

Creating a Continuous Area Cartogram from Census data in QGIS



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1. Introduction

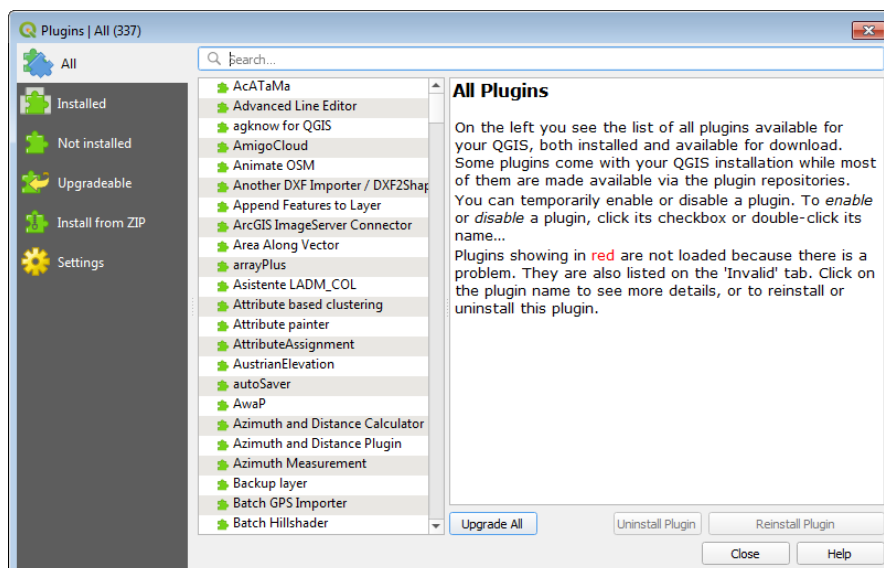
In this exercise we will create a continuous area cartogram using data on housing tenure from the 2011 census for the Leeds area at MSOA level.

2. Install QGIS Cartogram plugin.

QGIS by default does not include functionality to create Cartograms, but QGIS can be extended using plugins. A plugin is an extension written by someone or an organisation within the QGIS user community which adds additional functionality to QGIS beyond the functionality that is provided in the core QGIS installation. There are many useful plugins which make QGIS a very powerful environment. We are going to use one of these plugins which adds to QGIS the ability to create Cartograms.

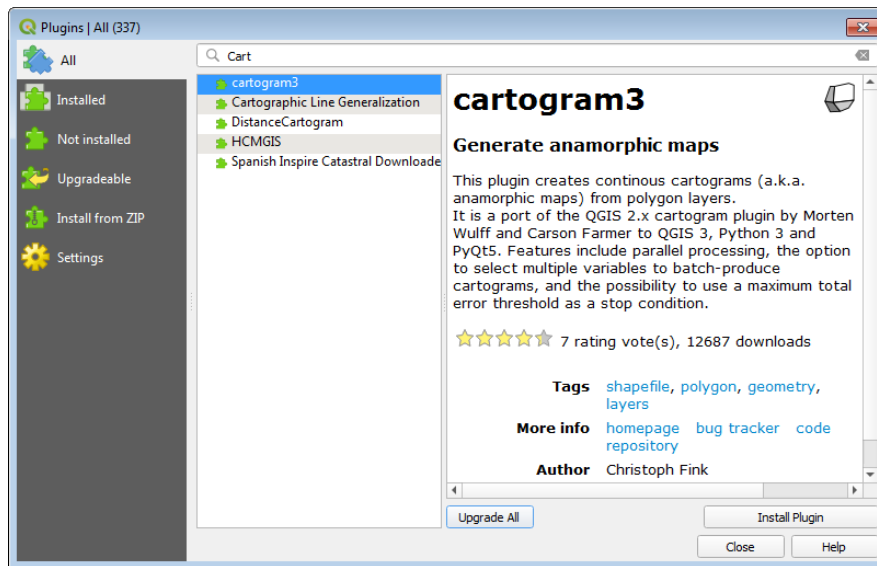
To add the Cartogram plugin to QGIS, if QGIS is not already open, open the application now. Then from the top Plugins menu, choose, Manage and Install Plugins...

