

## GeoDataViz Workshop

### *Thematic mapping techniques*

In this workshop we are going to explore various thematic mapping techniques. We will be using QGIS and Mapbox Studio to do this. By the end of it we will have created 5 different maps, all using the same data source.

The data that we're using is about the greenspaces in Greater London. We have processed [OS Open Greenspace](#) and created a centre point for each greenspace. We are also using some data from Boundary-Line and OS VectorMap District.

Let's get started :)

### Part one: QGIS

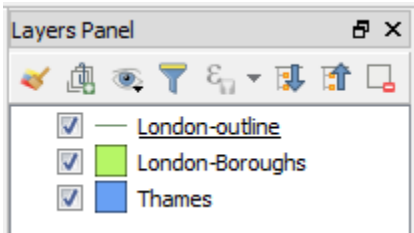
All the data for this workshop is held in the **Data** folder within this repository. Make sure it is downloaded onto your machine:

1. Open QGIS
2. First, we're going to add in some contextual layers.  
Add these 3 shapefiles (the files ending in .shp) from the 'Data' folder:
  - 'Thames.shp'
  - 'London-Boroughs.shp'
  - 'London-outline.shp'

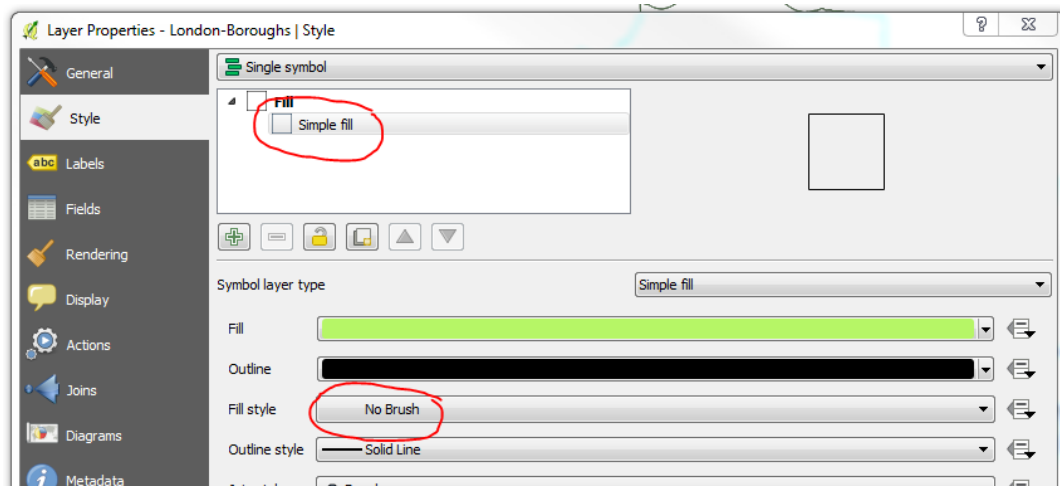
You can do this by dragging & dropping them into your QGIS window or by clicking the 'Add Vector Layer' button and browsing to the files on your machine:



3. Re-order them in the 'Layers Panel' like this:

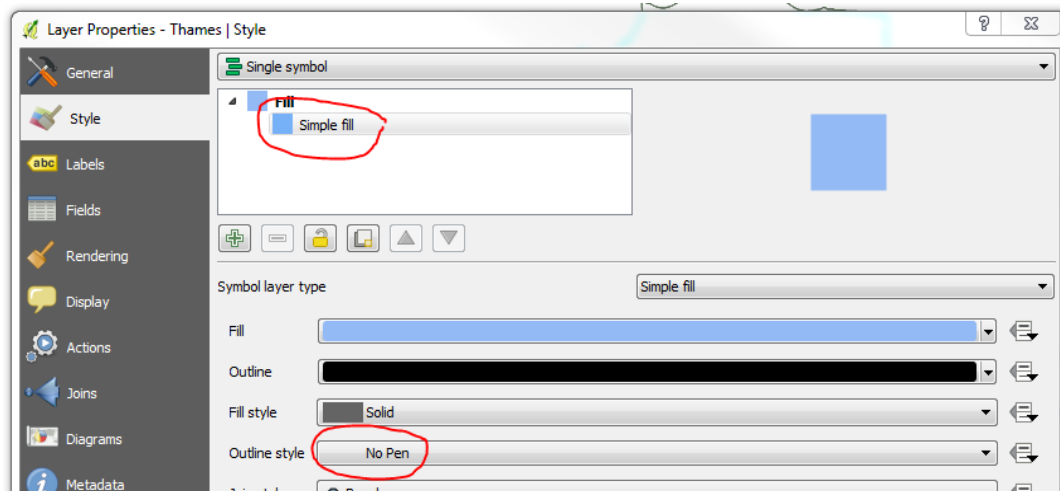


4. Now we're going to remove the fill from the Borough polygons.  
Open the 'Layer Properties' panel by double-clicking on the layer 'London-Boroughs'. Then click 'Simple fill' and change the 'Fill style' to 'No Brush', like this:



Click 'OK'.

- Now style the Thames polygon with a light blue fill and remove the outline:



Click 'OK'.

- Next, style the 'London-outline' to make it black with a width of 0.8mm.

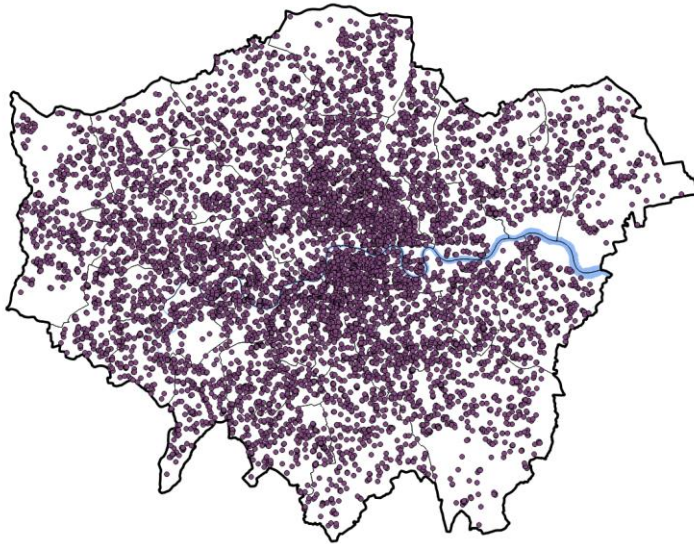
You should have your contextual map ready now and it should look something like this:



7. OK, now we're going to add in our data about the greenspaces in London.

From the 'Data' folder, add 'greenspace-within-london.shp' to your map and make sure it's at the top of the 'Layers Panel'.

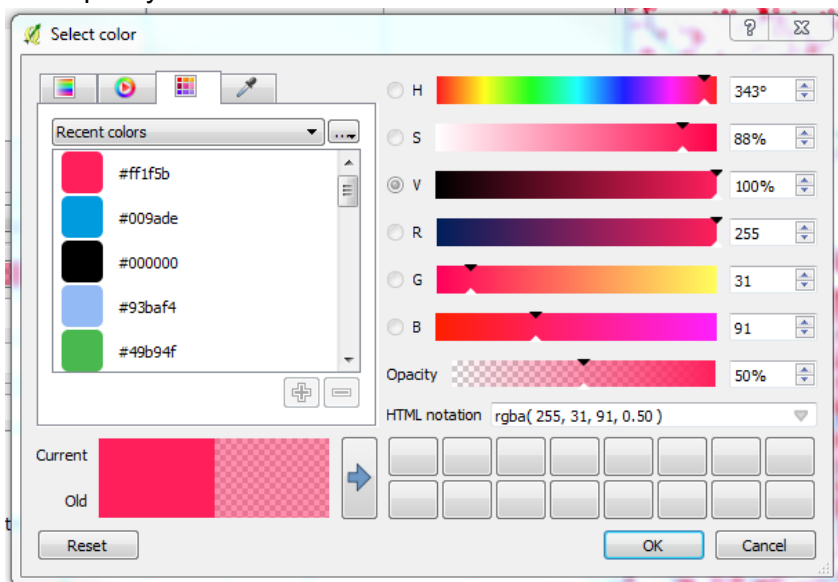
The points will be given a default style and will look something like this:



