PRIFYSGOL ABERYSTWYTH UNIVERSITY

Earth Observation and Ecosystems Dynamics Laboratory

ZAMEP GIS Training

An Introduction to QGIS
Worksheet 3

Recap of Worksheet 2

In Worksheet 2 we learn how to import a CSV dataset and covert it to a point vector layer

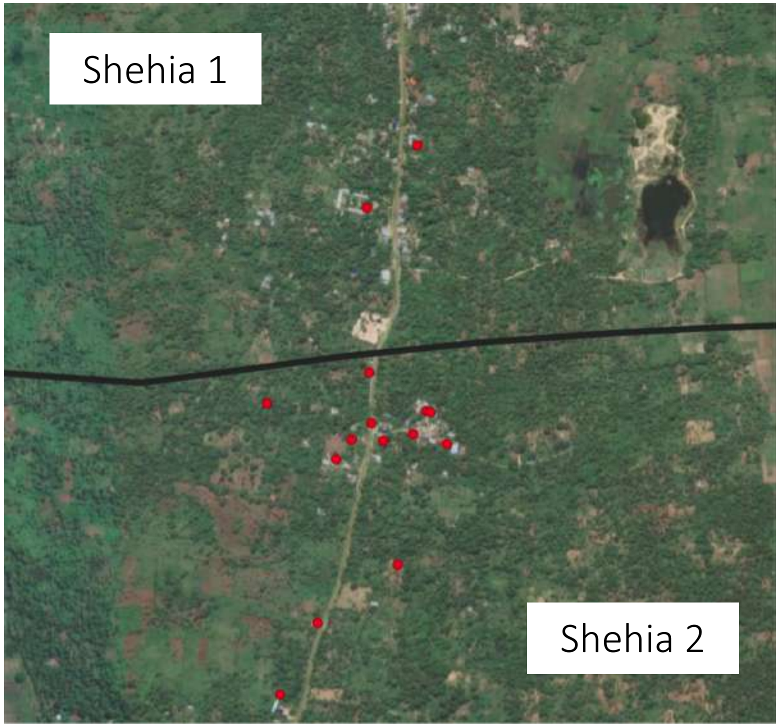
We then used a polygon layer to sum cases per shehias and visualize this data

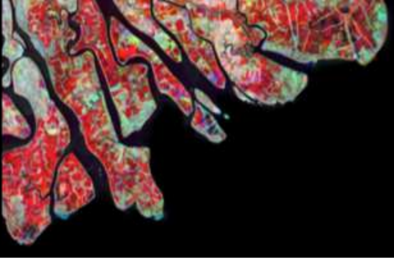
However, if we wanted to drive an intervention such as Larval Source Management it might be problematic to work in hotspots defined by shehias:

Consider the following scenario:

Most cases occur in Shehia 2

But the most important habitat in this area belong in Shehia 1





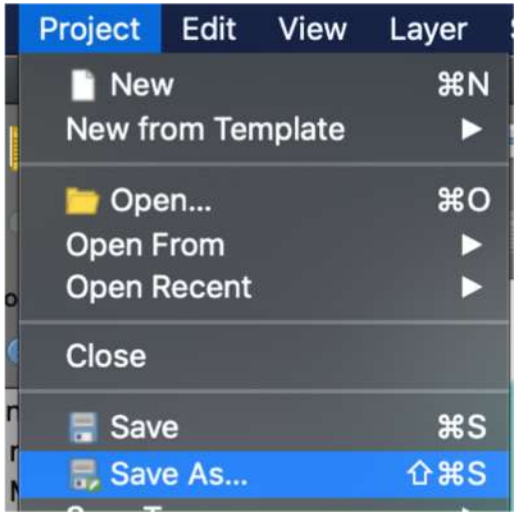
Worksheet 3 Overview

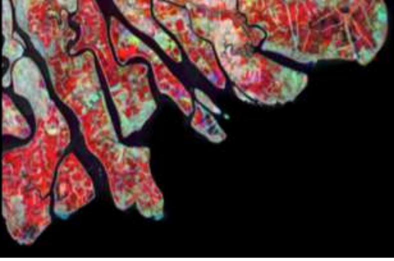
Rather than analyze cases at the shehias level we shall do some spatial analysis to determine where hotspots of cases are occurring

To do this, we shall perform a Point Density Analysis

If it is not open already, open the MCN_import QGIS project that you created in Worksheet 1

Then go to Save As and save this as a new project called MCN_point_density



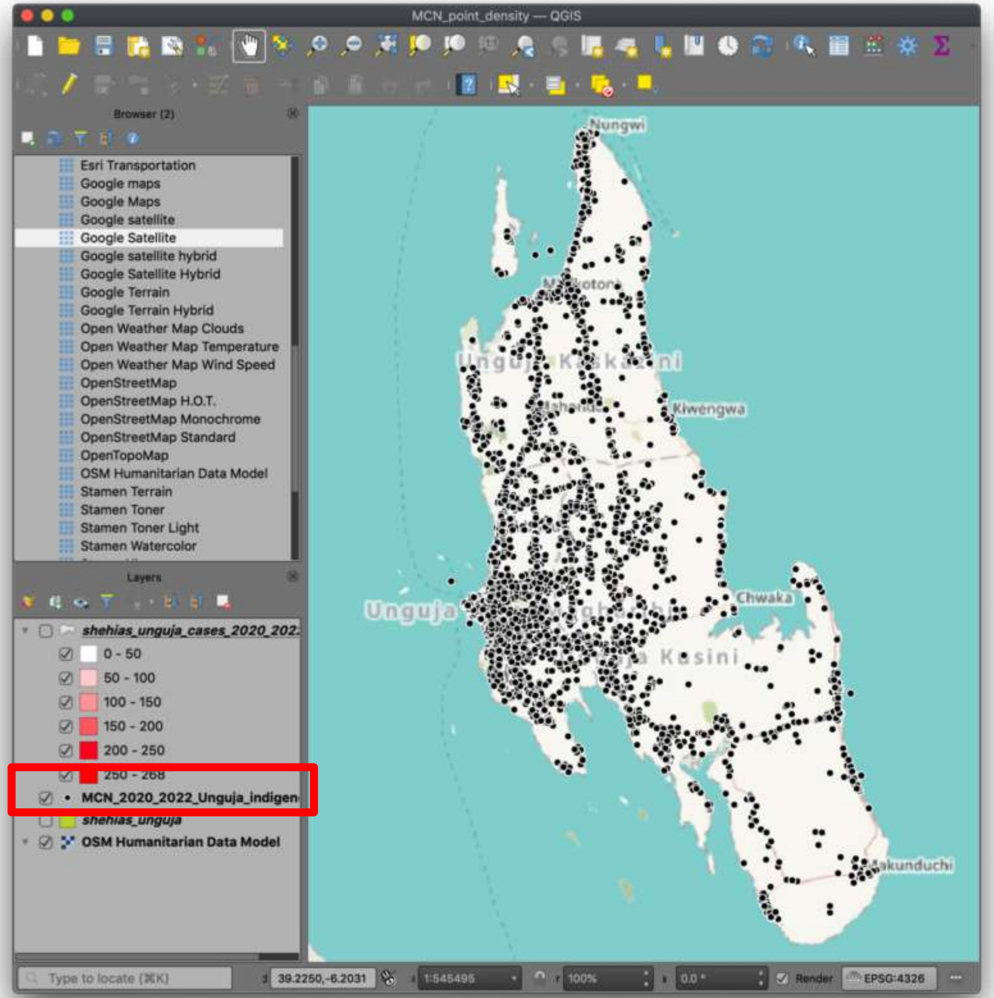


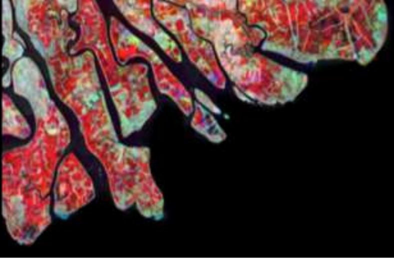
Viewing Points

Change your map display so you can see the distribution of indigenous cases

Untick the polygon layer

Ensure that the MCN point data is ticked





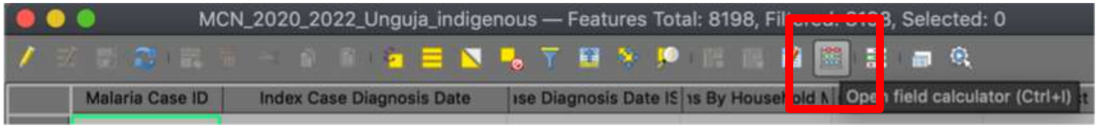
Selecting by Attributes

For this next stage of analysis we shall only consider cases that occurred between March-May 2022

To do this, we need to convert our Case Diagnosis Data to a format that QGIS will understand as a date

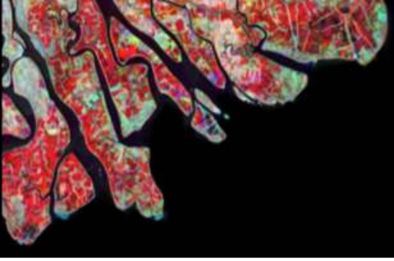
Open the Attribute Table for MCN_2020_2022_Unguja_indigenous

Open the Field Calculator



The Field Calculator can be used to create new Fields (columns of data in the Attribute Table)

