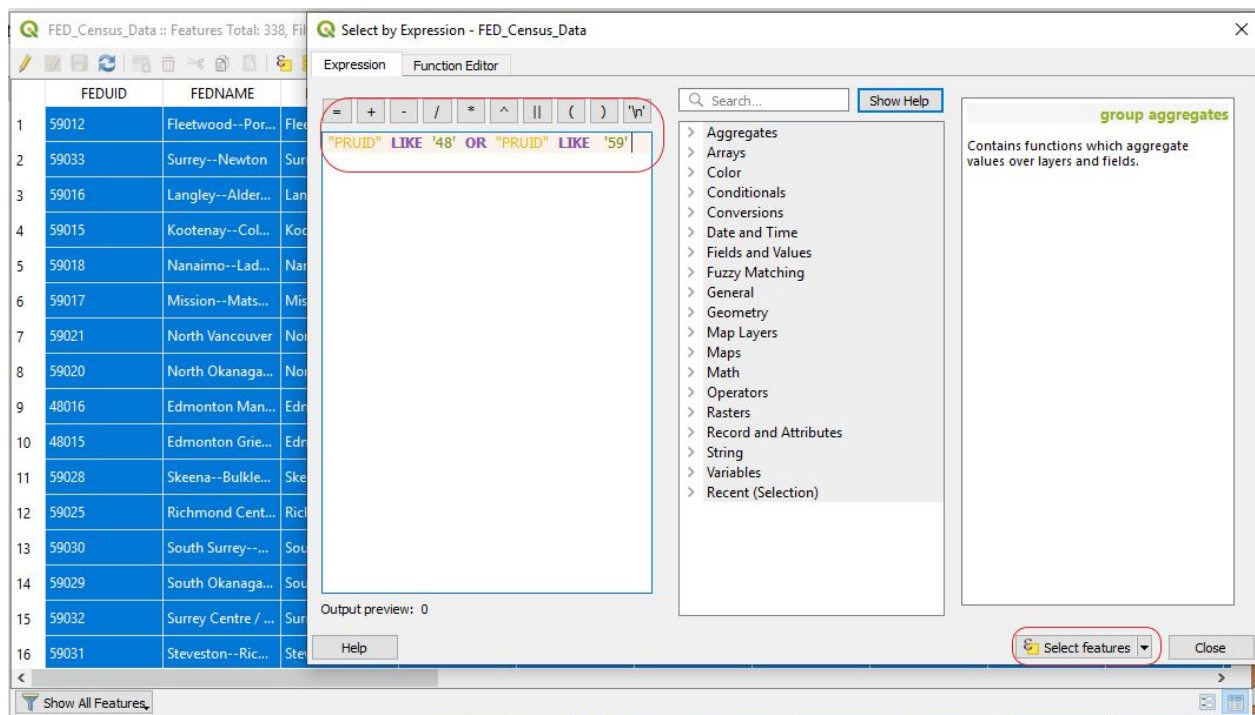
This will select both the province of British Columbia (59) and Alberta (48).

4. Right click on **FED_Census_Data** > **Export** > **Save _Selected_ Features as…** Change format to **Esri Shapefile** and ensure that **Save only selected features…** is selected. Click on the three dots next to the **File name** box and navigate to a folder to save the file as **AlbertaBC_FED_Data.shp**.

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## Add x,y data

In the first part of the exercise, we added a.csv file and visualized it by conducting an attribute join. In the following section, we'll visualize our .csv file by displaying its x,y coordinates.

1) In QGIS, go to **Layer** > **Add Layer** > **Add Delimited Text Layer…** to add the comma-separated values (.csv) to QGIS. The software will preview the corresponding data.
2) Fill in the following information then click **OK**
   a. File format: **CSV**
   b. Under **Record and Fields Options** | Number of header lines to discard = 0 (first record has feild names)
   c. Geometry definition: **Point coordinates**
      i. **x field = longitude, y field = latitude**

