

REMOTE SENSING

A PRACTICAL REPORT

ON

REMOTE SENSING

SUBMITTED BY

Mr. MOHD KAIF

Roll No: 22001

UNDER THE GUIDANCE OF

PROF. MEHDI REZAEI

Submitted in fulfilment of the requirements for qualifying
MSc. IT Part II Semester - IV Examination 2023-2024

University of Mumbai

Department of Information Technology

R.D. & S.H National College of Arts, Commerce & S.W.A.
Science College Bandra (West), Mumbai – 400 050



R. D. & S. H. National & S. W. A. Science College

Bandra (W), Mumbai - 400050

**Department of Information Technology
M.Sc. (IT – SEMESTER IV)**

Certificate

This is to certify that Remote Sensing Practical's performed at R.D & S.H National & S.W.A. Science College by Mr. Mohd Kaif holding Seat No. _____ studying Master of Science in Information Technology Semester – IV has been satisfactorily completed as prescribed by the University of Mumbai, during the year 2023 – 2024

Subject In-Charge

Coordinator In-Charge

External Examiner

College Stamp

INDEX

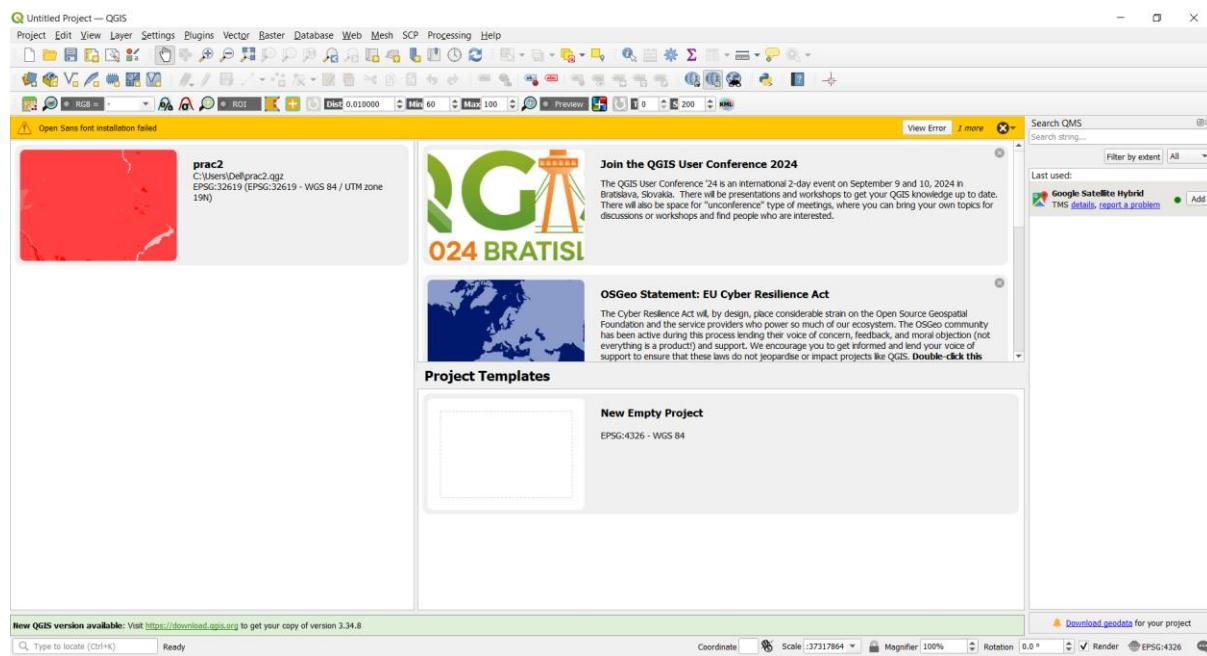
Sr. No	Date	Practical	Page No.	Sign
1	2/05/2024	Apply pre-processing techniques on satellite images	1	
2	2/05/2024	Apply geometric correction methods on satellite images	8	
3	18/05/2024	Perform contrast stretching on satellite images	20	
4	9/06/2024	Enhance the satellite image using Pseudocolor image processing	26	
5	12/06/2024	Apply different supervised classification techniques to classify the satellite image	33	
6	27/06/2024	Apply different unsupervised classification techniques to classify the Satellite Image	50	
7	3/07/2024	Apply Principal Component Analysis on satellite images	58	
8	3/07/2024	Apply raster analysis on satellite images	74	

Practical: 1

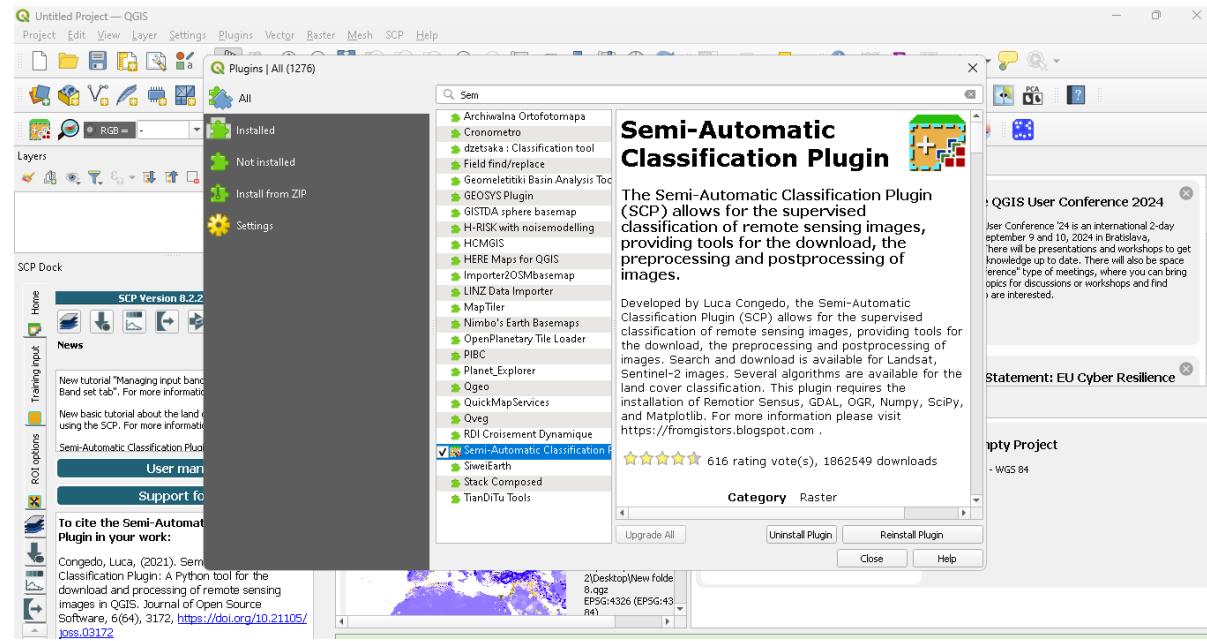
Aim: Apply pre-processing techniques on satellite images (Using Sentinel-2 Images).

Writeup:

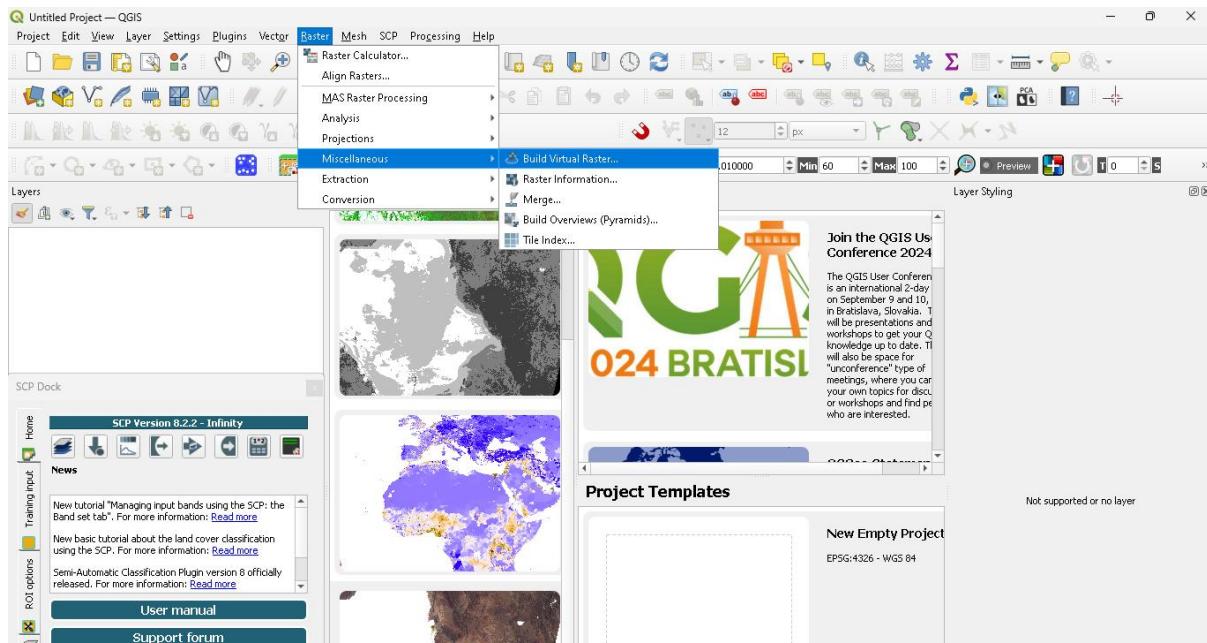
Step 1: Open QGIS



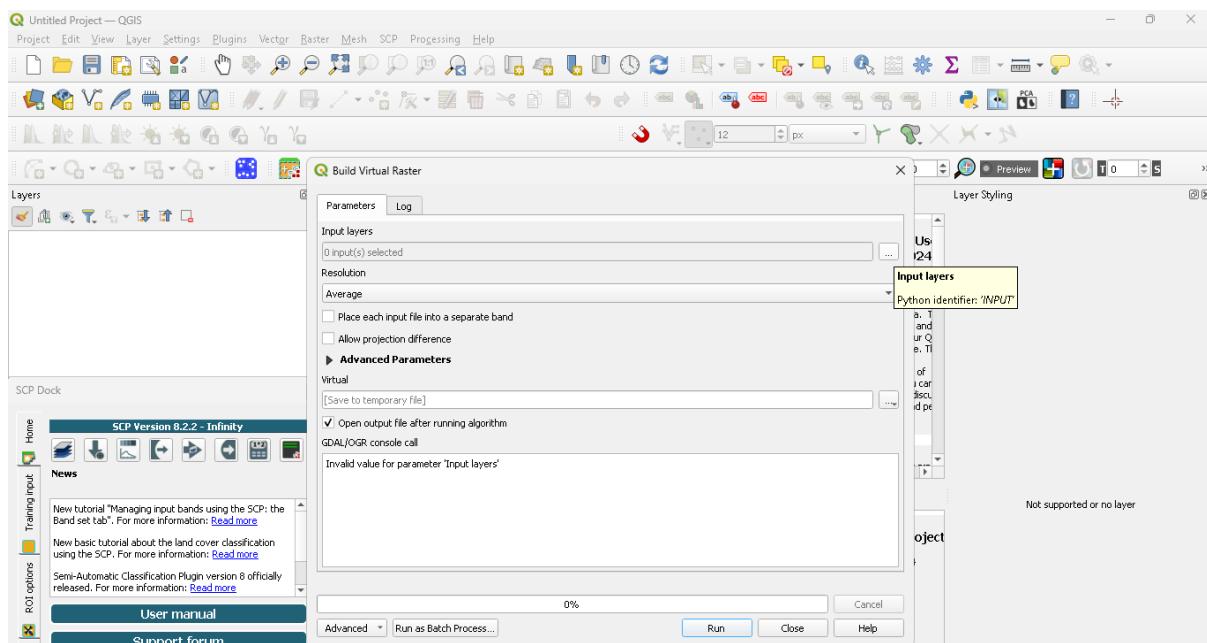
- Go to plugin and install Semi Automated classification plugin



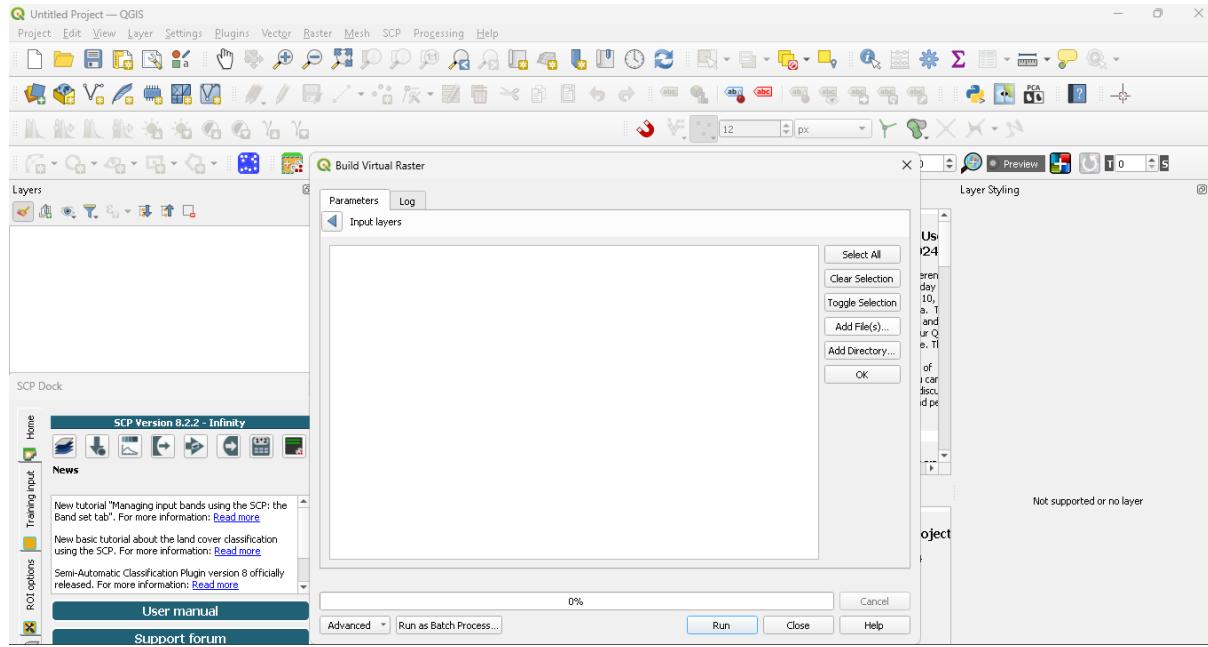
Step 2: Click on Raster and Select miscellaneous Under miscellaneous Select Build virtual raster



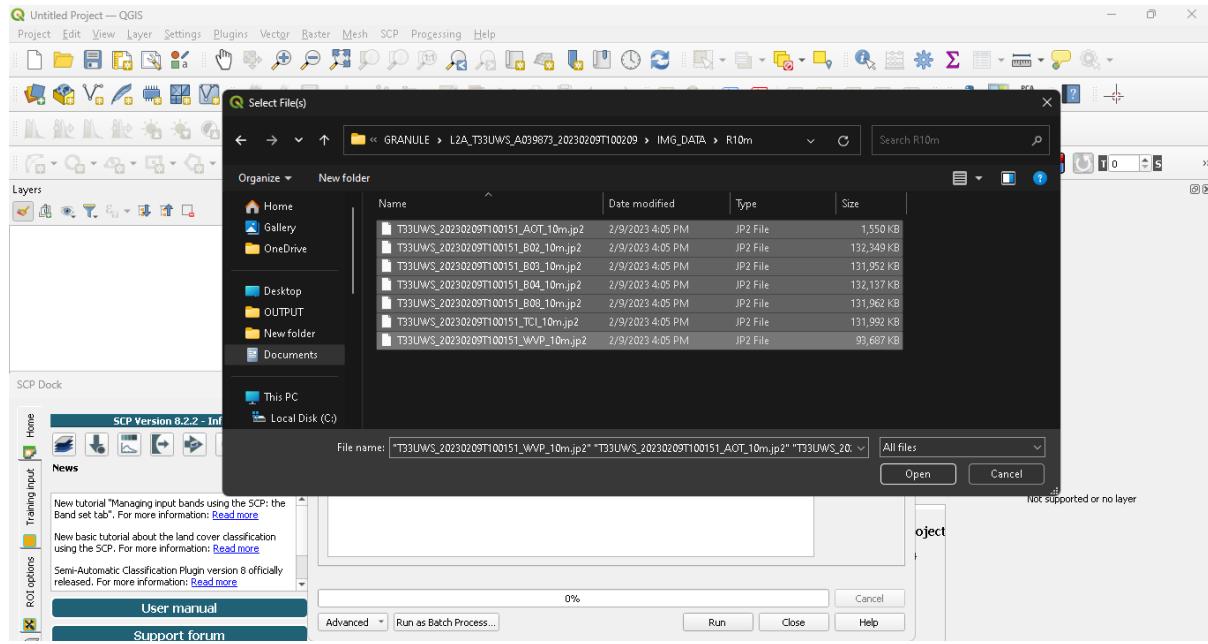
- Click on Input layer



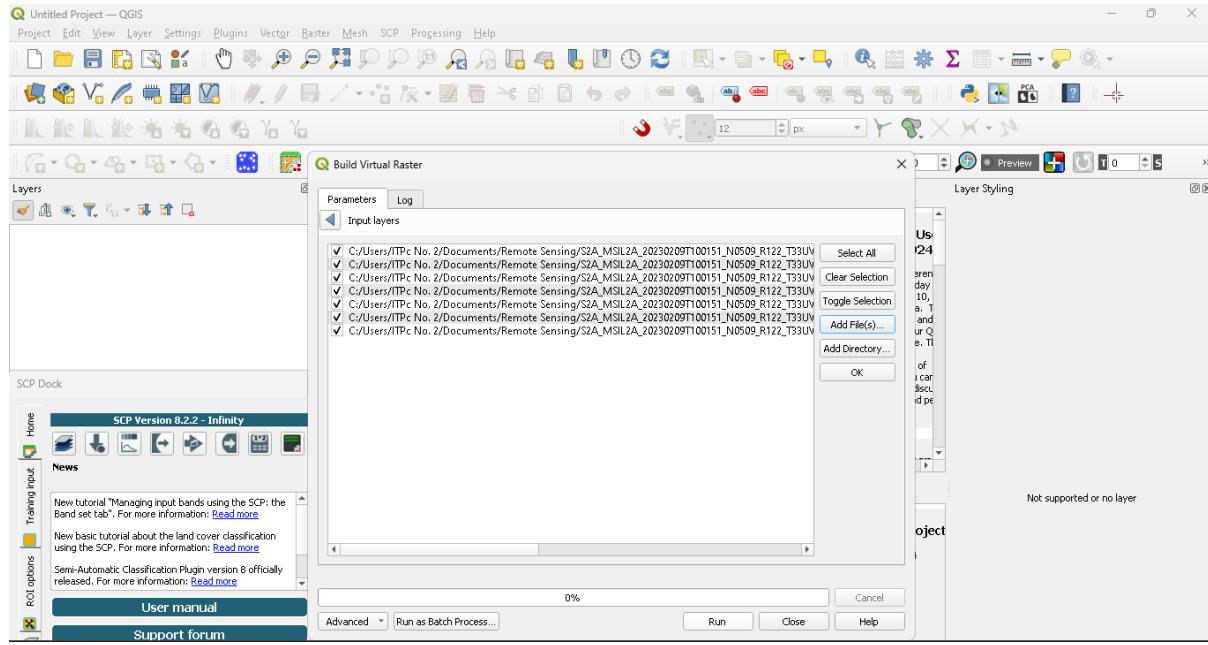
- Click on Add



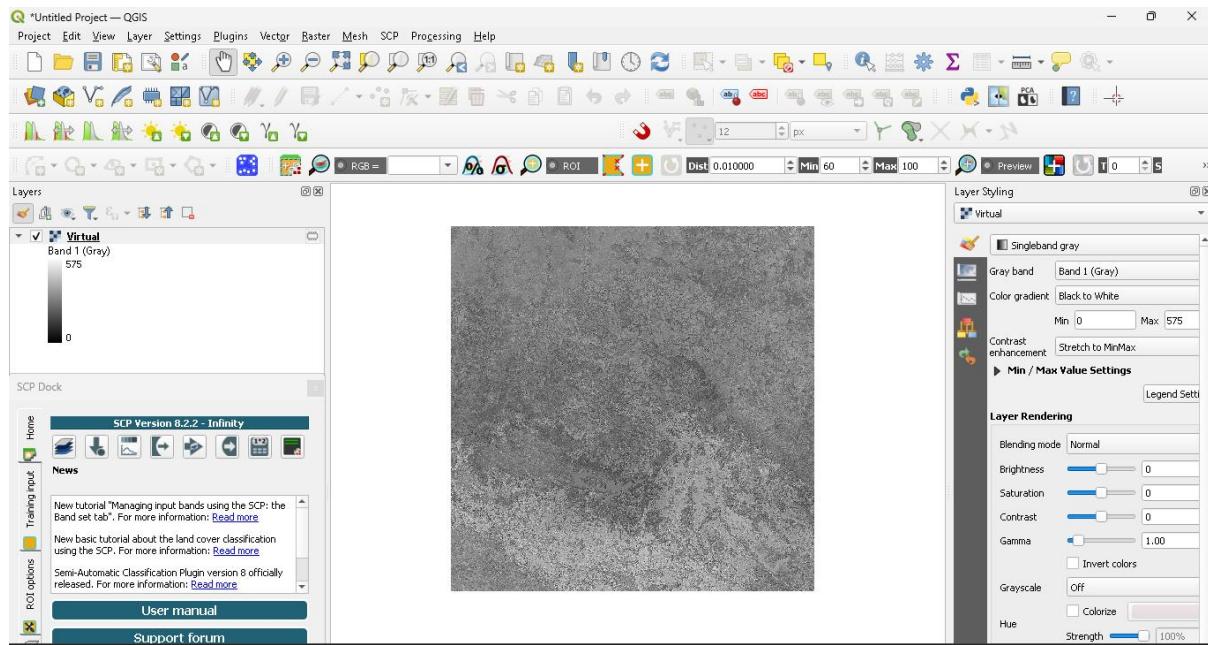
- Select All JP2 File and Click on Open



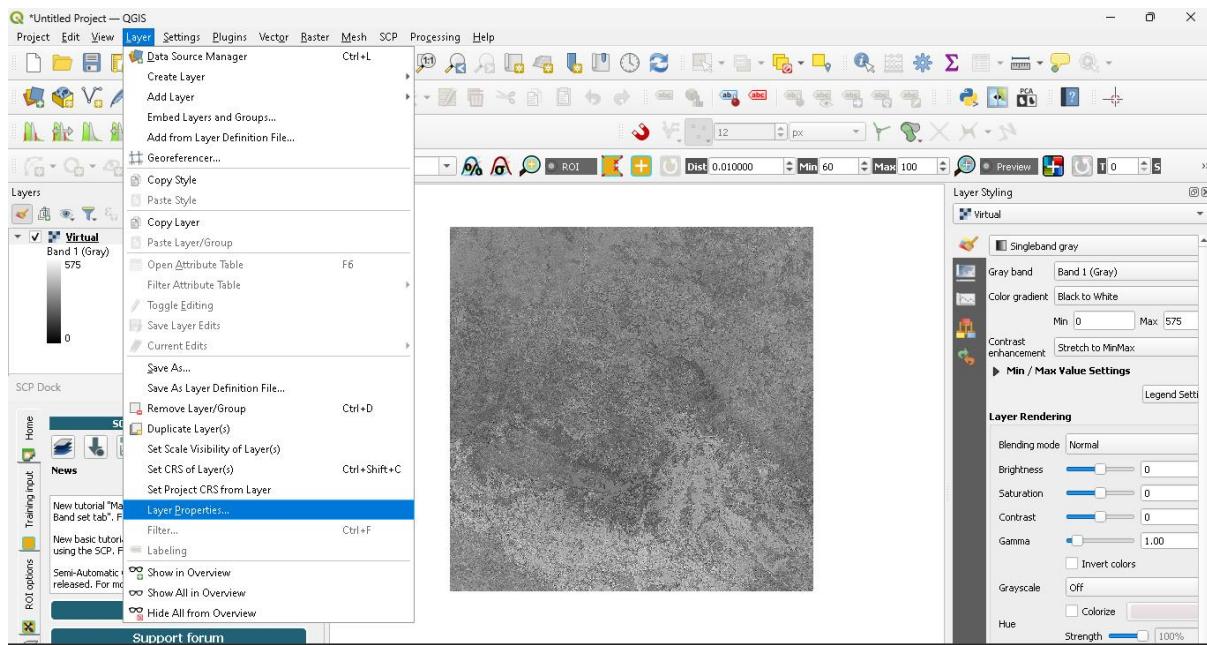
- Click on Run



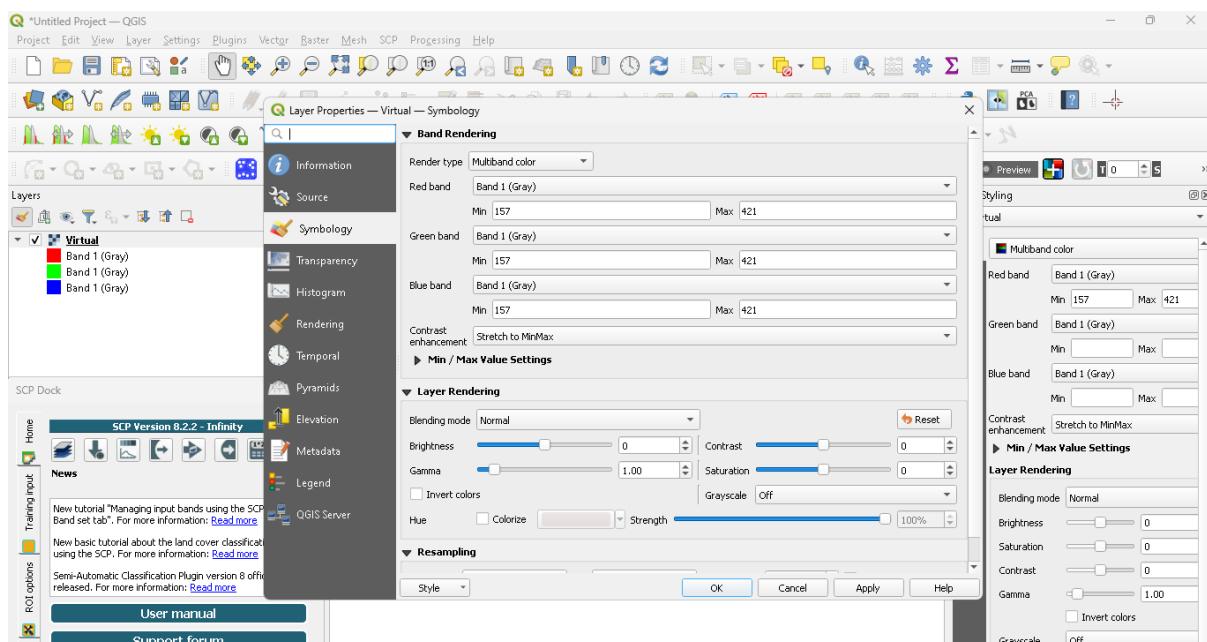
- We have sentinel 2 map.