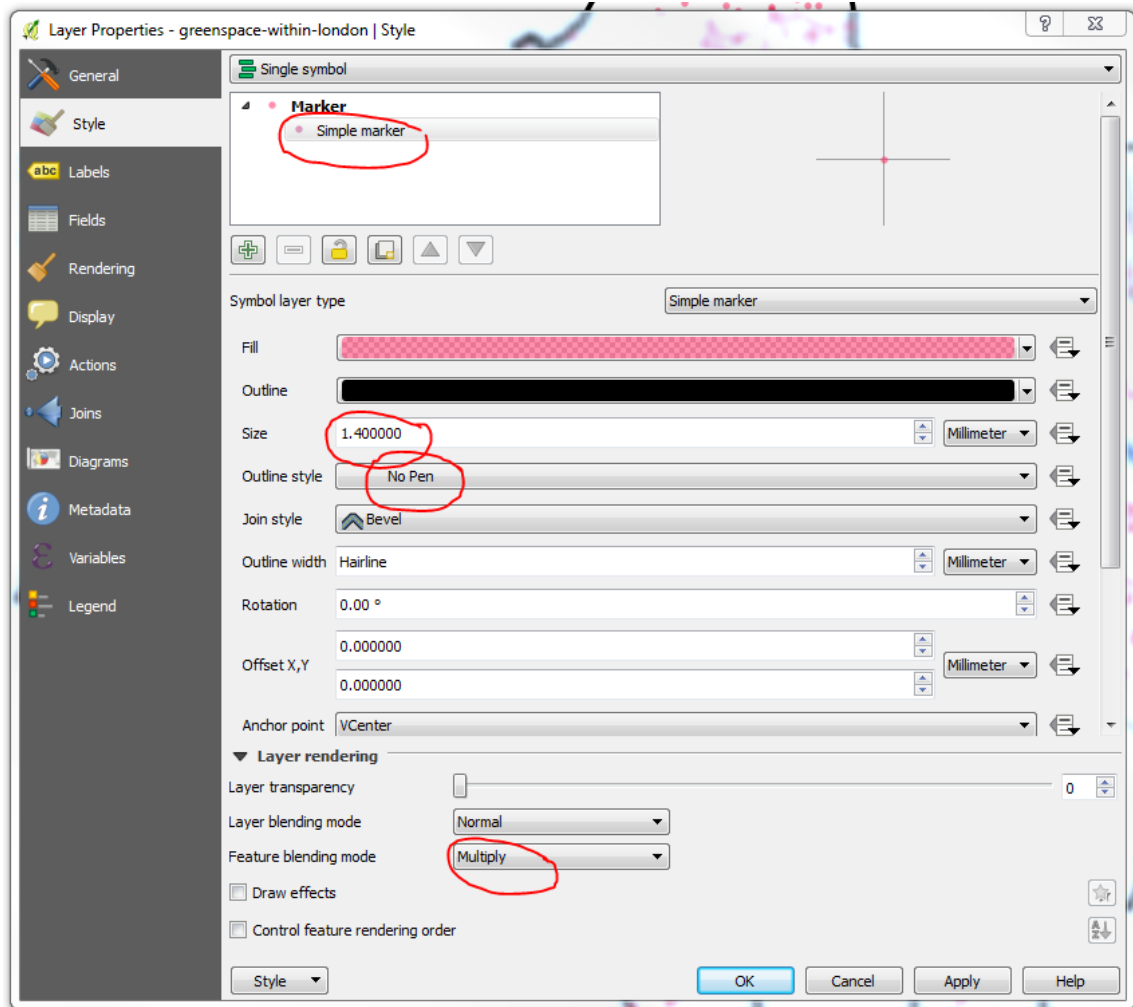
It isn't very easy to make sense of this data so we're going to style it to help improve the depiction.

8. Double-click on the layer to open up the 'Layer Properties' panel. Then click on the 'Color' to open the 'Select color' panel.

Within this panel, change the colour value (the 'HTML notation') to **#FF1F5B** and reduce the 'Opacity' to **50%**:



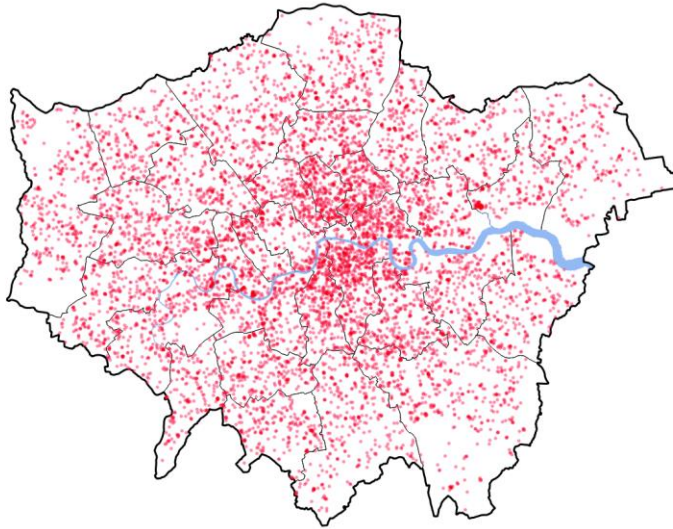
Click 'OK' and then adjust the settings in the 'Layer Properties' panel to look like this:



The 'Multiply' blend mode means that overlapping features will appear darker on the map, giving us a better idea of density. (You can read more about blend modes [here](#).)

With a couple of simple colour techniques we have created a nice **dot density map** which shows ALL the data and gives us a good picture of the density and distribution of greenspaces across Greater London.

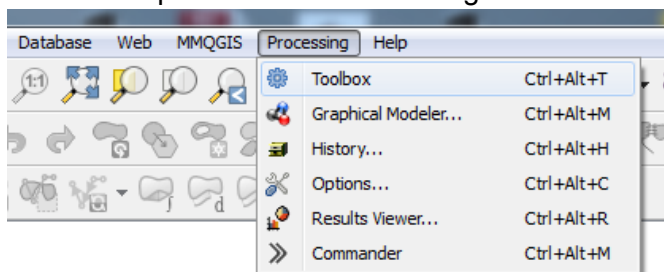
Your map should look something like this:



Next, we're going to explore some options for aggregating the data, and we'll start with a **proportional symbol map**.

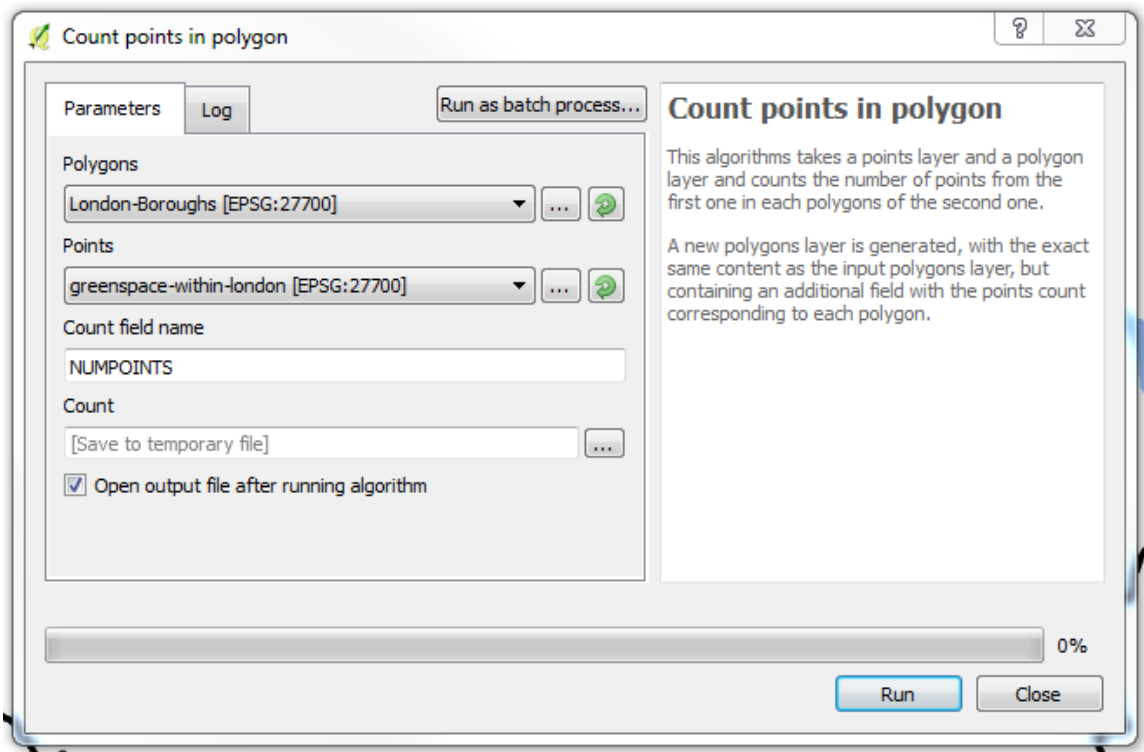
Before we do this, turn off the 'greenspace-within-london' layer by unchecking the box next to it in the 'Layers Panel'.

9. For this map we need to do some geospatial processing. We're going to count (or bin) the greenspace points into the London Borough boundaries.  
From the top menu click 'Processing' then 'Toolbox':

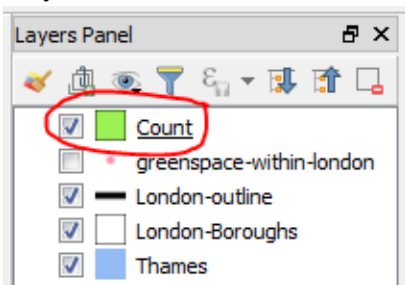


This should open up the 'Processing Toolbox' along the right-hand side of your QGIS window.

10. In the 'Processing Toolbox' search for **count points**.  
Under 'Vector analysis tools' you should see a tool called 'Count points in polygon' - double-click it to open the settings panel.
11. Change the settings so they look like this (*you can choose to save to file if you want*) and then click 'Run':



The processing should only take a few seconds, and then a new layer called 'Count' will appear in your 'Layers Panel':

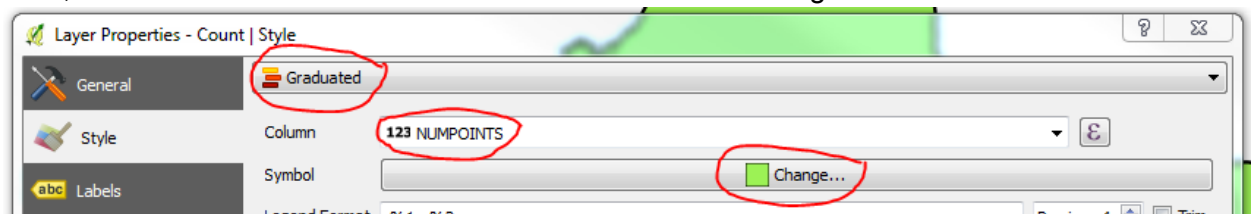


If for some reason this doesn't work, you can use 'Boroughs-with-counts.shp' from the 'Backup Data' folder.

