Data Visualization and Cartography

Advanced Cartography Lab

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Data Used:

1. Major Cities in CSV file format
2. Malawi Country Boundary (shape file)
3. Malawi District Boundary (shape file)
4. Malawi and Neighboring Countries Boundary (shape file)
5. Malawi Water Bodies (shape file)
6. Africa Countries (shape file)

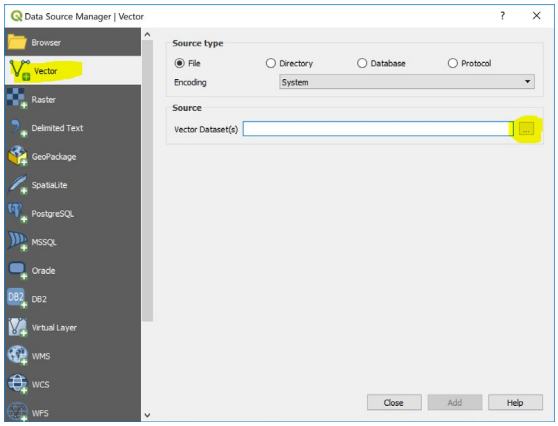
Data Sources:

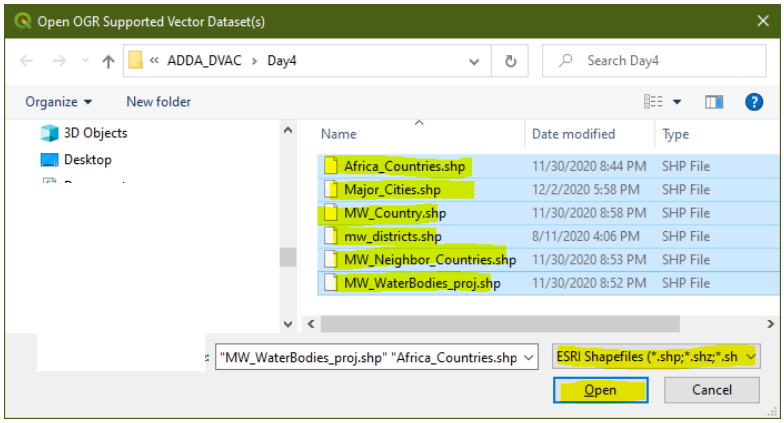
Data used in this exercise (provided on Moodle) were obtained from the following sources. You don't need to download any data from these sources but in the future, if you need to do any work in your own location, you can look for basic layers from these sources.

- Administrative Boundaries Data: https://www.diva-gis.org/datadown
- Data layers from Open Source Maps: https://download.geofabrik.de

Opening Data and Displaying Data:

1. Download **Day4Data.zip** file containing the data needed for the exercise from Moodle to your computer.
2. Right click on the Zip file and select **Extract All** to extract the data files to your lab folder.
3. Open Q-GIS from the Start Menu on your computer (click on the **Windows logo** located on the left bottom corner of the screen and search for QGIS).
4. Click "Layer" Menu, select **Add Layer → Add Vector Layer**
5. Navigate to your lab data folder.





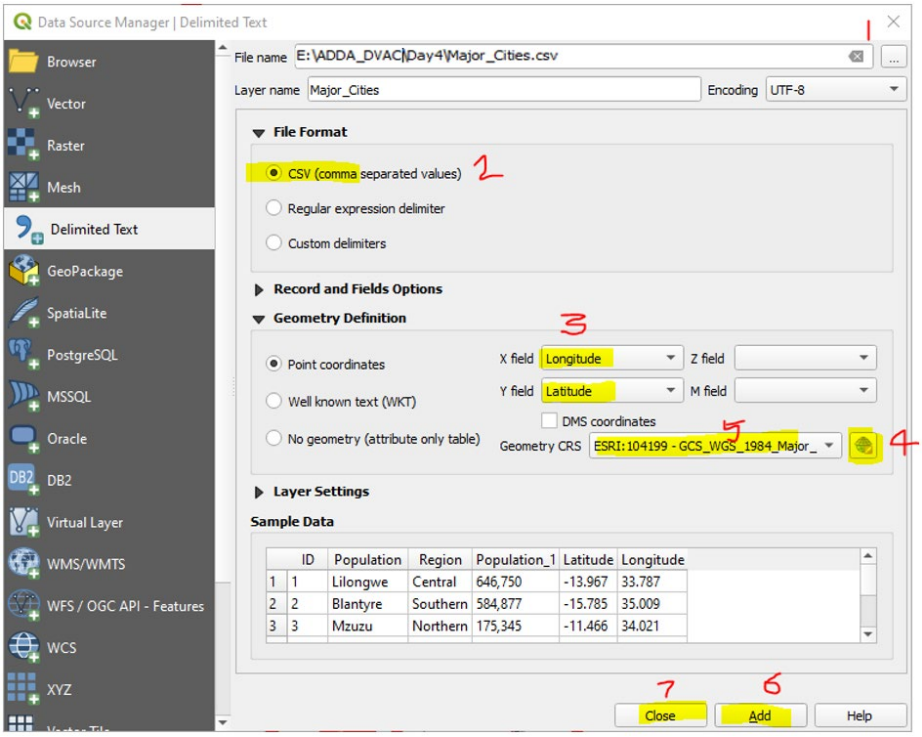
6. We are looking for files with extension **.shp**. You can sort the files by tile type to make it easy to select.
7. You can multiple select layers by holding control + click the files to select these files: **Africa_Countries.shp, Major_Cities.shp, MW_Country.shp, mw_districts.shp, MW_Neighbor_Countries.shp, MW_WaterBodies_proj.shp.**
8. Click OK to accept the selection.
9. On the **Data Sources Manager** window, click **Add** button to add the layers to your map.
10. Click **Close** to get out of the add data dialog. Your project window should display all the layers as shown below.
11. Click **Project → Save** to save your project. Get to the habit of saving your project frequently as you make progress. This will ensure that if the program crashes or computer turns off due to power outage, you will be able to recover everything until the last save.