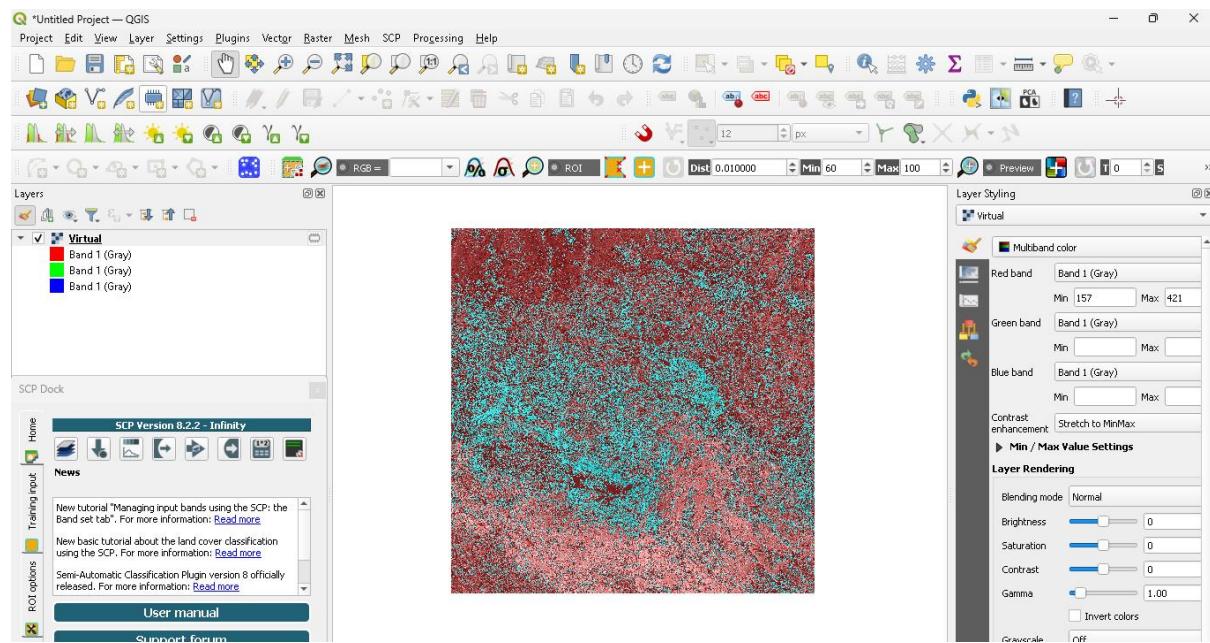
Step 3: Go to Layer & select layer properties, So, now we have to change bands and their respective values.



- Select Render type Multiband color and then Select Band 1 (Gray) For Red, Green and Blue bands and Type Min Value 157 and Max Value 421 and then Click on Apply and OK



- After applying some new bands Now, we have another transformed map.

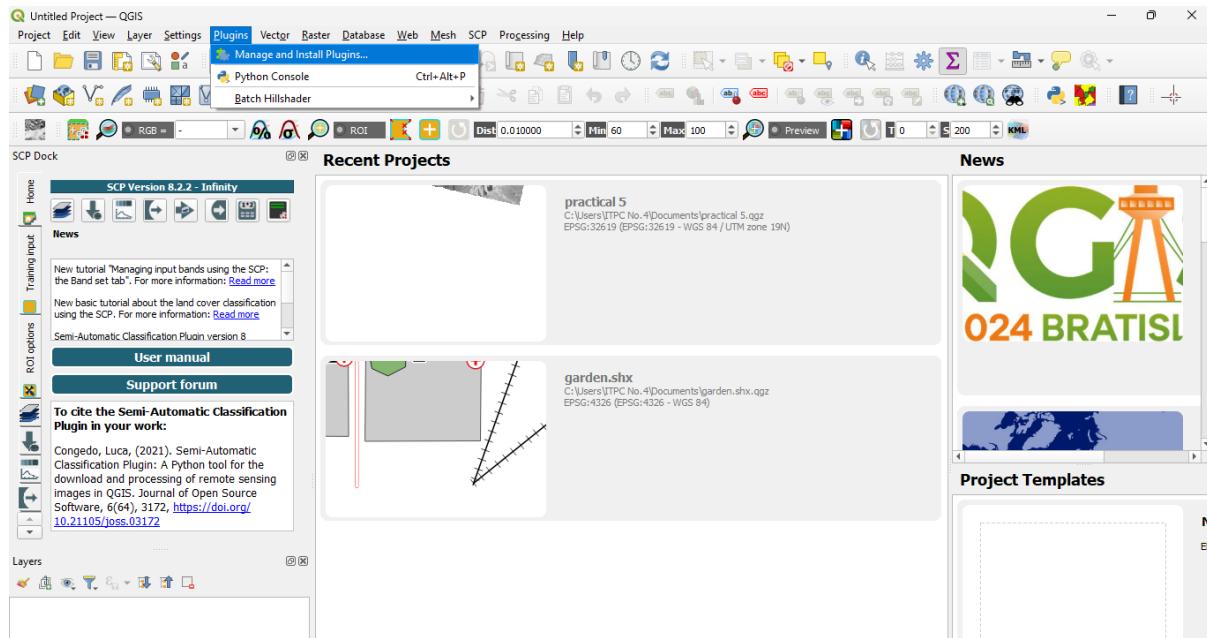


Practical: 2

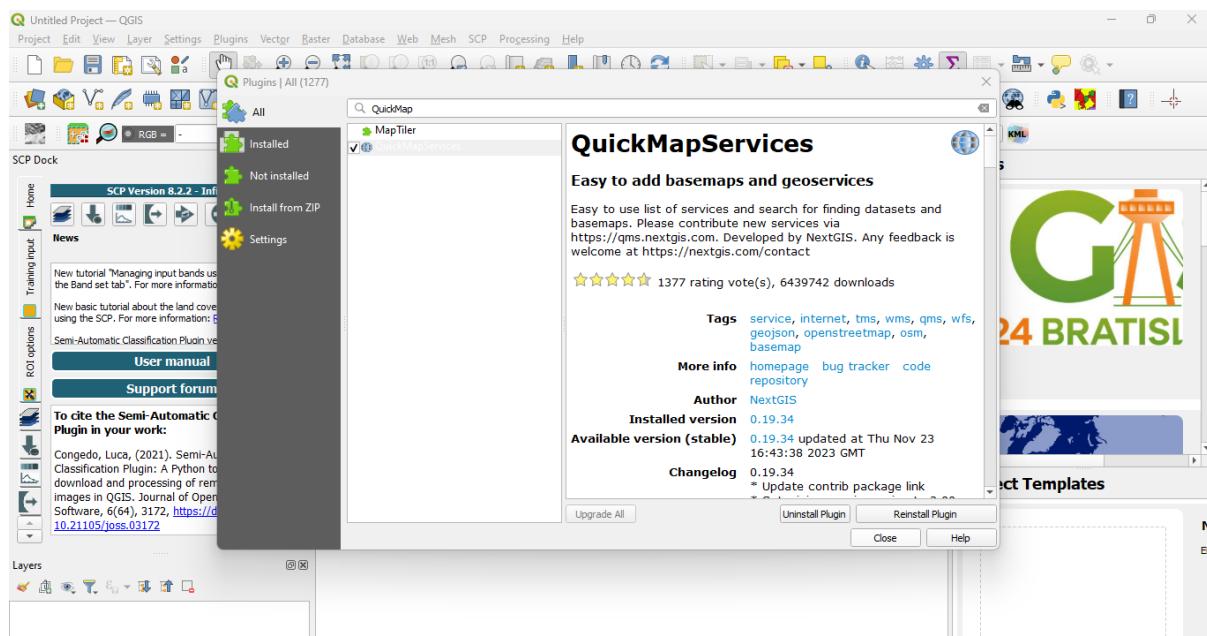
Aim: Georeferencing Satellite Images with Maps.

Writeup:

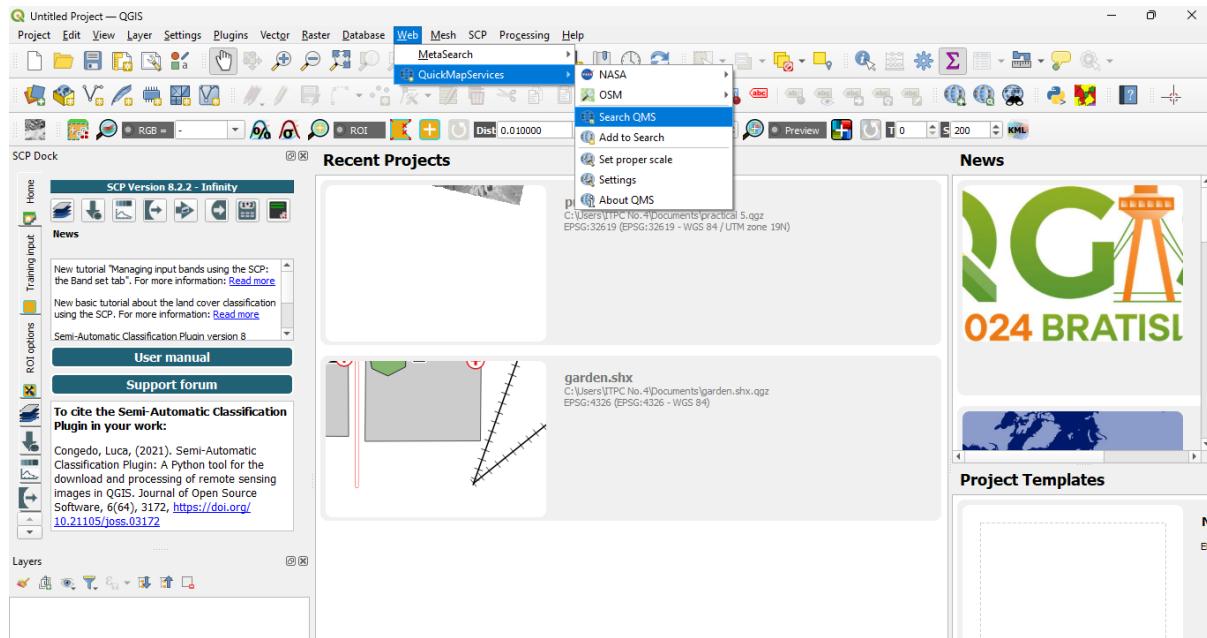
Step 1: Open QGIS and Click on Plugin and Select Manage and Install Plugins



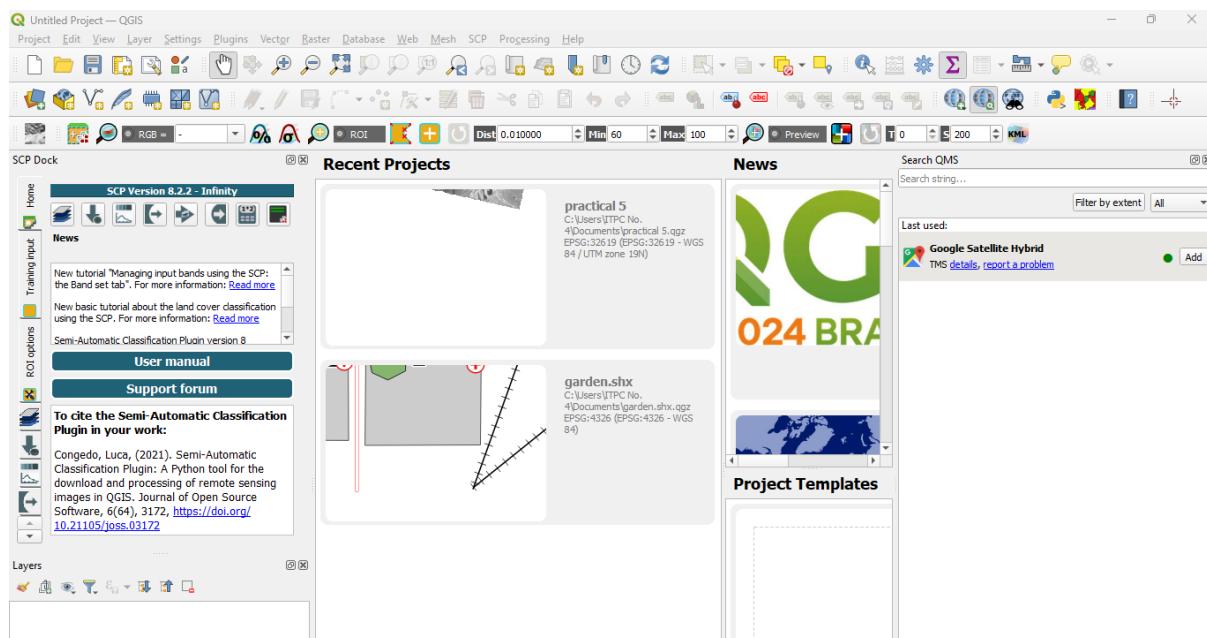
Step 2: Search for QuickMapServices and Install the plugin, after installation restart QGIS



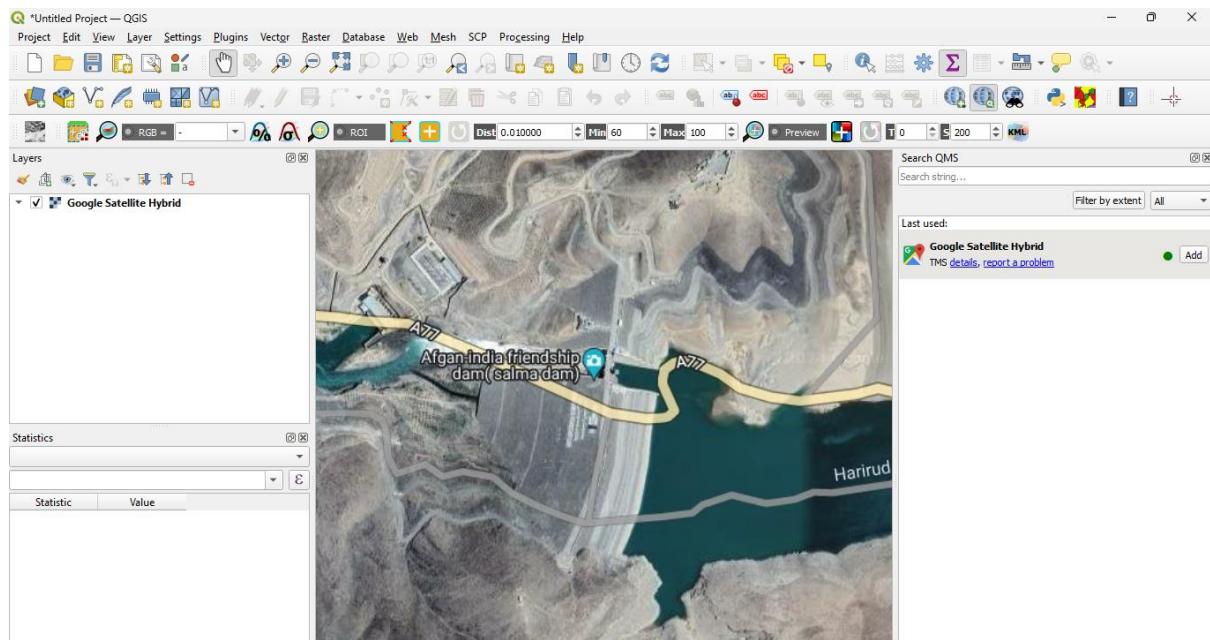
Step 3: Now Click on Web and Select QuickMapServices and Click on Search QMS



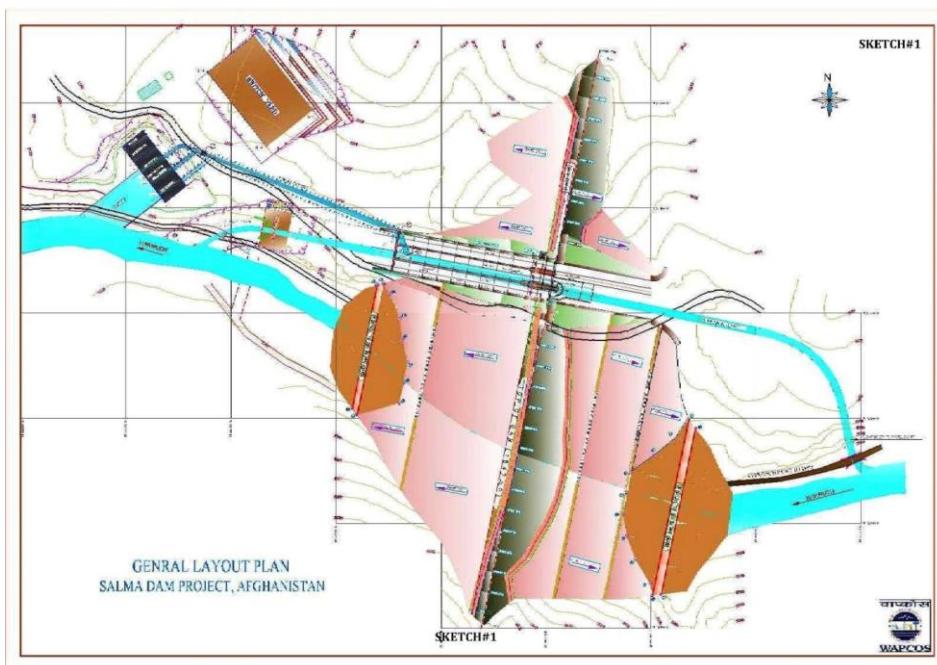
Step 4: Now Add the Google Satellite Hybrid



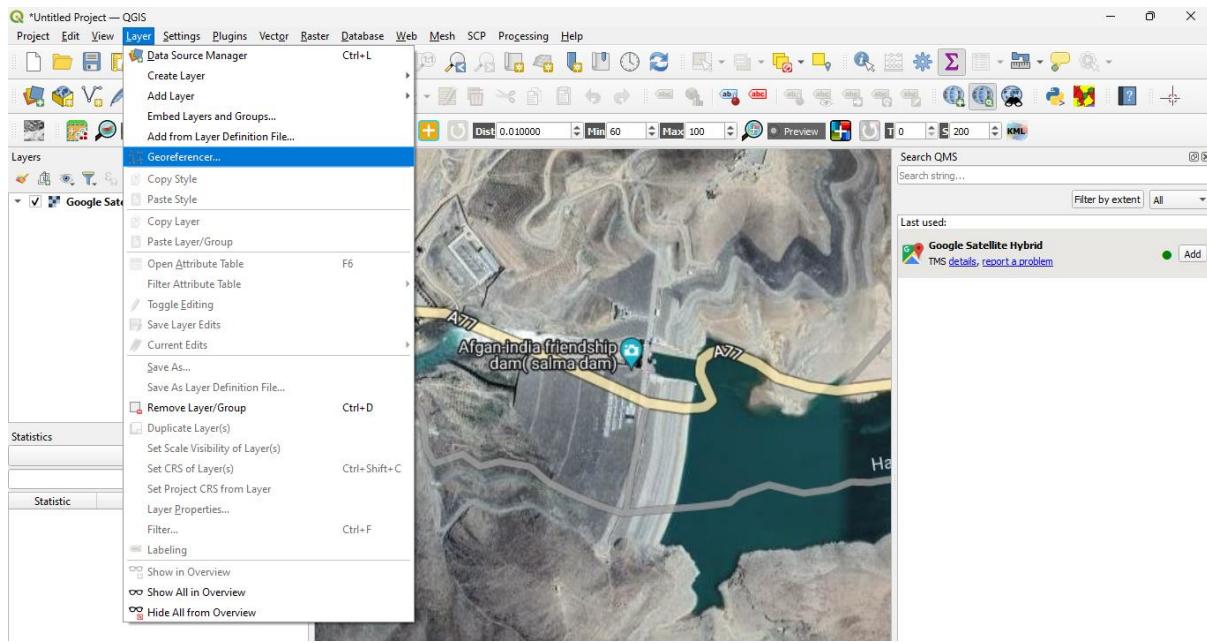
Step 5: Select the specific area or damn, Here we picked “Salma dam” from Afghanistan for our geo-referencing satellite image.



