Spatial Data Visualisation: Advanced Techniques In QGIS

Session 2

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WELCOME TO SESSION 2

In this session we will be looking at the following ideas:

- Making Choropleth Maps from points
- Making your proportional symbol map 3D

MAKING CHOROPLETH MAPS FROM POINTS

Sometimes in order to summarise or anonymise your data it is necessary to aggregate point data into polygons. The polygons have a count of the number of points within them that then let you visualise the data.

Start a new map and change the CRS to British National Grid again:

- Click on the bit at the bottom right of the map, where it says ⊕ EPSG: xxxx
- In the filter at the top of the dialog box that opens, type 27700
- In the predefined Coordinate Reference Systems box below select British National Grid

CREATING A DISTRICT CHOROPLETH:

In this exercise we are going to use the GIS to count the number of listed buildings in each natural neighbourhood of Edinburgh and then style them based on the new data. Both data sets come from Edinburgh Council:
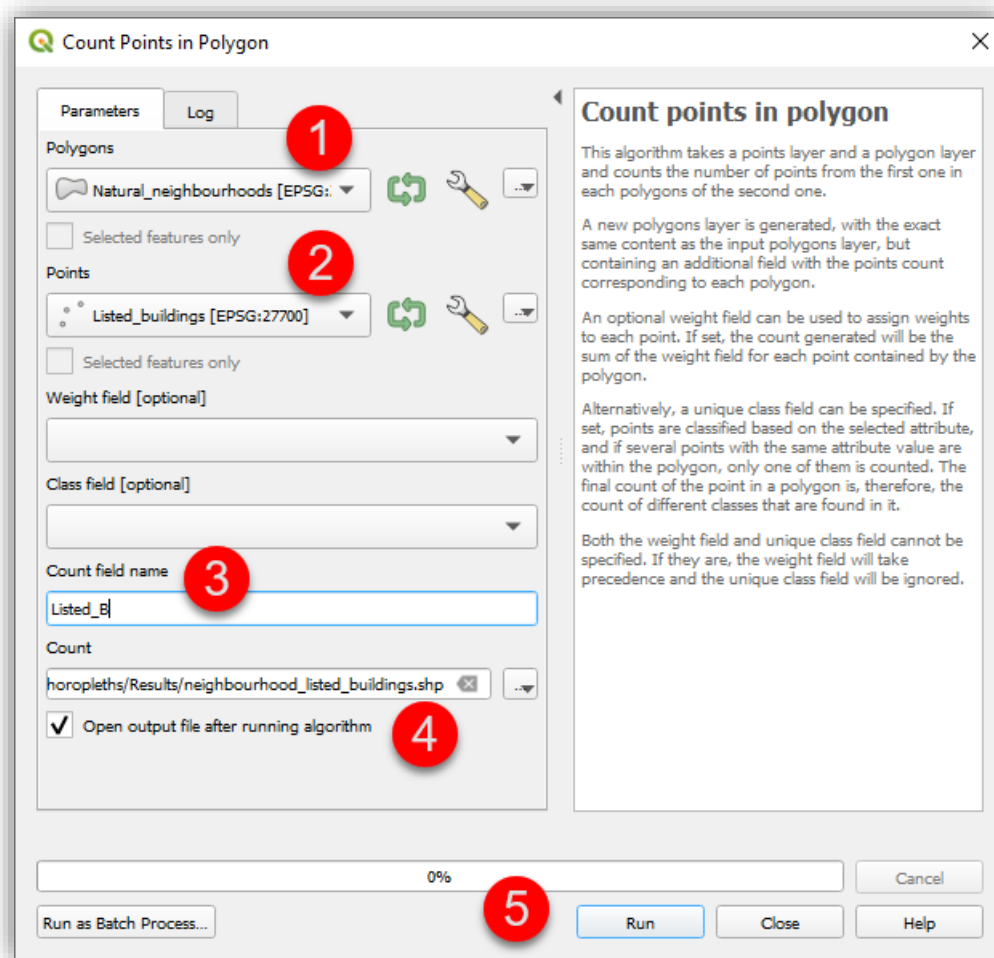
https://data.edinburghcouncilmaps.info/search

- Add the **listed_buildings.shp** dataset.
- Add the **natural_neighbourhoods.shp** dataset.

In the **Processing Toolbox**, search for **count** and select the **Count points in polygon option** from the **Vector analysis** section.

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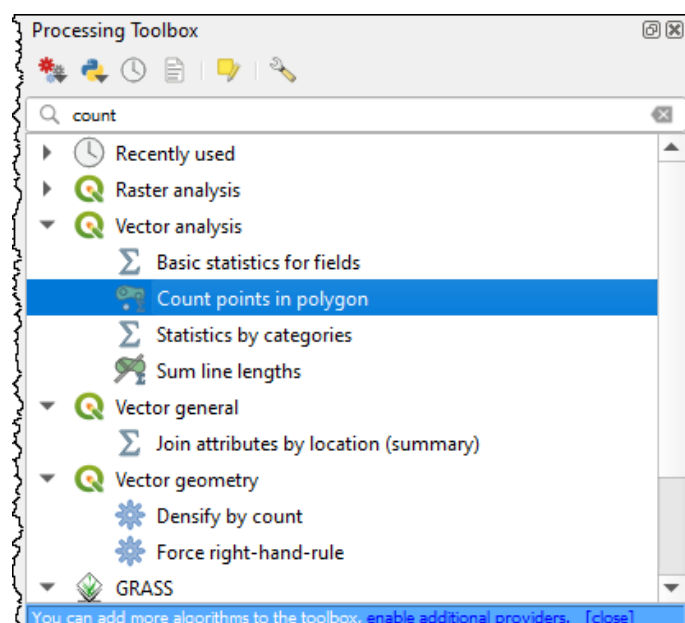
Use the following settings in the dialogue box that opens:

1. Set the **Polygons** to be the **natural_neighbourhoods**
2. Set the **Points** to be **listed_buildings**
3. Set the **Count field name** to be **Listed_B**
4. Save the resulting file as a shapefile called **neighbourhood_listed_buildings**
5. Click **Run**
6. Click **Close**

When you open the attribute table of this new data set you will see that the Listed_B column has been added to the table.