Adding Point Data from a table

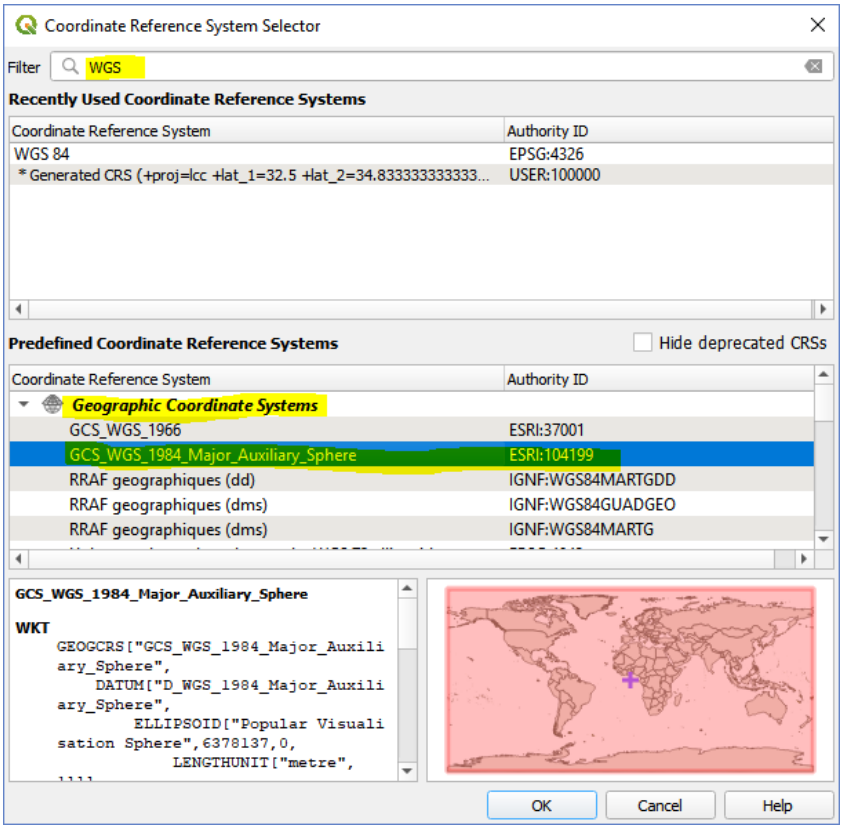
In addition to adding shapefiles to the map project, point files from a data table can be created with corresponding coordinates. For this exercise, we will bring a layer showing locations of major cities in Malawi. I created the list in an Excel document and then save it as Comma Separated Values (CSV, comma delimited) file type from Excel. To import this layer to our project, follow the instructions below:

We will now add the CSV (Comma Separated Values) file to our QGIS project.

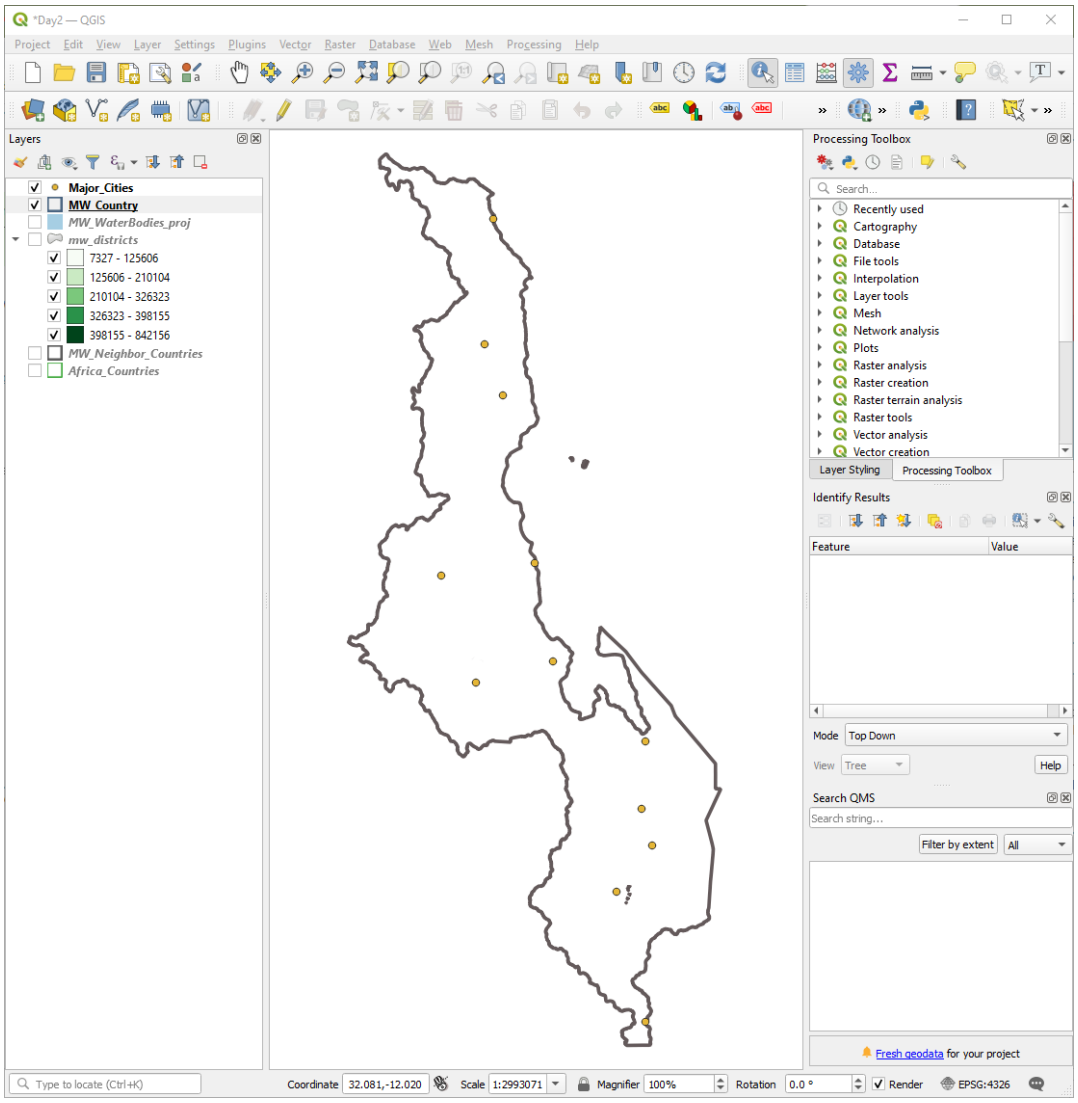
Click Layer → Add Layer → Add Delimited Text Layer



