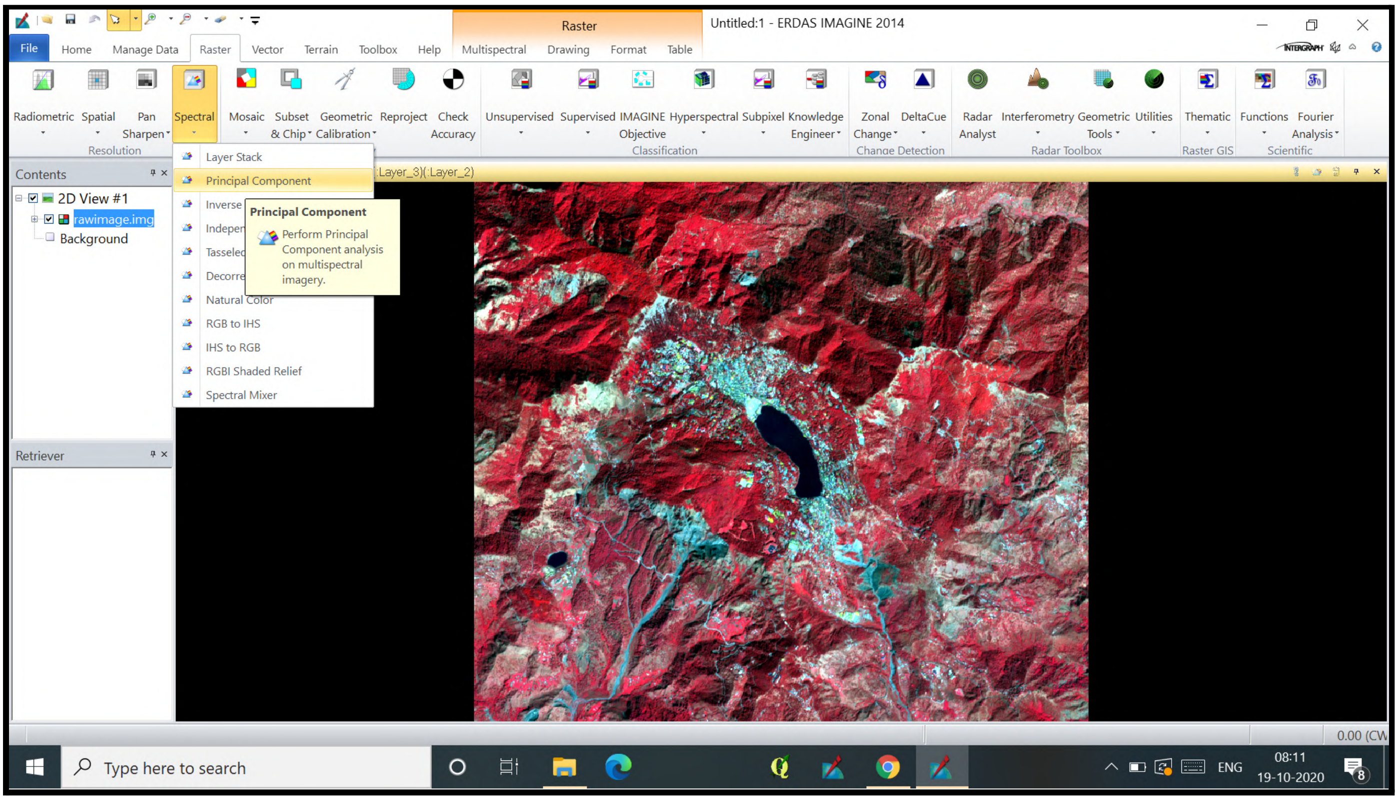
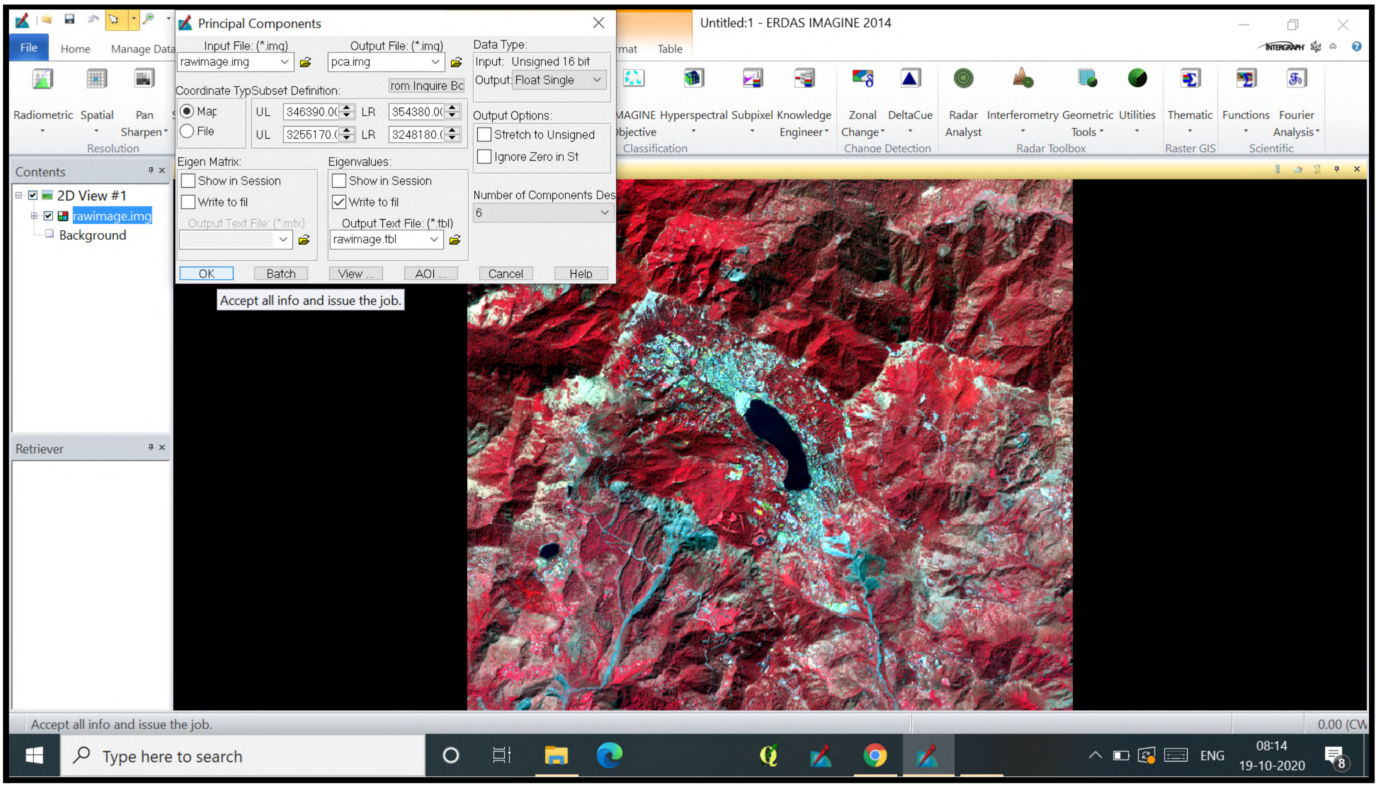
PART-1A

GENERATING PCA

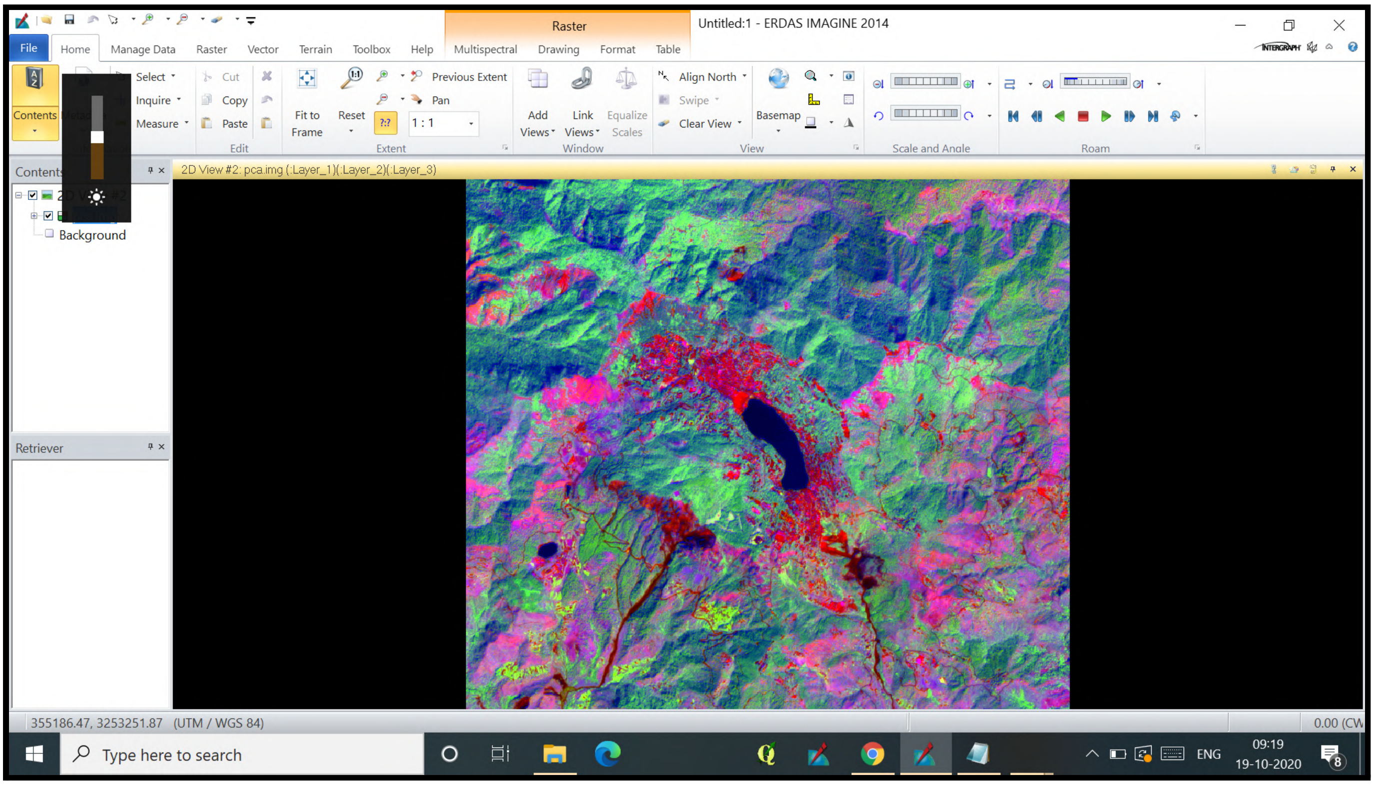
Step-1 To go **Raster > Spectral > Principal Component**



Step-2 Give the output image name, select the **no. of components** (here maximum 6 possible as 6 bands). In **Eigenvalues**- enable write to file, give output text file name. Then click on **OK.**

