

Exercise 7a - Investigating Raster Data, Styling and Analysis

Learning objectives: The purpose of this exercise is investigate some of the methods available in QGIS for rapidly investigating raster data to gain an understanding of the distribution of values and the structure of the data as well as a suggested method for further analysis.

QGIS has analysis capabilities built-in via Raster Calculator, which allows mathematical operations to be performed upon one or more overlaid raster datasets. In this tutorial, we will explore basics on using Raster Calculator and options available for styling rasters and viewing summary information.

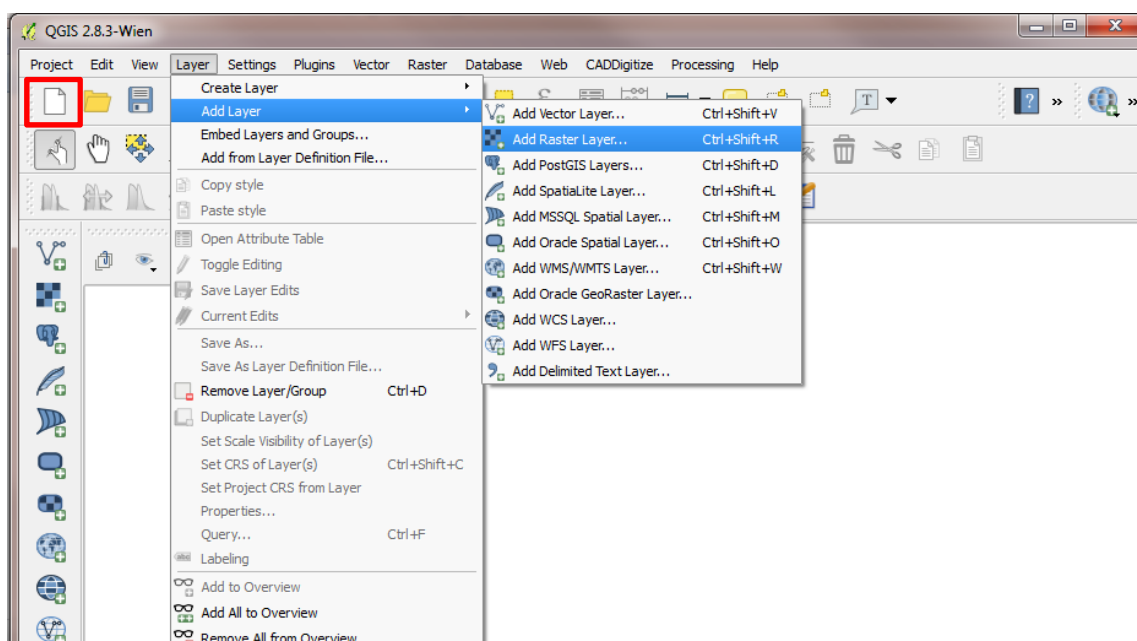
We will use population count grid data for two provinces in Nigeria. These datasets have been generated using the methods under discussion in this workshop. We will interrogate the data, style it and process it in order to fully understand the relative distribution of population.

Skills you will learn:

- Selecting and loading multiple datasets in a single step in QGIS
- Using the Identify tool to query datasets
- Viewing Raster metadata
- Styling Rasters
- Using Raster Calculator

Part 1 – Open QGIS, add and explore raster data.

1. Start QGIS from the **Windows Start** menu
 - Click **New**, highlighted below, to start with a blank map canvas
 - go to **Layer > Add Raster Layer...**



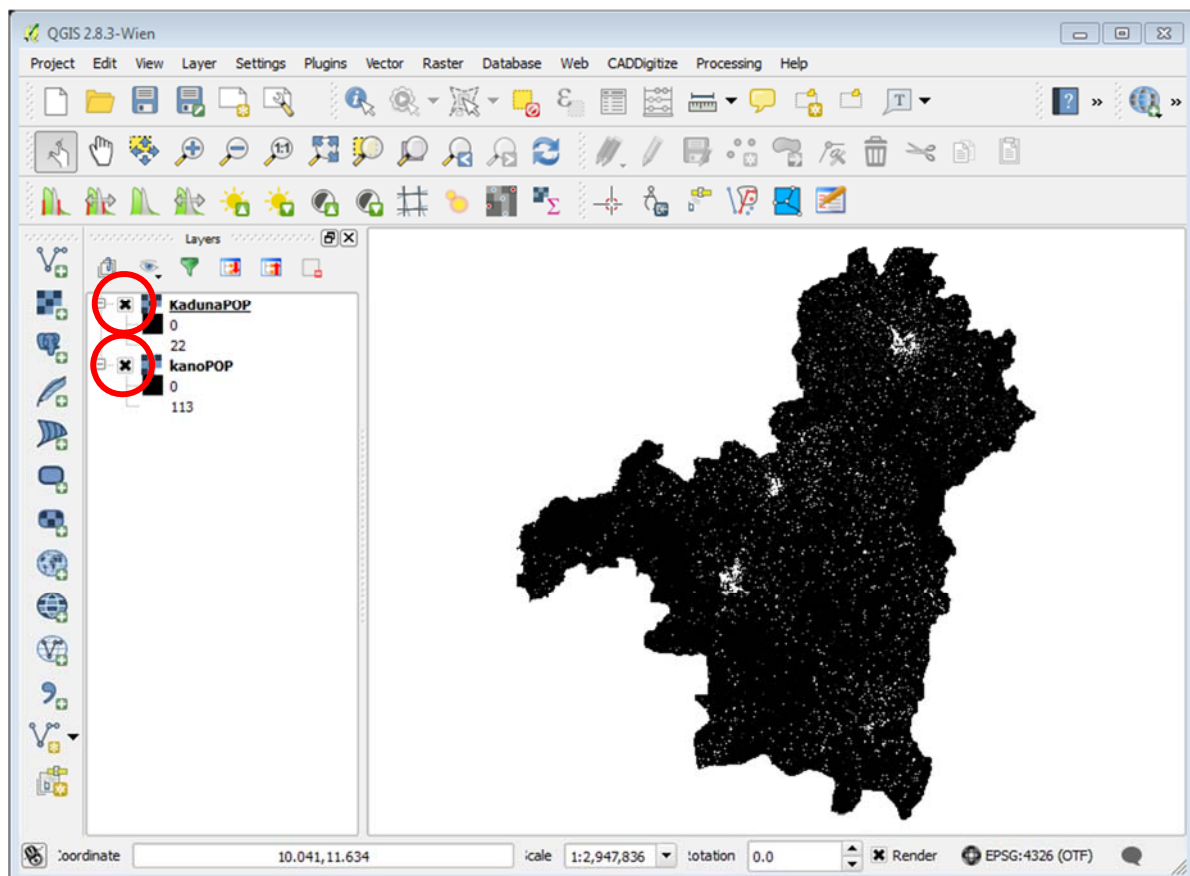
2. Browse to the following locations and select the Raster datasets:

