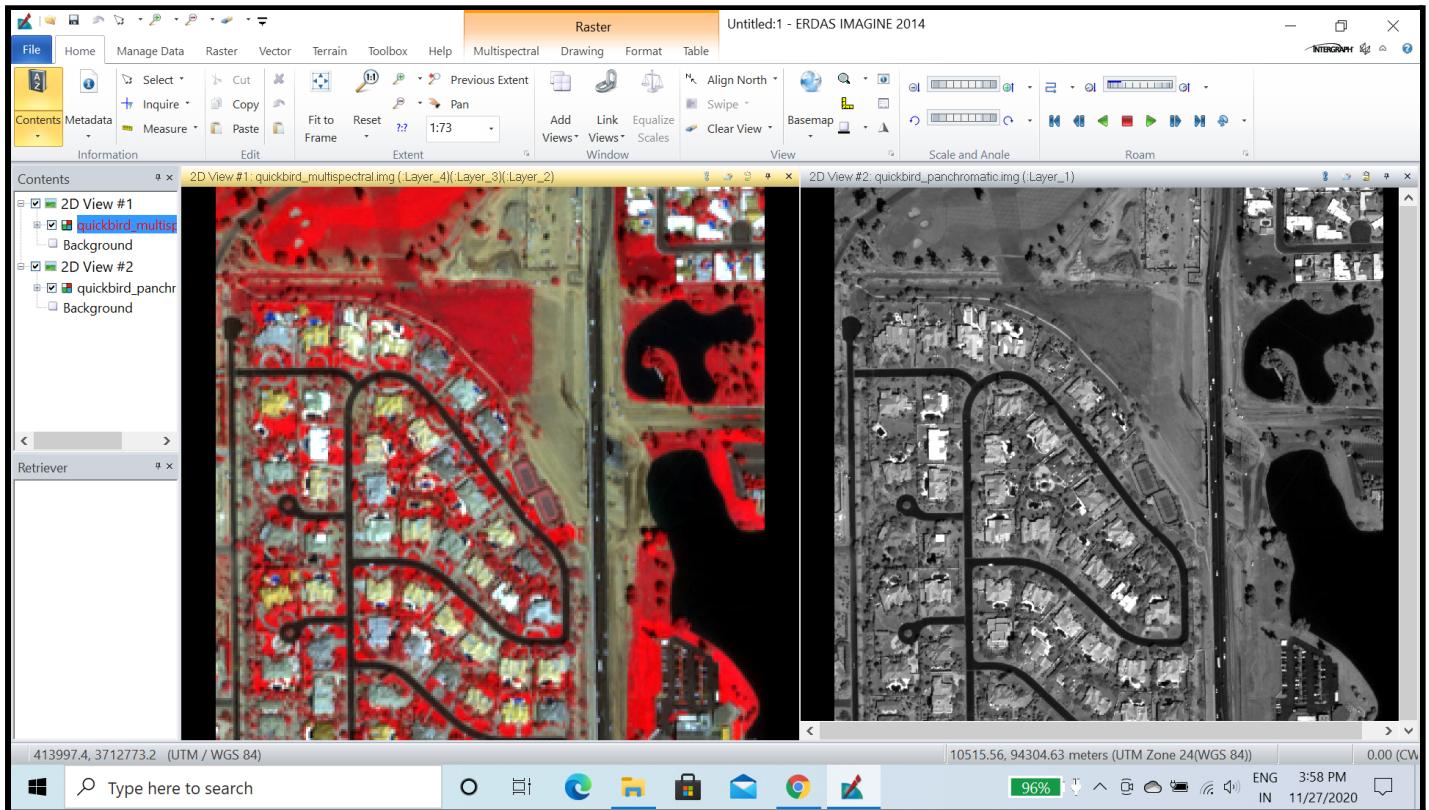


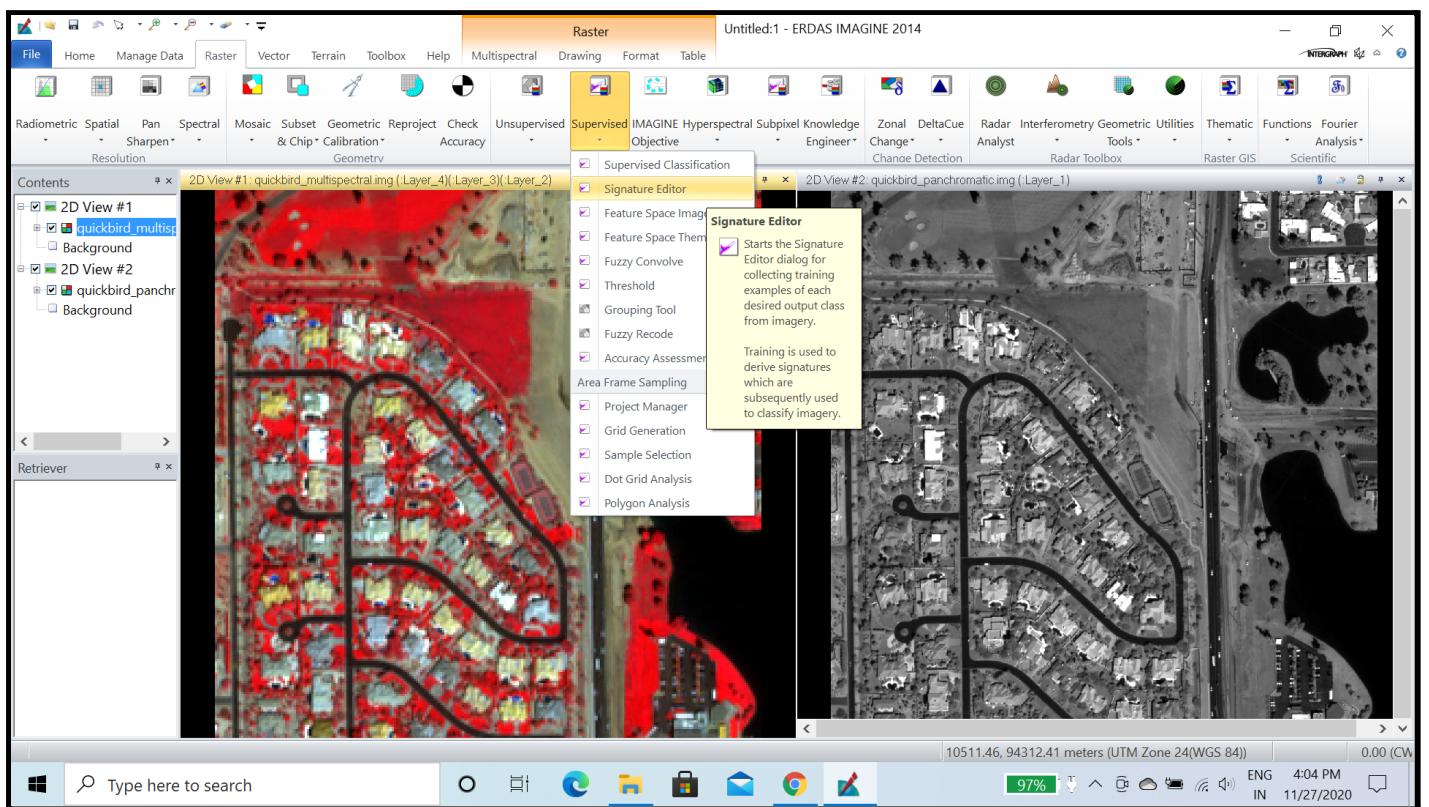
PART-1

SUPERVISED CLASSIFICATION

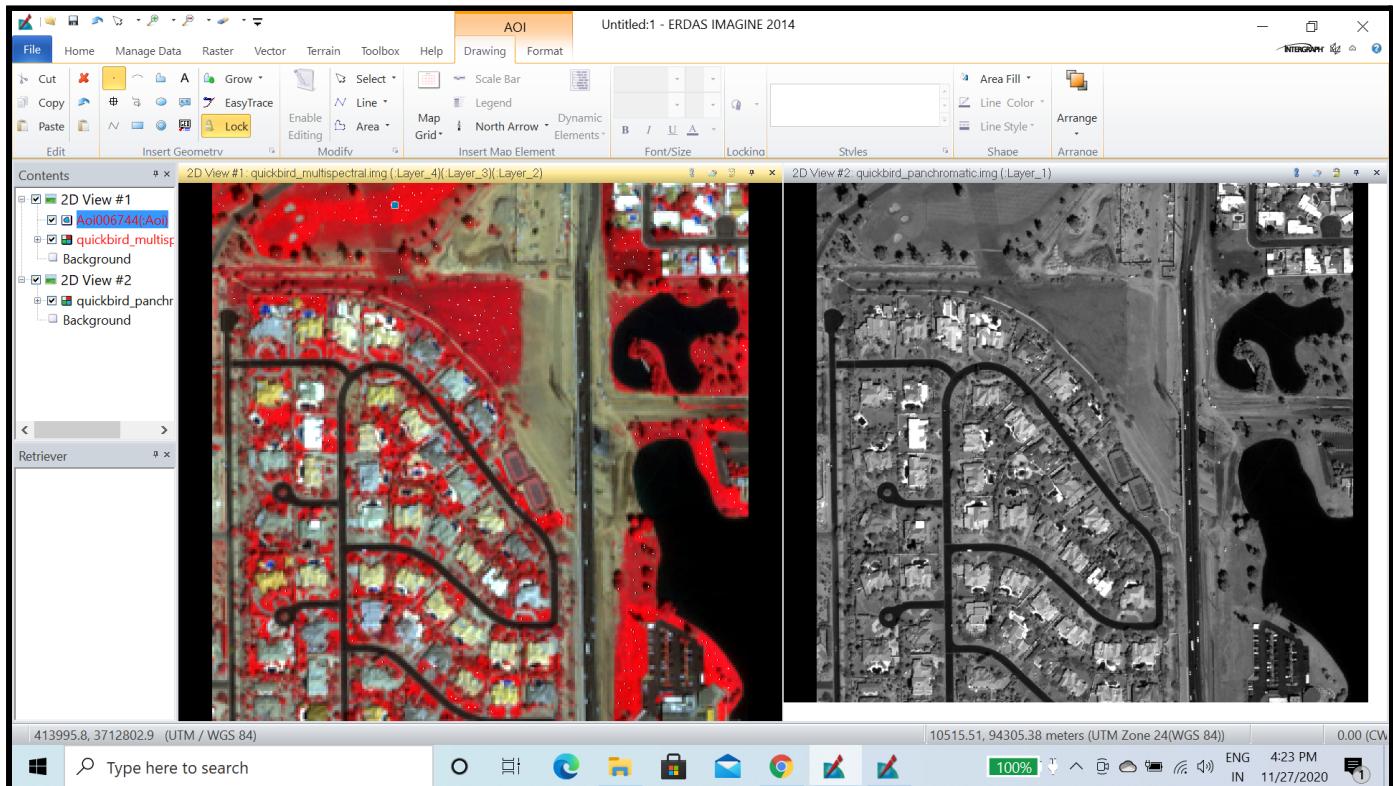
Step-1 Open both multispectral and panchromatic image (used as reference data: better resolution, clearer features)