This will open the Plugins dialogue which looks like this:



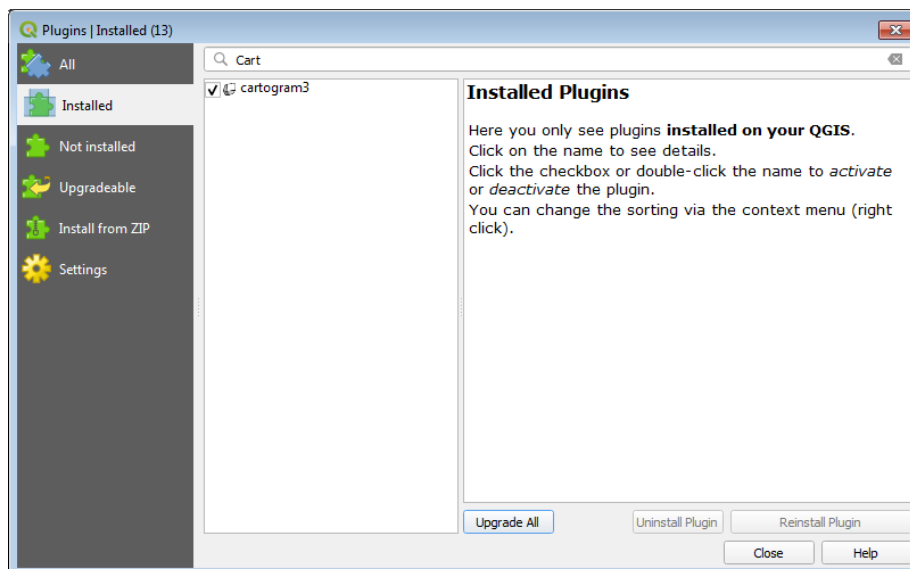
Click on **All** at left then start typing "Cartogram" into the Search box at the top of the Plugins dialogue. QGIS will filter the list of plugins available to install. There

should be a Plugin called **cartogram3** listed. Click on the listed cartogram3 item, read through the description and then click the **Install Plugin** button.



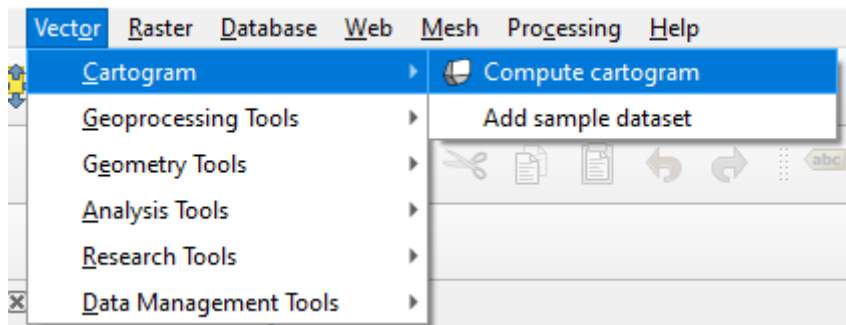
QGIS should proceed to install the plugin without further intervention.

If on the Plugins browser you now click on **Installed** at left this will list which Plugins have been installed in QGIS. Check that as shown below **cartogram3** is listed and is enabled (is ticked).



You can now close the Plugins dialogue by clicking the Close button.

Installing the cartogram3 plugin will add a new Cartogram sub-menu under the Vector item on the main QGIS menubar:



In addition, a new button will be added to the QGIS interface:

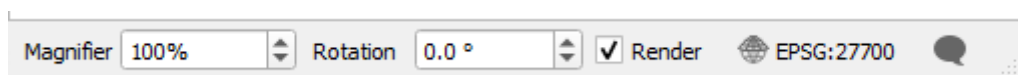



When you want to use the Cartogram plugin you can either click this button or use the Compute cartogram option from the QGIS menubar.

3. Add data for Cartogram to QGIS

Before adding new data to make our Cartogram from, make sure that in our current QGIS project the correct Coordinate Reference System for the UK is set.