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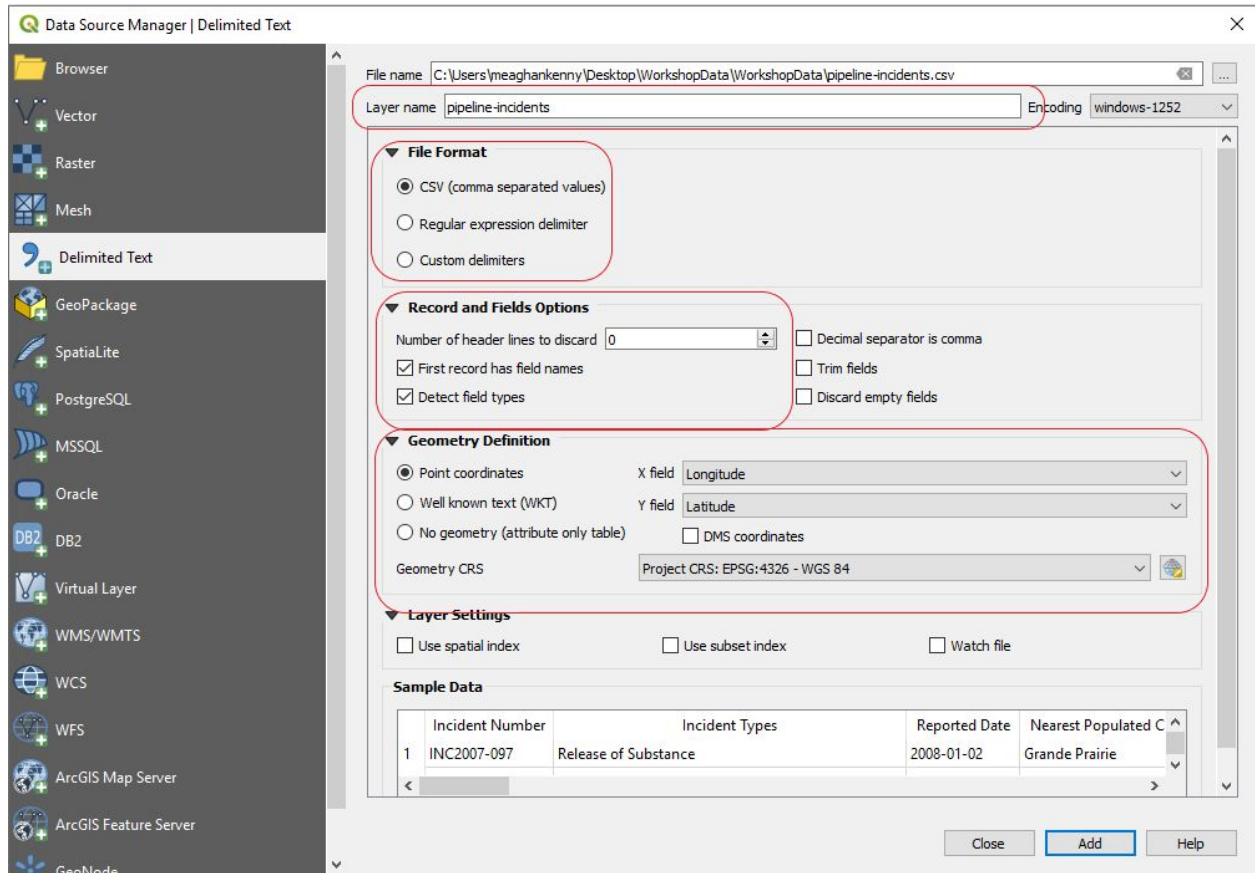
3) Right click on the pipelines incident in the table contents and select **Export > Save features as…**

4) Save the file and ensure that you change the coordinate reference system (CRS) to **EPSG: 3347**. This will allow us to conduct additional geoprocessing moving forward. We've save it as **PipielinesLambert.shp**