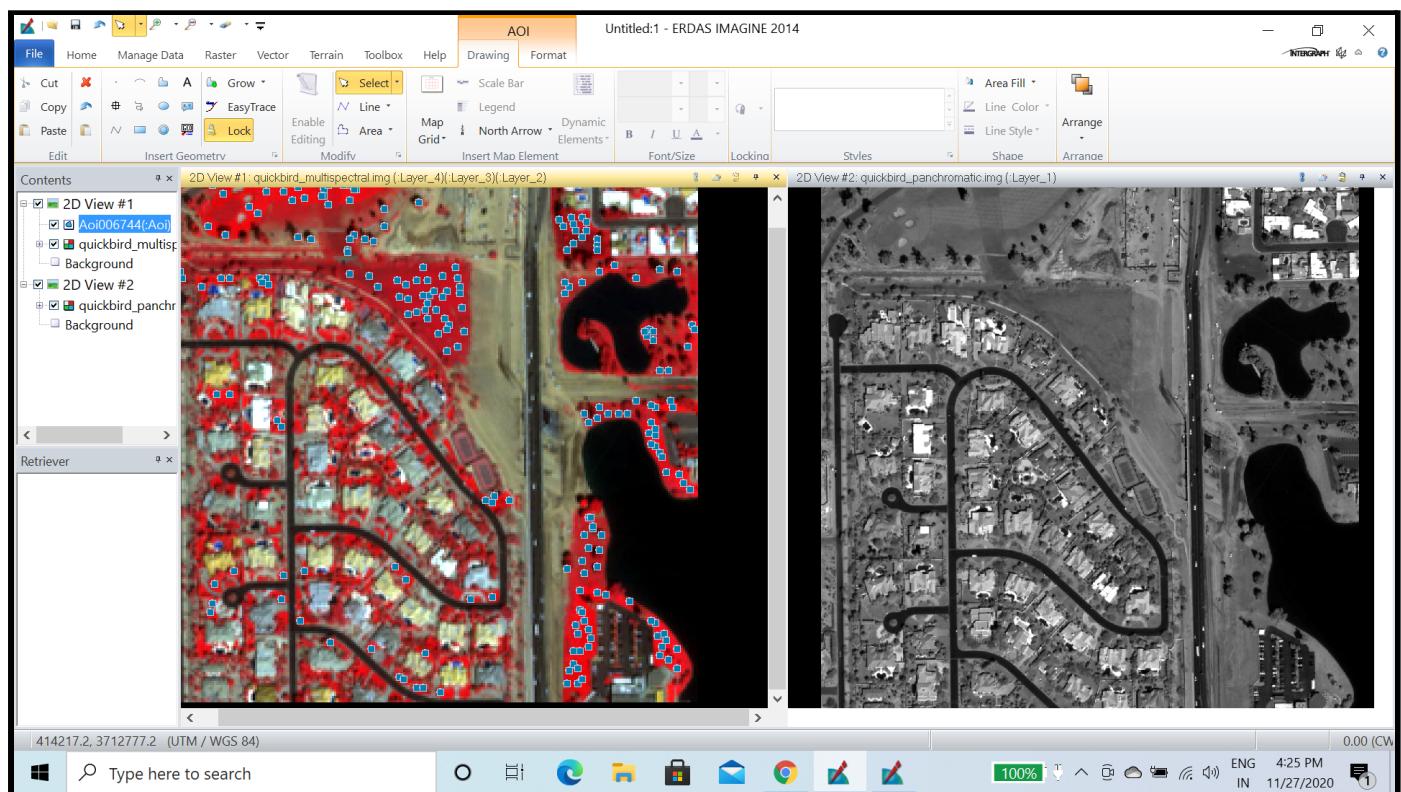
Step-2 Go to Raster > Supervised > Signature Editor



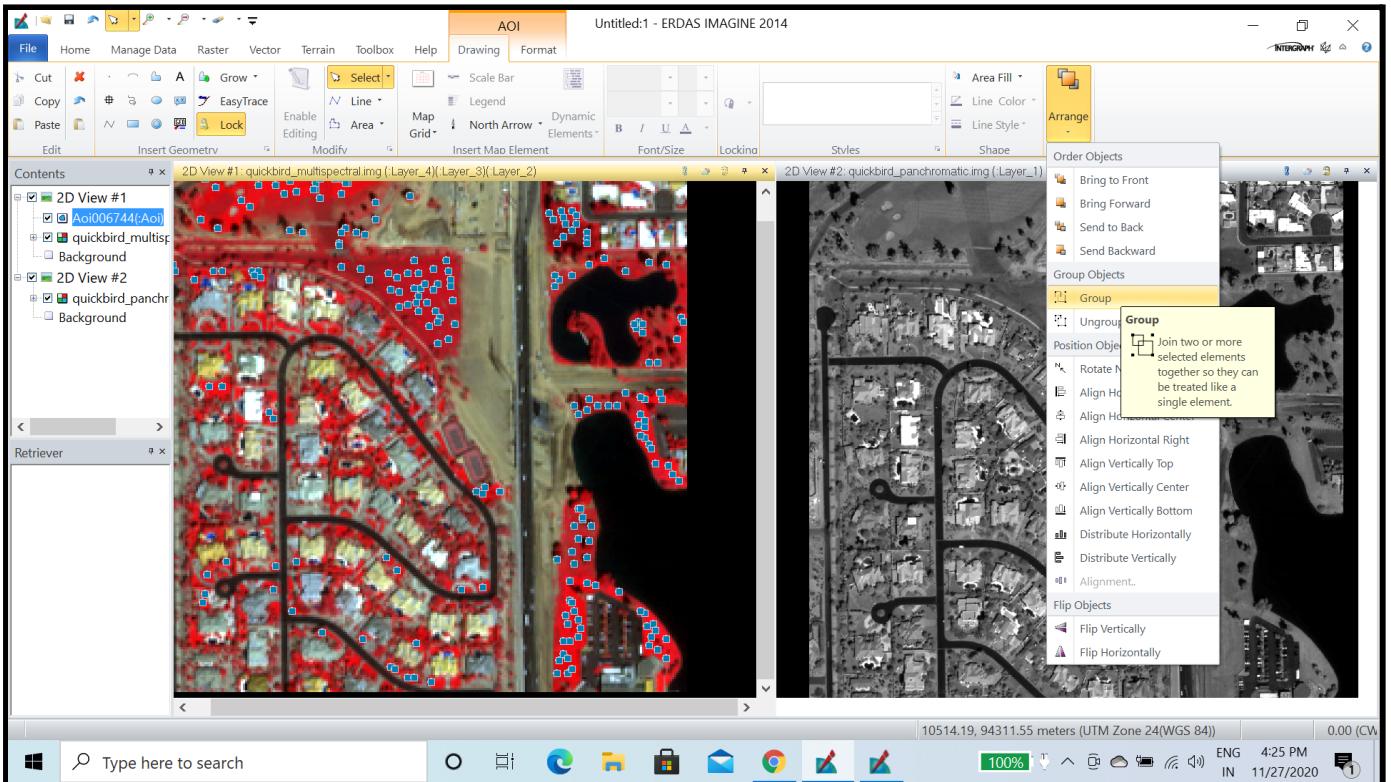
Step-3 Minimize signature editor tab and go to **Drawing > Select Point > Lock**. Collect pure samples.



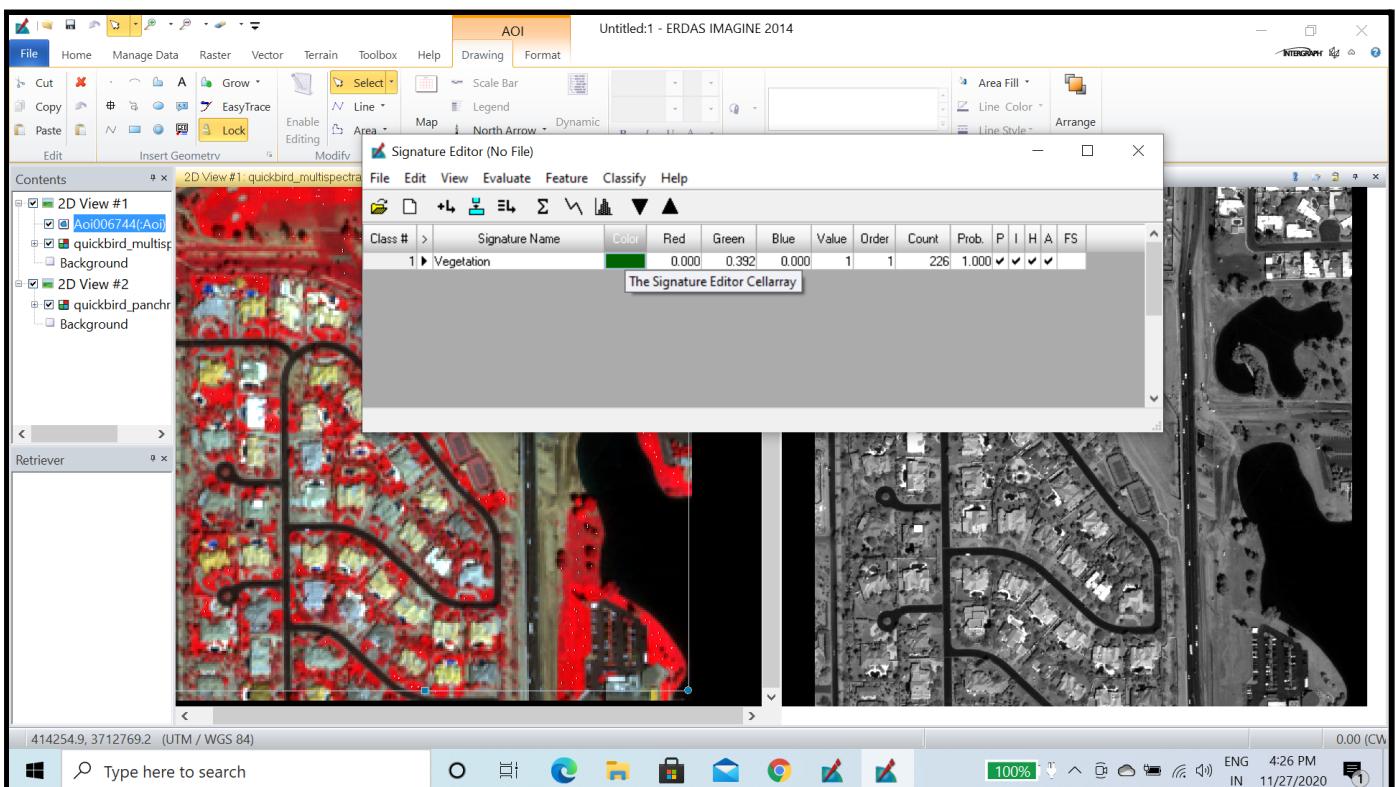
Step-4 Go to **Select > Select by box**.



