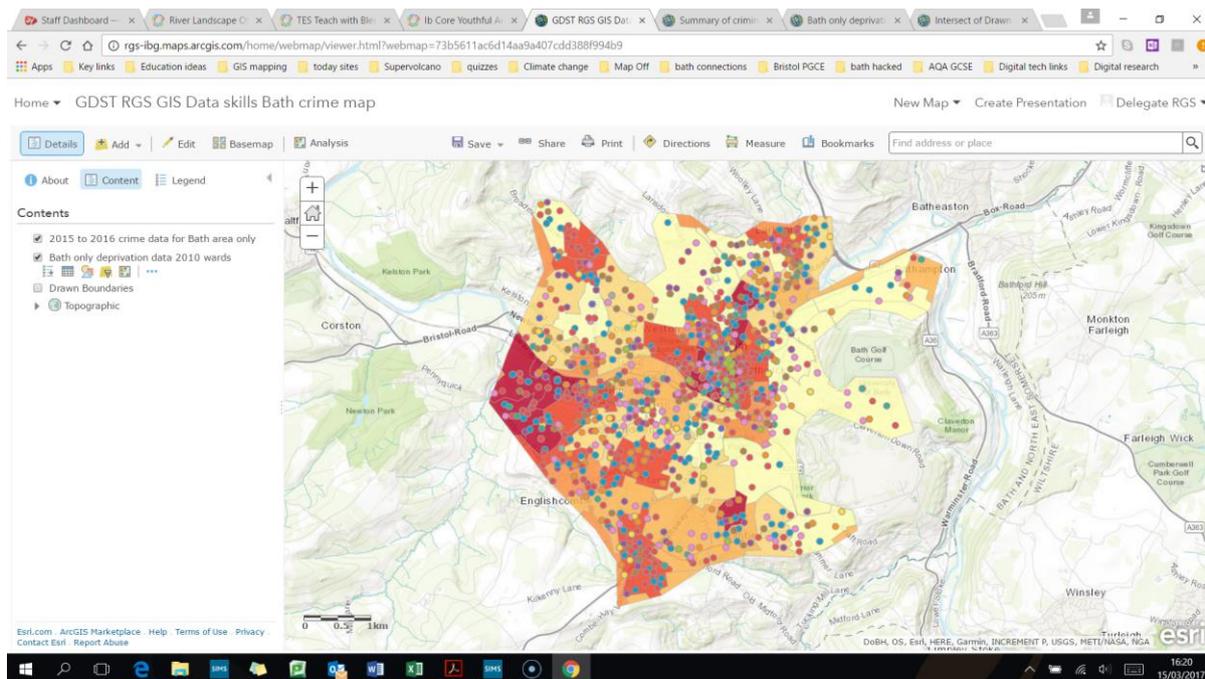


## Data Analysis using secondary data in ArcGIS

Topic – study of crime and deprivation patterns.

1. Open this map <http://arcg.is/1auzuj> Or search for “GDST RGS Data skills Bath crime map”

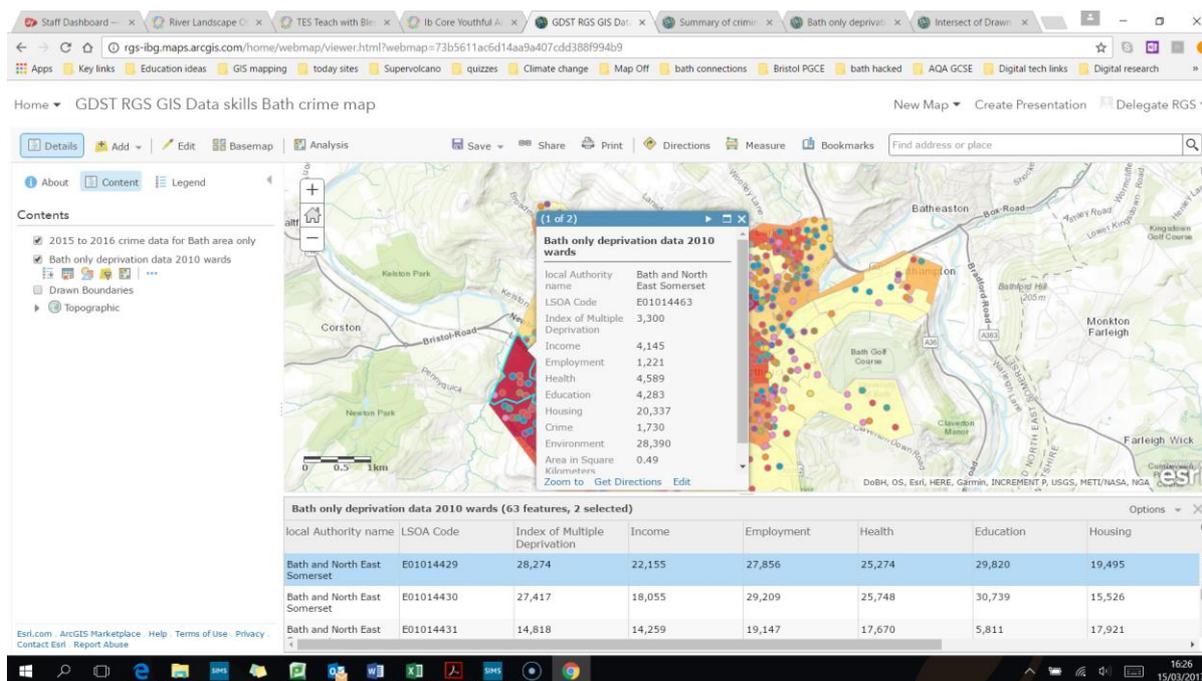
It contains some prepared data for crime across 2015 in Bath and deprivation data. The crime data was freely available from <https://data.police.uk/data/>. I saved a bit of time by editing it down to just the data for Bath. The deprivation data is freely available within AGOL – just search for “deprivation” – I just removed the data for the surrounding regions to make it quicker to analyse.



2. Click on the layer name for the Bath only deprivation and then the table under it to show the data. This brings up the data table at the base of the screen



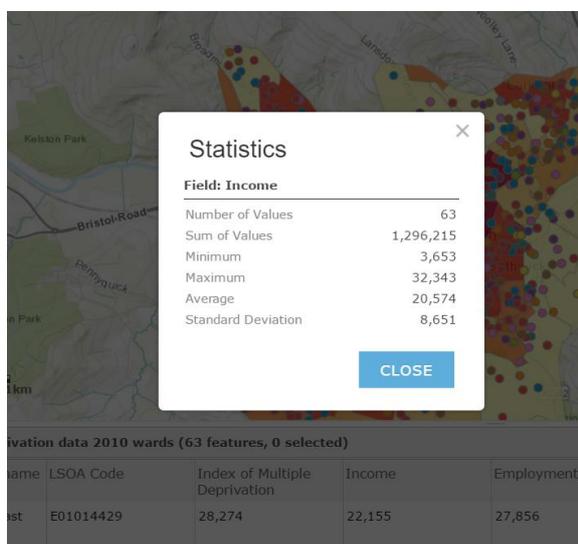
3. If you click on the map you will see the data in the map pop up window and within the table for each of the areas with deprivation information.



- If you click on the name in the top row of the table such as “income” it will bring up a sub menu with options to sort the data and to show statistics. (if you personally made/ own the layer then you will also have the option to delete and run calculations – as shown below)



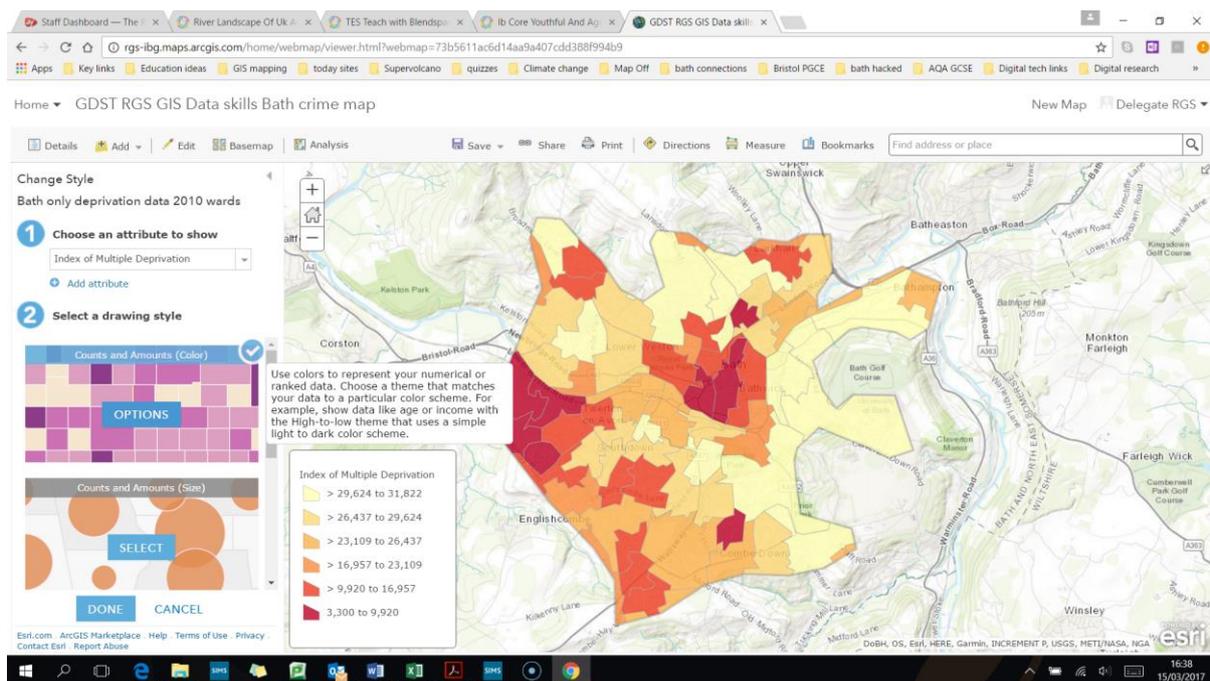
- Click on “statistics” and it will bring up useful summary data such as max, min value, mean and standard deviation. All these are useful for student’s data skills.



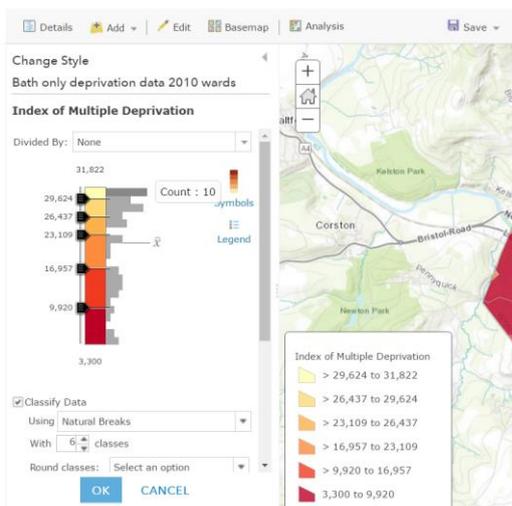
- Now close this pop up and the table. Go to the layer name again for the deprivation data and click change style this time



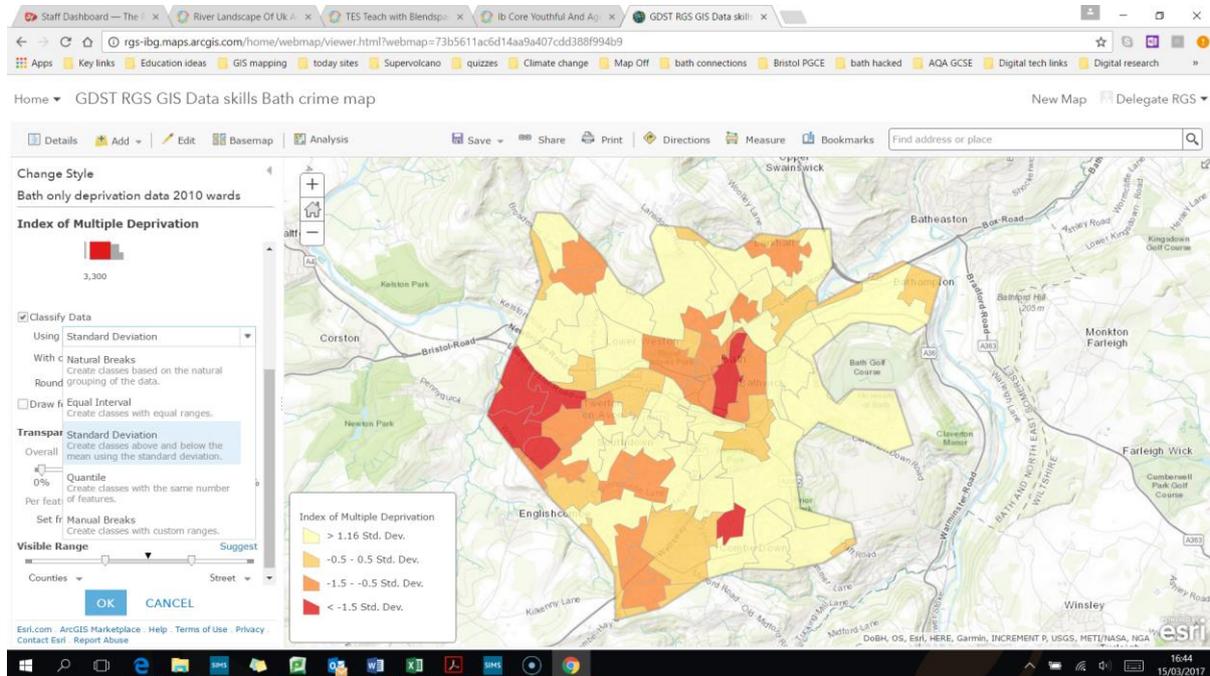
- Then go to the options for the “counts and amounts” style