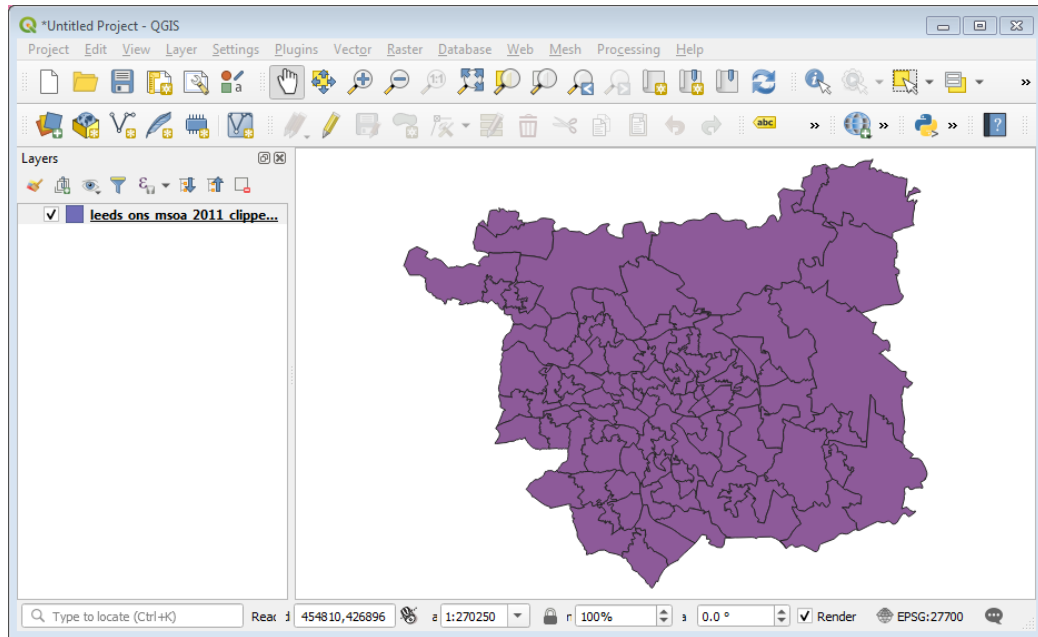
By default QGIS has the project Coordinate Reference System set to EPSG:4326 i.e. the Global WGS84 CRS. Since we are using UK census data, we are using data provided in EPSG:27700 and so make sure that the QGIS project Coordinate Reference System is set to EPSG:27700 as below. If you need help on how to do this refer to exercise 1.



Use the Data Source Manager, click the  icon and open the

Census_Training_Data\Cartogram\LeedsMSOA\leeds_ons_msoa_2011_clipped_gen.shp

dataset. It will look something like this:



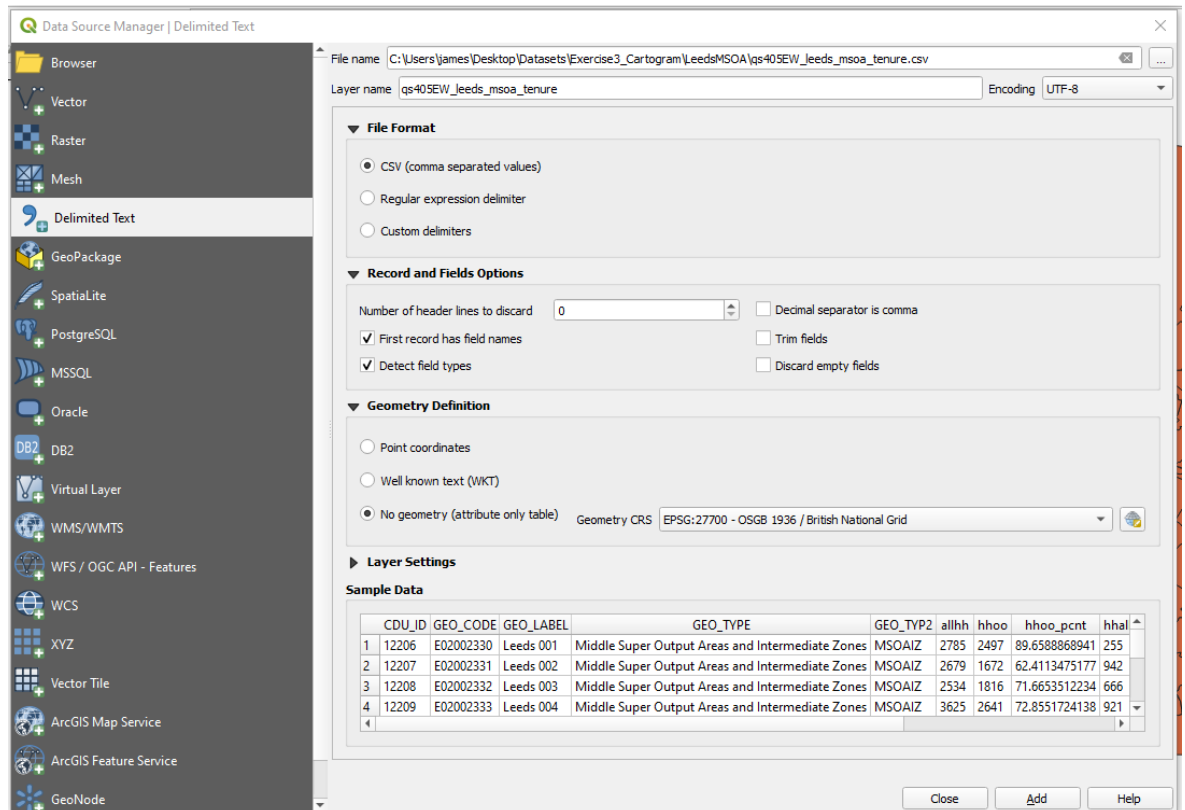
This leeds_ons_msoa_2011_clipped_gen.shp shapefile dataset provides 2011 Middle Layer Super Output Areas for Leeds. The boundaries themselves have been generalised (the complexity of their geometries has been reduced) in order to speed up the processing needed to create the Cartogram.