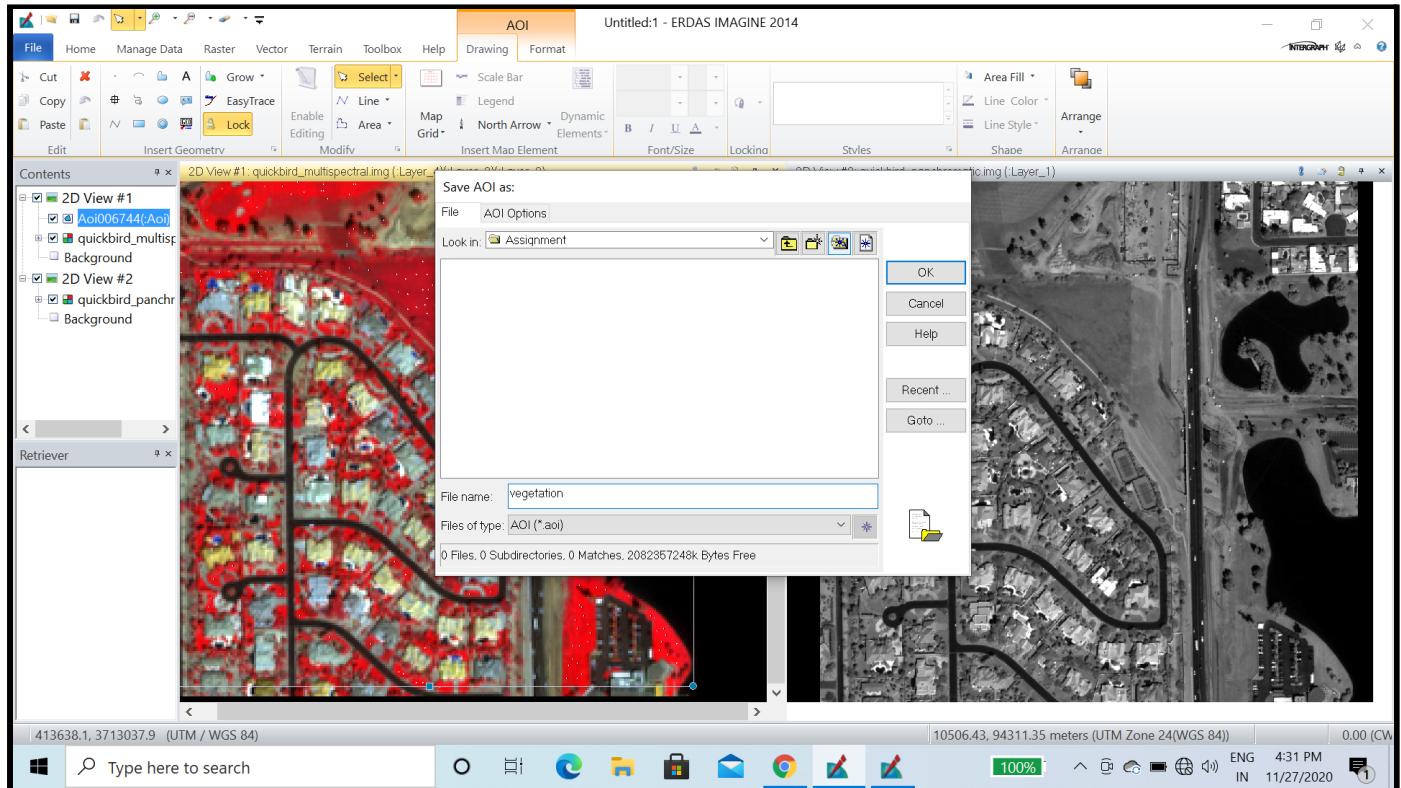
Step-5 Go to Arrange > Group



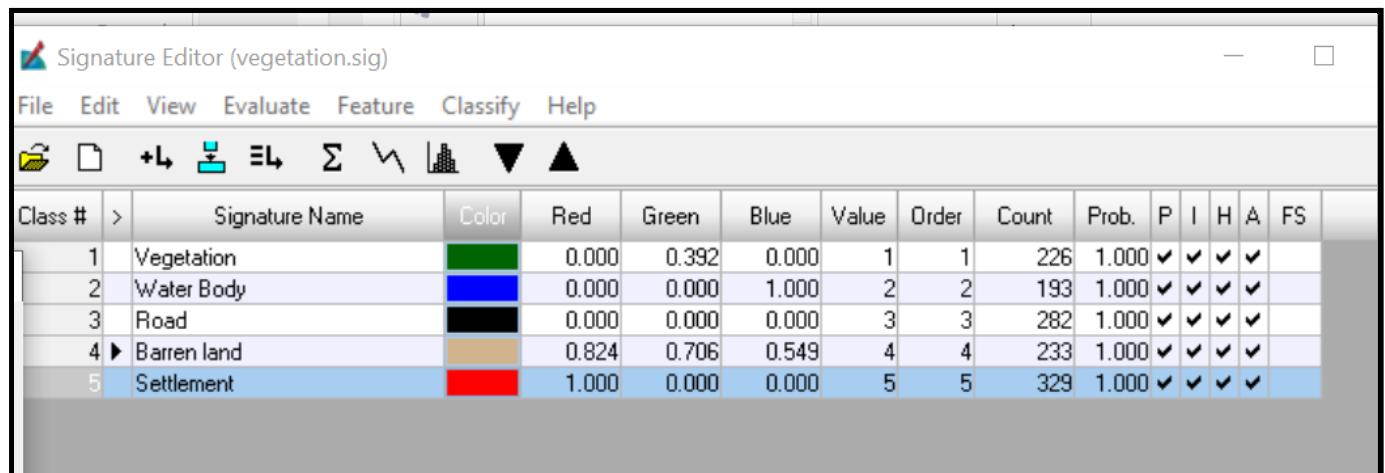
Step-6 Open signature editor tab. Go to **create a new signature from AOI**. Give signature name and colour accordingly.



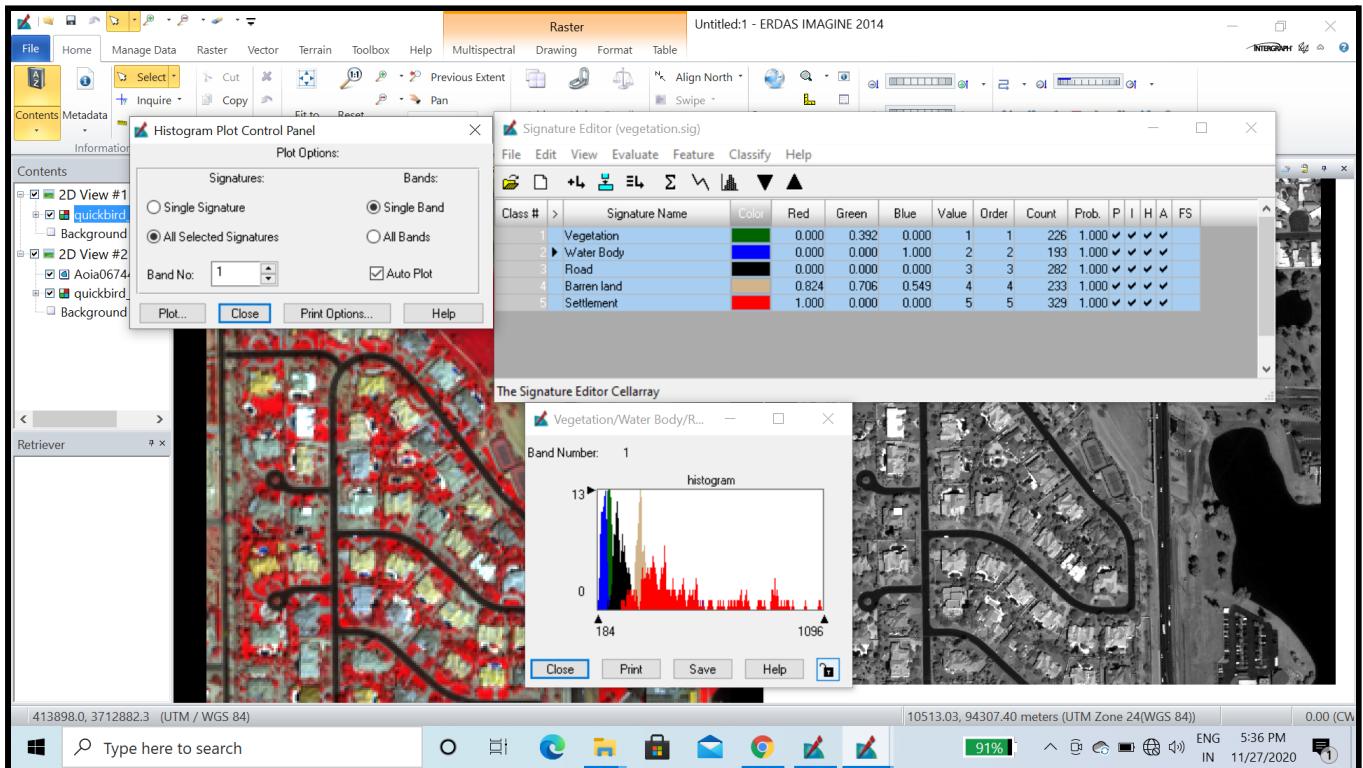
Step-7 Save the AOI Layer. Right click on the layer. **File > Save as > AOI Layer**. And then remove the AOI layer.



Step-8 Continue the same process for the rest of the features.

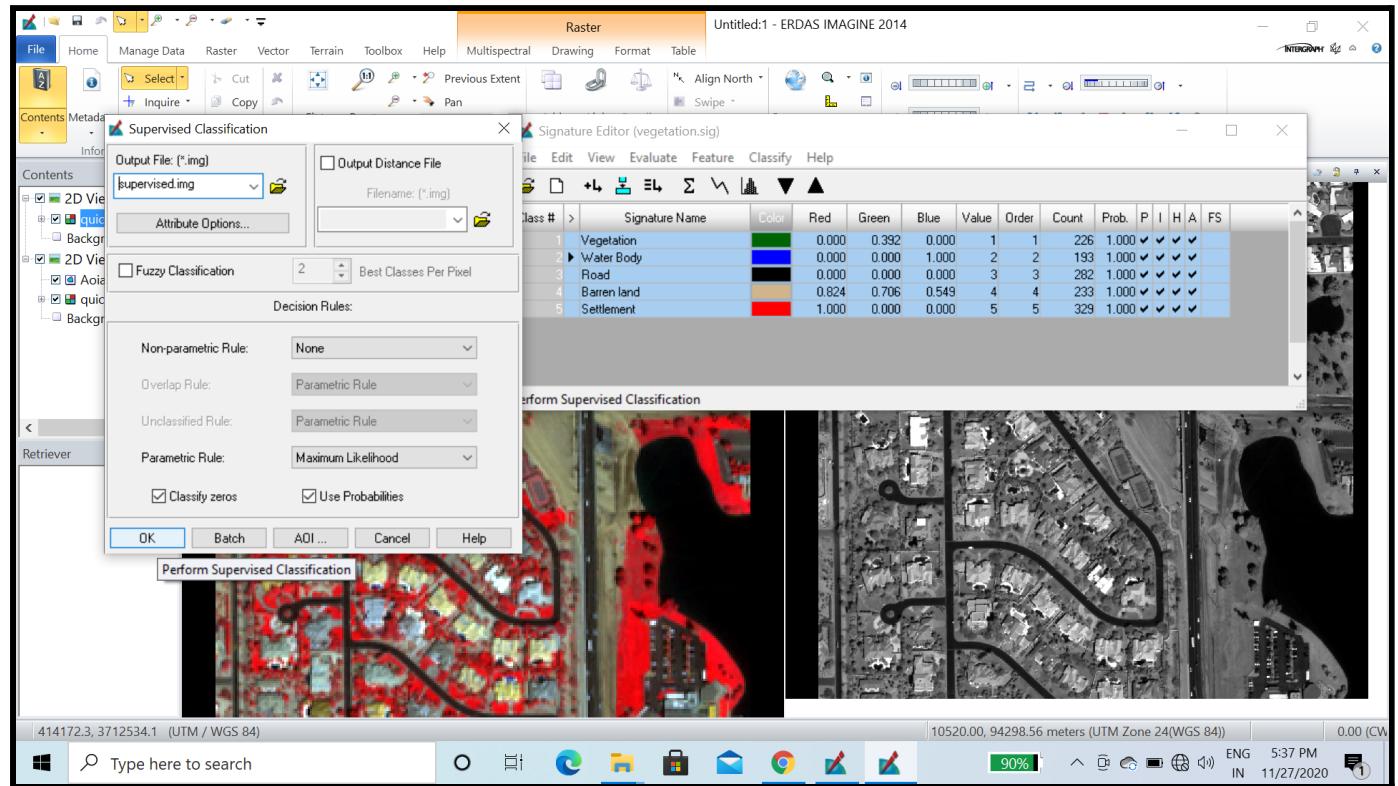


Step-9 Go to **View > Histogram**. Signatures: **All selected signatures**; Band: **Single band**; **Enable Auto Plot** and then click on plot.

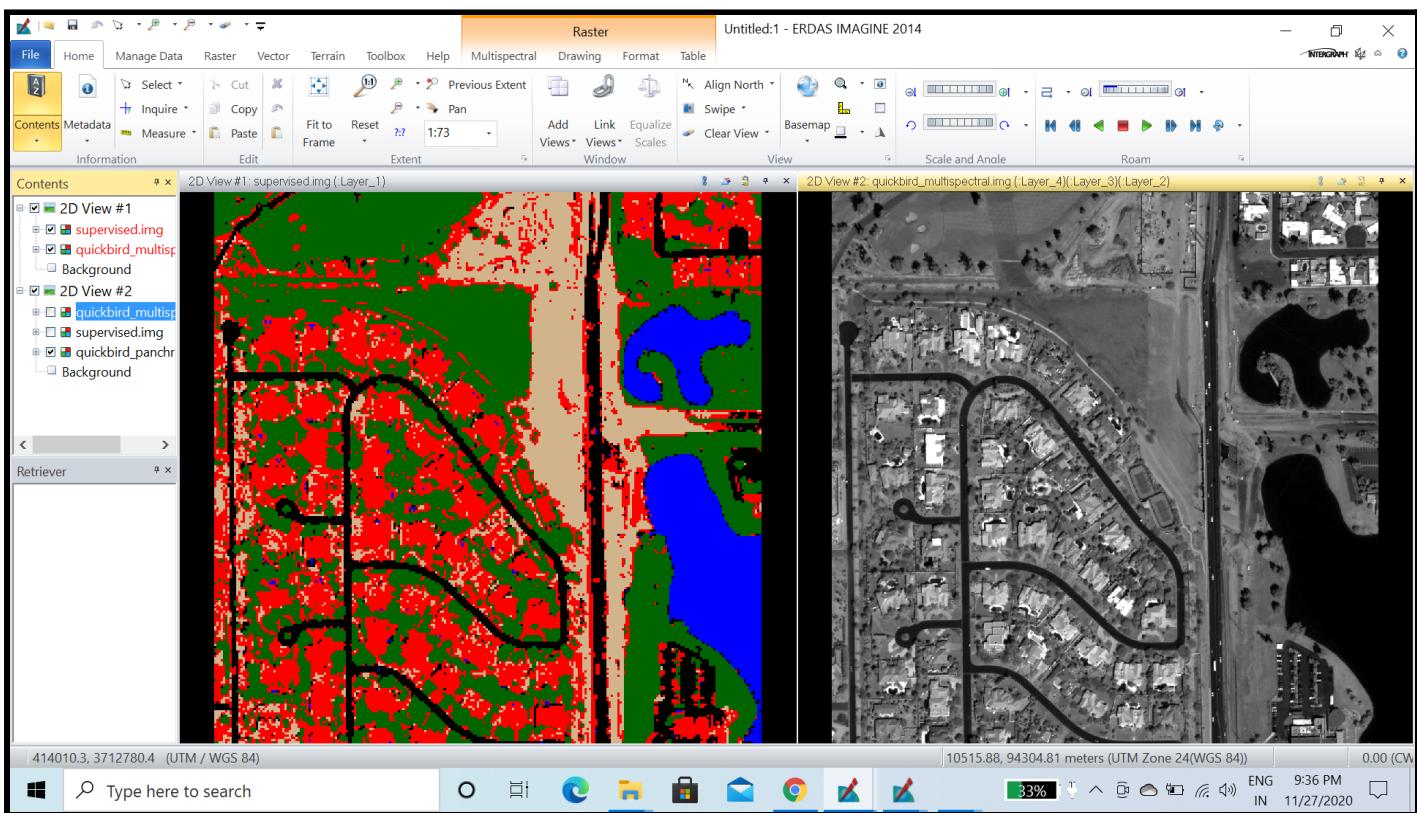


From the histogram, in band no. 1 there is **mixing of forest and road** and similarly, there is **mixing between settlement and barren land**. Thus, histograms of different bands can be seen and it's a visual idea and accordingly the sample set can be modified to better and accurate results.