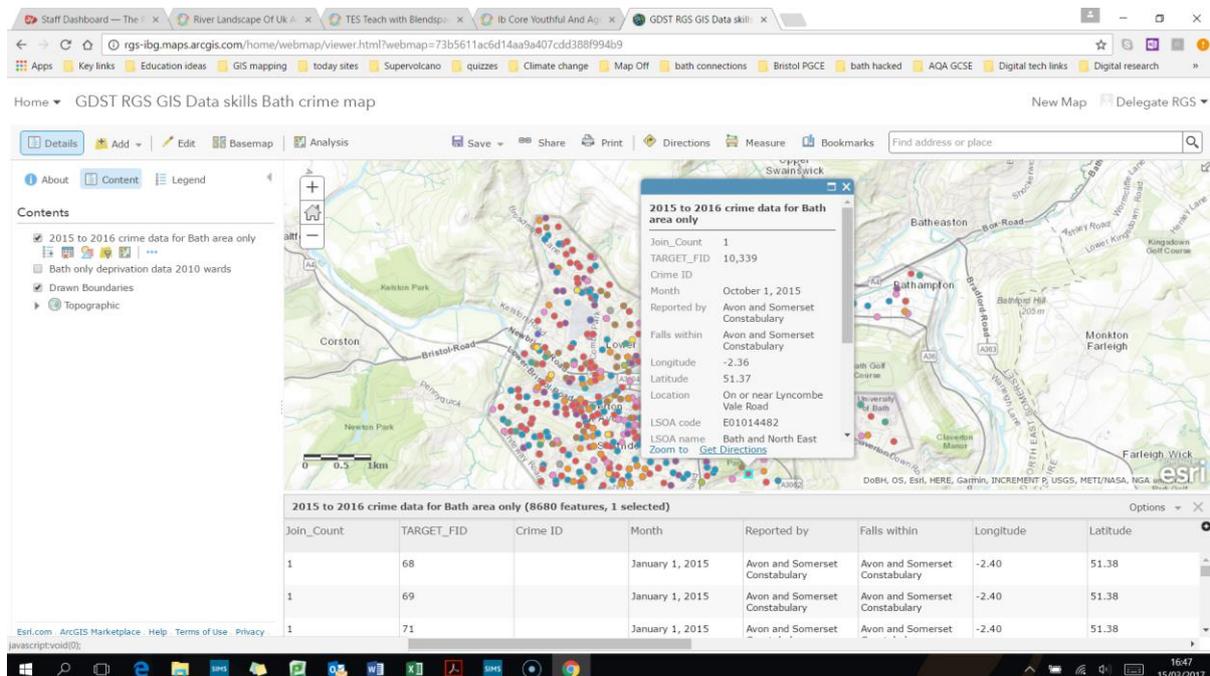
- Note that this brings up a range of tools. But notice the bar chart alongside the colour scale which shows the mean and the distribution of the data. Here we can see that distribution is biased towards the higher value ranks (less deprived areas). Again this is a useful data skill on data distribution and frequencies.



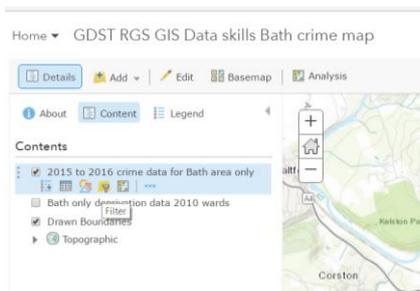
- In addition there are lots of data skills thinking points for students within changing style to consider such as where to place the colour breaks within this data. Also the class intervals can be based on standard deviation – which again is a good way to reinforce this mathematical concept and what it means.



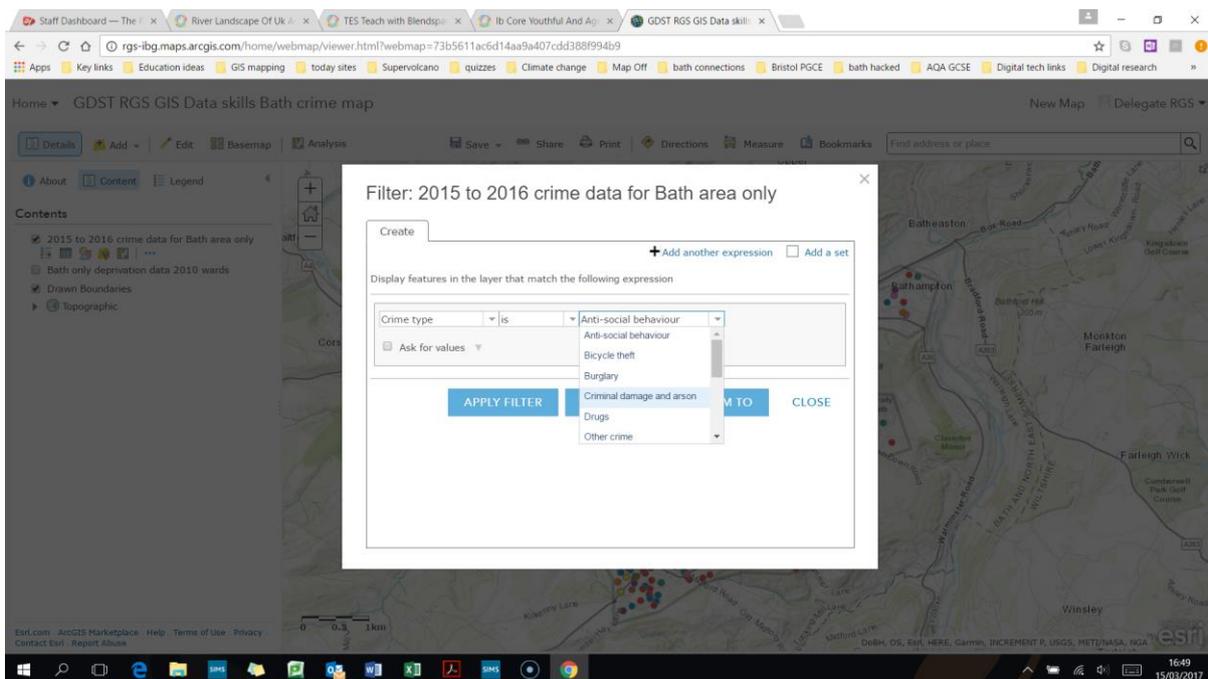
- Now click “details” on the top left to return to the content list. Untick the deprivation layer and tick the crime data layer. Open the table for this layer and you will see that there are 8660 crimes recorded for this area over the year.



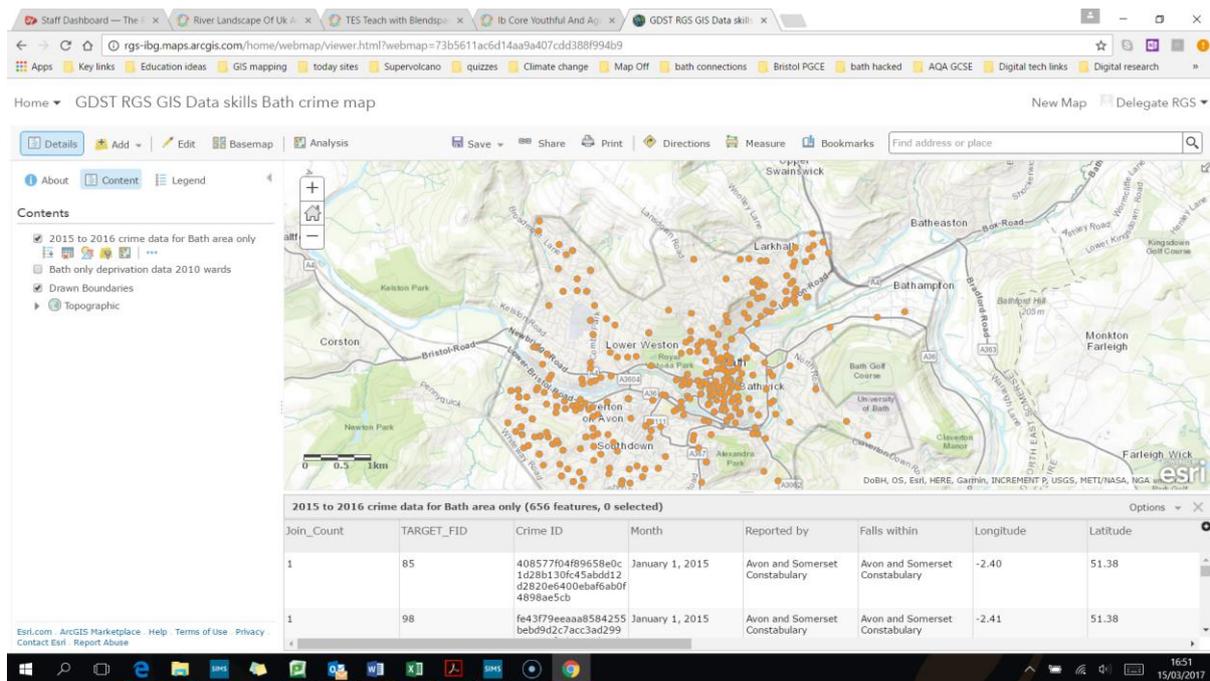
- This shows all crimes. Lets filter it to one type. Click on the layers name and this time pick the yellow funnel which is the filter tool.



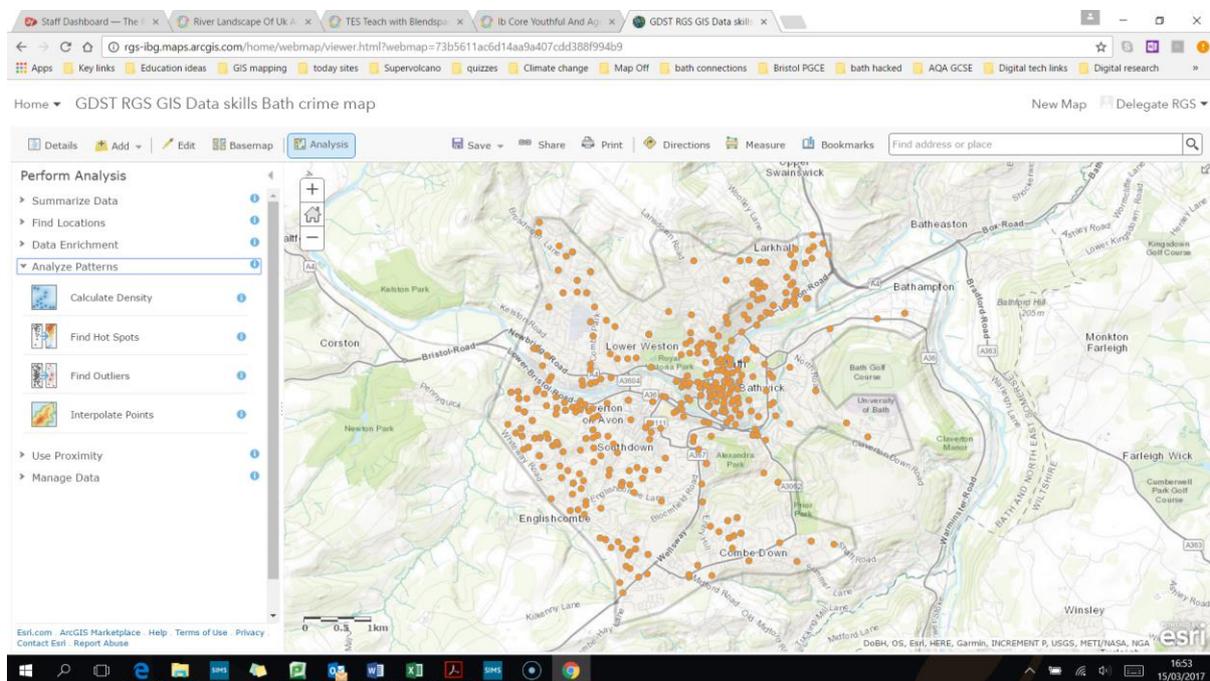
12. Then in the first box pick the field called “crime type”, then in the second “is” and the third “criminal damage and arson” (it is easier to find if you tick the “unique” option in the third box). Then apply filter. This now only shows this data.