Also, use the Data Source Manager to add:

Census_Training_Data\Cartogram\LeedsMSOA\qs405EW_leeds_msoa_tenure.csv

CSV file to this new project in the same way you did in Exercise 1.

So, from the Data Source Manager, pick type as Delimited Text and navigate to the location of the qs405EW_leeds_msoa_tenure.csv file. Ensure settings are as per screenshot below and then click the **Add** button and then the **Close** button to return to QGIS.



The CSV contains data from the 2011 Census QS405EW 2011 table, data which can also be downloaded using InFuse from the UK Data Service.

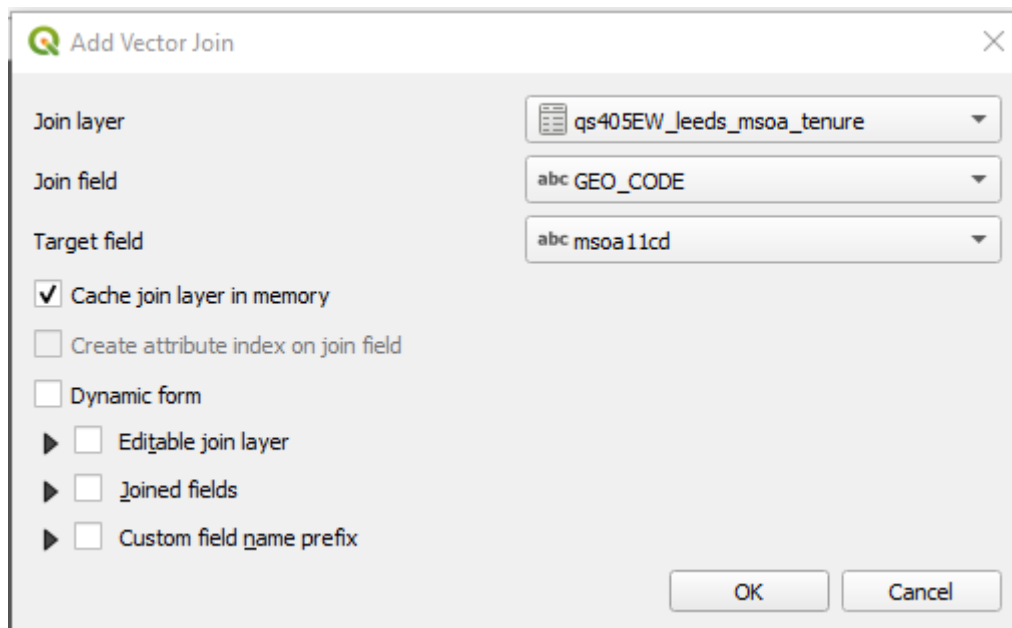
The CSV contains data from the 2011 census on housing tenure at the MSOA level and includes the following columns:

COLUMN NAME	DESCRIPTION
CDU_ID	Internal UK Data Service Record Identifier of the record
GEO_CODE	Unique GeoID (Geographic Identifier) of the MSOA i.e. E02002330
GEO_LABEL	Geographic Name of the MSOA i.e. Leeds 001
GEO_TYPE	The type of Geography i.e. Middle Super Output Areas
GEO_TYP2	The type of Geography alternative form i.e. MSOAIZ
allhh	Total number of all households in the MSOA
hhoo	Number of owner occupied households in the MSOA
hhoo_pcmt	Number of owner occupied households as a % of all households
hhalrt	Number of households renting in the MSOA
hhalrt_pcmt	Number of households renting as a % of all households
hhrts0	Of households renting, number that do so from a local authority etc
hhrts0_pcmt	Of households renting, number that do so from a local authority as a %
hhrtpv	Of households renting, number that do so from a private landlord
hhrtpv_pcmt	Of households renting, number that do so from a private landlord as a %

The `_pcnt` version of each column are the relevant column expressed as a percentage.