C:\Intro_Quantum_GIS\Exercises\Data\Raster\WorldPop\kanoPOP.tif

C:\Intro_Quantum_GIS\Exercises\Data\Raster\WorldPop\kadunaPOP.tif

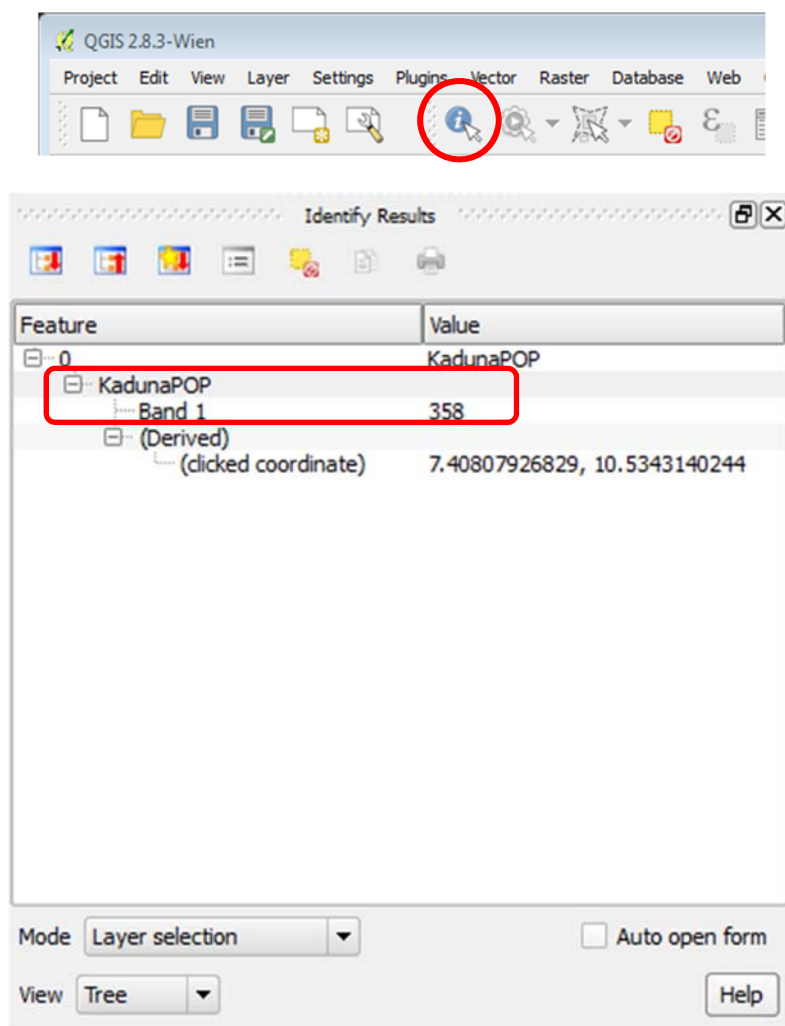
Note: Holding down the Ctrl key and click on both files will enable you to load both the files in a single step.

Now you will see both the rasters loaded in QGIS. The raster is rendered as in grayscale, where darker pixels indicate lower values and lighter pixels indicate higher values. Click the black cross, circled below, to understand where the boundary lies between these two provinces.



Each pixel in the raster has a value assigned. This value is the modelled population Estimate for that grid.

3. Click on Identify Features button (circled below) to select the tool and click anywhere on the raster to see the value of that pixel. (**Note.. if the *Value* field is not visible as below, you will need to expand the width of the *Identify Results* window in order to reveal it.**)



The Identify Results window will display the population estimate for the specific pixel you clicked. (In the **Value** field for **Band 1**). Click around the image to understand its range of values.