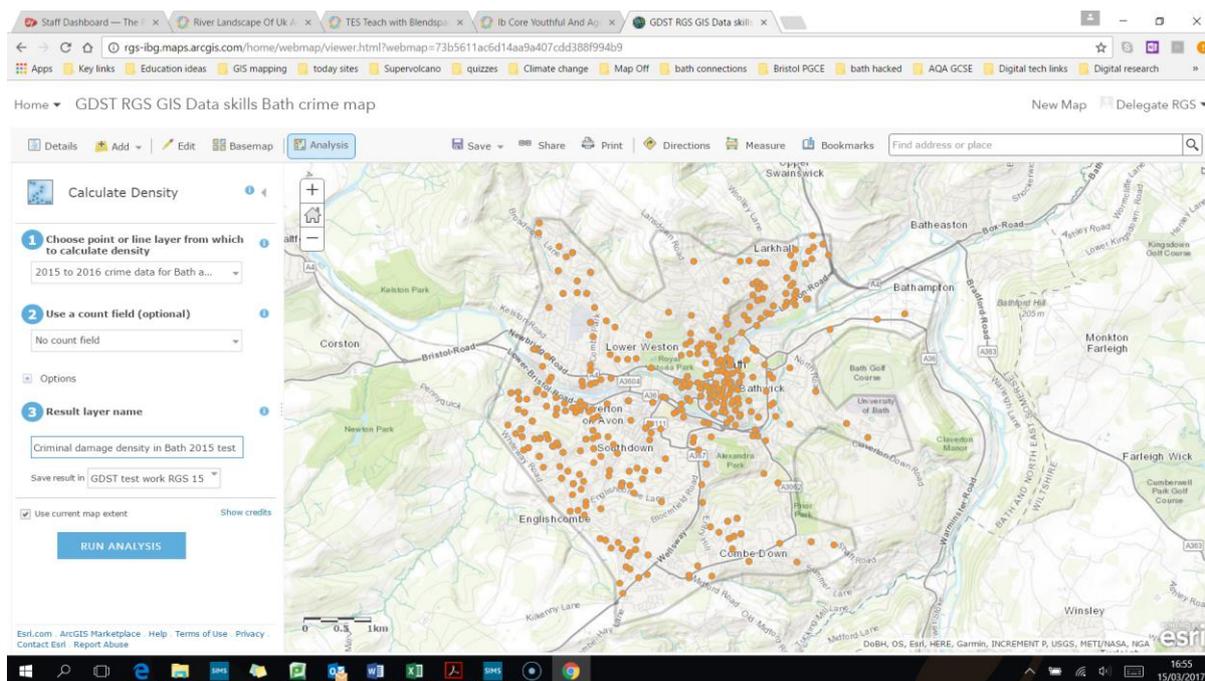
13. If you now click on the table for this layer we can see there is only a total of 656 such incidents.



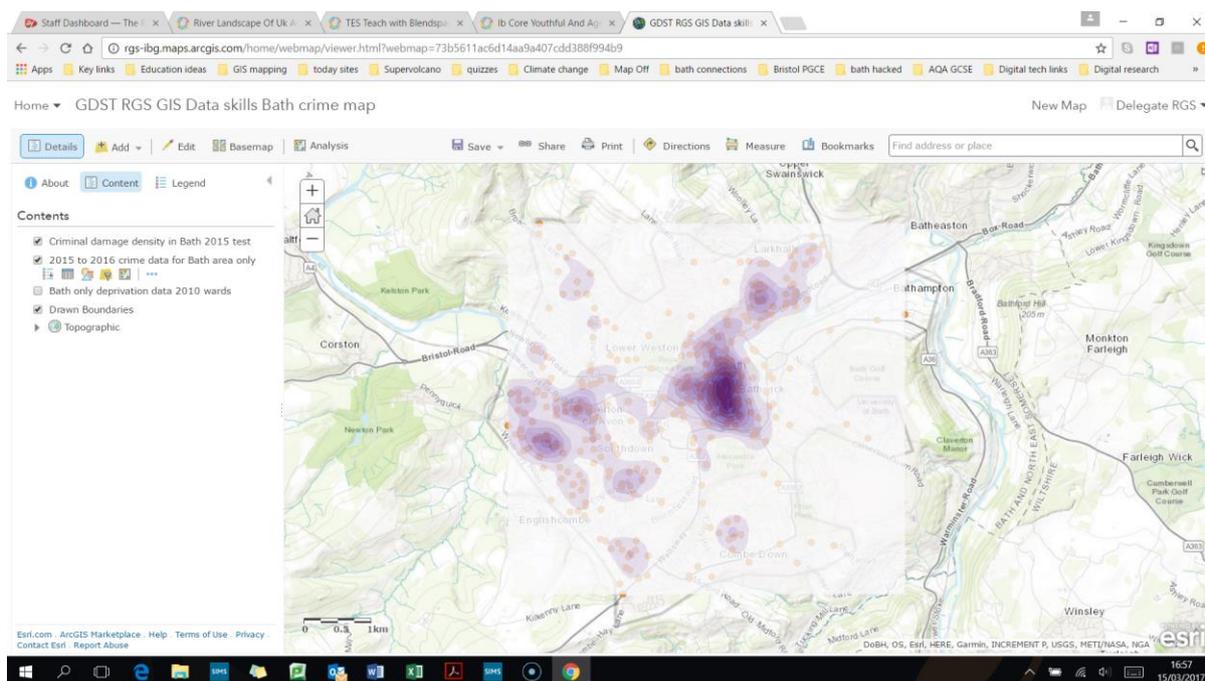
14. Now this is a dot map – which is another data skills. It is a good time to discuss the pros and cons of this type of mapping. One key issue is that dots may be on top of each other and also it can be hard to see the pattern correctly. Now lets run an analysis on this layer. Click the analysis button on the top left and then choose - analyse patterns and calculate density



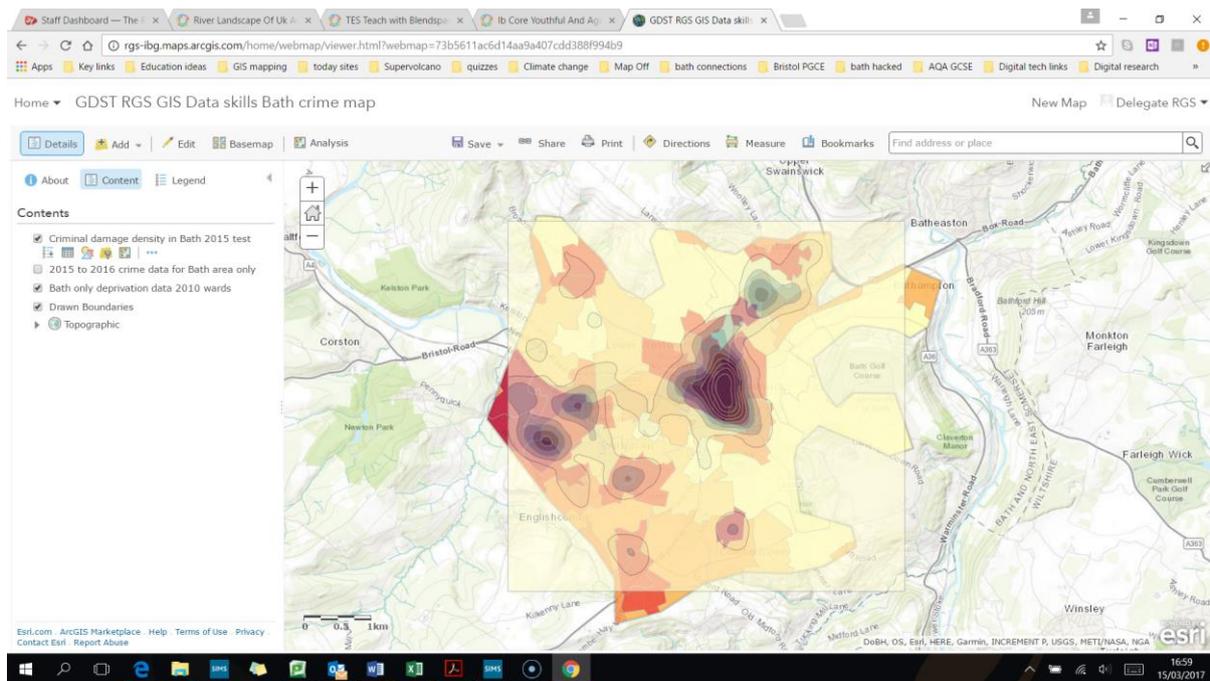
15. Now make sure the first box has the 210 to 2016 crime data selected. Ignore the second box. In the third give it a name like Criminal damage density in Bath 2015. Then run analysis....



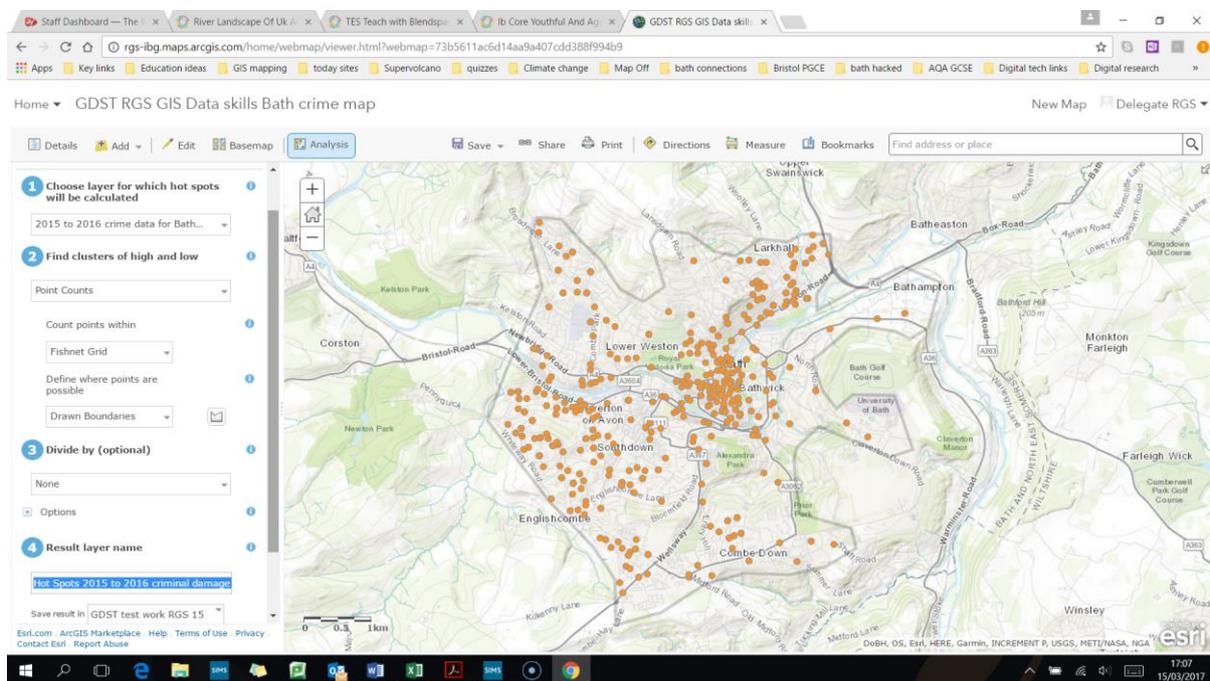
16. This now produces a density map. One of the data skills is to understand densities and this is a good way to reinforce the concept.



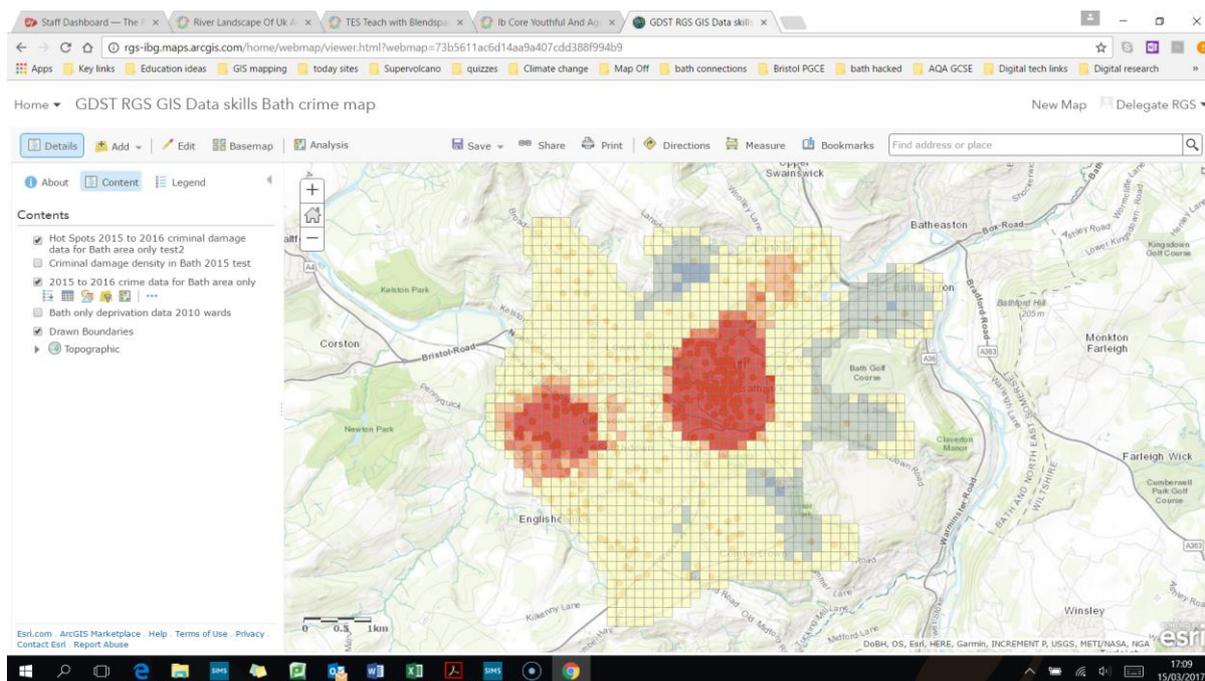
17. You can recolour this layer and make it show the maximum density value of these crimes per km<sup>2</sup>. You can also tick on the deprivation layer and consider if there is any matches in the patterns. It appears that areas with worse deprivation seem to have more criminal damage incidents.