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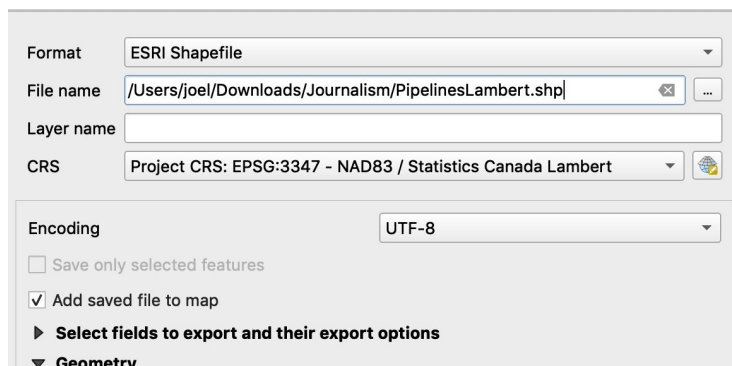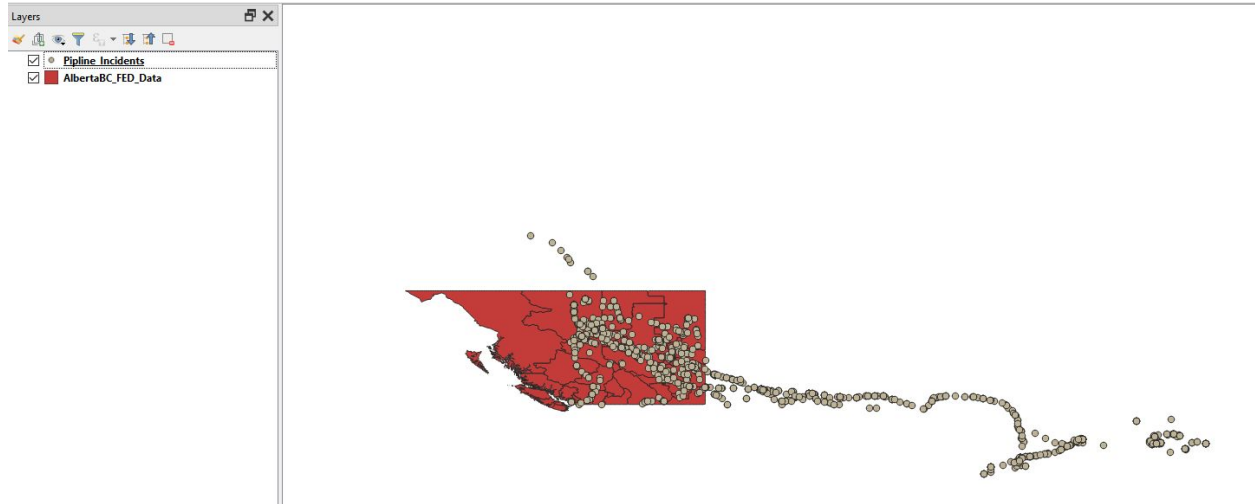
Clipping

Our next exercise will allow us to focus on a smaller geographic region, British Columbia and Alberta.

1) In the menu click on **Vector** > **Geoprocessing Tools** > **Clip**.
2) Fill in the information as outlined below. You'll be using the boundary file for AlbertaBC_FED to cookie cut the PipelinesLambert. Click **Run**

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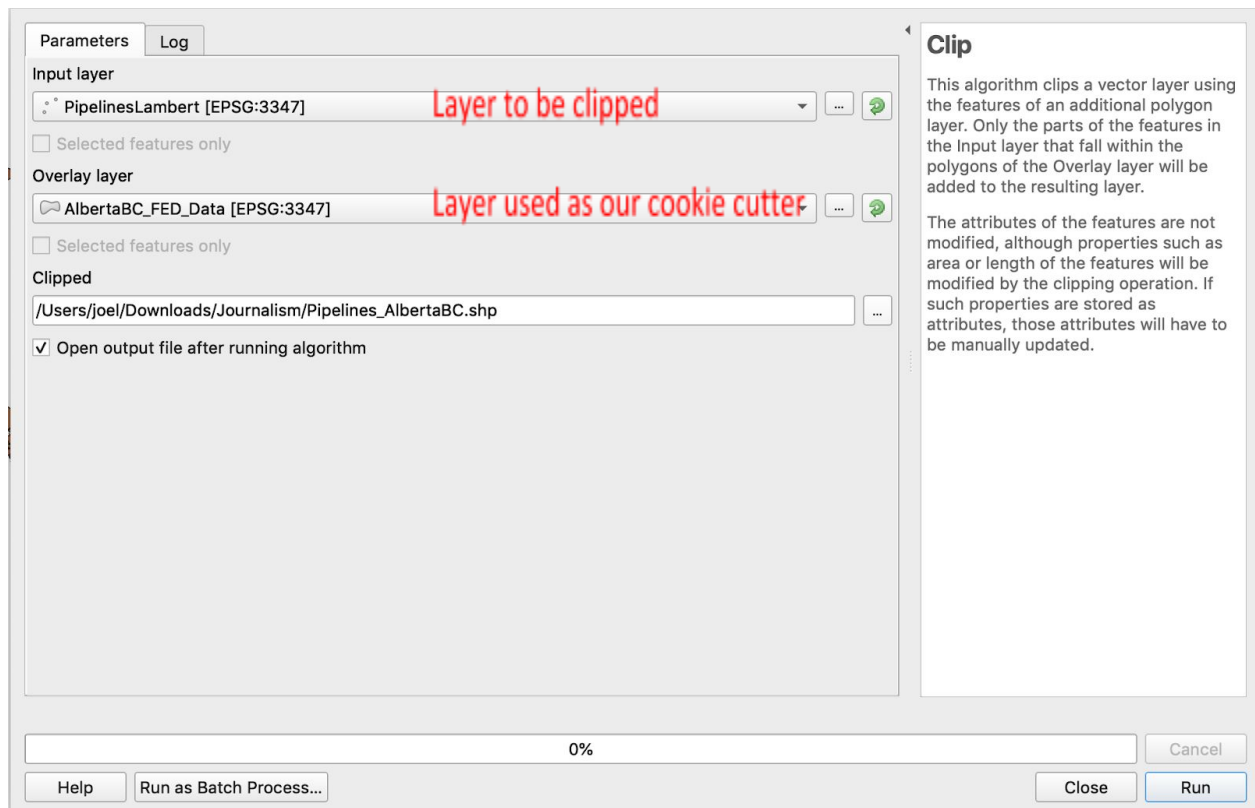
3) The newly created **Clipped** file will be added to the table of contents. Feel free to rename this by right clicking on it and selecting **rename**. I've renamed it Pipelines Alberta BC.