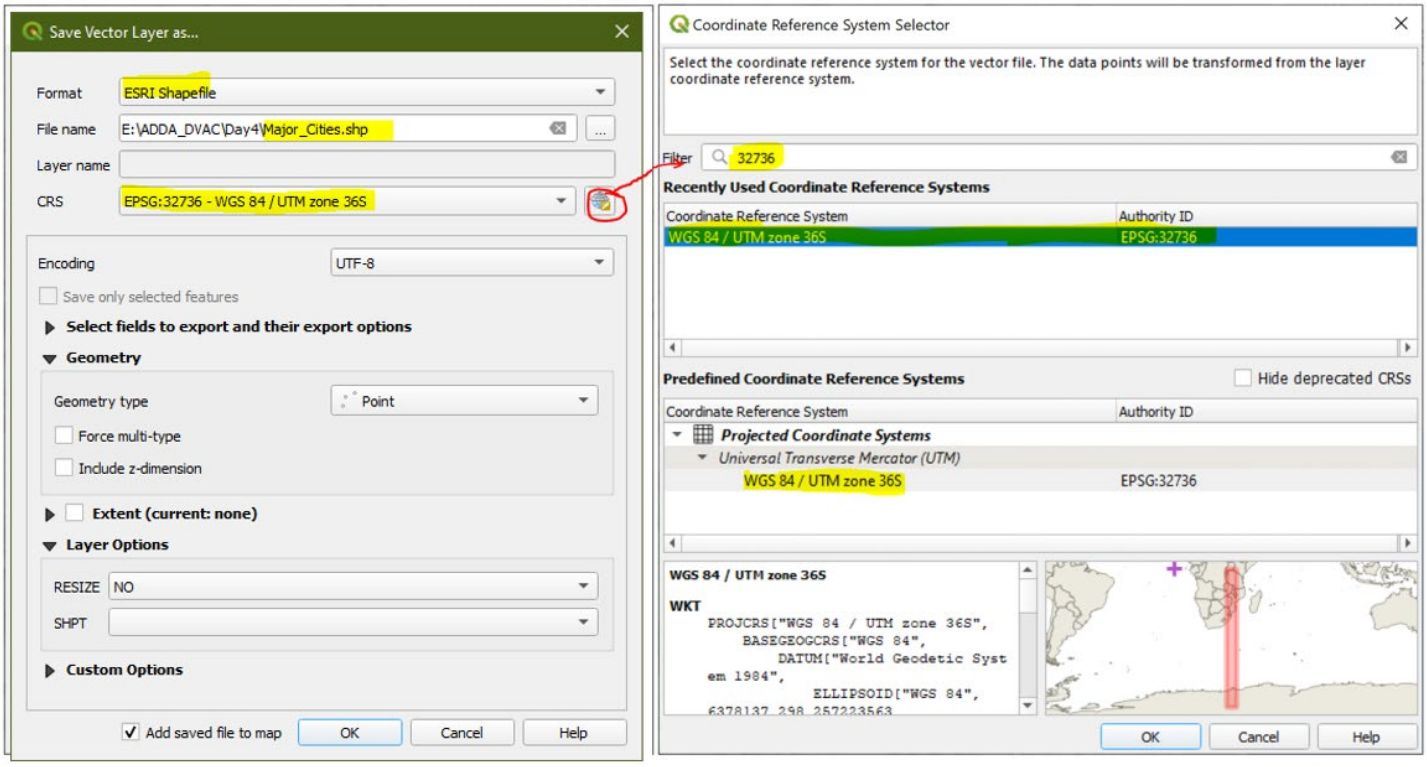
1. When the Data Source Manager window opens, click on Open File button and navigate to where you have saved your **Major_Cities.csv** file on your computer.
2. Make sure to match latitude and longitude values to the right X and Y fields.
3. We need to assign projection information for the point locations. Latitude and Longitude values were mostly acquired using handheld GPS units. The GPS projection setting are required to assign the proper geometry to the file before importing. We know from the source that the GPS was using GCS_WGS_1984 (a type of un-projected, geographic coordinate system with WGS_1984 as the reference datum surface), so we will assign it. Click on the button next to Geometry CRS field (4 on the figure). In the resulting **Coordinate Reference System Selector** window, type WGS to filter all projects with the followed by selecting **GSC_WGS_1984_Major_Auxillary_Sphere** (**ESRI:104199**) as the coordinate system. Click OK to get out of this window.
4. Click **Add** on the Data Source Manager window. If the projection information was assigned properly, you should see all the cell towers get mapped and identified as points and displayed. Now explore the displayed data. Remember that the points