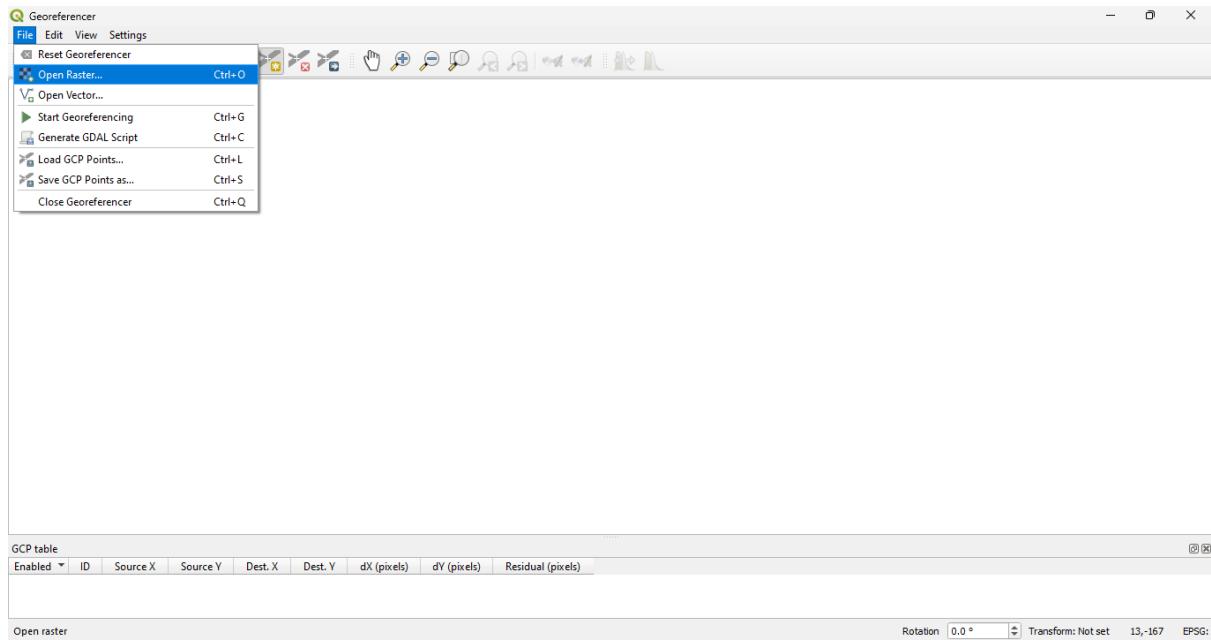
Step 6: Now we have to align this with our reference image shown below



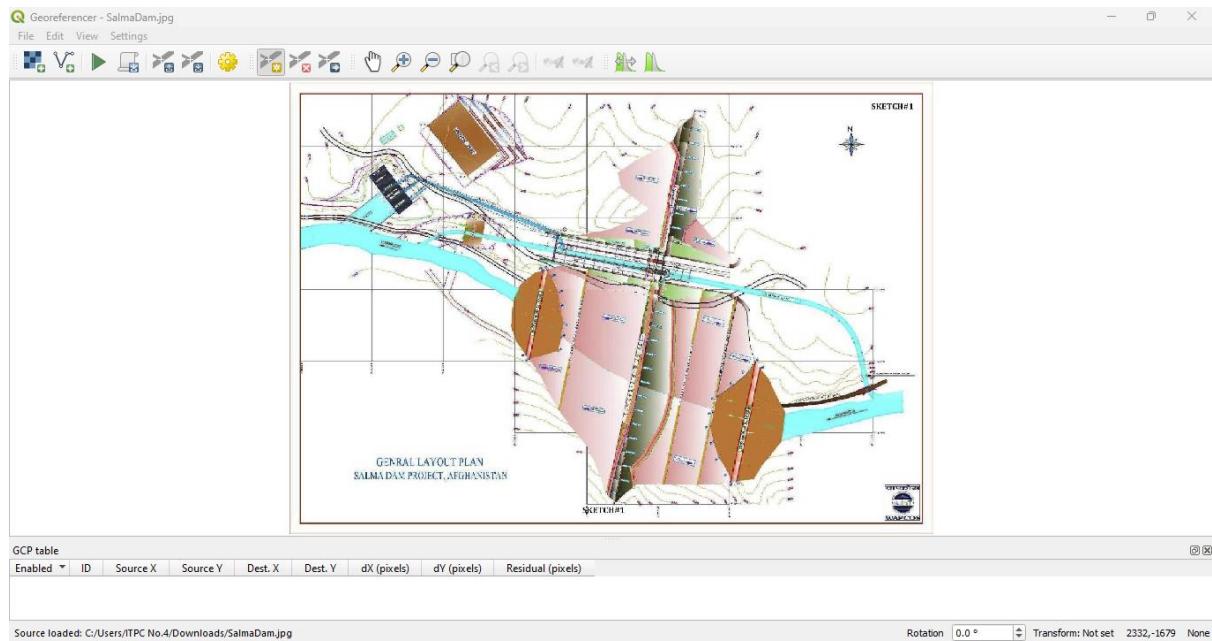
Step 7: Now Click on Layer and Click on Georeferencer



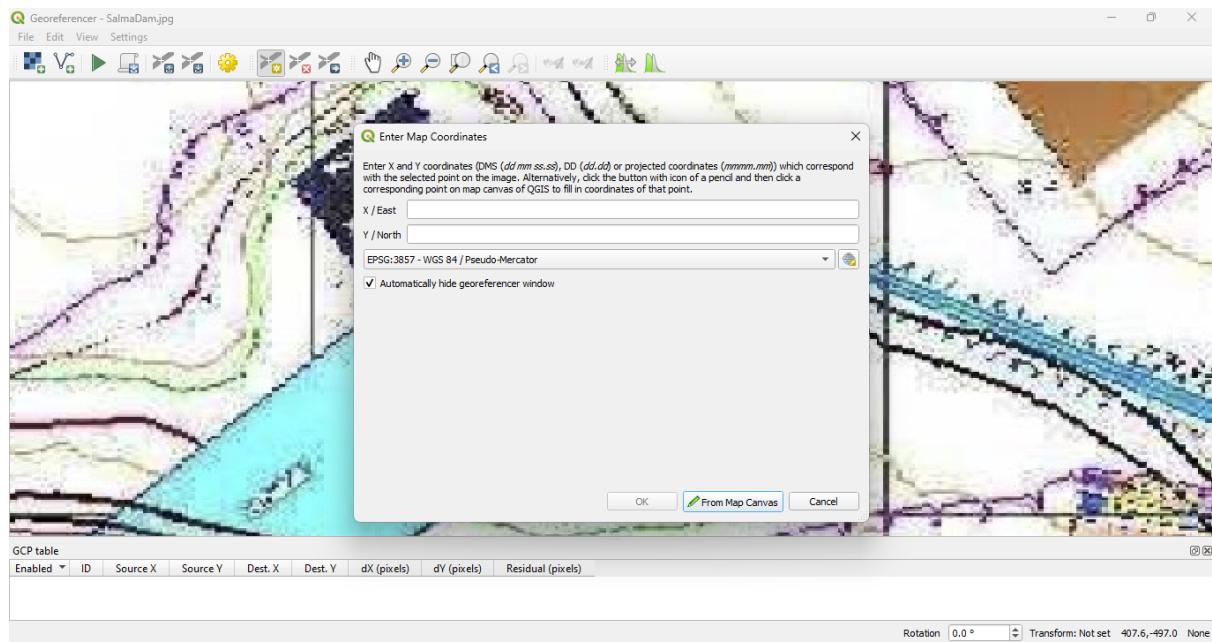
Step 8: Within Georeferencer Click on File and Select Open Raster



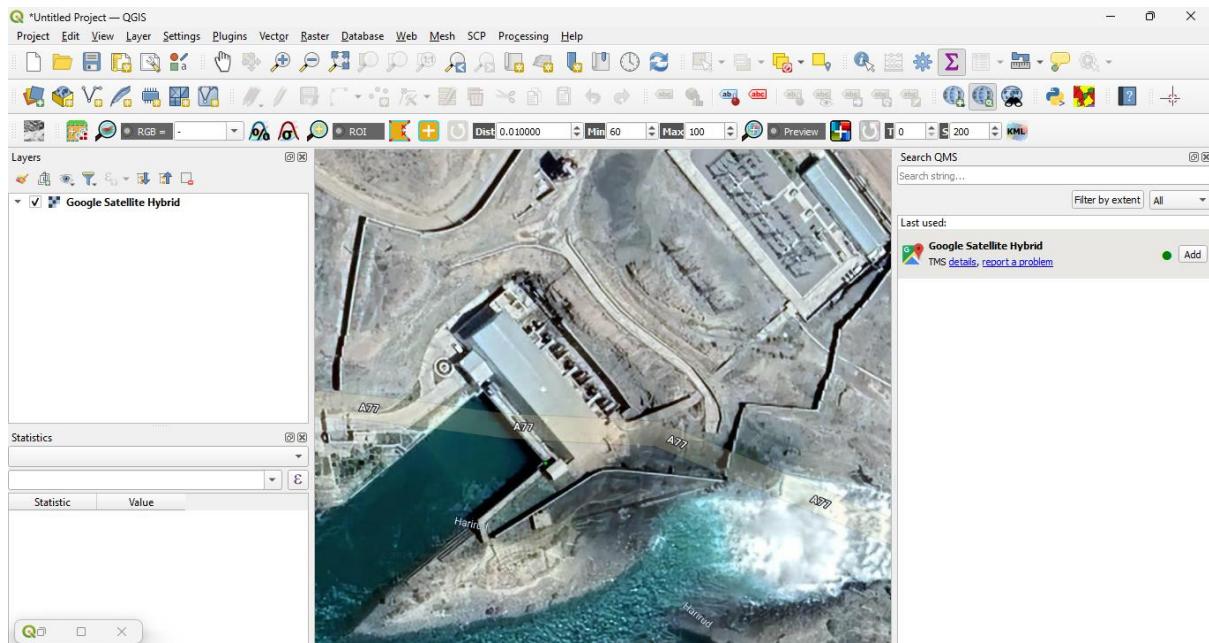
Step 9: Browse your directory and select your Salma Dam jpg file



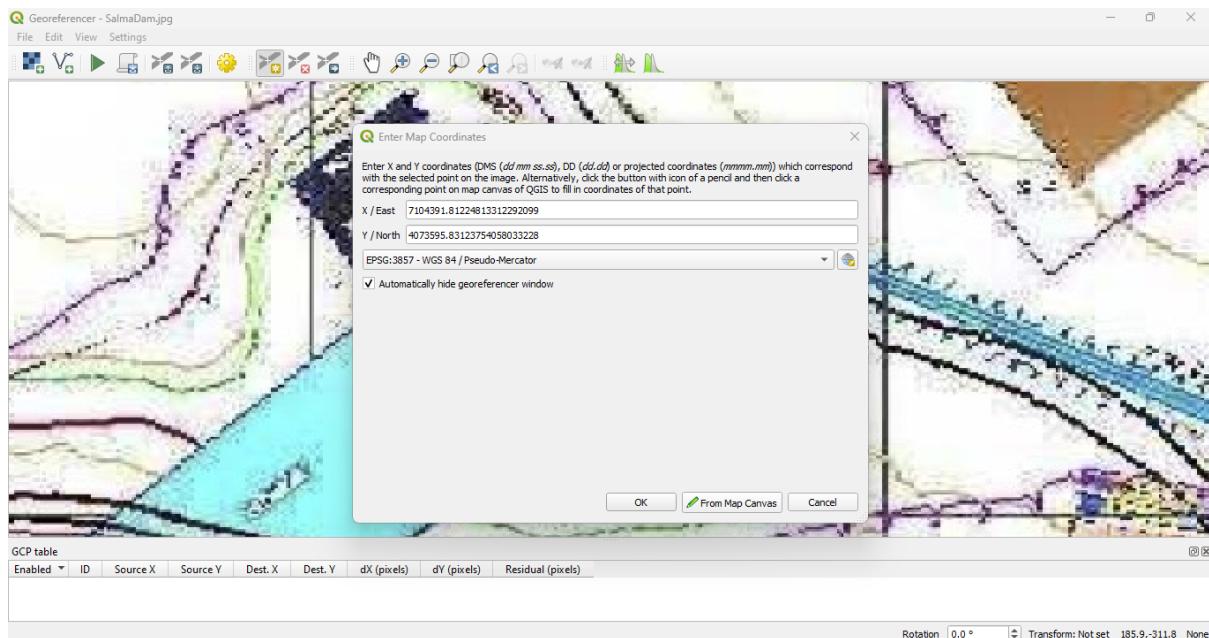
Step 10: Now select a point on the map and Click on **From Map Canvas**



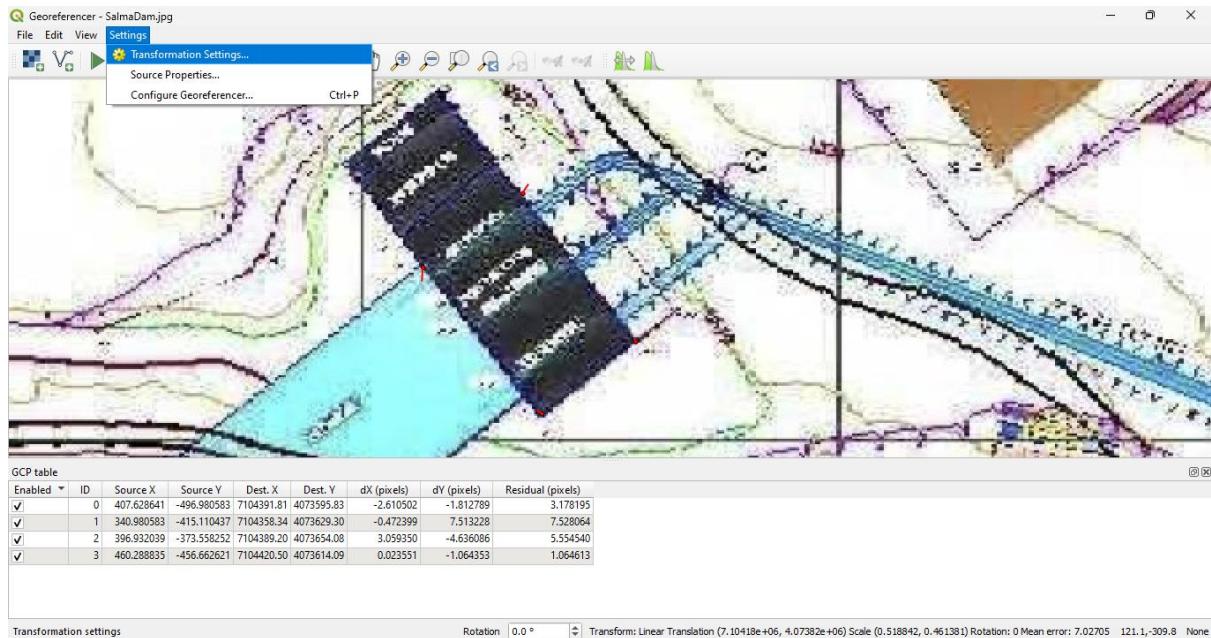
Step 11: Now Search for the exact same point on your Satellite area



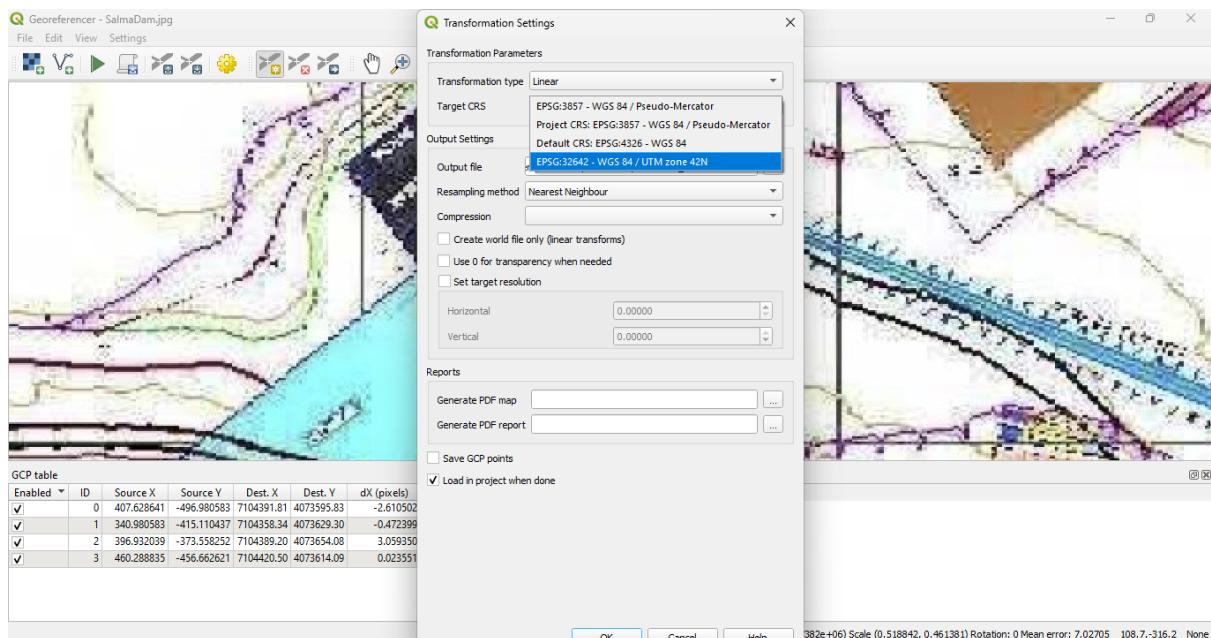
Step 12: Click Ok



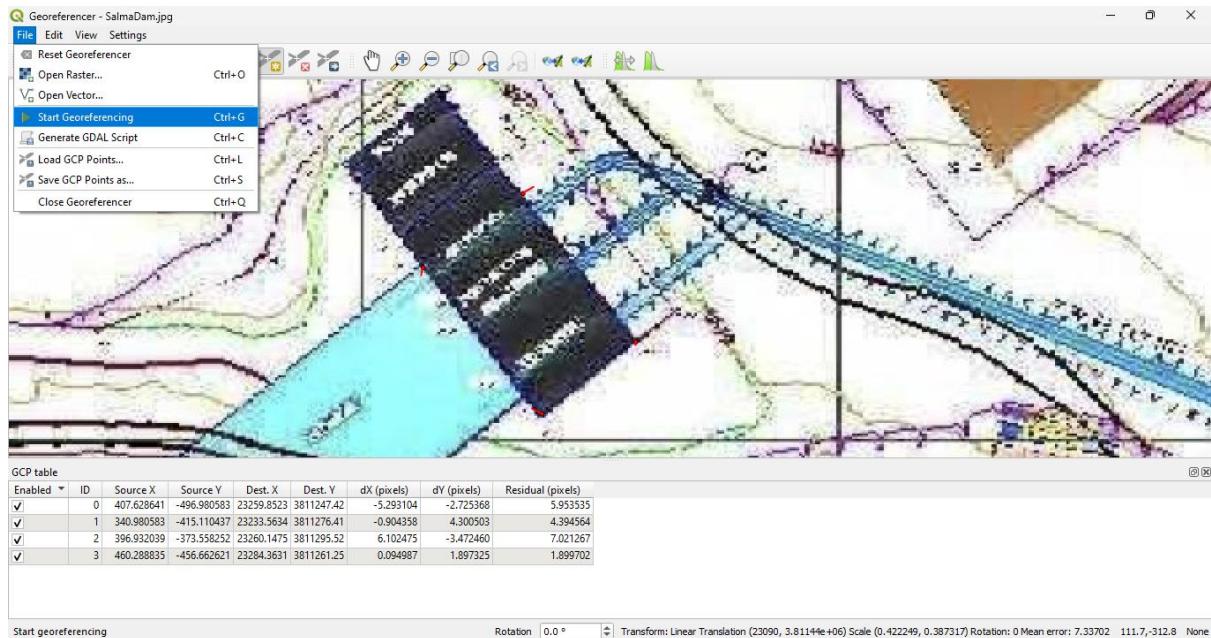
Step 13: Select at-least 4 points, after which Click on **Settings** and Click on **Transformation Settings**



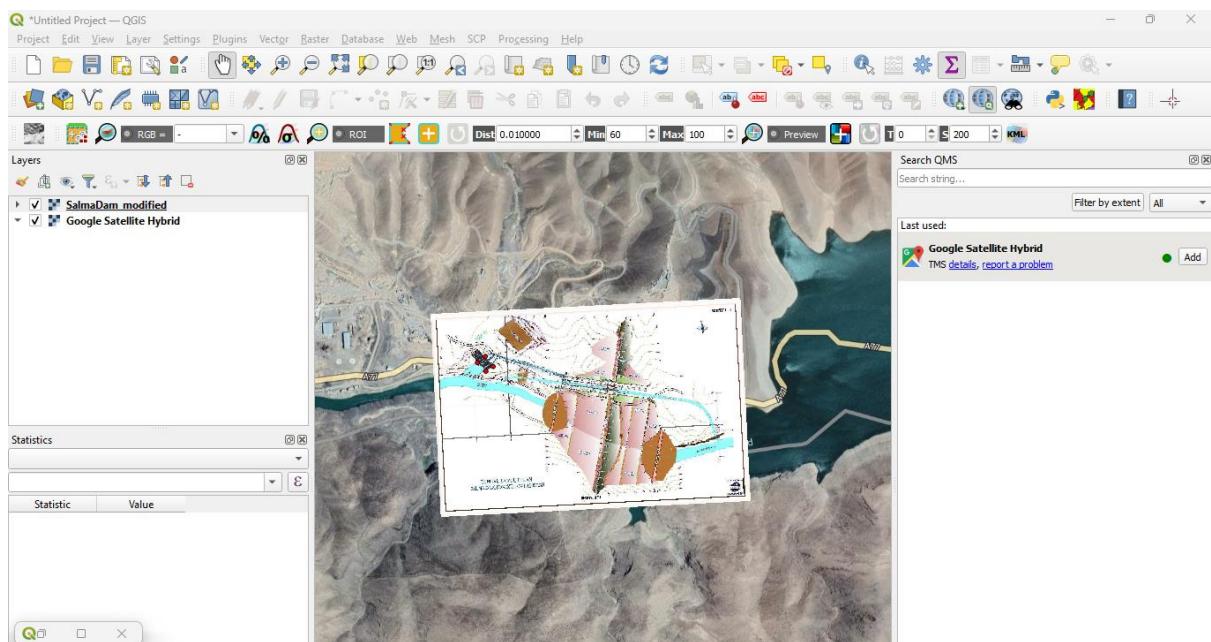
Step 14: Now Click on **Target CRS** and Select **EPSG:32642** and Click **Ok**



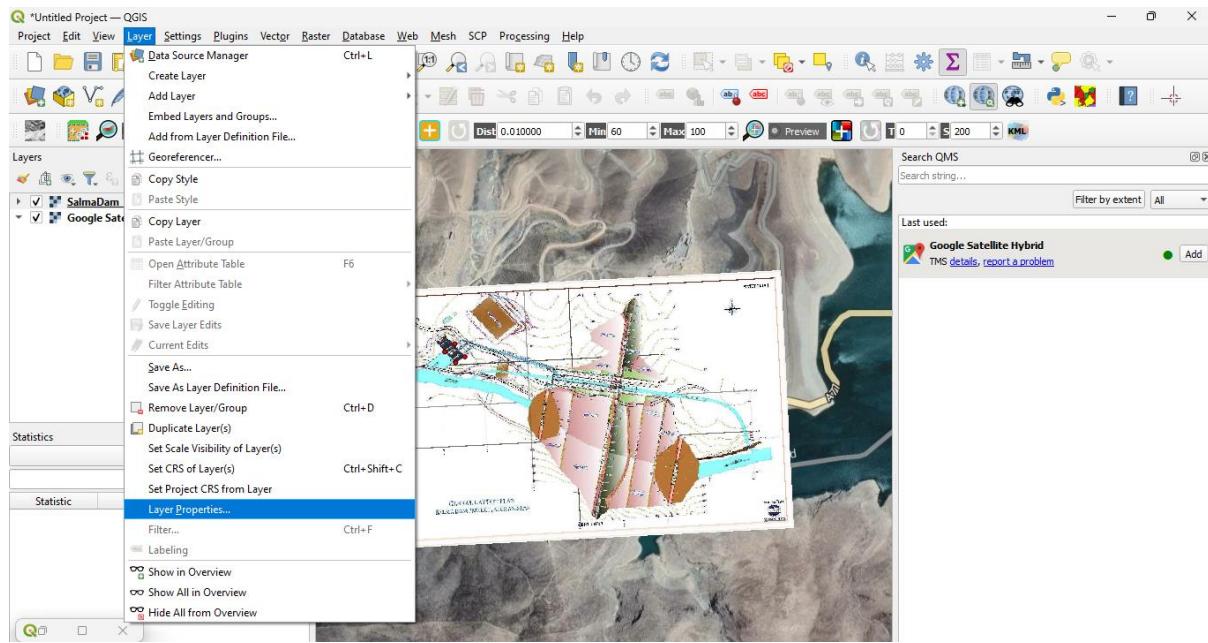
Step 15: Now Click on File and Select Start Georeferencing



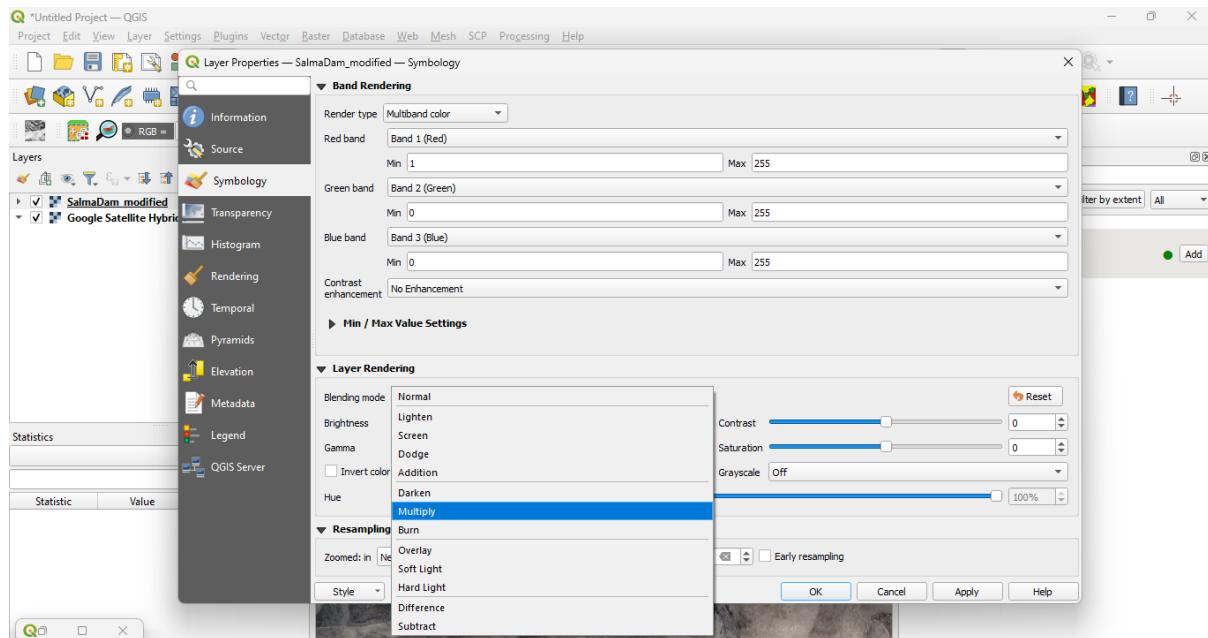
Step 16: After successful geo-referencing you will see an overlaid image onto the satellite image