Step-10 Go to **Classify > Supervised**. Give the output file name. Parametric: **Maximum likelihood**, Enable **classify zeroes** and **use probabilities**. And then click **OK**.

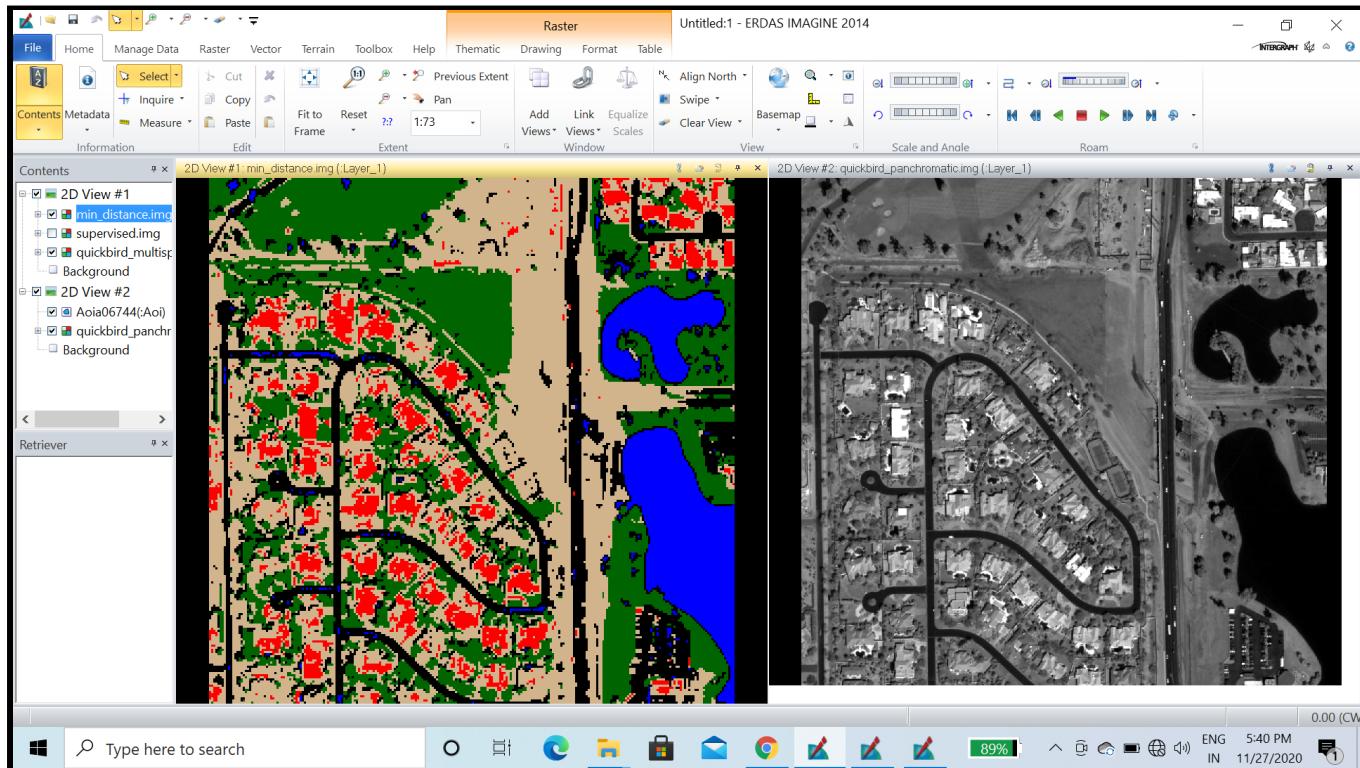


Output: Maximum likelihood



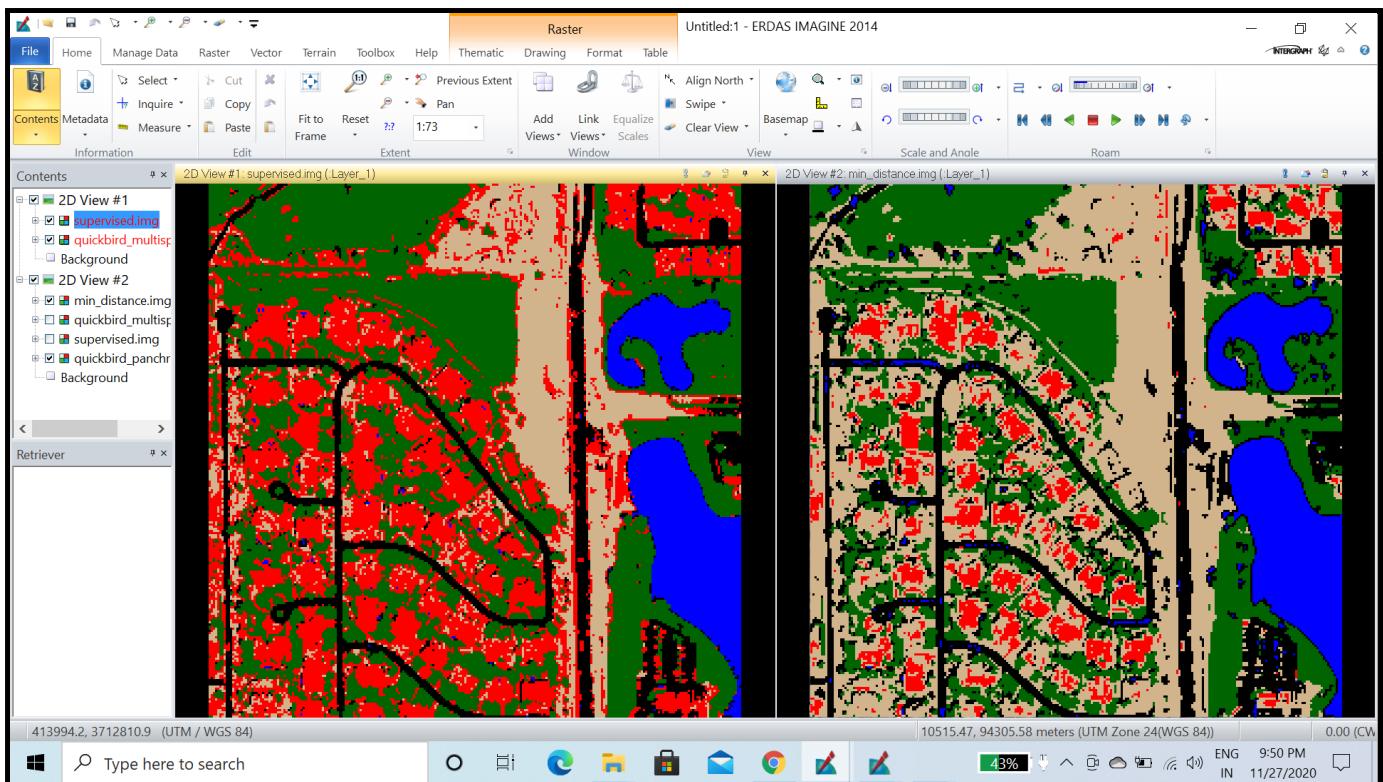
The result of maximum likelihood is accurate. Vegetation, water body, and barren land has been classified very accurately. However, there are some problems in classification of roads and settlements. But overall, the **results are quite good and accurate.**

Output: Minimum Distance



All the features have some problems in classification. The results are **not very good and need improvements** (change sample set). Water is over classified (Less variance), settlement not properly classified.

Visual Comparison between Maximum Likelihood and Min Distance

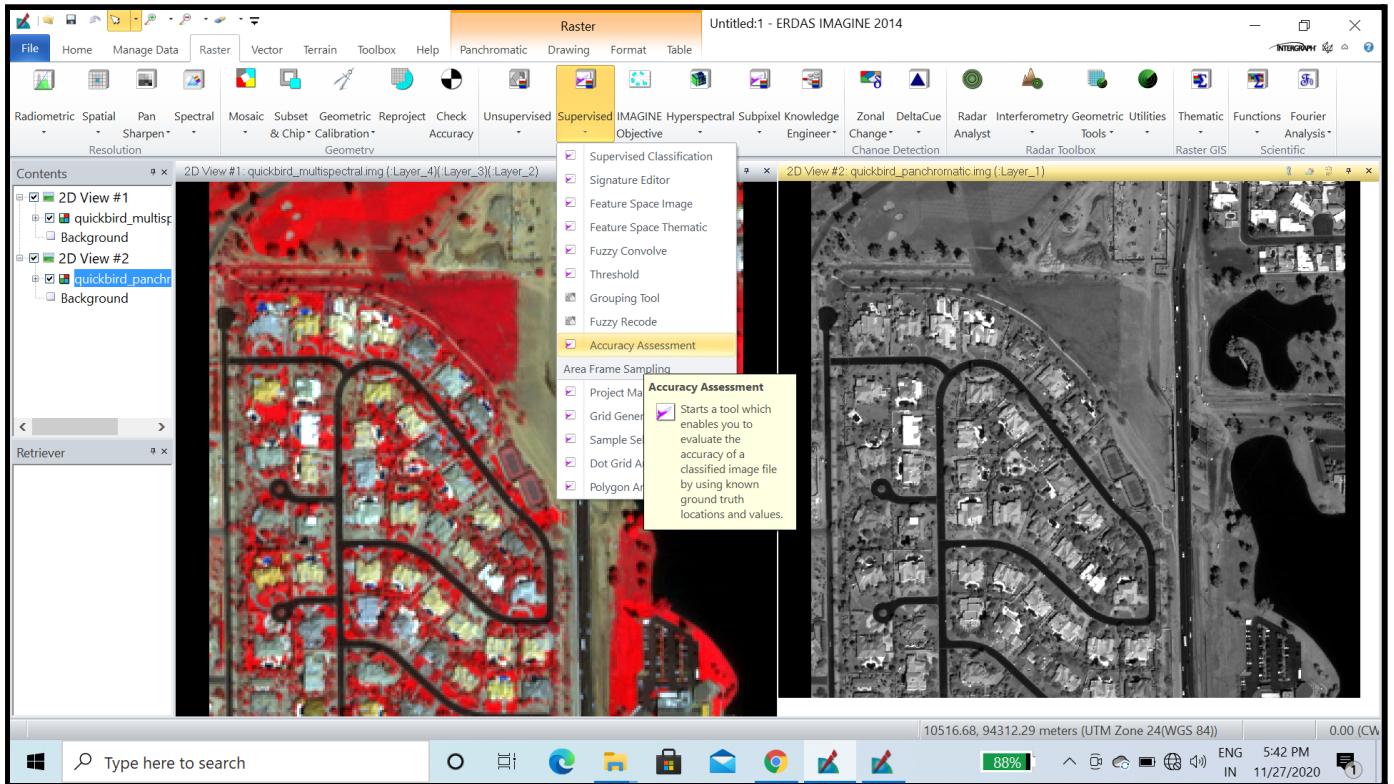


The results of maximum likelihood are better and accurate than the minimum distance method. In maximum likelihood, class variance is taken care of where in minimum distance, class variability is not considered. Minimum distance is not suitable for urban areas as seen in the results above. In minimum distance, settlement is not classified properly. Inversely, a class with less variance, like water, may tend to over classify.