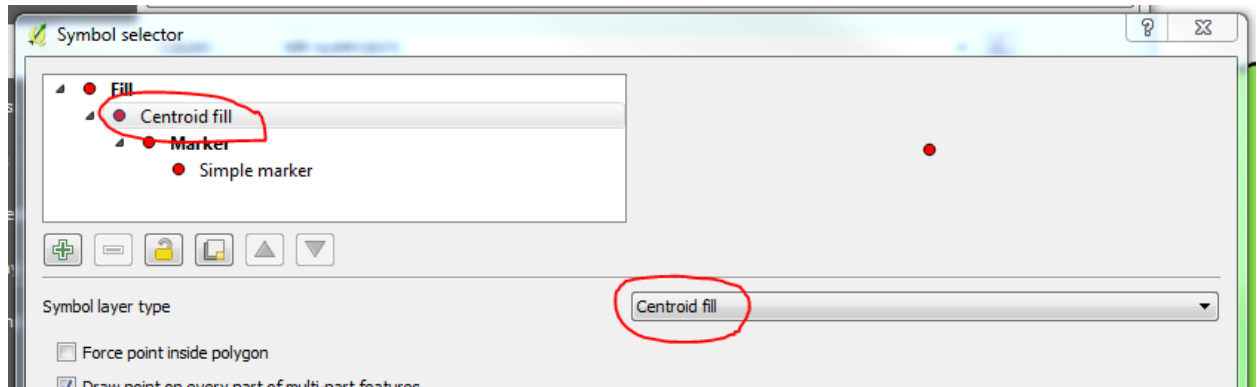
12. OK, now we need to style this layer to create our proportional symbols (*circles in this instance*).

Double-click the layer to open up the 'Layer Properties' panel and under the 'Style' tab, select 'Graduated'.

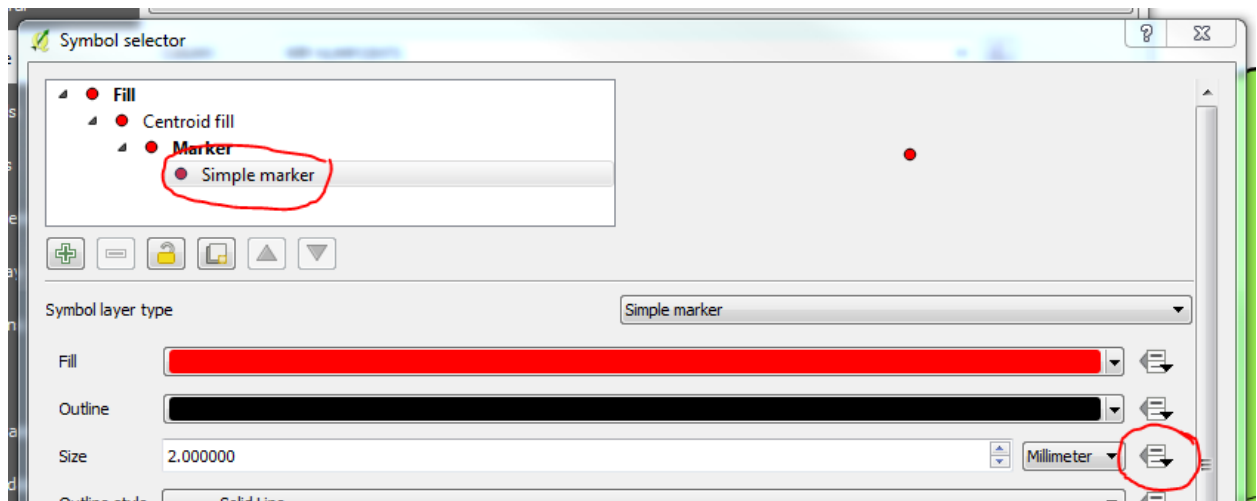
Next, choose 'NUMPOINTS' as the column and click on 'Change...':



13. In the 'Symbol selector' panel change the 'Symbol layer type' from 'Simple fill' to 'Centroid fill':



Now click on 'Simple marker' to expand the style options.  
Next, click on the 'Data defined override' button next to 'Size' (see image below) and click 'Edit...':

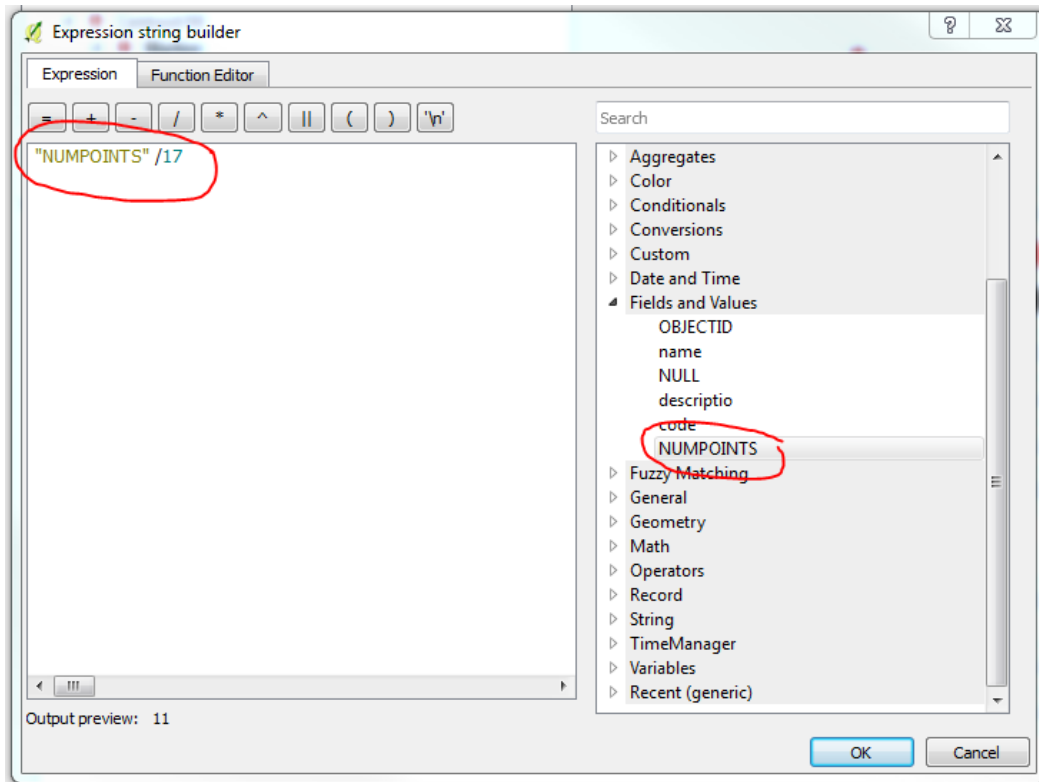


14. We're now going to write a short expression to size the circles based on their value - we need to divide the values in order for the sizes to be correct for our scale of map.

In the 'Expression string builder' add in the following expression:

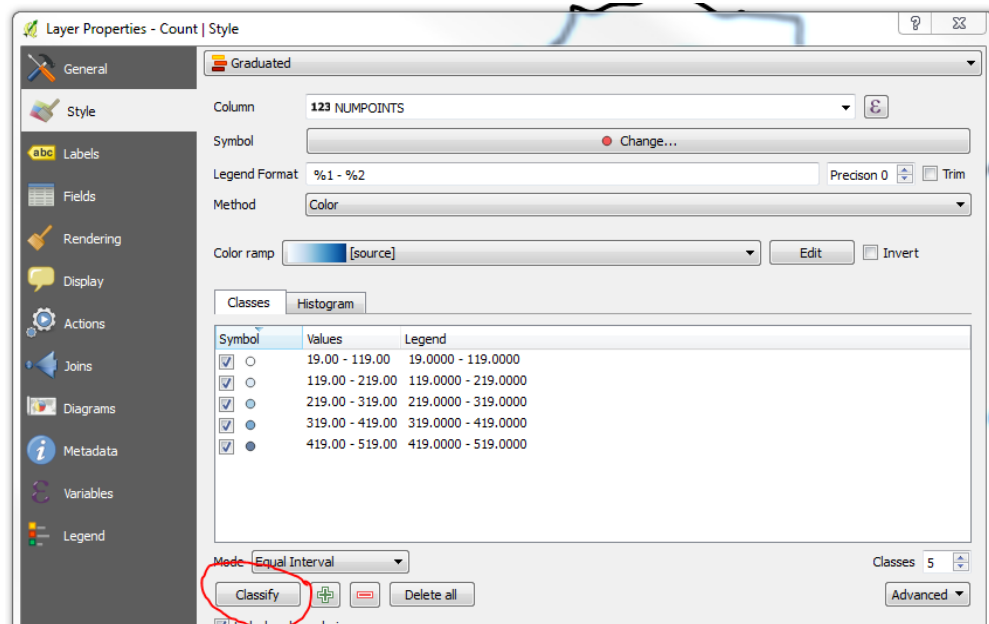
**"NUMPOINTS" / 17** ← you can copy & paste this if you want to

*The number 17 here is arbitrary really and may need to be changed dependent on the scale of your map and size of your monitor.*



Click 'OK' to return to the 'Layer Properties' panel.