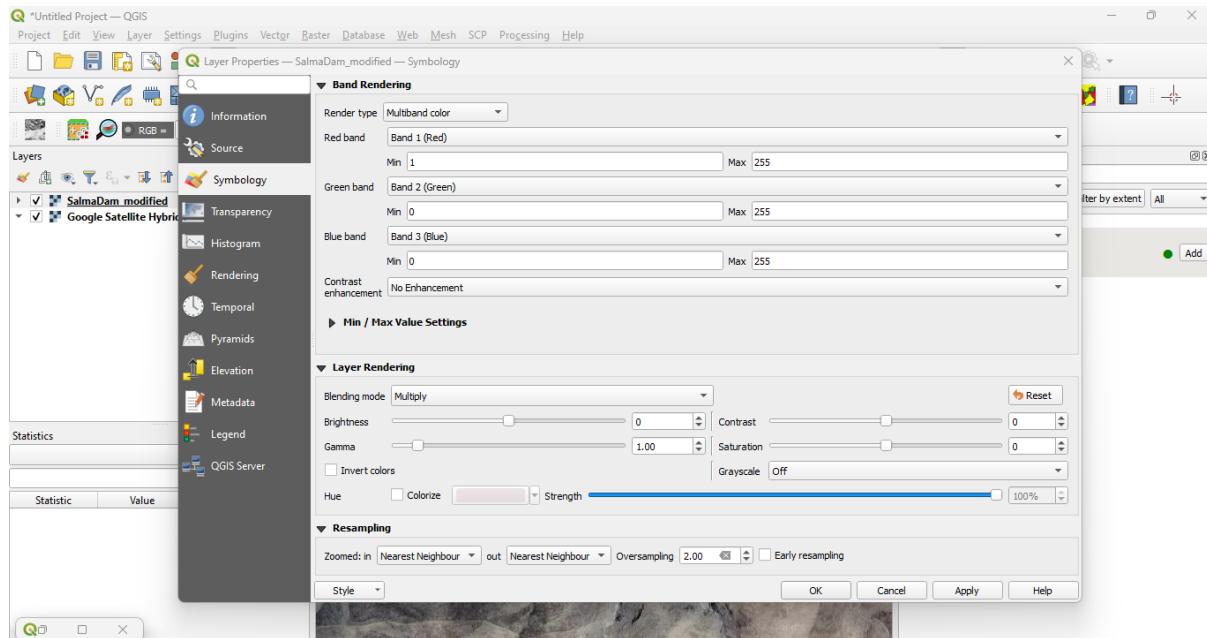
Step 17: Now Click on Layer and Select Layer Properties



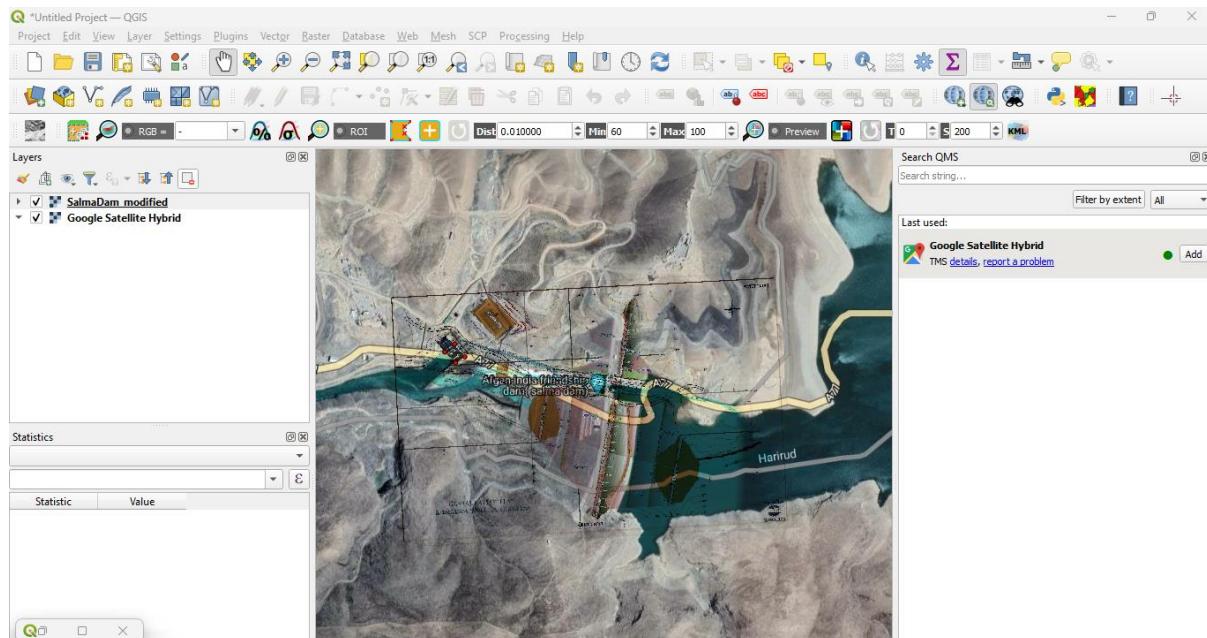
Step 18: Now within Symbology and Click on Blending and Select Multiply



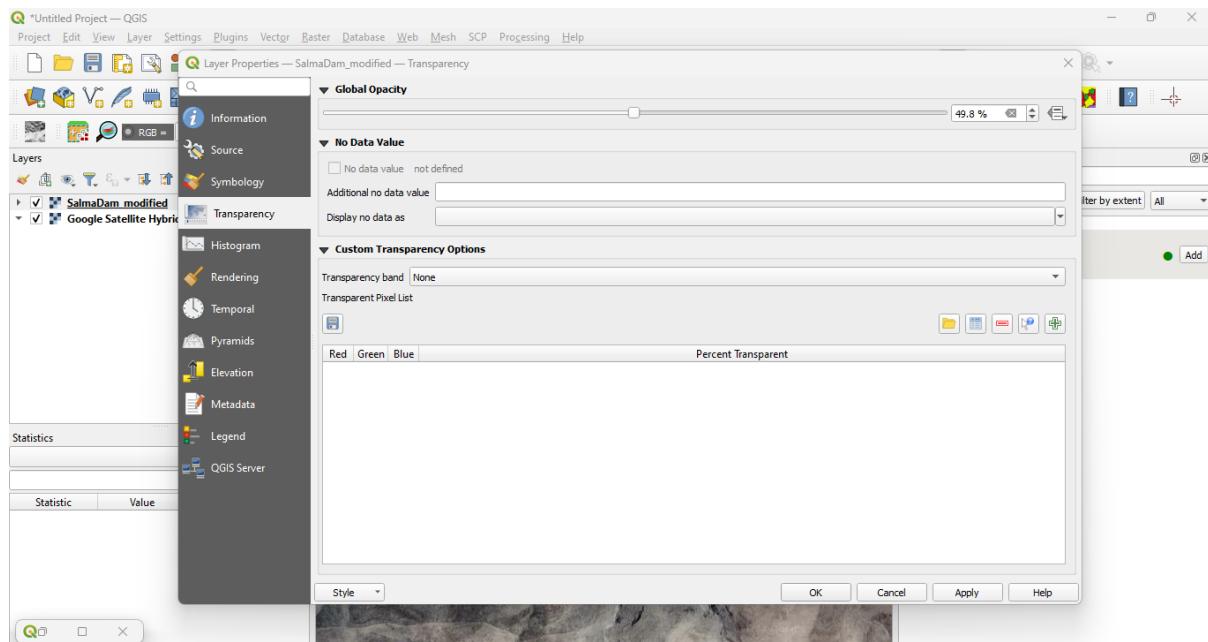
Step 19: Now after selecting Multiply and Click on Apply



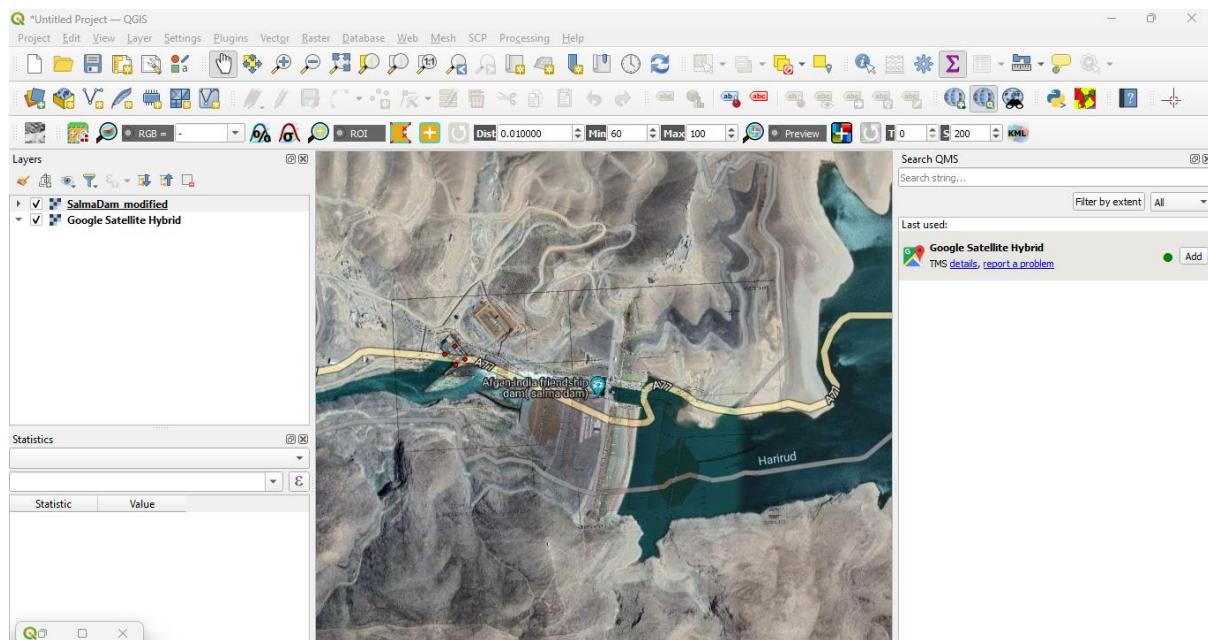
Step 20: Now the reference image and satellite image have blended into 1.



Step 21: Now to enhance it further Click on **Layer** and Select **Layer Properties** and Select **Transparency** and keep it less than **50%** and Click on **Apply**



Step 22: Now the image has overlapped with only a few elements visible.

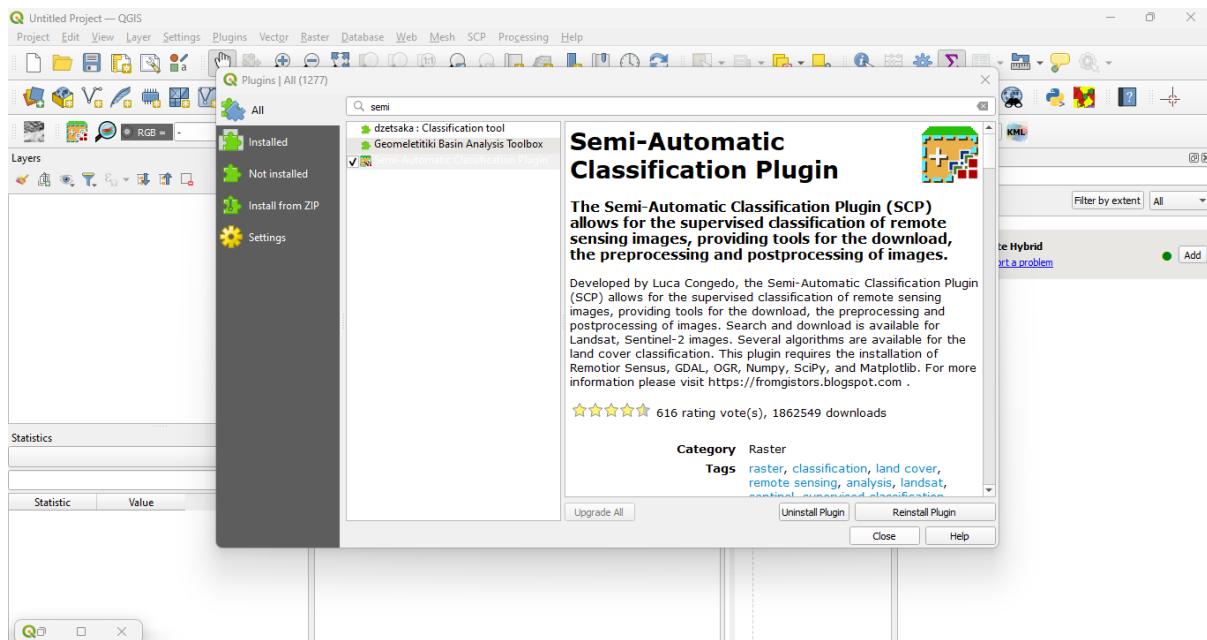


Practical: 3

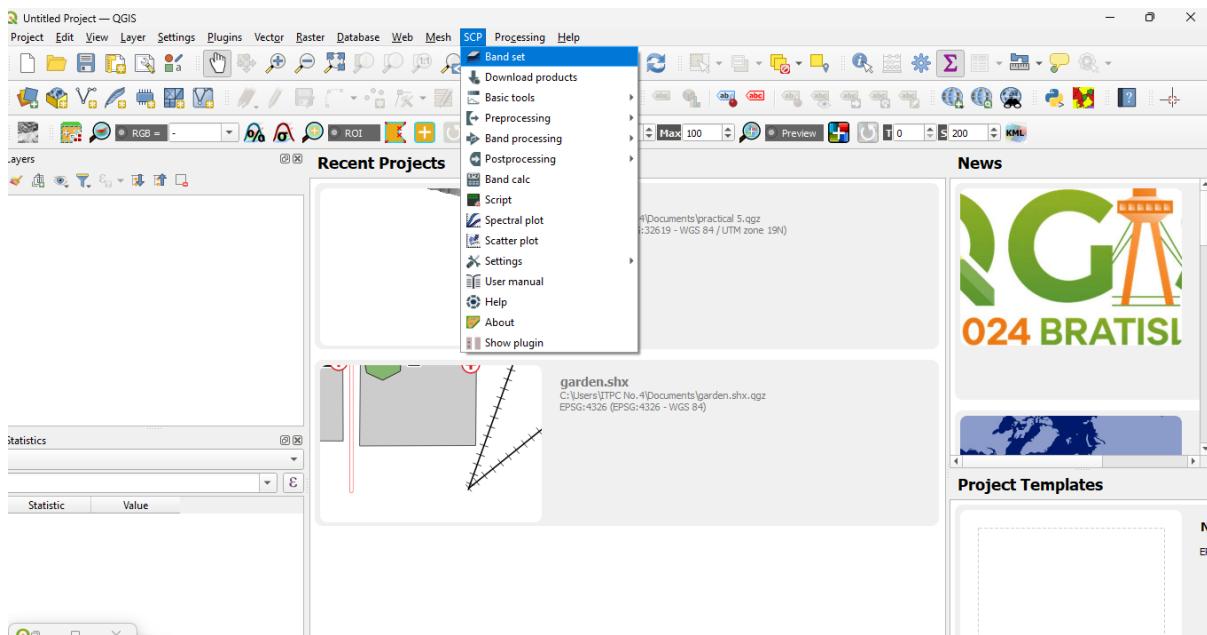
Aim: Perform contrast stretching on satellite images.

Writeup:

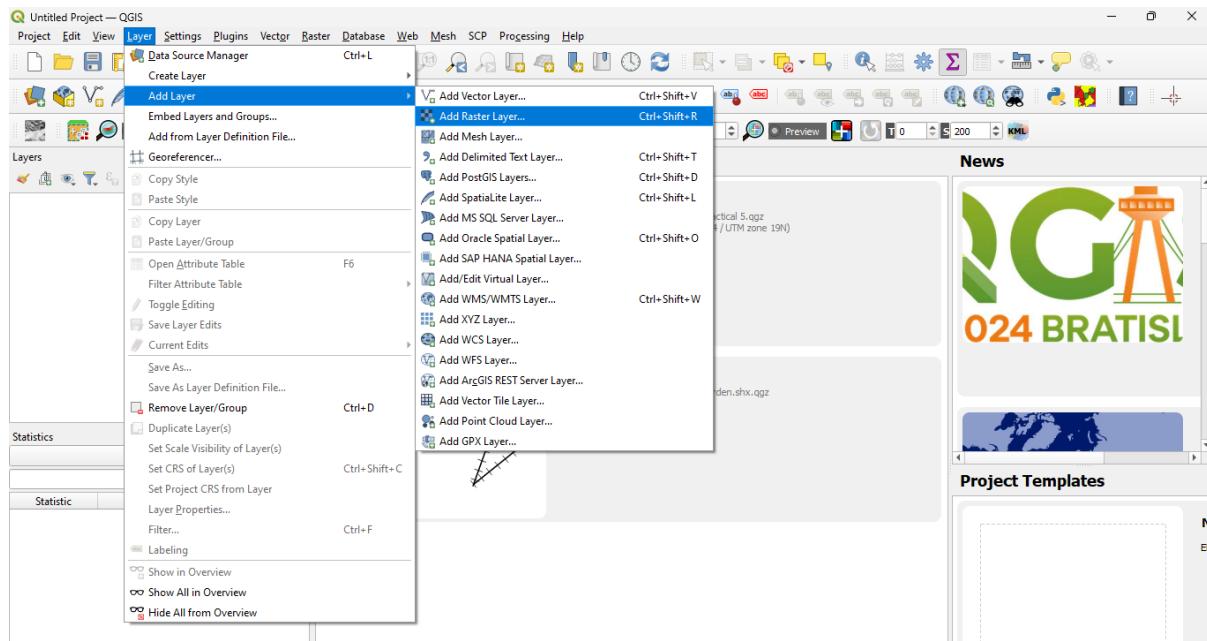
Step 1: Open QGIS and go to **Plugin** Click on **Manage and Install** and search for **semi-automatic classification** Plugin and **Install**. (Previously installed in Practical 1)



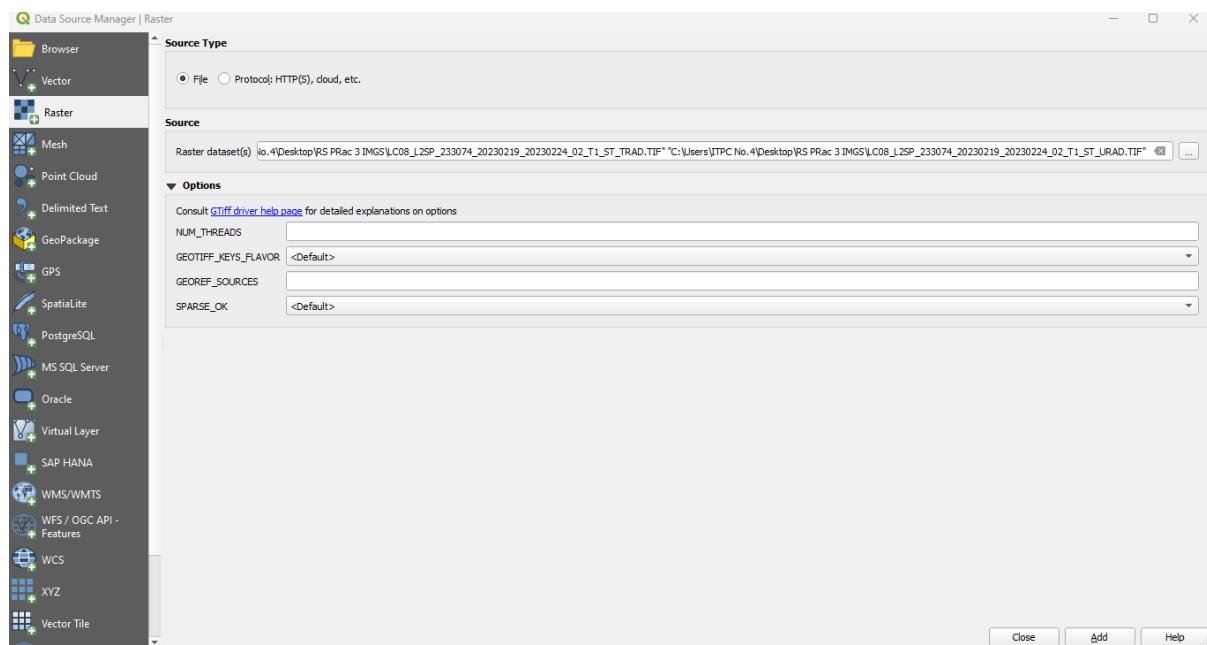
Step 2: Now Click on **SCP** and Open **Band Set**



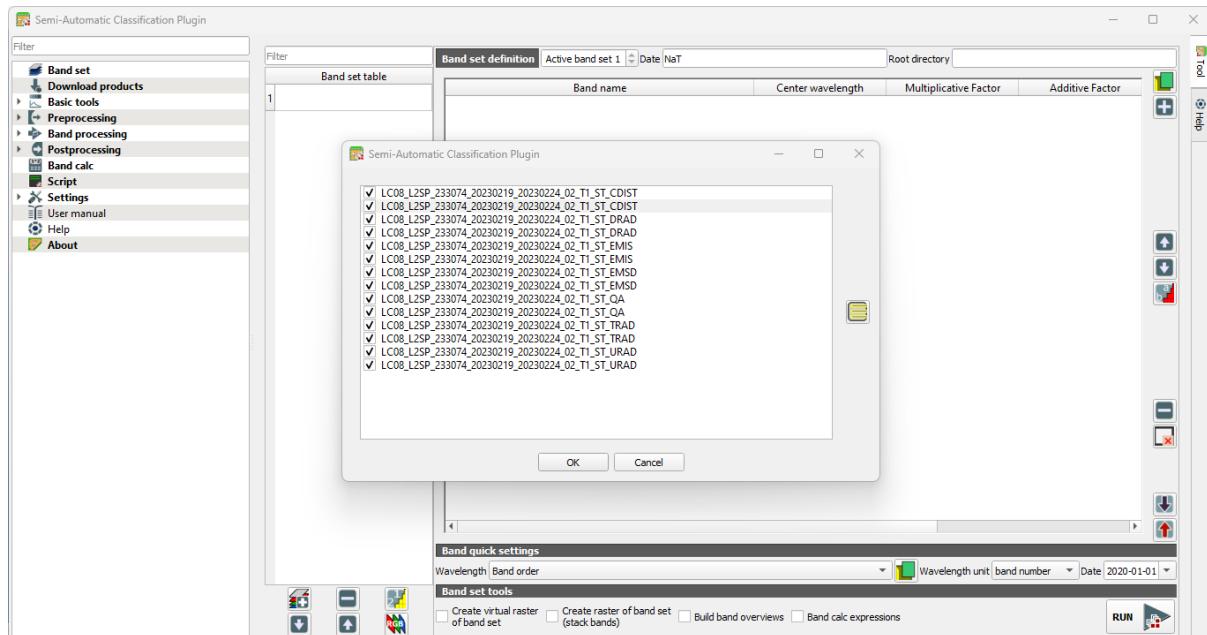
Step 3: Now Click on Layer and Select Add Layer and Click on Add Raster Layer



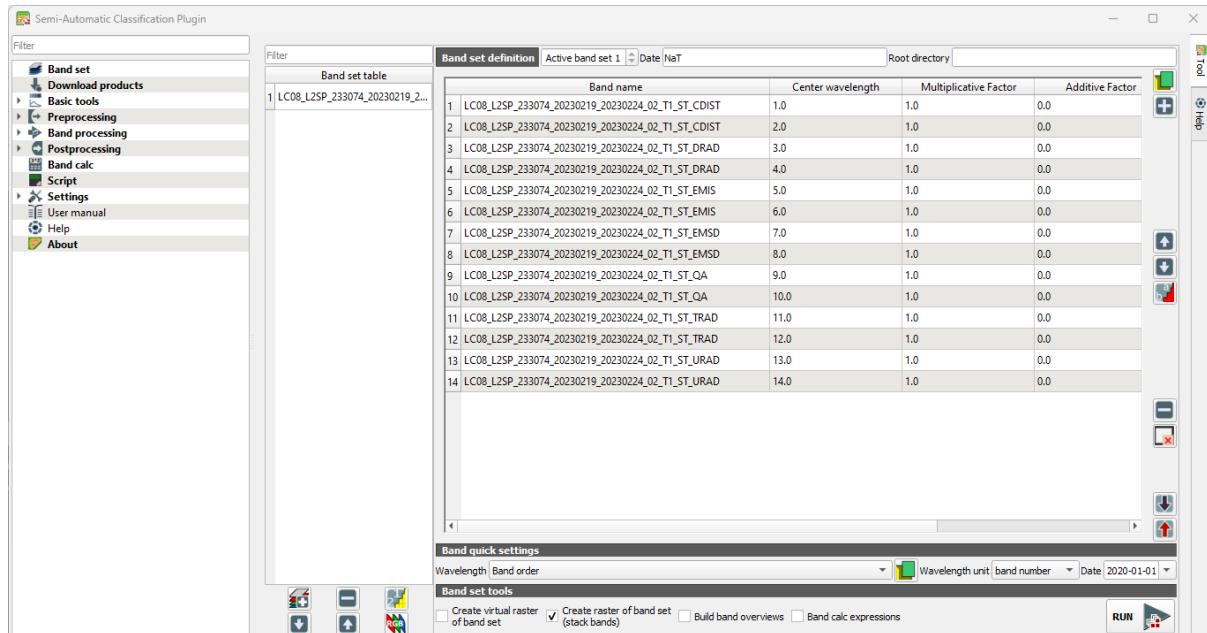
Step 4: Browse for the required files and Click Add