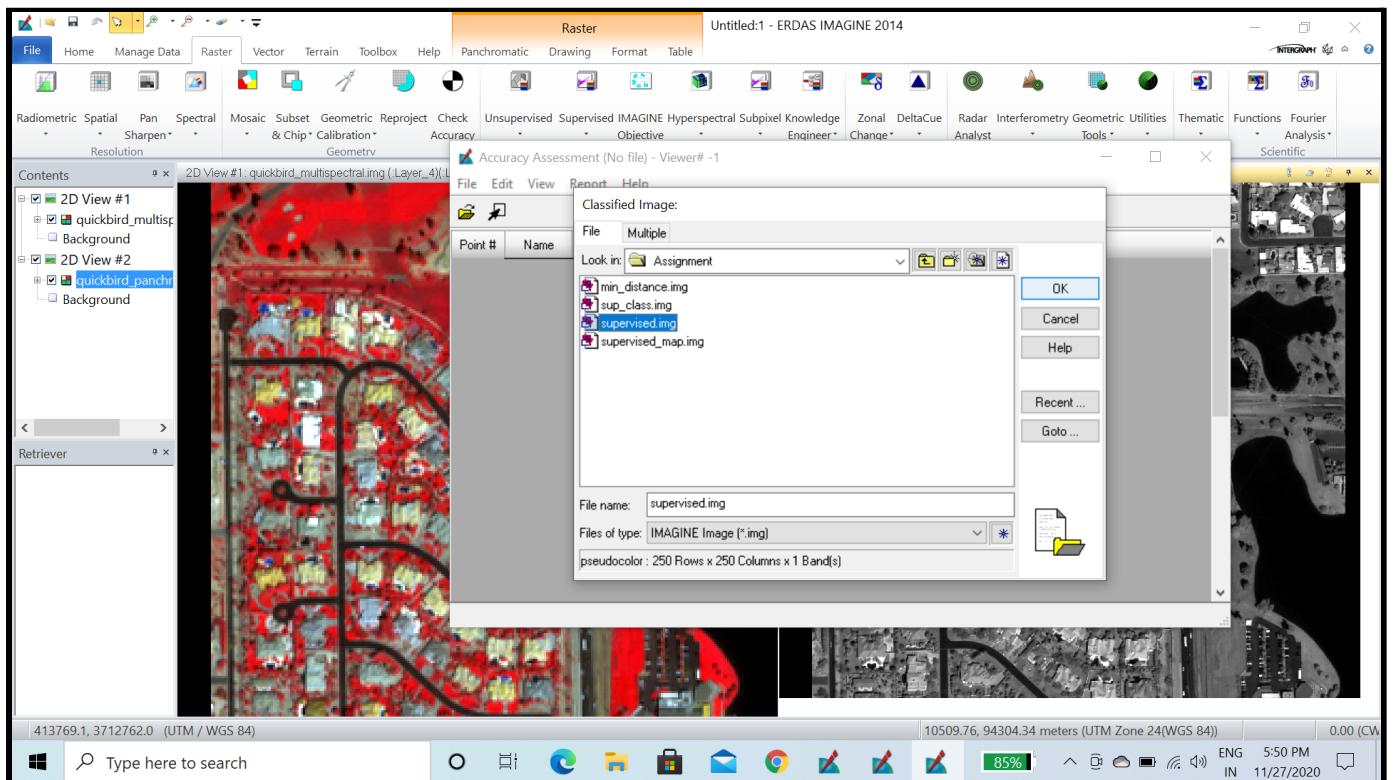
Part-2

ACCURACY ASSESSMENT

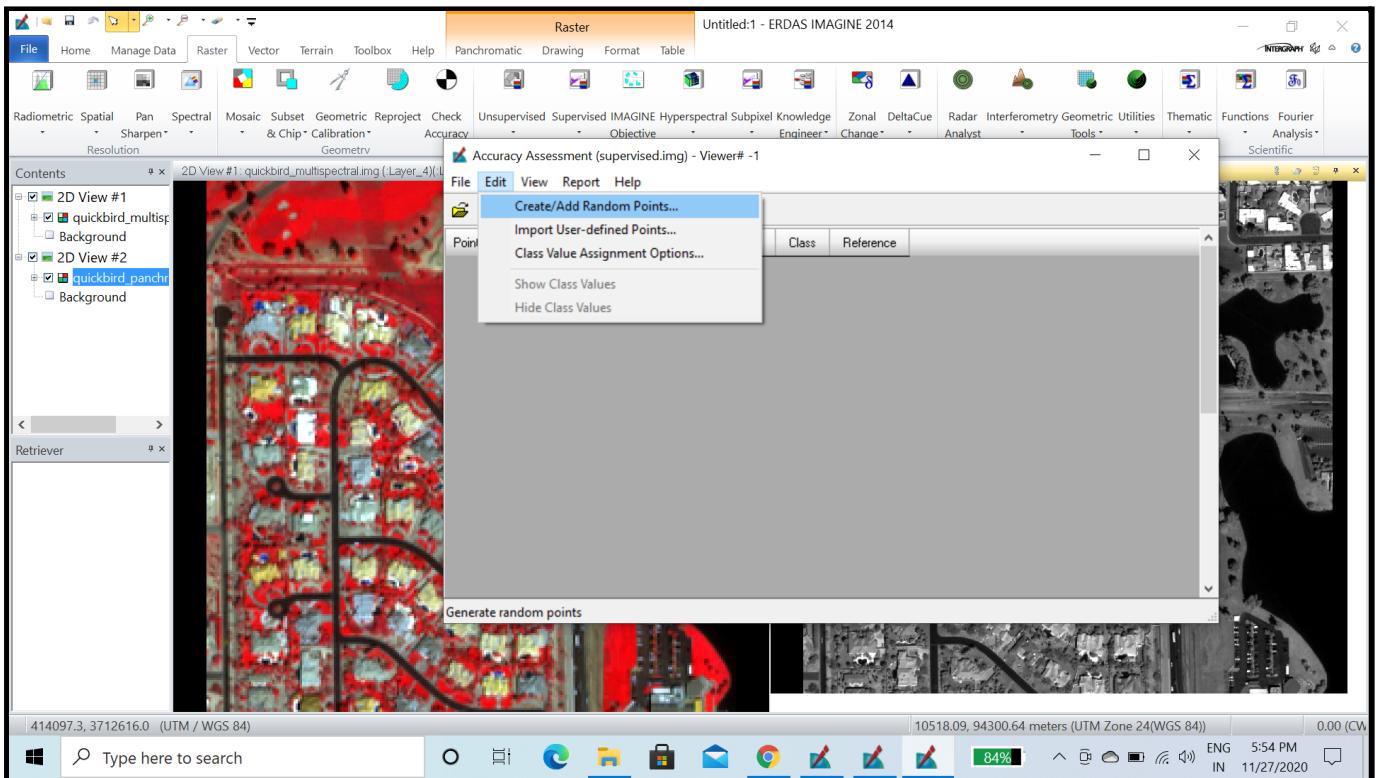
Step-1 Go to **Raster > Supervised > Accuracy Assessment**.



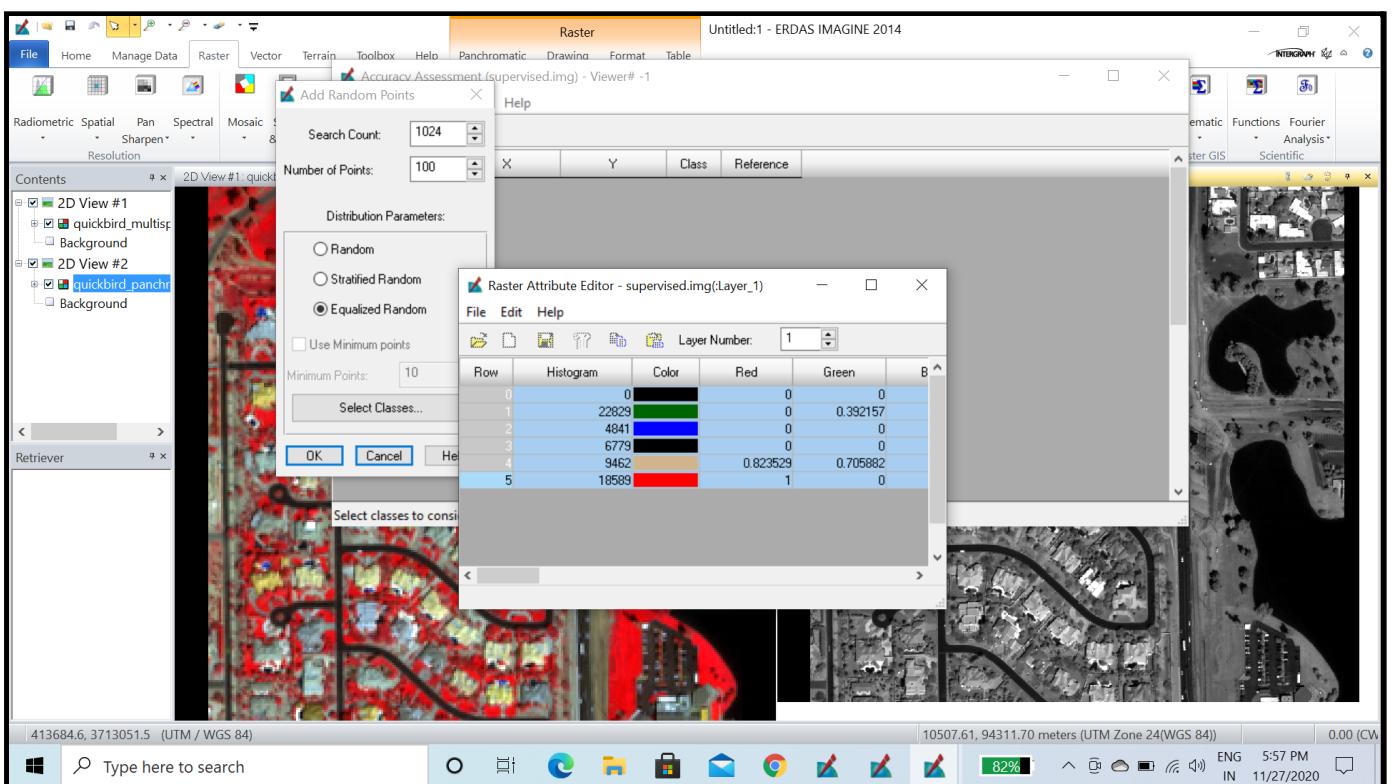
Step-2 Accuracy Assessment tab will appear. Browse the **classified map(maximum likelihood)**. Go to **File > Open**.