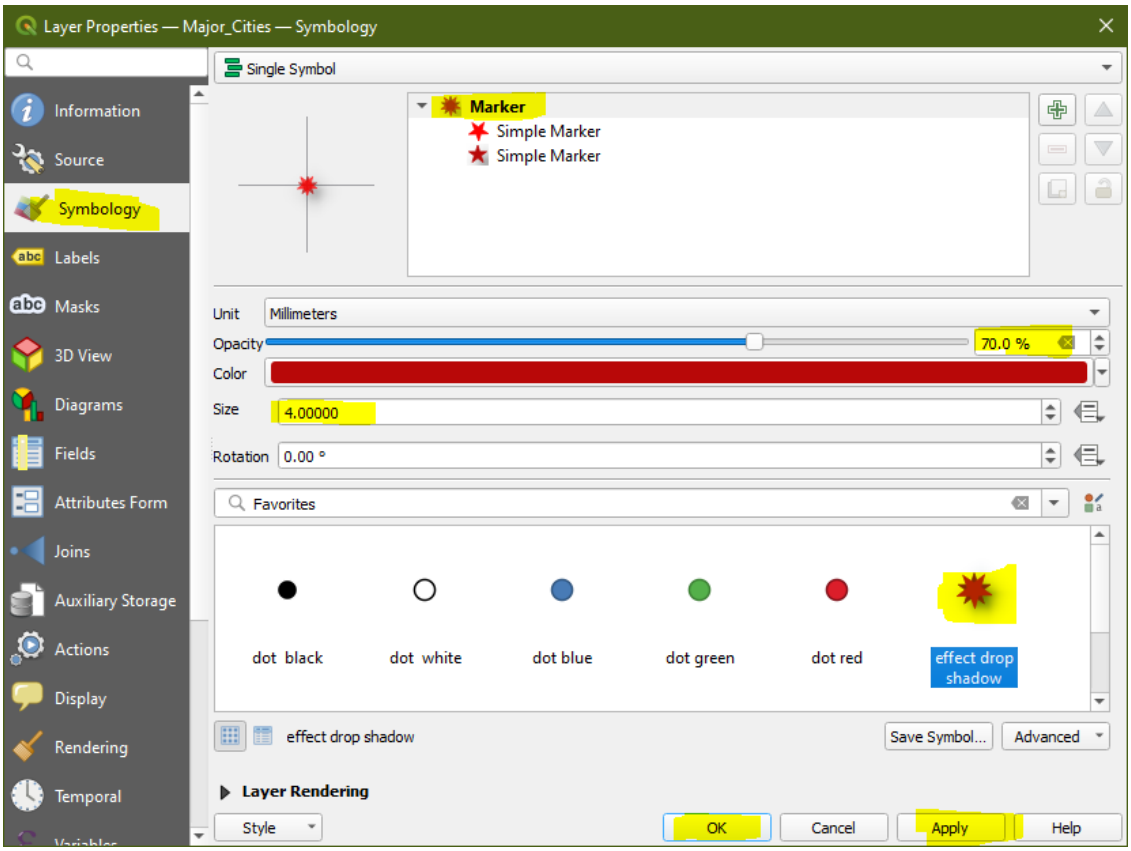
are just being displayed directly from the CSV file. We must export the displayed data to a GIS compatible file format to be able to do further analysis. We will export this to a GIS compatible format after we study and understand the data.



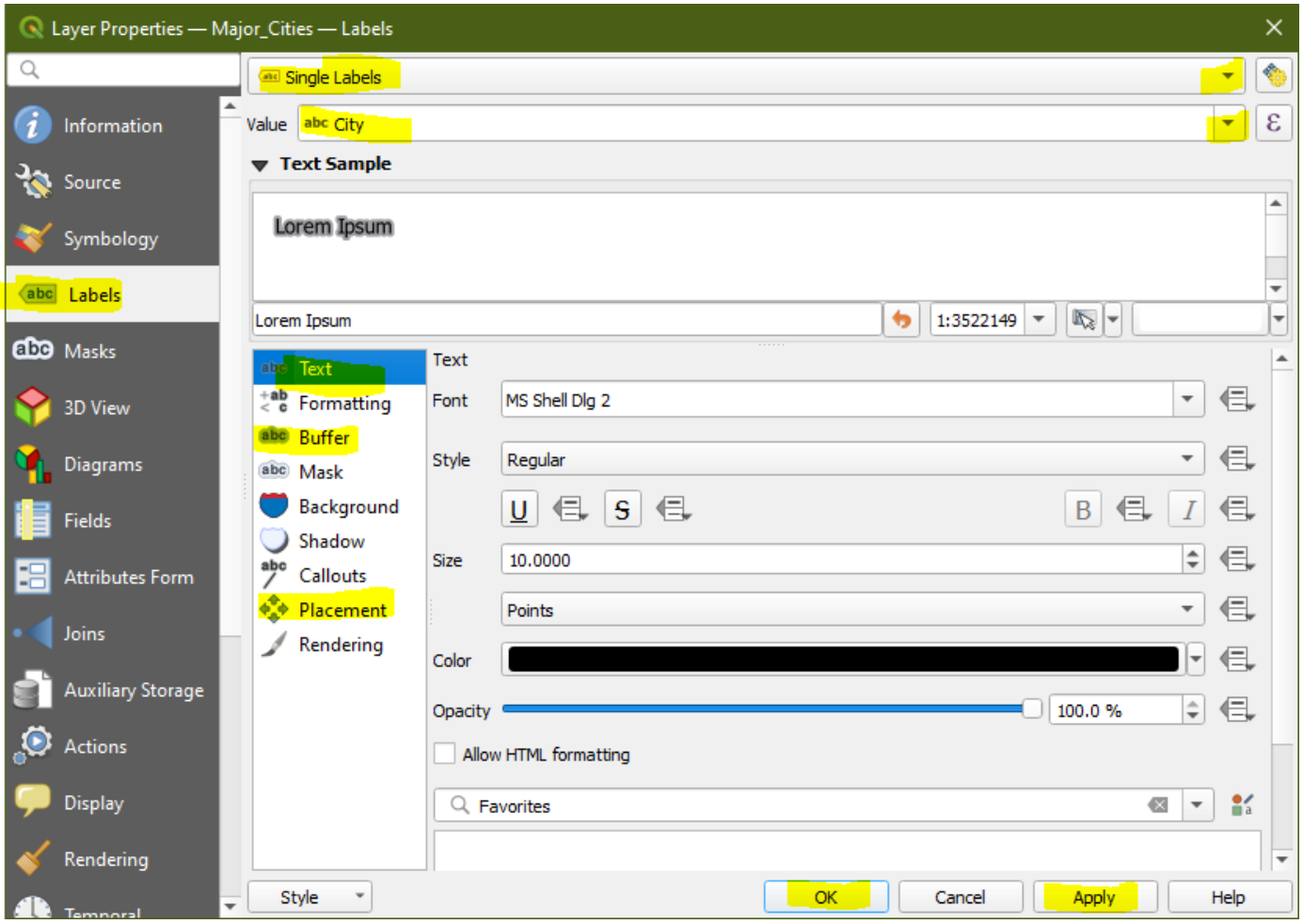
5. To save this point data as a permanent GIS data, we must export the data - **Right-Click** on the Major_Cities layer and select **Export → Save Features As…**
6. Now, in the new window, make sure to select the output file **Format (ESRI Shapefile), provide a file name** (click on the button with three dots next to it) and select a new **Projected Coordinate System** under **CRS.**
   a. **Selecting new projection for the layer being Exported**: To do any kind of spatial analysis with your data, your data should have a proper projected coordinate system. Since the CSV was displayed using a Geographic coordinate system, we have to now assign a new projected coordinate system. This time, we will pick **Universal Transverse Mercator (UTM)** as the projection. UTM requires you specifying a zone number where your study area falls. For Malawi, it is **Zone 36 South**, so we will pick **WGS 84 / UTM Zone 36S** (you can search for this by typing the number **32736** or **UTM 36S** in the **Filter** box on top). Under Geometry, select **Point**. Then Click Ok.
7. Click OK to export the layer as new ESRI Shape File. It should add the file to your project in addition to saving the new file on your designated folder.
8. Now, you can get rid of the CSV file displayed in your table of contents by right clicking and selecting **Remove Layer**