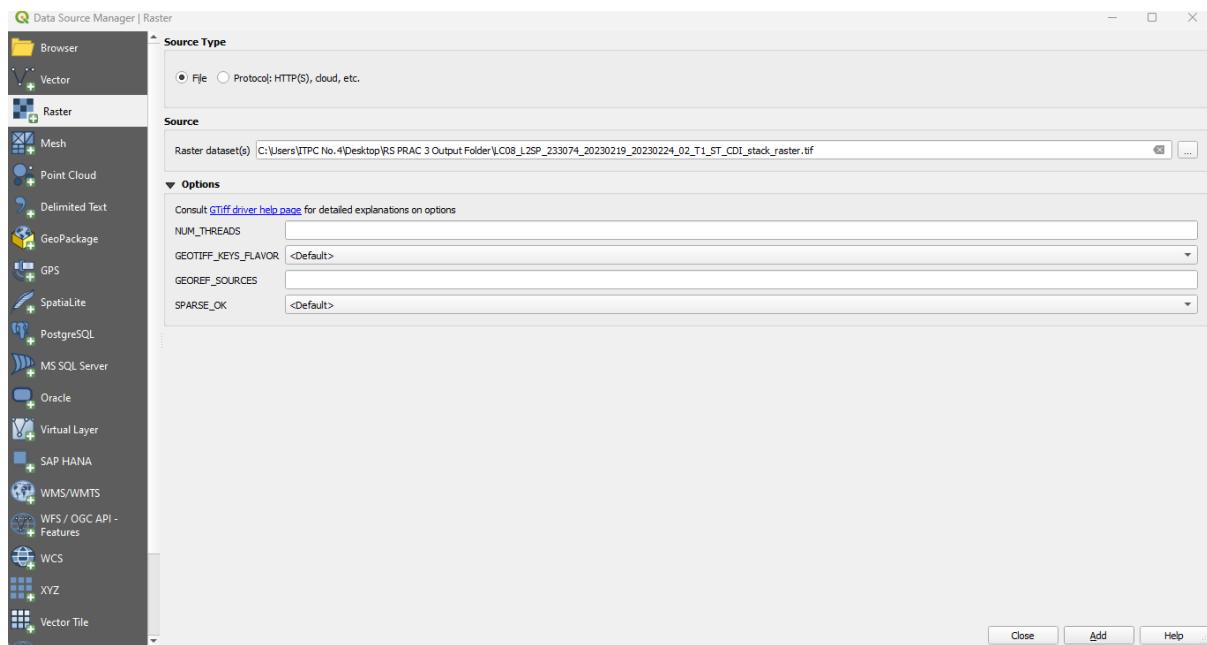
Step 5: Click on SCP and Select Band Set and Click on the Add Symbol on the Top right corner and Select All the images and Click on Ok



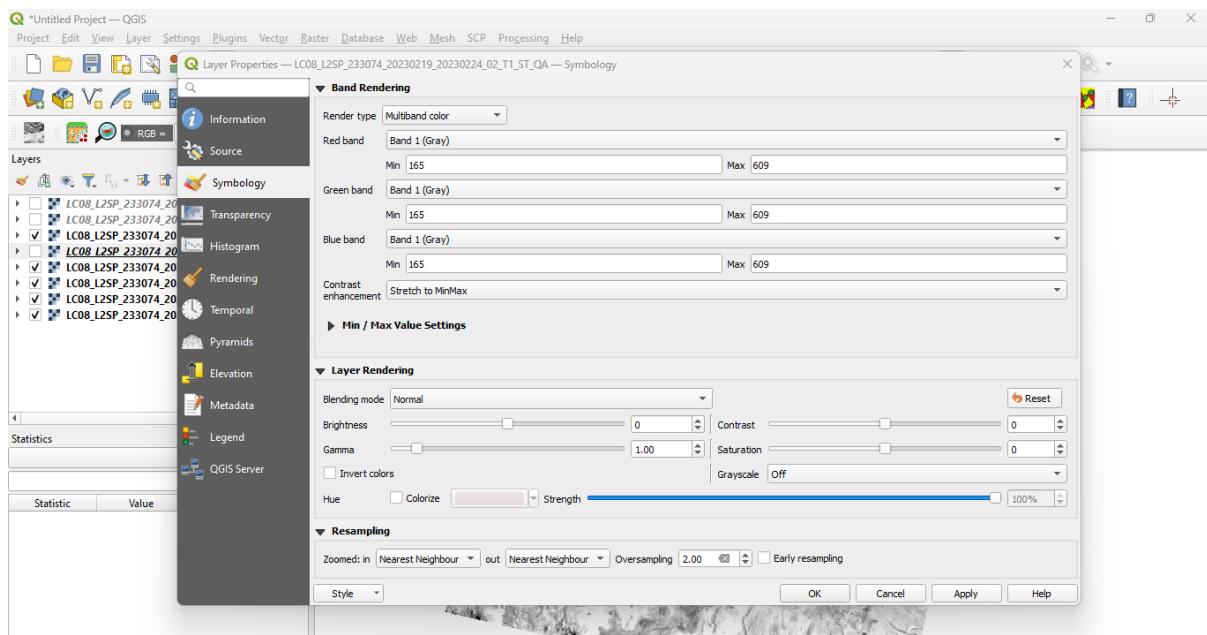
Step 6: Now Select Create raster of band sets and Click Run



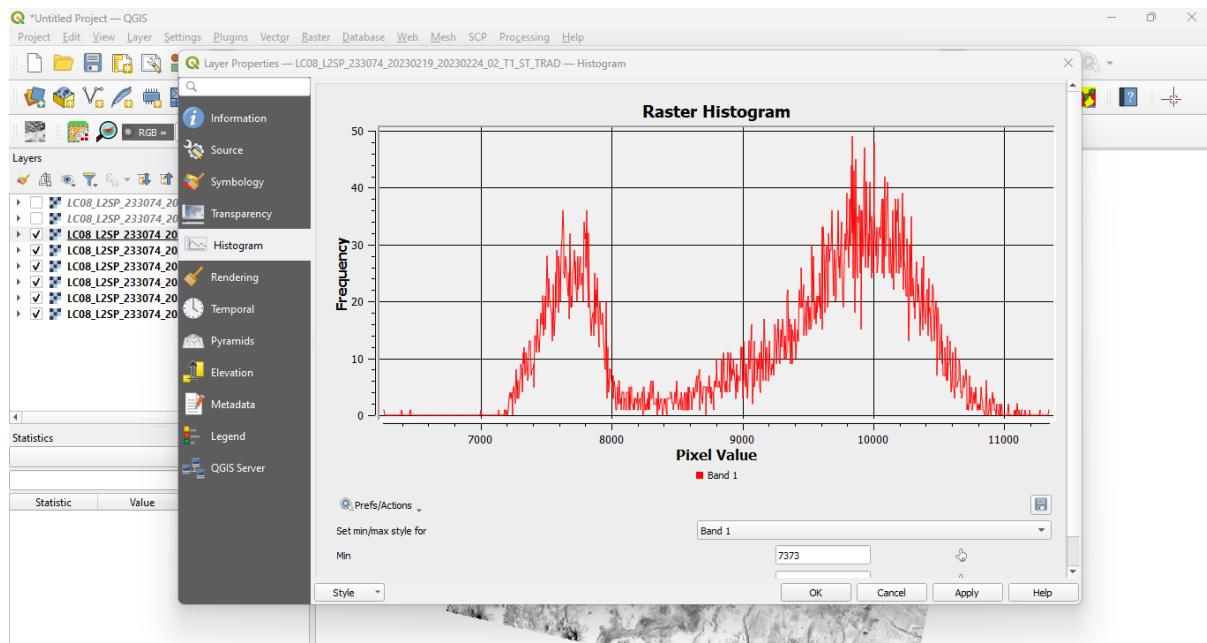
Step 7: Now Select Layer and Add Layer and Select Add Raster Layer and Browse for the newly created Output File and Click on Add



Step 8: Now Click on Layer and Select Layer Properties and Within the Symbology tab change the values of the three bands as shown below and Click Apply



Step 9: Now Click on Layer and Select Layer Properties and Click on Histogram Tab and Click on Compute Histogram

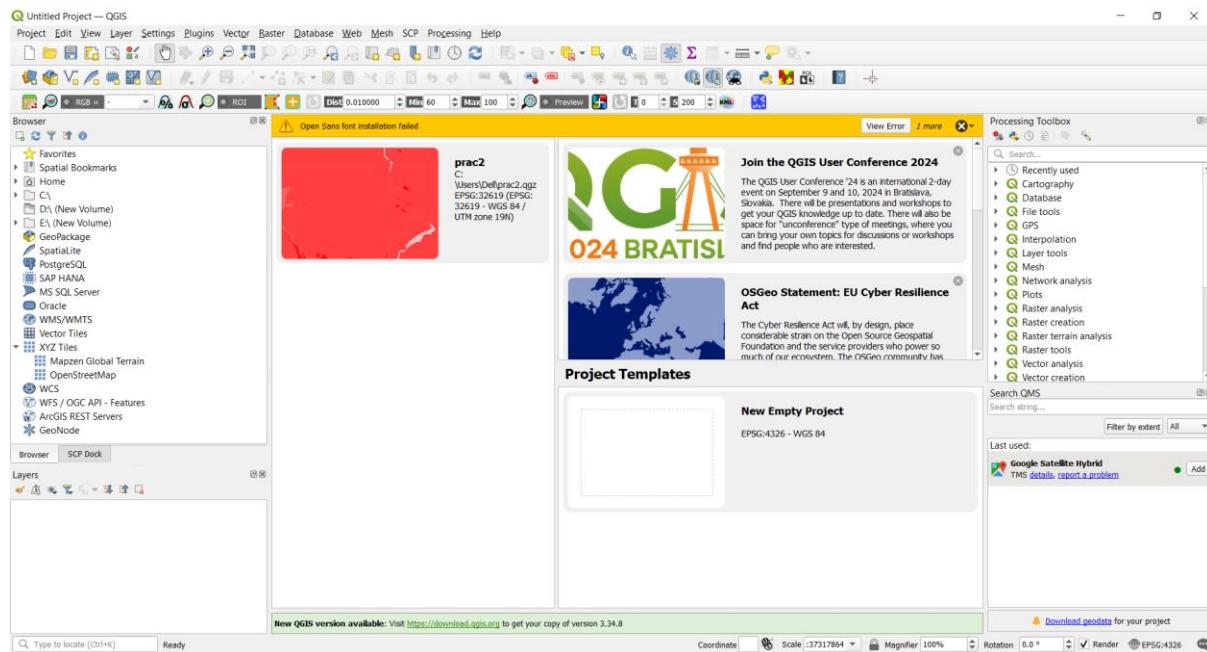


Practical: 4

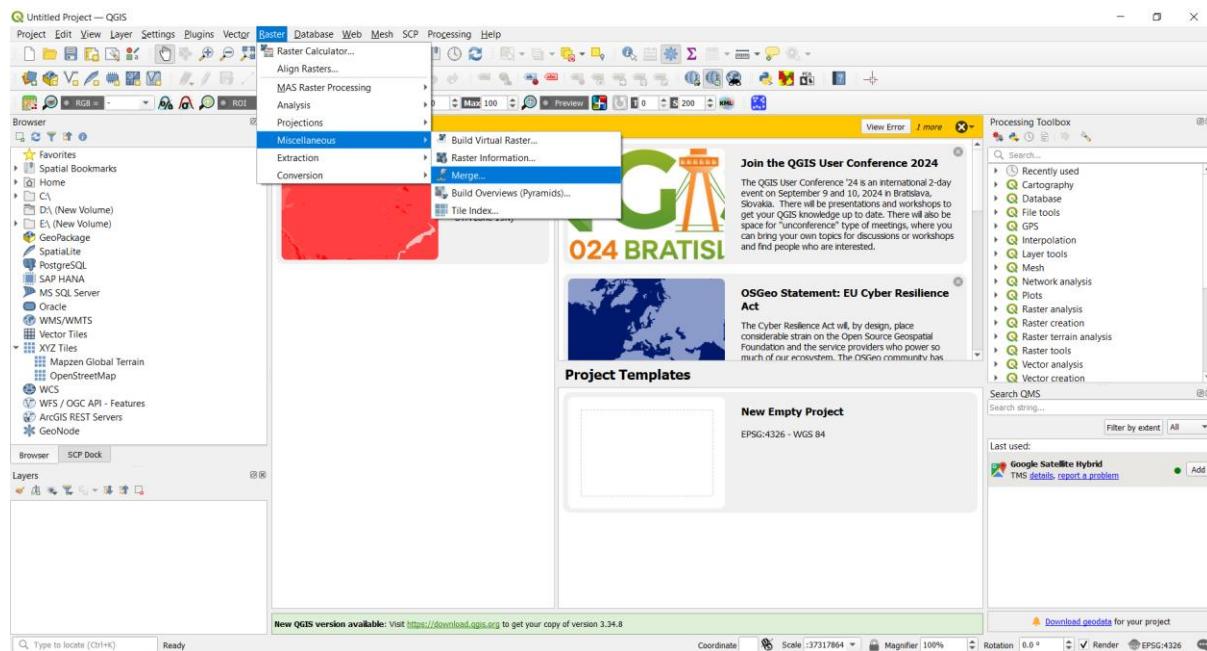
Aim: Enhance the satellite image using Pseudocolor image processing.

Writeup:

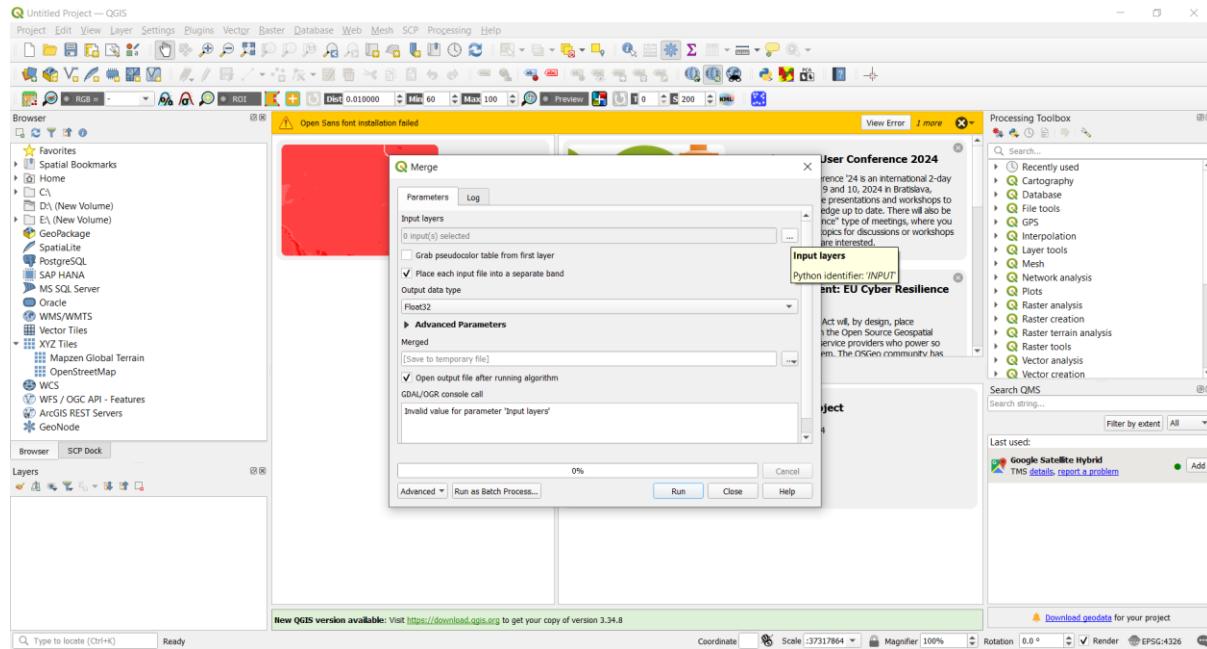
Step 1: Open QGIS



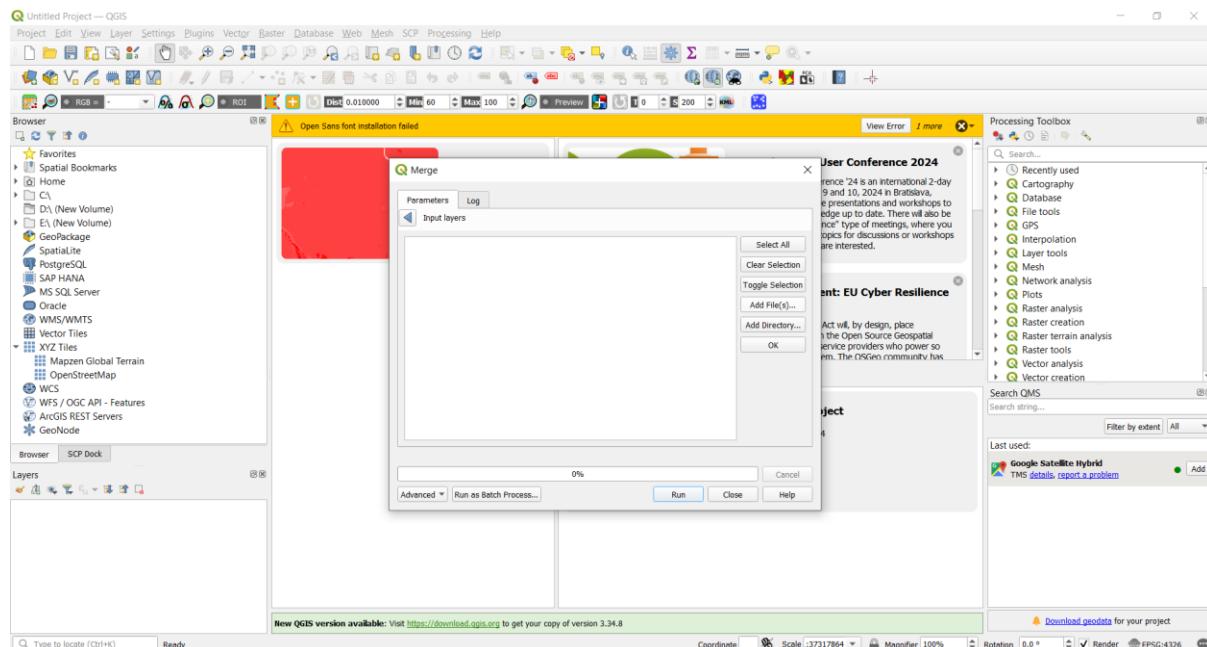
Step 2: Click on Raster then Select Miscellaneous and then Select Merge



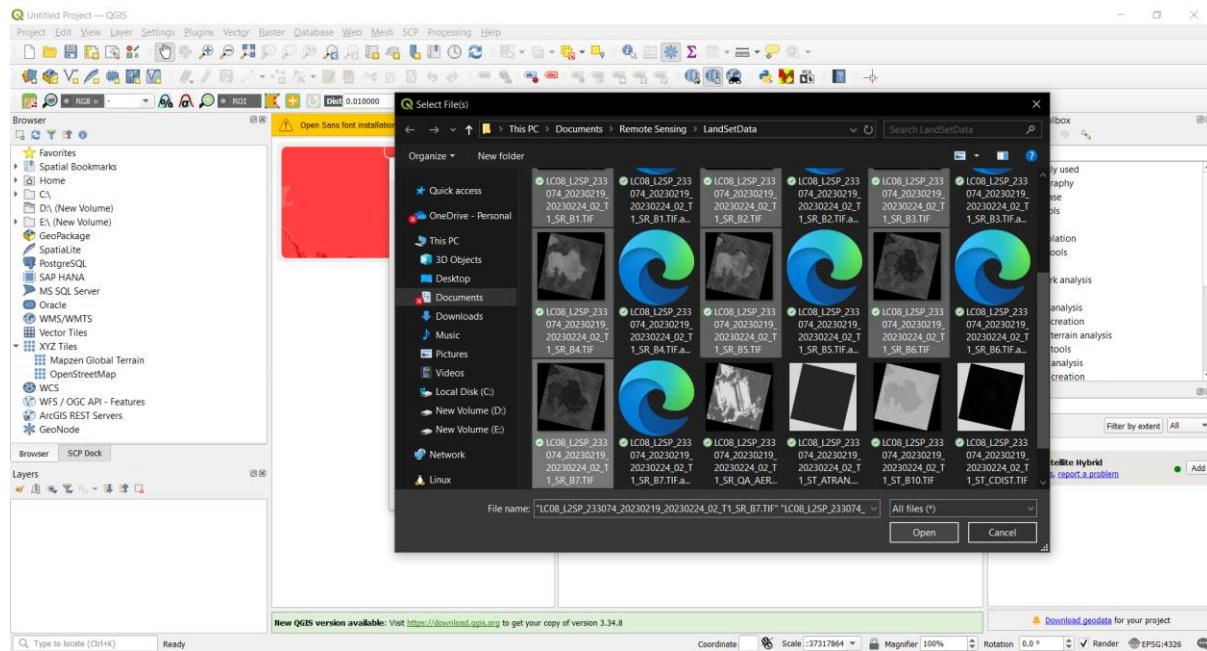
- Click on Browse and then Select Input layers



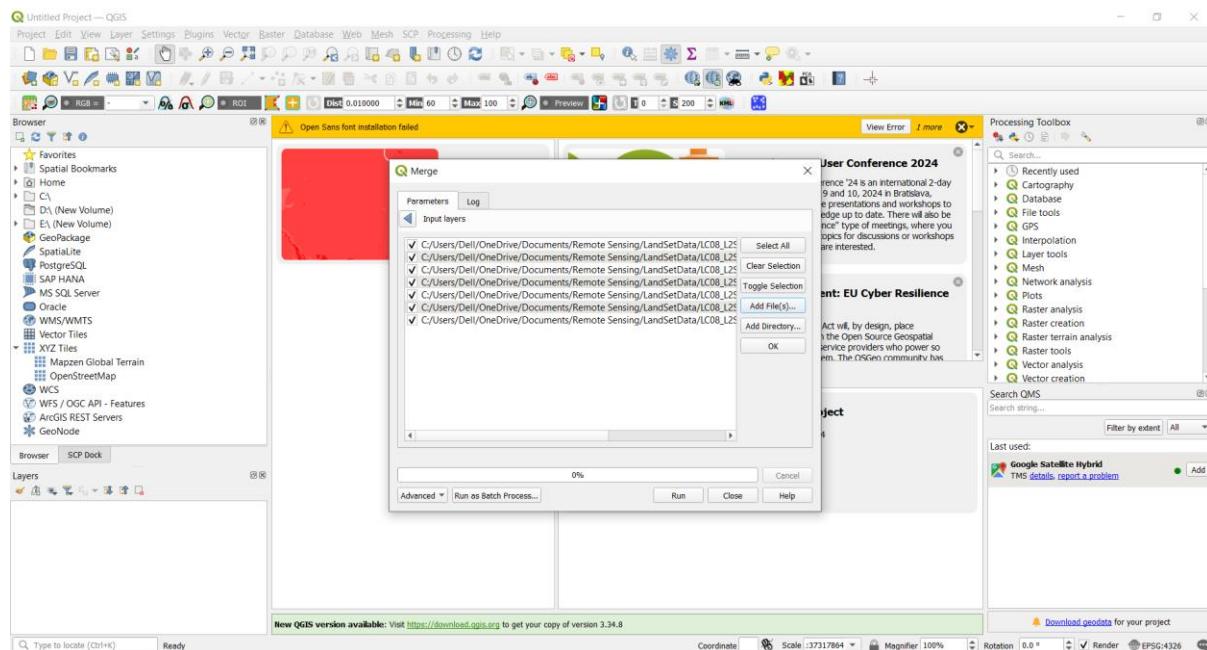
- Click on Add File



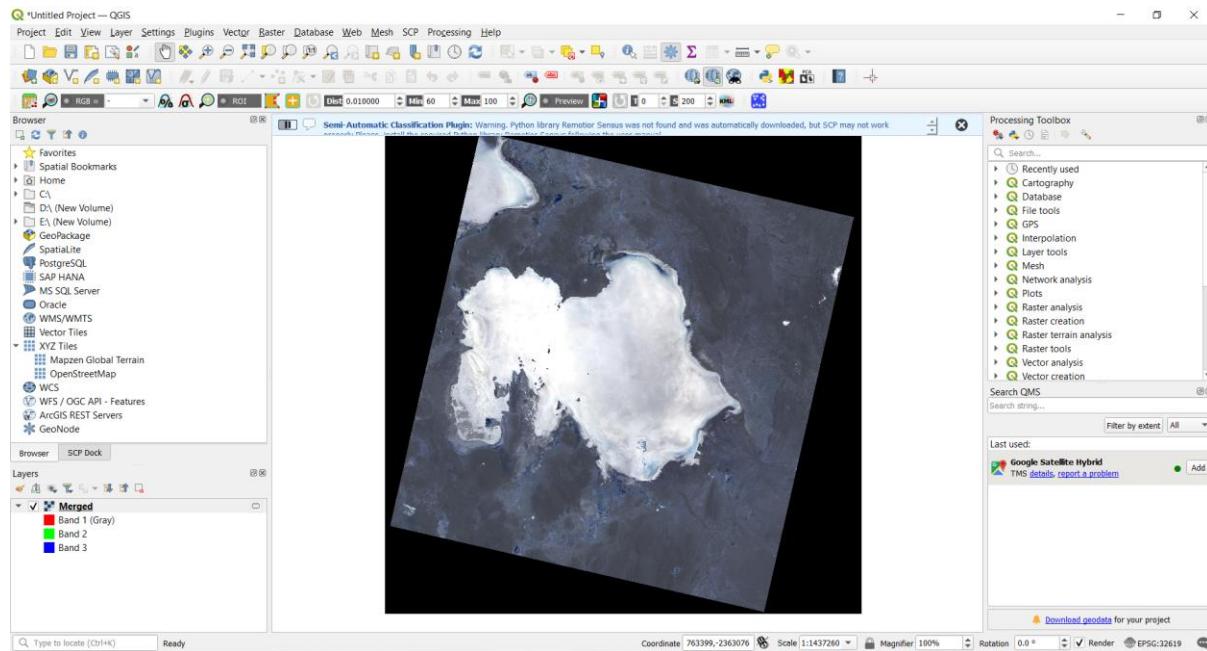
- Select 7 TIF File and then Click on Open