You can now use this column to style the data:

- Select the **neighbourhood_listed_buildings** layer in the **Layer Styling** panel on the right of the screen
- Change **Single symbol** to **Graduated**
- Change the **value** to be **Listed_B**
- Choose a **colour Ramp**
- Change the **Mode** to be **Natural Breaks**

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- Set the number of classes to be **5**
- Click **Classify**
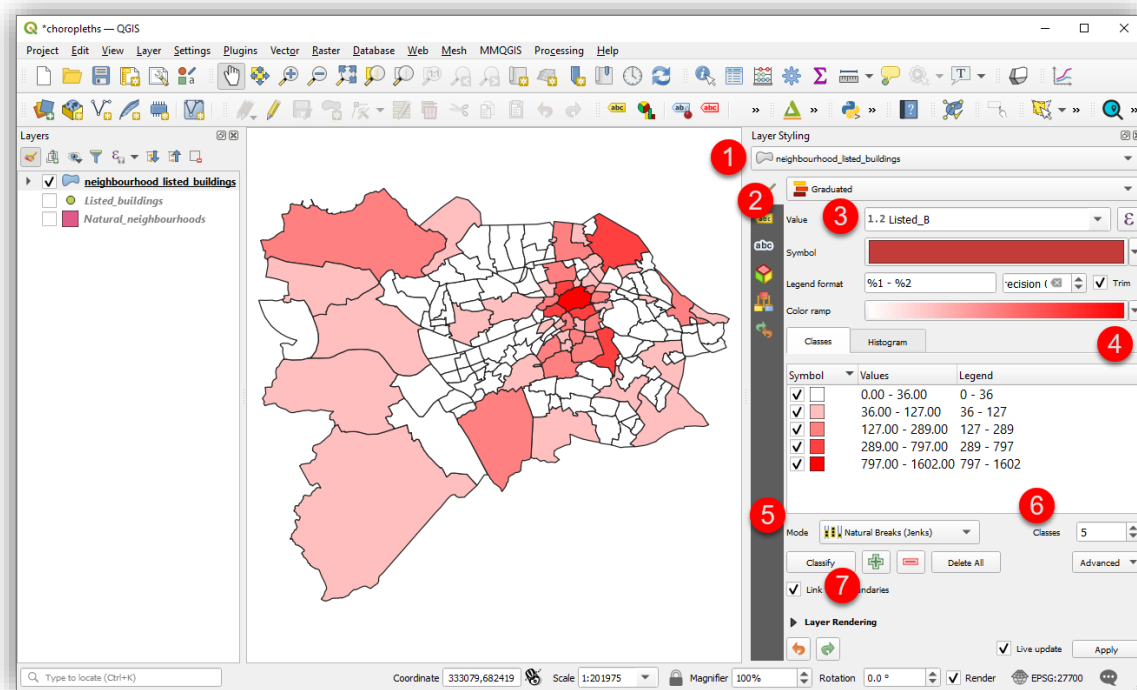
This map looks good, but there is something we have forgotten to do. Currently the colours represent the number of listed buildings in each neighbourhood, but it doesn't take into account the size of the neighbourhood. Is the number high because there are a lot of buildings or because the area is large?

We can easily normalise this dataset by area but you could also use the total number of buildings if you had this data to hand. To normalise the data by area we need to click on the E button next to where we set the value and set up a formula:
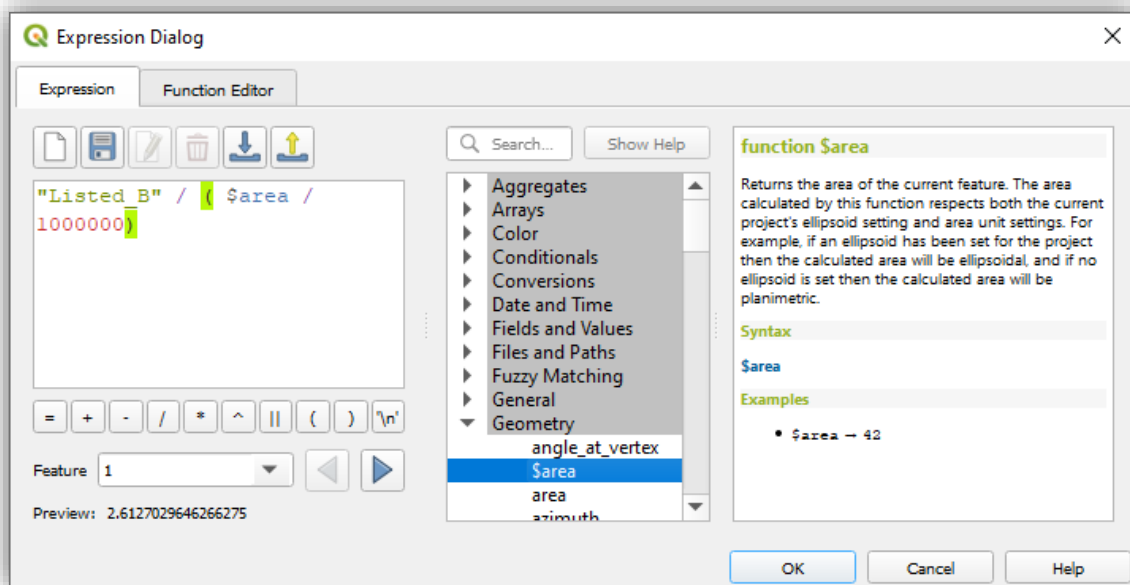
- Click on the button at the end of the Value:
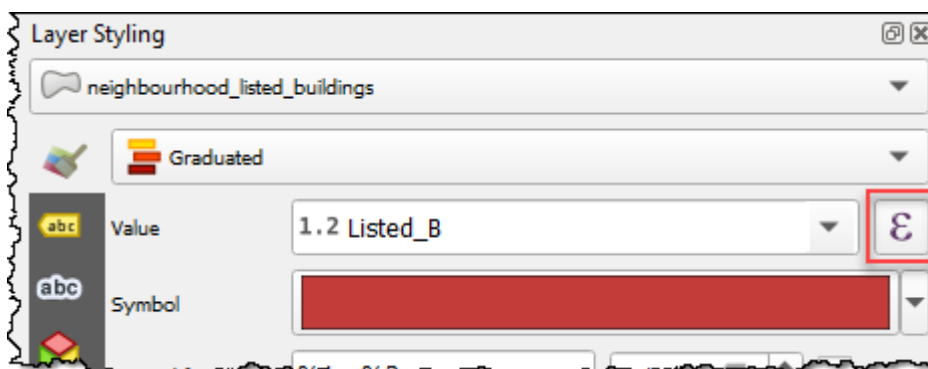

- Enter this formula in the Expression dialog:

```
"Listed_B" / ($area / 1000000)
```

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This converts the area into square kilometres before dividing the number of listed buildings by it. The resulting field is the number of Listed buildings per square kilometre.

- Click **Classify** again to use the new calculated value.