15. Now click 'Classify':

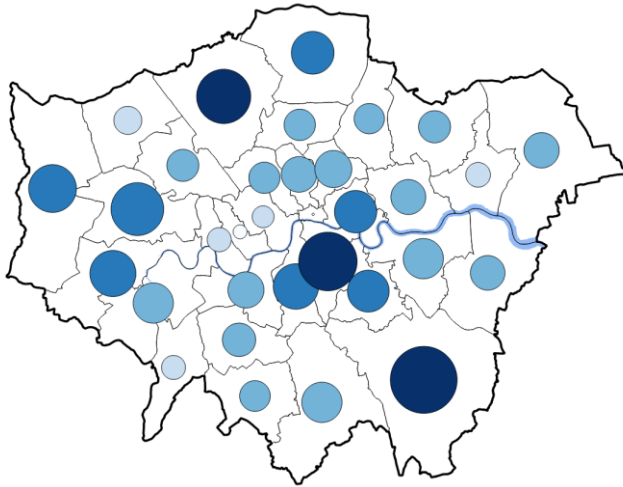


By default this adds in 5 classes using the 'Equal Interval' algorithm (you can read more about the different options [here](#)).

Feel free to change the 'color ramp' and then click 'OK'.

Your **proportional symbol map** should look something like this:





Next we're going to look at creating a **choropleth map** and for this we are going to use the same data but change the styling.

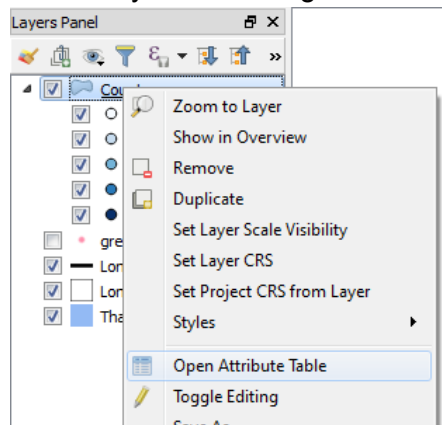
First we need to run an extra bit of analysis on the data. You will often hear cartographers discussing the problems of mapping totals using choropleth maps ([read more here](#)).

Without normalising our data to a consistent denominator the map is not very useful and we can't make any sensible interpretations of the information.

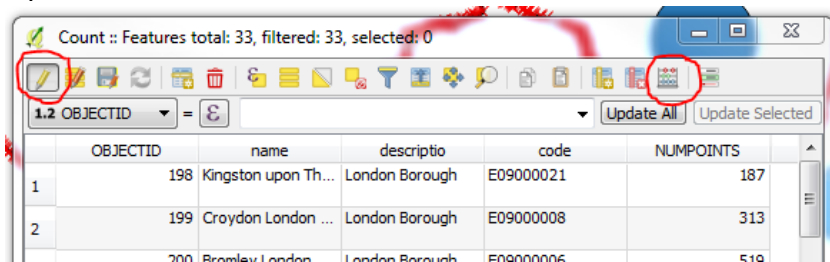
We are going to normalise our greenspace data against the size of each Borough. We will be mapping the amount of greenspaces per km<sup>2</sup> in each Borough rather than the total number of greenspaces per Borough. This takes into account the fact that they're all different shapes and sizes and makes comparison fairer across the whole map.

16. OK, so we need to add a new attribute to our data.

In the 'Layers Panel' right-click on the 'Count' layer and then click 'Open Attribute Table':



17. Click on the little yellow pencil button to start editing then click on the abacus button to 'open field calculator':

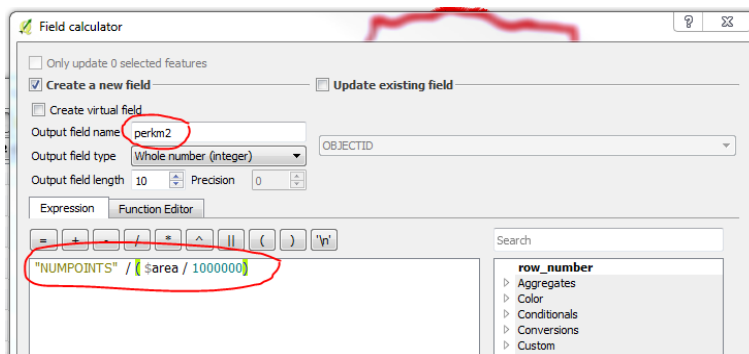


18. Now we're going to create a new field.

Type in **perkm2** as the 'Output field name' and then add in this expression

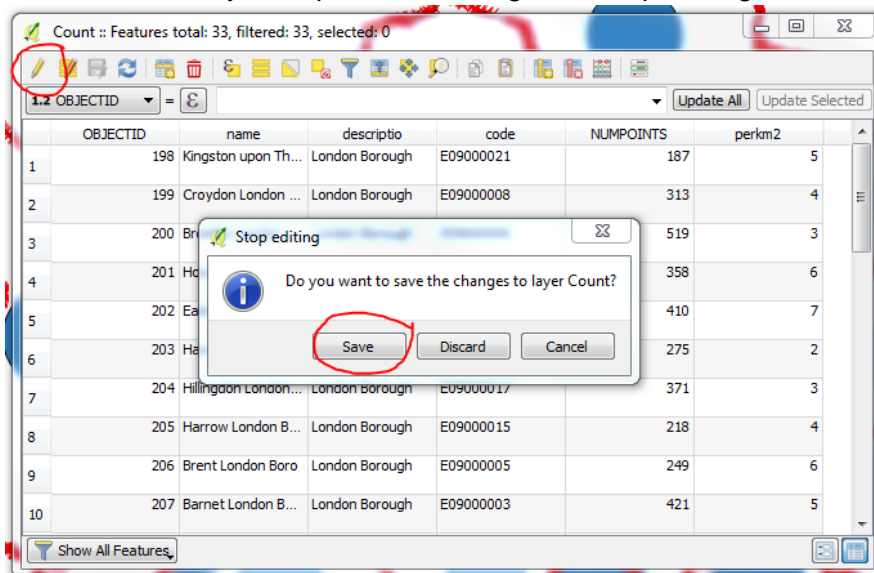
**"NUMPOINTS" / ( \$area / 1000000)** ← you can copy & paste this if you want to

*We're working in British National Grid (ESPG: 27700) so our map units are metres. This calculation converts our values to kilometre squared.*



Click 'OK'.

19. Click on the little yellow pencil button again to stop editing and then click 'Save':

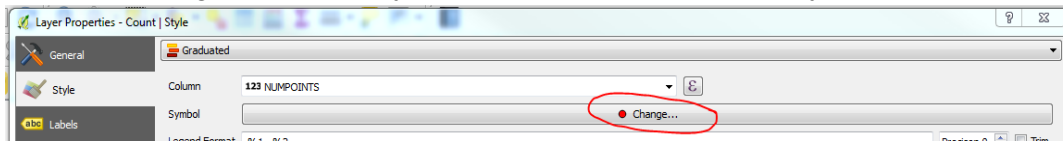


We now have a new attribute field called **perkm2** which contains a number for every Borough which represents the number of greenspaces per km<sup>2</sup>.

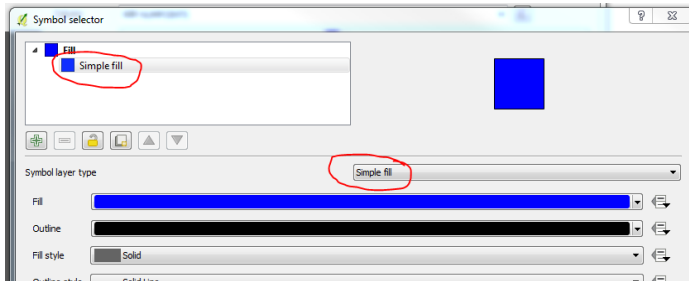
Close the attribute table and now we're going to style our choropleth...

20. In the 'Layers Panel', double-click on the 'Count' layer to open up the 'Layers Properties' panel.

Click on 'Change...' next to 'Symbol' in order to open up the 'Symbol selector':