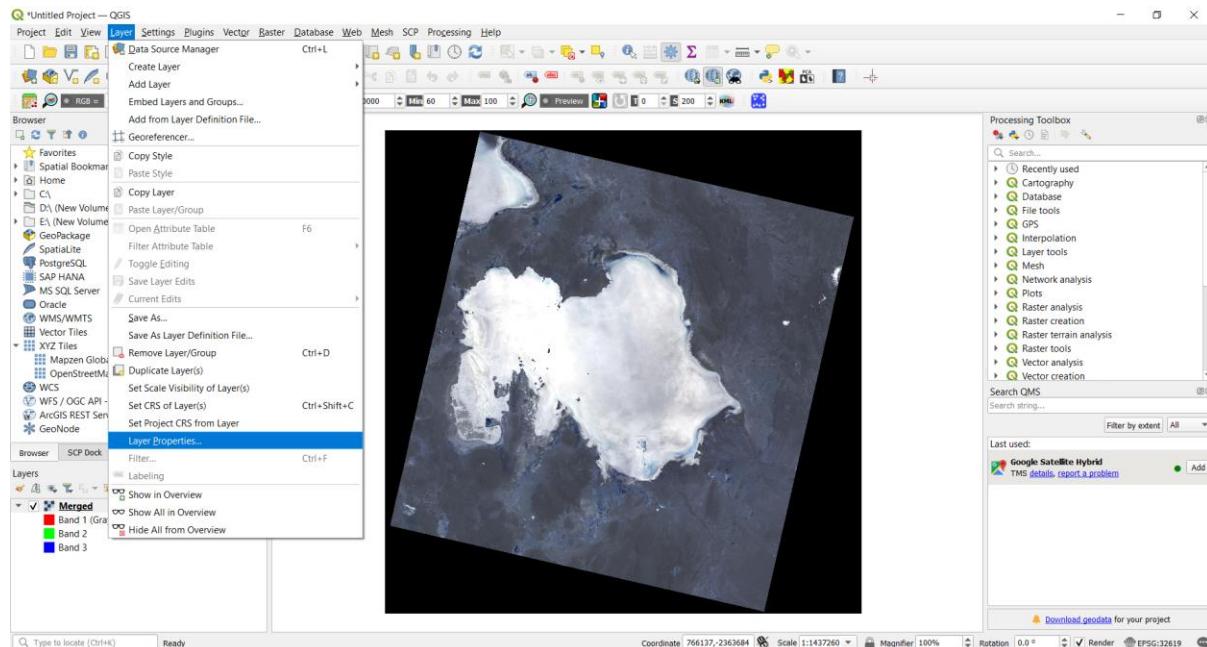
- Click on Run



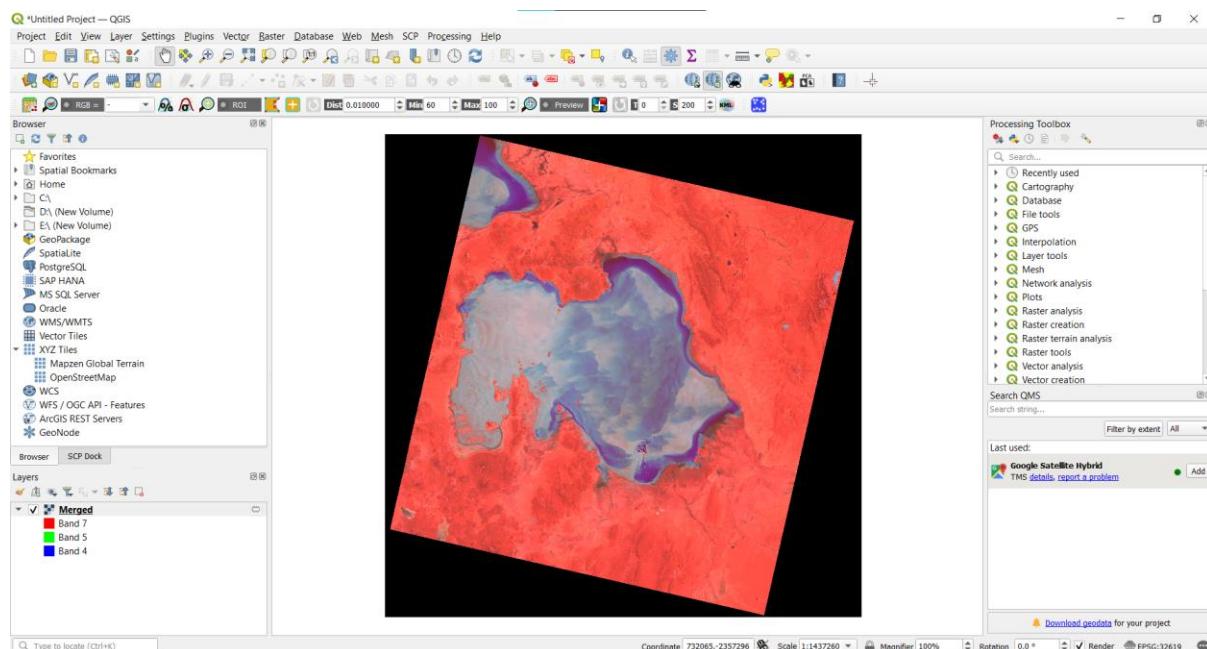
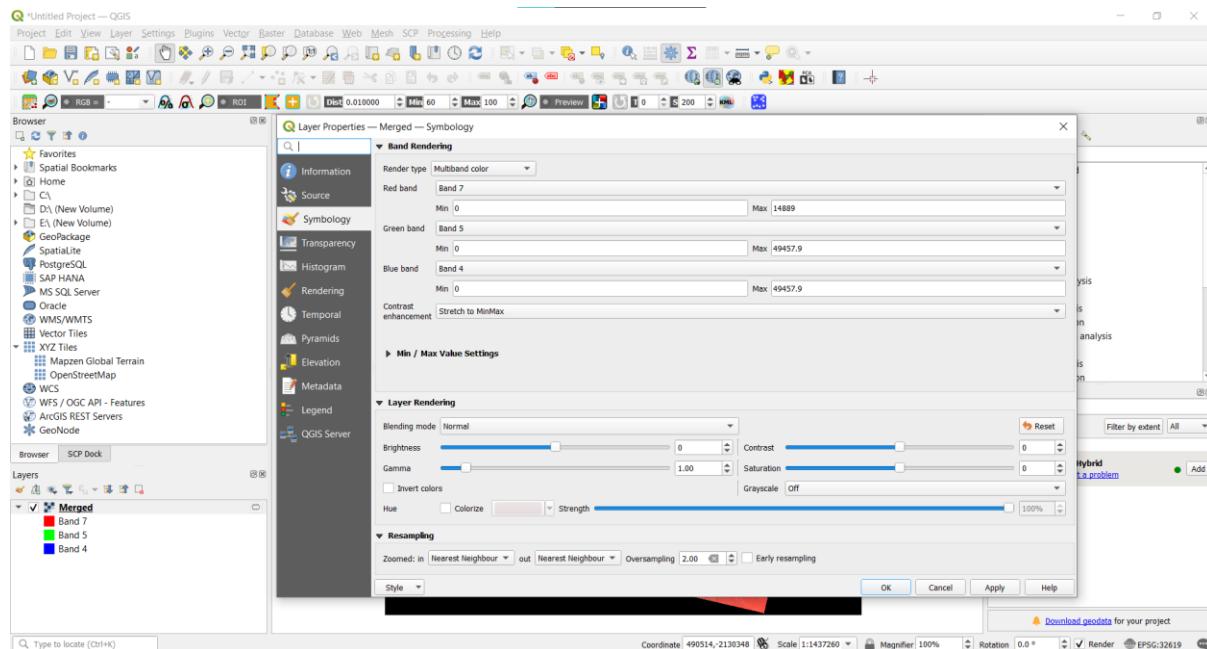
- So all the seven image files are successfully merged together.



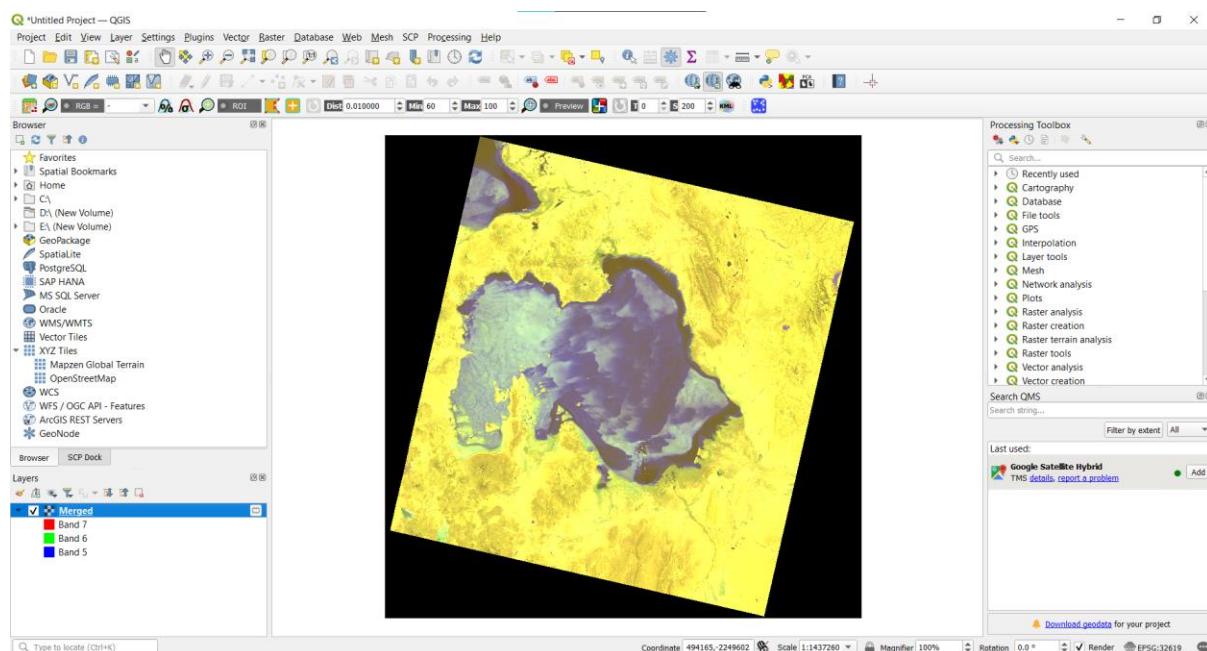
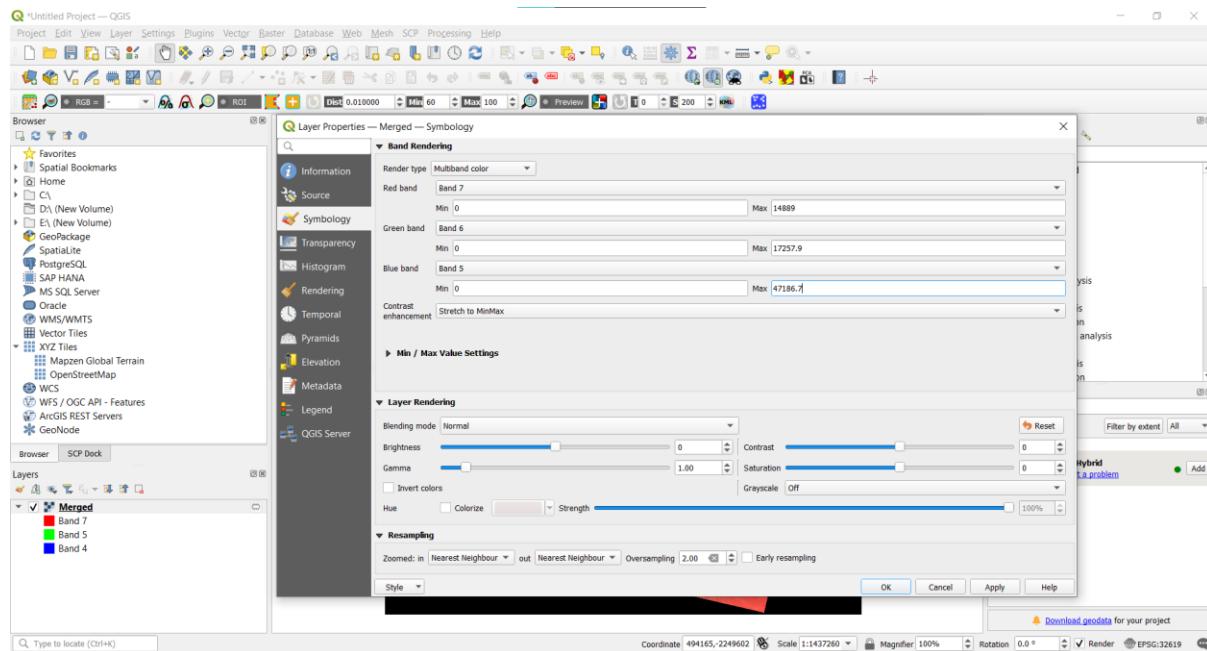
Step 3: Click on Layer and then Select Layer Properties



- Click on symbology, Change, render type to multiband color” and keep changing the rest of the RGB bands according to your needs for more enhancement using Pseudocolor image processing.



- Here is one more example of using **Pseudocolor** image processing with different bands and their respective values.

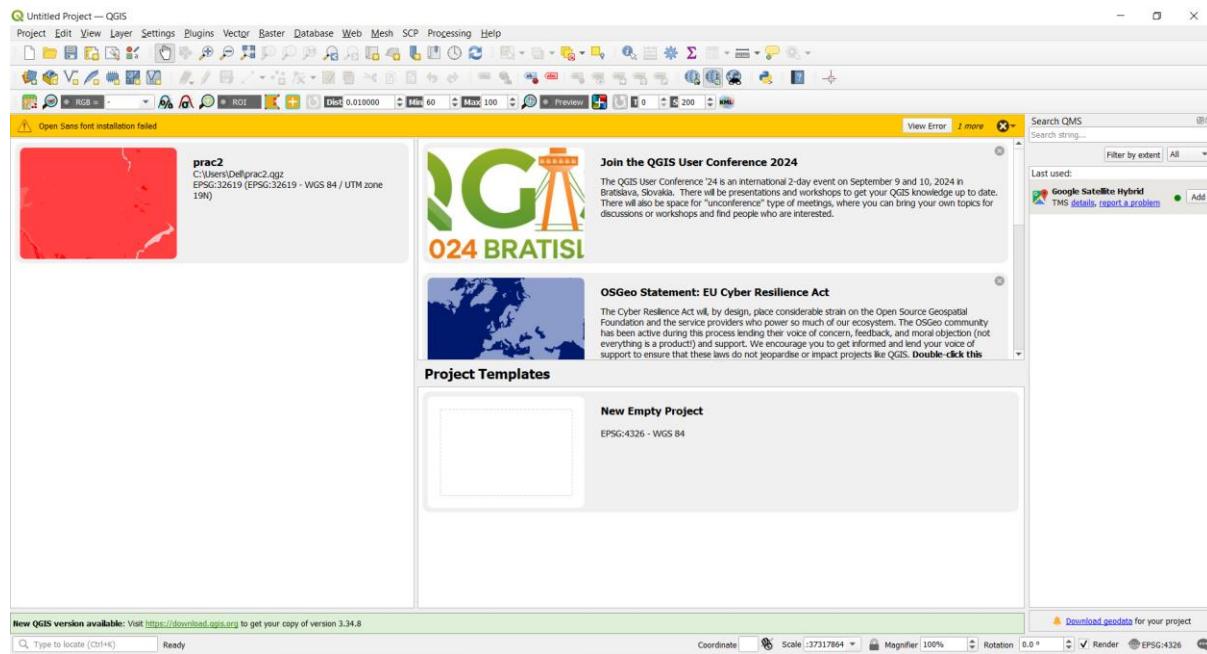


Practical: 5

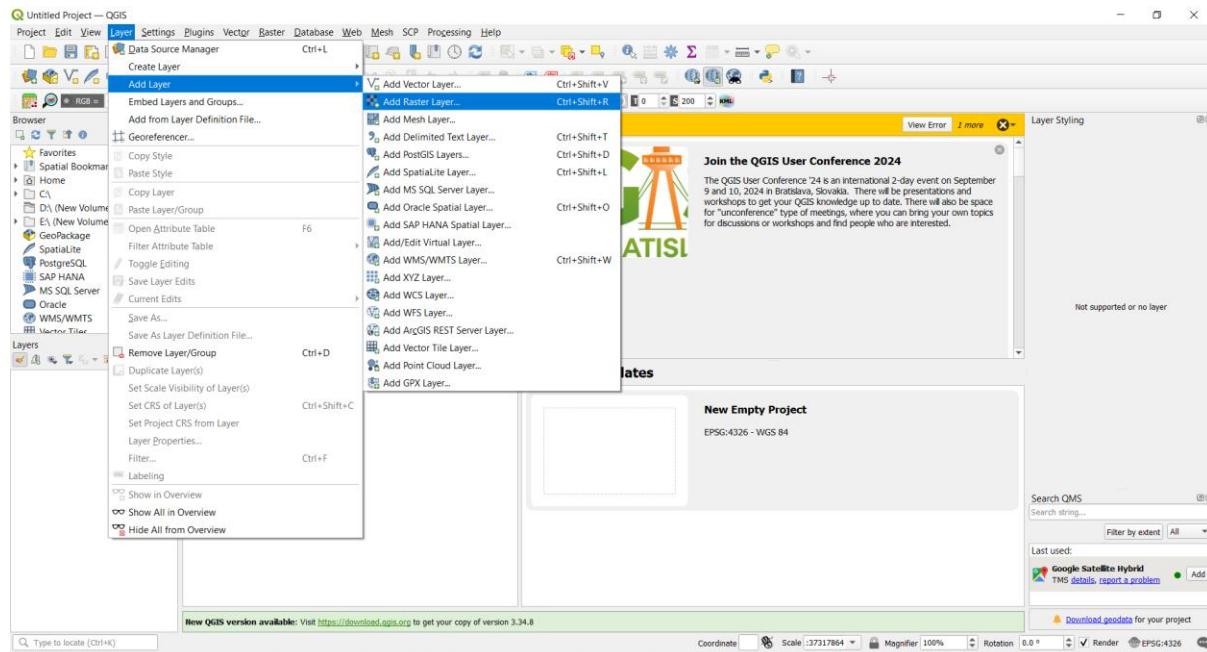
Aim: Apply different supervised classification techniques to classify the satellite image.

Writeup:

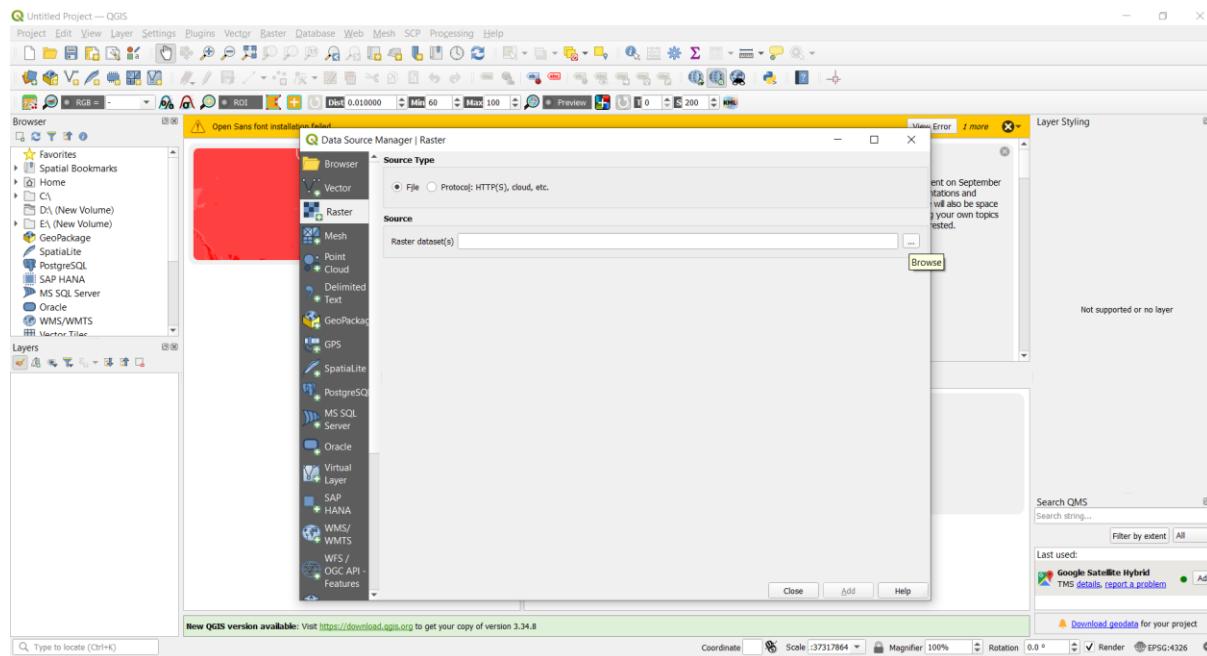
Step 1: Open QGIS



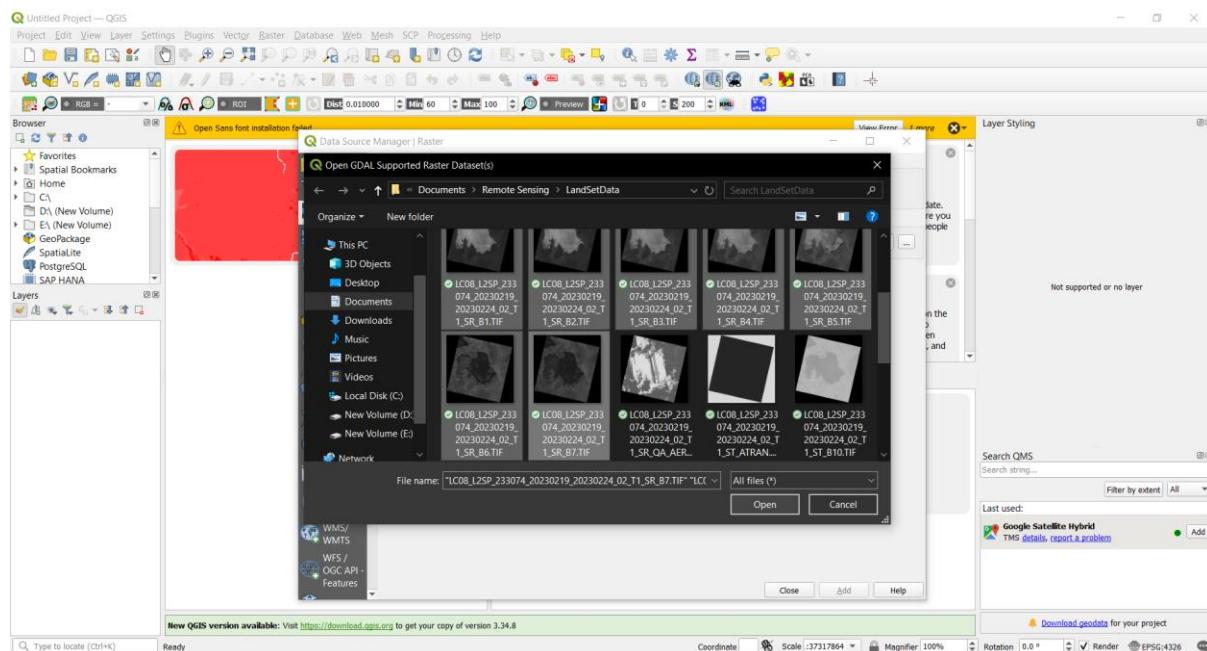
Step 2: Click on Layer and Select Add Layer and then Select Add Raster Layer