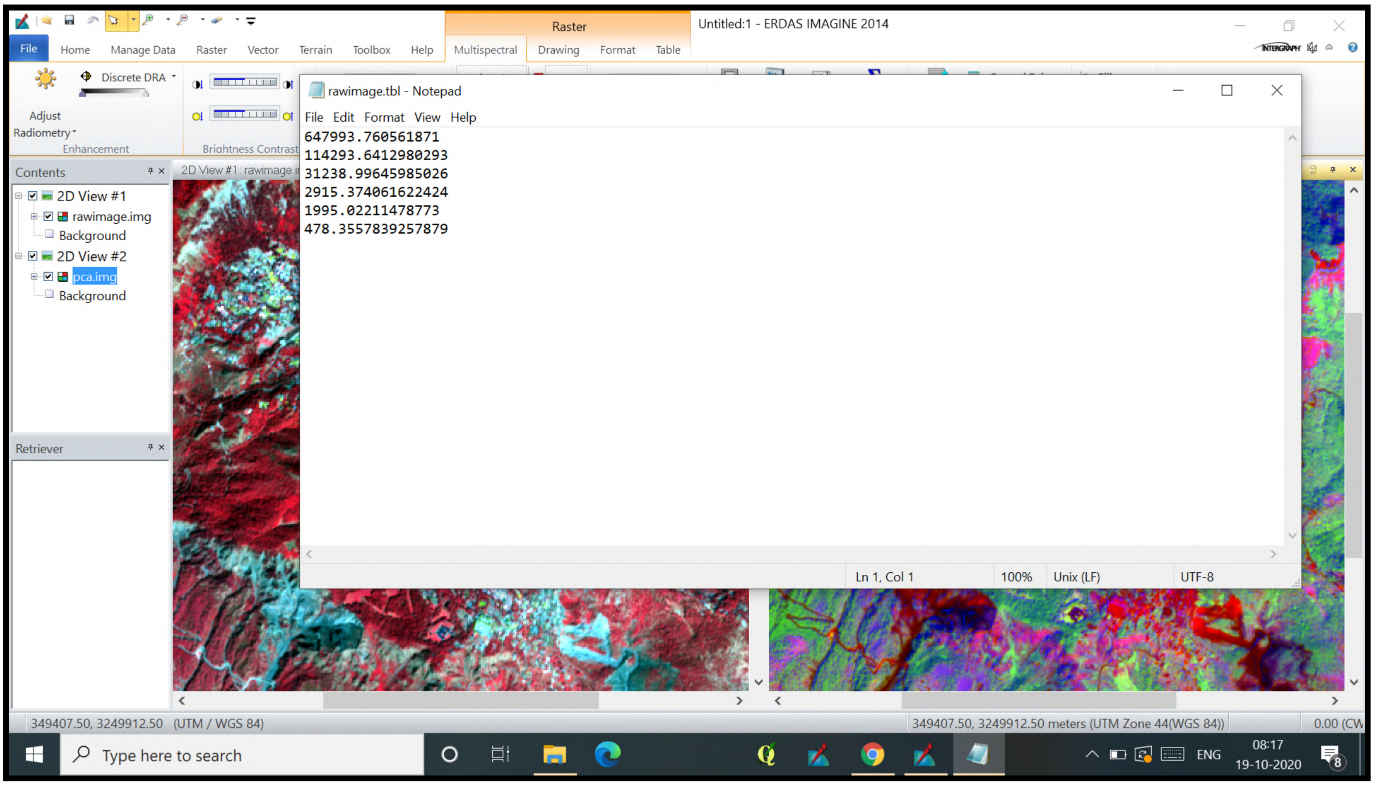


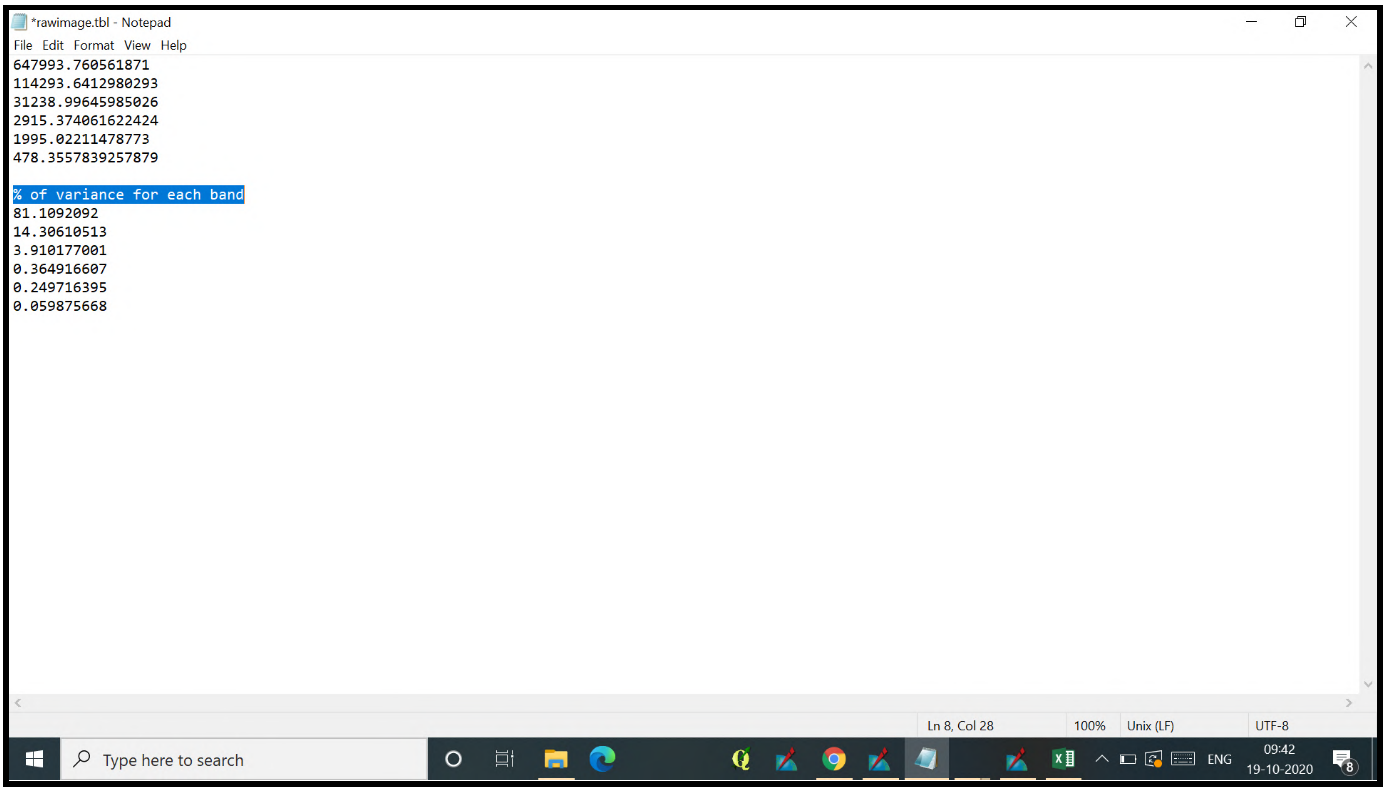
Step-3 After computation, open the PCA generated. (RGB Color Composite using PCA-1, PCA-2, PCA-3)



In the RGB generated (using PCA-1,2,3) , a lot of different **colours can be seen, representing different land covers.** There are Colour variations therefore, **distinct features visible and easier to interpret.** The water body is in blue, settlements in red, different vegetation types. In vegetation, variety can be seen i.e. there are in different shades. **All the variations present in the image can be seen in the first 3 bands.** Thus, the **variance** in input image can be represented using the first three PCA and these three are **sufficient** to understand the dynamic nature as the **maximum information** is extracted from these bands and no need to analyse all the bands which is a tedious and cumbersome task.

Step-4 Open the **engine value file (.tbl)**



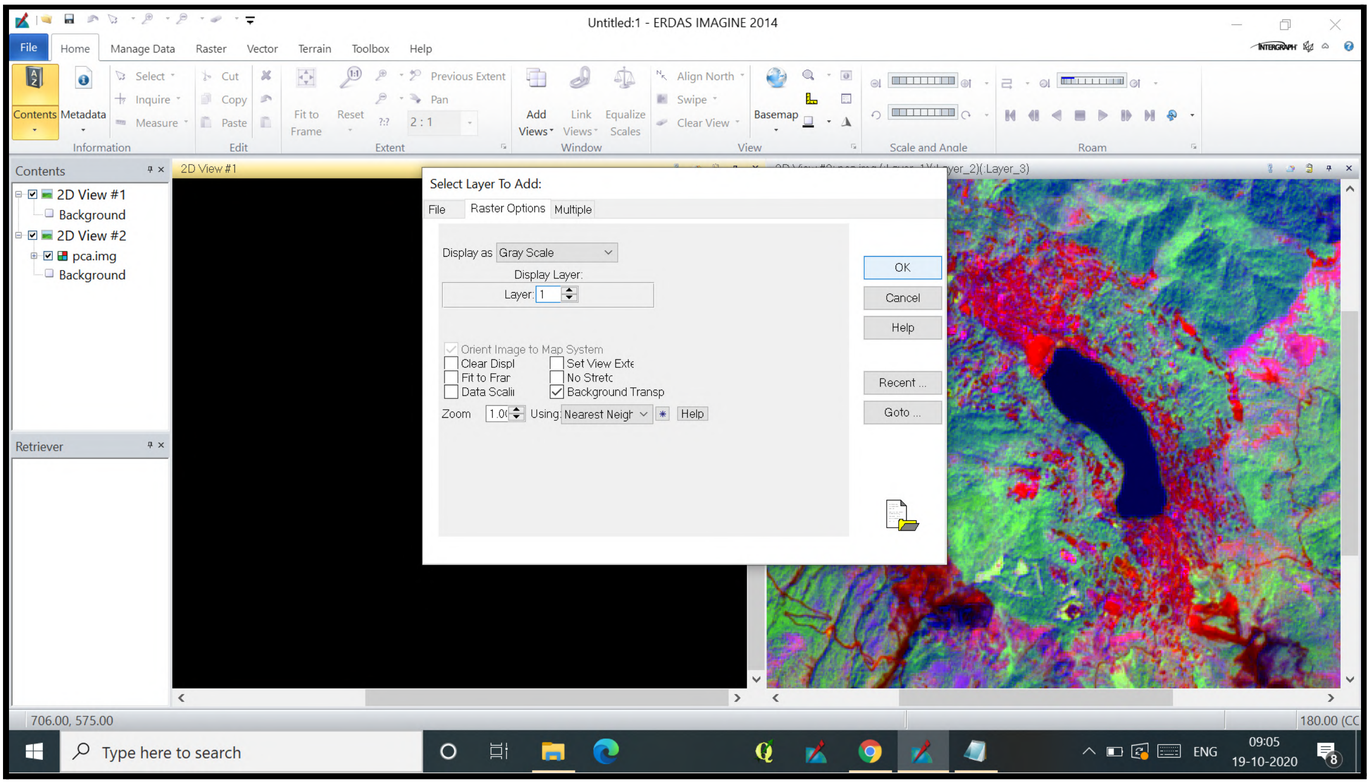


From the above, it is evident that around **81% of variation is captured by PCA-1**. This implies that it records **maximum information (uniqueness in data).** PCA-2 records around **14%** of variation. And in PCA-3 approximately **4%** of variation is recorded. **PCA-4,5,6** record negligible variation and therefore **minimum information**.

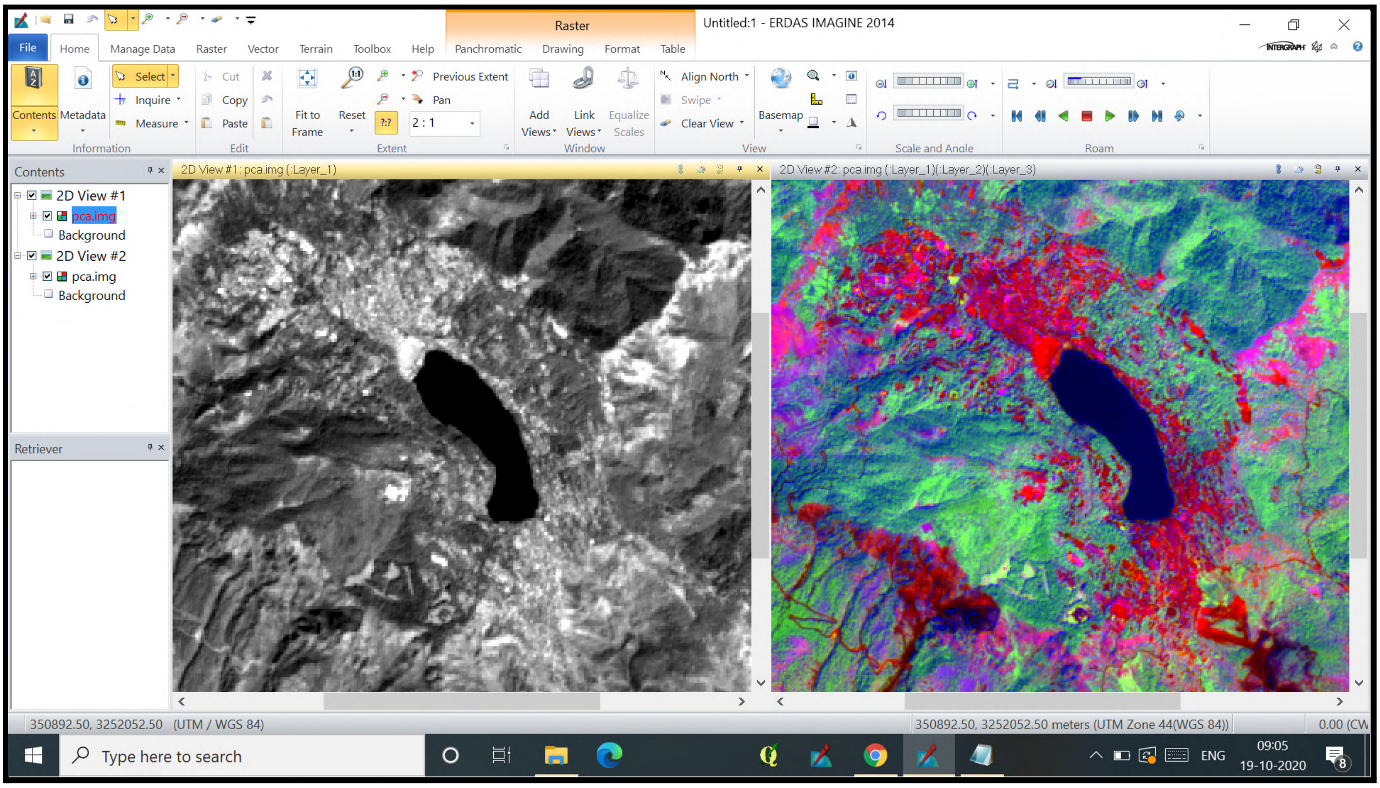
PART-1B

VISUALIZING INDIVIDUAL BANDS

Step-5 Open PCA generated. To go **Raster Options > Grayscale > Choose the layer** to be displayed. And then click on **OK.**

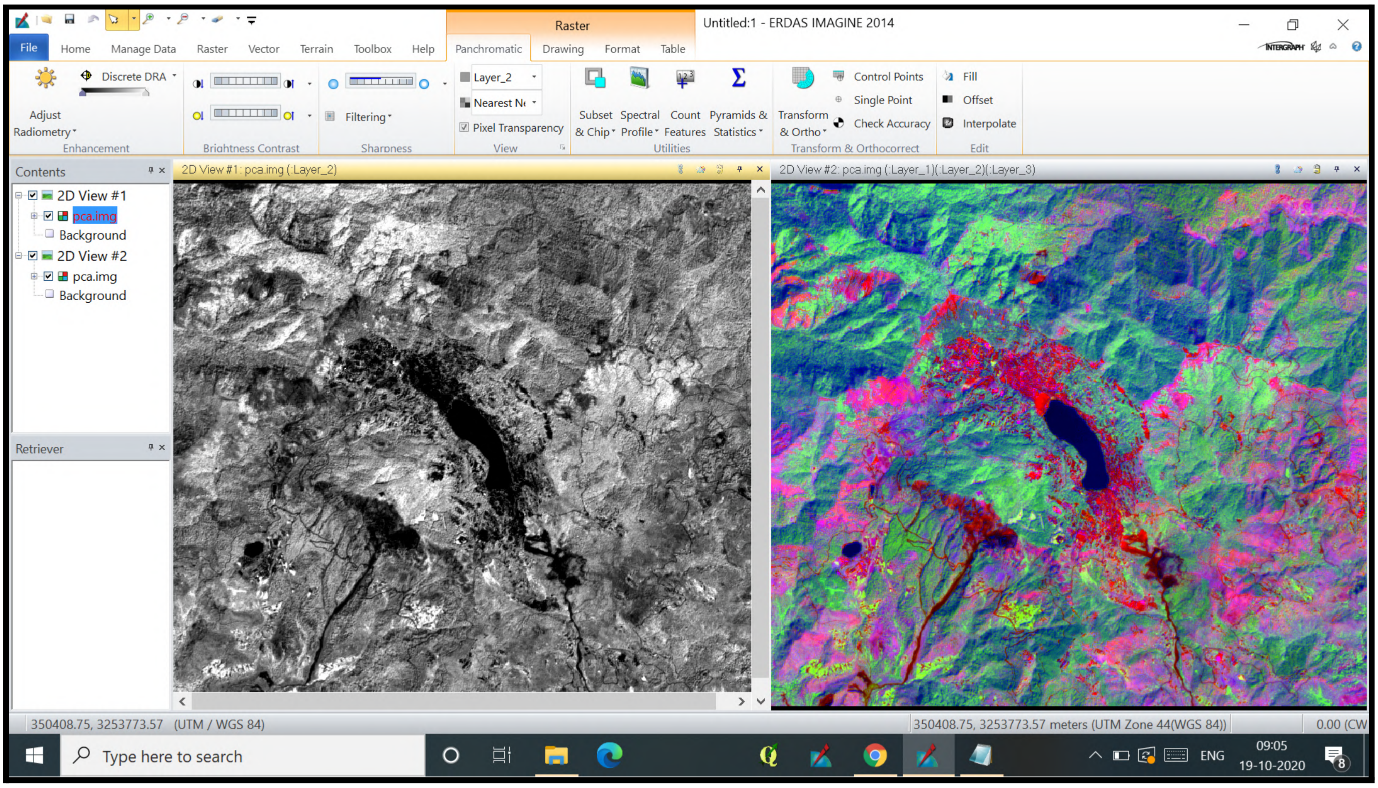


PCA-1



Maximum variation i.e. all the variability (not correlated i.e. unique information) is captured in PCA-1. PCA-1 has the largest spread of data.