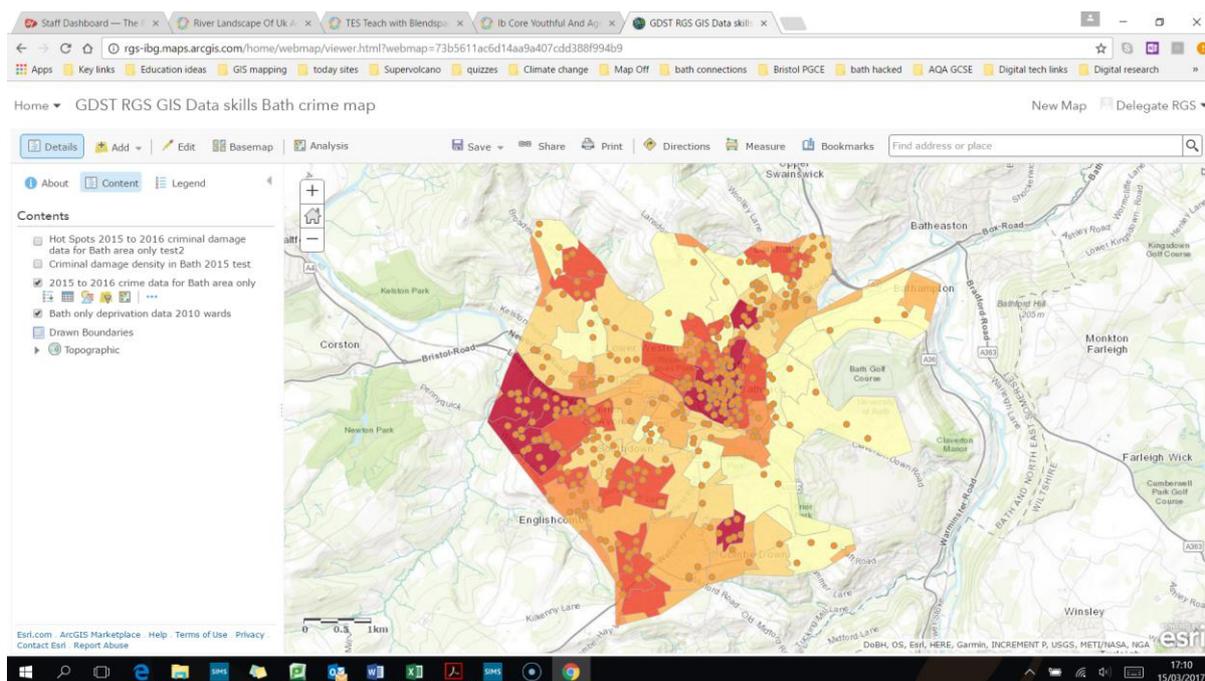
18. Other spatial patterns can be produced via the analysis tool such as a hot spot analysis. Follow the menu options shown below. In option 1 pick the 2015 crime data layer. In two choose count of points and then within “fishnet grid” and define it within the “drawn boundaries” (I drew this on the map before using map notes to set the limits for Bath – you don’t need to have this). Give it a name like Hot Spots 2015 to 2016 criminal damage data for Bath



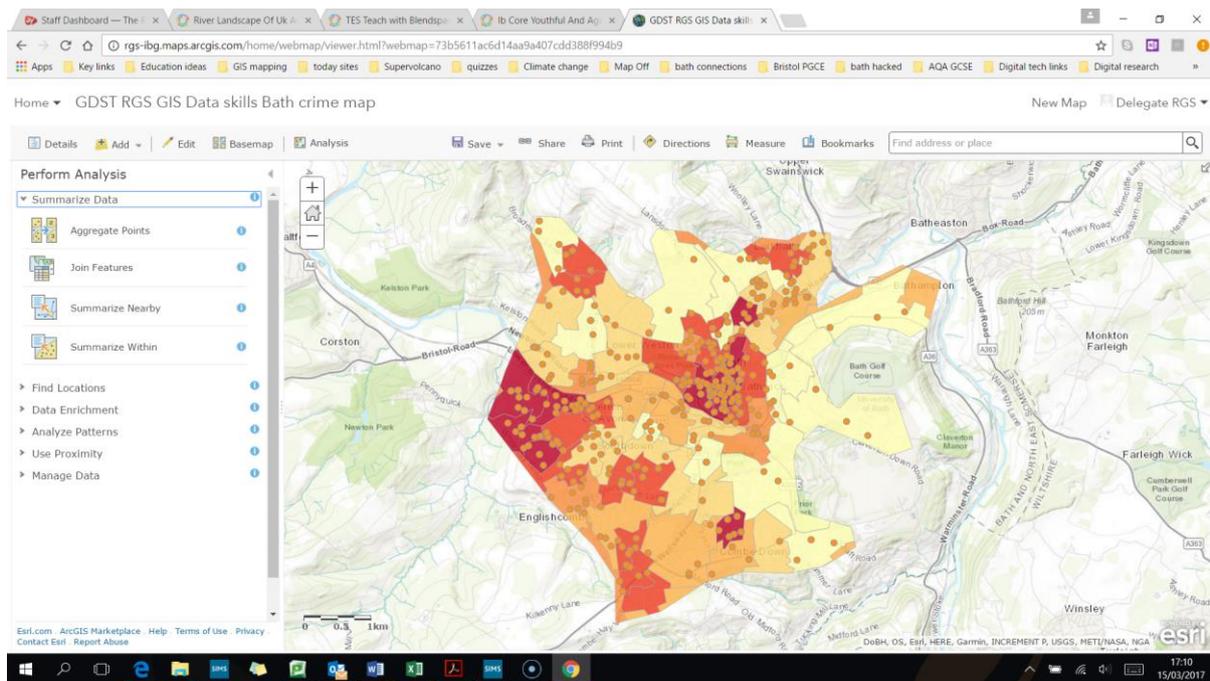
19. This map show statistically high and low clusters of the data distribution. It is a complex spatial statistical test – useful for personal investigaiton projects.



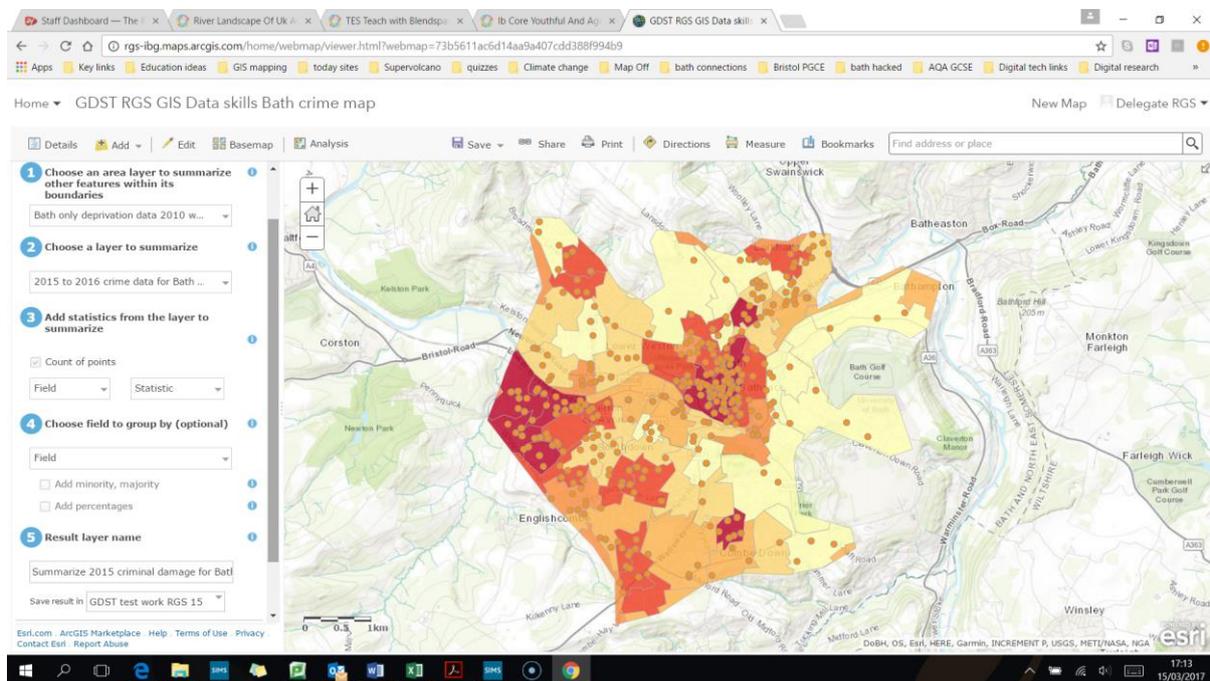
20. Now lets turn off all the layers, except the bath only deprivation one and the 2015 to 2016 crime dots.



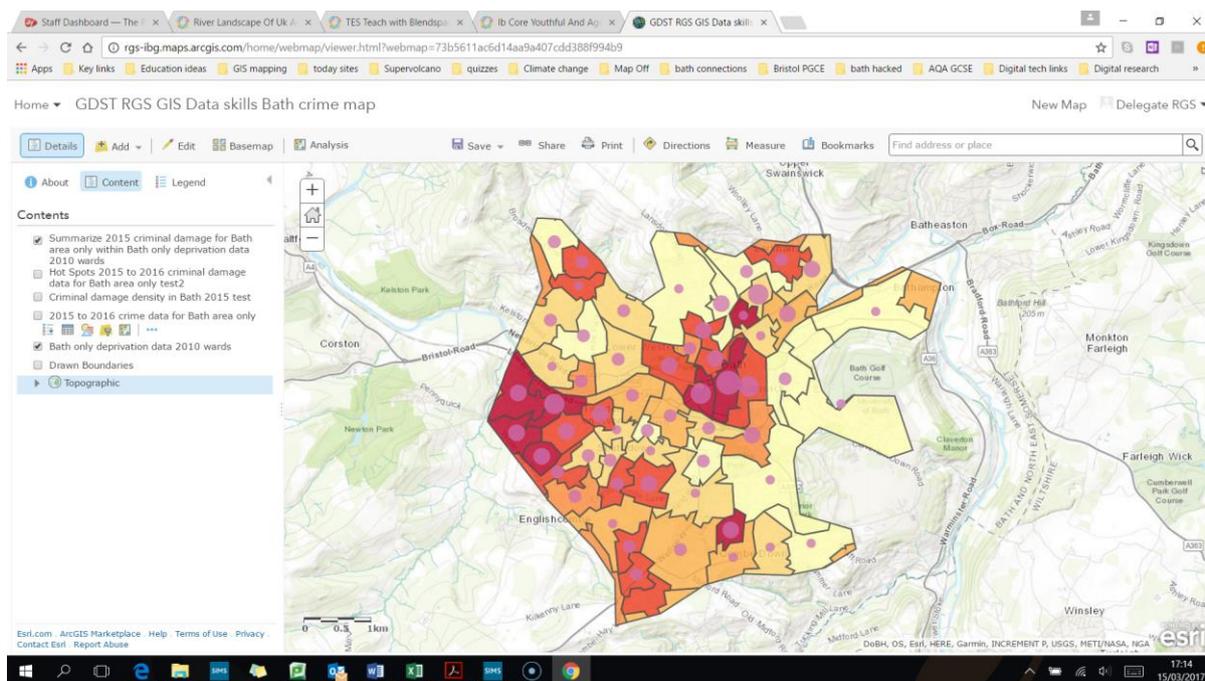
21. Click on analysis again and this time summarise data and "summarise within".