Next page…



Converting Dates

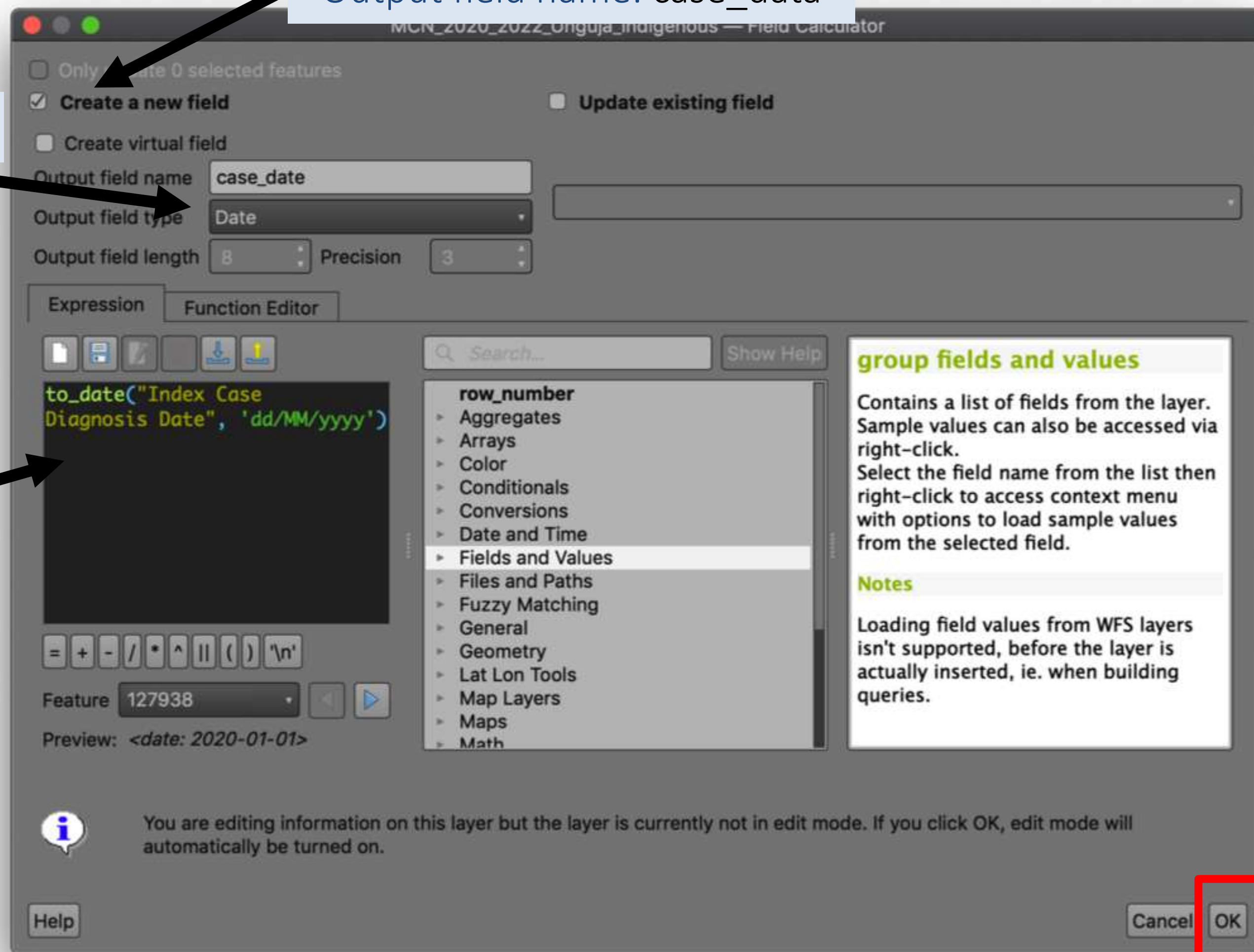
Use the following settings:

Output field name: case_data

Output field type: Date

Expression:
`to_date("Index Case Diagnosis Date", 'dd/MM/yyyy')`

Click OK



Video 3.1

Converting Dates

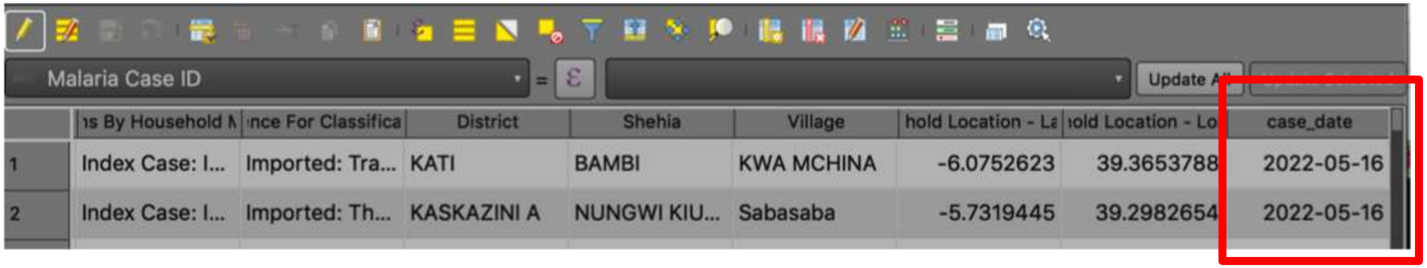
Our expression includes the function to_date that takes some text and coverts it to a date type

Here, our text comes from the field Index Case Diagnosis Date

We also define the format that our date is written in, e.g. 01/10/2021

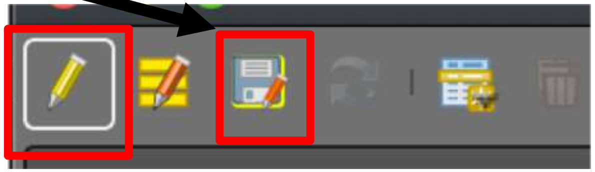
```
to_date("Index Case Diagnosis Date", 'dd/MM/yyyy')
```

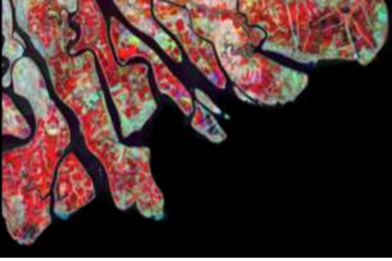
Once we click OK we should notice that a new Field has been added with our dates…



Make sure you save your edits and then

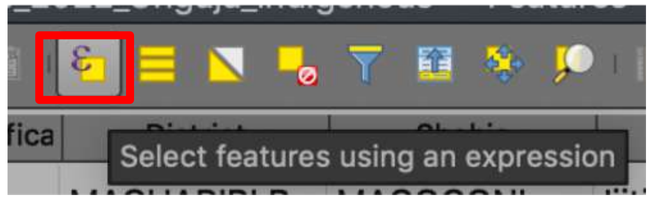
click the Stop editing button





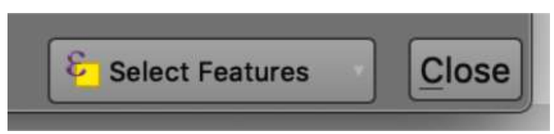
Selecting by Date

In the Attribute Table, now go to Select features using an expression

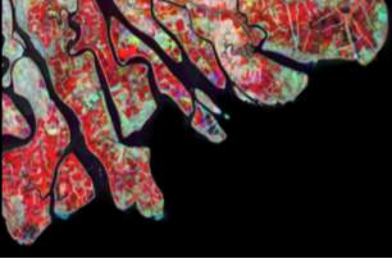


Use the following expression

Then click Select Features, then Close



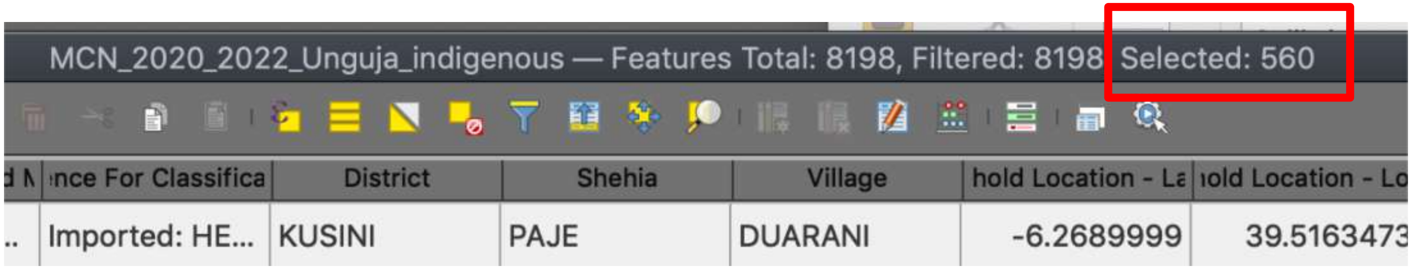
Video 3.2



Selecting Dates

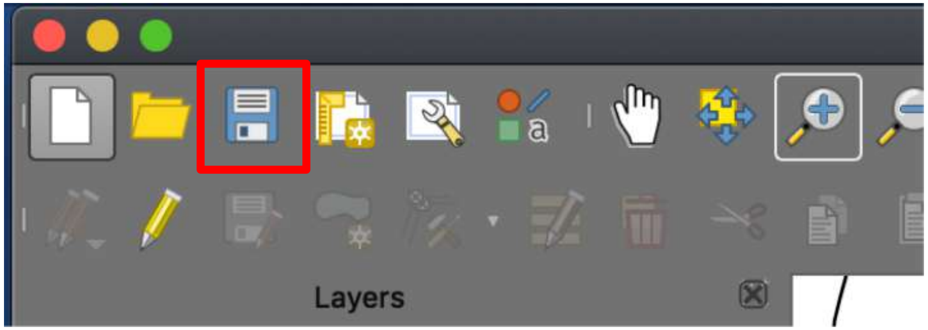
We should now have 550 points selected

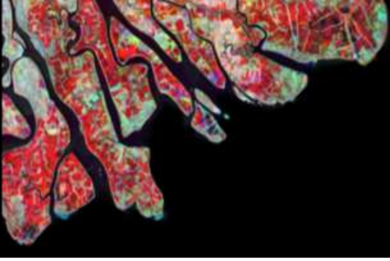
Check this in the Attribute Table



Also, check your map display – you should see hundreds of points highlighted in yellow:

Save your map

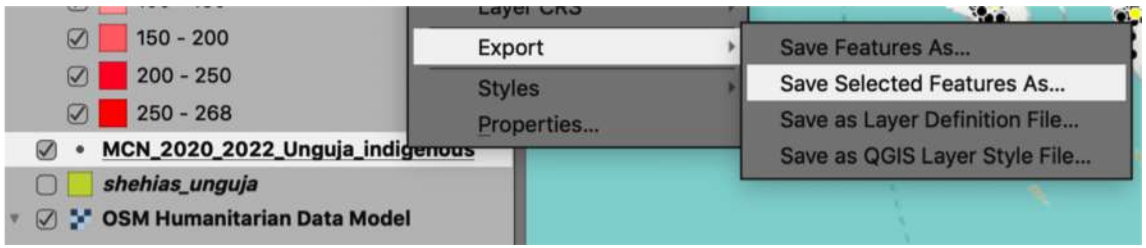




Export Selected Points

We shall now export our selected points to a new point vector layer

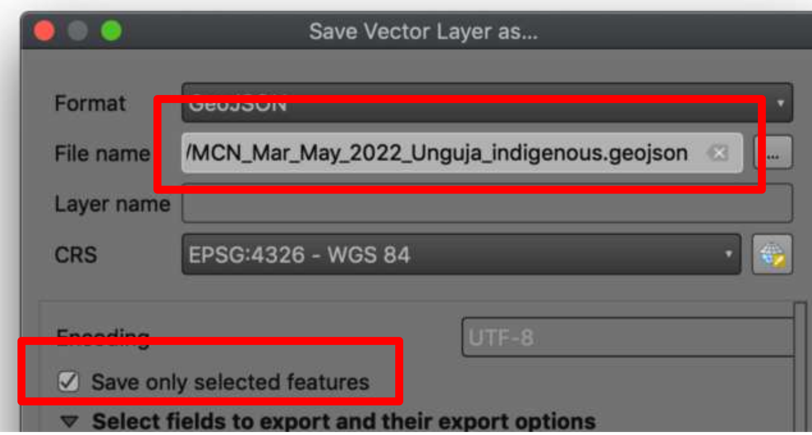
Do this by right-clicking MCN_2020_2022_Unguja_indigenous and selecting Save Selected Features As

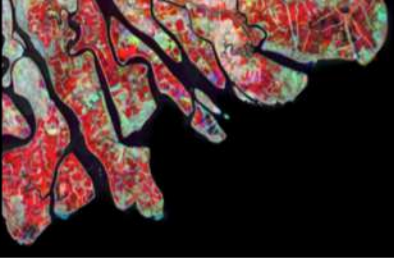


Use the following settings and then click OK

Filename:
MCN_Mar_May_2022_Unguja_indigenous.geojson

Tick Save only selected features



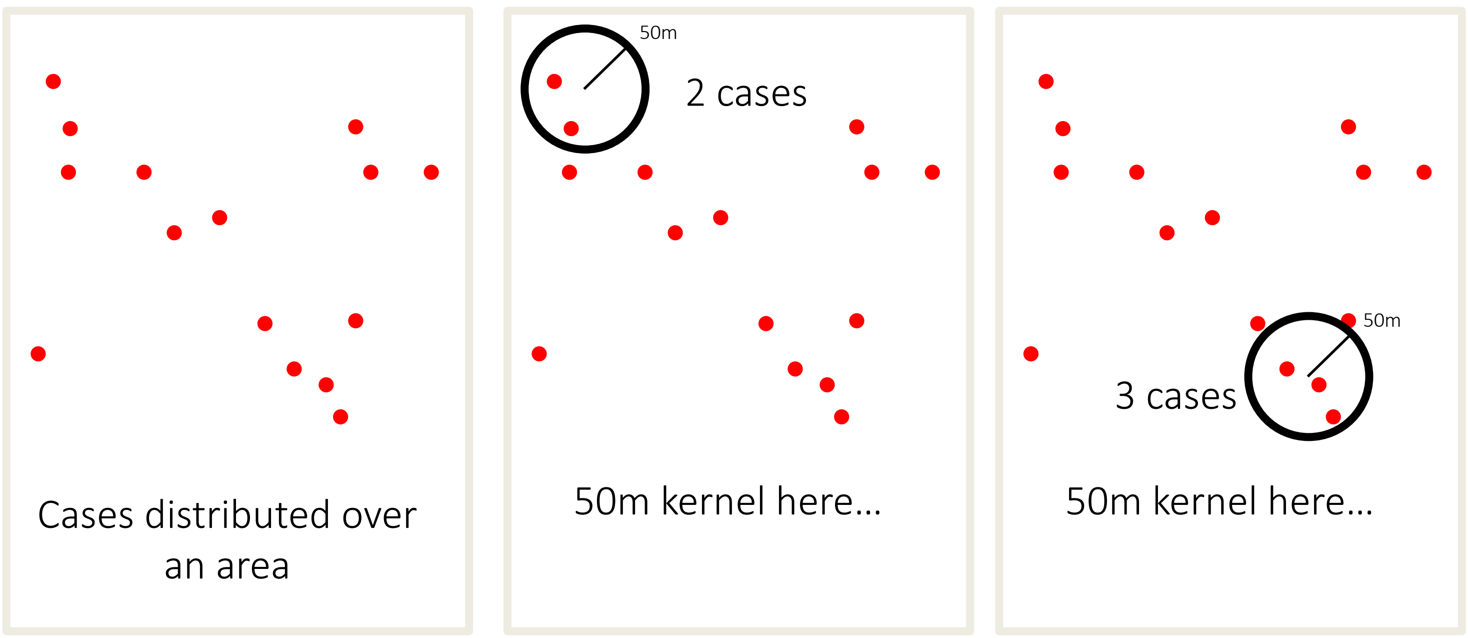


Density Analysis

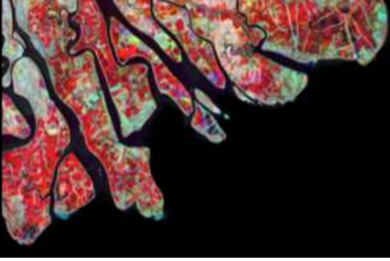
We shall now perform some Density Analysis

Here, cases will be summed over a moving window or ‘kernel’

Consider the following example:

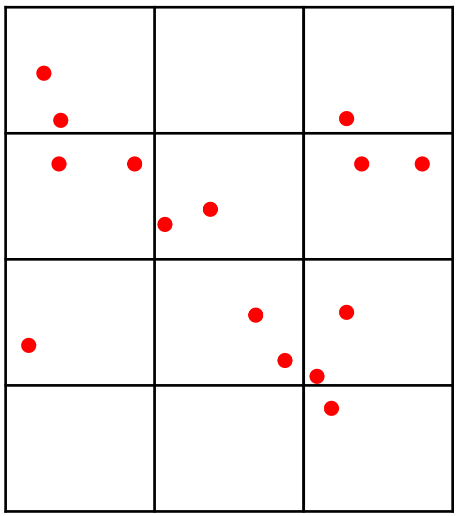


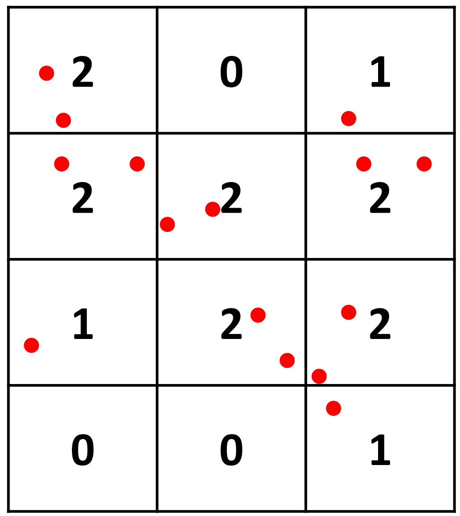
Repeat the kernel everywhere…



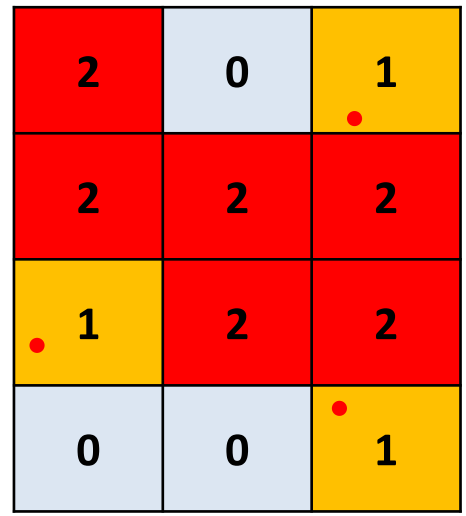
Density Analysis

We build a pattern of high density of cases (hotspot) and low density of cases (coldspot)



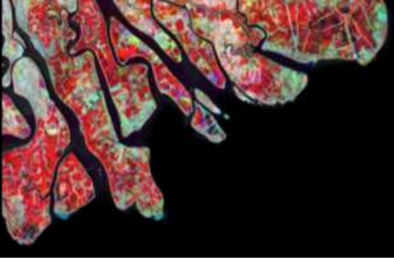


Sum of cases per kernel



Colour-coded for visulatization

We can apply this analysis to map hotspots of cases across Unguja…



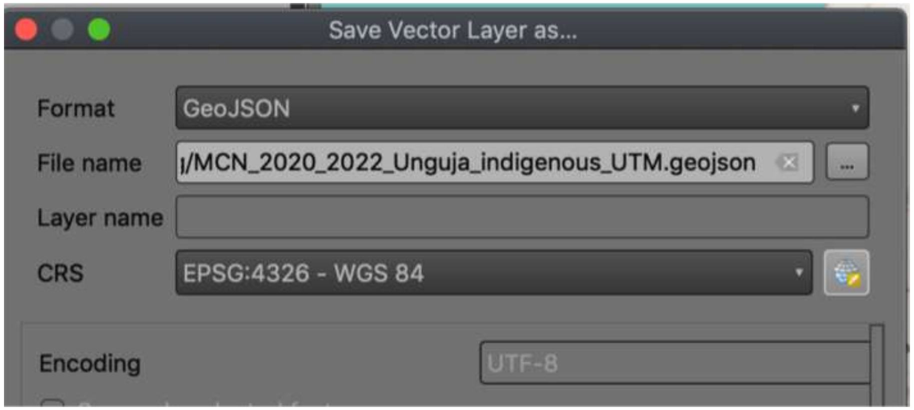
Density Analysis

Firstly, we need to change the projection of our point layer

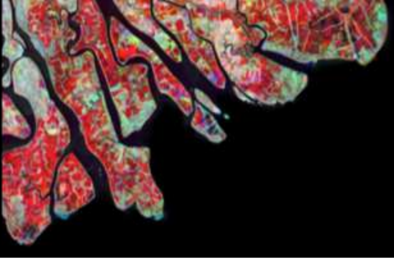
This is because the Density Analysis defines the size of the kernel by meters

To do this, right-click MCN_Mar_May_2022_Unguja_indigenous and Select Save Features As

In the settings, give the file name MCN_Mar_May_2022_Unguja_indigenous_UTM.geojson



Next page...