The resulting map shows an increased concentration in the centre of Edinburgh:

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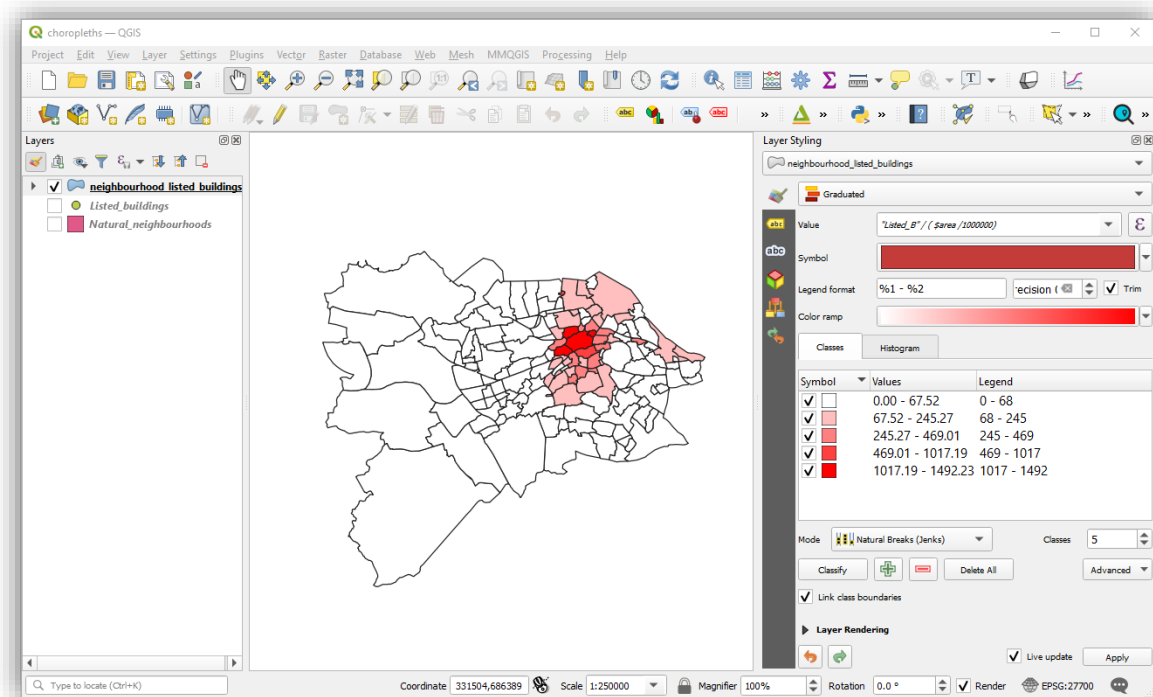
CREATING A GRID CHOROPLETH:

Similar to before we are going to count the number of points in polygons but this time rather than using the natural neighbourhoods we are going to use a regular grid we have created ourselves.

- First save the map as choropleths.qgz
- Next switch off the polygon layers just leaving the points switched on
- Right click on the Listed Buildings points layer and choose the top option of **Zoom to layer**
- The points will now all be shown on the map.
- You can zoom out just a little further by rounding up the scale at the bottom of the map
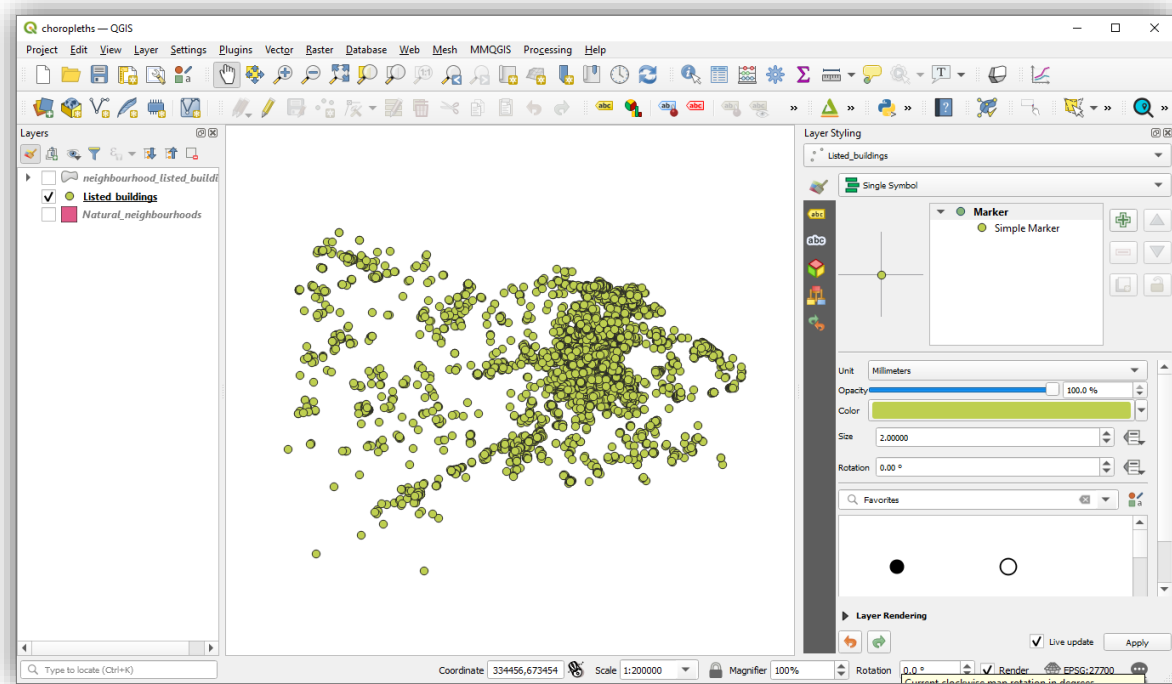

- In the top bar click on the MMQGIS button then Create → Create Grid Layer

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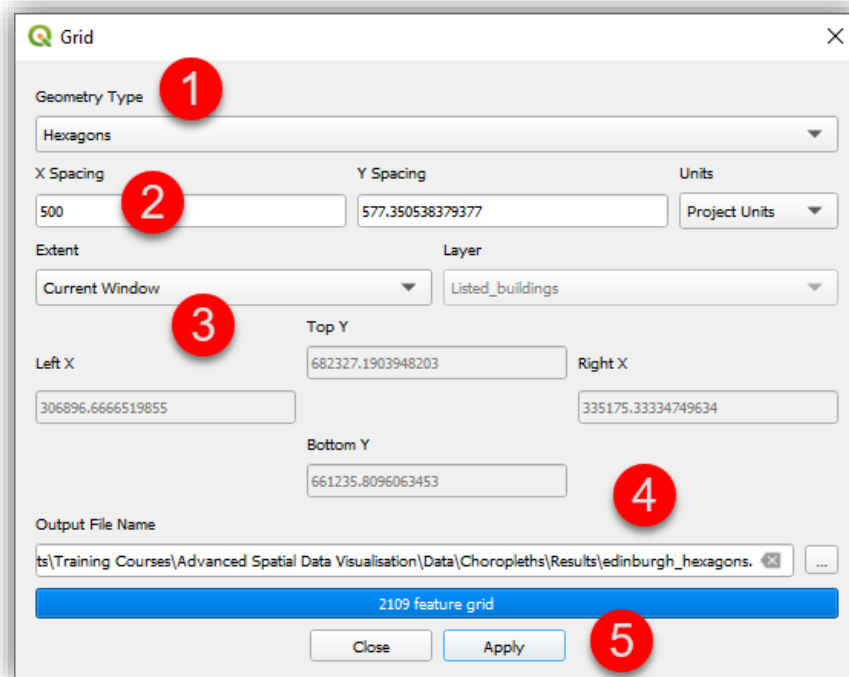
- Change the **Geometry Type** to **Hexagons**
- Set the **X spacing** to be **500 metres** (the **Project Units**)
- Set **Output File Name** to be **Edinburgh_hexagons** and save it in a local folder
- Click **Apply**

You should now have a hexagon surface covering the map window, which we can now use like the natural neighbourhoods. As before we are going to use the gis to count the number of points in each hexagon:

In the **Processing Toolbox**, search for **count** and select the **Count points in polygon option** from the **Vector analysis** section.