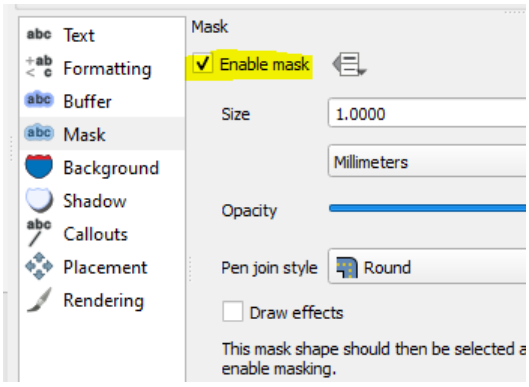


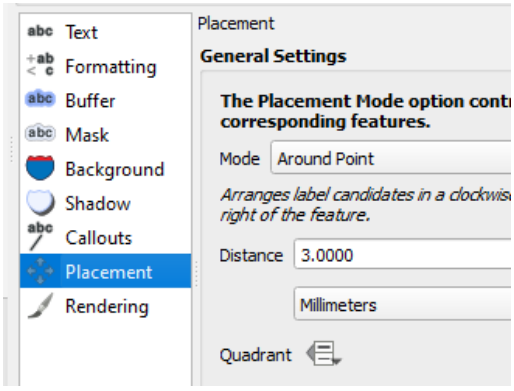
9. Next, we will change the symbol and add name of the city as label. Click on layer properties (right click on the layer name and select **Properties** in the menu that appears).
10. Click on **Symbology** tab. We will use **Single Symbol** and select the **star** as the symbol to represent the cities. Change the size to 5.0 mm and click **Apply.**



11. To add the names of the cities, click on **Labels** tab on the left under **Layer Properties** window.
12. Click the top box and select **Show Labels for the Layer**
13. Under **Label with**, select **name** as the filed containing the names of the cities.
14. Under **buffer**, check the box to draw a white **buffer** around the label. This increases label visibility by adding a think white boundary around the label text.
15. Under **Placement,** select **Around point** option and enter 3 mm as the **Distance** where the label will be placed