As in exercise, we need to join the aggregate census data held in this CSV file to the MSOA boundaries. As in exercise 1 this can be done by double-clicking on the `leeds_ons_msoa_2011_clipped_gen` layer to open the Layer Properties dialogue and, clicking on Joins at left, followed by the green `[+]` button.

On the Add Vector Join dialogue ensure that the options are set as follows



So:

Join layer: `qs405EW_leeds_msoa_tenure`
 Join field: `GEO_CODE`
 Target field: `msoa11cd`

Then click OK to close the Add Vector Join dialogue. Then click Apply followed by OK to close the Layer Properties and return to the QGIS main window.

If you open the Attribute Table of the `leeds_ons_msoa_2011_clipped_gen.shp` or use the identify tool to click on any of the MSOA polygons you should see that each MSOA now contains the columns of data from the CSV tenure dataset i.e. `hhoo_pcnt` etc. Note that when QGIS joins a CSV file to a vector file it adds a prefix to each of the joined column names to indicate which source table the data came from, so in the attribute table the joined column names will be shown with

headers like qs405EW_leeds_lsoa_tenure_hhoo_pcmt etc rather than just hhoo_pcmt.

4. Explore data in QGIS

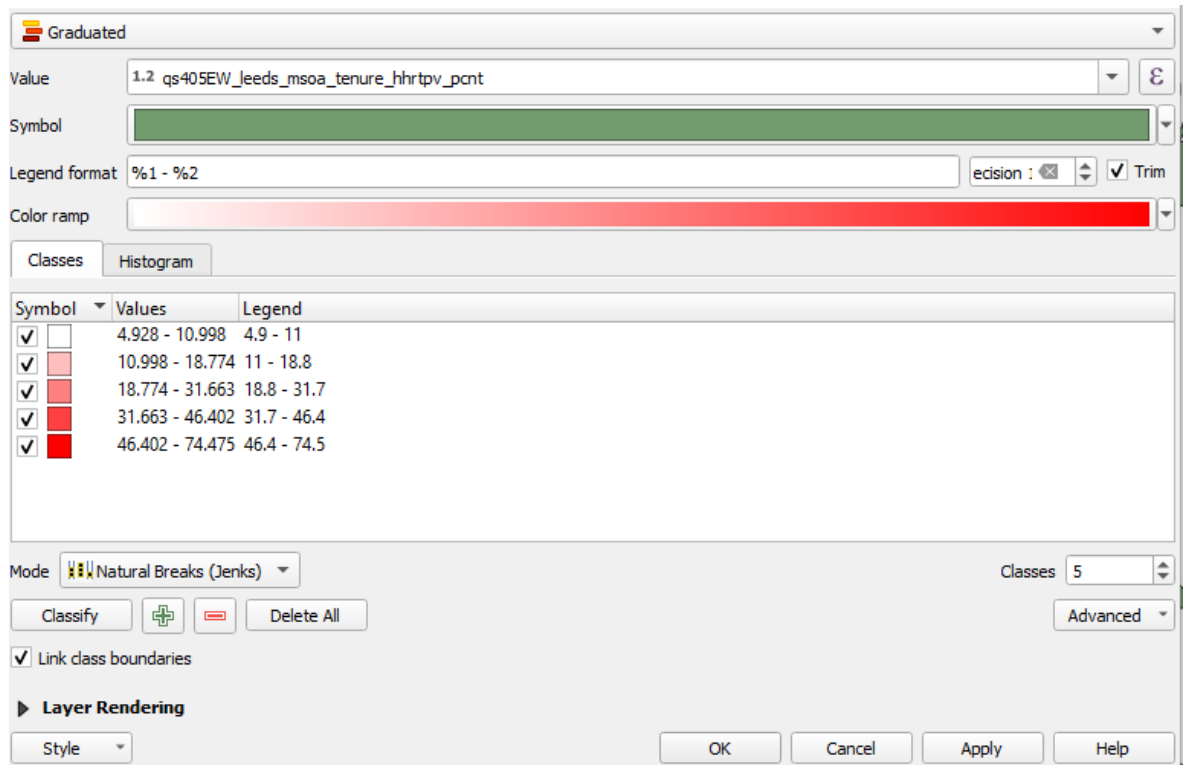
We are now in a position to create our Cartogram.