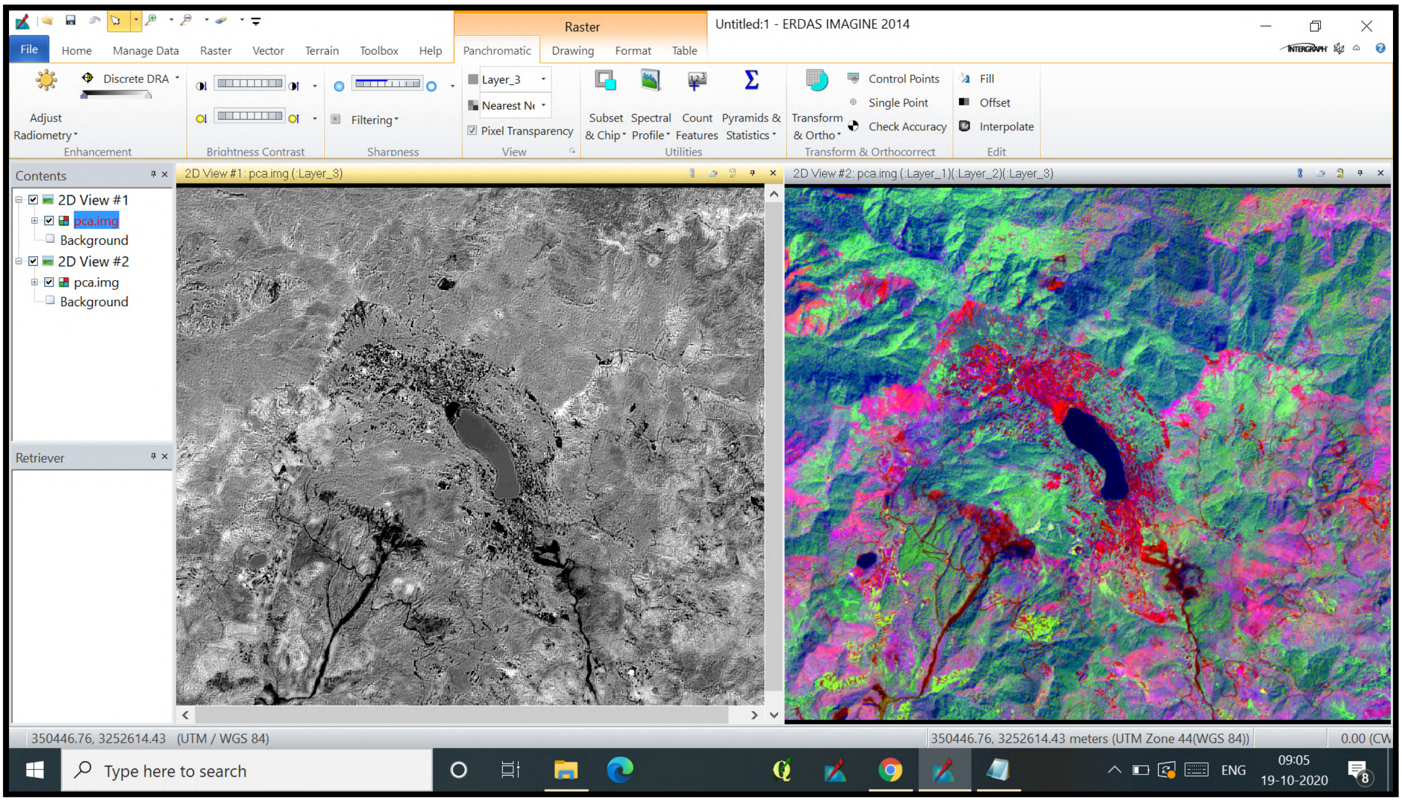
PCA-2



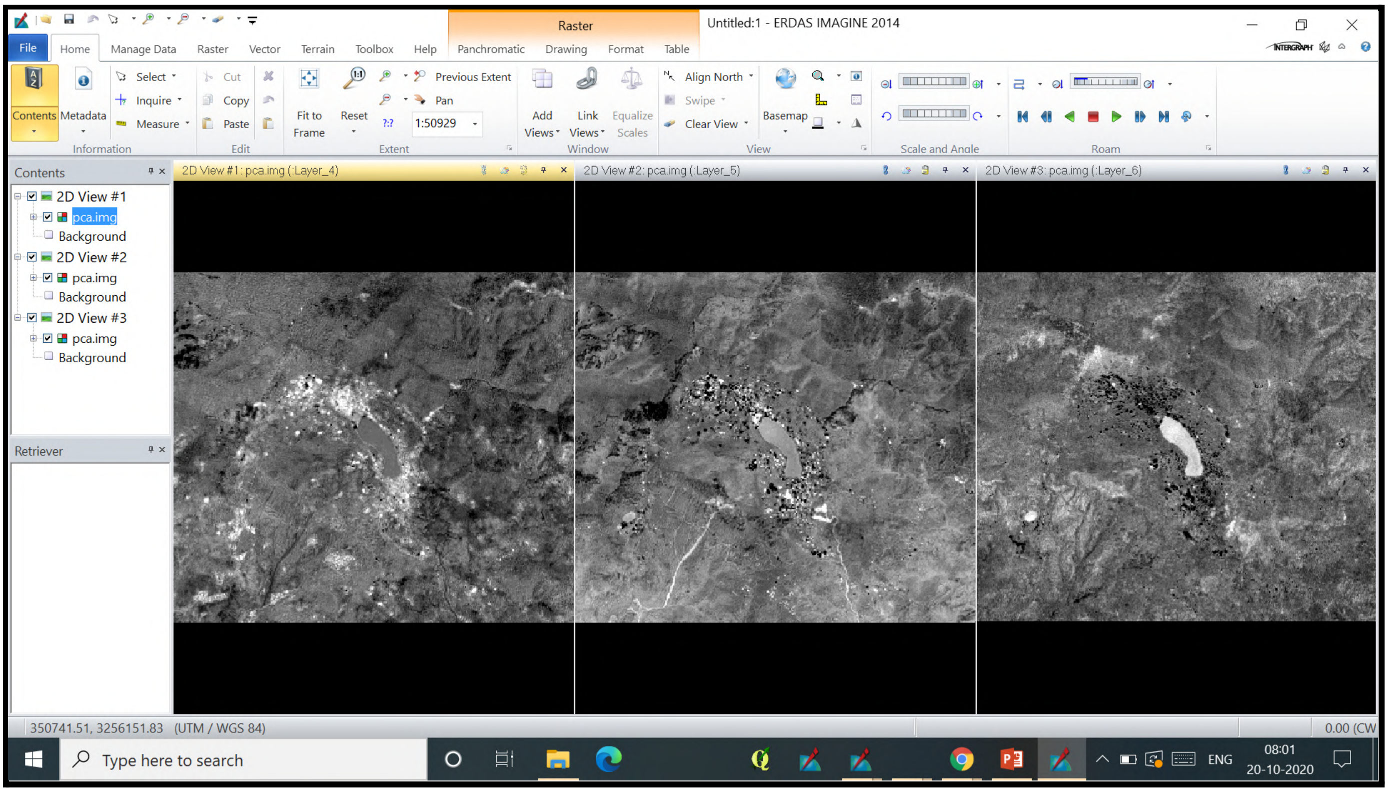
<u>Order of information extrcated</u>

PCA-1 >>> PCA-2 >> PCA-3 > (PCA-4, PCA-5 PCA-6 - Negligible)

PCA-3



PCA-4, PCA-5, PCA-6



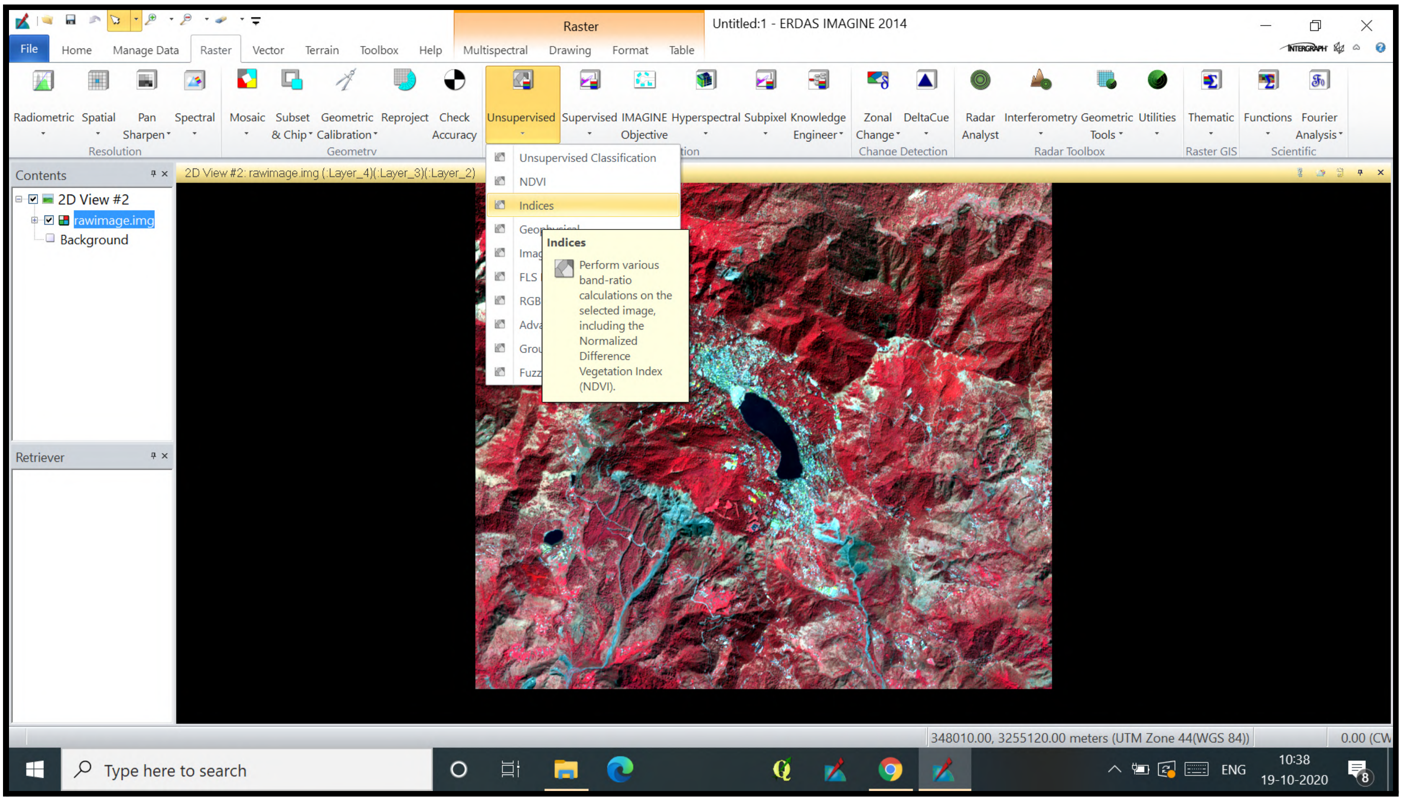
In **PCA-4 , PCA-5 and PCA-6, there is not much information.** It is a bit hazy or seems like some filter is applied. It is **hazy** because resampling from 20m pixel size to 10m using **nearest neighbour resampling** in which edges are more prominent. Thus, **PCA-1, PCA-2 and PCA-3 are sufficient to extract information** and make **interpretation easier.**