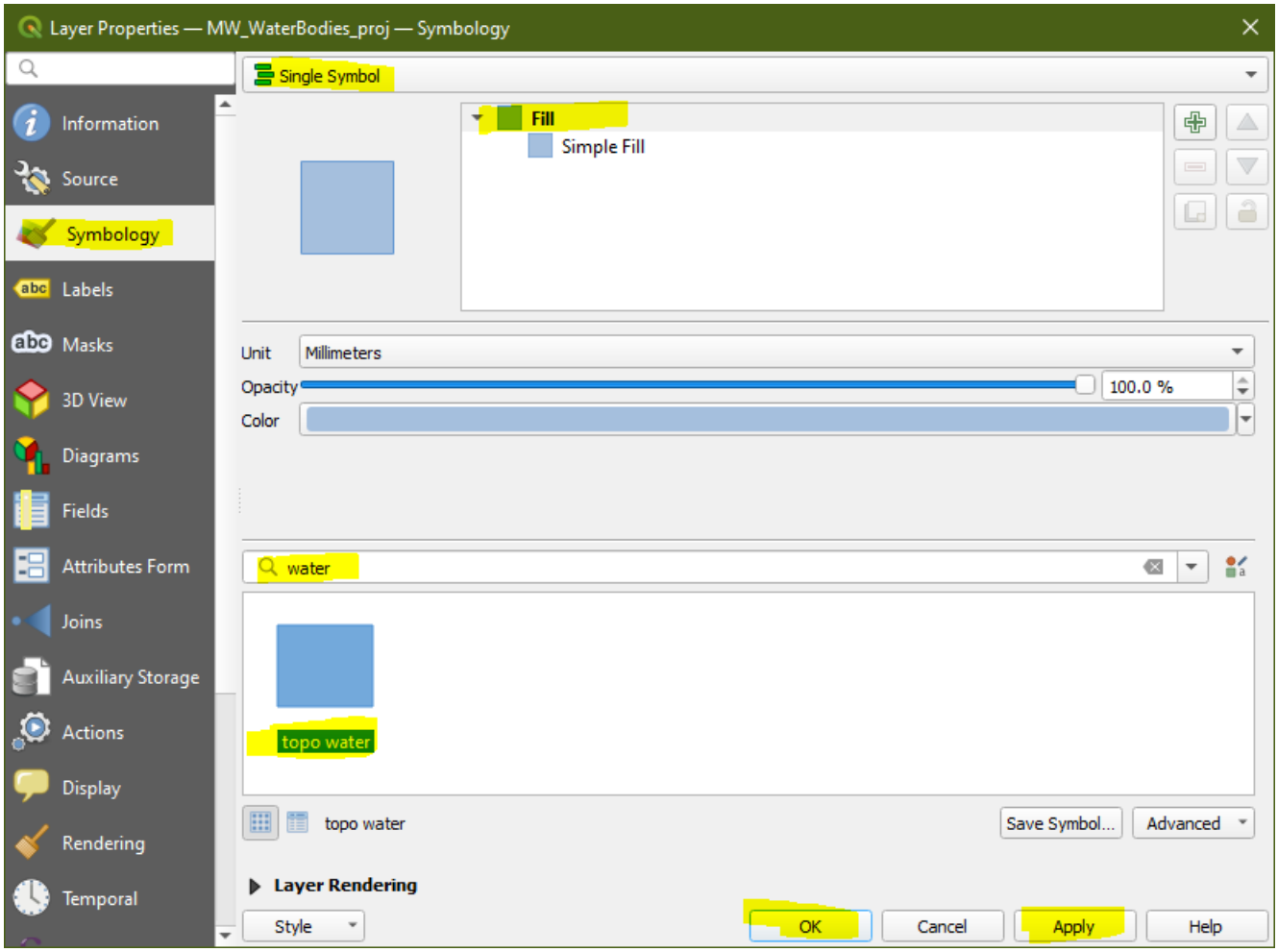




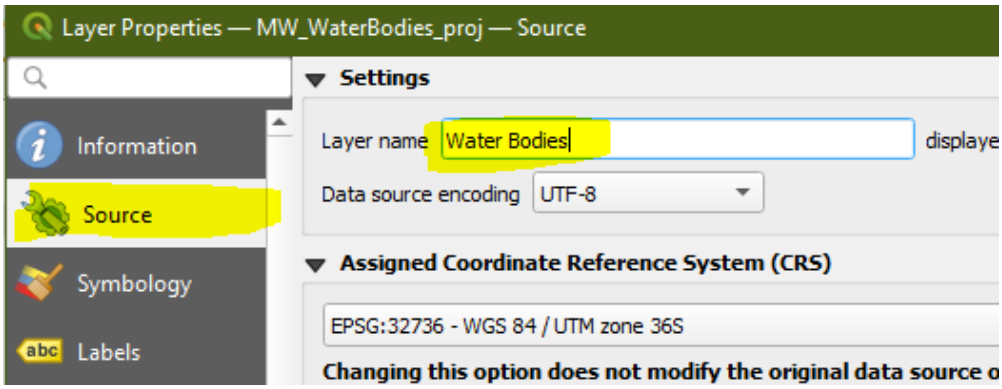


16. Click **Apply** and check the map to ensure it looks good and then click OK and close the window.

17. Now, let's make change to MW_WaterBodies_proj layer to assign **blue** color so they look nice on the map. We will also change the name to make it what it is - "**Water Bodies"**
18. Right click on **MW_WaterBodies_Proj** layer in your table of contents and select **Properties**.
19. In the layer properties window, you can search for **topo water** color by typing water in the search box as shown below



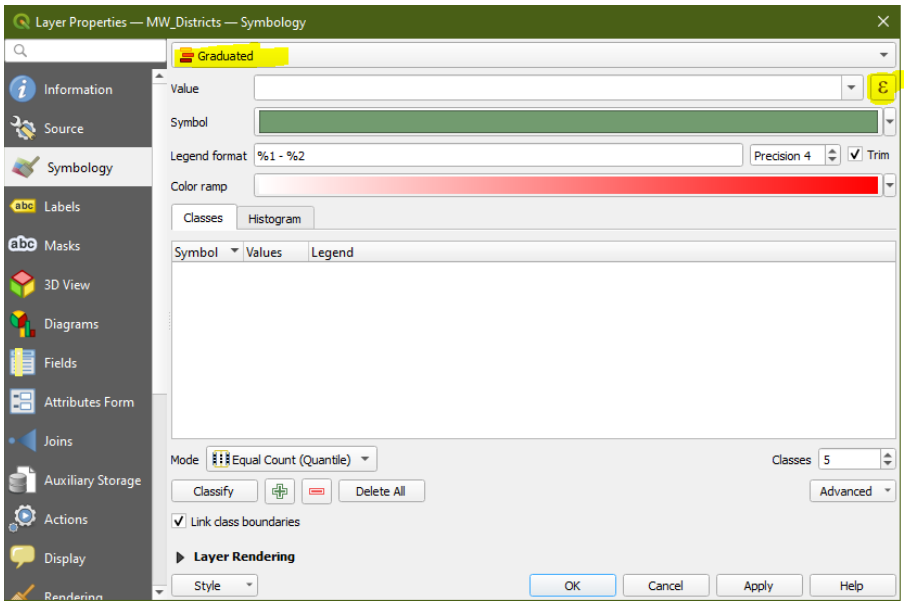
20. Click **Apply** but don't close the **Layer Properties** window.
21. Now, switch to **Source** tab on the **Layer Properties** window and change the layer name to **Water Bodies.**



22. By repeating the steps 17 to 20, change the Africa_Countries layer color black outline color without any fill color. So, we should only see the outlines of the countries. Tip: instead of selecting **Fill** color, you should **Simple Fill** under symbology. Then do the same to other appropriate layers.
23. Using step 21 instruction, rename all remaining layers to make them appropriate and professional. Keep them short (1-3 words at the most). Alternately, you can rename a layer by **Right Clicking → Rename.** 😊
24. Now all layers are ready to be taken to the map shop 😉 – our layout manager!