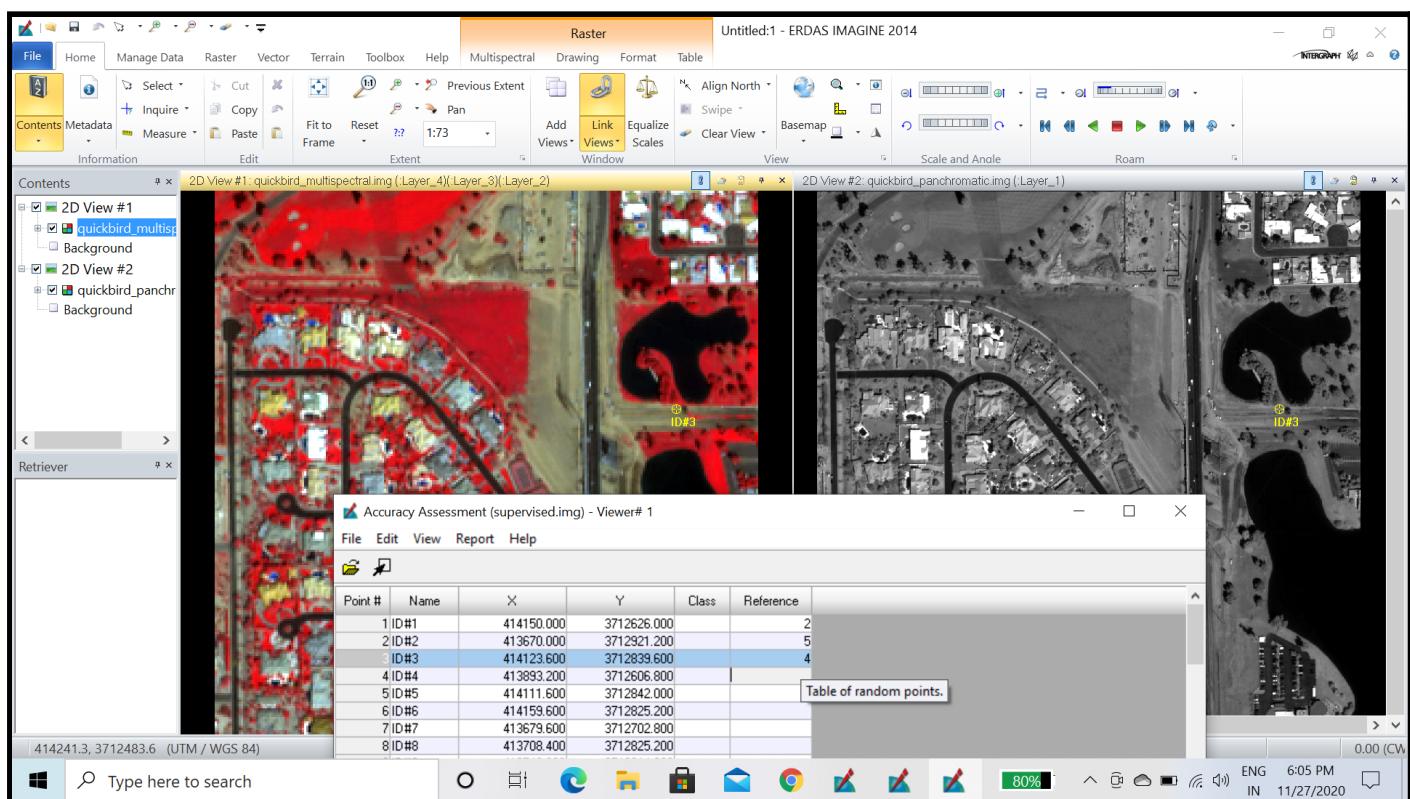
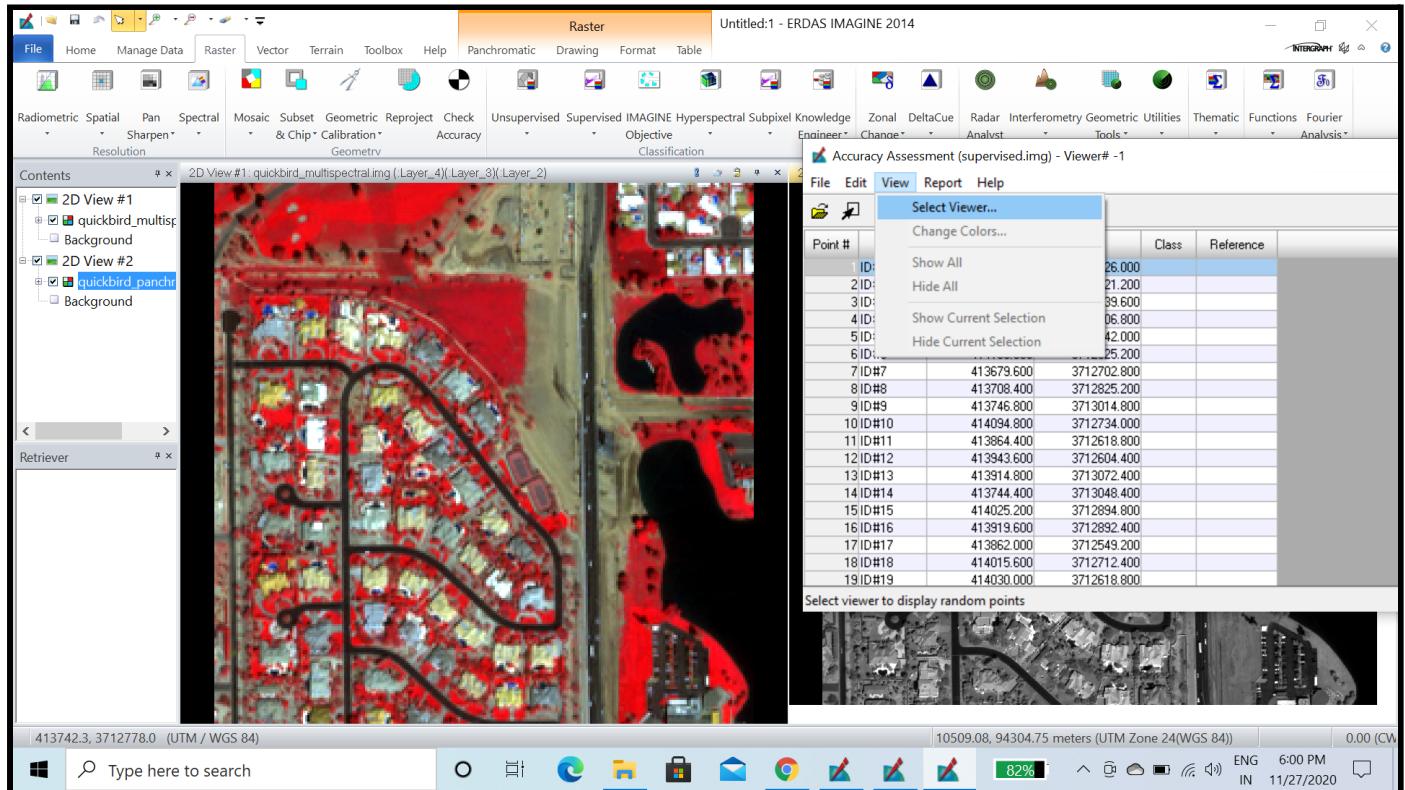
Step-3 After loading the classified map. Go to Edit > Create/ Add Random Points.



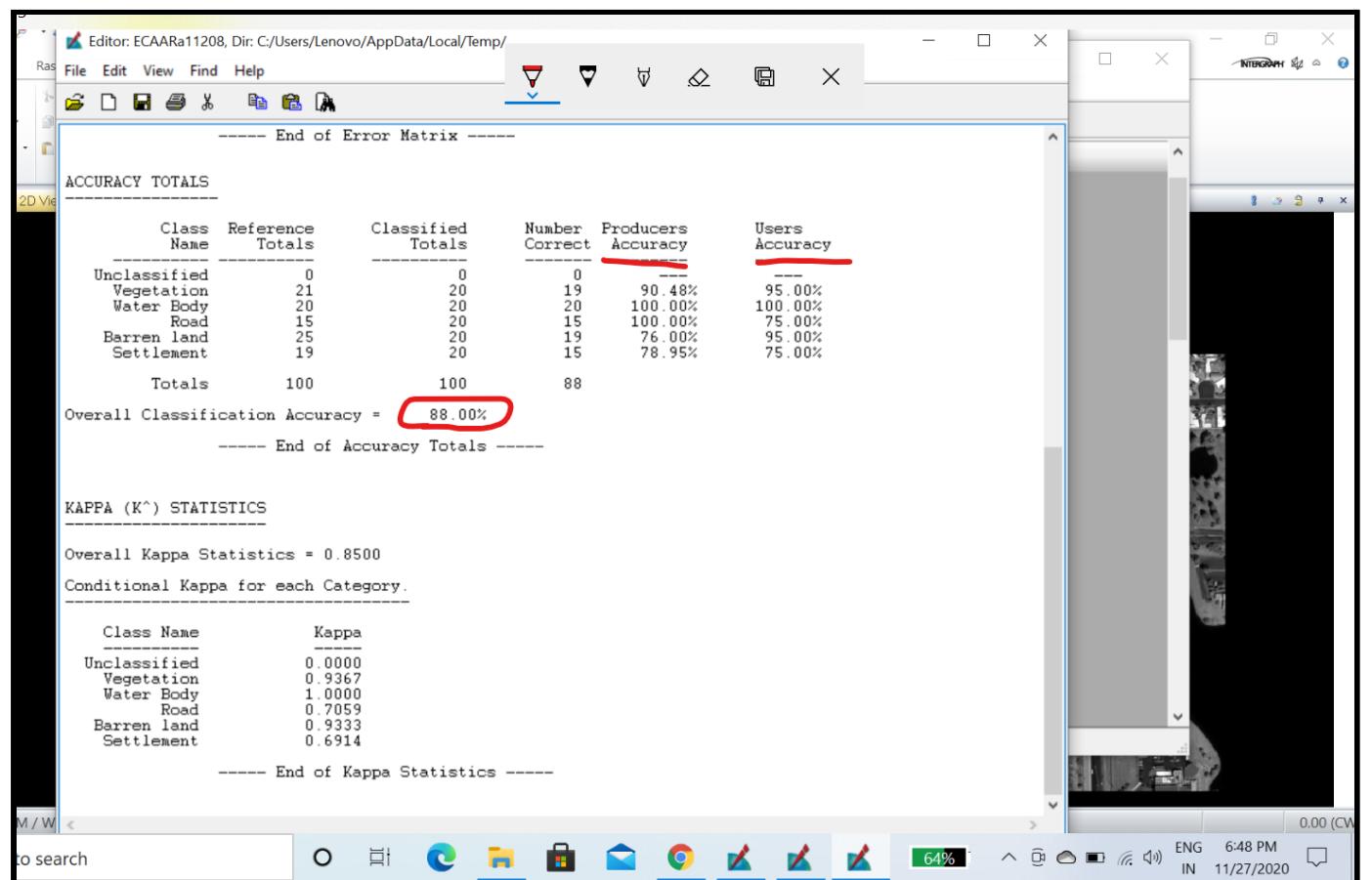
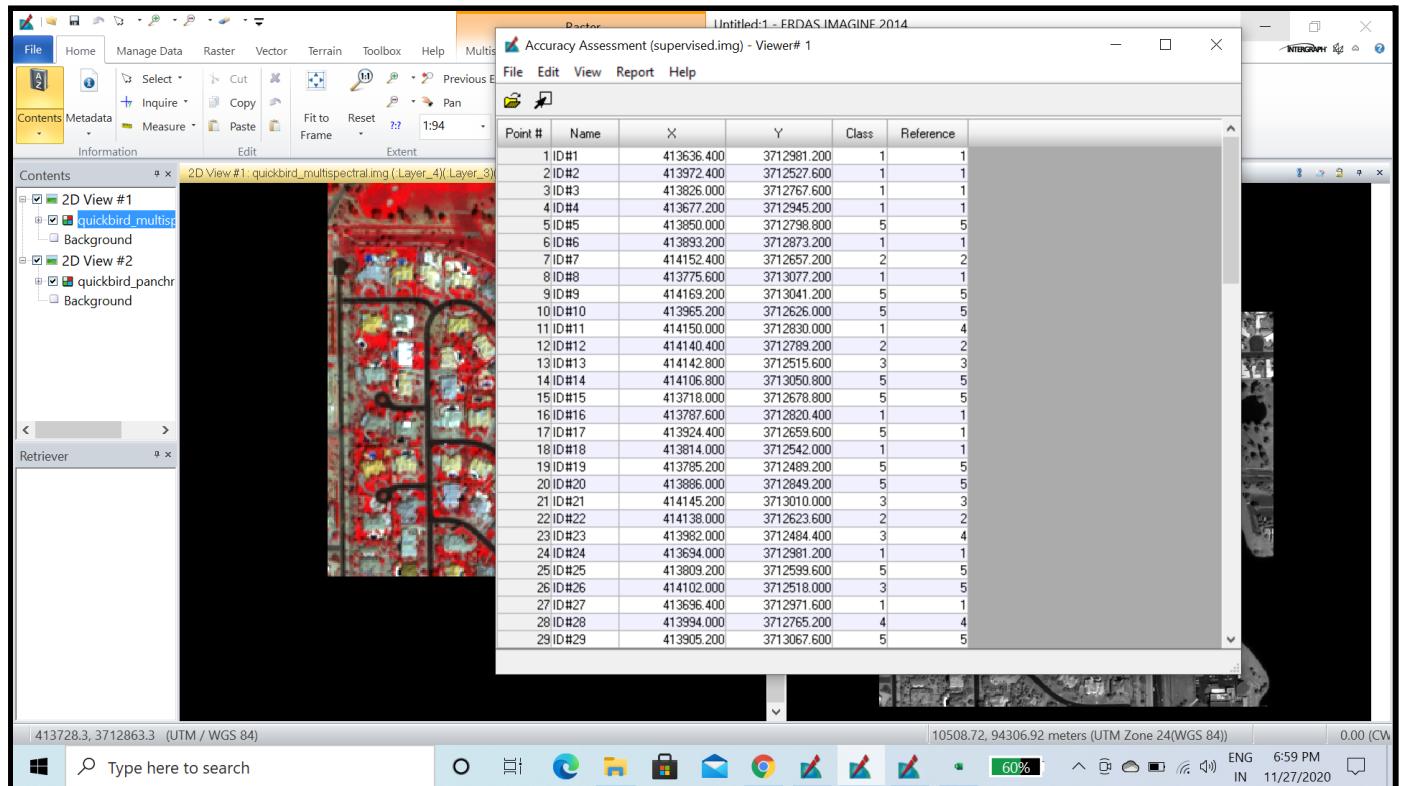
Step-4 In add random points tab, select the number of points(100), Distribution Parameter: **Equalized Random**, Select Classes: **All classes**, and then click **OK**.