Let's clean-up our table of contents and remove unwanted layers. Let's remove the following layers by right clicking on each and selecting remove:

- **Pipeline_Incidents**
- **FED_Census_Data**

We should now be left with **Pipelines_AlbertaBC** and **AlbertaBC_FED**.

Spatial Join

A spatial join allows us to combine information from multiple layers that cover the same geographic footprint. For this analysis, we want to know how many pipeline incidents (points) exist in each FED (polygon).

1) In the menu, select **Vector** > **Analysis** > **Count Points in Polygons.**
2) Select the following parameters.

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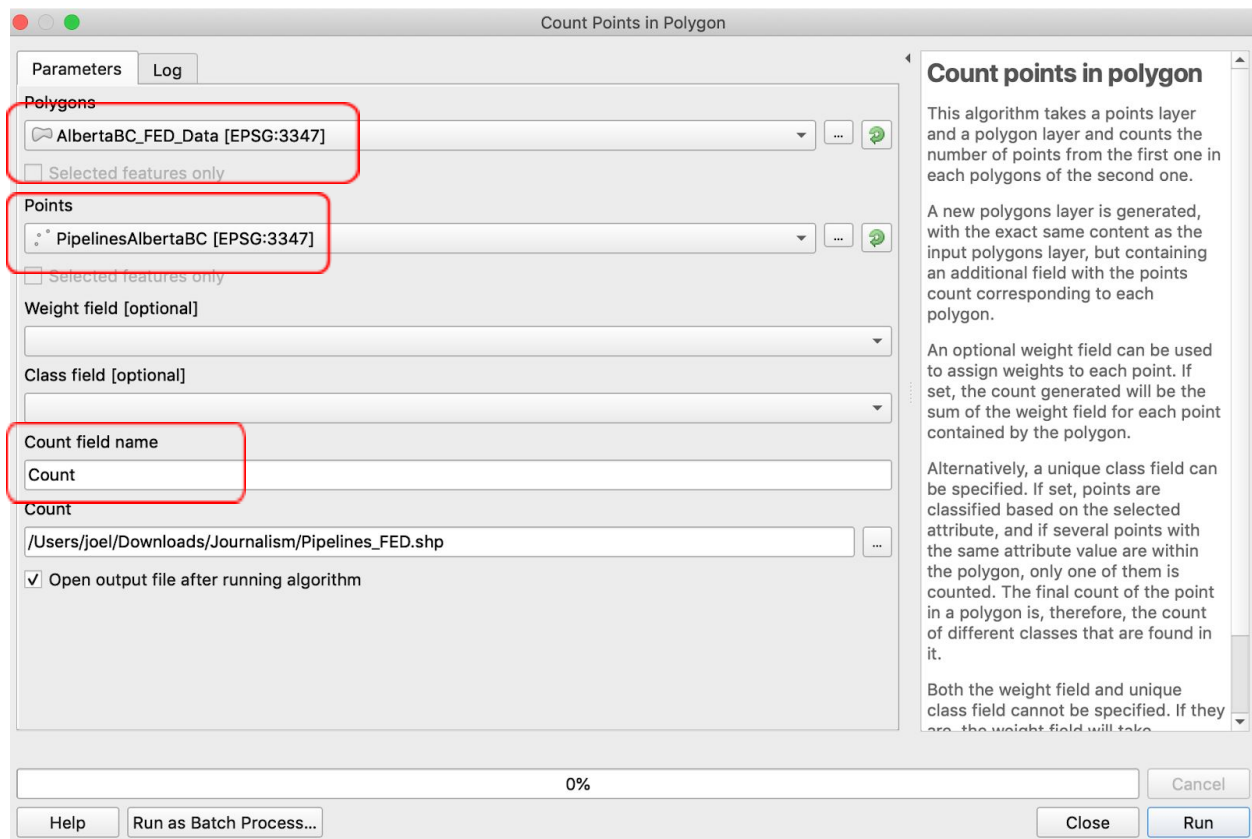
This will add a count field as well as add the number of pipeline incidents for each federal electoral district. The name of layer in the table of contents with be **Count**. Feel free to change that to something a bit more meaningful such as **PipelinesCountFED** (right click on the file > **rename**).