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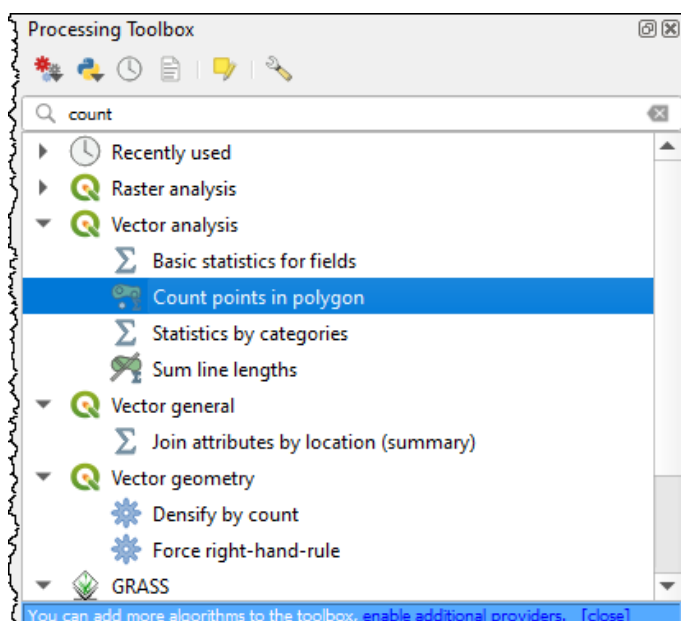
Use the following settings in the dialogue box that opens:

1. Set the **Polygons** to be the **edinburgh_hexagons**
2. Set the **Points** to be **listed_buildings**
3. Set the **Count field name** to be **Listed_B**
4. Use dropdown at the end of the Count row to select **Save to File.**
5. Save the resulting file as a shapefile called **hex_listed_buildings**
6. Click **Run**
7. Click **Close**

This time we can go ahead and just style the hexagons without any need to normalise by area as we have accounted for this with each hexagon being the same size.

- Select the **hex_listed_buildings** layer in the **Layer Styling** panel on the right of the screen
- Change **Single symbol** to **Graduated**

Time for you to experiment:

1. Have a look at how you can change the classifications manually.
2. See how you can make the hexagons that have no listed buildings invisible.

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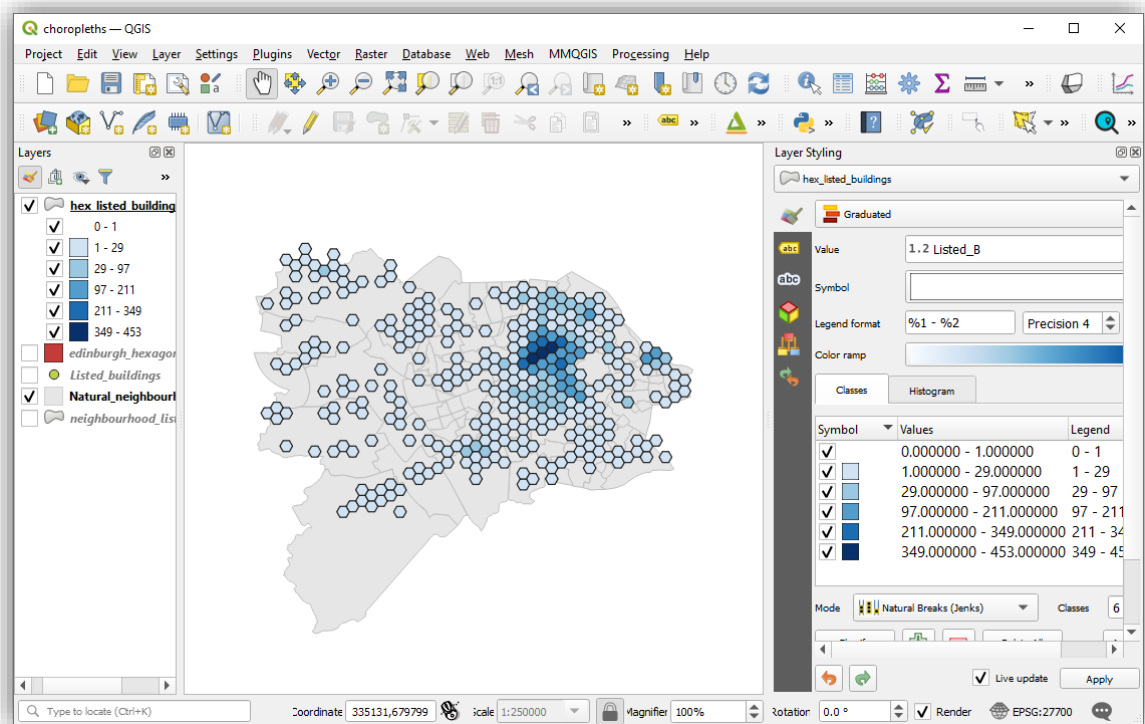
MAKING YOUR PROPORTIONAL SYMBOL MAP 3D

3D Prism maps are an Ideal way to represent 2 different attributes of a feature at the same time. In this example we are going to use the same cities data but vary the diameter of the points by the area of the city and use the 3D dimension to represent the population. We are going to make a map of Australia this time.

- Open the **Proportional Symbol Map** we saved in Session 1.
- In the style panel open the **data defined override** for the …copy data and go back to the **Size assistant.**
1. Change the **POP_MAX** to be **MAX_AREAKM.**
2. Change the **Size** to be **2** to **15.**
3. Change the **Values** to be **0** to **1554** (the largest area of a city in Australia, Melbourne)
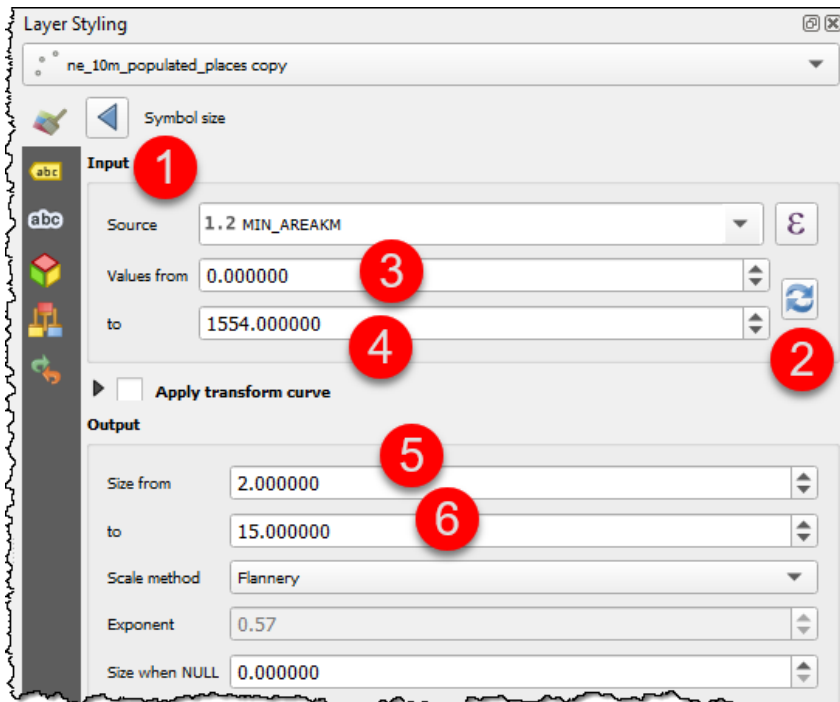
- Before we go back to the map change the outline to be transparent so there aren't a lot of white circles on the map.