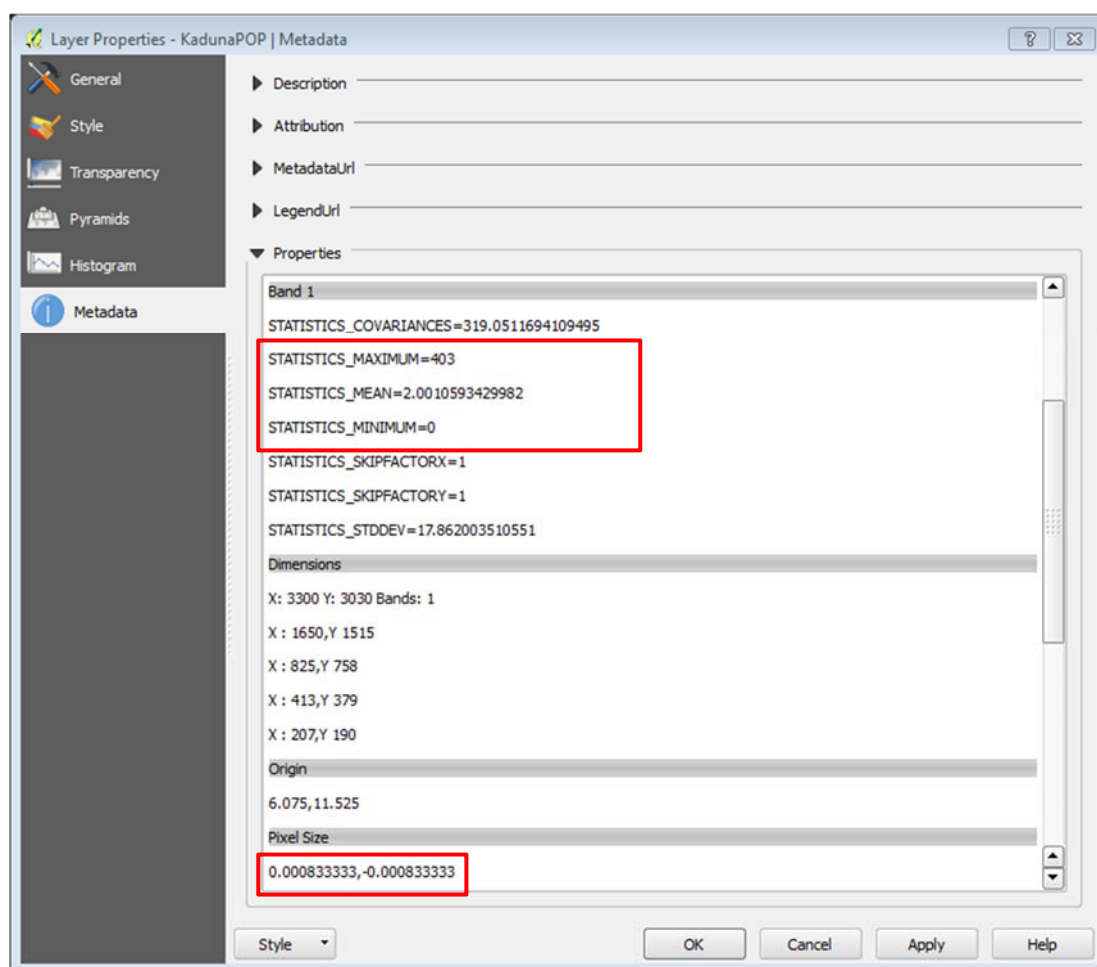
When you first start investigating population datasets, or indeed any raster datasets, there are several key bits of information to find out, such as:

- Pixel resolution
 - Min / Max pop values
 - Mean pop value
 - File location
4. Refer to the raster Metadata to find useful information.
 - Right-click the raster dataset in the **Layers** panel and select layer **Properties**
 - Select the **Metadata** tab

- Scroll down to **Properties**

Alongside these useful statistics, the metadata tab contains useful information on the raster file location, coordinate reference system and geographic extents.

Note: regarding **pixel size**, the population datasets featured in this exercise have pixel dimensions of 0.000833333,-0.000833333. This is an angular unit because the data is referenced by a geographic coordinate system. The values represent fractions of a degree of longitude and latitude. In this case, 0.000833333 equates to approximately 100m, at the equator.