Style & Labels (again!)

Now, we'll change the style of **PipelinesCountFED** to visualize and represent the electoral districts by after-tax income and the number of pipeline incidents.

Step 1: Change the Style of the Map

1) Right click on **PipelinesCountFED** and select the **Symbology** tab from the left.
2) At the top, change the symbol **single symbol** to **Graduated**.
3) Under **column,** select **AfterTaxIn.**
4) Click on the **colour ramp** and select **YlGN.**
5) Change the Mode to **Natural Breaks (Jenks)** and click on **Classify**.
6) Click **Ok.**

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## Step 2: Add Labels to the Map

In this section, we'll add labels to our map.

1) Now let's label each FED with the number of pipeline incidents.
2) In **Properties**, select the **Labels** tab.
3) Select **Show labels for this layer** and set the label field to **Count**
4) Choose your label font. In the example it's Arial, size 12, bold, black.
5) Click **OK**.

Our final should look like this. Each FED is colour-coded to represent the median income and labelled to show how many schools in each FED.
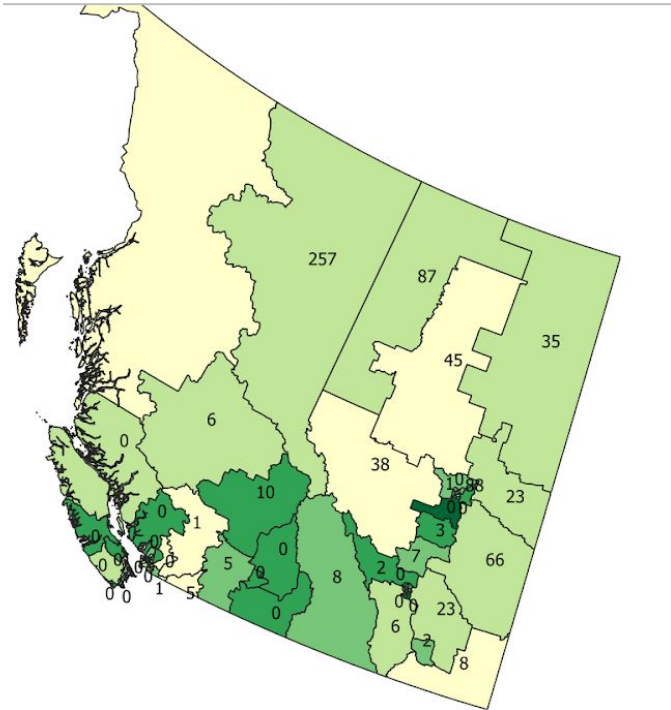
Feel free to change which variable to map instead of income. Maybe language?

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Export the Map

1) When your ready to export your map, click on **Layout** > **Export as Image** or **Export as PDF**.
2) Select the name for your output map and click **ok.**
3) Your map should now be saved as an **Image** or a **PDF**.

Bonus:

In this bonus section, we'll get students to add the voting results by electoral districts for the 2015 federal election.

1) Download Table 11: Voting results by electoral district from Elections Canada's website. This is a .csv file.
2) Add the .csv file to QGIS (see previous steps on how to add a .csv)
3) Conduct an attribute join using the FED code as the common field. Make sure you have the correct field type. Don't forget to export your newly join data to a new shapefile.
4) Symbolize and label your new layer.

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