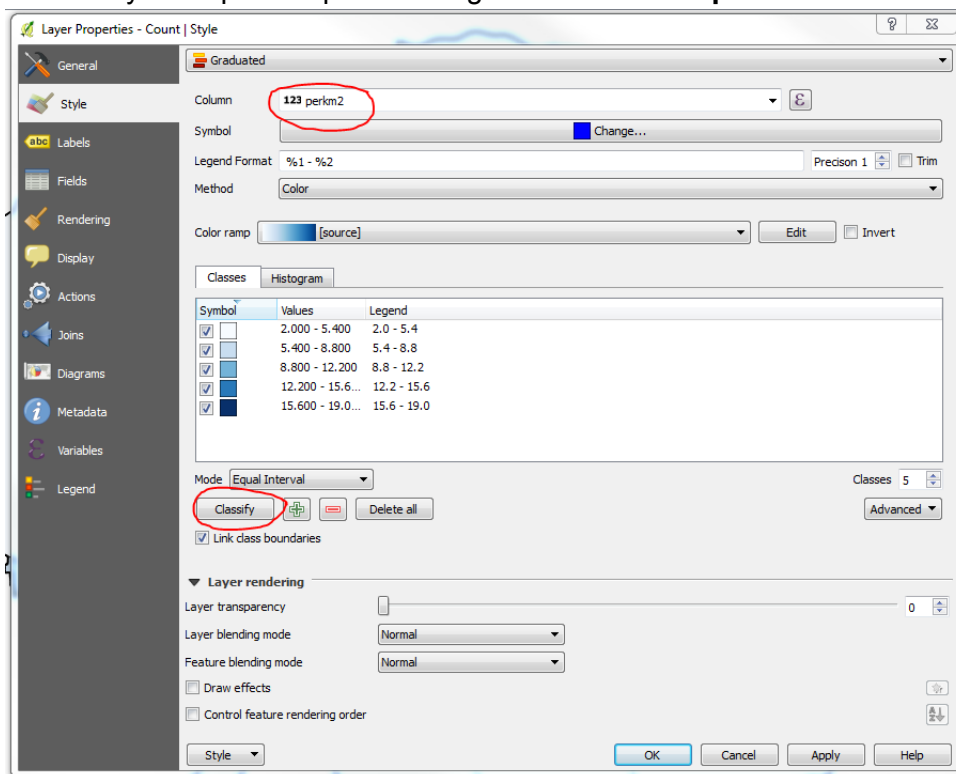


21. In this panel, change the 'Symbol layer type' from 'Centroid fill' to 'Simple fill':

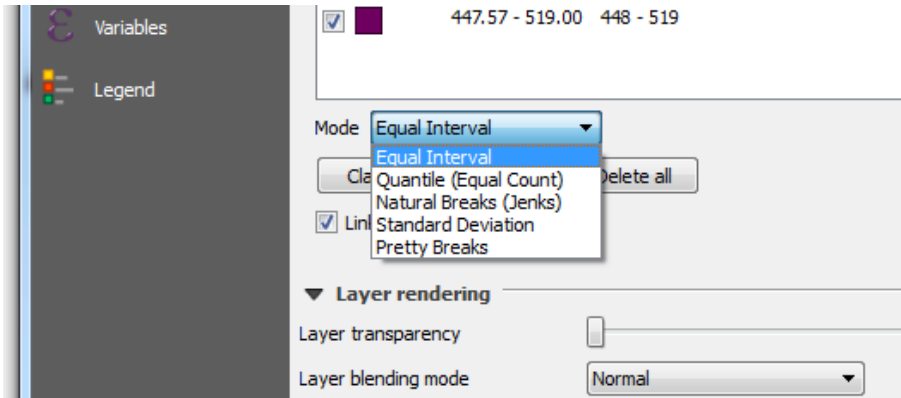


Click 'OK'.

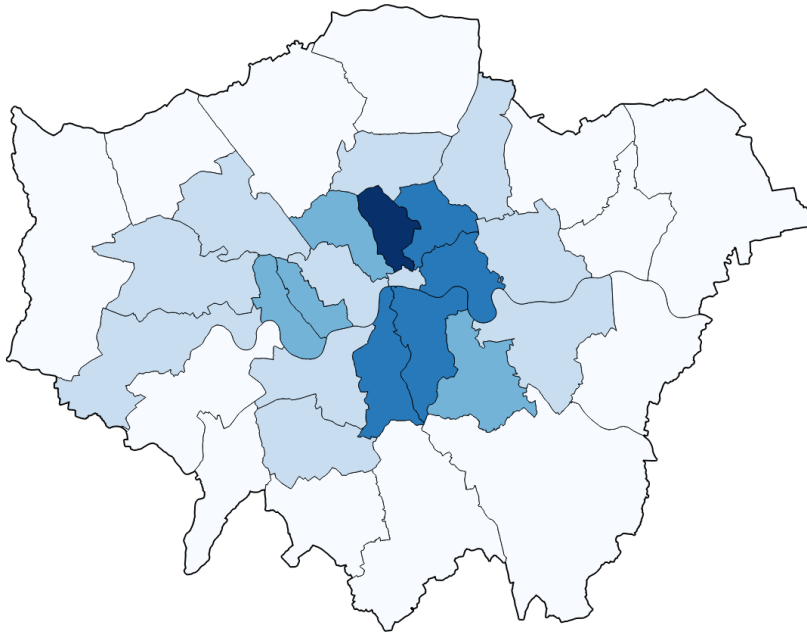
22. In the 'Layer Properties' panel change the 'Column' to **perkm2** and click on 'Classify':



Feel free to experiment with the different classification algorithms:



Click 'OK' and you have a **choropleth map** that should look something like this:



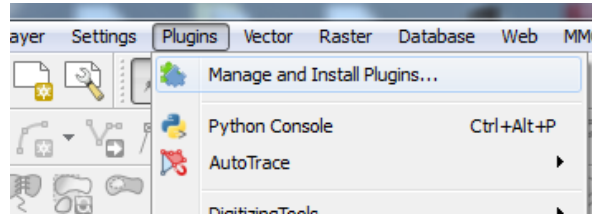
YAY! We've already made 3 different maps from the same data source!

So far we have been using the London Borough boundaries and these geometries are of irregular shapes and sizes.

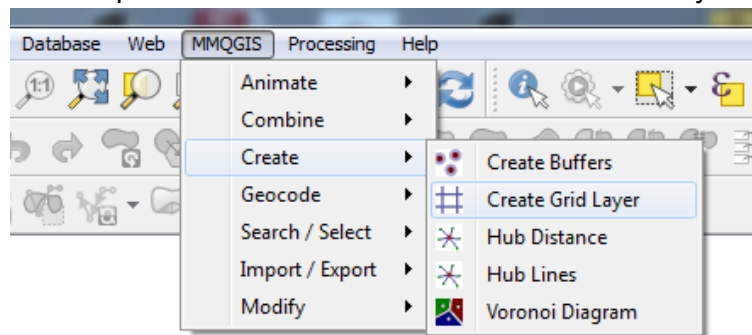
Next we are going to look at using a regular grid and we're going to use hexagons to create a **hexbin map**. [Read this](#) for more information about the benefits of using hexagons over other tessellating shapes such as squares.

23. We are going to use a QGIS Plugin called 'MMQGIS' to generate our hexagon grid. If it doesn't appear in your top menu then you will need to install it by clicking 'Plugins' then 'Manage and Install Plugins...'

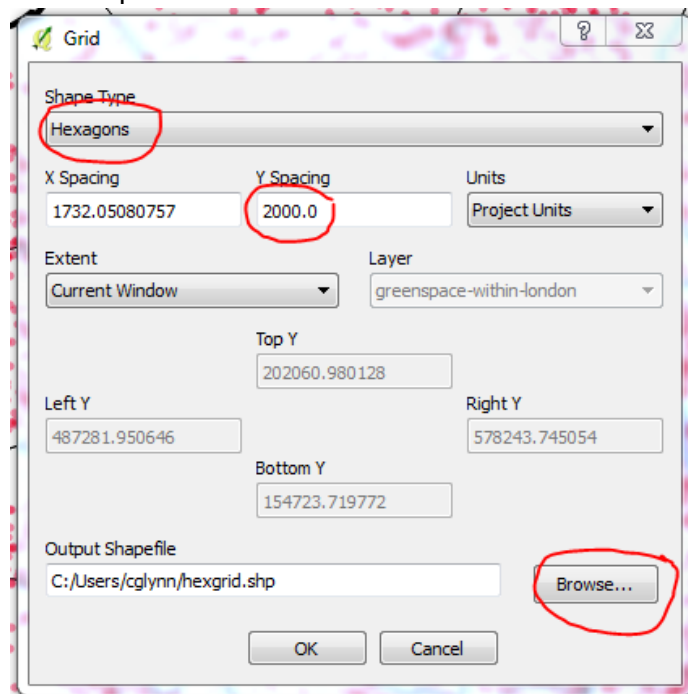
Search for 'MMQGIS' and click 'Install plugin'



24. In the top menu click 'MMQGIS' then 'Create Grid Layer' to open up the 'Grid' panel:



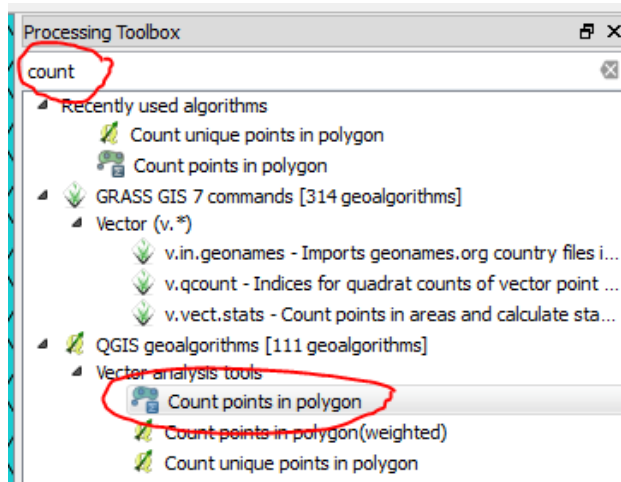
In the 'Grid' panel choose **Hexagons** as the 'Shape Type' and change the 'Y Spacing' to **2000** (this will give us hexagons that are 2km in height). Choose a location to save your new shapefile and then click 'OK':



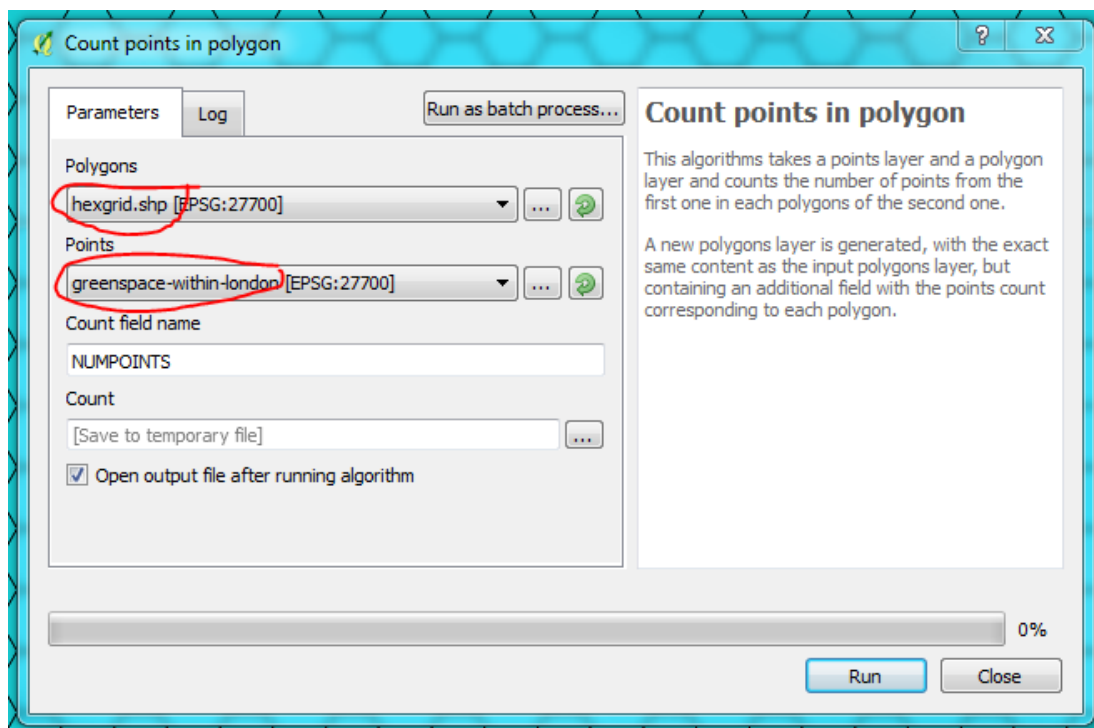
You should now have a new layer in your 'Layers Panel' and a hexagon grid covering the extent of your map window.