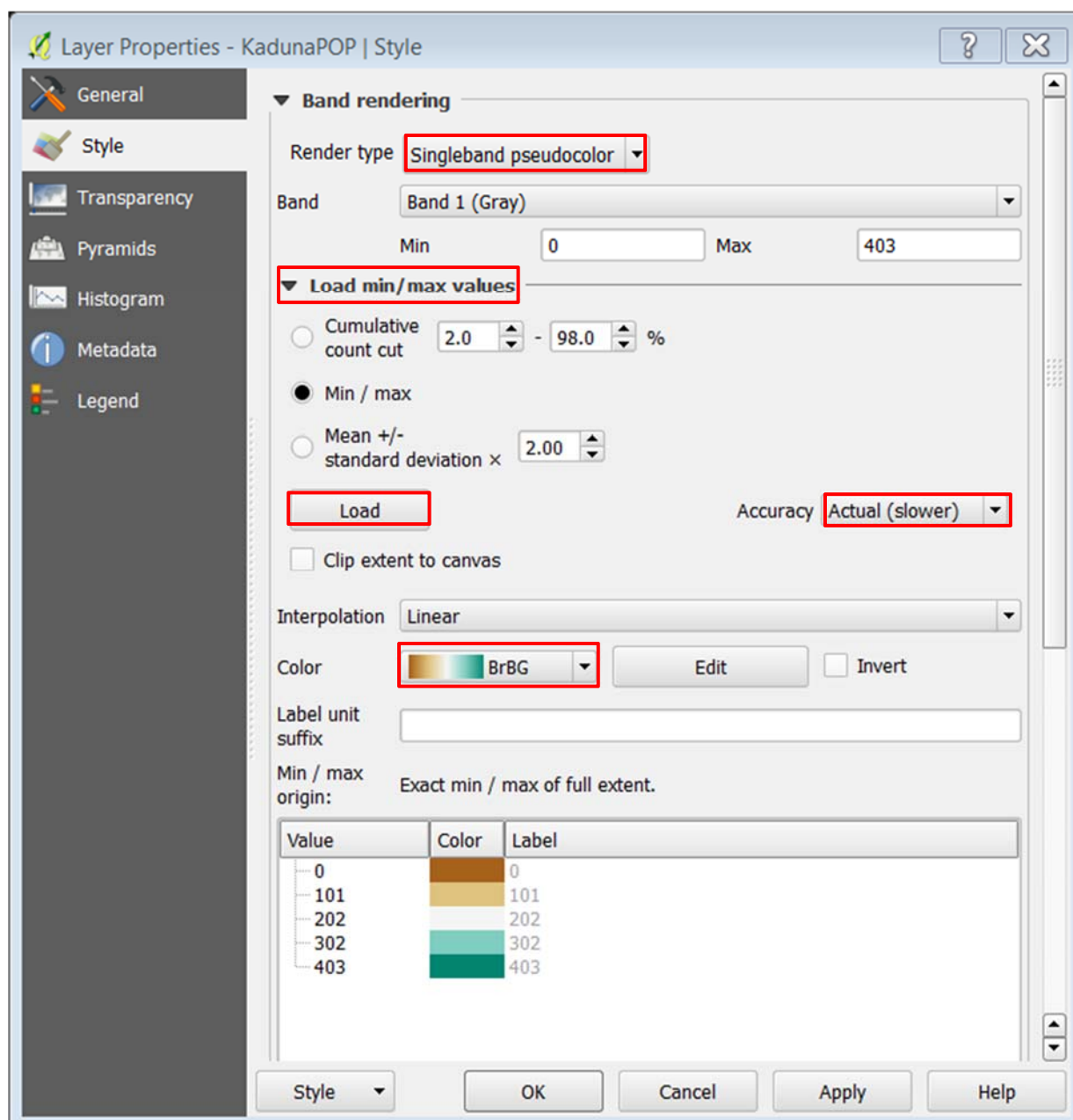
Returning to the map window, you may have noticed that the min/max values in the **Layers** list do not match the true values as listed in the Metadata. To understand why this is the case we will now turn to the **Style** tab of the Layer Properties.

Styling Raster Data

The Black-white colour ramp provide a basic visualisation of the data, however there are enhanced visualization options which better illustrate the pattern of population density.

5. Experiment with the visualisation options for styling raster datasets

- Right-click on **KadunaPOP** and select **Properties**. You can also double-click on the layer name in the TOC to bring up the Layer Properties dialog
- Under **Render Type** at the top of the window, change the Render type to **Singleband pseudocolor**
- In the boxed area named **Load Min/Max values** select **Min / max**
- In the **Accuracy** boxed area, select **Actual (slower)**
- Click **Load**