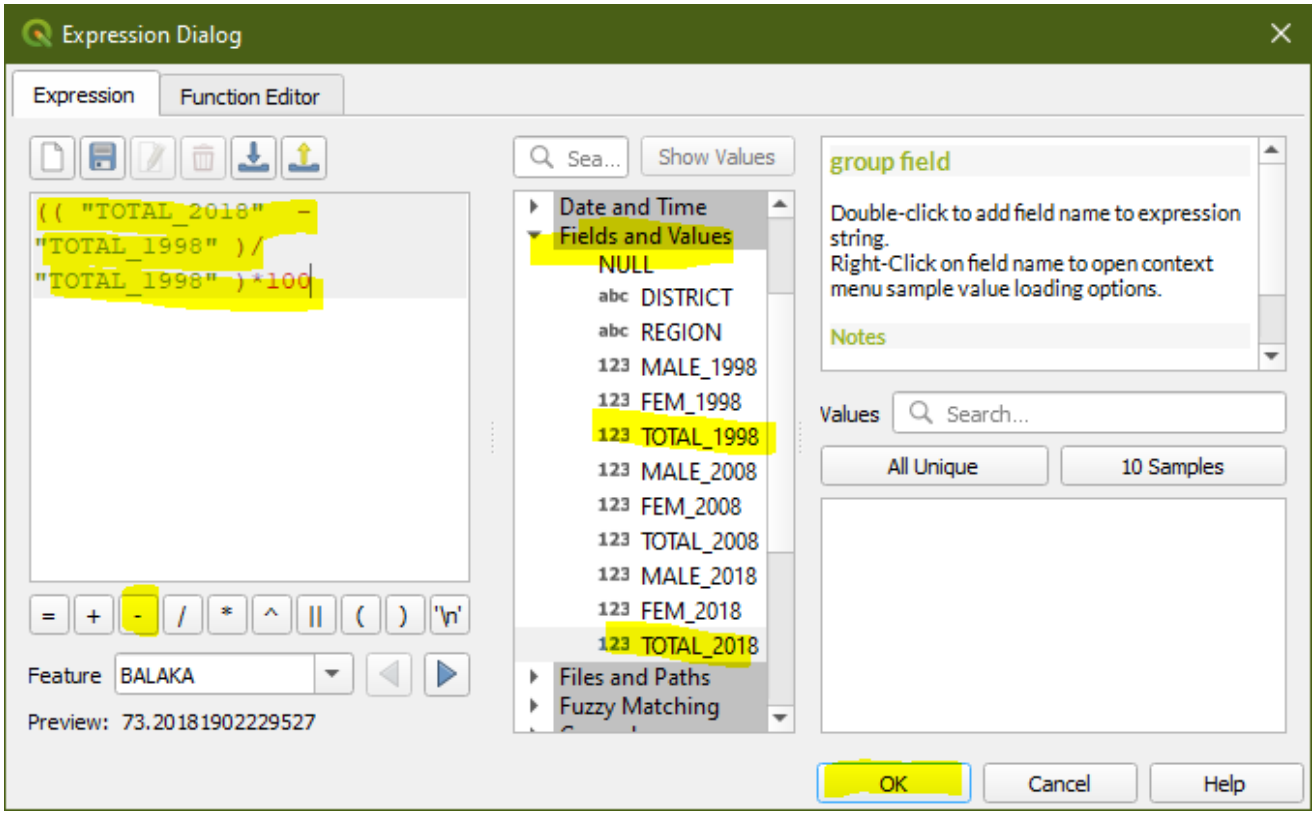
Make a Map of Population Change from 1998 to 2018 in Malawi Districts

1. You already know how to map one of the fields in the layer and make a map like you did on day 2. However, it is possible to map the results of a complex calculation performed within the layer properties using simple SQL query. In this lab, we are going to calculate population change in Malawi from 1998 to 2018.
2. Right click on Malawi Districts layer and select **Properties**.
3. In the top field under properties, select **Graduated.** Instead of picking one of the existing fields to map, we are going to use existing fields, and calculate percentage population change between 1998 and 2018. Click on the **Expression Dialog** button  to the right of the **Value** field.