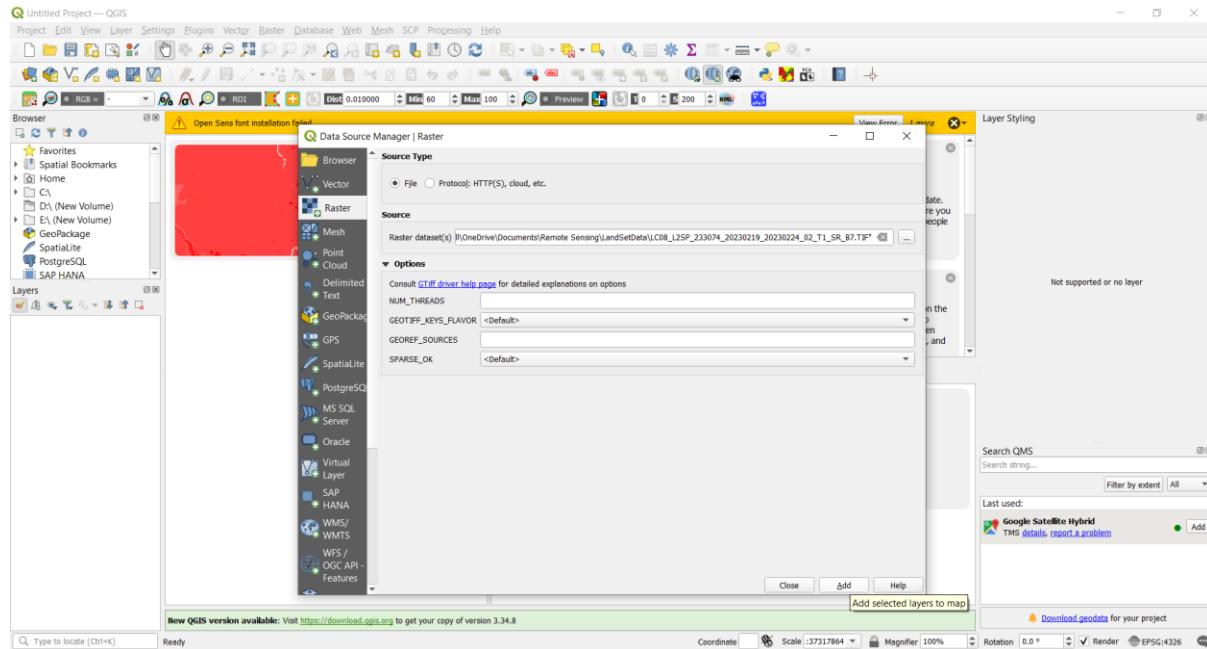
Step 3: Select Source Type File and then Click on Browse



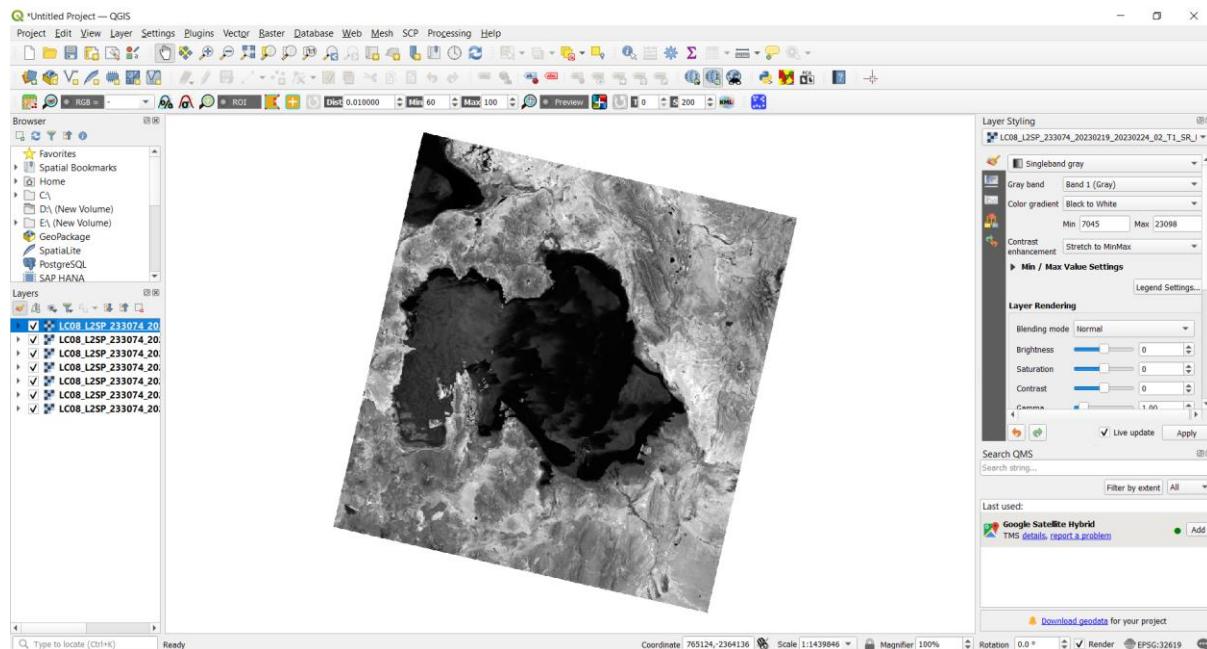
Step 4: Select at least 7 Tif files and then Click on Open



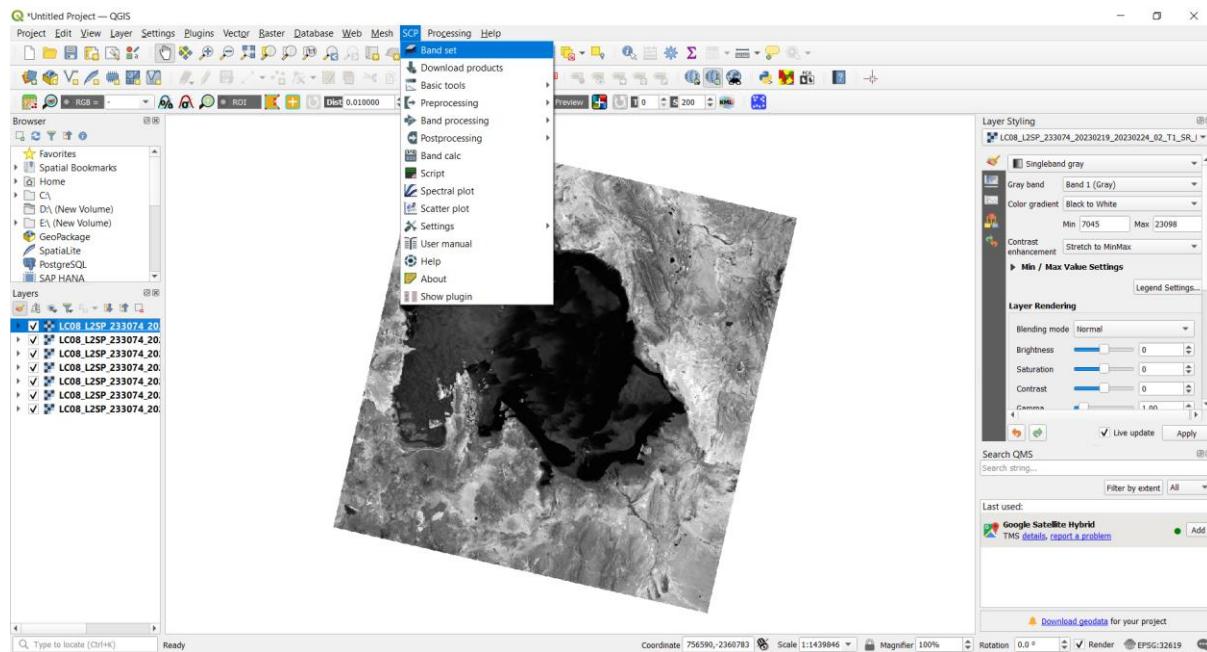
- Click on Add



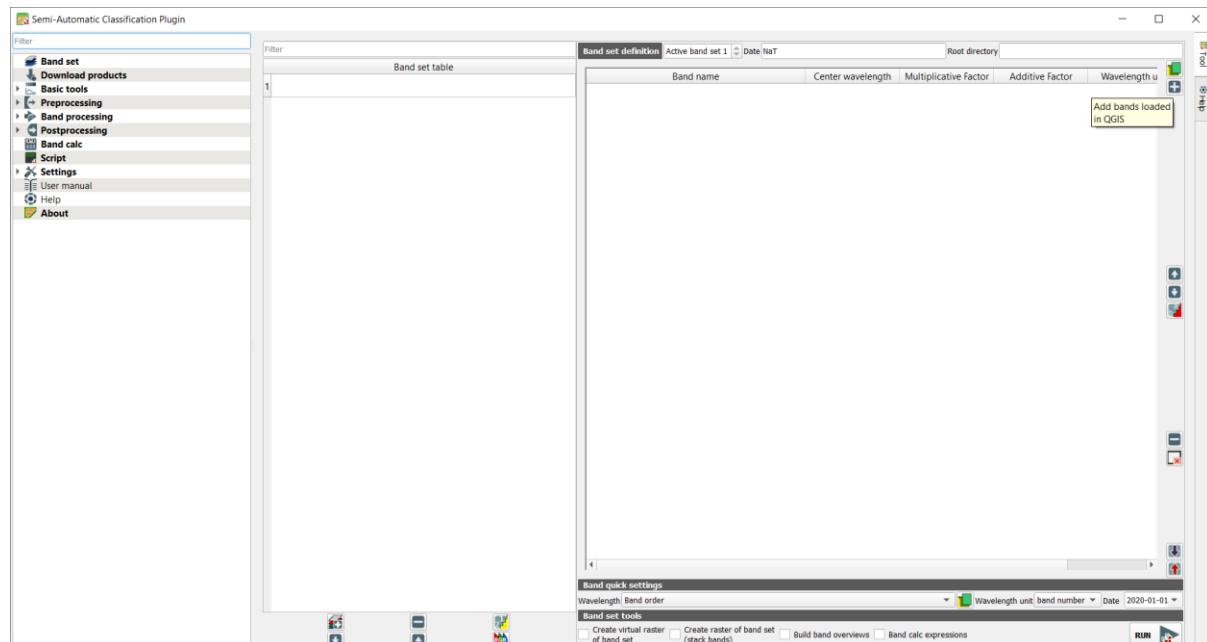
- landsat 8 satellite image



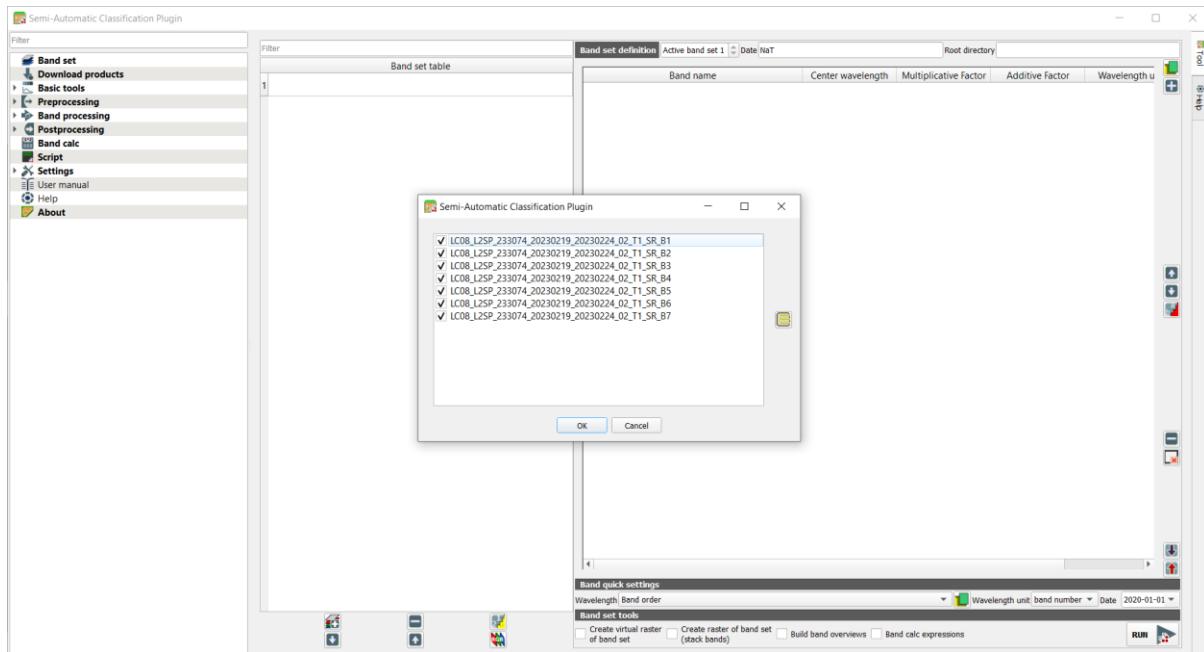
Step 5: Click on SCP and then Select Band set



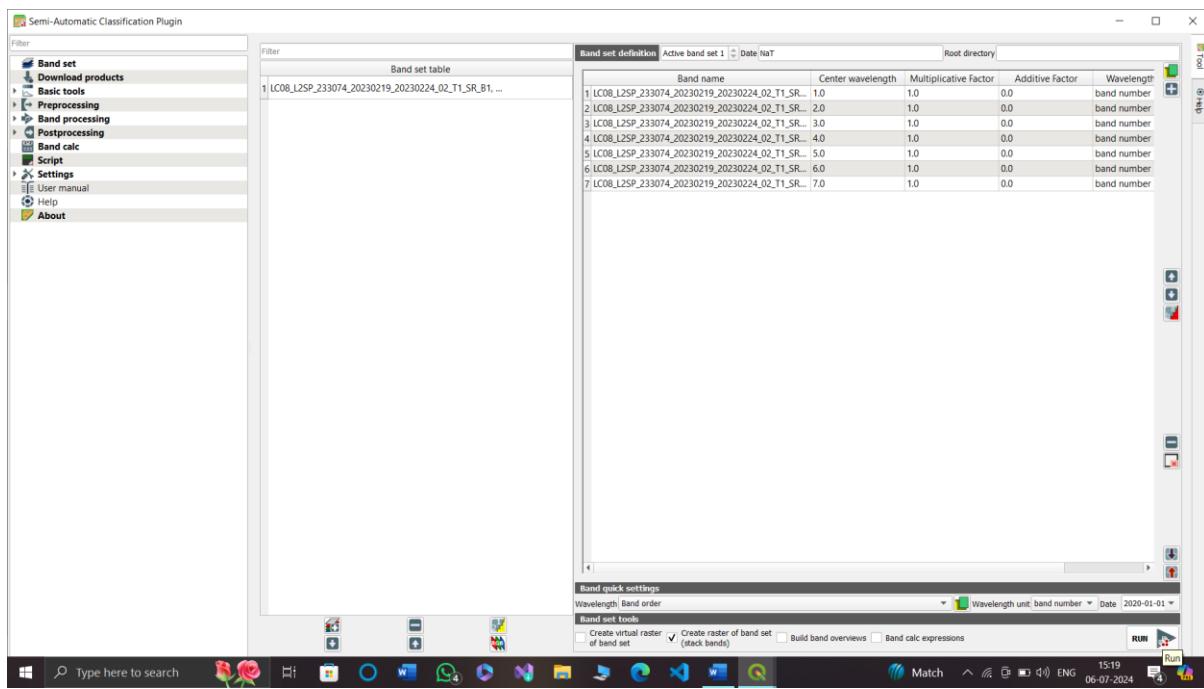
- Click on Add bands loaded in QGIS



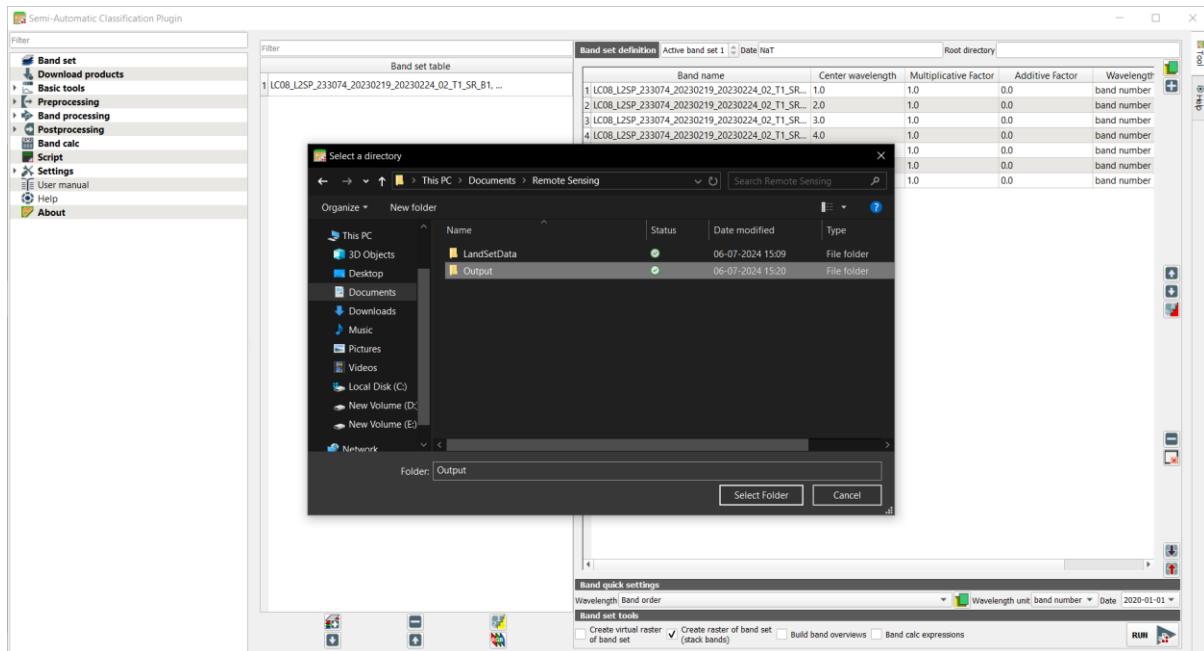
- Select All Files and then Click on OK



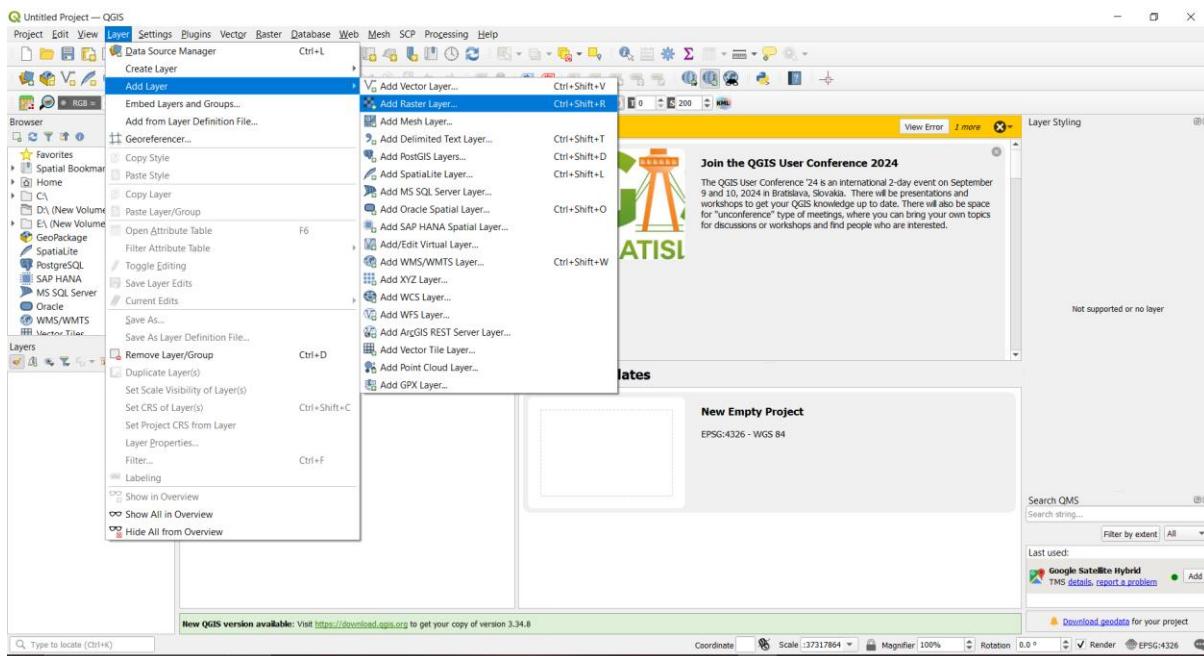
- Check Create raster of band set (stack bands) and then Click on Run



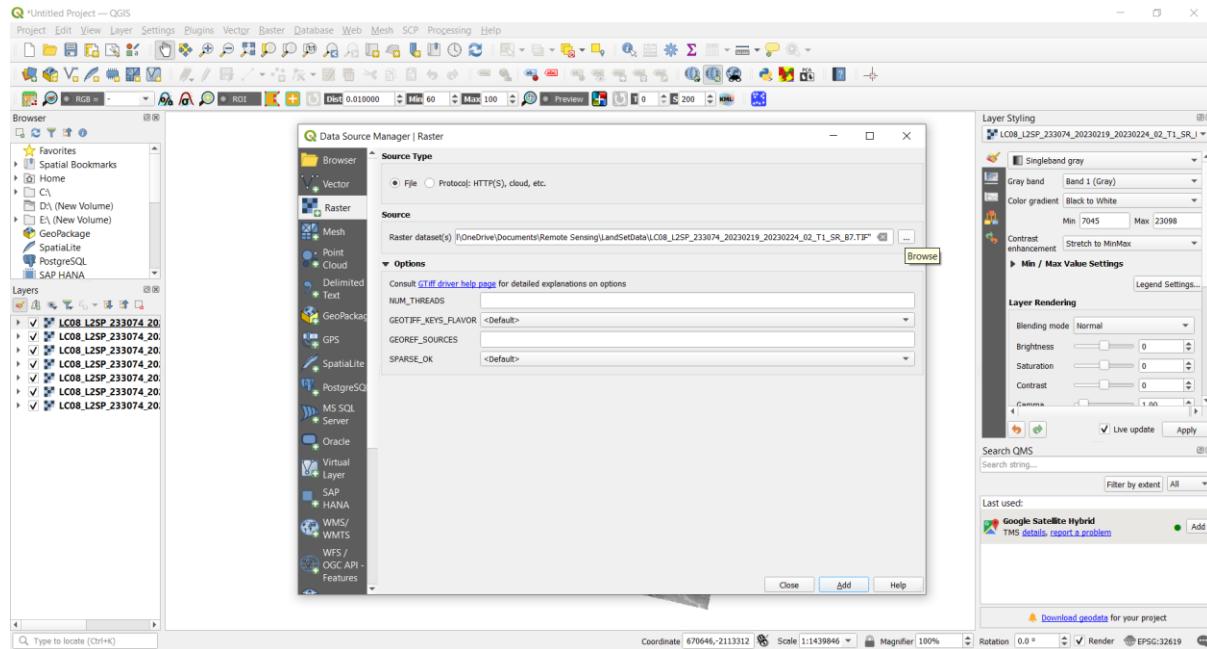
- Create New folder and Give Name **Output** and then Click on Select Folder