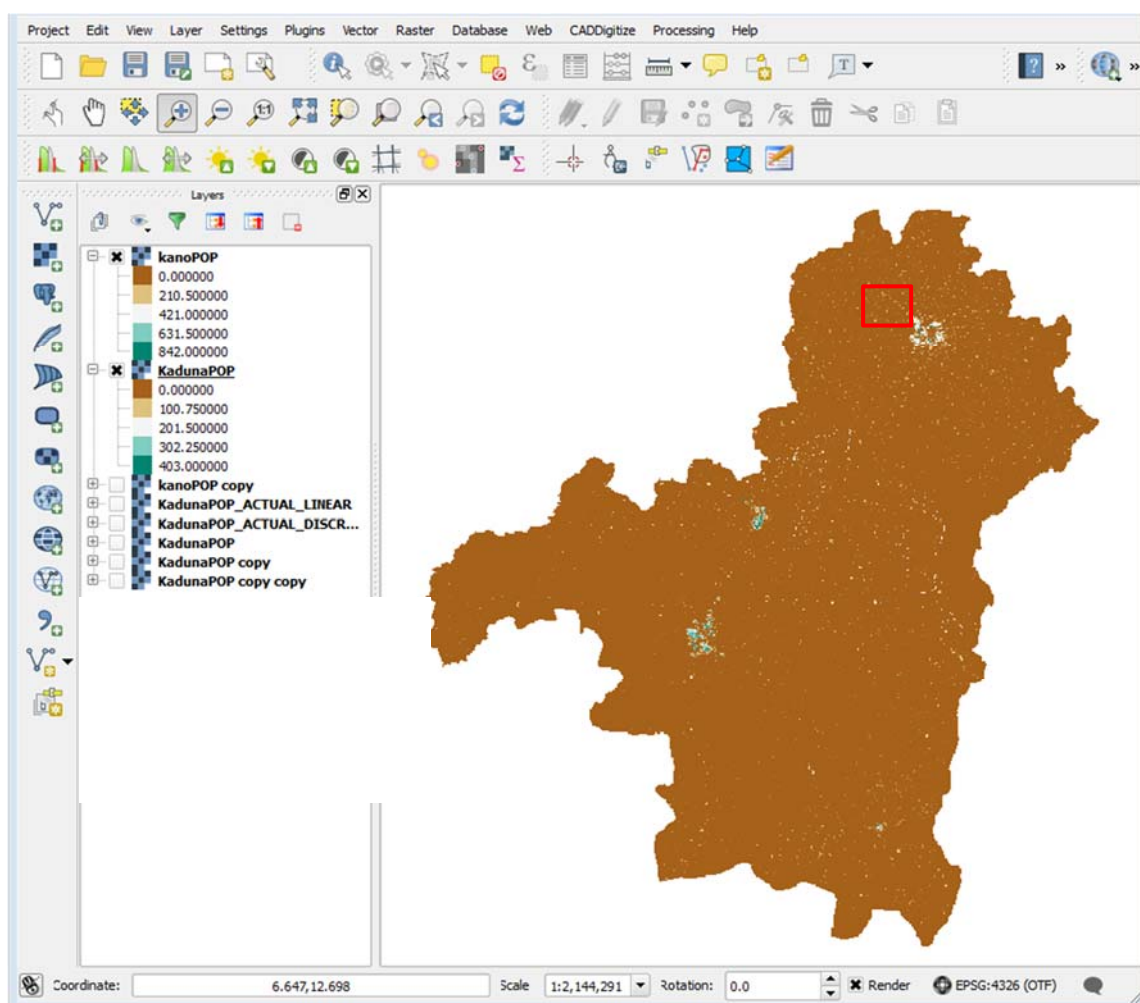


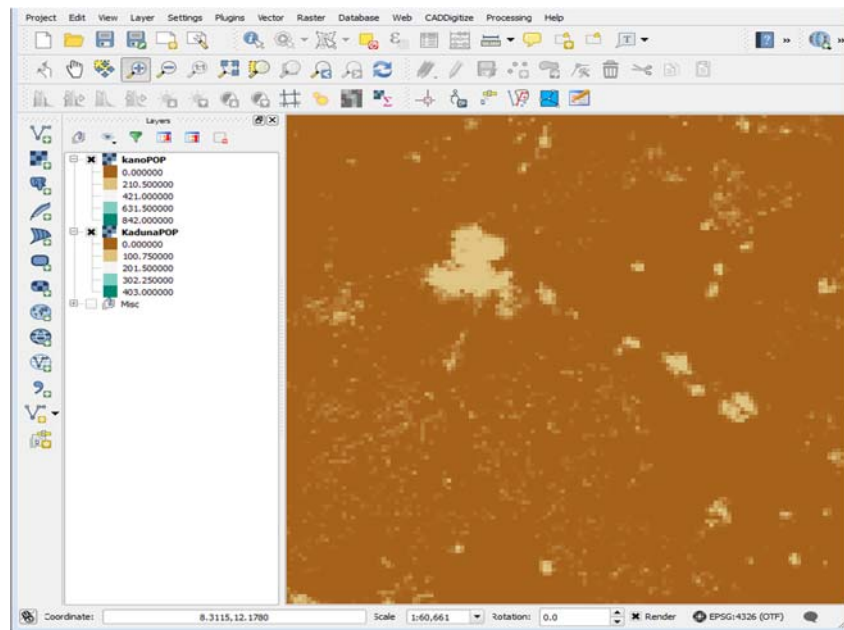
You will notice that the min / max values have updated and are in line with the true statistics for the dataset. For reference, the truncated min / max range of 0 to 22 is generated by the option **Cumulative count cut** (from Load min/max values box, with the Style tab). This option is useful if you want to display more variation in the dataset by apportioning the colour ramp to the central belt of values only, hence disregarding outlying values.

- Under the **Color** drop-down menu, select a colour ramp of your choice; we have selected *BrBG* (i.e. brown to green) but choose as you wish
- Five new colour value bands are created (if not, click **Classify**).
- Click **Apply** to see the new visualisation of the data, and then click OK.

Back in the QGIS Canvas, you will see a heatmap-like rendering of the raster. Repeat the same process for the other raster as well.

6. Enhance variability in the raster visualisation. An additional feature of the Raster Style tab is the ability to zoom in to an area and limit the colour ramp to values within your new 'zoomed' extent, rather than the full dataset
 - Zoom into an area of the small area of the map (e.g. as in the red square area below)





- Return to the Style tab within Layer Properties, *for the raster dataset you are currently viewing!*
- In the boxed area named **Load Min/Max values** again select **Min / max**
- Click in the box next to **Click extent to canvas**
- In the **Accuracy** boxed area, again select **Actual (slower)**
- Click **Load** and note that the min / max range updates
- Click **Classify** to reclassify according to the new range
- Finally, click **Apply** to see the changes on screen