Step-5 Accuracy Assessment Viewer tab will appear. To view the point, to go **View > Select Viewer**. Then again to go **View > Show current selection**. Give the Reference class to each point. (Note: Hide the class value to avoid biases and link the views to get a better idea. Here, 1=vegetation, 2=water body, 3=road, 4=barren land, 5=settlement)



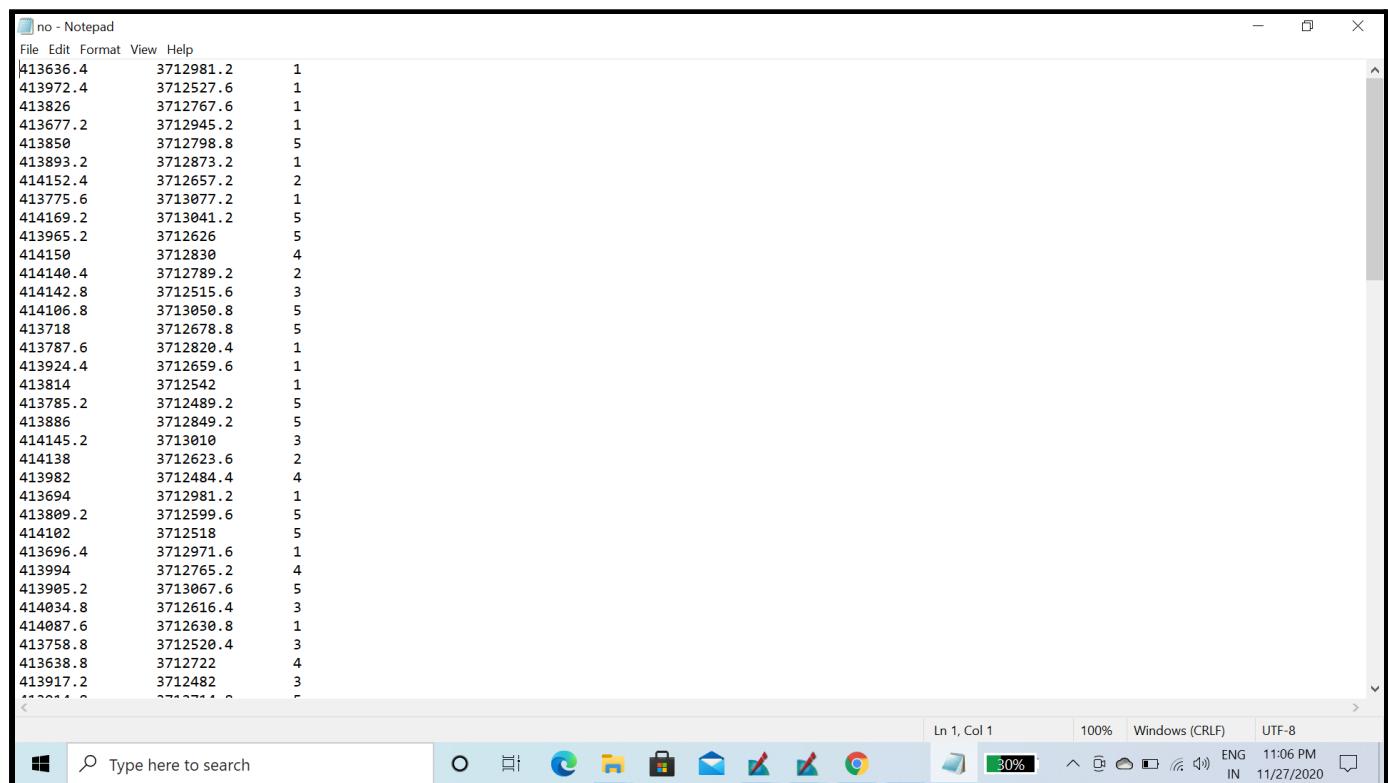
Step-6 After given reference value to 100 points. **Go to Edit > Show class values.** This will show the actual class values of the random points selected. Then Go to **Report > Accuracy report.**



ACCURACY ASSESSMENT: Minimum Distance

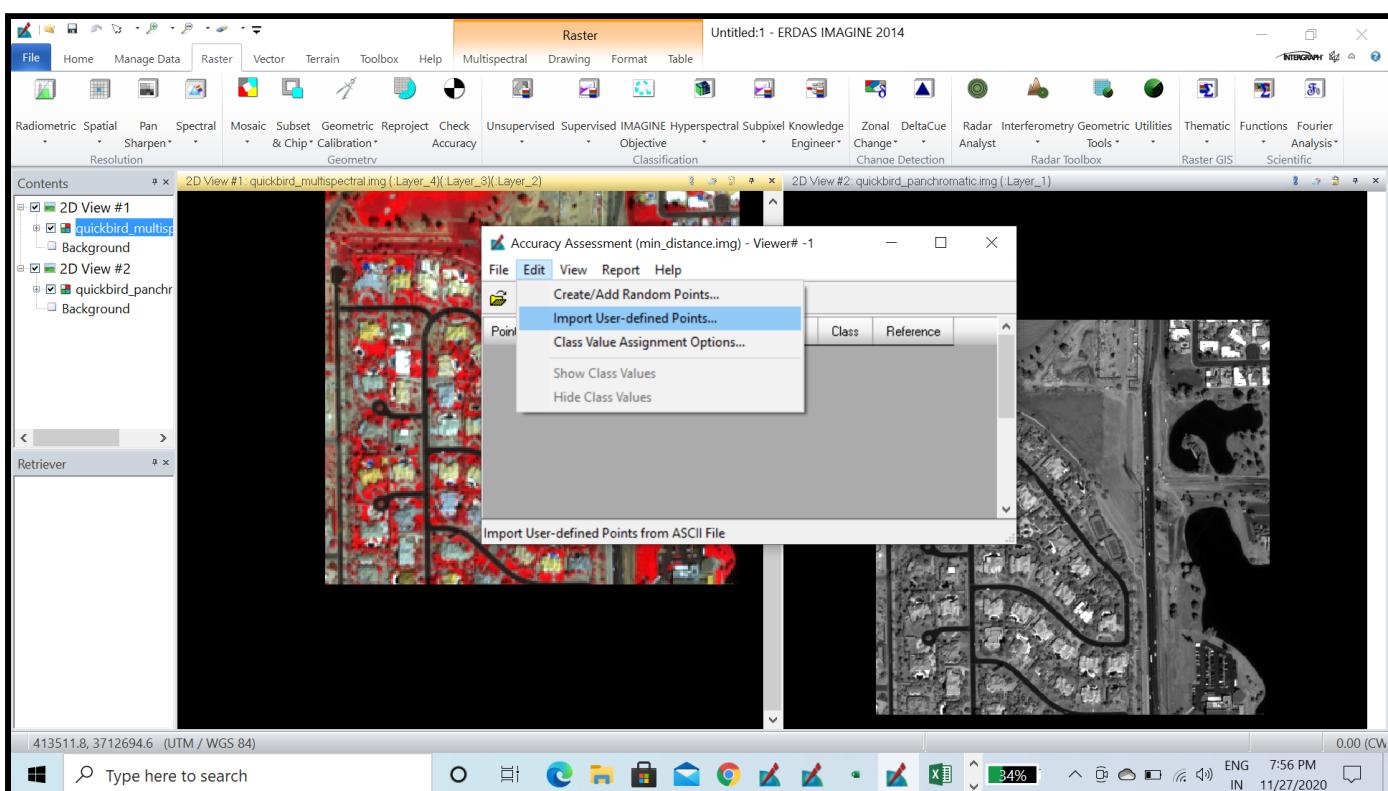
(using same random point as above)

Step-1 Save the random points of maximum likelihood and reference values. (Shift to select X,Y and reference code) in a notepad as a **.txt** file.

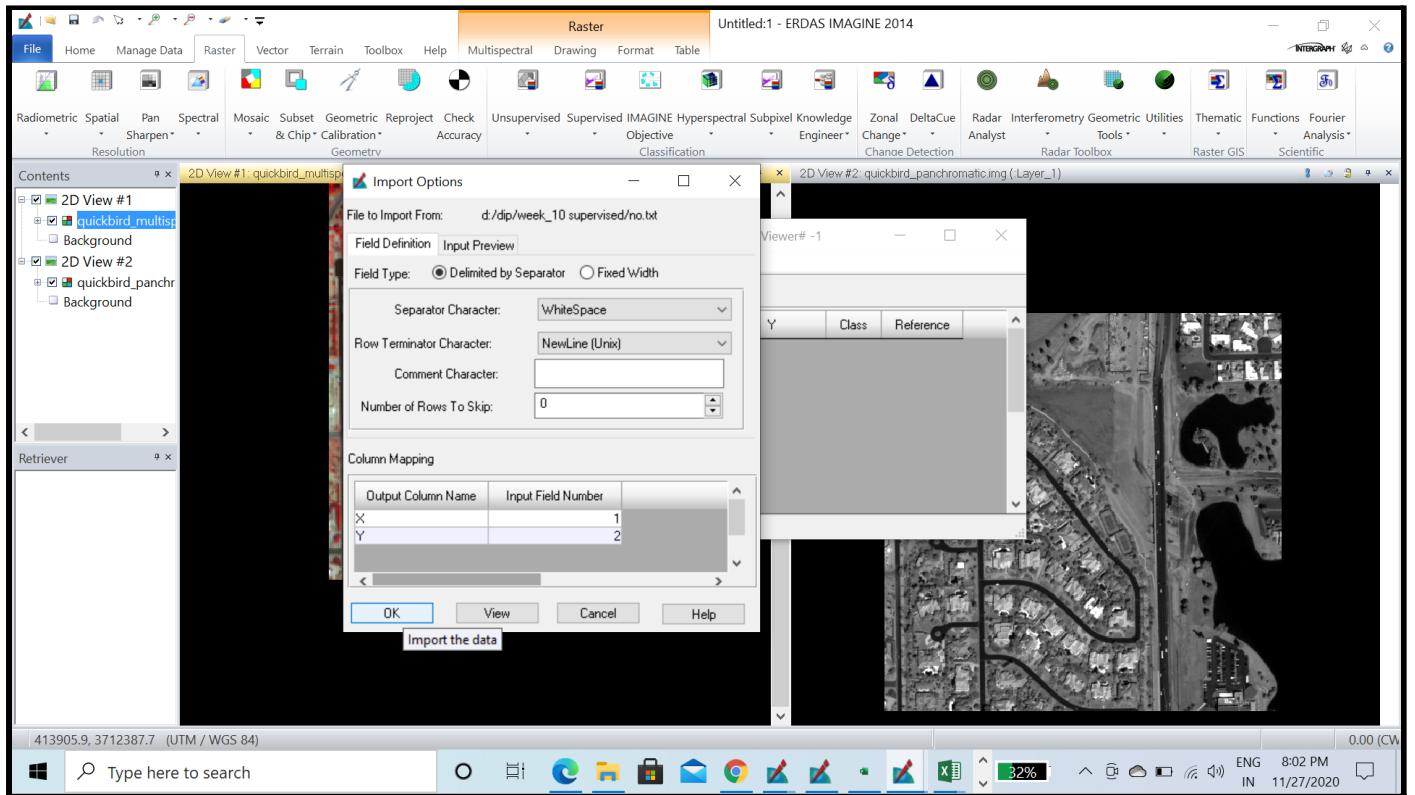


413636.4	3712981.2	1
413972.4	3712527.6	1
413826	3712767.6	1
413677.2	3712945.2	1
413850	3712798.8	5
413893.2	3712873.2	1
414152.4	3712657.2	2
413775.6	3713077.2	1
414169.2	3713041.2	5
413965.2	3712626	5
414150	3712830	4
414140.4	3712789.2	2
414142.8	3712515.6	3
414186.8	3713050.8	5
413718	3712678.8	5
413787.6	3712820.4	1
413924.4	3712659.6	1
413814	3712542	1
413785.2	3712489.2	5
413886	3712849.2	5
414145.2	3713010	3
414138	3712623.6	2
413982	3712484.4	4
413694	3712981.2	1
413889.2	3712599.6	5
414182	3712518	5
413696.4	3712971.6	1
413994	3712765.2	4
413985.2	3713067.6	5
414034.8	3712616.4	3
414087.6	3712630.8	1
413758.8	3712520.4	3
413638.8	3712722	4
413917.2	3712482	3
413024.0	3712711.0	-