<u>PART-2</u>

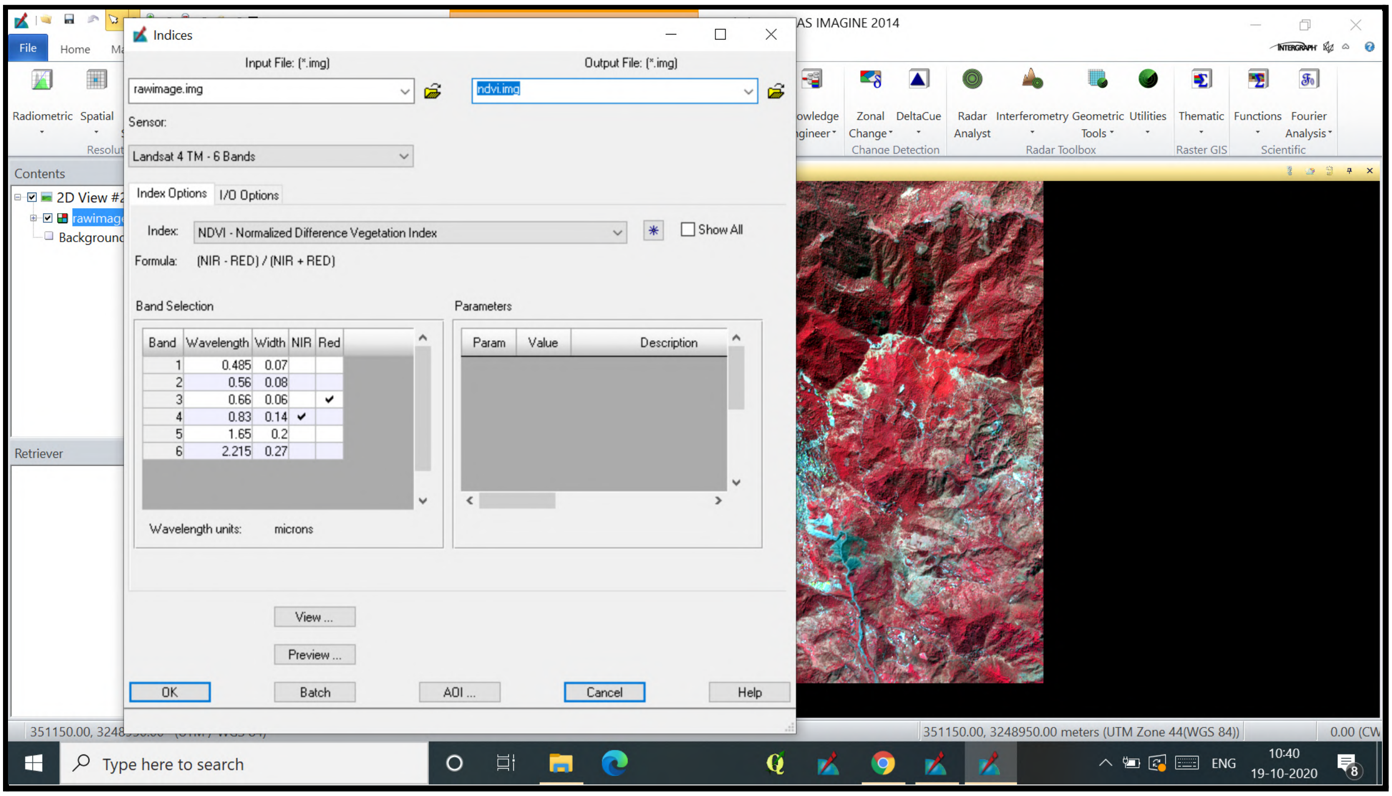
INDICES

1. NDVI

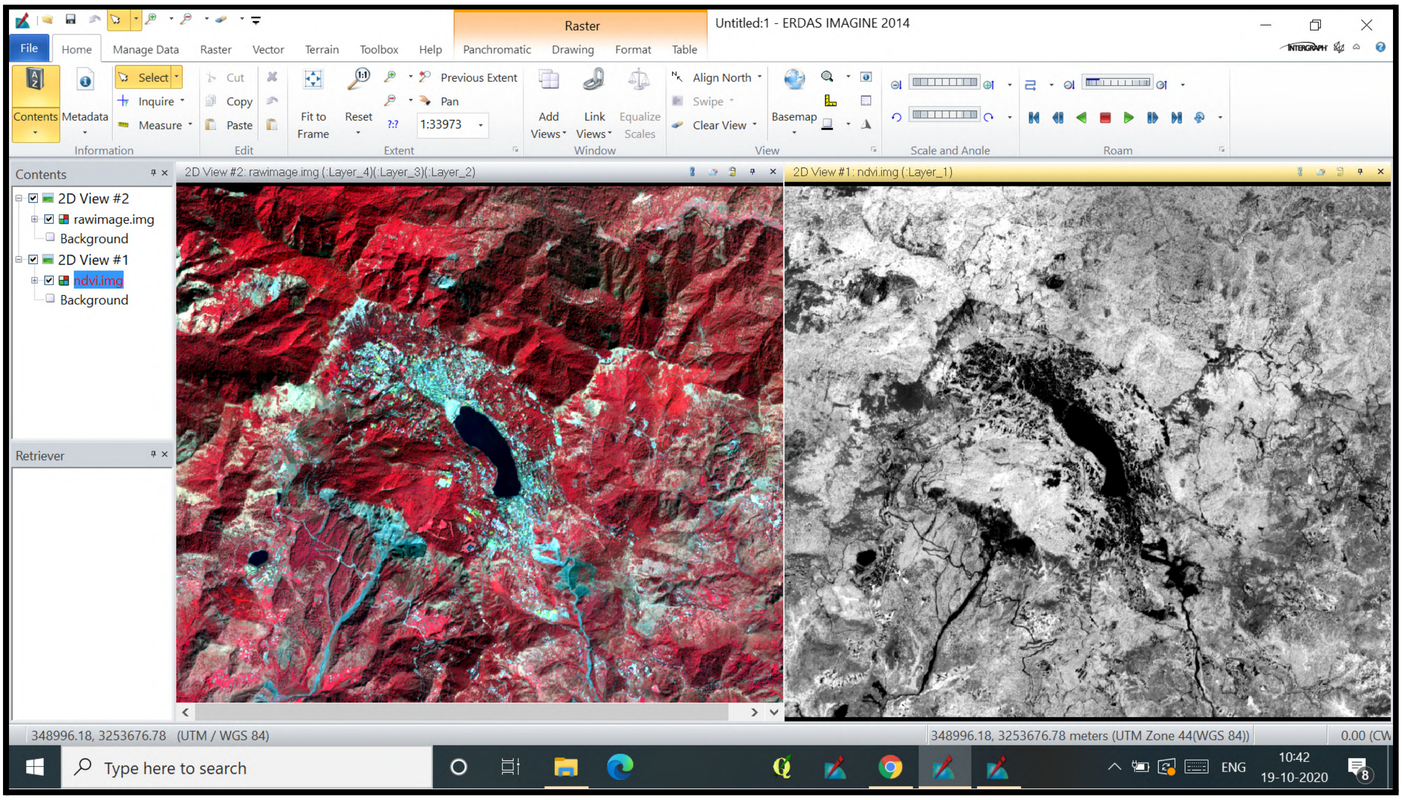
<u>Step-1</u> **Rater > Unsupervised > Indices**



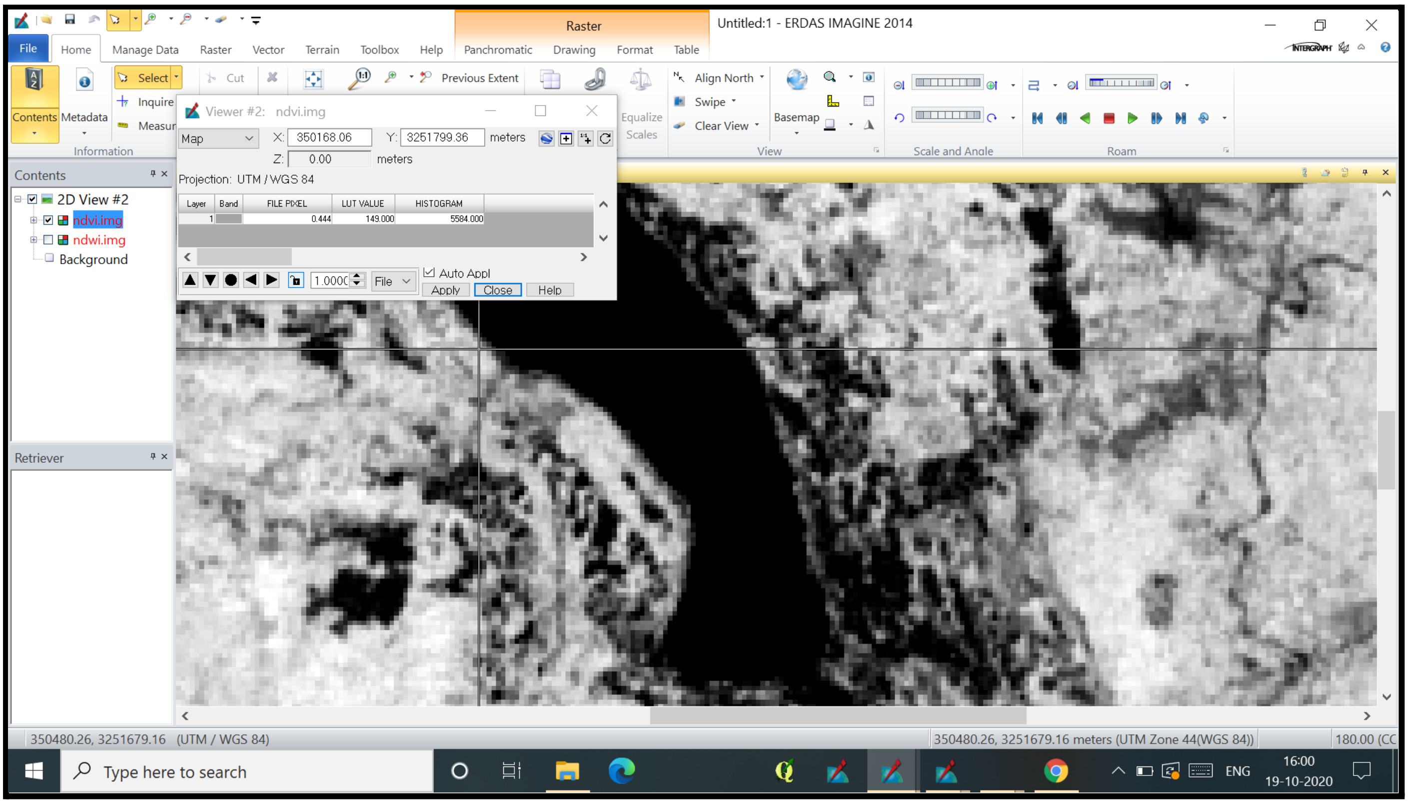
<u>Step-2</u> Choose **NDVI** in Index and in band selection, check that **NIR** (first) and **Red** (second) bands are selected. Give output file name and click **OK.**



Step-3 Open the NDVI created



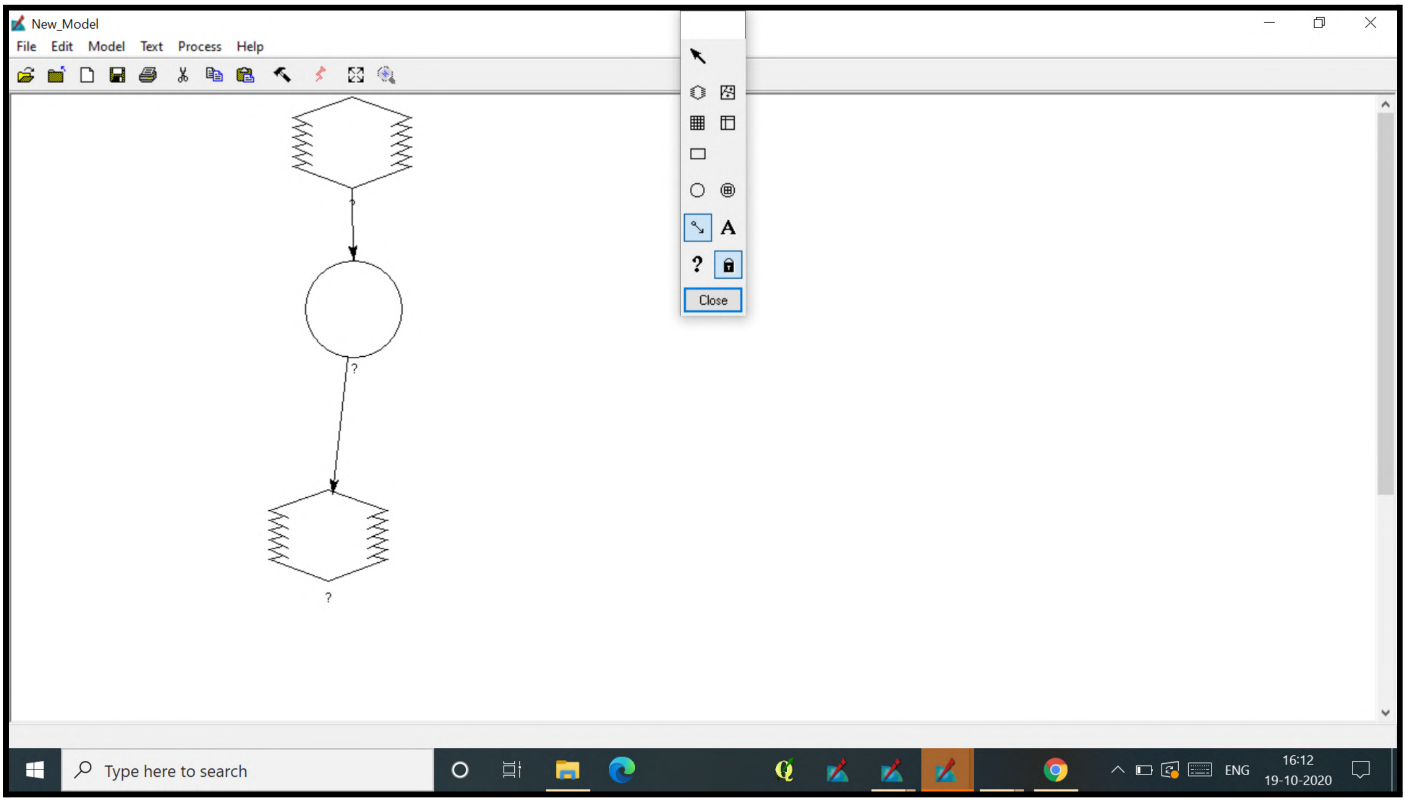
Step-4 Find the **threshold** value of vegetation using the **inquire.**



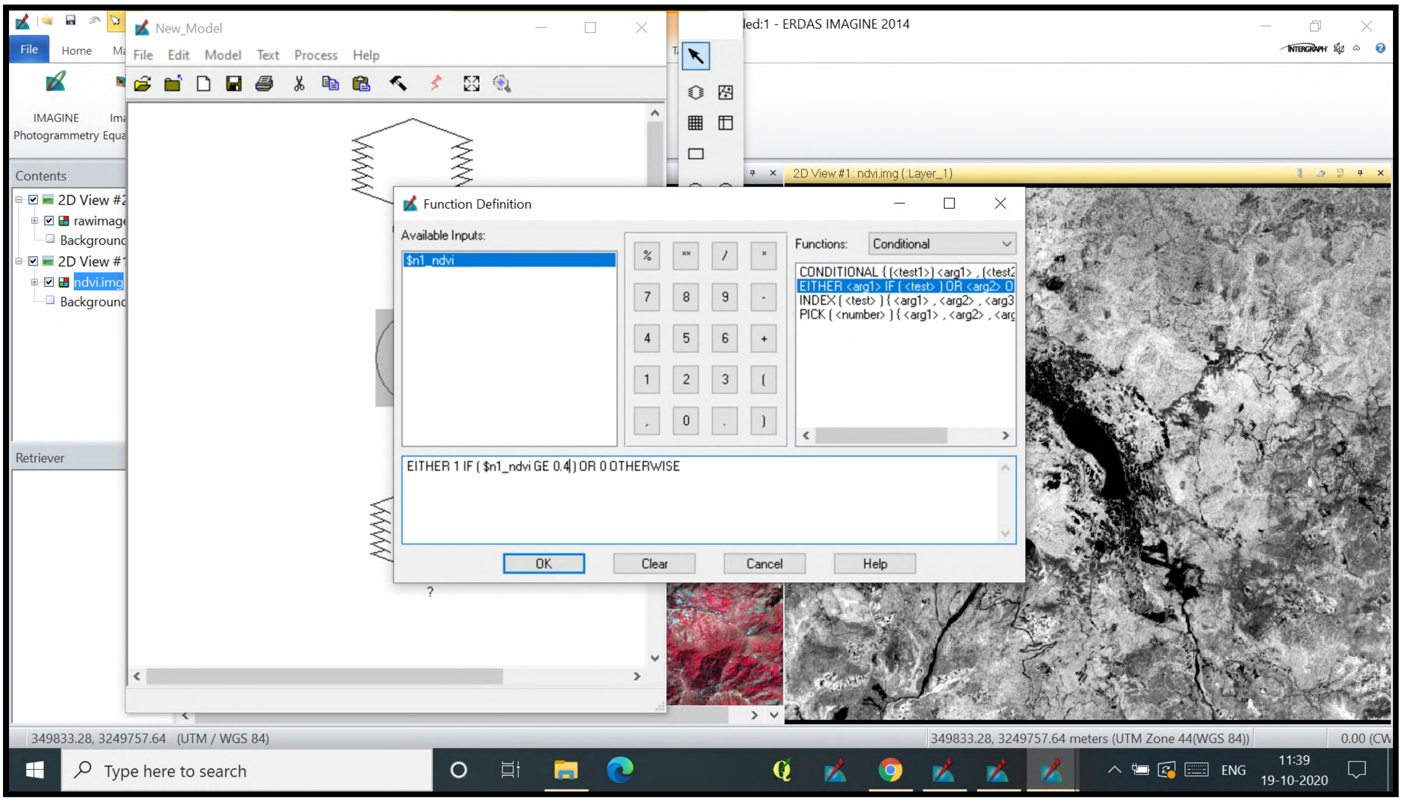
Here, threshold value of vegetation is 0.4