▼ Load min/max values

☐ Cumulative count cut 2.0 - 98.0 %

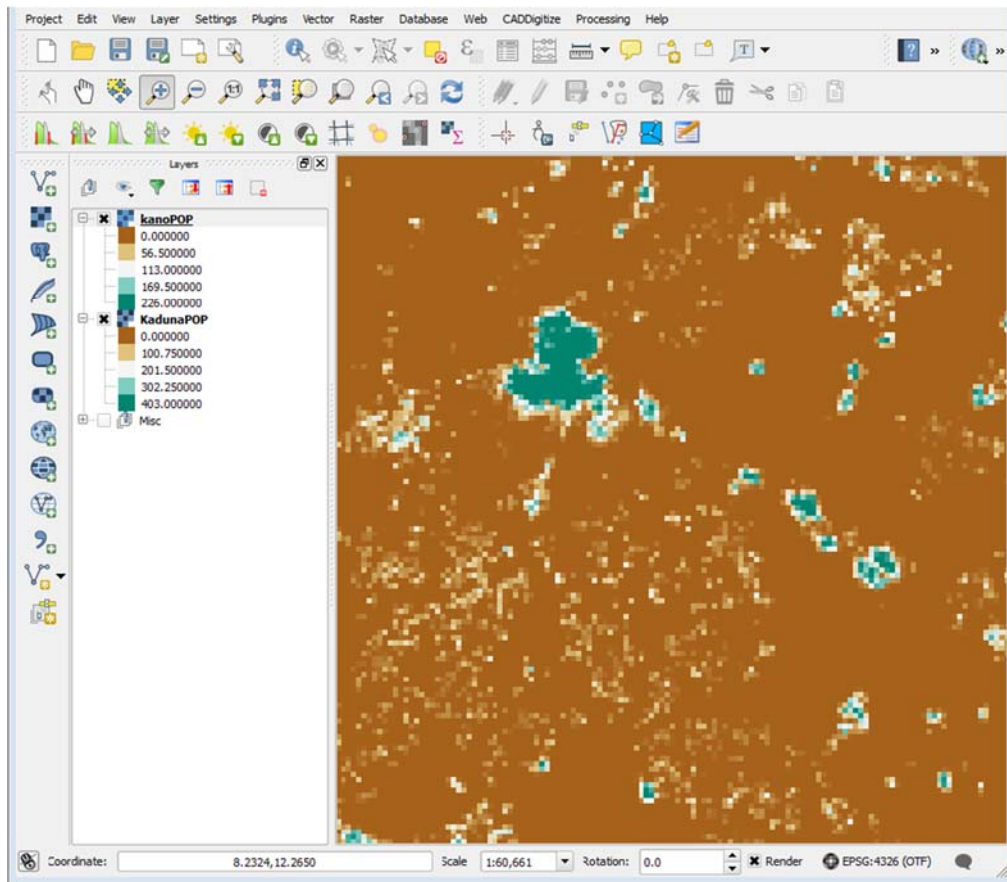
☒ Min / max

☐ Mean +/- standard deviation × 2.00

Load

Accuracy Actual (slower) ▼

☐ Clip extent to canvas

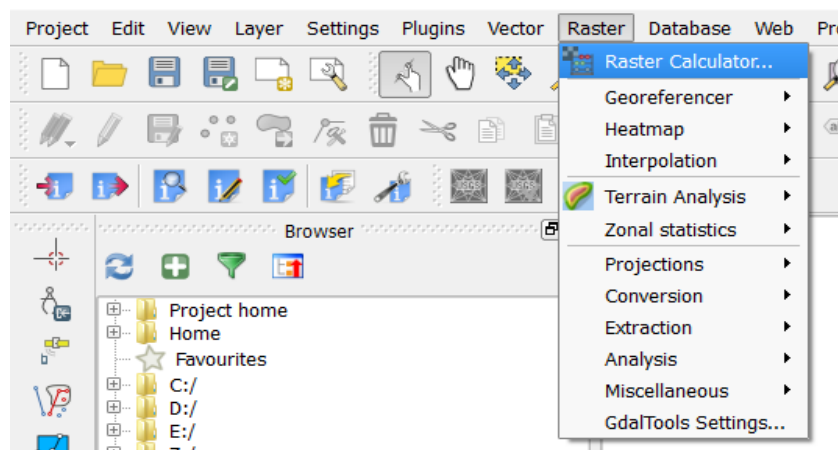


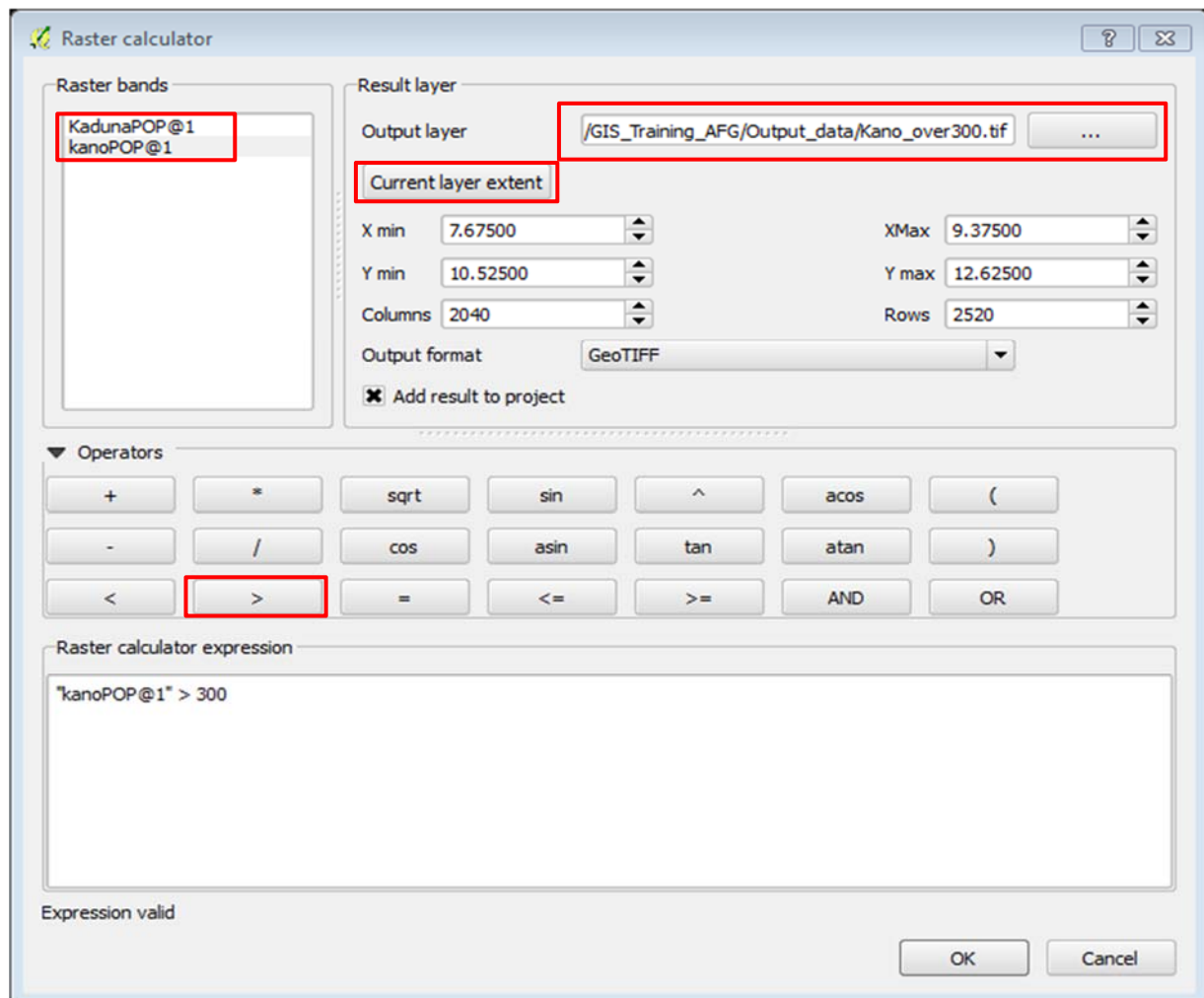
This is a useful method of displaying variation in data within a limited defined area, establishing greater visual contrast in values.