*If for some reason this doesn't work, you can use 'hexagon-grid.shp' from the 'Backup Data' folder.*

25. Now that we have a grid, we need to count (or bin) our greenspace points into each grid cell. To do this, we're going to go back into the 'Processing Toolbox' and use the 'count points in polygon' tool again:



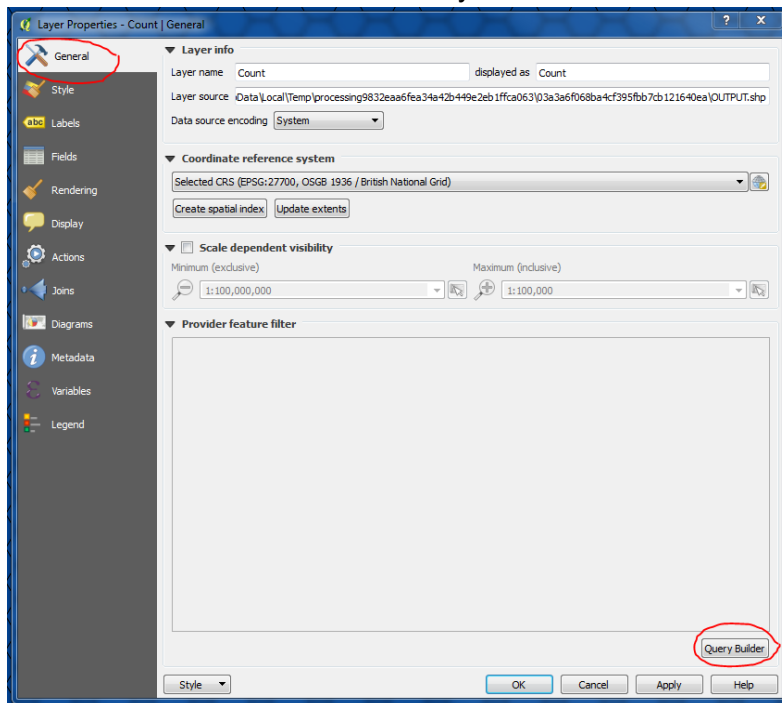
In the settings panel select your hexagon grid layer as the 'Polygons' and 'greenspace-within-london' as the 'Points':



Click 'Run'. This will add a new layer into your 'Layers Panel'.

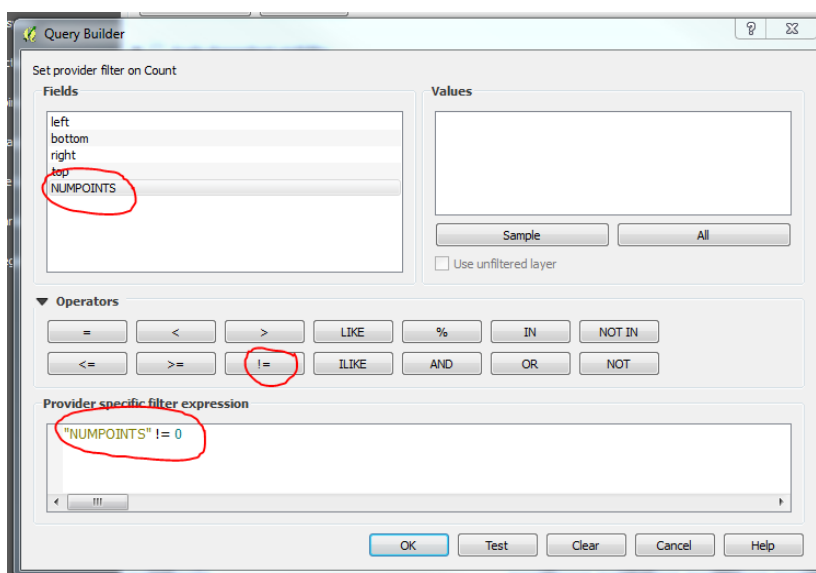
If for some reason this doesn't work, you can use 'hex-with-counts.shp' from the 'Backup Data' folder.

26. Before styling our grid, we're going to add a filter on it so we only see the cells that contain data. Double-click the layer to open up the 'Layer Properties' panel then switch to the 'General' tab and click 'Query Builder':



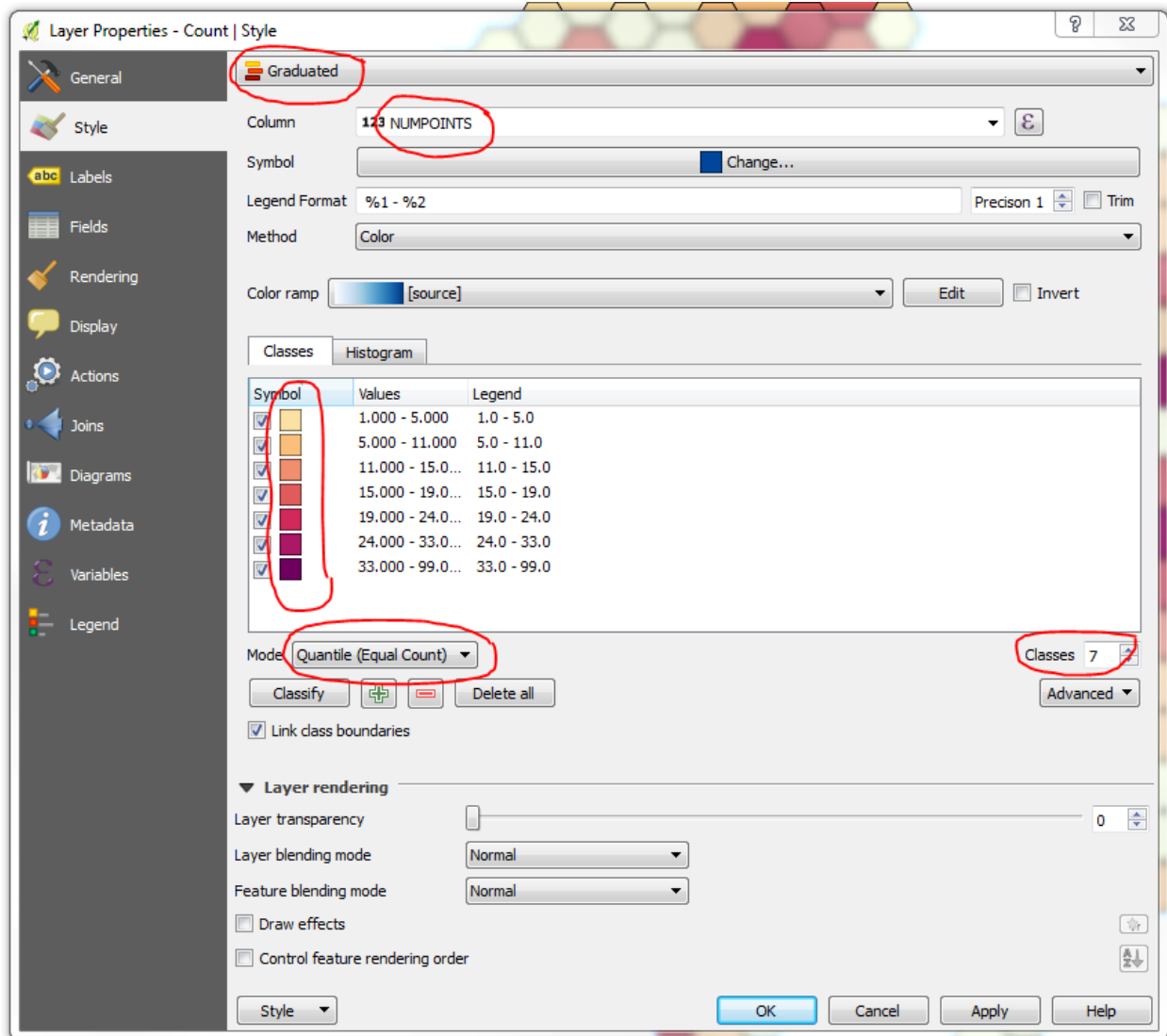
27. Add in this expression:

**"NUMPOINTS" != 0** ← you can copy & paste this if you want to



Click 'OK'.