The column we want to use to create a cartogram from is the qs405EW_leeds_msoa_tenure_p_hhrtpv column. This census variable indicates that of the households that rent the property that the household lives in, the percentage that do so from a private landlord which could be an individual landlord or a letting agency acting on behalf of an owner etc.

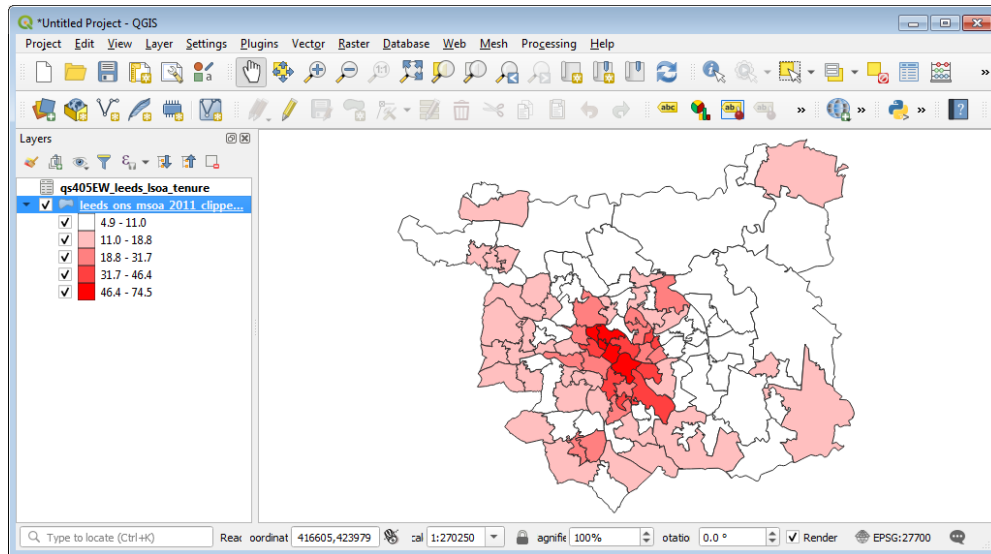
Before we create the Cartogram, lets quickly create a normal choropleth map from this same variable to give us something to compare the cartogram against.

So like you did in exercise 1, double-click the leeds_ons_msoa_2011_clipped_gen layer to open up the Layer Properties dialogue.

Then click on Symbology at left and set things as follows:



So Symbology type is set to *Graduated*; the value (column) we want to create the choropleth map from is *qs405EW_leeds_msoa_tenure_hhrtpv_pcmt*; number of classes is 5; classification method is *Natural Breaks (Jenks)* and we use a red colour ramp. Then click the Apply button followed by the OK button. The Layer Properties dialogue will close and you will be returned to the main QGIS application window where you should see something like this:



Looking at the Choropleth Map we can see that the MSOAs with the highest percentage of private renters are located at the centre of Leeds. However our eyes are drawn to the MSOAs at the edges of Leeds with low to medium percentages of private renters as these MSOAs cover a much larger area. By creating a Cartogram that draws the MSOAs based on the characteristic of the population within the MSOA rather than purely on the geographic area this draw away will be lessened and the data will have much more impact.