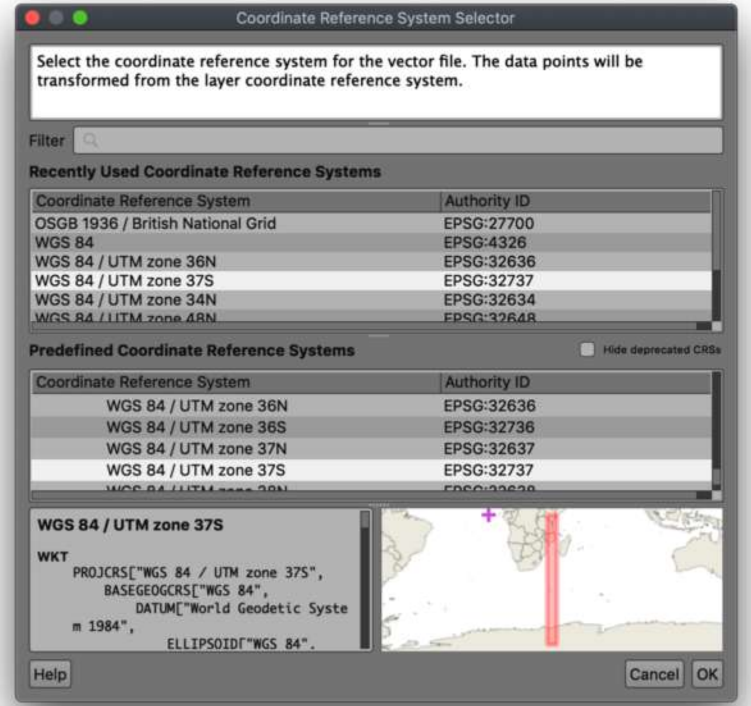
Changing Projection

Then, click on the Select CRS button

Scroll down until you see

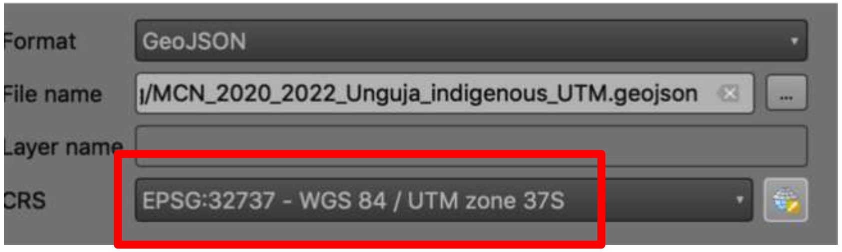
WGS 84/UTM Zone 37S

This is the zone that corresponds to Tanzania and Zanzibar



Click OK

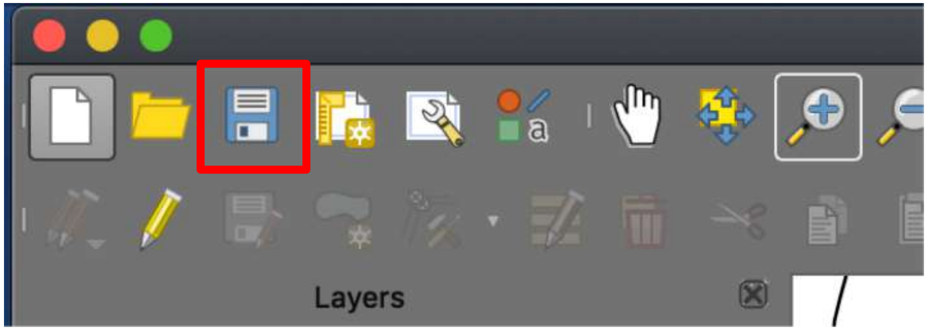
Make sure the Save Vector window looks like this

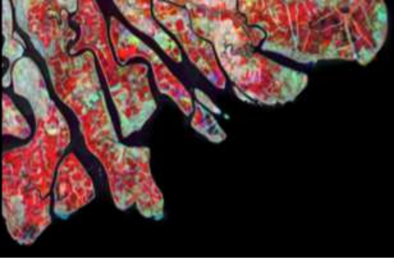


Then OK to export

Video 3.3

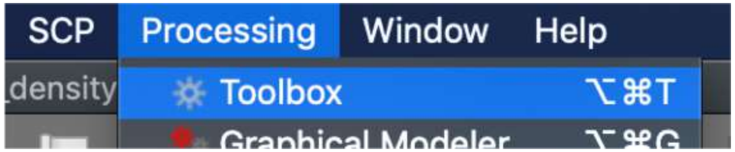
Save your map





Density Analysis

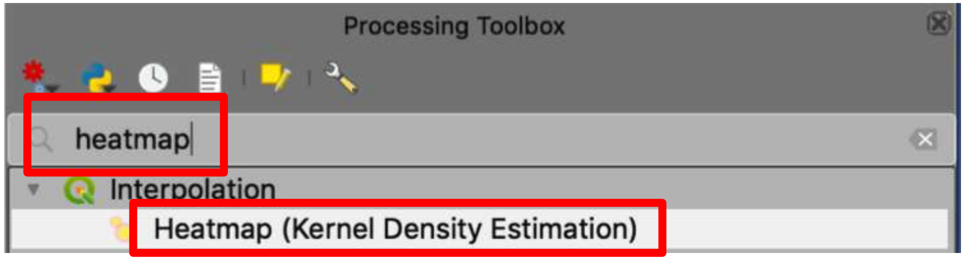
Go Processing > Toolbox



This will open up the Processing Toolbox in a panel on the right-hand side

Here you will see a large range of tools for analyzing and processing GIS layers

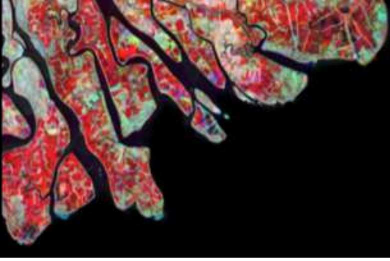
Search for heatmap



Double-click on Heatmap (kernel density estimation) to open the tool

Next page…

Video 3.4



Heatmap

Use the following settings:

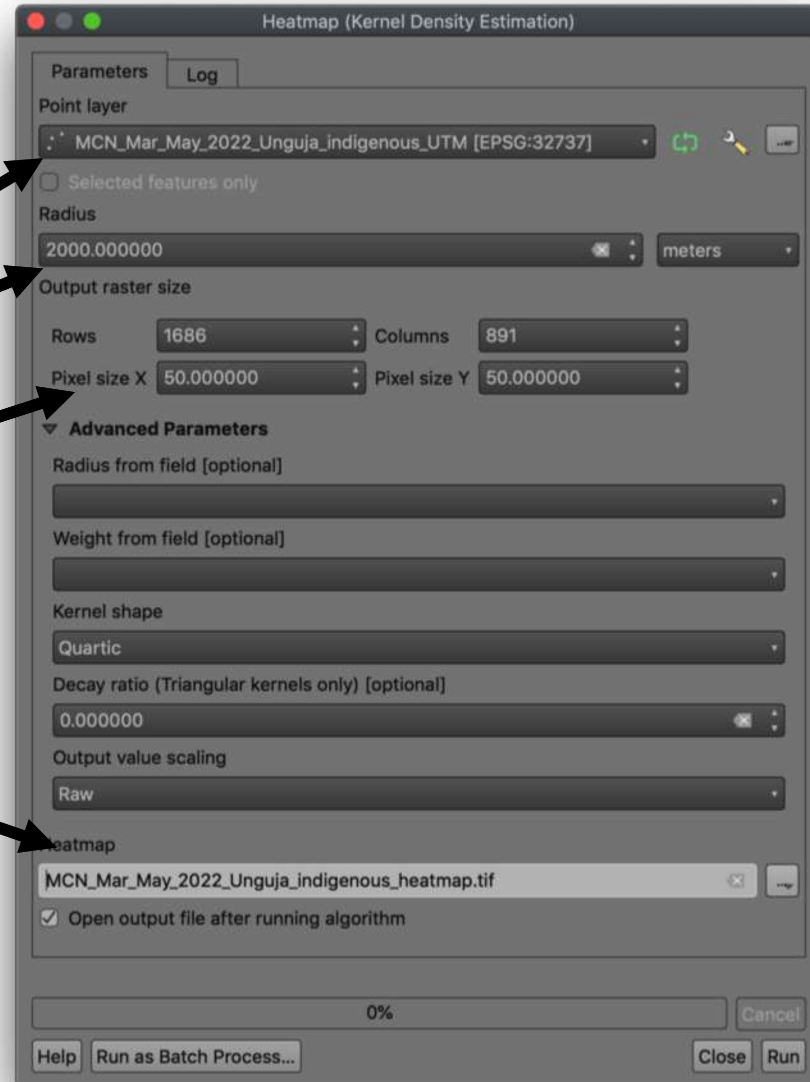
Point layer:
MCN_Mar_May_2022_Unguja_indigenous_UTM