Zoom and pan to Australia, try and get just Australia on the map, it should look a little like this:

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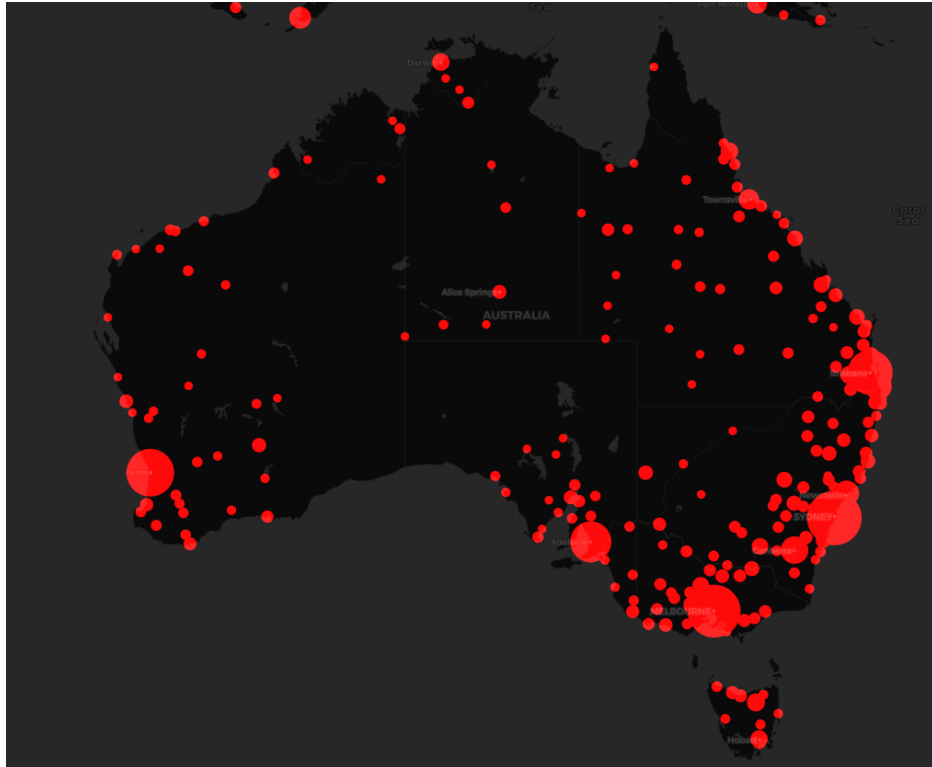
ADDING SOME DRAW EFFECTS.

To add a little extra impact to the map we can add some draw effects. As the symbols overlap and we don't want it to get too busy we need to add the effect to the layer not the individual features.

- Switch on the Draw Effects by checking the box in the Layer Styling panel and then open them by clicking on the Yellow Star:

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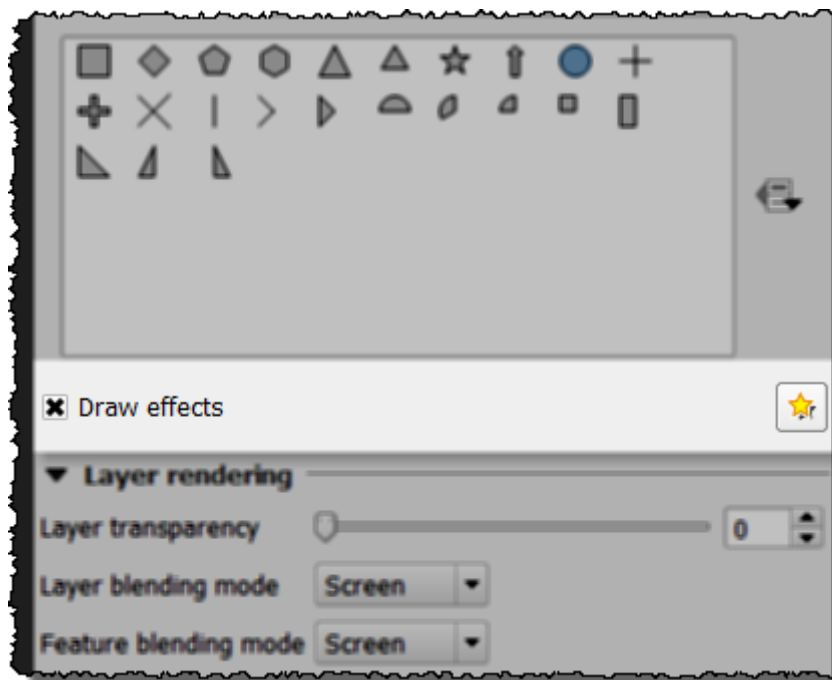
- Check the Outer Glow box.
- Click on the Outer Glow to open up the options:
- Set the **Spread** to be **2**
- Set the **Blur radius** to be **2**
- Set the **Opacity** to be **50%**
- Set the **Single color** to be **Red**
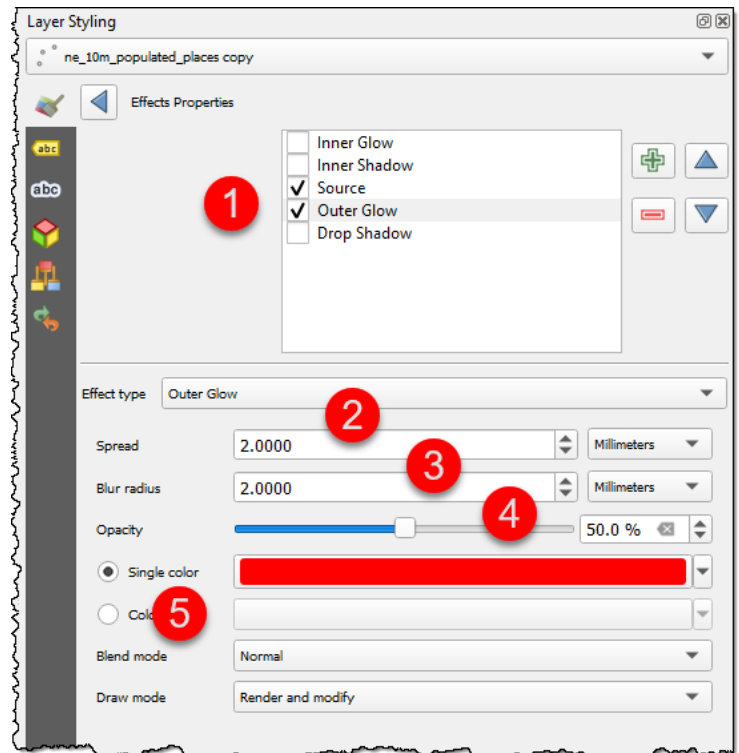
The map now has a bit more character, and we can get to work on adding the 3rd dimension.