5. Create Cartogram

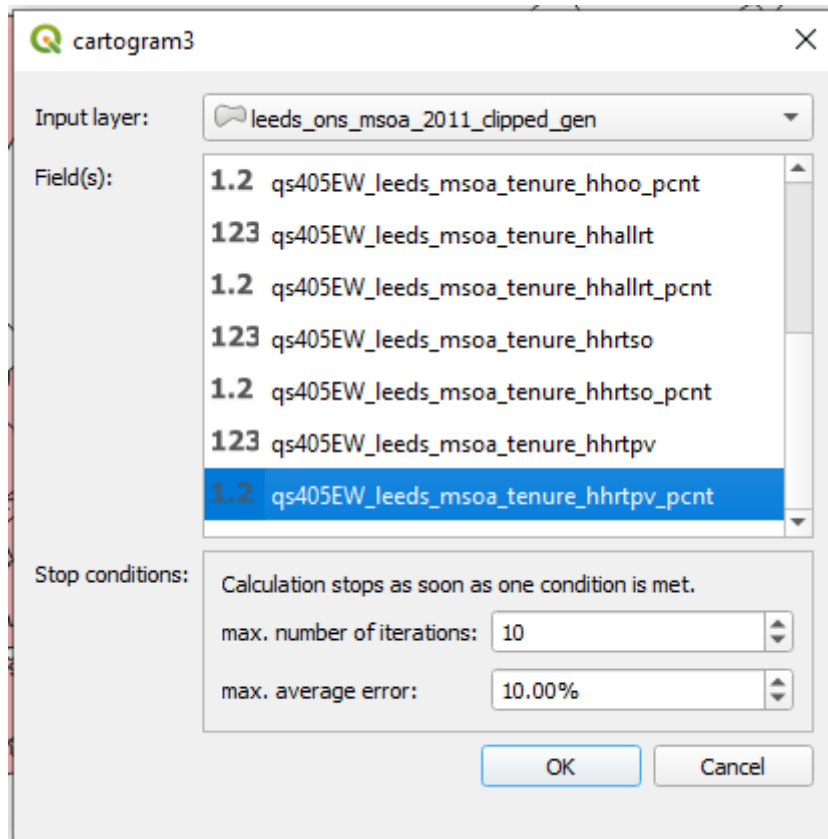
To create the Cartogram, open the Cartogram plugin either from the

Vector >> Cartogram >> Compute Cartogram

option on the main QGIS menubar or by clicking the newly added Create Cartogram button:



Doing so will bring up the QGIS Cartogram plugin dialogue:



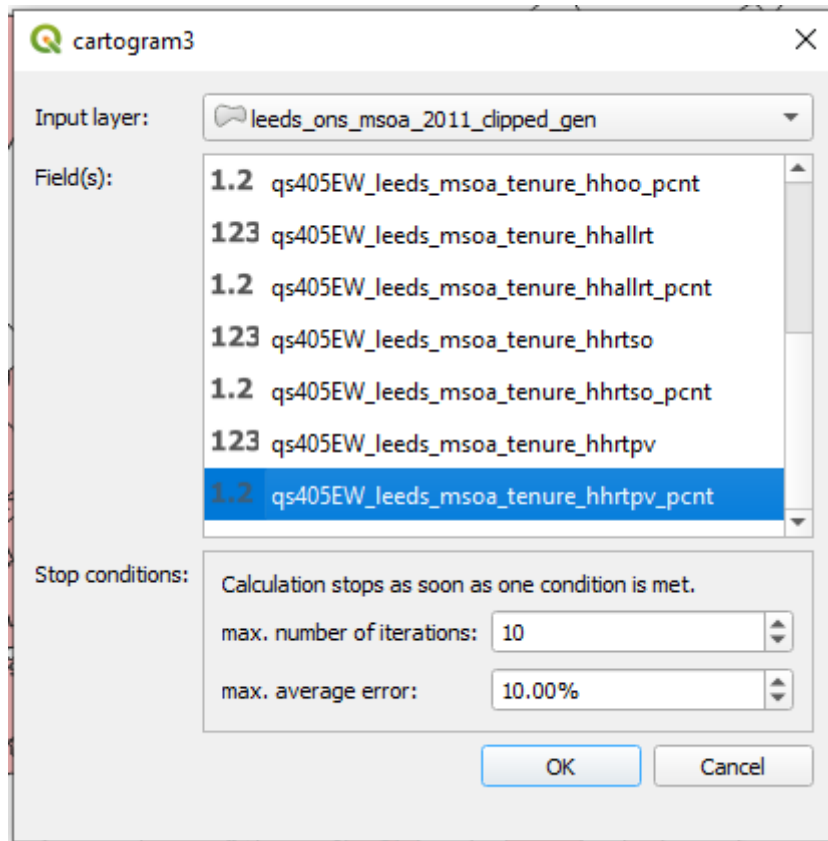
There are not too many options available to generate the Cartogram.

Using the Input Layer dropdown we need to tell QGIS which data layer to base the Cartogram on. In our case this will be the layer of MSOAs which we joined the CSV containing the housing tenure data to.

Using the Field(s) list we need to then tell QGIS which column in the data, the plugin should use to create the Cartogram from. In our case we want to change the shape of the MSOA features based on our *qs405EW_leeds_msoa_tenure_hhrtpv_pcmt* column.