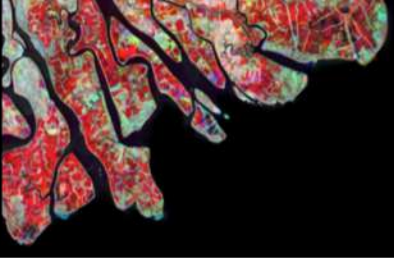
Radius (kernel size): 2000 meters

Pixel size x and y: 50

Heatmap (output filename):
MCN_Mar_May_2022_Unguja_indigenous_UTM_heatmap.tif

Note that here, we are producing a raster image layer



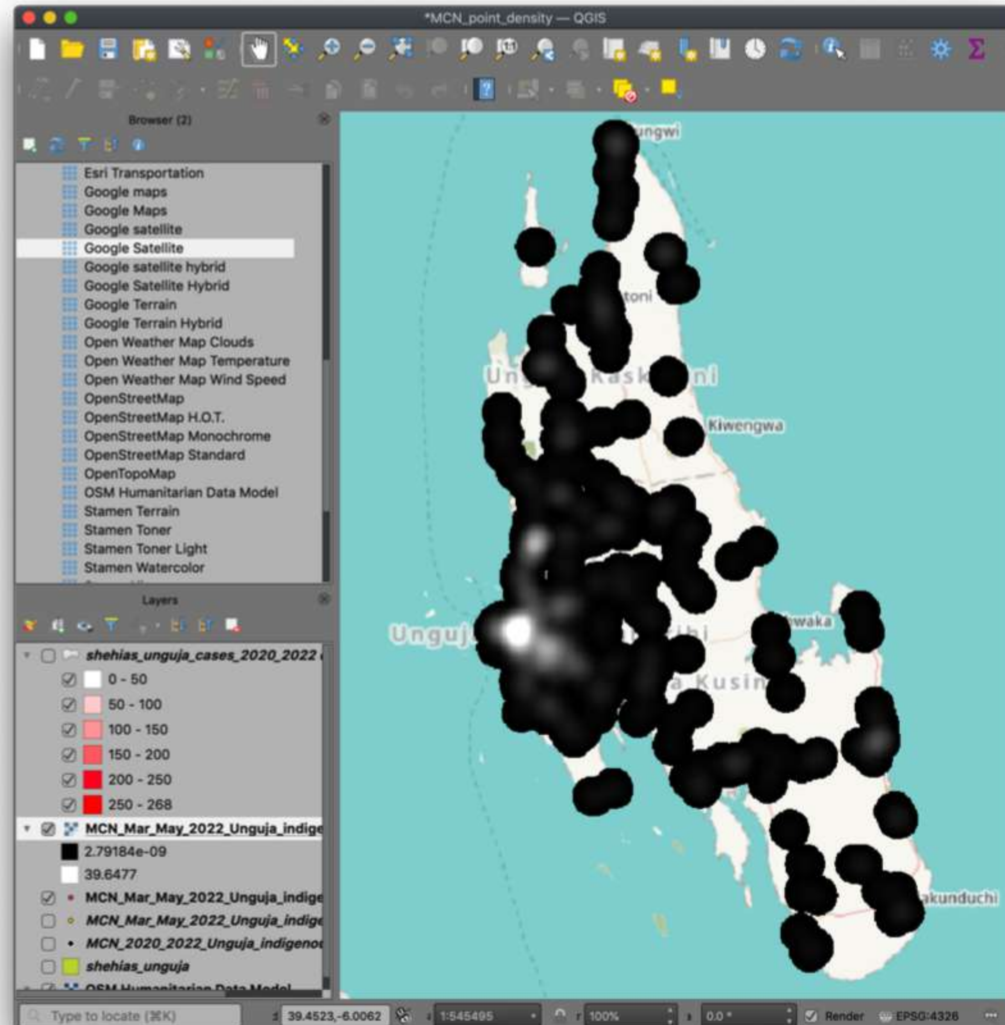


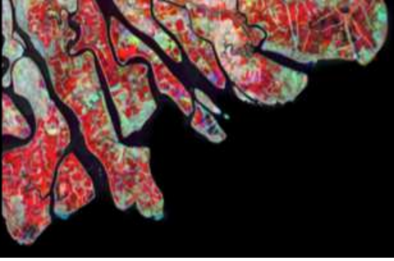
Heatmap

Once complete, the Heatmap will be added to the map view

We can improve the visualization of this raster layer by adjusting the symbology

-- Can you remember what a raster layer is? --



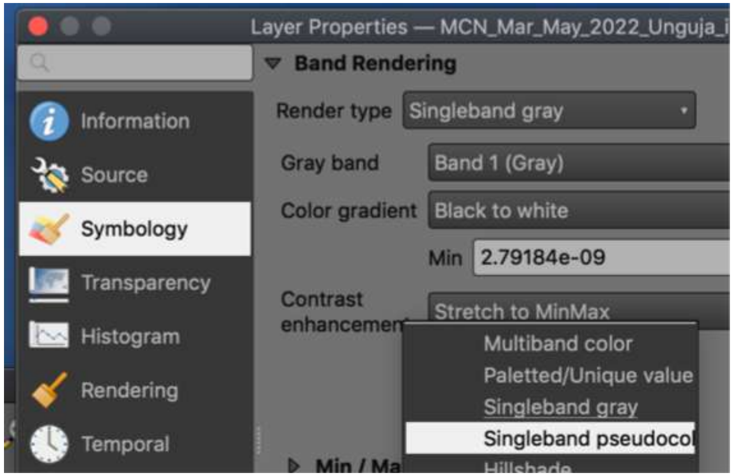


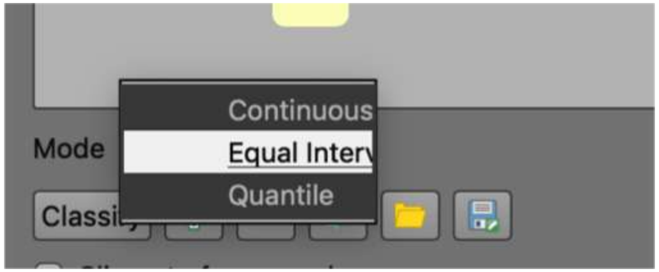
Raster symbology

Right-click the heatmap layer and select Properties

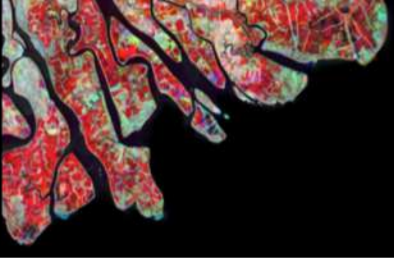
Under Render type, change to Singleband pseudocolor

In the options, change the mode to Equal Interval and click Classify





Next page…

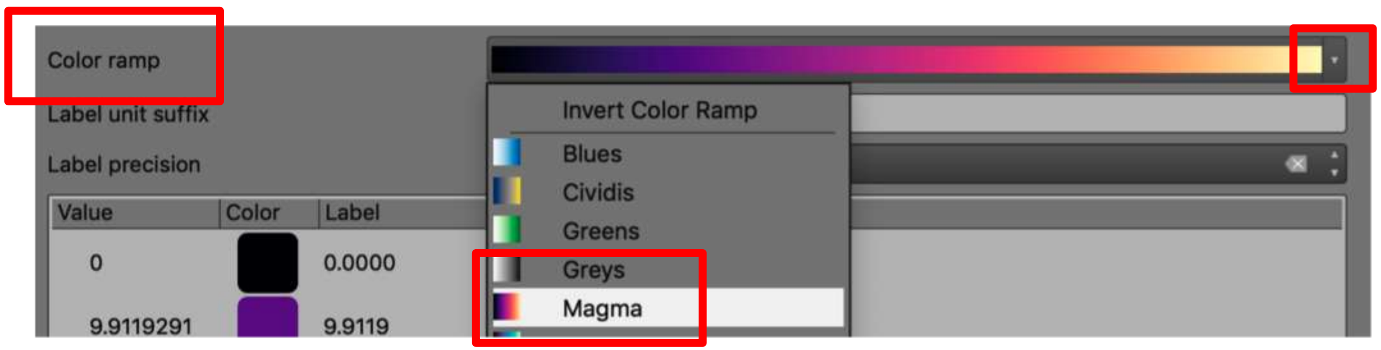


Raster Symbology

We can now choose what colors we want to visualize the data

Under Color ramp, select the drop down list

In our experience, the Magma colour ramp works best

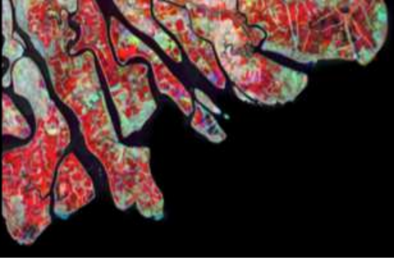


Our classification color-scheme should

Look something like this:

Value	Color	Label
0		0.0000
9.9119291		9.9119
19.8238583		19.8239
29.7357874		29.7358
39.6477165		39.6477

Next page

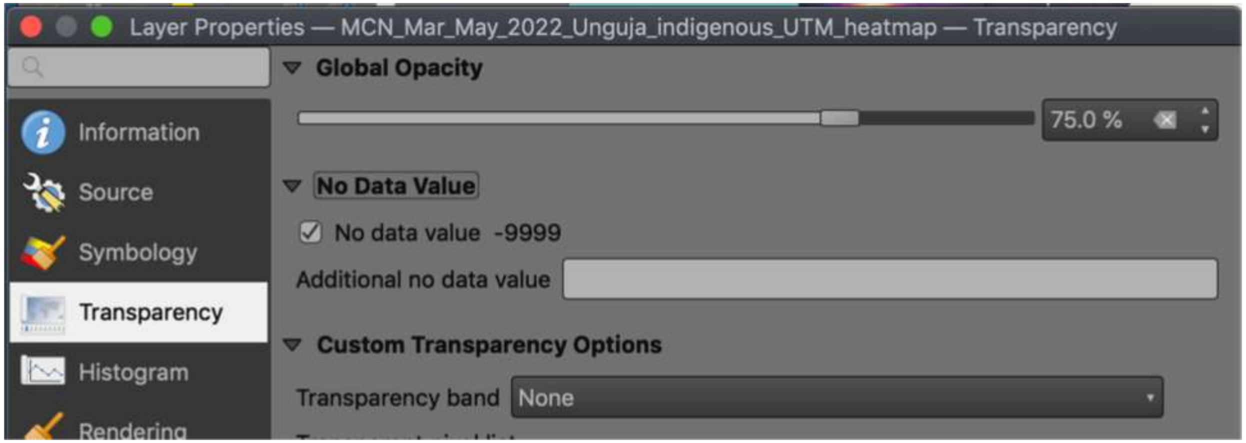


Raster Symbology

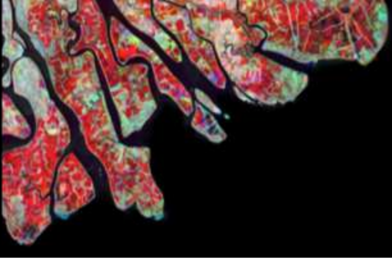
Finally, we shall change the transparency of our raster layer so we can view the background basemap information at the same time