28. Now we're going to style our hexagon grid. Switch back to the 'Style' tab.  
Change the style settings so they look like this:



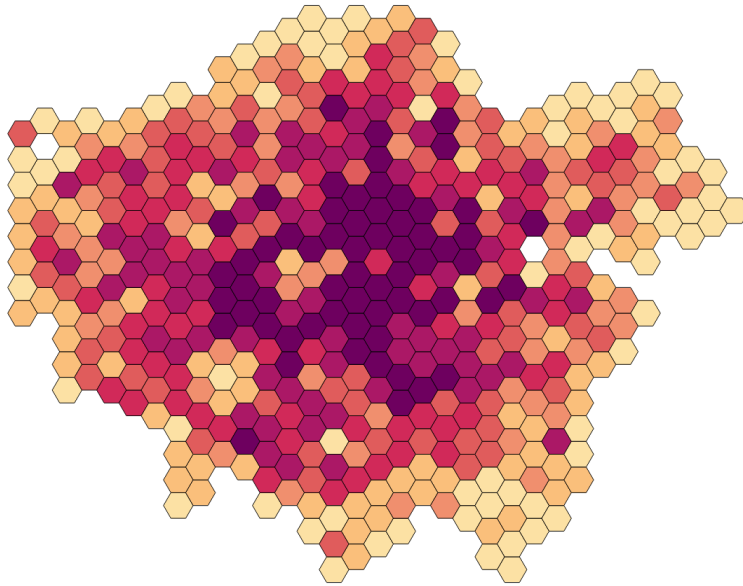
These colours are from the [GeoDataViz Toolkit](#):

**#FCE1A4, #FABF7B, #F08F6E, #E05C5C, #D12959, #AB1866, #6E005F**

*Feel free to choose a different colour palette.*

Click 'OK' and your map should look something like this:



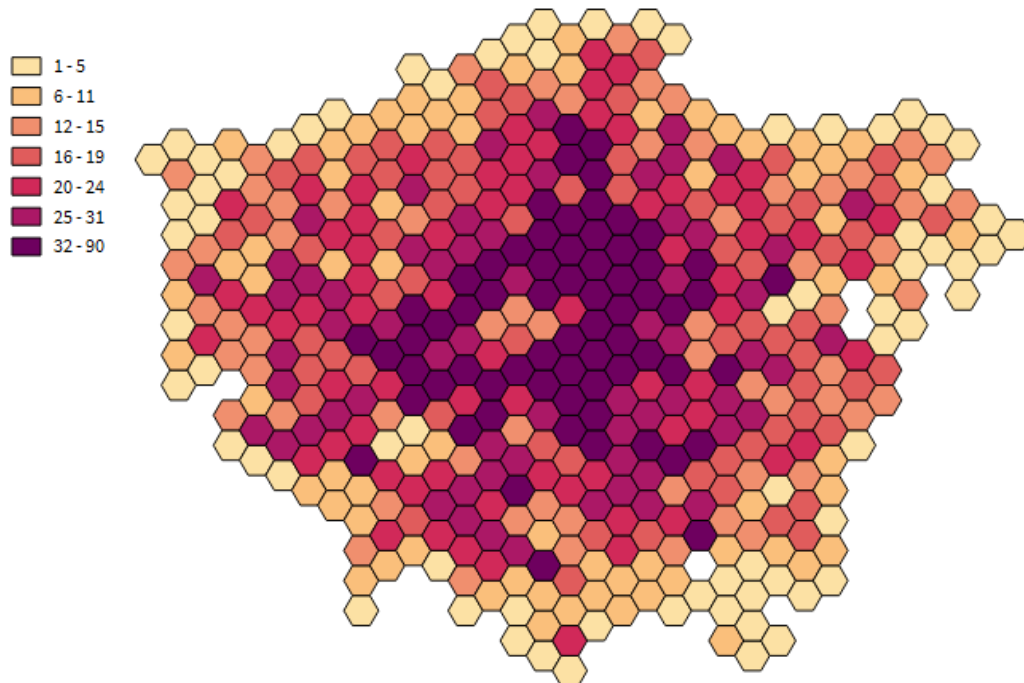


So far, we have explored 4 different mapping techniques within a GIS. If we were creating a finished map, then we would probably add some other features. These may include a title, description, legend, labels/annotations and possibly even a scale bar or locator map.

That may end up looking something like this:

### Where are the greenspaces in Greater London?

November 2017



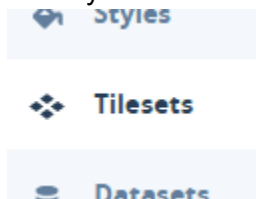
Contains Ordnance Survey data (c) Crown copyright 2017

Now we're going to look at Mapbox Studio and create a web map that will be mobile friendly by default. We're going to take our hexbin map a step further and explore the z-axis - adding a 3rd dimension to our data.

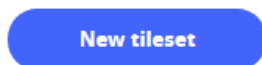
## Part two: Mapbox Studio

1. In a web browser, preferably Google Chrome, go to [mapbox.com/studio](https://mapbox.com/studio) and sign in.  
*If you don't have an account then you can sign up for a free one - it doesn't take long.*

2. Once you're in Studio click on the 'Tilesets' tab from the left-hand menu:



3. Click on 'New Tileset':



4. Click 'Select a file' then browse to the 'Data' folder and select 'hex-with-counts.geojson':

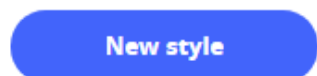


Click 'Upload'.

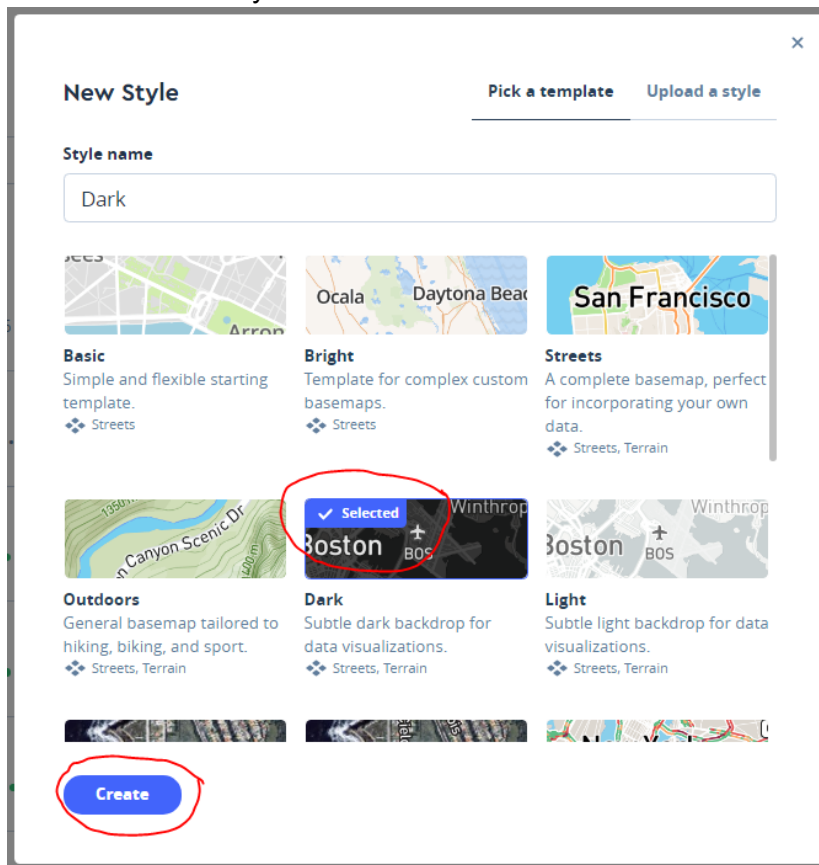
It may take a few minutes to upload the new data (*but it will be worth it, honest*).

When our new tileset has successfully uploaded it will appear at the top of our Tileset list.

5. Now we're going to create a new map. Click on the 'Styles' tab on the left-hand menu and then click 'New style':



6. Select the 'Dark' style and click 'Create':



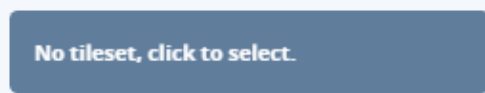
This will load up the map interface. Pan around and zoom into the UK.

Now we're going to load our hexagon grid into this map.

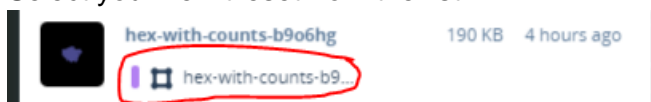
7. Click on the 'Add new layer' button in the top-left:



8. Click on this button to select your tileset:



9. Select your new tileset from the list:

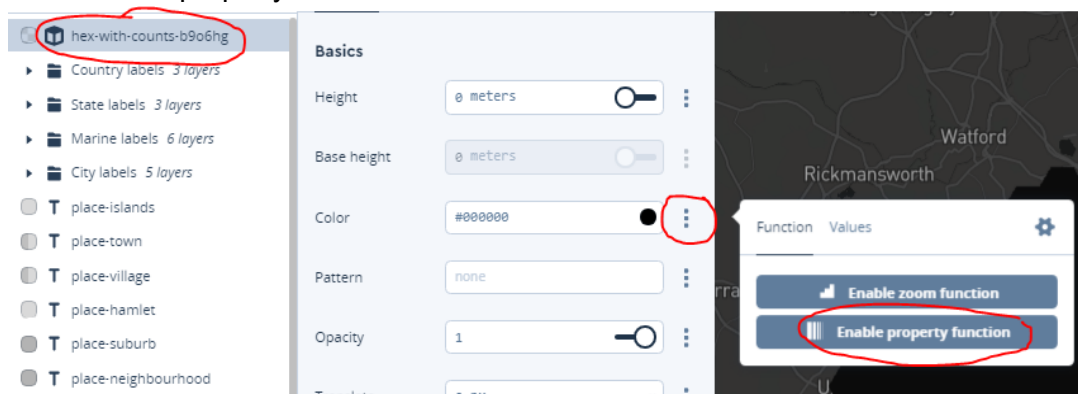


10. Change the 'Type' to 'Fill extrusion' and click 'Create layer':

The screenshot shows the 'Source' section with the tileset 'hex-with-counts-b906hg'. Below it, the 'Type' dropdown is set to 'Fill extrusion' and is circled in red. The 'Zoom' section shows a range from 0 to 22. The 'Filter' section is set to 'Geometry type' with 'Polygon', 'LineString', and 'Point' all selected. At the bottom, the 'Create layer' button is circled in red.