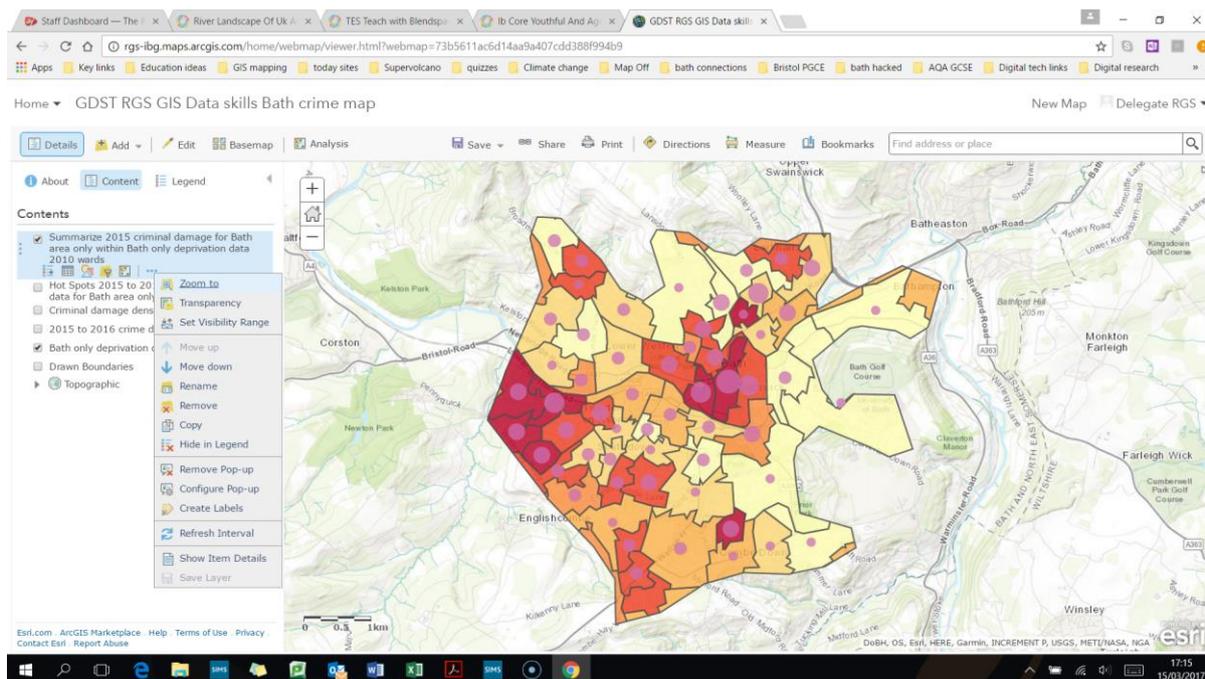
22. In the first box pick “Bath only deprivation...” In the second box pick “2015 to 2016 crime data...” Ignore box 3 and 4. Give it a name like “Summarize 2015 criminal damage for Bath area only within Bath only deprivation data 2010 wards. Then run analysis.



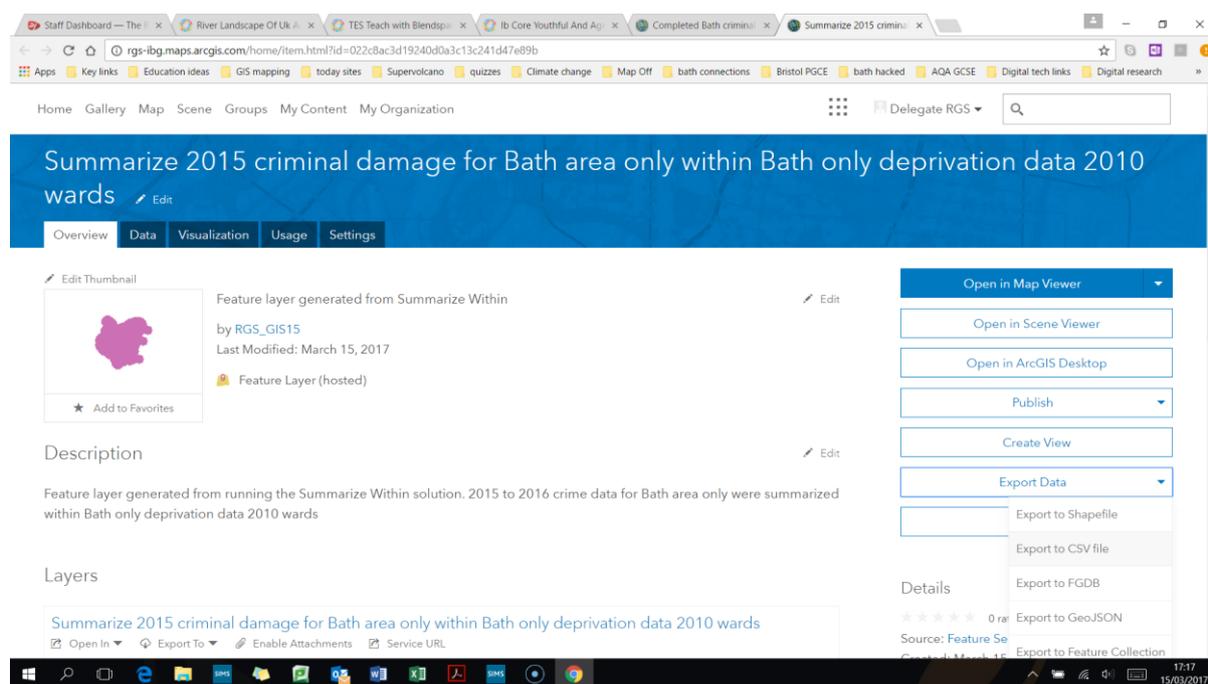
23. This produces a summary count of the number of criminal damage crimes which occurred within each of the deprivation areas across Bath. You can change the look/ style of this new layer. At first it shows it as proportional circles for the count of the points.



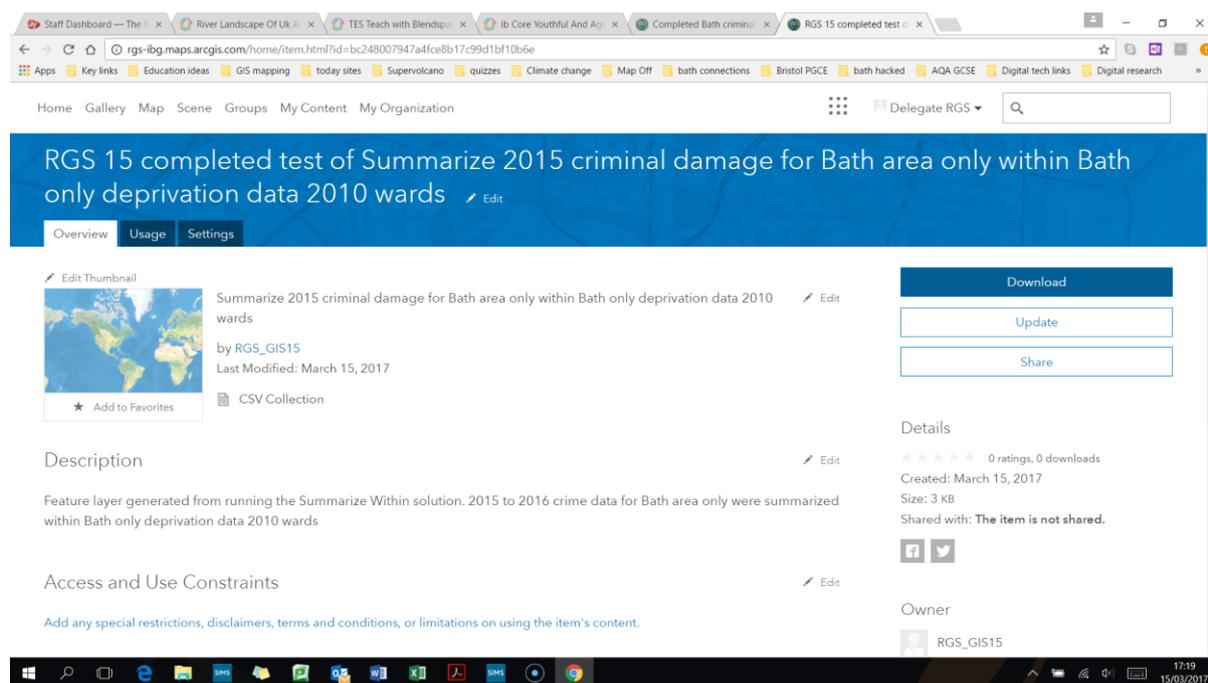
24. Now click on this layer's name and then the three dots under the name and pick "show item details".



25. Then it opens a new tab in your browser. In the bottom right is the option to export the data – pick to csv file. Then fill out the details for the layer name in the pop up. (note you need to give the file a shorter name) e.g. "Bath criminal damage and deprivation"

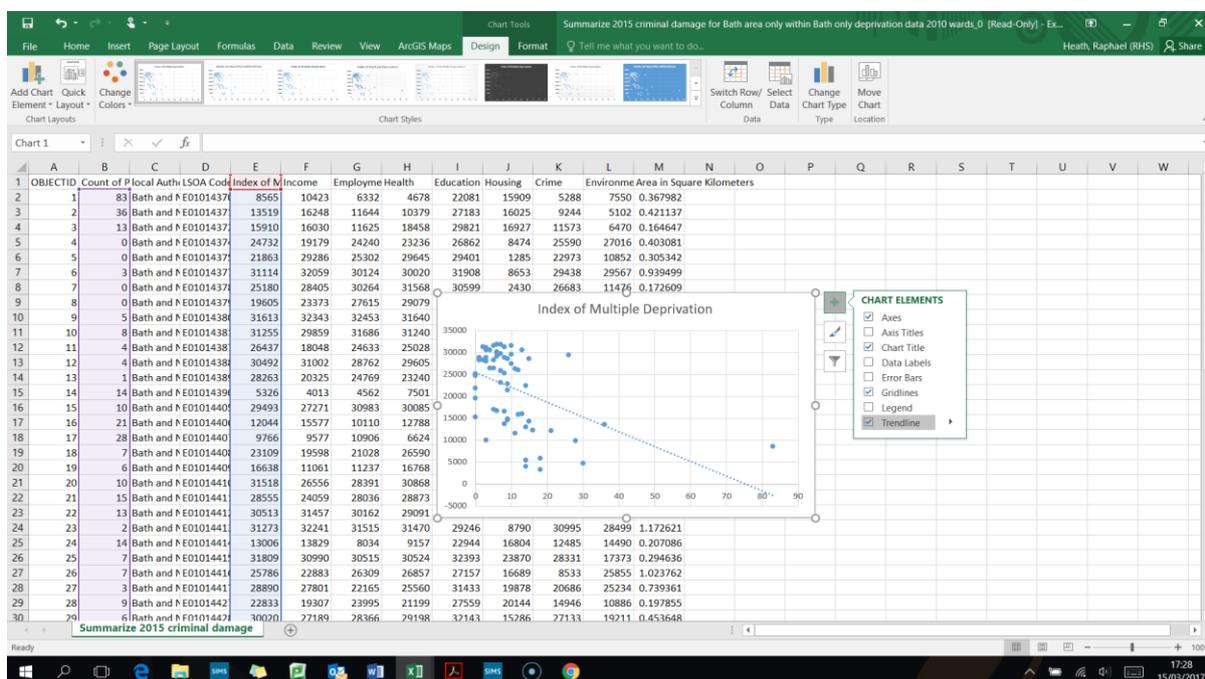


26. In the new screen then click download



OBJECTID	Count of P	Local Auth	LSOA Code	Index of M	Income	Employme Health	Education	Housing	Crime	Environme Area in Square Kilometers
1	83	Bath and N E0101437	8565	10423	6332	4678	22081	15909	5288	7550 0.367982
2	36	Bath and N E0101437	13519	16248	11644	10379	27183	16025	9244	5102 0.421137
3	13	Bath and N E0101437	15910	16030	11625	18458	29821	16927	11573	6470 0.164647
4	0	Bath and N E0101437	24732	19179	24240	23236	26862	8474	25590	27016 0.403081
5	0	Bath and N E0101437	21863	29286	25302	29645	29401	1385	22973	10852 0.305342
6	3	Bath and N E0101437	31114	32059	30124	30020	31908	8653	29438	29567 0.939499
7	0	Bath and N E0101437	25180	28405	30264	31568	30599	2430	26683	11476 0.172609
8	0	Bath and N E0101437	19605	23373	27615	29079	24297	2030	11959	10835 0.194782
9	5	Bath and N E0101438	31613	32343	32453	31640	32212	8809	28381	30227 1.574742
10	8	Bath and N E0101438	31255	29859	31686	31240	32387	18865	24337	17547 0.48702
11	4	Bath and N E0101438	26437	18048	24633	25028	25855	27407	20269	21287 0.390702
12	4	Bath and N E0101438	30492	31002	28762	29605	32158	9476	30241	23699 0.585502
13	1	Bath and N E0101438	28263	20325	24769	23240	27252	22703	30346	26819 0.459213
14	14	Bath and N E0101439	5326	4013	4562	7501	3052	5800	15483	20878 0.175008
15	10	Bath and N E0101440	29493	27271	30983	30085	31179	16088	19630	15814 0.540171
16	21	Bath and N E0101440	12044	15577	10110	12788	28591	10388	5340	5126 0.417646
17	28	Bath and N E0101440	9766	9577	10906	6624	24018	17375	5424	3937 0.231808
18	7	Bath and N E0101440	23109	19598	21028	26590	24154	20621	22237	9186 0.113055
19	6	Bath and N E0101440	16638	11061	11237	16768	19997	18501	24920	22606 0.303756
20	10	Bath and N E0101441	31518	26556	28391	30868	28657	25367	29972	26877 0.409921
21	15	Bath and N E0101441	28555	24059	28036	28873	29168	18251	22857	16244 0.427807
22	13	Bath and N E0101441	30513	31457	30162	29091	32114	16276	15165	24873 0.326514
23	2	Bath and N E0101441	31273	32241	31515	31470	29246	8790	30995	28499 1.172621
24	14	Bath and N E0101441	13006	13829	8034	9157	22944	16804	12485	14490 0.207086
25	7	Bath and N E0101441	31809	30990	30515	30524	32393	23870	28331	17373 0.294636
26	7	Bath and N E0101441	25786	22883	26309	26857	27157	16689	8533	25855 1.023762
27	3	Bath and N E0101441	28890	27801	22165	25560	31433	19878	20686	25234 0.739361
28	9	Bath and N E0101442	22833	19307	23995	21199	27559	20144	14946	10886 0.197855
29	6	Bath and N E0101442	30020	27189	28366	29198	32143	15286	27133	19211 0.453648

27. Now you have the data as a spreadsheet and can conduct further statistical analysis of the data. You can produce a scatter graph to visualise the relationship between the “count of points” of criminal damage in each area and the deprivation rank scores. We can see as deprivation rank is lower than the count of these crimes rises.