Step-5 To create **Classified Vegetation Map**

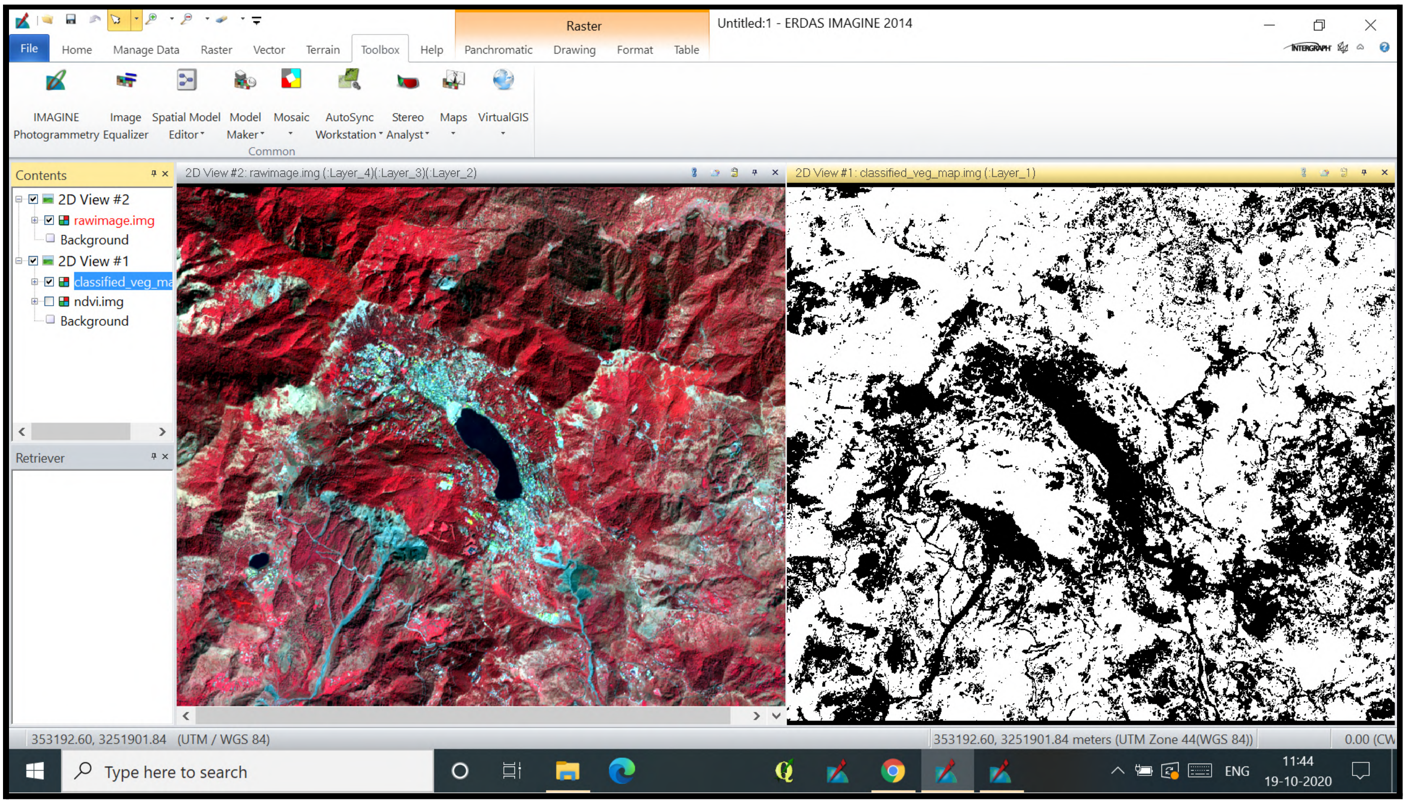
To go **Toolbox > Model Maker > Model Maker.** Create the model needed.

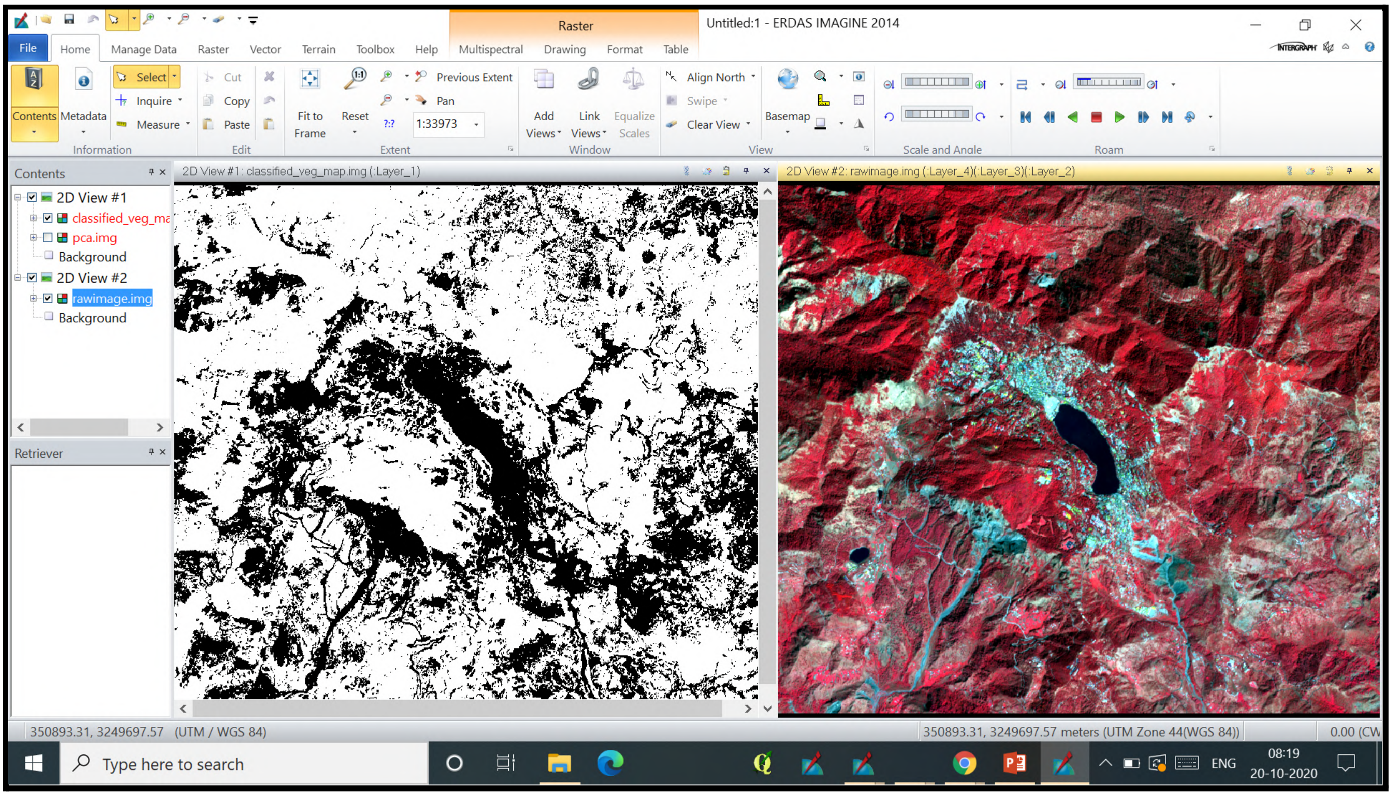


Step 6 Browser the NDVI image in the input raster. In **functions, choose Conditional > Either.** Write the syntax. (**if its vegetation, return 1 otherwise 0 and threshold value is 0.4.** Therefore, **>=0.4 is vegetation)** And in the output raster, give the output file name. And then Execute the model.



Step-7 Open the **classified vegetation map** generated.





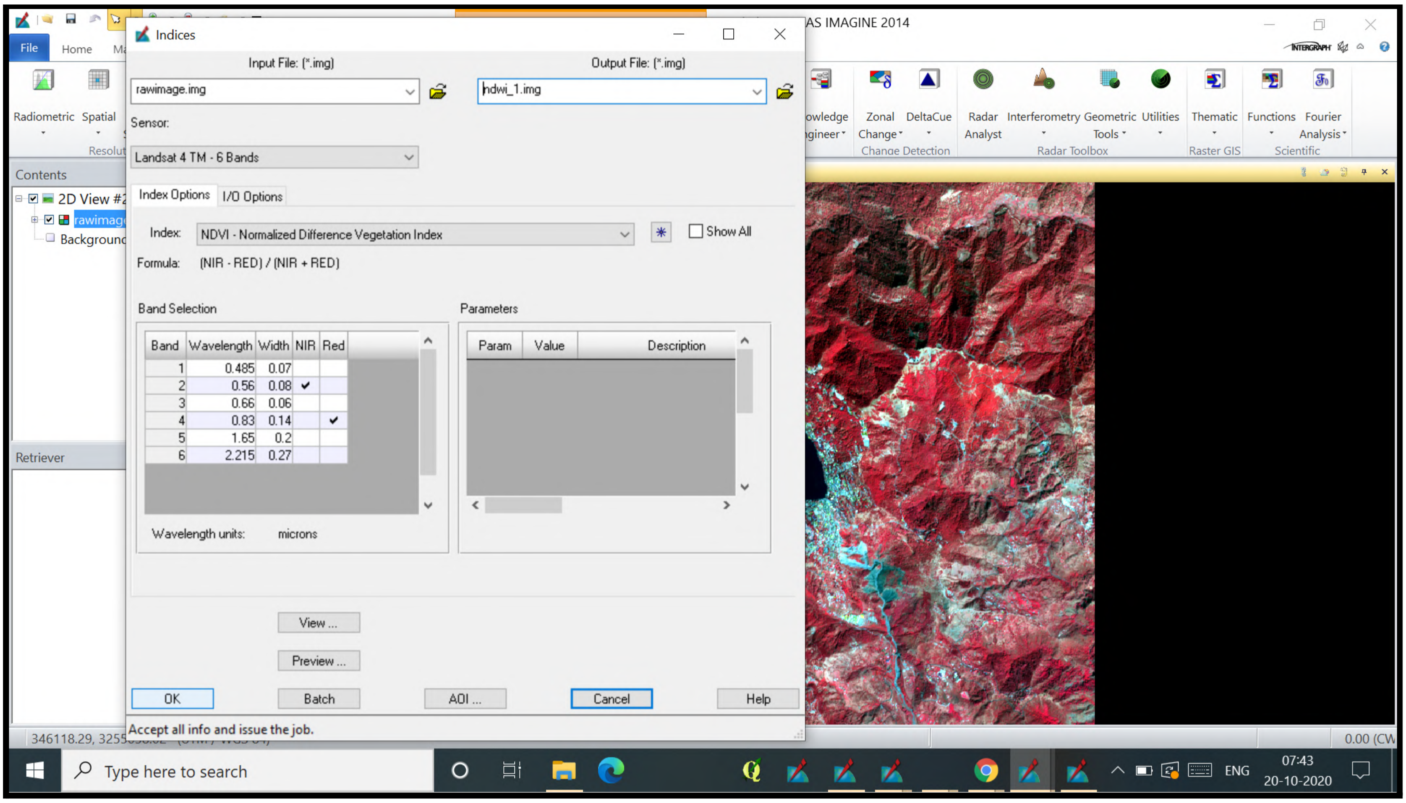
Here, the **bright part represents vegetation** and dark portions are other things which are not vegetation. Thus, this index will be very helpful in **interpreting** the image.

NDVI is very useful, not just tells how much vegetation but also density can also be calculated. This is very useful in **precision agriculture.** Also helpful in **monitoring seasonal and inter-annual changes** and reduces many forms of **multiplicative noise.**

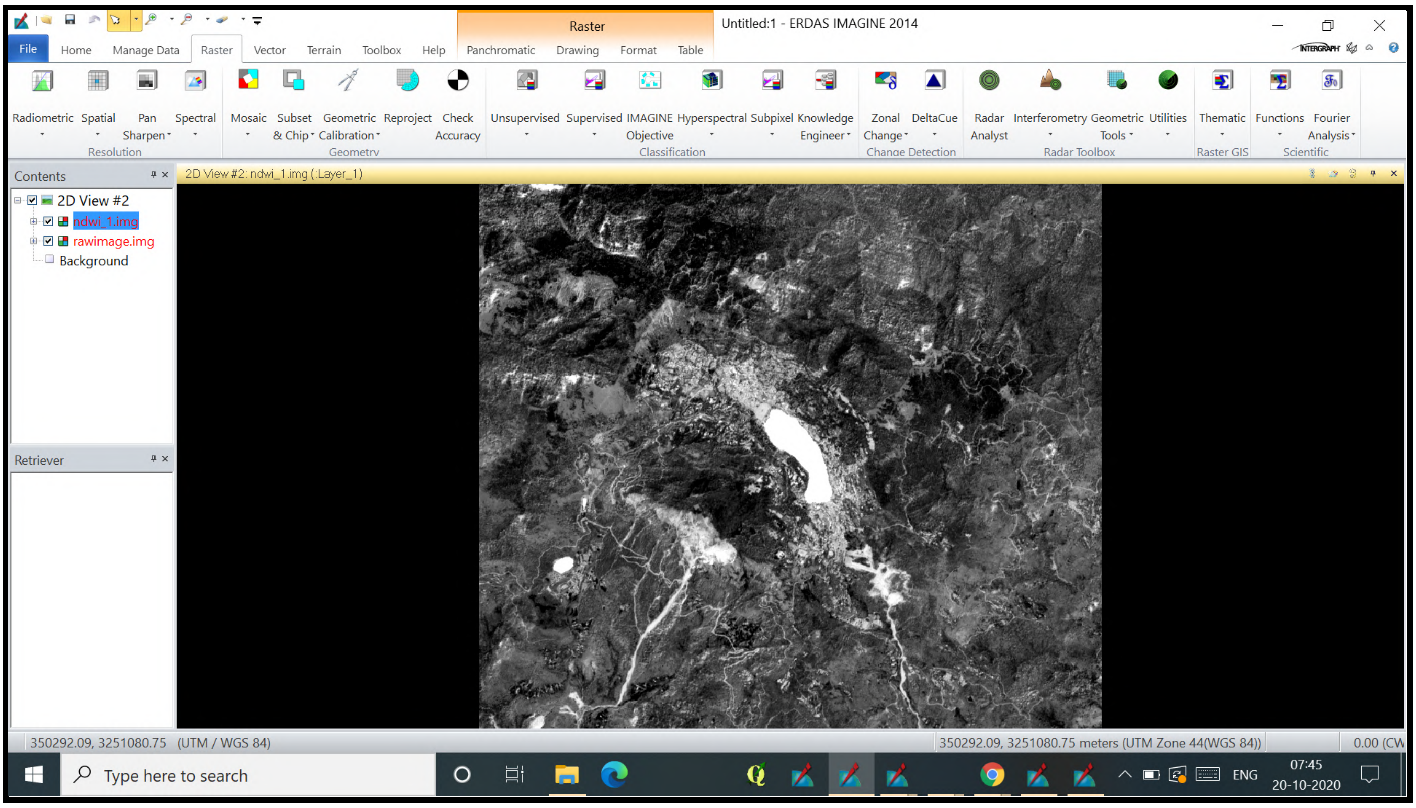
2. NDWI

Step-1 Choose **NDVI** in Index (as NDWI is not available here) and in band selection, check that **Green** (first) and **NIR** (second) bands are selected. Give output file name and click **OK.**