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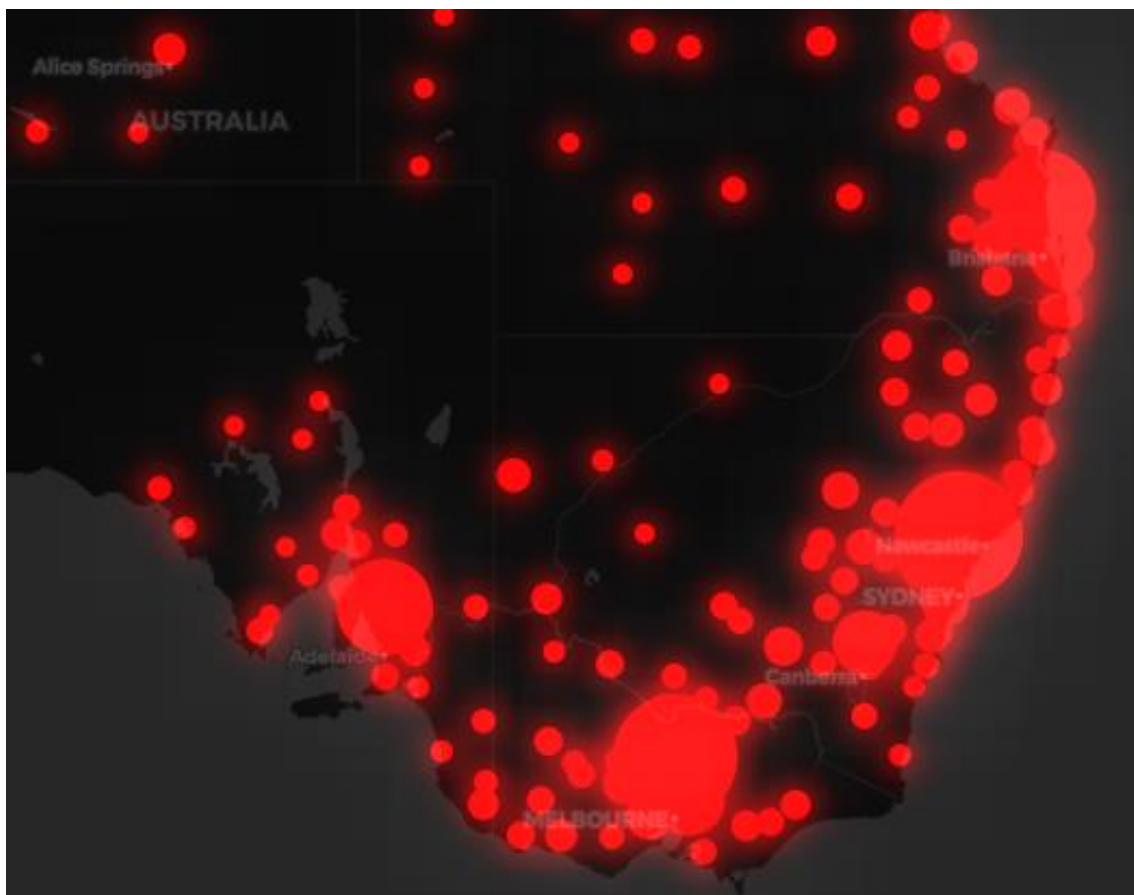
QGIS has the ability to create 3D maps however we are going to use a plugin that is great for making 3D visualisations that are more portable and easier to share, the Qgis2threejs plugin. The plugin can be found in the web menu in the top bar of QGIS:
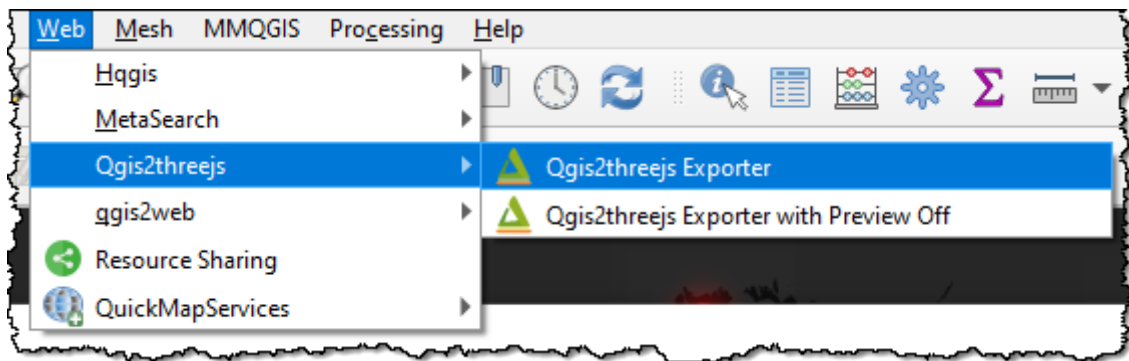
There is a whole raft of options to look at with this plugin as it can be used not only for Prism Maps but for accurate 3D landscape models too. We'll run through the changes needed to make a Prism Map, the rest of the parameters can be left as the default settings.

Well start at the Scene option in the top bar:

SCENE SETTINGS

The only thing to change here is the **Background** colour. The default is **sky** which works well for landscapes, but I have set this to **black** which works better for the colours of this map.

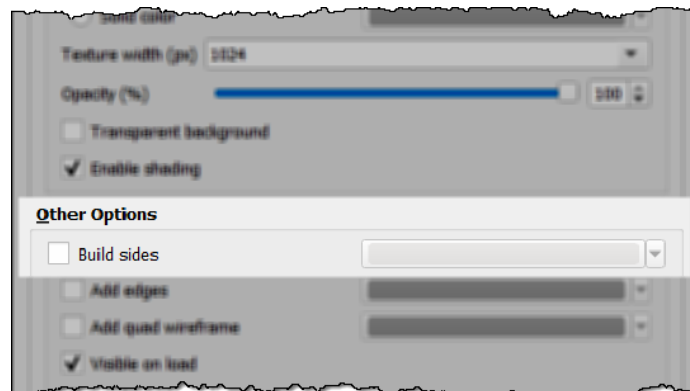Written and Presented by Tom Armitage.