28. Use the formula “=CORREL(B:B,E:E)” to produce a correlation analysis value. In this case - 0.46. You can run a spearmans rank test off this data also. There are online calculators where you can copy and paste your data in to run this.

OBJECTID	Count of P local Auth	LSOA Code	Index of M Income	Employme Health	Education	Housing	Crime	Environme Area in Square Kilometers			
1	83	Bath and N E0101437	8565	10423	6332	4678	22081	15909	5288	7550	0.367982
2	36	Bath and N E0101437	13519	16248	11644	10379	27183	16025	9244	5102	0.421137
3	13	Bath and N E0101437	15910	16030	11625	18458	29821	16927	11573	6470	0.164647
4	0	Bath and N E0101437	24732	19179	24240	23236	26862	8474	25590	27016	0.403081
5	0	Bath and N E0101437	21863	29286	25302	29645	29401	1285	22973	10852	0.305342
6	3	Bath and N E0101437	31114	32059	30124	30020	31908	8653	29438	29567	0.939499
7	0	Bath and N E0101437	25180	28405	30264	31568	30599	2430	26683	11476	0.172609
8	0	Bath and N E0101437	19605	23373	27615	29079					
9	5	Bath and N E0101438	31613	32343	32453	31640					
10	8	Bath and N E0101438	31255	29859	31686	31240					
11	4	Bath and N E0101438	26437	18048	24633	25028					

29. For example open this website

<http://www.socscistatistics.com/tests/spearman/default2.aspx> copy the crime count data into one column and the deprivation data into the second and it will run the test for you. The result here is statistically significant

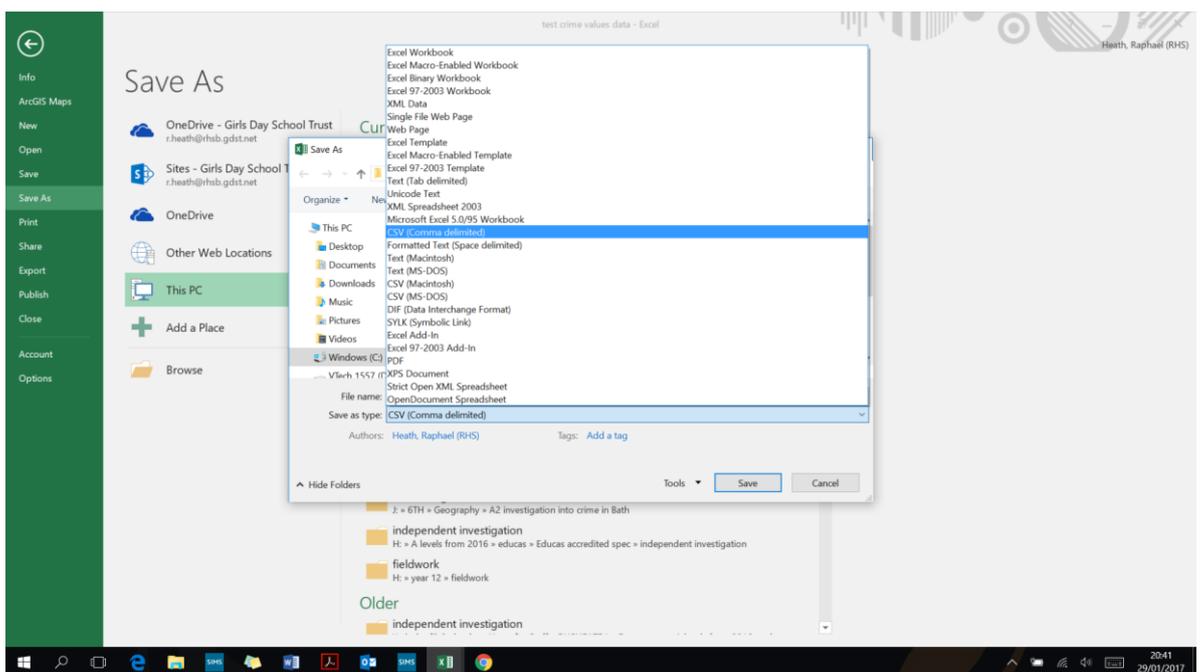
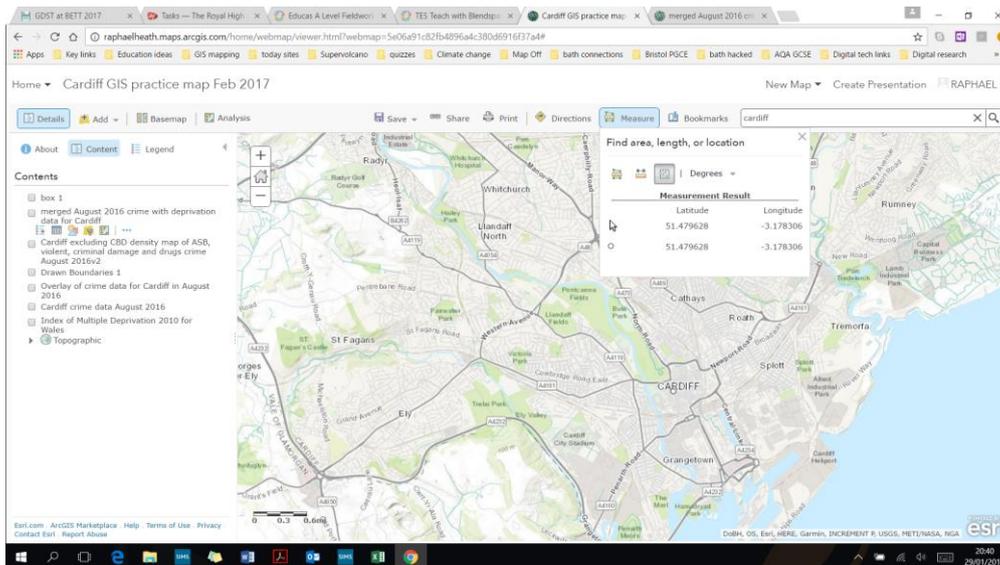
**Spearman's Rho Calculator**

The value of R is: -0.496821.

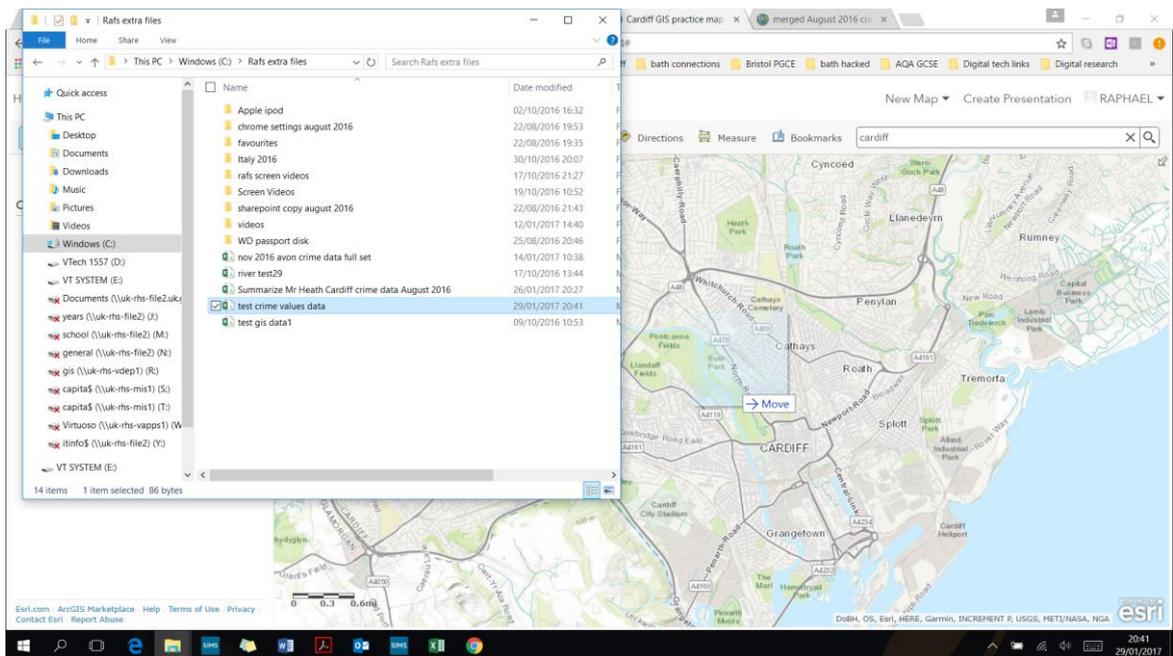
X Values	Y Values
11	15910
6	21521
3	24732
1	21863
1	31595
3	31114
1	25180
2	19605
5	31613
2	31255
2	26437
0	30492
1	28263
14	5326
0	27510
0	21155
0	22234
0	28009
3	29493
6	12044
2	23109
12	16638

The value of R is -0.49682 and the two-tailed value of P is 1E-05. By normal standards, the association between the two variables would be considered statistically significant.