In the Layer Properties Window, go to the Transparency tab

Change the Global Opacity setting to 75%



Click OK to close the Layer Properties Window



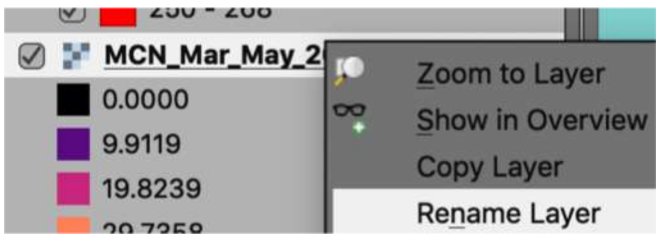
Save your map

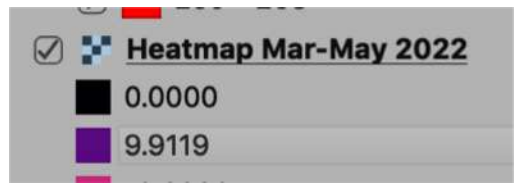
Our layer name is quite long: MCN_Mar_May_2022_Unguja_indigenous_UTM_heatmap

When we come to create a map, this name will not fit in our map key

You can change the name of layer by right-clicking it and selecting Rename Layer

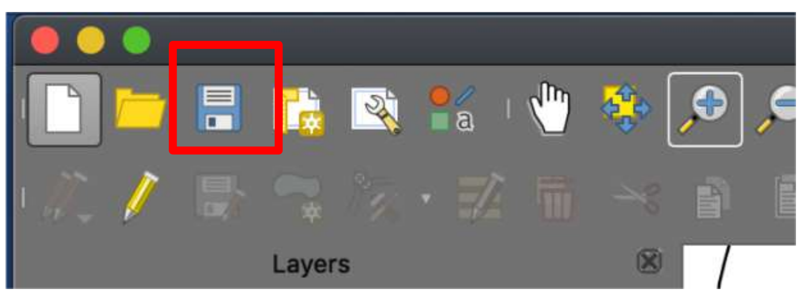
Do this now and call it Heatmap Mar-May 2022

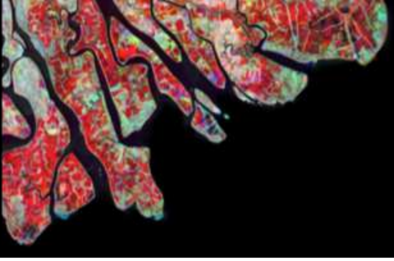




Note that this does not change the filename for the layer

Save your map

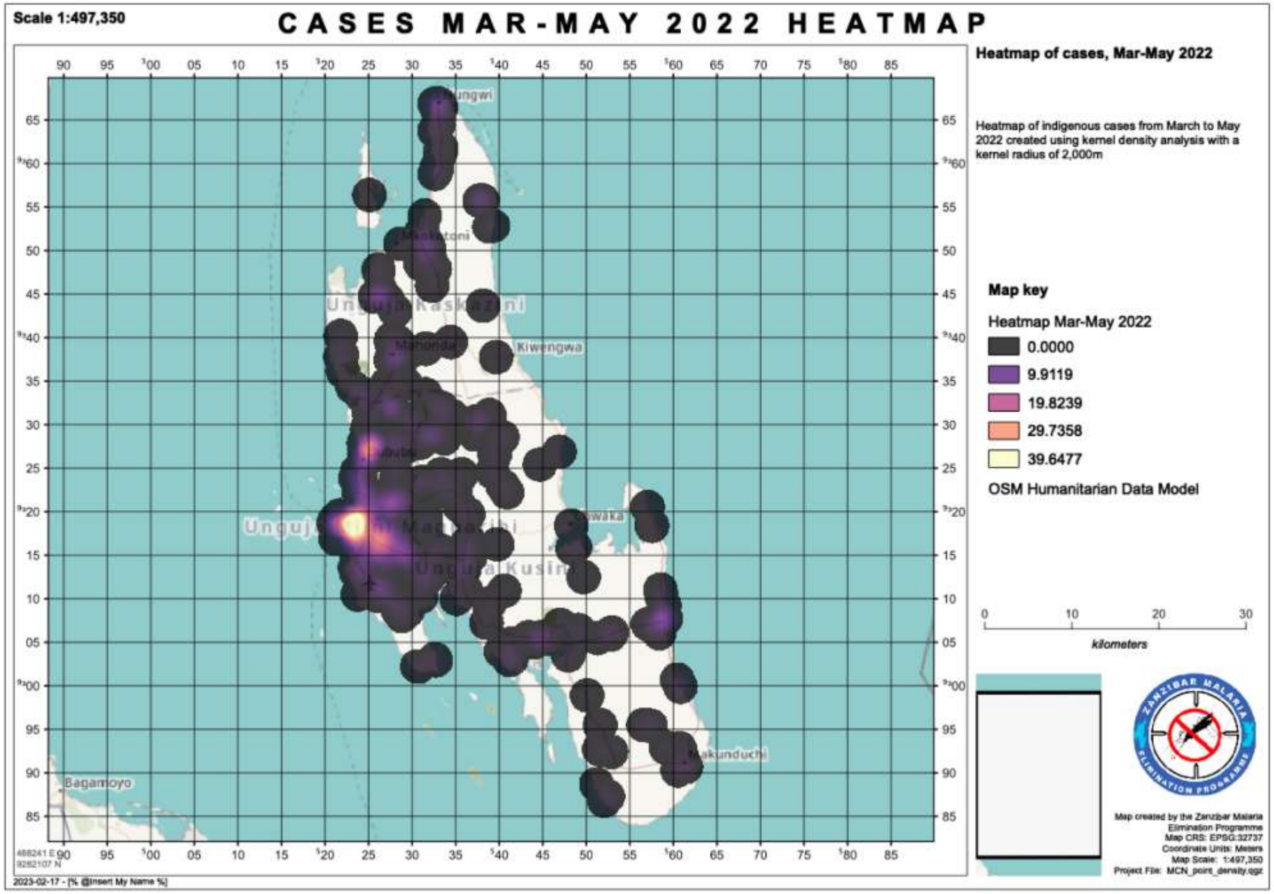


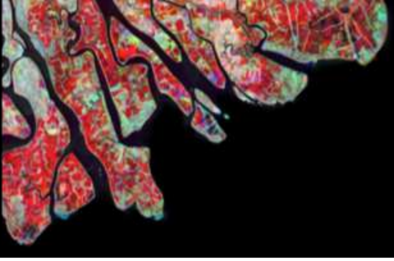


Creating a Map

Using the skills you have learnt in Worksheets 1 and 2, see if you can create a map of your case heatmap. Call it cases_mar_may_2022_heatmap

Try to make it look something like this:





Threshold Analysis

Our Heatmap gives us a good indication of where hotspots of cases are occurring

In Larval Source Management we may have a clear definition of how many cases is considered a hotspot

For example, we may decide that anywhere with more than 5 cases is considered a hotspot

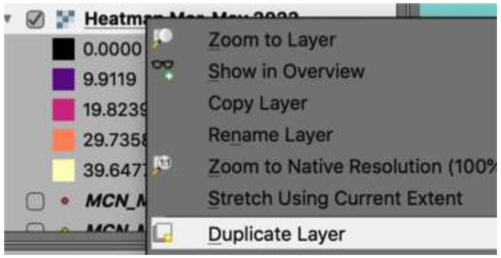
We can use this information to perform a threshold analysis in QGIS

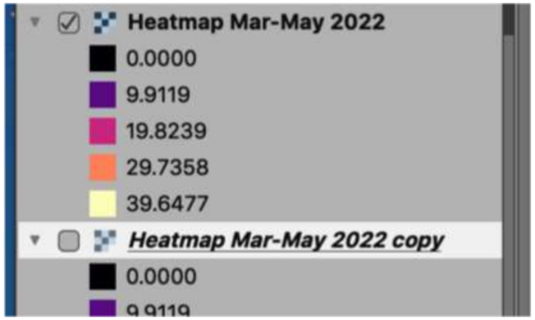
First, we shall duplicate the Heatmap layer

Right-click Heatmap Mar-May 2022 and select Duplicate

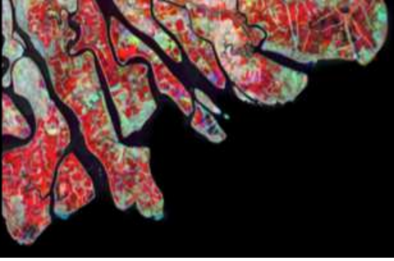
Notice that this creates a duplicate of the layer and its symbology labelled Heatmap Mar-May 2022 copy

Next page…





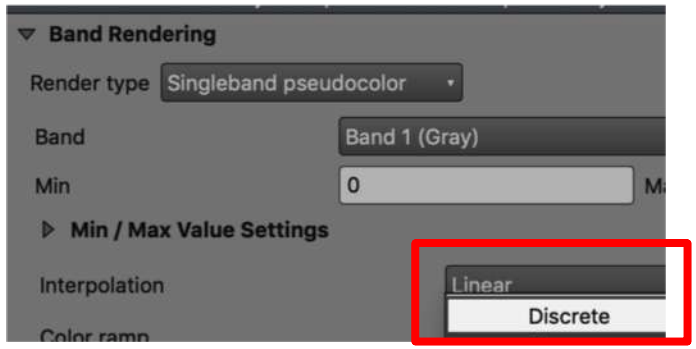
Video 3.5



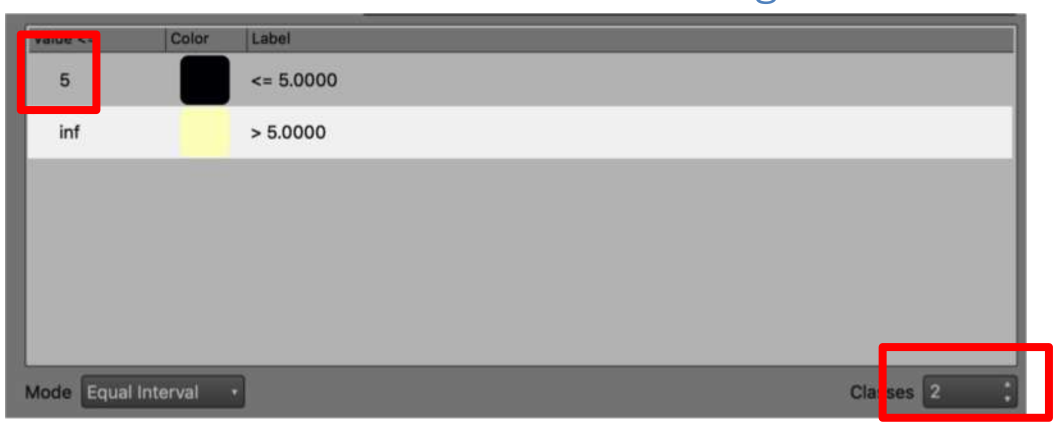
Threshold Analysis

Open the Layer Properties for Heatmap Mar-May 2022

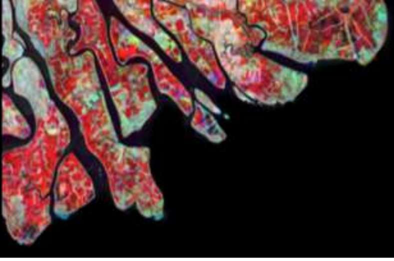
With the Render type set as Singleband pseudocolor change the Interpolation type to Discrete