DEM

First Tick the Flat Plane option for the DEM and then right click on the text and open the properties:
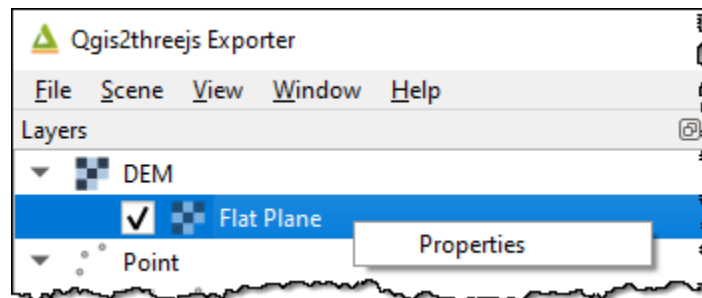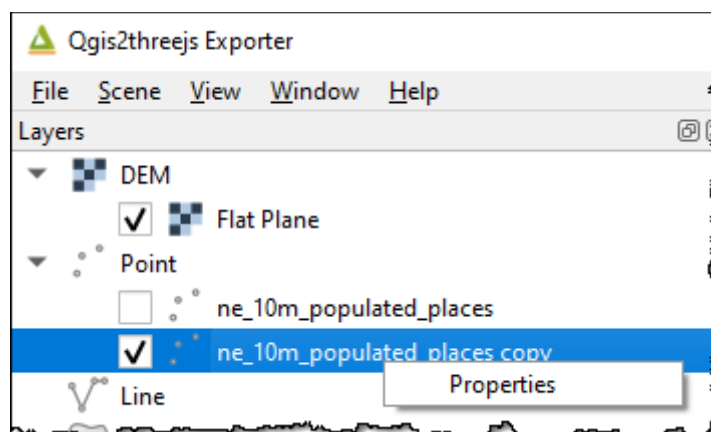

All we are going to change in here is to turn off build sides. Again, this looks good on the landscape models, but we are building a visualisation.

POINT

Now we are going to add in the cities, so we need to tick the box for the **ne_10m_populated_places_copy** data and then **right click** to open the **properties**:

There are a great many things to change on this list as we turn the city points into 3d Cylinders with the radius representing the city area and the height representing the population.

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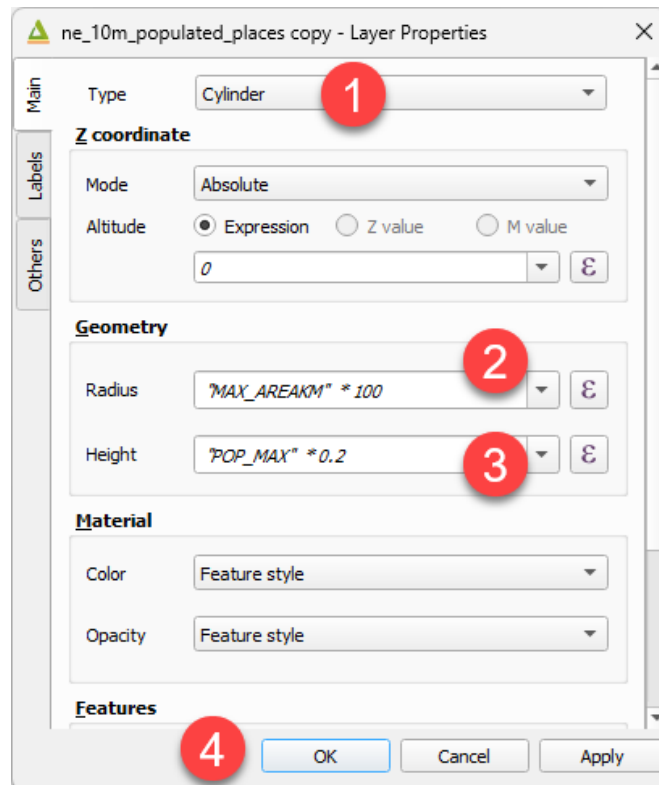
1. Set the **Type** to Cylinder

2. Set the **Radius** using the [ε] button to be **"MAX_AREAKM"** with a **multiplier** of **100.**

You can use the **Field and Values** box in the middle column of the Expression Dialog to save typing.

3. As above, set the **Height** to be **"POP_MAX"** with a **multiplier** of **0.2**

4. Click **OK**

We should now have a fully interactive map in the preview window, but it is very busy with the glowing cities on the base map as well as the cylinders.
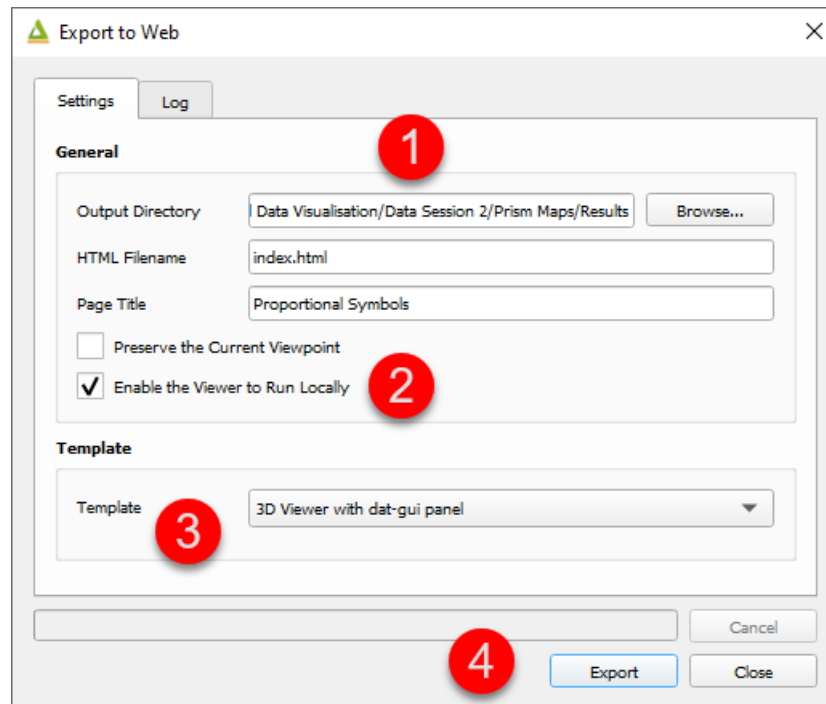
If you switch these off in the main QGIS window behind the preview will automatically update.
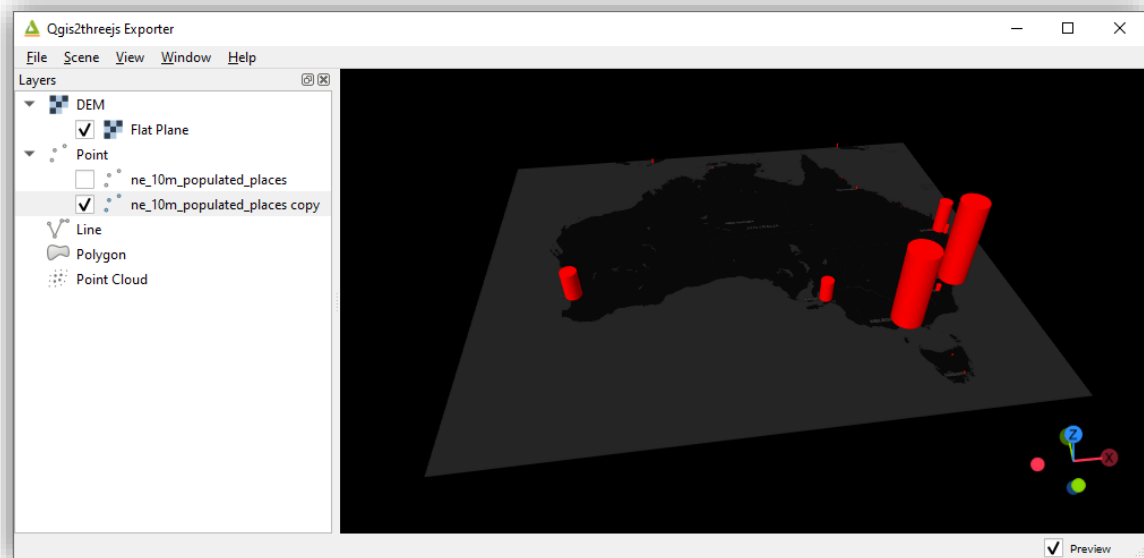
We are now ready to export the map to a self-contained web interface. These can easily be added to a website for public viewing.