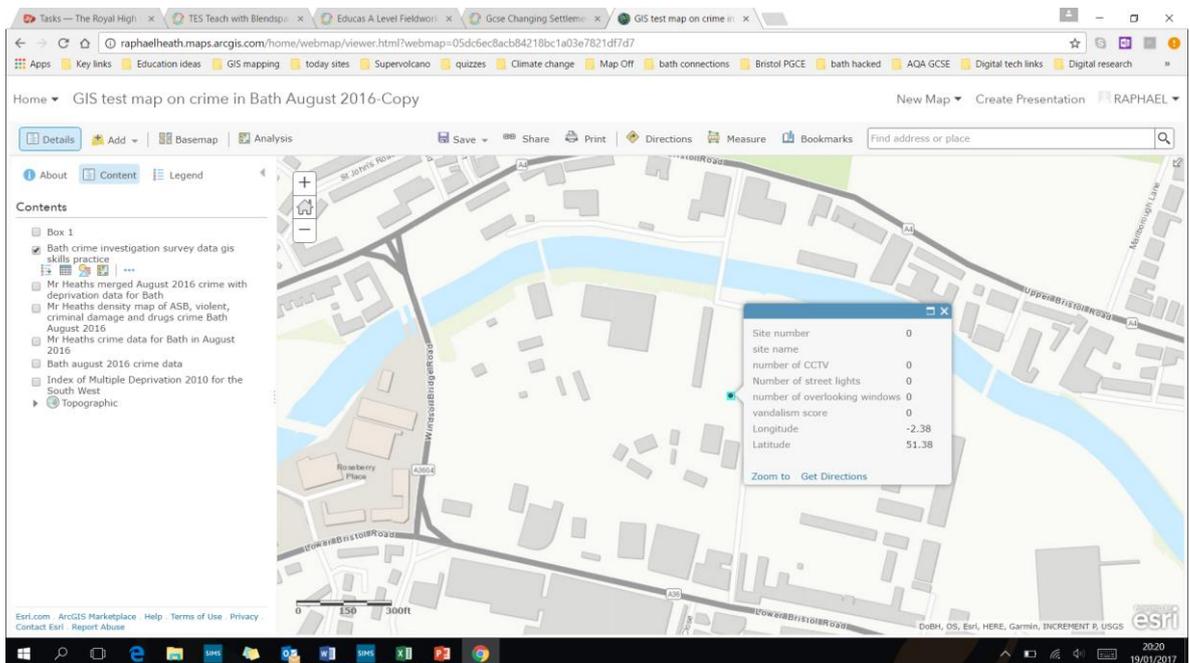




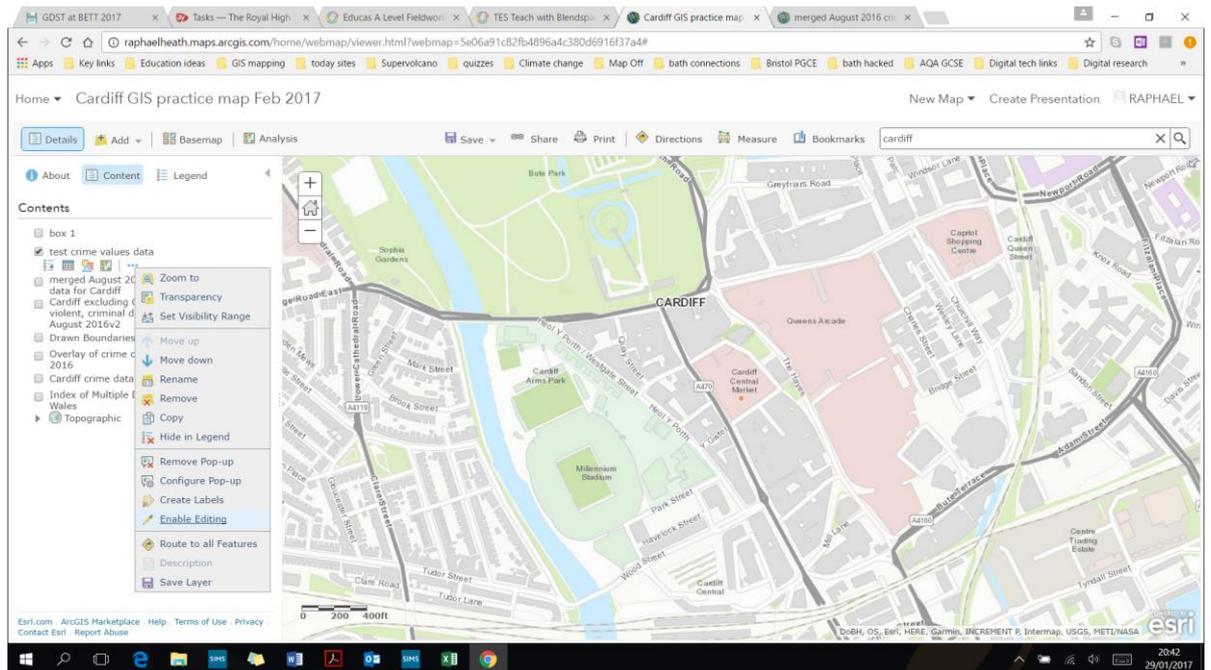
2. Now open the folder with your nearly created spreadsheet file and drag and drop it onto your map.



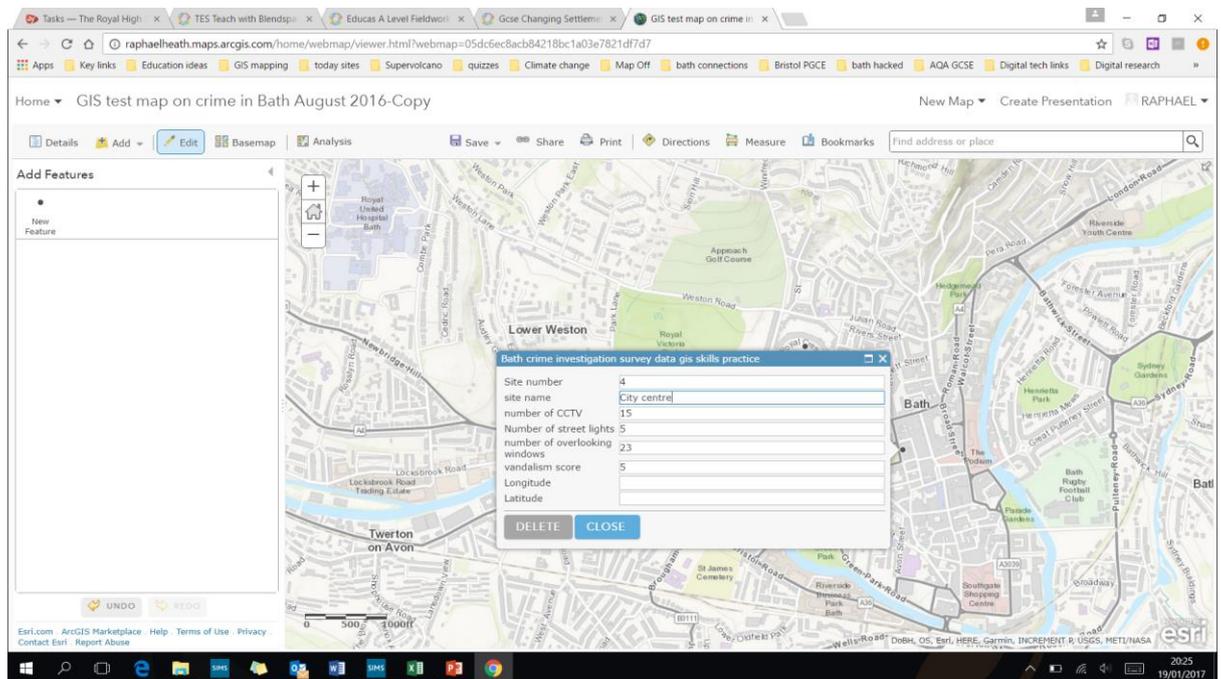
3. This will put a dot onto your map. It may zoom you in very close so zoom out a bit and cancel the change style screen so you can see your list of layers. Click on the dot to see the information it contains.



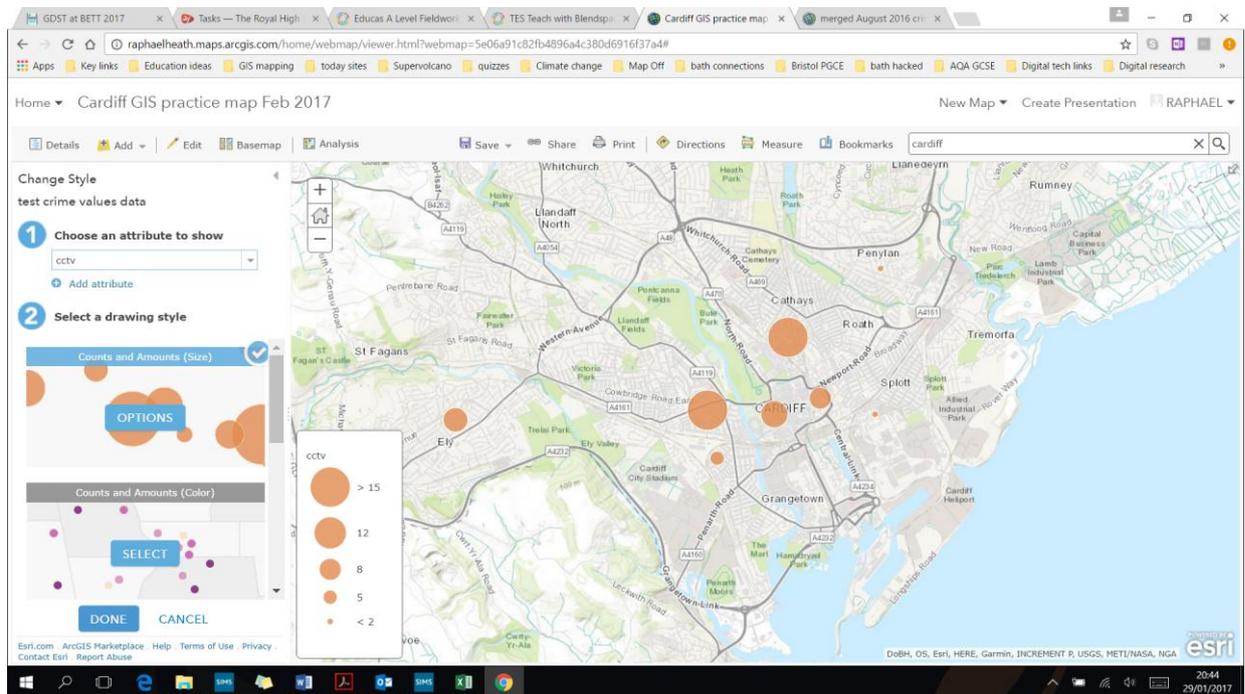
4. Now click on the name of the new layer you have added. Then pick the three little dots under the name and from the drop down menu pick "enable editing". Then click "edit" on the top left of the screen.



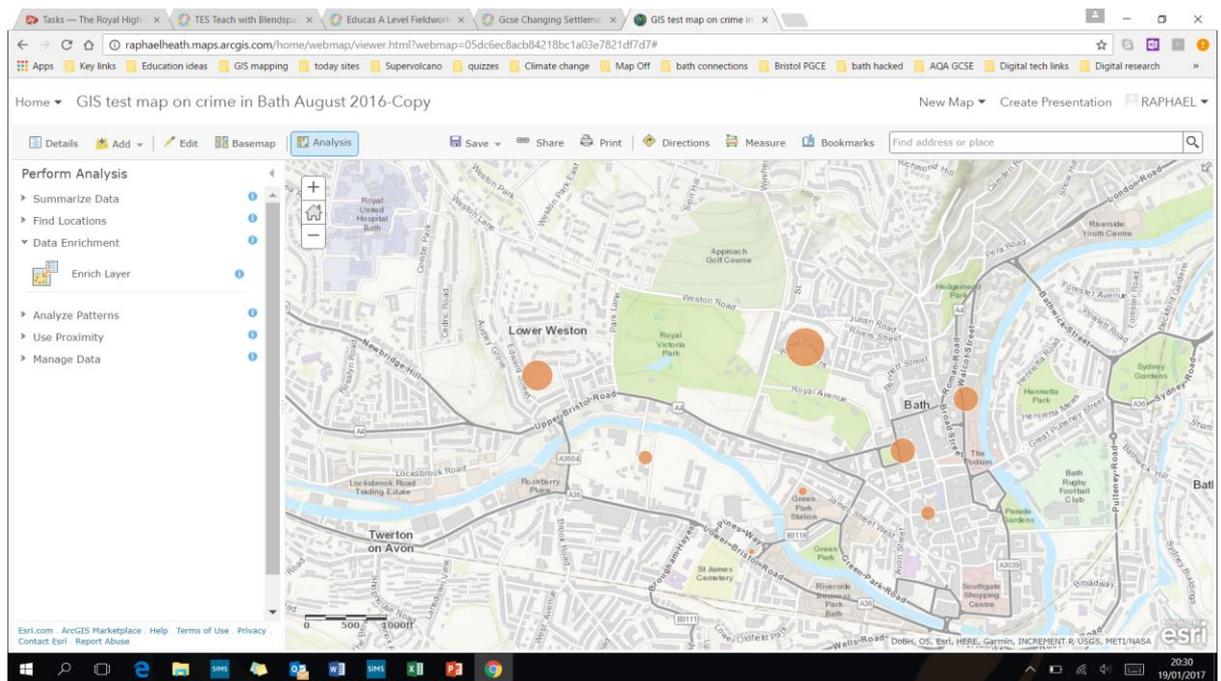
- Now you can edit the dot you put into the map – move its location to the correct site you are doing measurements at, and enter real data. You can then click on a new dot from the left side menu and add more data points to your map. Add 5 to 10 site points with made up data in to your map.



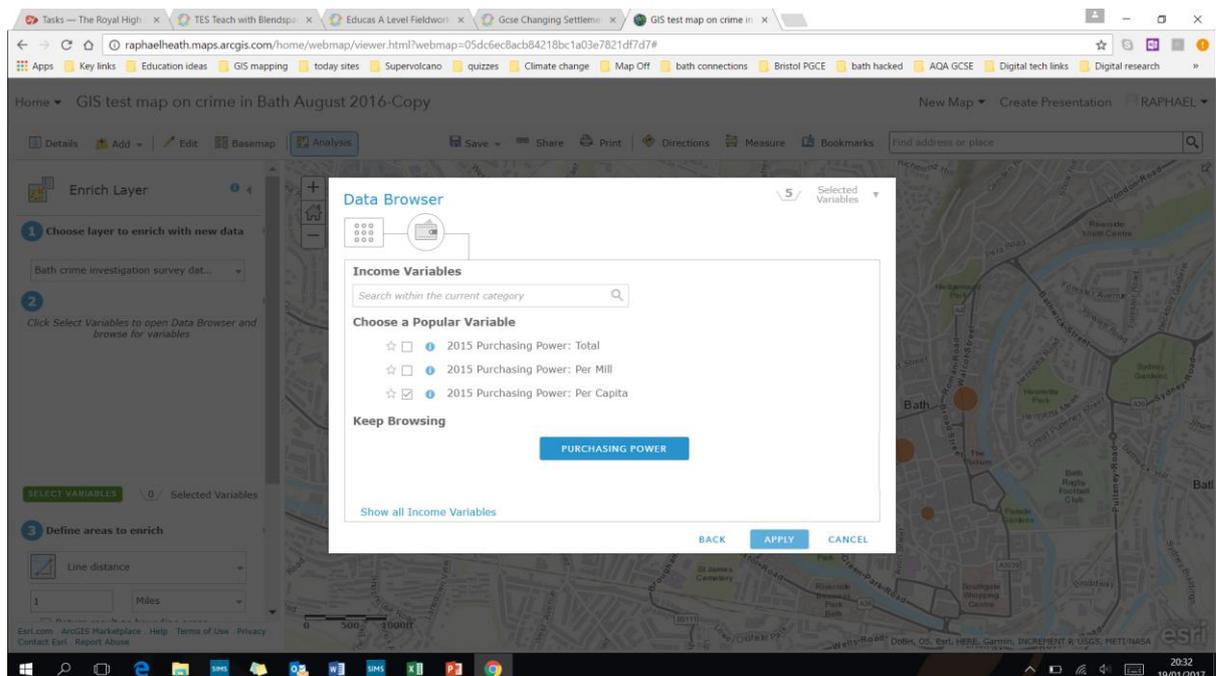
- Once you have some data in you can change the symbols to display this data like as proportional symbols