(Note: These bands are chosen because it's a LANDSAT 4TM image. Cross-checked from Geo University site)



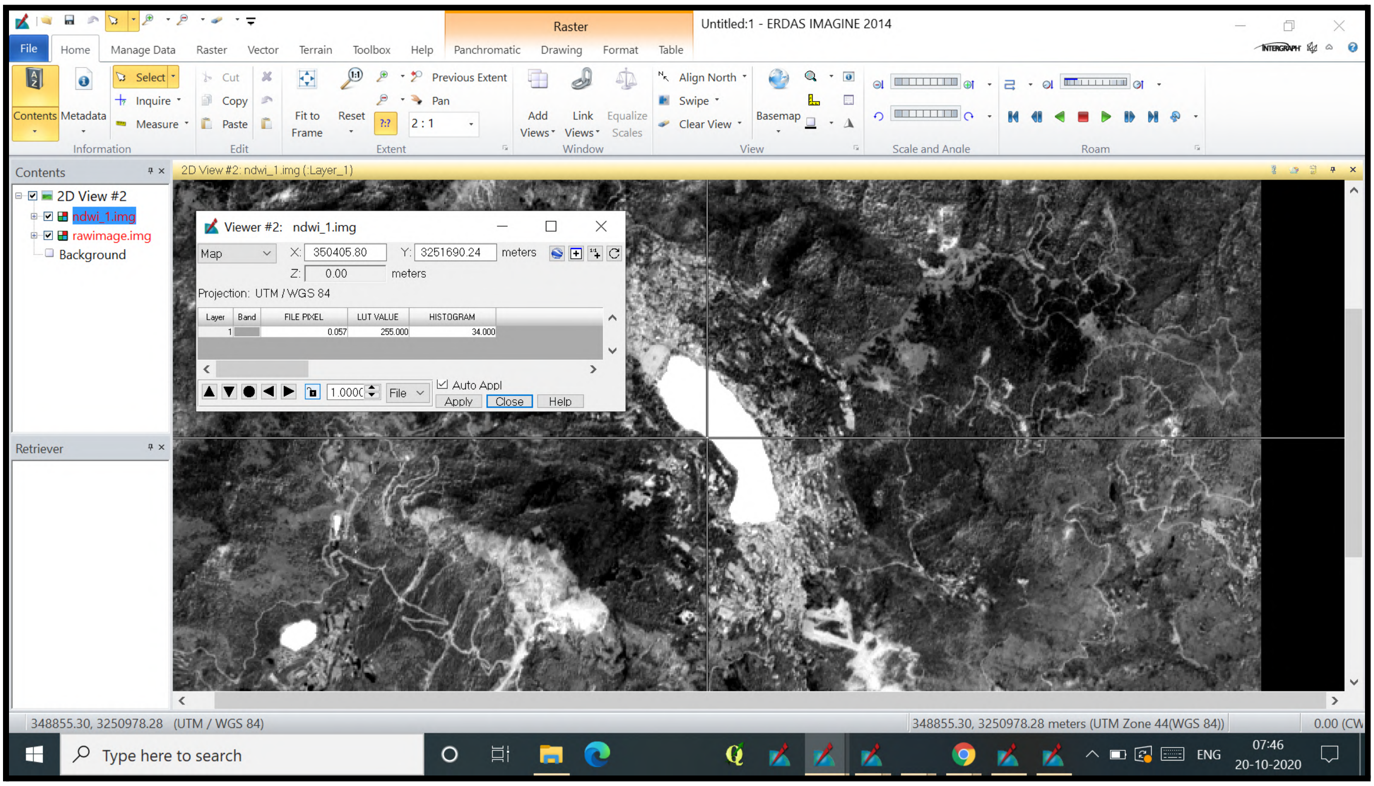
Step-3 Open the NDWI created.



Water body clearly visible in **bright white colour.**

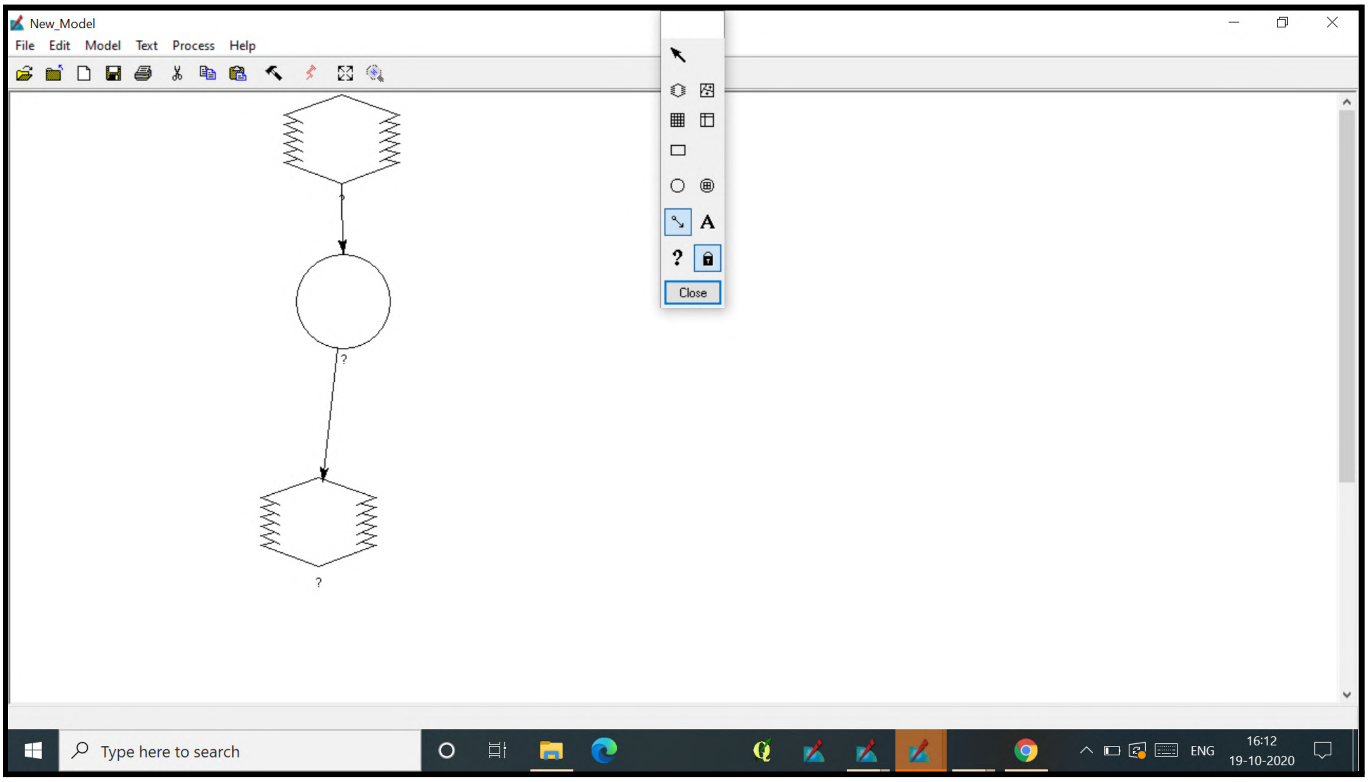
Step-4 Find the **threshold** value of water using the **inquire.**

Here, threshold value of 0.

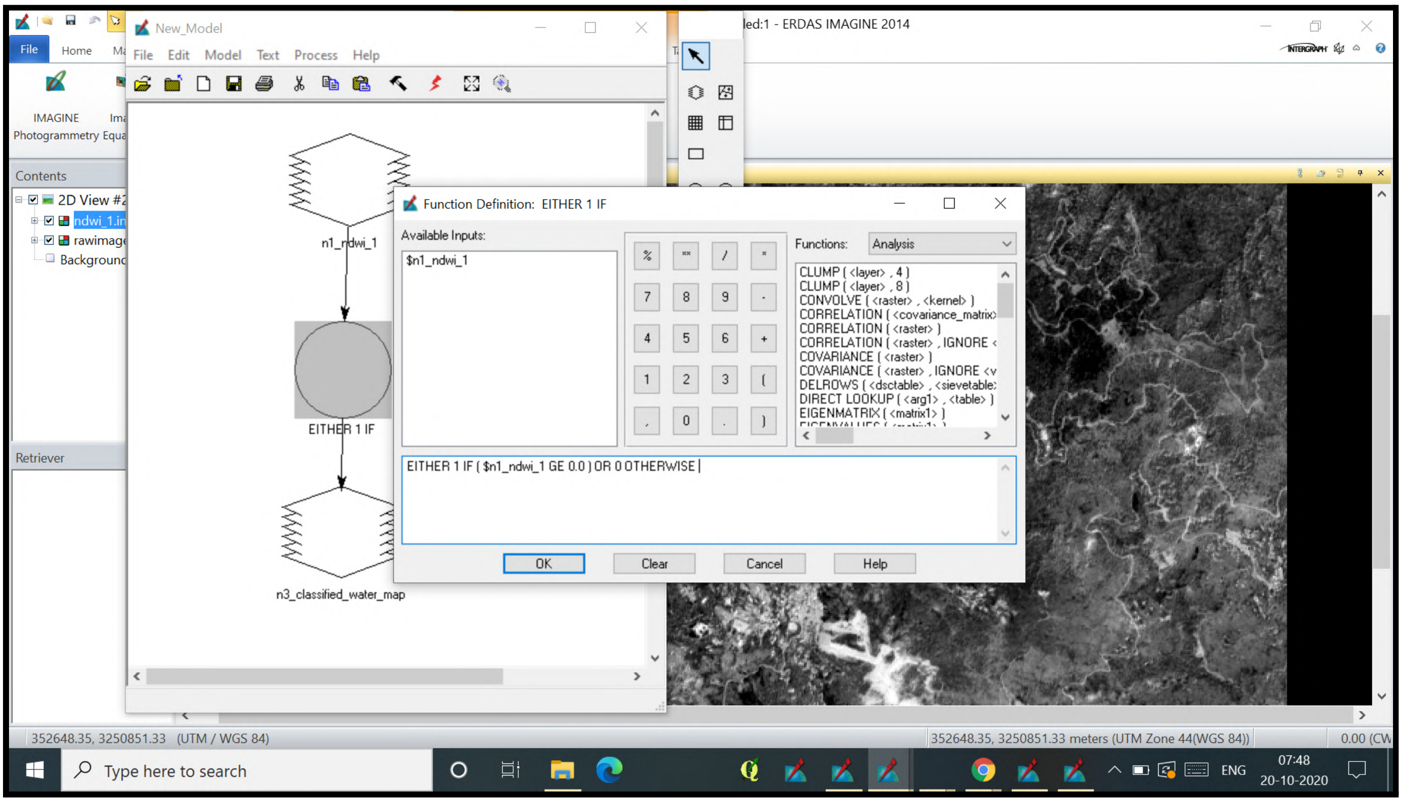


Step-5 To create **Classified Water Map**

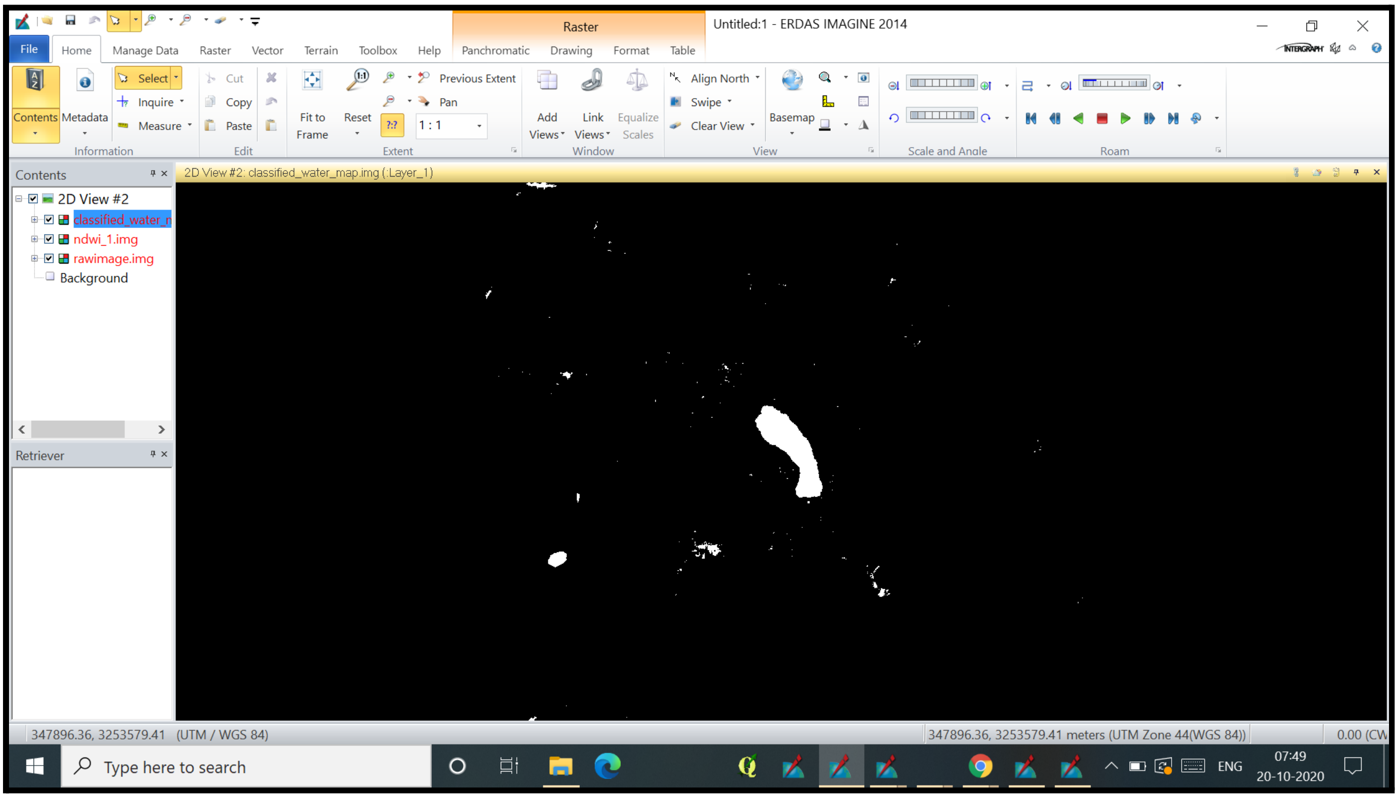
To go **Toolbox > Model Maker > Model Maker.** Create the model needed.