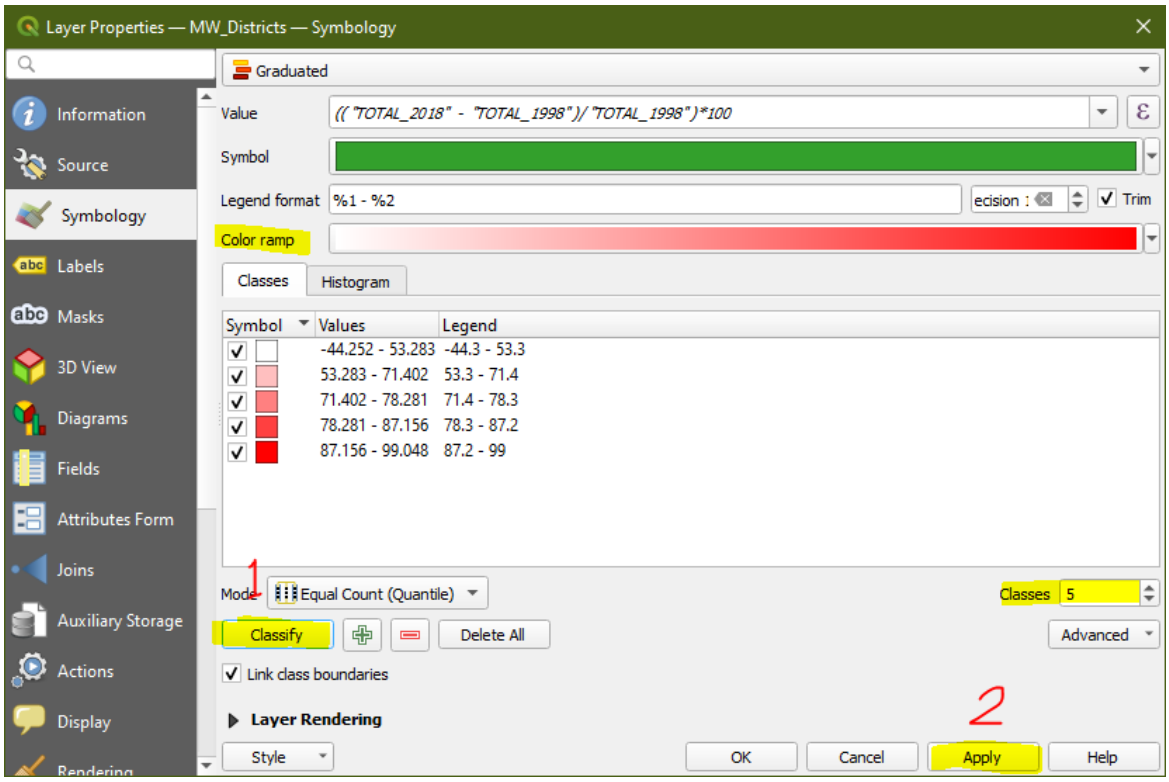


4. In the Expression dialog, copy and paste this expression:

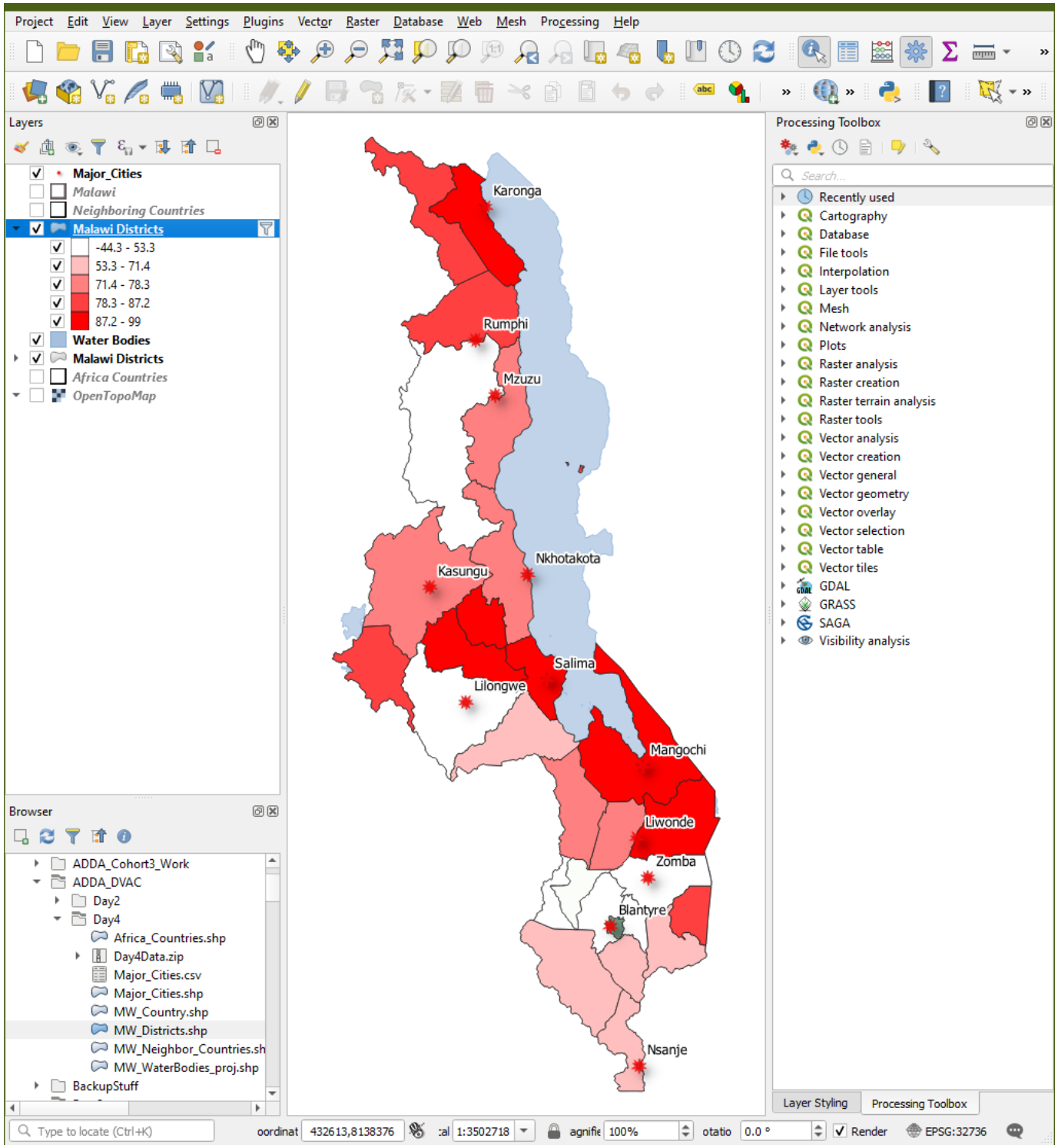
(("TOTAL_2018" - "TOTAL_1998")/ "TOTAL_1998")*100



5. **Click OK** to close the dialog



6. This should produce a map that looks like the one below:



7. You can see interesting patterns emerging here. Some districts have lost population whereas some have increased tremendously. One important observation you should make note of is how the classes are broken down in this classification. All districts with -44.3 to + 53.3 % change in population have been grouped together in one class. This is not quite useful. You can explore further to find a good way to classify the data so that districts with reduction in population are shown distinctly compared to those that have experienced positive growth.

Part 1 Ends. We will continue in Part 2 where we will make the map! Nice work so far!