Our new layer should appear in the layer panel on the left and if we zoom into Greater London we can see our hexagons. The data is given a default black fill - so now we're going to style it.

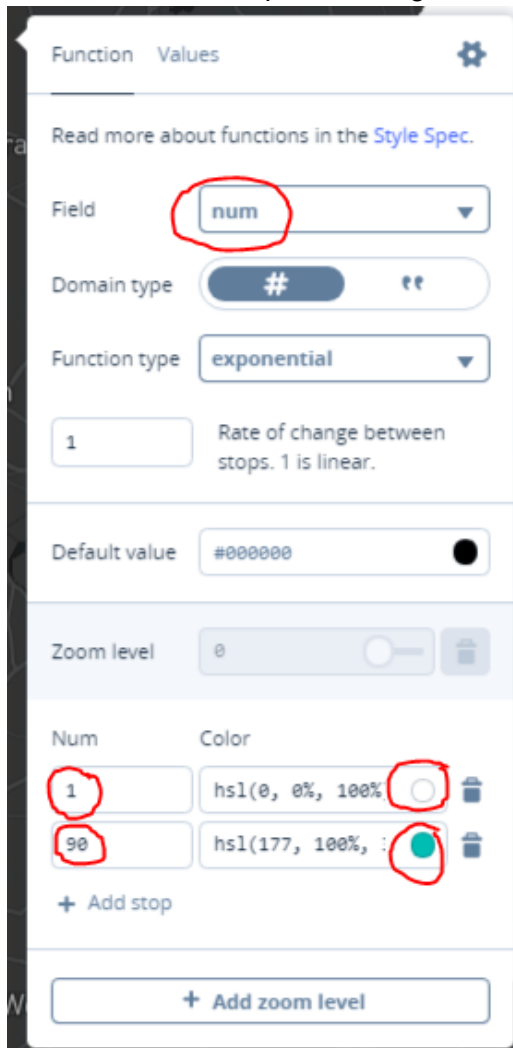
11. Select the new layer in the left-hand panel. Click on the 3 vertical dots next to 'Color' and then 'Enable property function':



12. Firstly, select 'num' as the 'Field'.

Then at the bottom of the panel change the first 'Num' to '1' and change the colour to white using the colour picker.

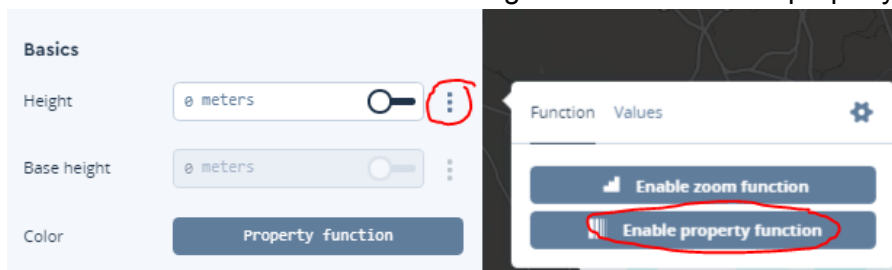
Then add a new stop and change the 'Num' to '90' and add a colour of your choice:



You will see the map update as you change the values.

13. Now we're going to add some height to our data.

Click on the 3 vertical dots next to 'Height' and then 'Enable property function':



14. In the same way as we did for the colour, select 'num' as the field. Then change the first 'Num' to '1' and change the 'Height' to **100**. Then add a stop and change the 'Num' to '90' and add a 'Height' of **10000**:

*These height values are fairly arbitrary so feel free to change them.*

Function Values

Read more about functions in the [Style Spec.](#)

Field: num

Domain type: #

Function type: exponential

1 Rate of change between stops. 1 is linear.

Default value: 0 meters

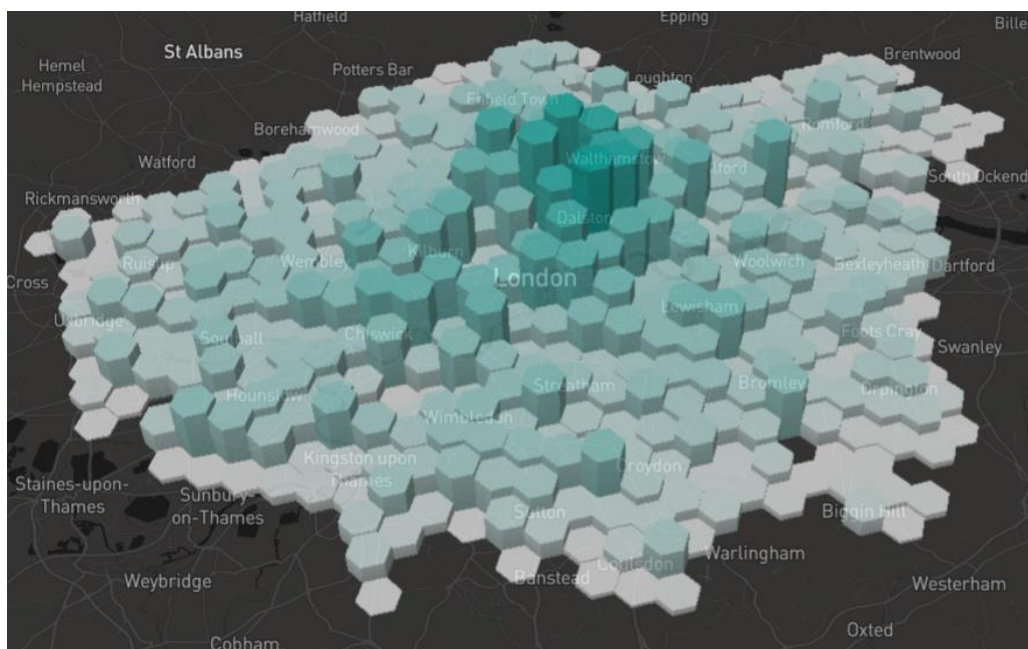
Zoom level: 0

Num	Height
1	100 meters
90	10000 meters

+ Add stop

+ Add zoom level

You can adjust the opacity on the layer to unveil the detail from underneath and you can use your mouse to adjust the pitch and bearing of your map. It should now look something like this:

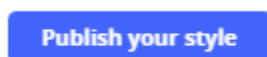


Feel free to play around with the other layers in the map (roads, water, labels etc.) - style it to suite your own needs or preferences.

It is also good practice to move your new thematic layer below the map labels. You can do this by dragging and dropping it in the left-hand panel.

15. When you're happy with your map, you're ready to publish it!

Click on the button in the top-right hand corner:

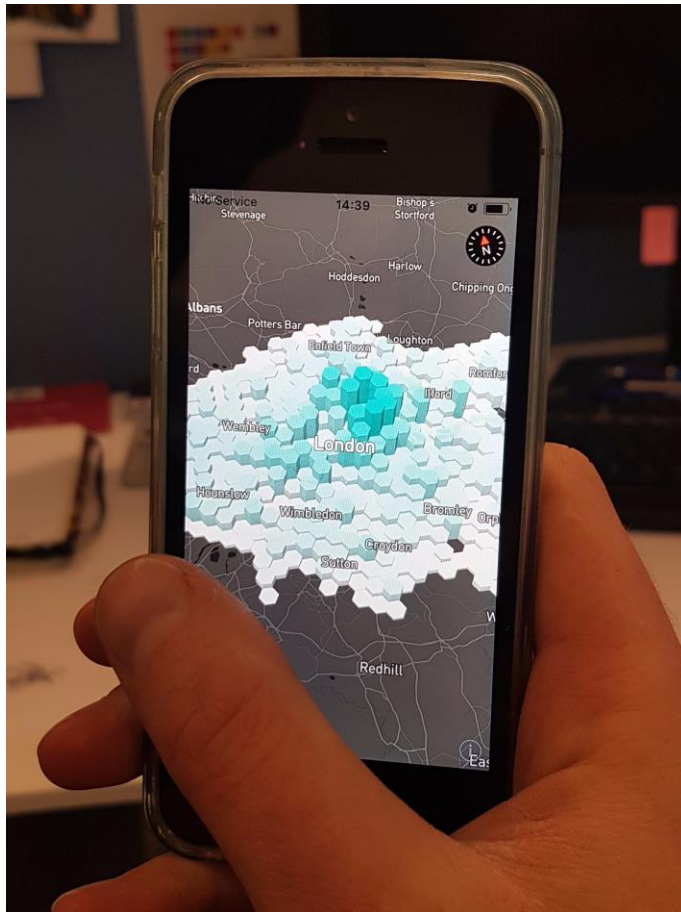


Your map is now hosted on your Mapbox account and you have a number of options for how you can use it; from simply sharing it, viewing it in a GIS or developing it further using one of Mapbox's libraries.

For our final step we're going to check that our map looks good on a mobile device. Mapbox have an app that makes this easy for us.

If you have an Android or iOS device then install the **Mapbox Studio Preview** app from the relevant store.

Using this app you can sign-in with your account details and view your styles on your device.



Looks good!

Happy mapping :)