Raster Calculator

Let's assume we would like to find areas with the highest density population. Raster Calculator will generate a new 'binary' raster containing pixel values of just 0 and 1, where '1' represents pixels that satisfy an expression.

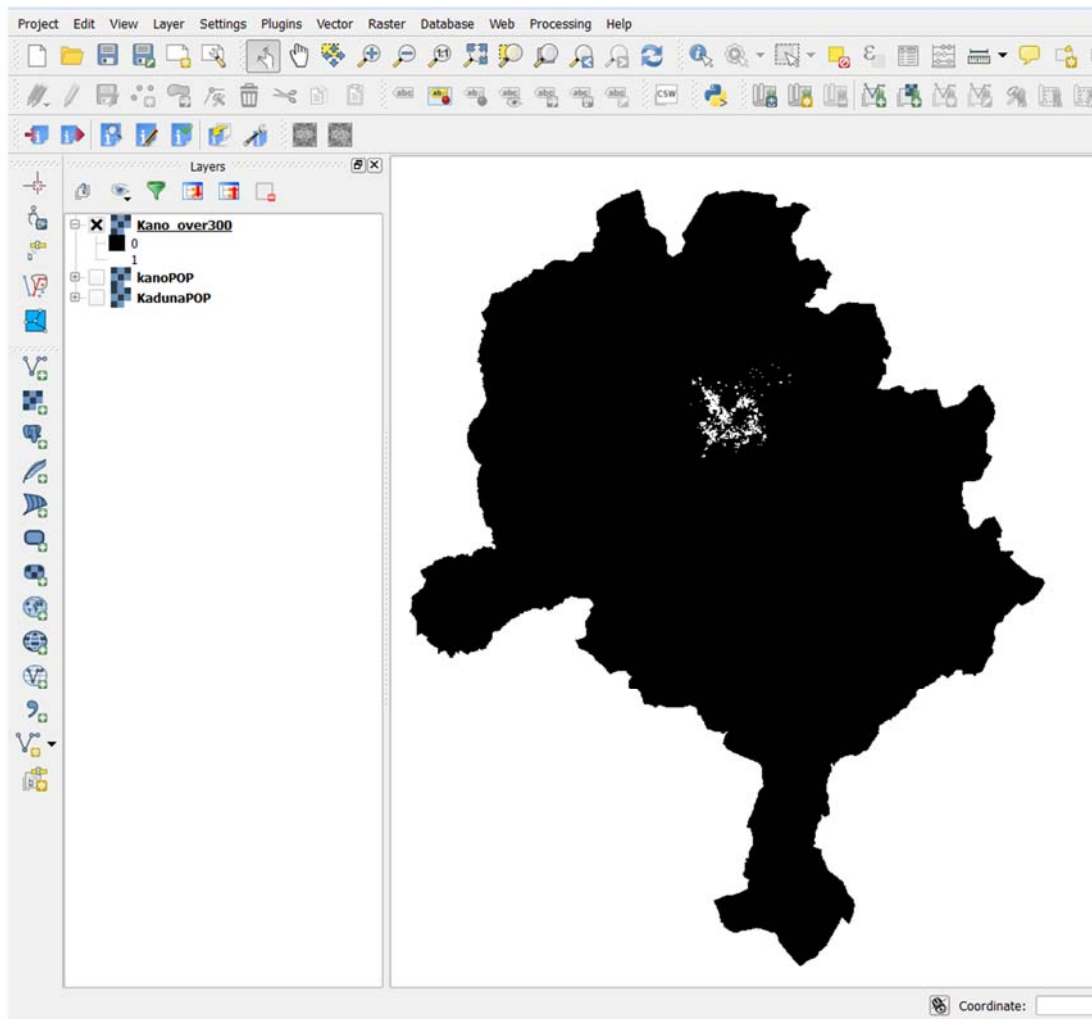
7. Launch Raster Calculator via the **Raster** drop-down menu