<u>Step 6</u> Browser the NDWI image in the input raster. In **functions, choose Conditional > Either.** Write the syntax. (**if it's a water body (high moisture content), return 1 otherwise 0 and the threshold value is 0.** Therefore, **>=0 is water body**) And in the output raster, give the output file name. And then Execute the model.



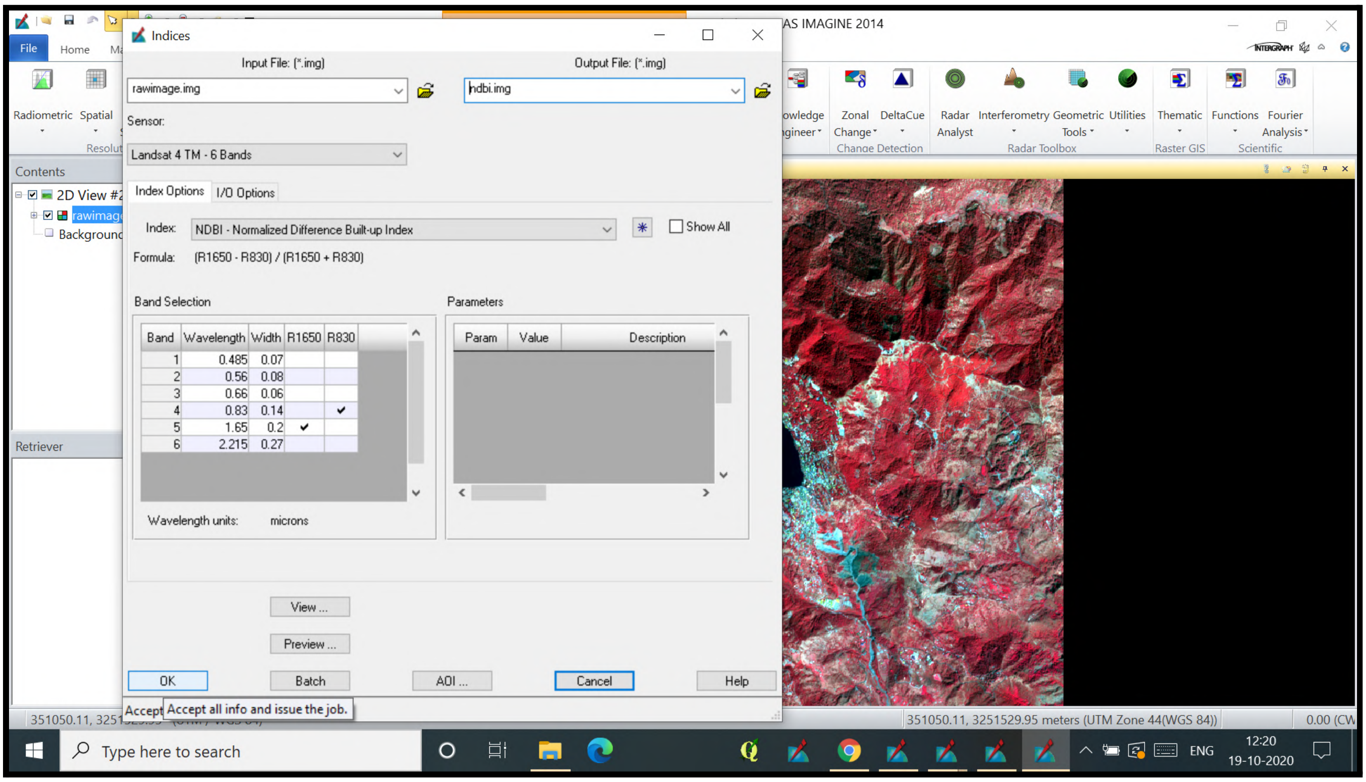
<u>Step-7</u> Open the **classified water map** generated.



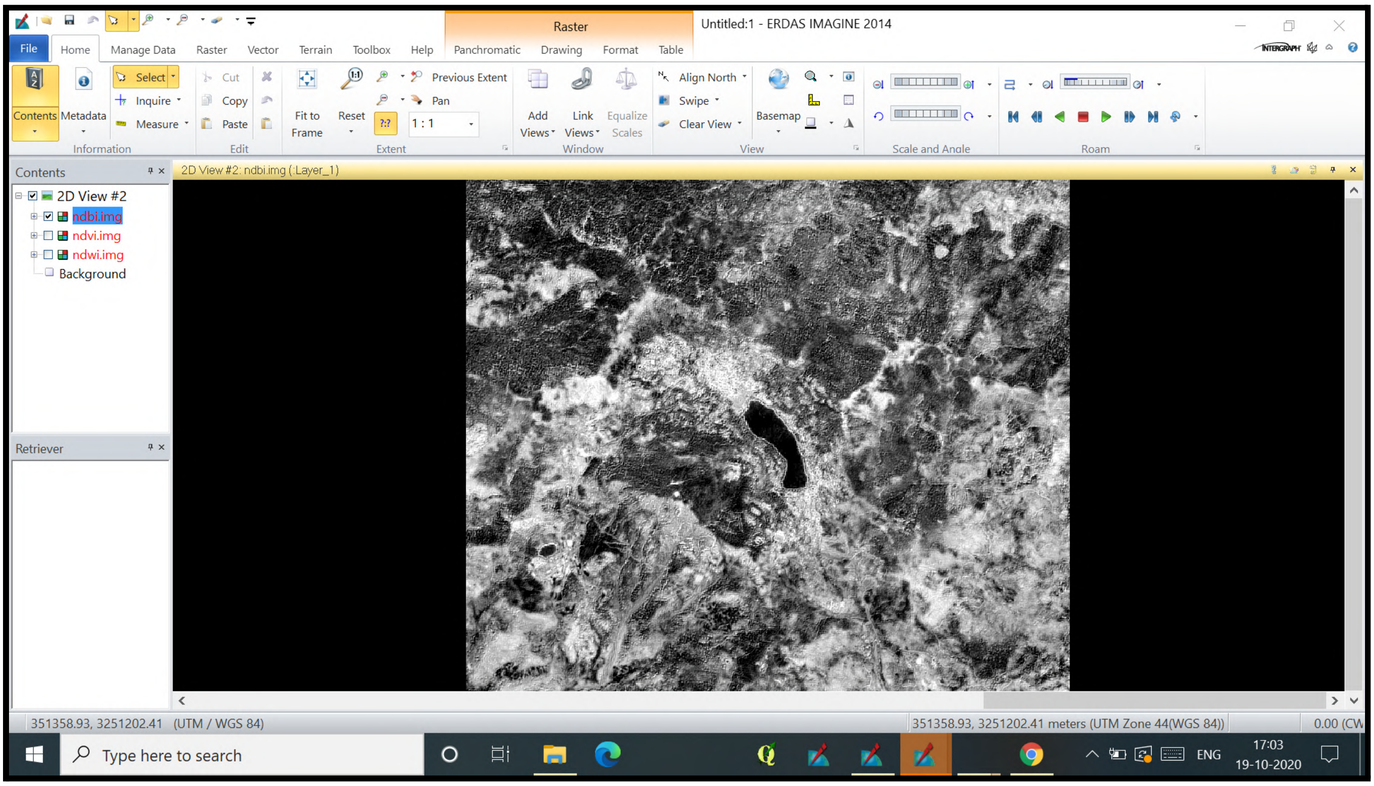
Here, the **bright part represents the water body** and dark portions are other things. This index enables us to clearly **visualize the water bodies** present. Same can be used as a **moisture gradient.** Bright parts represent **maximum moisture** that is in the water body and black portions have 0 moisture content.

3. NDBI

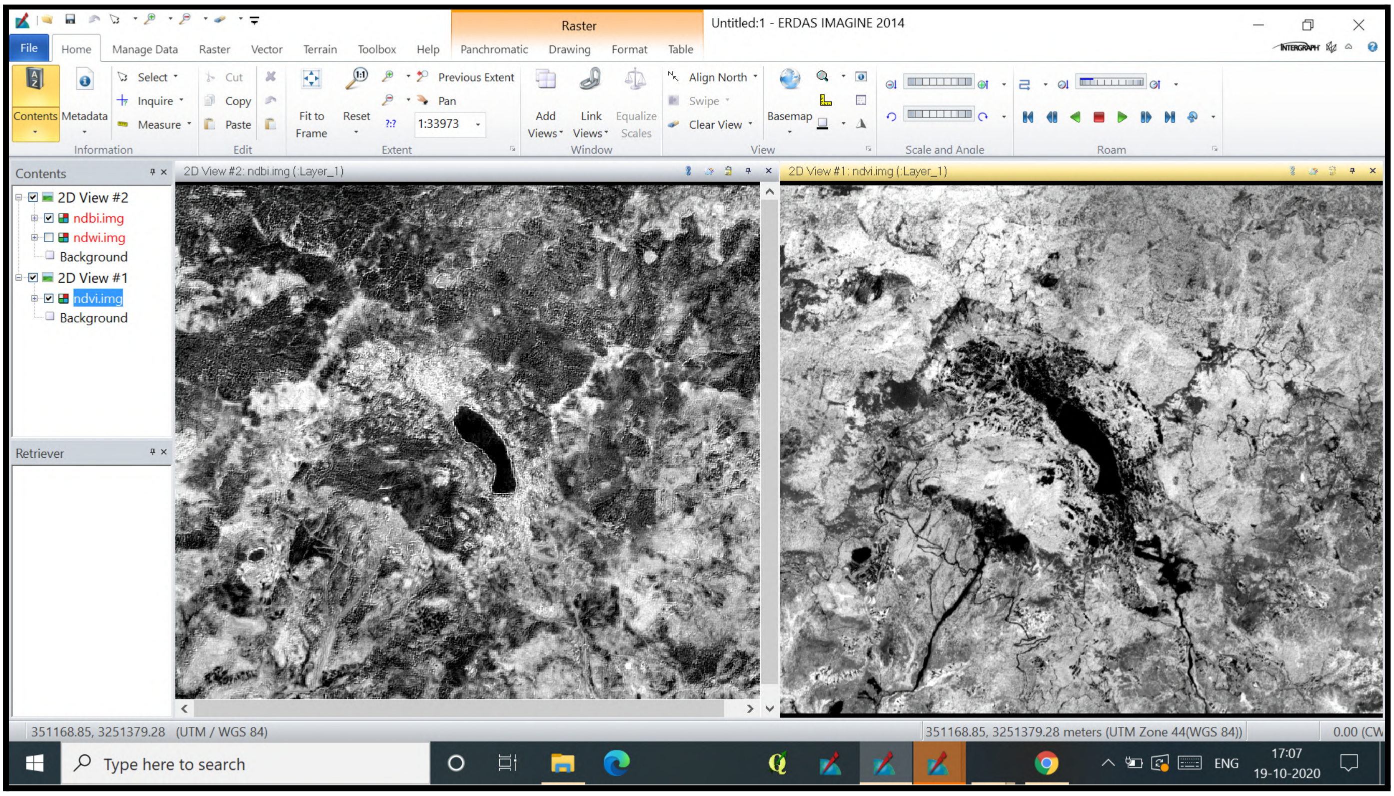
Step-1 Choose **NDBI** in Index and in band selection, check that **SWIR** (first) and **NIR** (second) bands are selected. Give output file name and click **OK.**



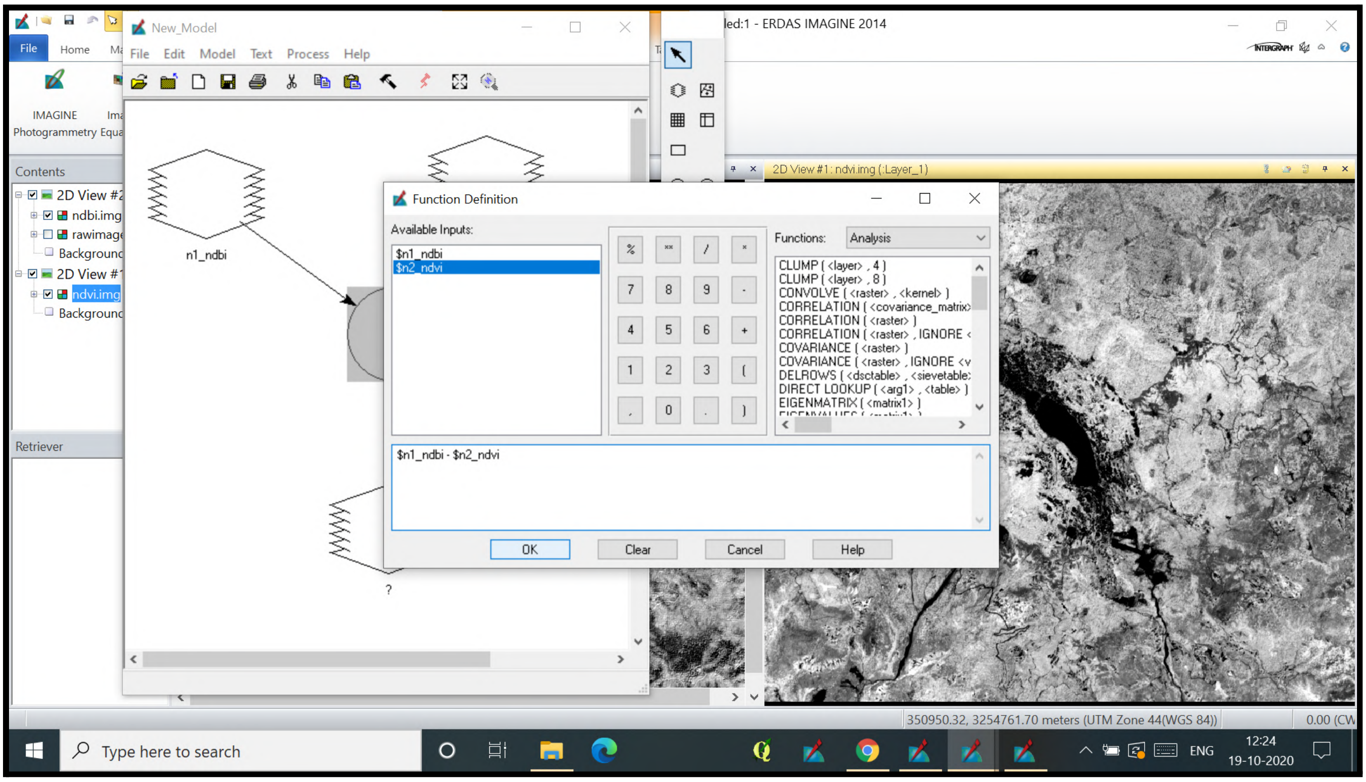
Step-3 Open the **NDBI** created.