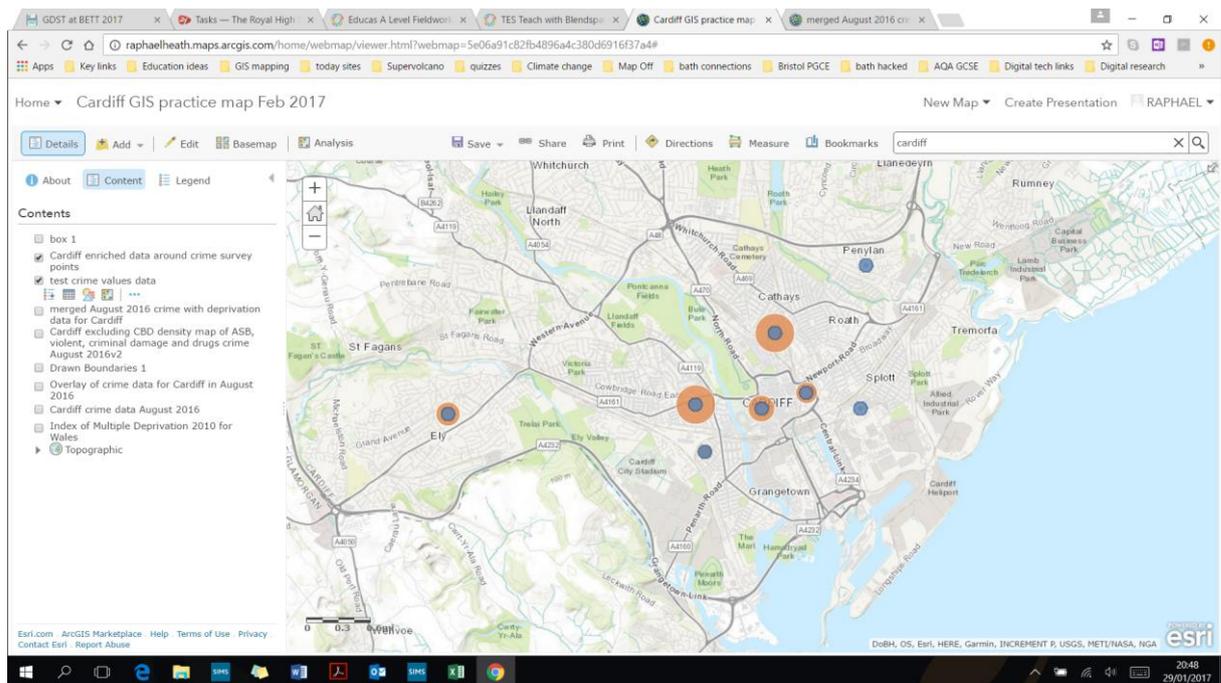


- If you want some specific data added to your study sites you could use the data enrichment tool. Click on the name of the layer you have just created with your new sites in, and pick the analysis option. Pick “data enrichment” and then “enrich layer”.

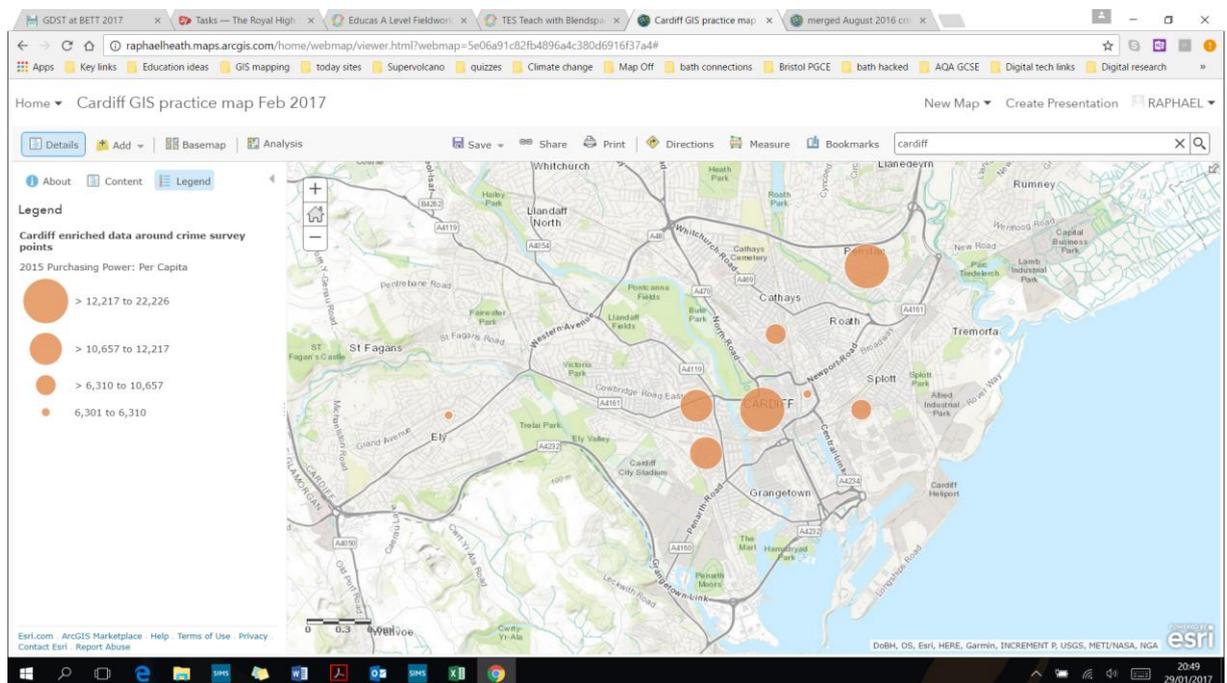


8. Then make sure it has chosen the correct layer in step 1. In step 2 click on the green button called “select variables” and add in things of interest to you – such as population size, income, education level, etc. Then in step 3 you can choose the distance around your point to produce this data based on. For example, try 100m as a line distance around each point. Give the layer a name like “Bath enriched data around crime survey points” and then run analysis.

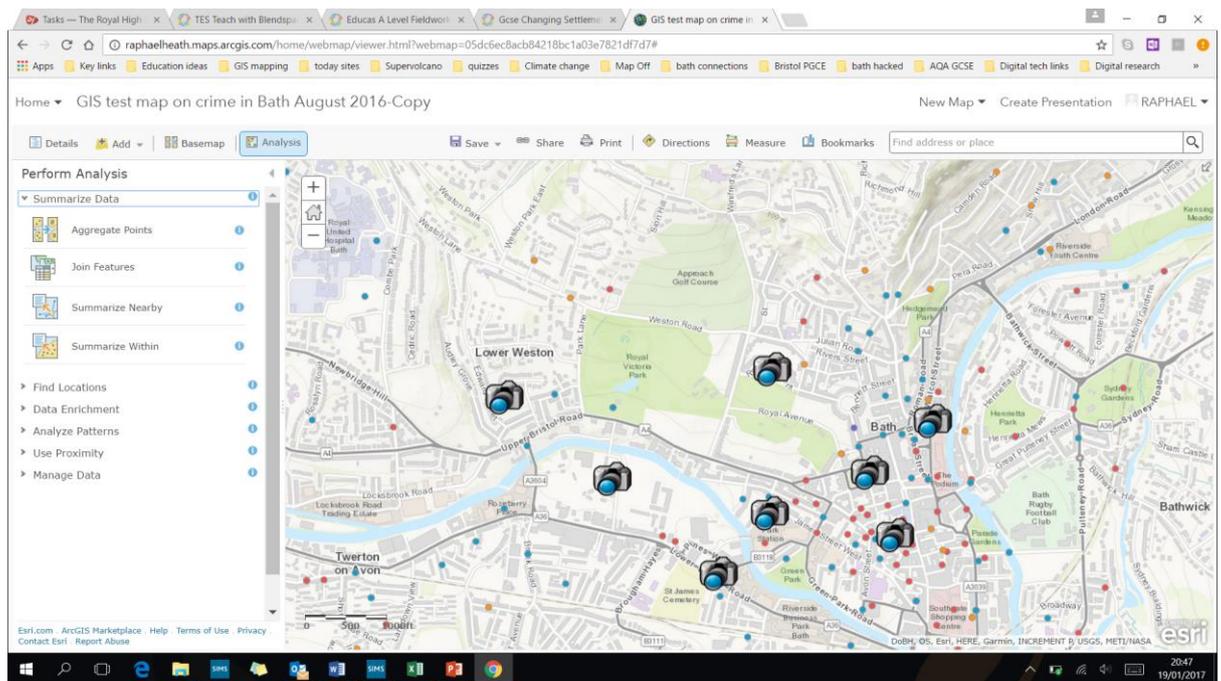




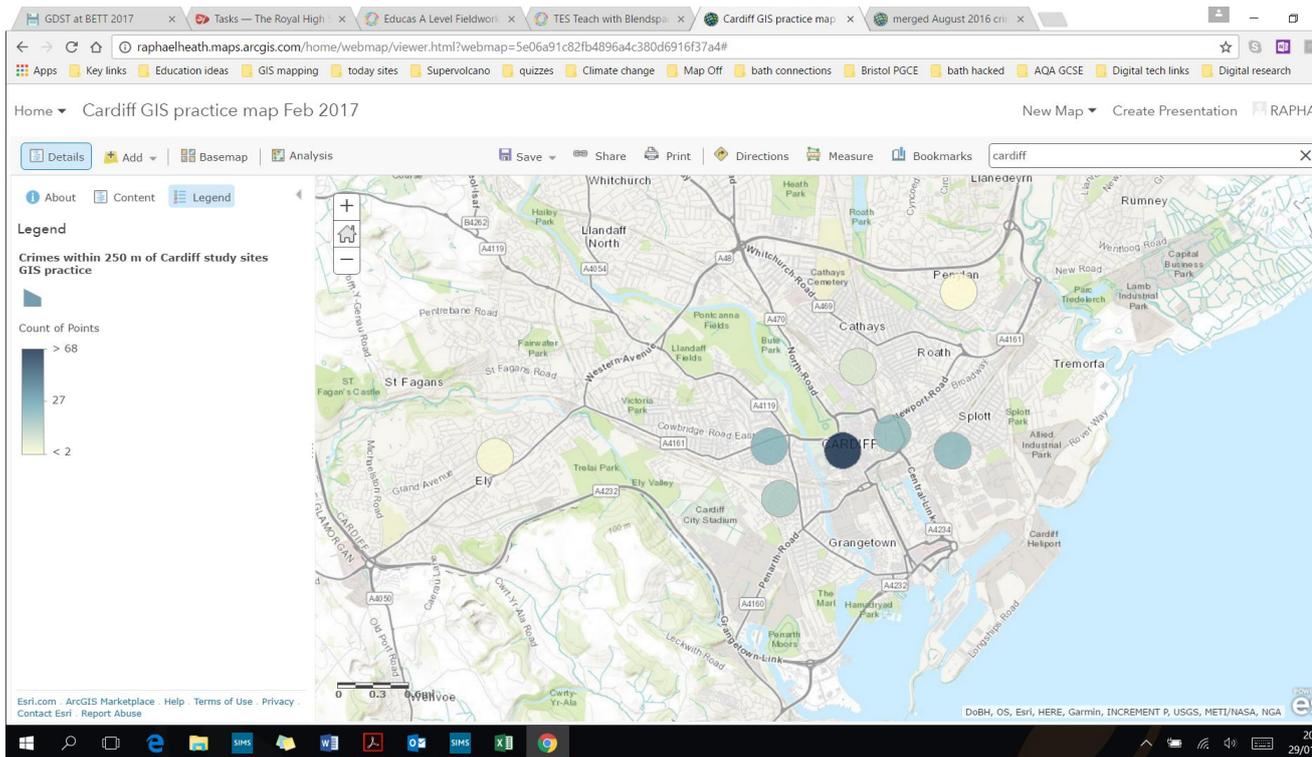
9. Once this is completed click on a dot in this new layer (turn other layers off) and you will see it contains some new original data. Now change the symbols for this data to display it on the map – such as incomes.



10. You could change the symbols of the CCTV camera to look like cameras. You could also calculate the number of crimes within a distance of each of your measurement sites. So click on the site name and the analysis option. Then pick summarise data and summarise nearby.



11. Then make sure step 1 has your CCTV camera layer chosen and step 2 has the Bath crime data. Then pick a line distance – say 250m from each site. Ignore step 4 and 5. Give it a name and run the analysis. It will produce a symbol to show the counts of crimes within 250m of your study sites.



12. A similar result but with a different visual effect is using the analysis for your CCTV layer – this time pick “use proximity” and then “find nearest”. Set the distance in step 4 to 250m again but untick the “limit the number of locations to”.