Finally there are a set of Stop conditions at the bottom part of the dialogue which control the behaviour of the Cartogram generation process.

Input layer and Field(s) should be set as in the screenshot below. You can leave Stop conditions should be left at their default values.

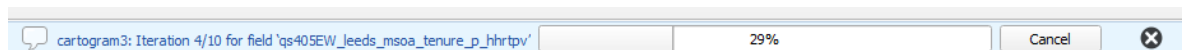


So, set Input layer to **leeds_ons_msoa_2011_clipped_gen**. This is the vector dataset that will be used to create the Cartogram.

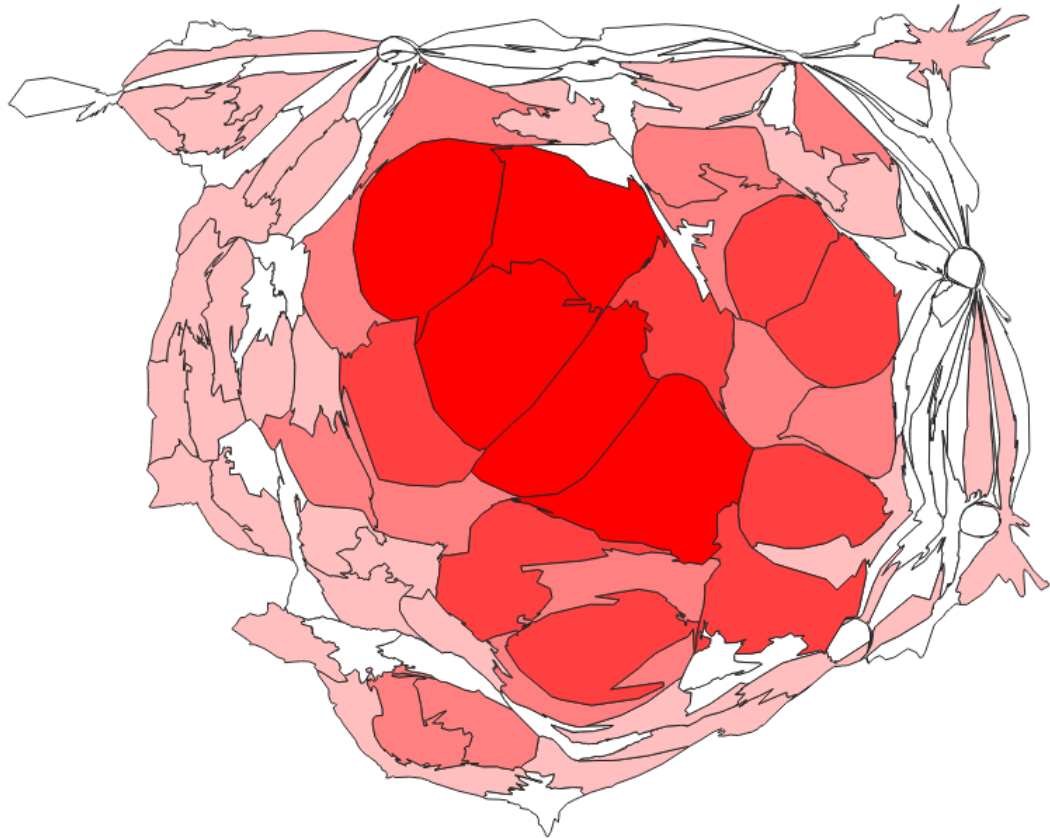
Set Field(s) to **qs405EW_leeds_msoa_tenure_hhrtpv_pcmt**. This is the field that the Cartogram will be based upon.

Leave Stop conditions at defaults.

Click OK – QGIS will display a progress bar indicating that the cartogram is being generated. The process to create a Cartogram is quite a computationally intensive operation and how long this takes will depend on your computer and what else you have running at the same time as QGIS. As the Cartogram generation process runs, QGIS will display a progress bar so you can see how it is progressing:



When done a new layer will be created. The polygon MSOA polygon geometries have been reshaped such that the size and shape of each MSOA is based on the value of the percentage of households renting privately within each MSOA. MSOA polygons with high percentages have been inflated with larger areas whilst MSOA polygons with lower percentages have deflated and shrunk away. Unlike some other Cartogram methods, this continuous area Cartogram has maintained the topology (MSOA polygons which were neighbours before are still neighbours in the Cartogram).



If you have time you might want to try creating a Cartogram from some of the other variables or compare the Cartogram visualisation with the normal Choropleth map.



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