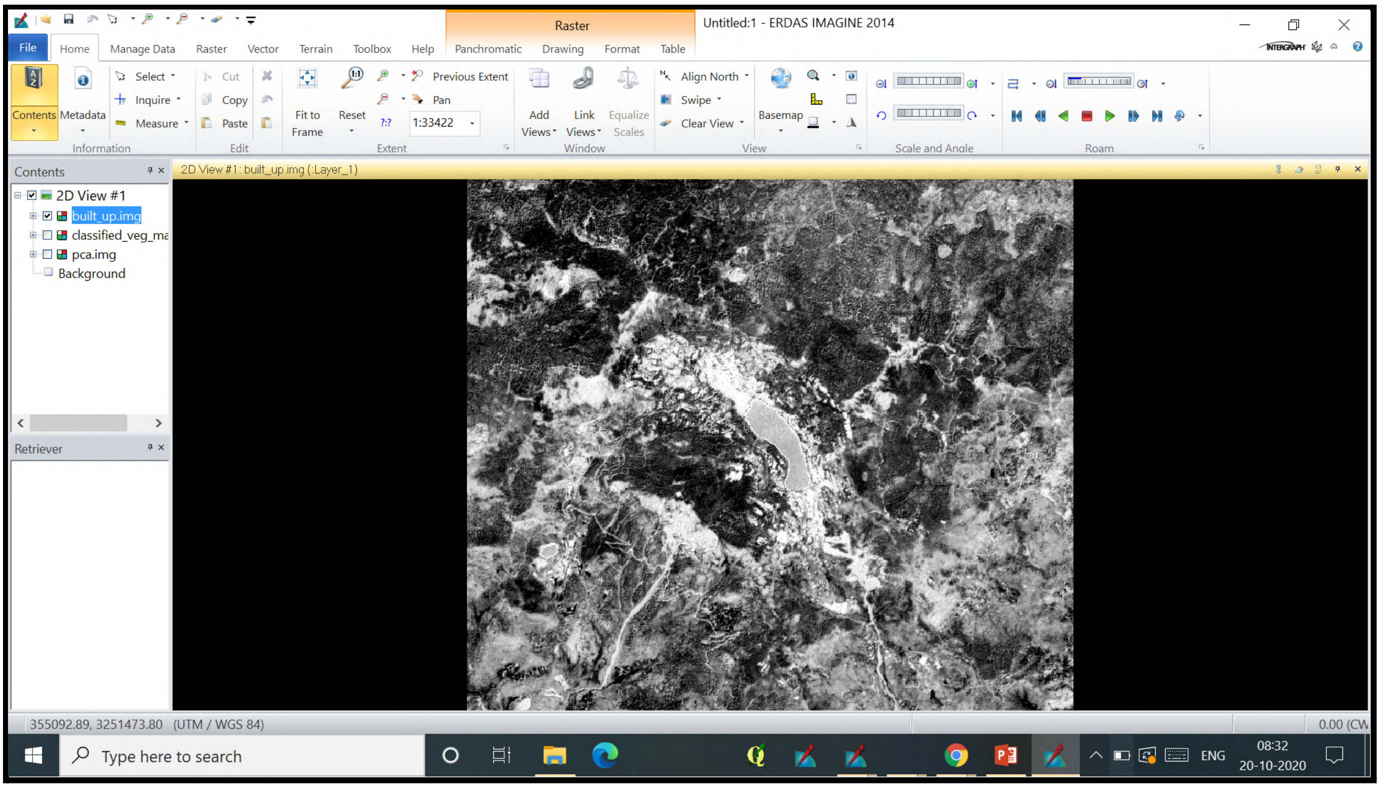
Step-4 Open NDVI and NDBI.



Step-5 Using the **model maker, subtract NDBI from NDVI** and give output file name: new build up. And change the data type to **float single.**

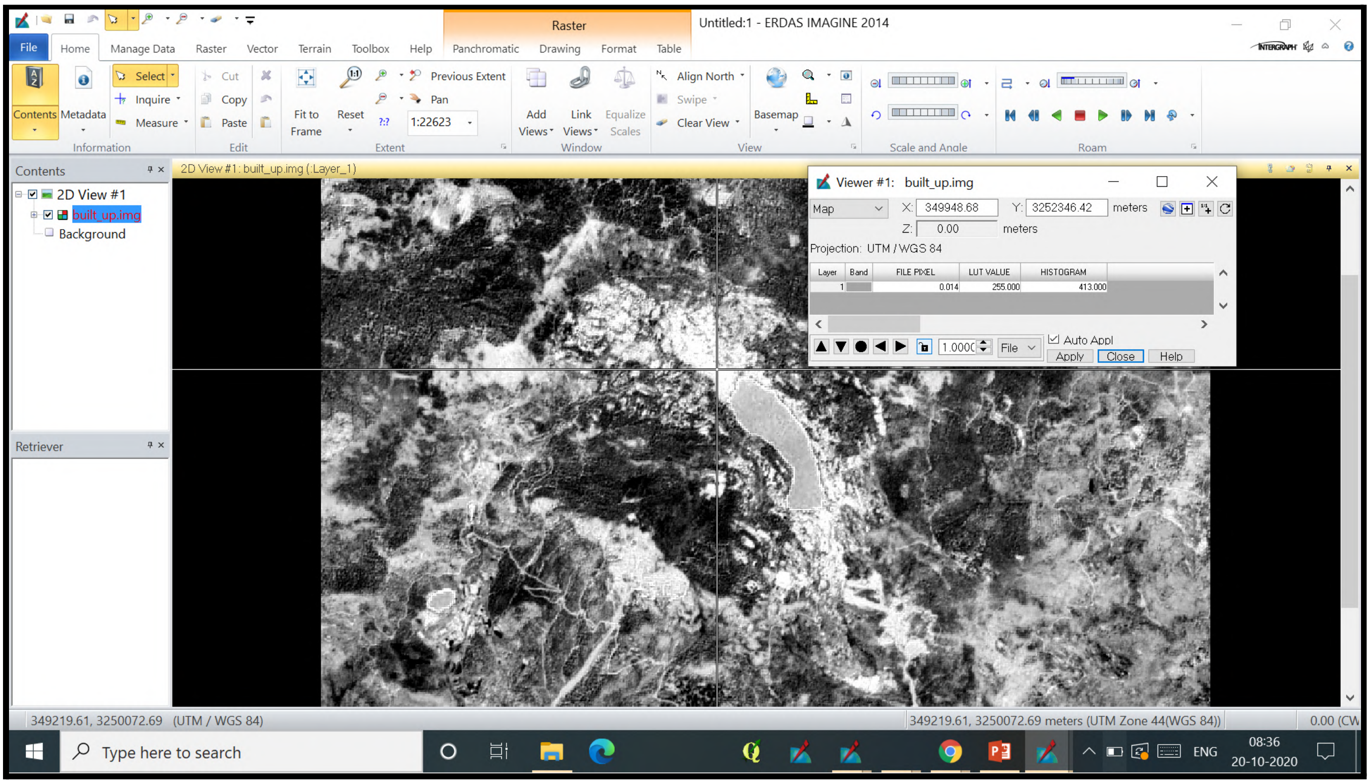


Step-6 Open the build area map generated (after subtracting the 2 indices)

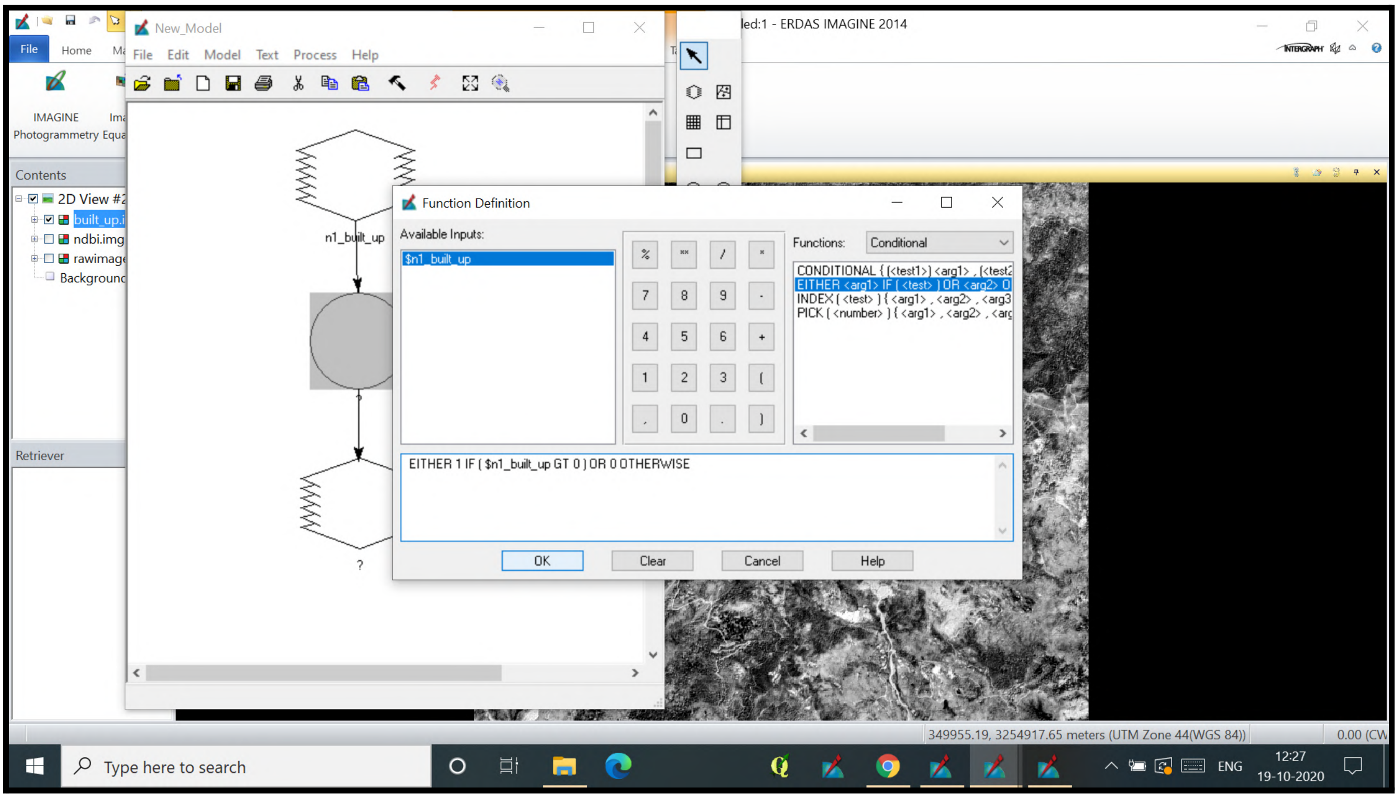


Step-7 Find the **threshold** value of the built up area using the **inquire**

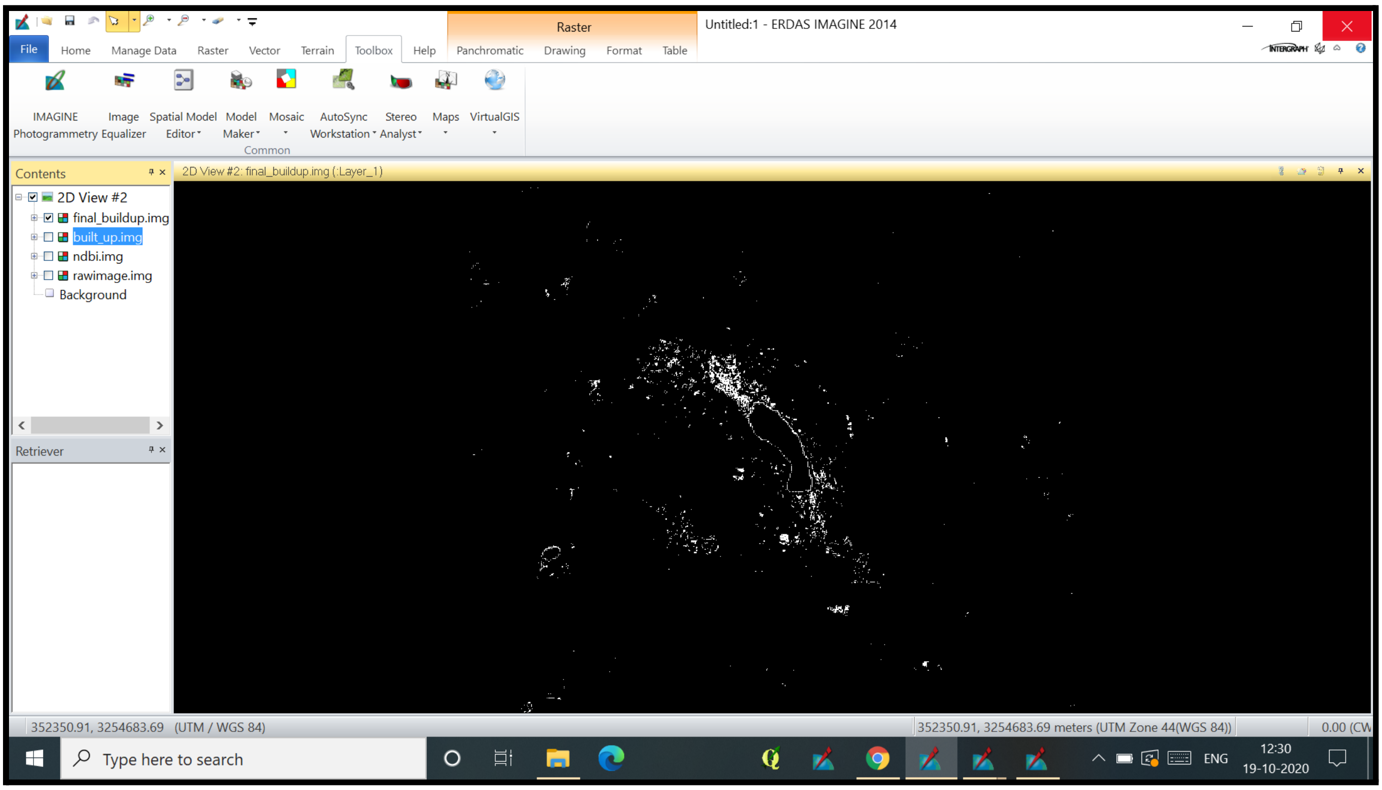
Here, threshold value of 0.



Step-8 Open the build area generated and **classify it** using a model maker. **I**n the input raster, choose the build area. In the functions, choose **Conditional:Either (if its built up area, return 1 otherwise 0. Threshold value is >0 for build up area)**



Step-7 Open the **Classified Build up area map.**



Here, the **build up area** is clearly visible in **bright white colour.** Thus, this index is very useful to clearly visualize the build up in any image and will be useful in **interpreting** the image.