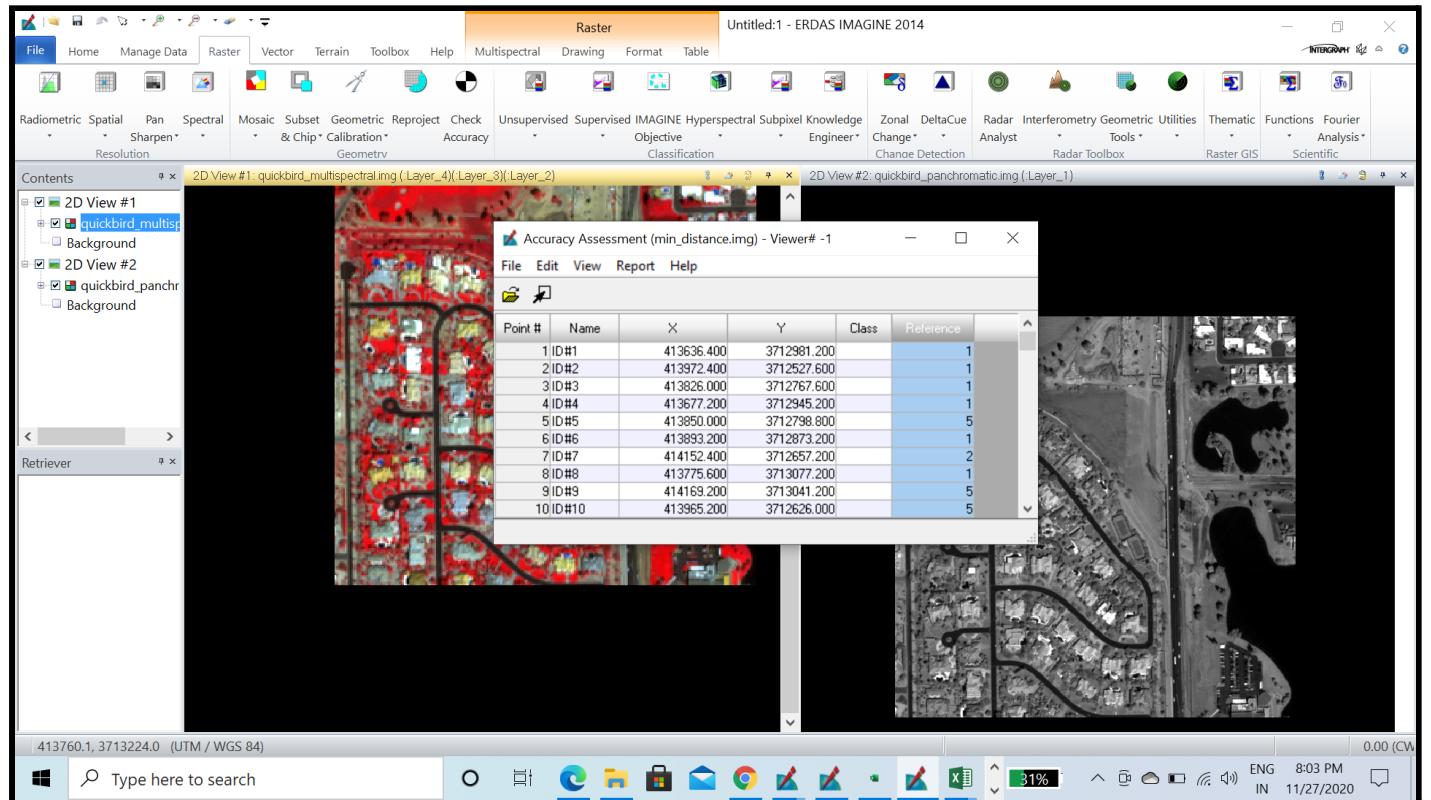
Step-2 Follow the first two steps as done above. After loading the classified map. To go **Edit > Import user Defined Points**. Browse the .txt file saved and click OK.



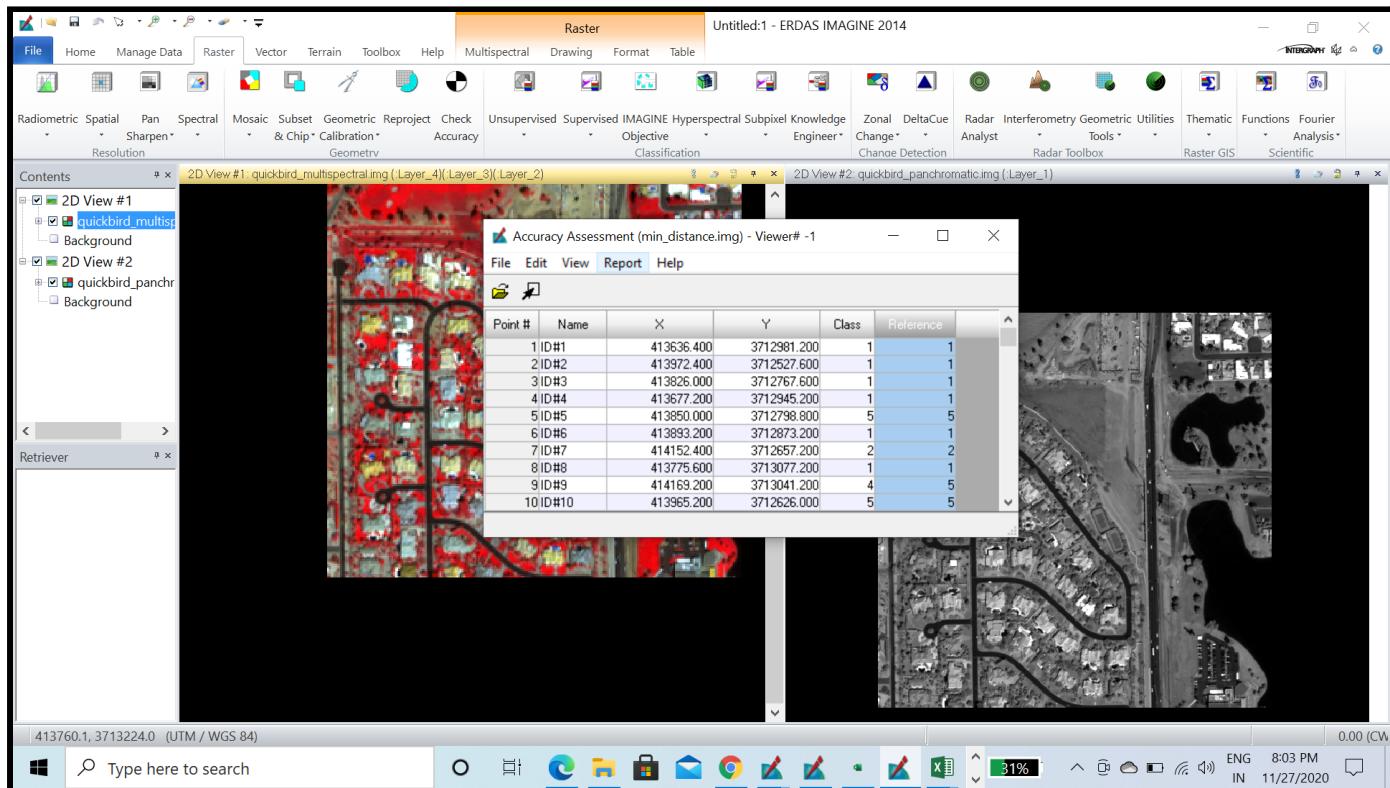
Step-3 In the import option tab, make sure that in the X output column, 1 input Field Number is there and in Y, 2 is there and then click OK.



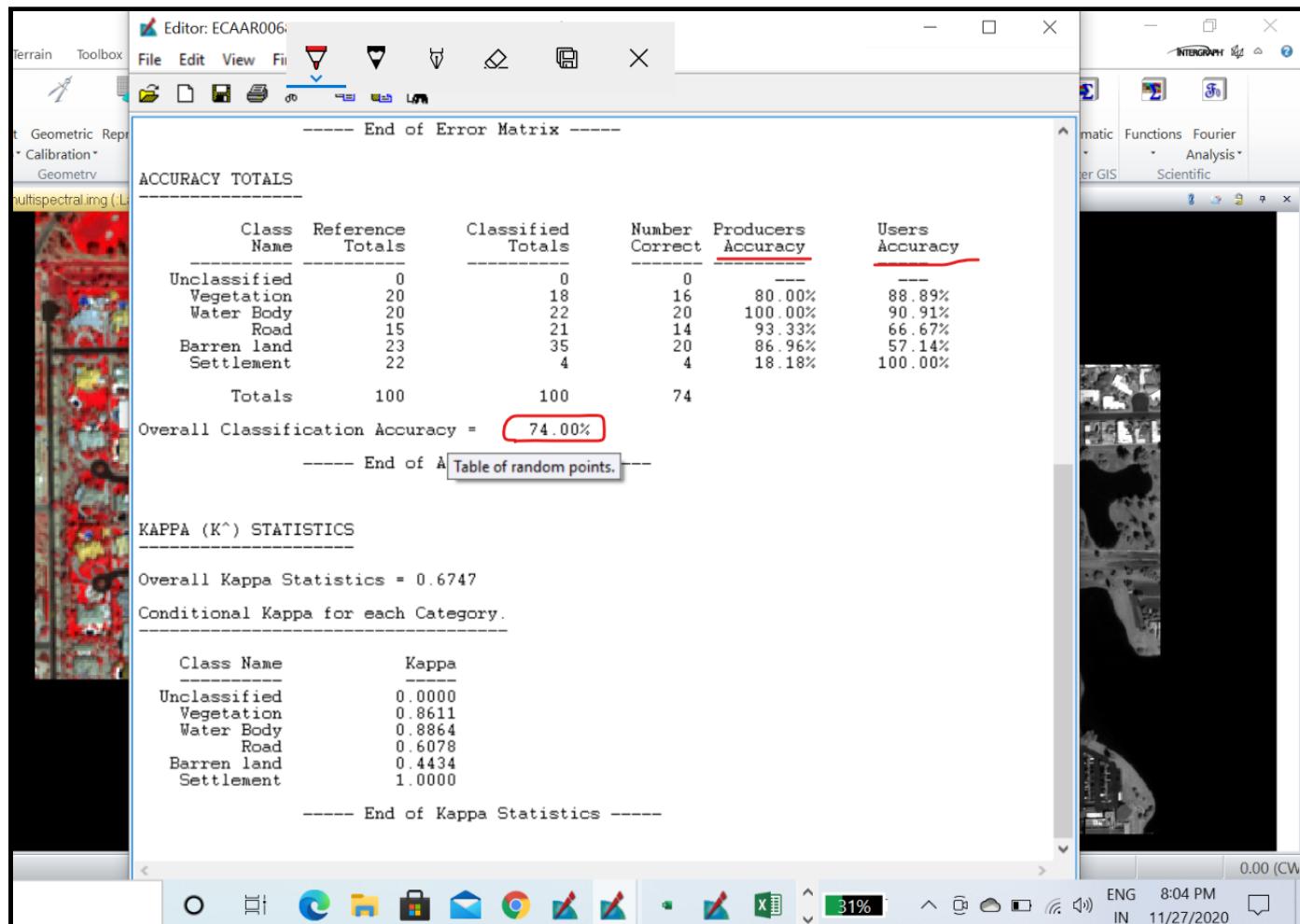
Step-4 Copy the reference value from notepad and paste in the reference column here.



Step 5. Show the class values. Go to View > Show class value.



Step-6 Go to Report > Accuracy Report



Comparison between Maximum likelihood accuracy and minimum distance accuracy

ACCURACY TOTALS						
Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy	
Unclassified	0	0	0	---	---	
Vegetation	21	20	19	90.48%	95.00%	
Water Body	20	20	20	100.00%	100.00%	
Road	15	20	15	100.00%	75.00%	
Barren land	25	20	19	76.00%	95.00%	
Settlement	19	20	15	78.95%	75.00%	
Totals	100	100	88			
Overall Classification Accuracy =	88.00%					
----- End of Accuracy Totals -----						

ACCURACY TOTALS						
Class Name	Reference Totals	Classified Totals	Number Correct	Producers Accuracy	Users Accuracy	
Unclassified	0	0	0	---	---	
Vegetation	20	18	16	80.00%	88.89%	
Water Body	20	22	20	100.00%	90.91%	
Road	15	21	14	93.33%	66.67%	
Barren land	23	35	20	86.96%	57.14%	
Settlement	22	4	4	18.18%	100.00%	
Totals	100	100	74			
Overall Classification Accuracy =	74.00%					
----- End of Accuracy Totals -----						

KAPPA (K ^a) STATISTICS	
Overall Kappa Statistics = 0.8500	
Conditional Kappa for each Category.	
Class Name	Kappa
Unclassified	0.0000
Vegetation	0.9367
Water Body	1.0000
Road	0.7059
Barren land	0.9333
Settlement	0.6914
----- End of Kappa Statistics -----	

KAPPA (K ^a) STATISTICS	
Overall Kappa Statistics = 0.6747	
Conditional Kappa for each Category.	
Class Name	Kappa
Unclassified	0.0000
Vegetation	0.8611
Water Body	0.8864
Road	0.6078
Barren land	0.4434
Settlement	1.0000

The overall accuracy of maximum likelihood is **88%** whereas for minimum distance, it is **74%** for the same random points. The accuracy is more in maximum likelihood method as in this **class variance is taken care of**. It is based on the **probability** of a pixel belonging to a particular pixel. On the other hand, in the minimum distance method, **class variance is not resolved i.e. class variability is not resolved**. In the minimum distance method, the pixel that **should remain unclassified becomes classified. (can be controlled by thresholding)**

From above, in the minimum distance method, the **producer's accuracy** is very low for **settlement i.e. only 16%**. Thus, this needs improvement. Using, **minimum distance method is a problem in urban areas**. Urban land cover is made up of pixels with a high variance, which may tend to be farther from the mean of the signature. Using this decision rule, outlying urban pixels may be improperly classified. Inversely, a class with less variance, like **water**, may tend to over classify (that is, classify more pixels than are appropriate to the class), because the pixels that belong to the class are usually spectrally closer to their mean than those of other classes to their means.