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EXPORT

Click on **File** at the top left of the Qgis2threejs Exporter, and select **Export to web…**

1. Select a location for the **Output Directory** that you can easily get to for saving your web interface.
2. Check the box to **Enable the Viewer to Run Locally**.
3. Change the template to **3D Viewer with dat-gui panel**. This will allow us to change things like the opacity of the cylinders in the interface.
4. Click **Export**

Close the exporter once it has finished and then open up your file explorer, navigate to where you saved the Output Directory, **Double click** on the **Index.html** file and it will open in your default Web Browser.

The map should automatically open in your default web browser complete with the controls to navigate it in 3D.

- Use the **mouse wheel** to **zoom in and out.**
- Click and **hold the left mouse button** and move it to **shift your point of view** of the map.
- Click and **hold the right mouse button** and move it to **shift the map** from your point of view

At the top right of the map is a layer control use it to make the cylinders semi-transparent:

- Open the **Layers** menu
- Open up the …**copy** section
- Set the **opacity** to be **50%**

The map will now look like the one overleaf.

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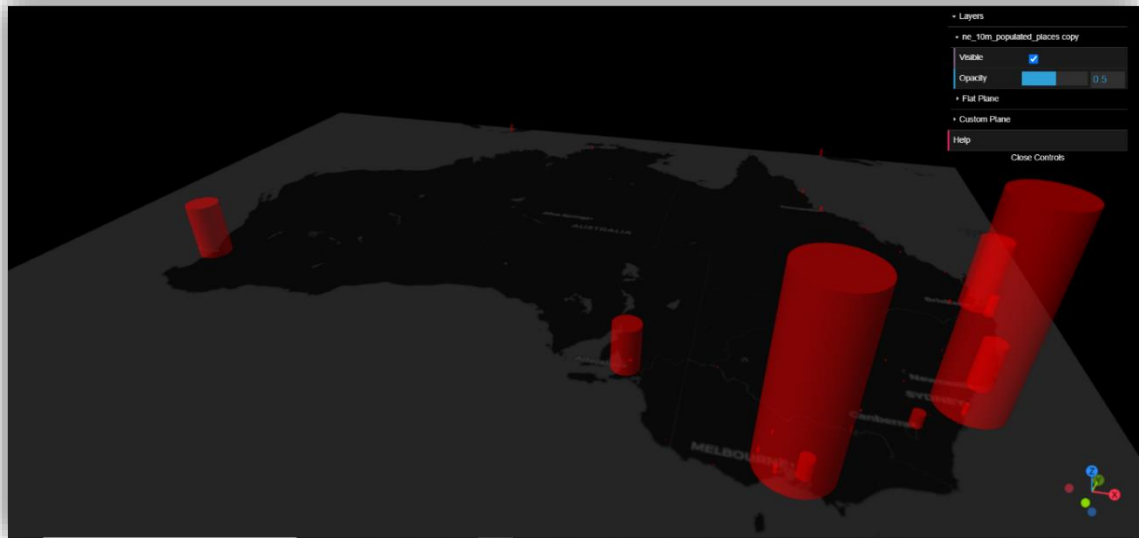
The height of the columns represents area, and the diameter relates to the footprint of the city.

You should be able to tell that Sydney is a more densely populated than Melbourne as its column is taller and narrower.

Save your map and we are finished for this session.

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Congratulations!

Well done for working through these exercises, we look forward to seeing you in the next session.

CONTACT DETAILS:

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DATA SOURCES:

NATURAL EARTH LAND OUTLINES AND POPULATED PLACES:
http://www.naturalearthdata.com/downloads/

EDINBURGH LISTED BUILDINGS:
https://data.edinburghcouncilmaps.info/search

EDINBURGH NATURAL NEIGHBOURHOODS
https://data.edinburghcouncilmaps.info/search

VECTORMAP DISTRICT BUILDINGS
https://osdatahub.os.uk/downloads/open/VectorMapDistrict

LONDON BOROUGHS ELECTION DATA
OS BoundaryLine:
https://www.ordnancesurvey.co.uk/opendatadownload/products.html#BDLINE

FOR HIGHER EDUCATION:
http://digimap.edina.ac.uk/

ELECTION RESULTS:
https://www.electoralcommission.org.uk/

TRAIN DATA FOR FINLAND:
https://github.com/tjukanovt/tjukanovt.github.io/blob/master/data2share/trainGPS.csv

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OTHER RECOMMENDED PLUGINS:

QGIS2WEB:
Converts your QGIS Map into a webmap in either leaflet OpenLayers or Mapbox

DATA PLOTLY:
Allows you to put interactive charts alongside your maps! Highly recommended for data visualisation.

TERRAIN SHADING:
Gives you extra power for creating nice hillshades for your maps, including open sky and ambient occlusion… essentially it makes them more realistic.

QGIS RESOURCE SHARING:
Access to styling and SVG point markers created by other people.

OTHER RESOURCES AND PEOPLE:
Highly recommended blog, and YouTube beautiful data visualisations and maps in QGIS:

http://www.statsmapsnpix.com/

https://www.youtube.com/@automaticknowledge/videos

TOPI TJUKANOV:
Great blog for really pushing what is capable with QGIS, some amazing styles and resources too:

https://tjukanov.org/

KLAS KARLSSON:
More traditional analysis but again more styles to download and reuse and he explains things really well:

http://geosupportsystem.se/

https://www.youtube.com/channel/UCxs7cfMwzgGZhtUuwhny4-Q

UJAVAL GHANDI:
A huge amount of information, some out of date but he is very active so it usually gets updated. He has covered a huge range of functionality in QGIS:

https://www.qgistutorials.com/en/

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