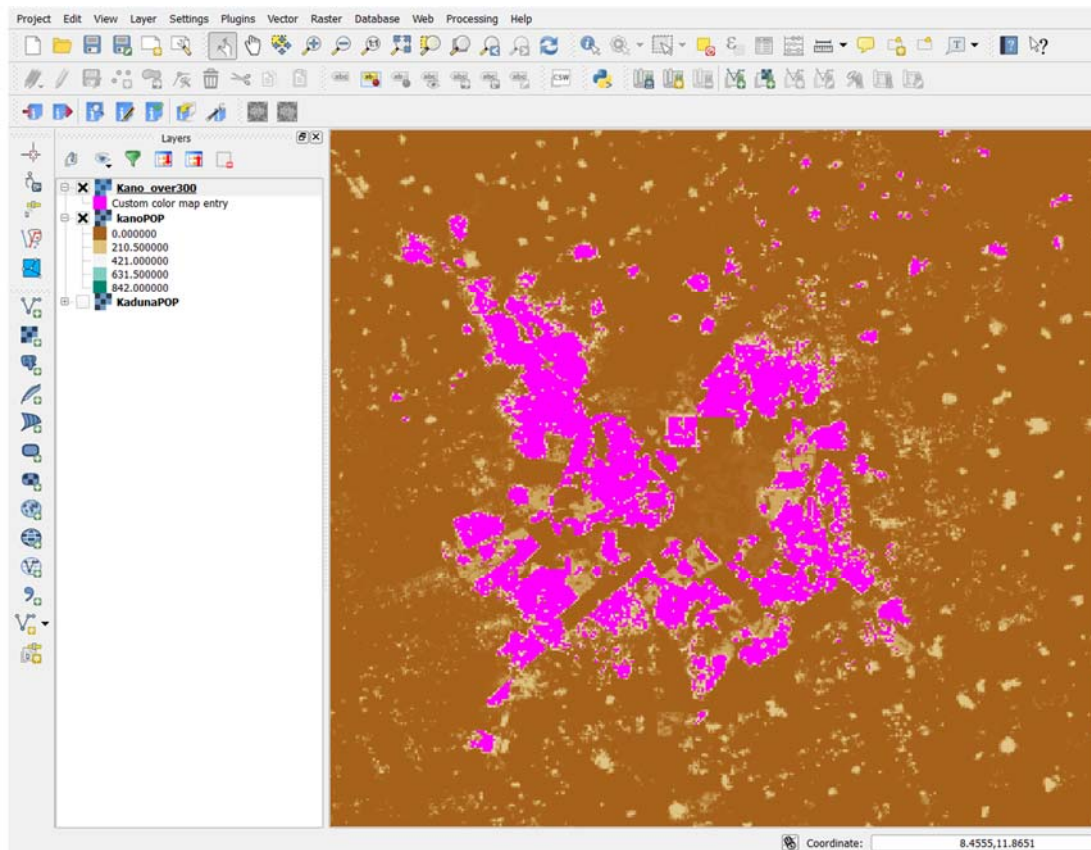
8. Create a raster calculator expression:
 - Double-click the items highlighted to build the expression
 - Type in '300'
 - (Note: This expression is searching for pixels that have a value greater than 300, i.e. 300 people per pixel)
 - Click **Current layer Extent** to set the size of the output raster
 - Specify an output location for the resultant raster. Save it as follows:
 - C:\GIS_Training_AFG\Output_data\Kano_over300.tif

The output raster should be added to the map window automatically. It should appear like this:



Challenge

- Using Layer Properties for layer **Kano_over300**, see if you can make the raster display in the following way, wherein areas of 300 people per pixel are overlaid on the original raster.



Further applications of Raster Calculator

If population data for the same area is available for two time periods, it is possible to produce a raster displaying the change in population at the pixel level over the time period. The way to accomplish this is to use Raster Calculator to find the difference between each grid's pixel value in both the layers.