Now change the number of classes to 2 and change the value of the first class to 5



Click OK



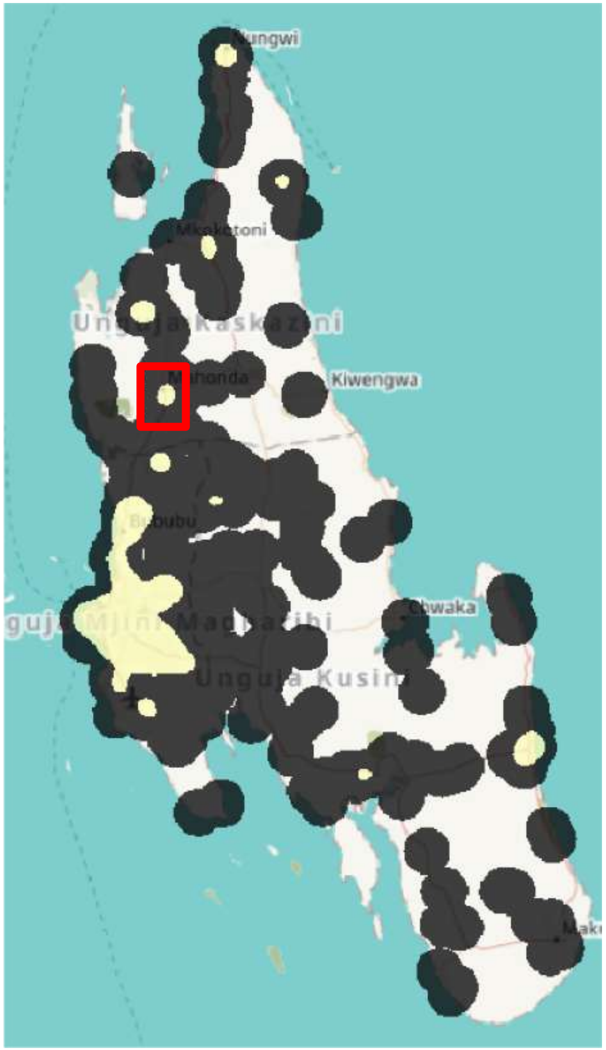
Threshold Analysis

Our resulting map identifies (in the pale yellow color) where the density of cases is more than 5

Try zooming into areas to identify where these areas occur

Notice that some cross multiple shehias

Example hotspot near Mahonda



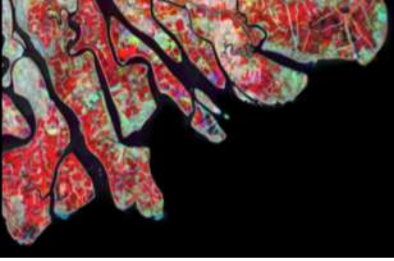
Buffer

We may want to deploy Larval Source Management in our hotspot areas

But we also need to account that mosquito vector can fly long distance to obtain a bloodmeal

Therefore, we want to consider an area 500m surrounding our hotspot areas

To do this we will a) convert our threshold analysis to a polygon vector layer then b) carry out buffer analysis



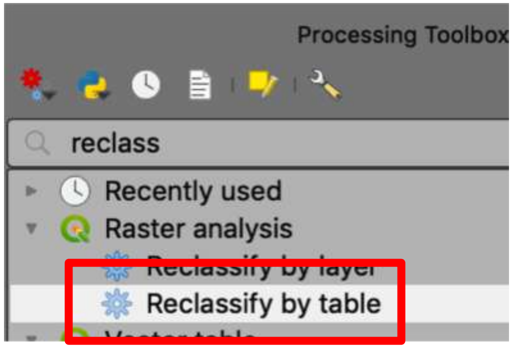
Reclass Raster

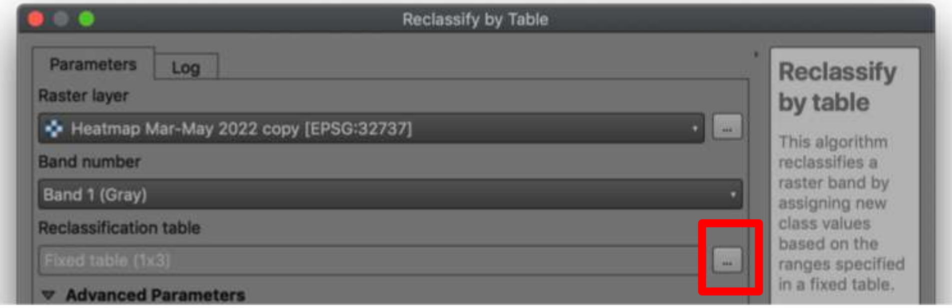
First, we shall reclassify our heatmap raster to a binary raster where: 1 = hotspot (i.e. >5 cases) and 0 = coldspot (i.e. < 5 cases)

In the processing toolbox. Search for reclass and open the tool Reclassify by table

Define you heatmap as the input Raster layer

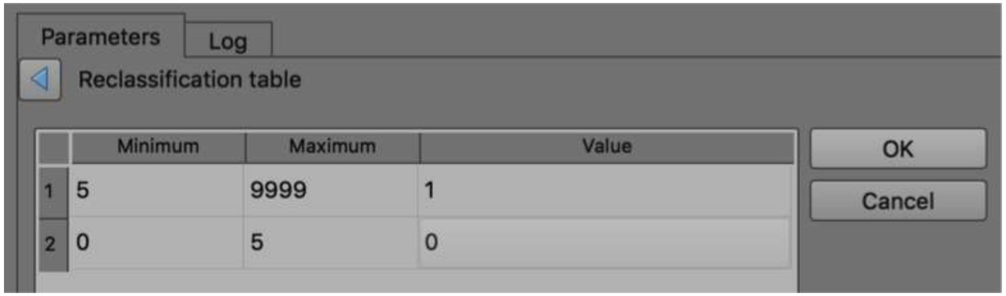
Then, click here to open the Reclassification table window





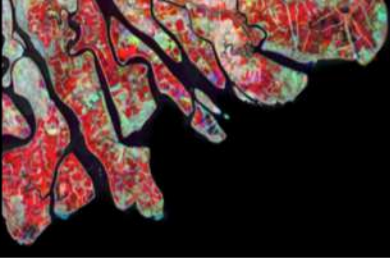
Use the following values for your table then click OK

Next page…



	Minimum	Maximum	Value
1	5	9999	1
2	0	5	0

Video 3.6



Reclass Raster

Here, a value between 5 and 9999 will be reclassed as 1 and a value between 0 and 5 will be reclassed as 0

	Minimum	Maximum	Value
1	5	9999	1
2	0	5	0

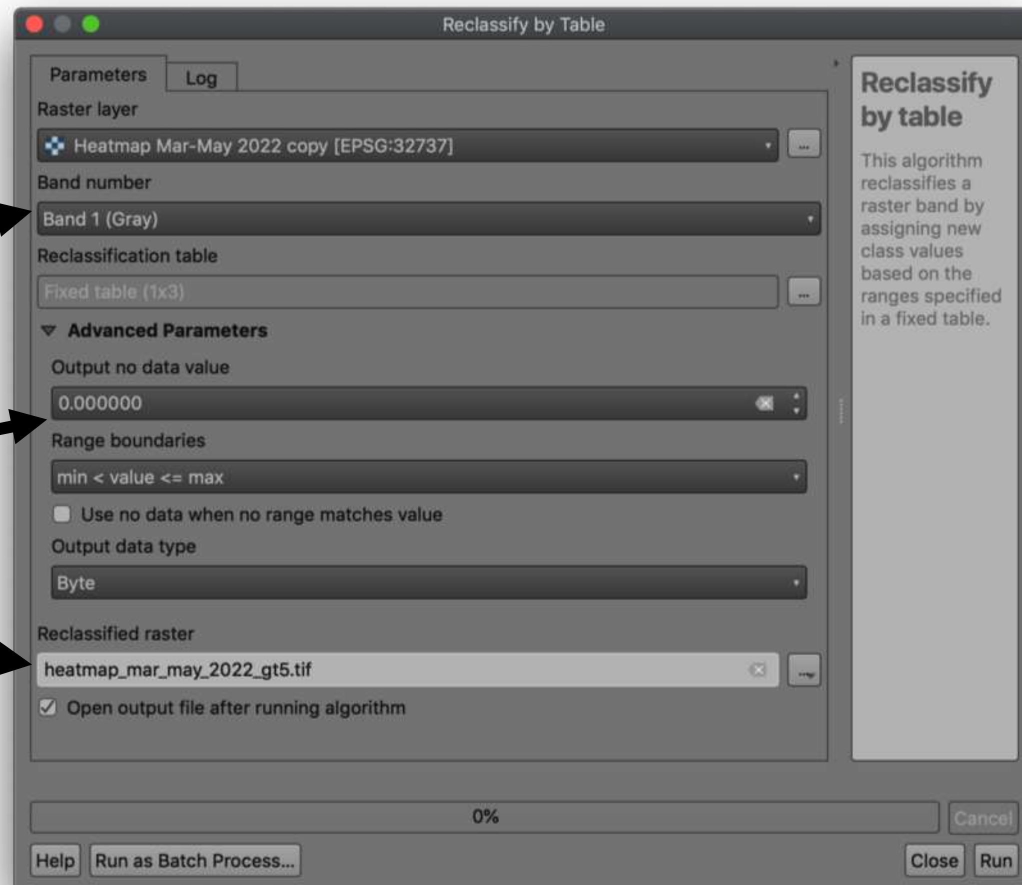
Also use the following settings:

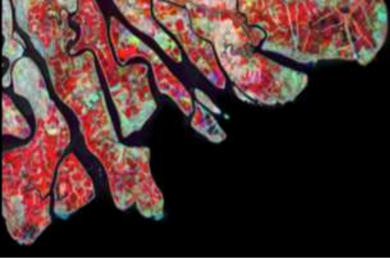
Output no data value of 0

Output data type Byte

Output filename heatmap_mar_may_2022_gt5.tif

Click Run





Convert Raster to Polygon

Your output should look like this, with a clear indication of where hotspots are occurring

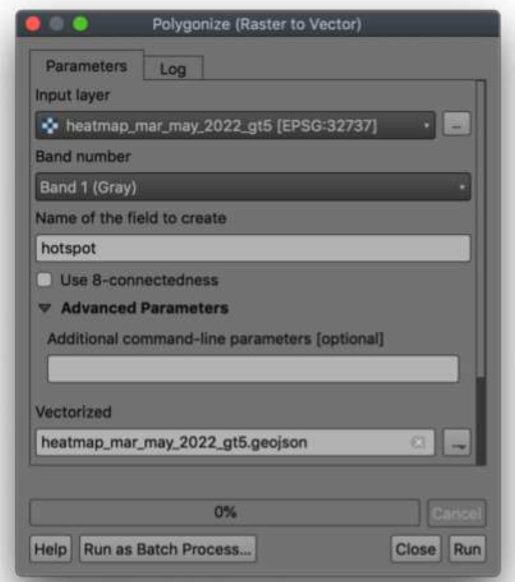
We will now convert this to a vector polygon feature

Go to Raster > Conversion > Polygonize

Input layer
heatmap_mar_may_2022_gt5

Name of field: hotspot

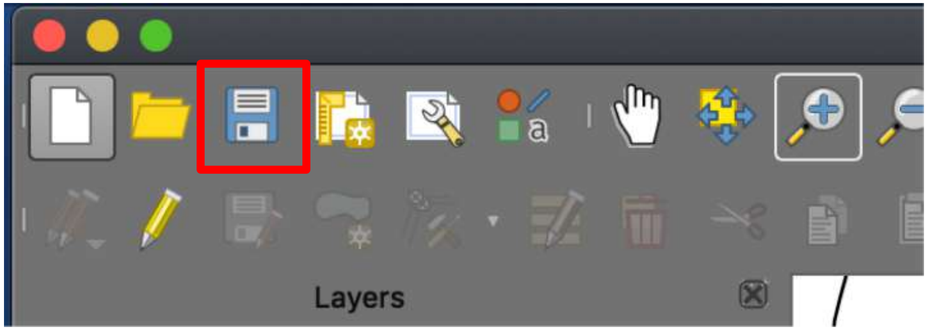
Vectorized
heatmap_mar_may_2022_gt5.geojson

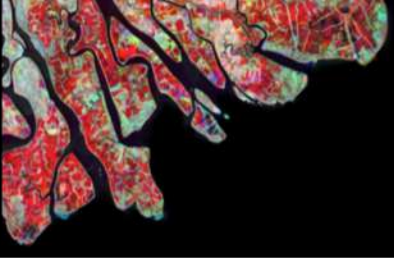


Click Run

Video 3.7

Save your map

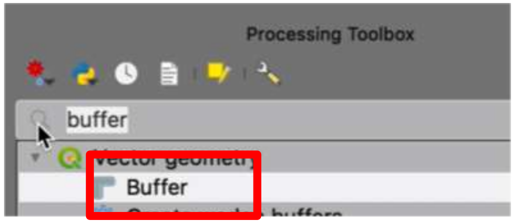




Buffer Analysis

We can now place a 500m buffer around our hotspot areas to define the area where LSM will take place

In the Processing toolbox, search for buffer and open the Buffer tool

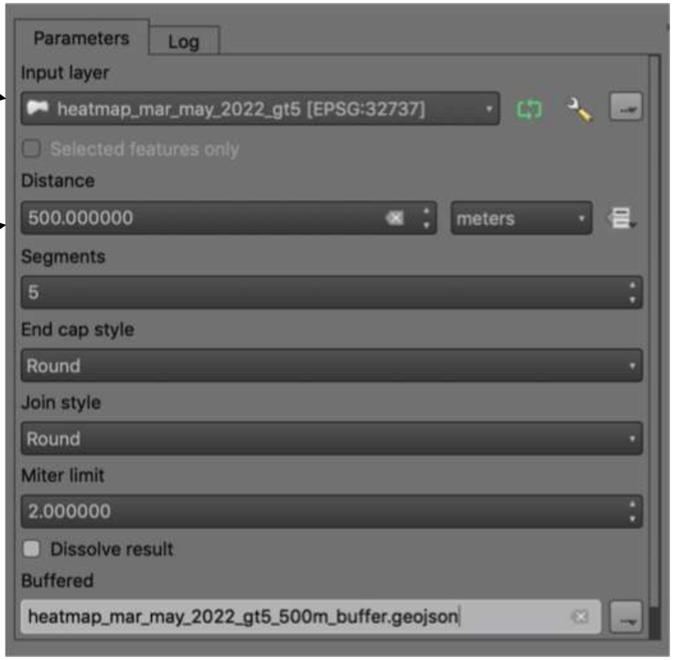


Set:

Input layer
heatmap_mar_may_2022_gt5

Distance 500m

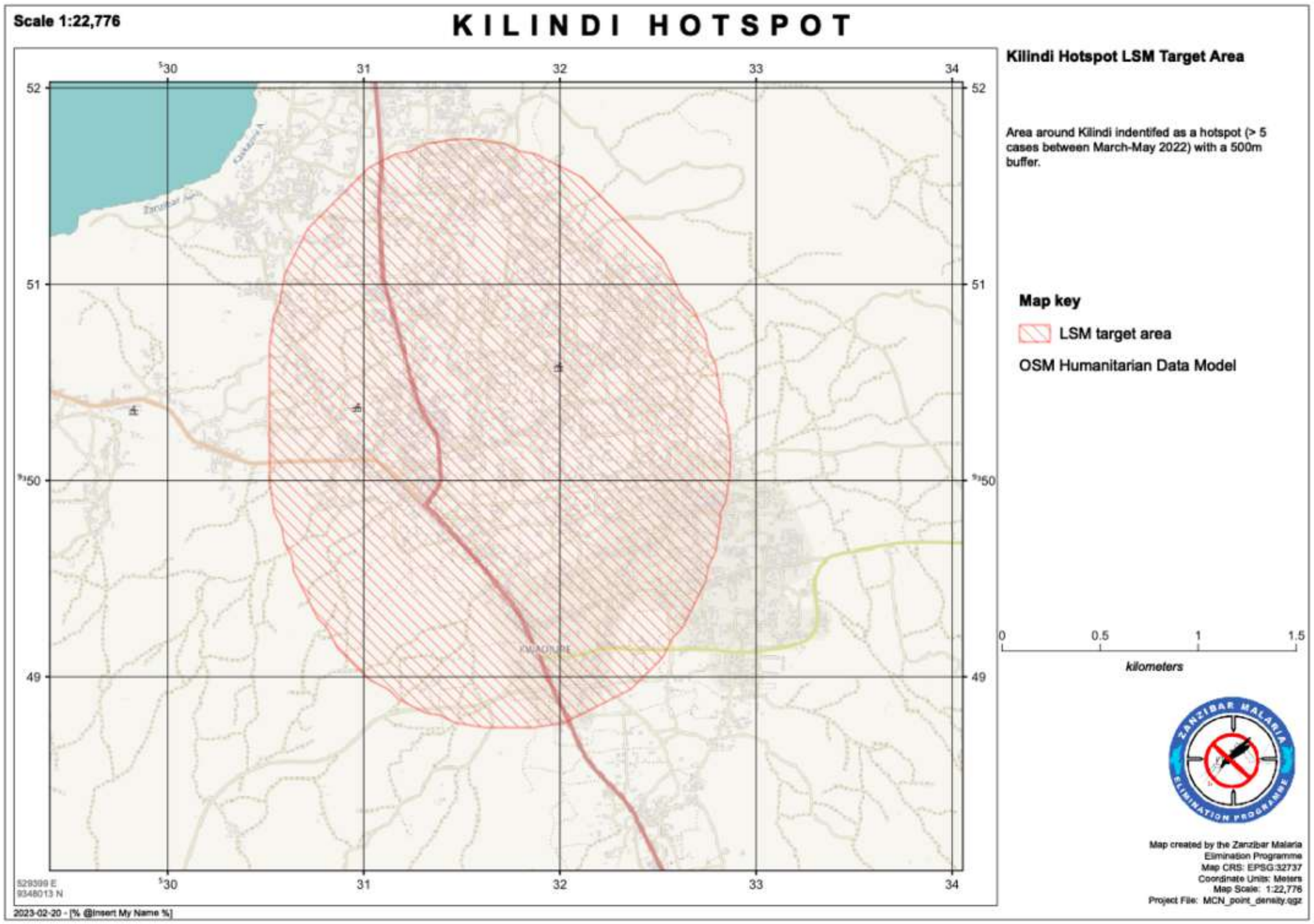
Buffered
heatmap_mar_may_2022_gt5_500m_buffer.geojson

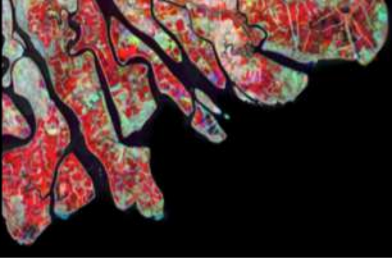


Video 3.8

Create a Map

Finally, create a map of the LSM target area for Kilindi in the North of Unguja





End

Well done. You successfully carried out density analysis to define malaria case hotspots

Through collaboration with Zzapp, we can import these polygons into Zzapp and use them to define our LSM campaign