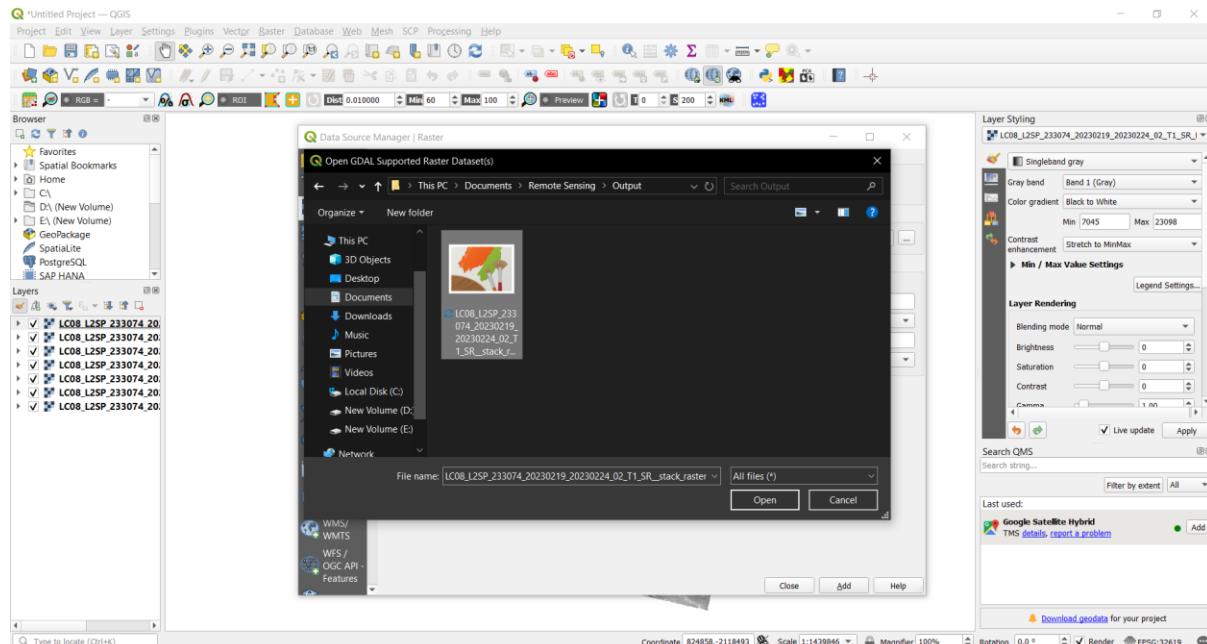
Step 6: Again, Click on Layer and Select Add Layer and then Select Add Raster Layer



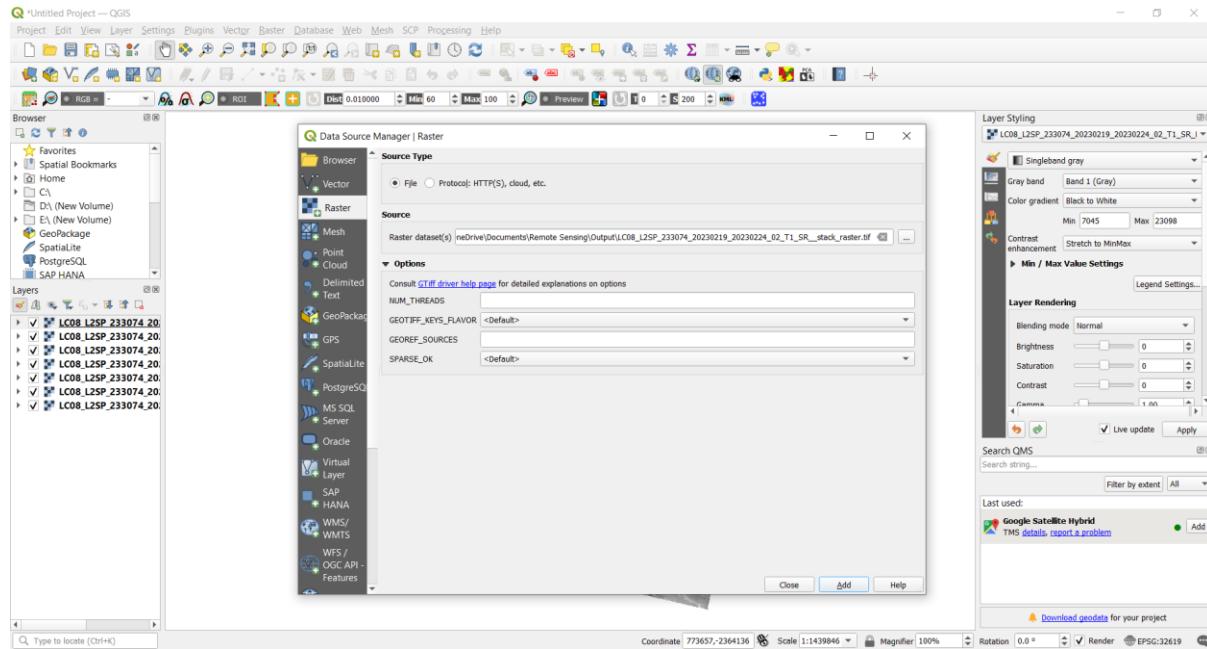
- Select Source Type File and then Click on Browse



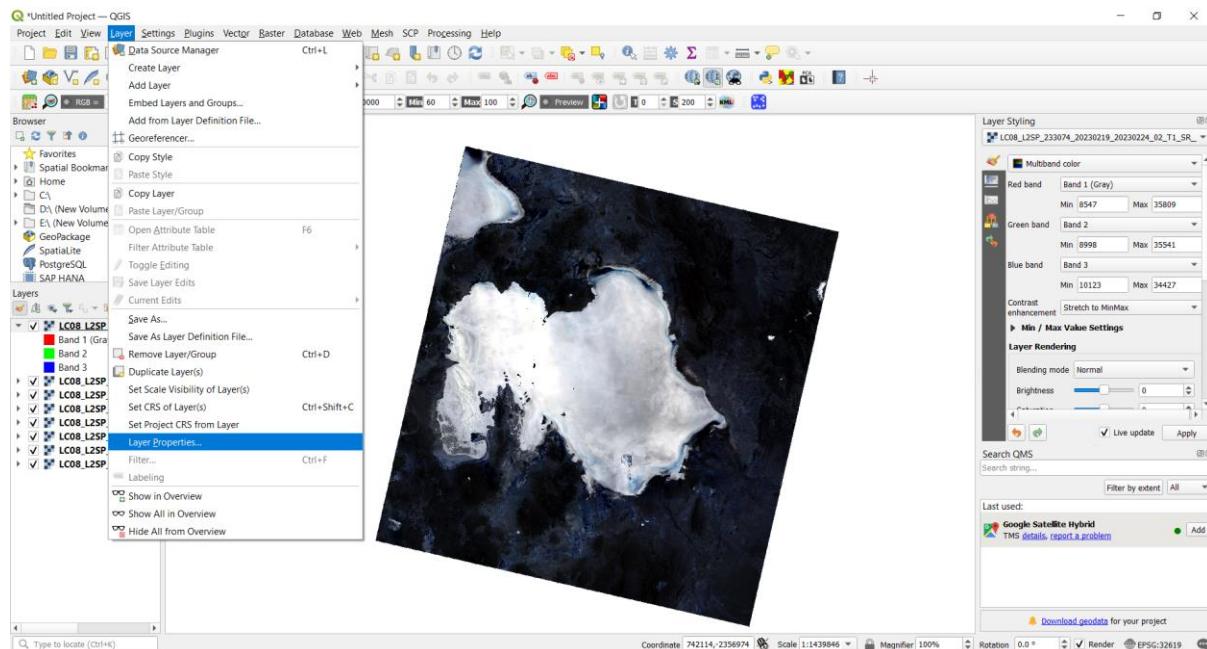
- Select stack raster files and then Click on Open



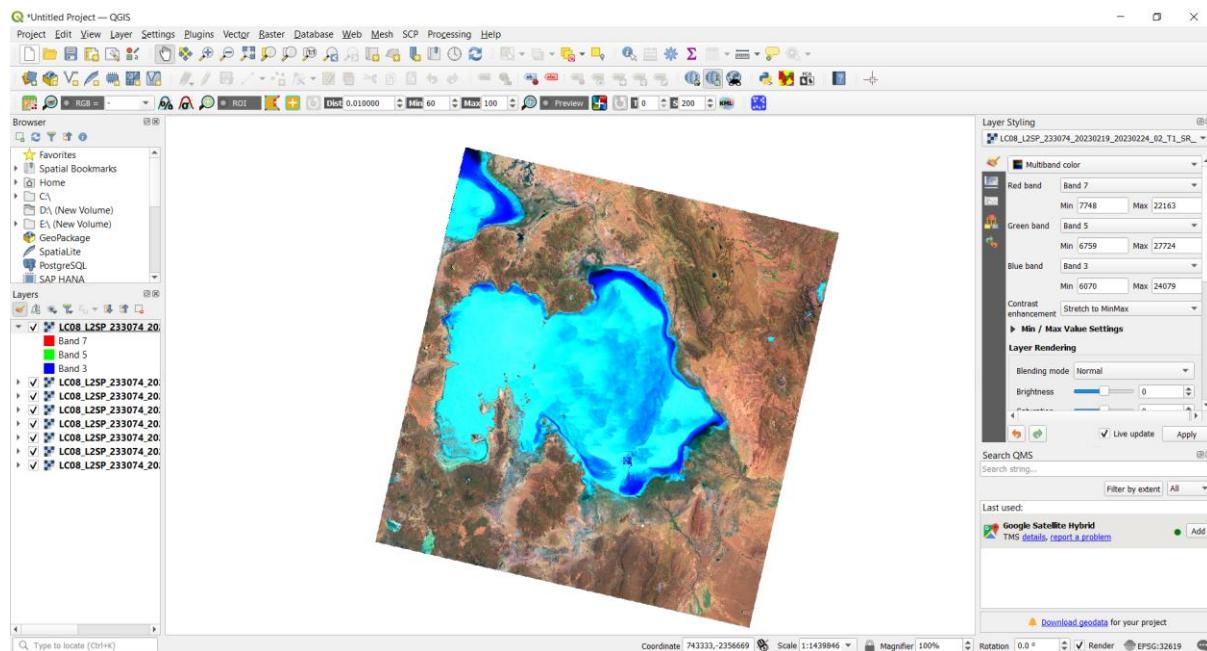
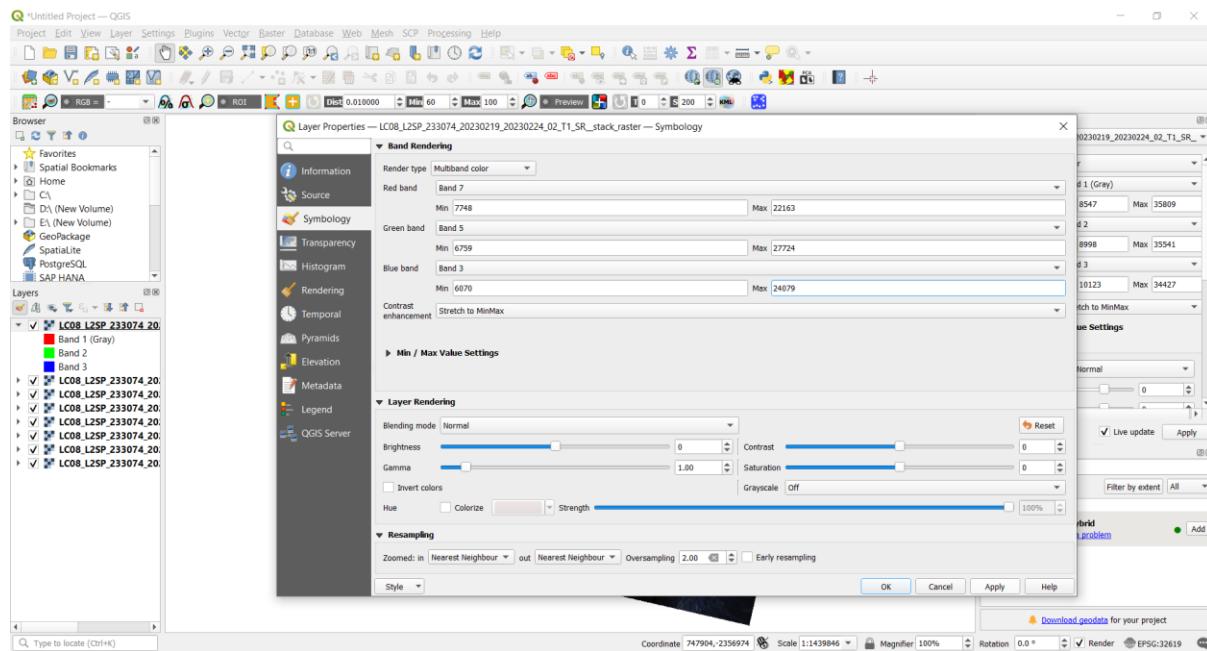
- Click on Add



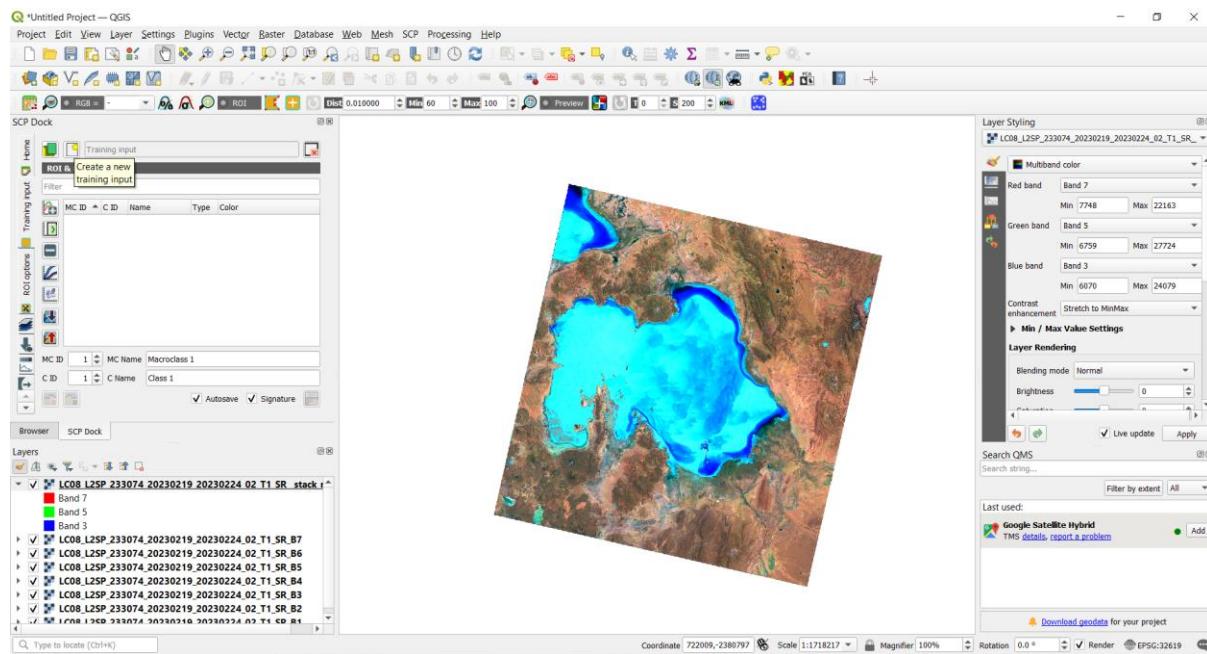
Step 7: Click on Layer and then Select Layer Properties



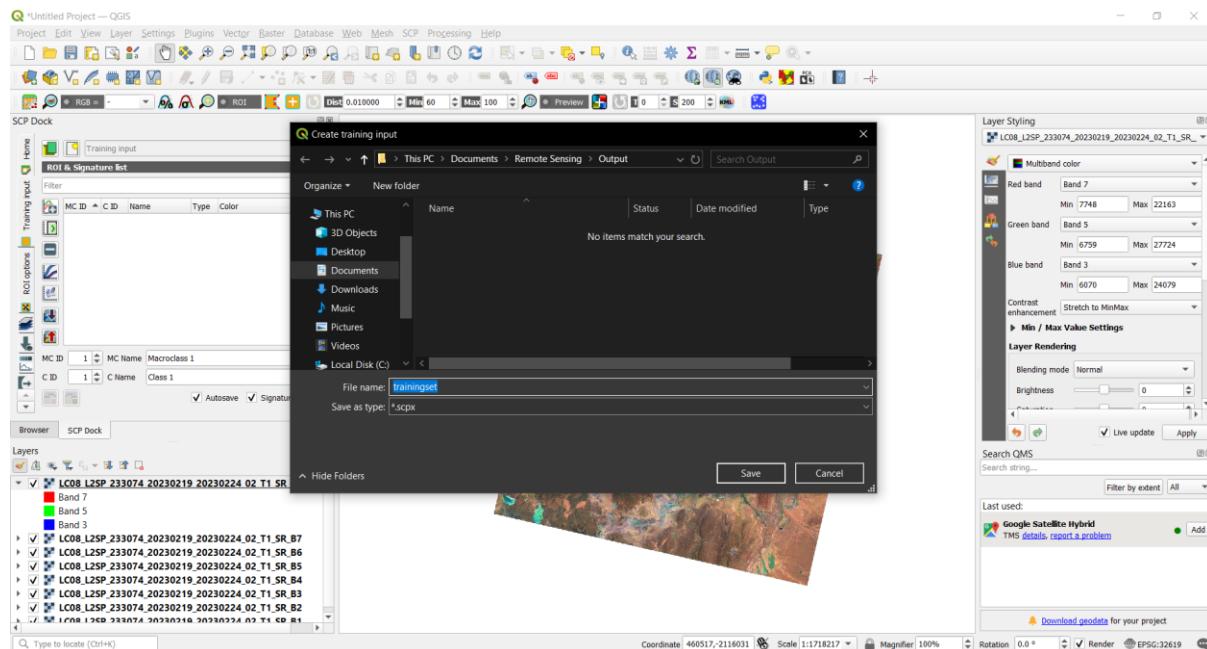
- Under Layer Properties Click on symbology, change render type to “multiband color” and select RGB bands as shown in figure, Click on Apply.



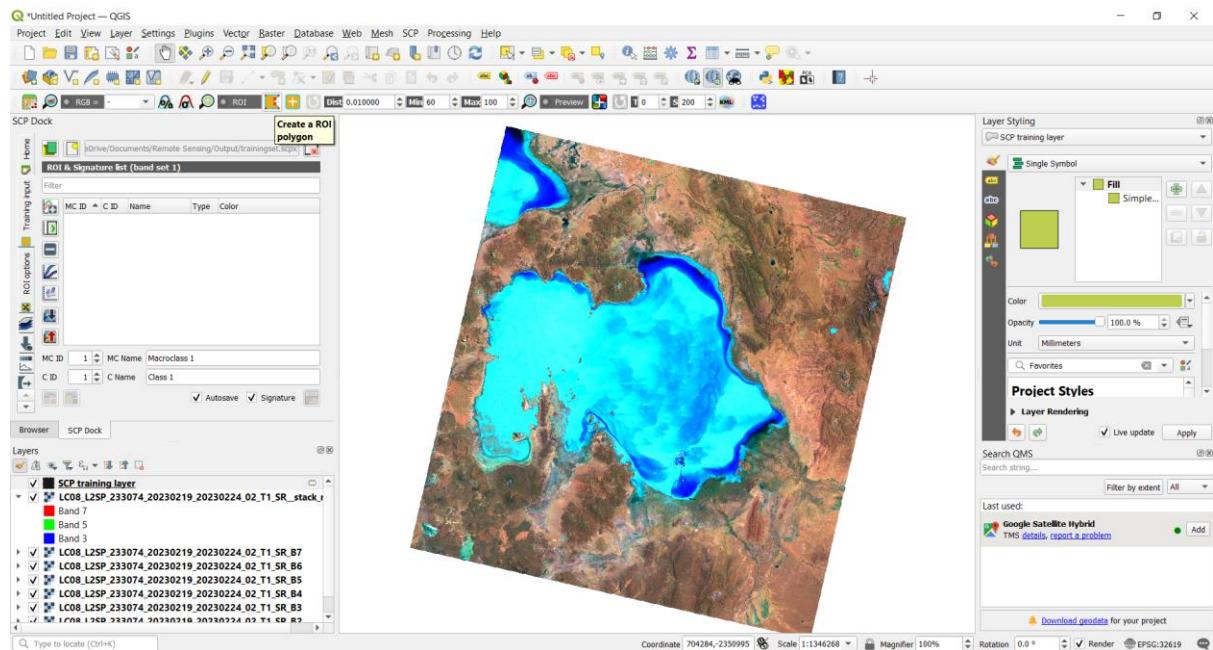
Step 8: Click on SCP Dock and Click on Training input and then Click on Create a new training input



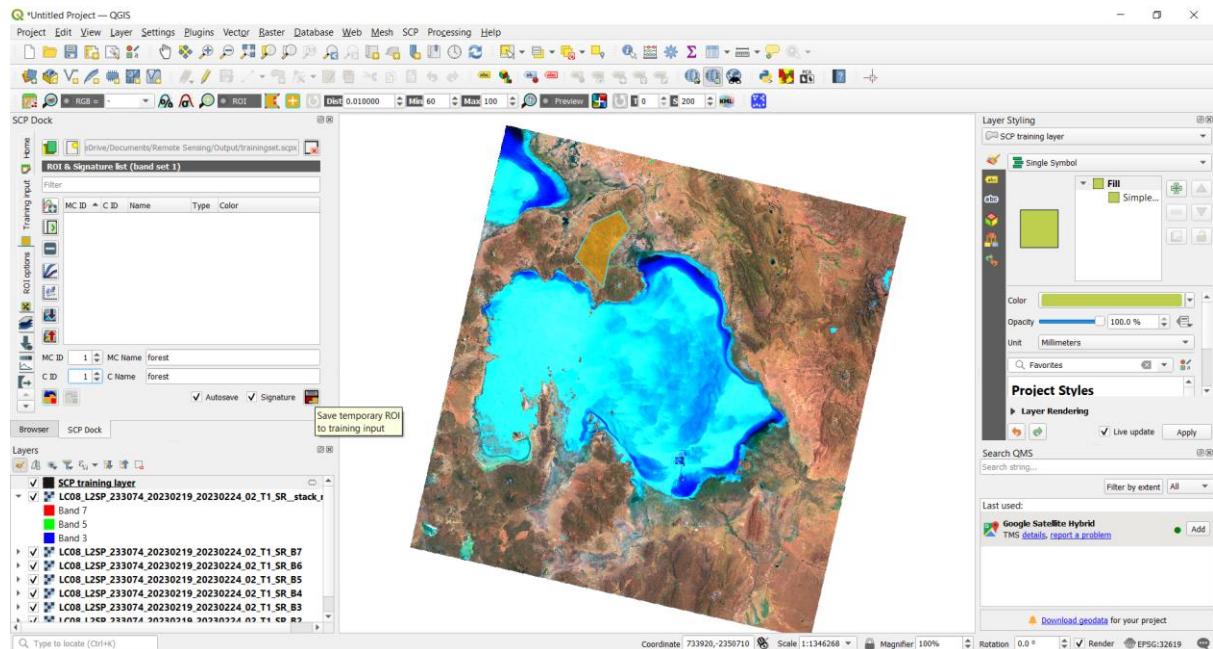
- Give File name (Here it is: **trainingset**) and then Click on Save

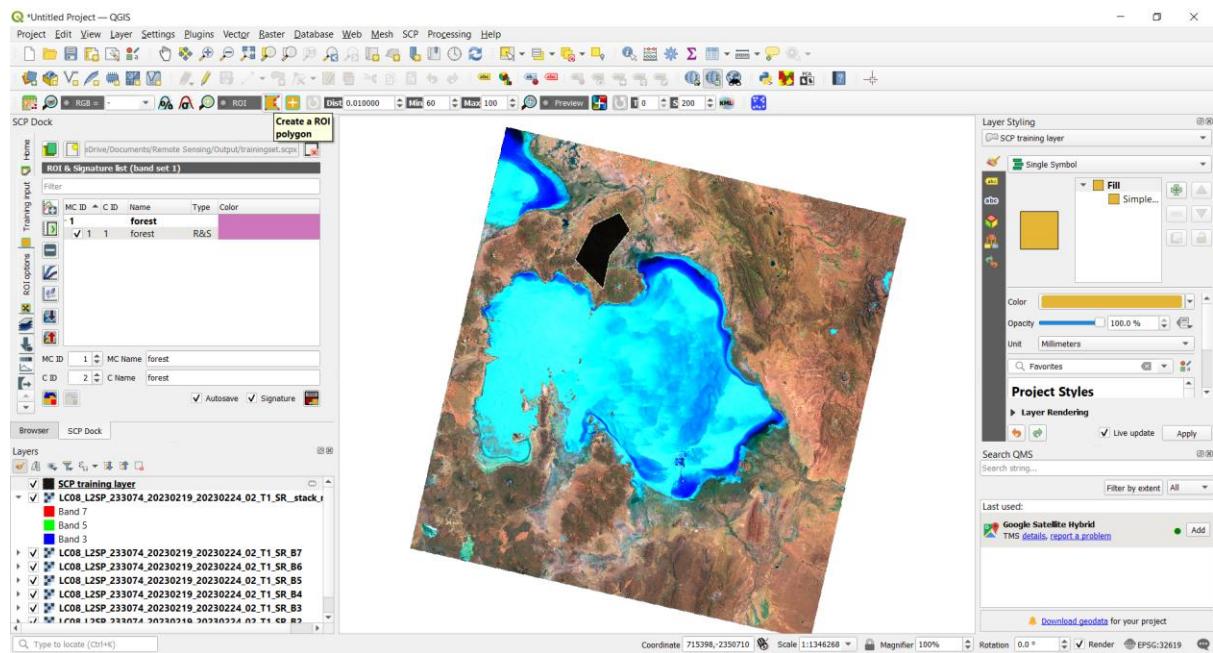


Step 9: Click on Create a ROI polygon

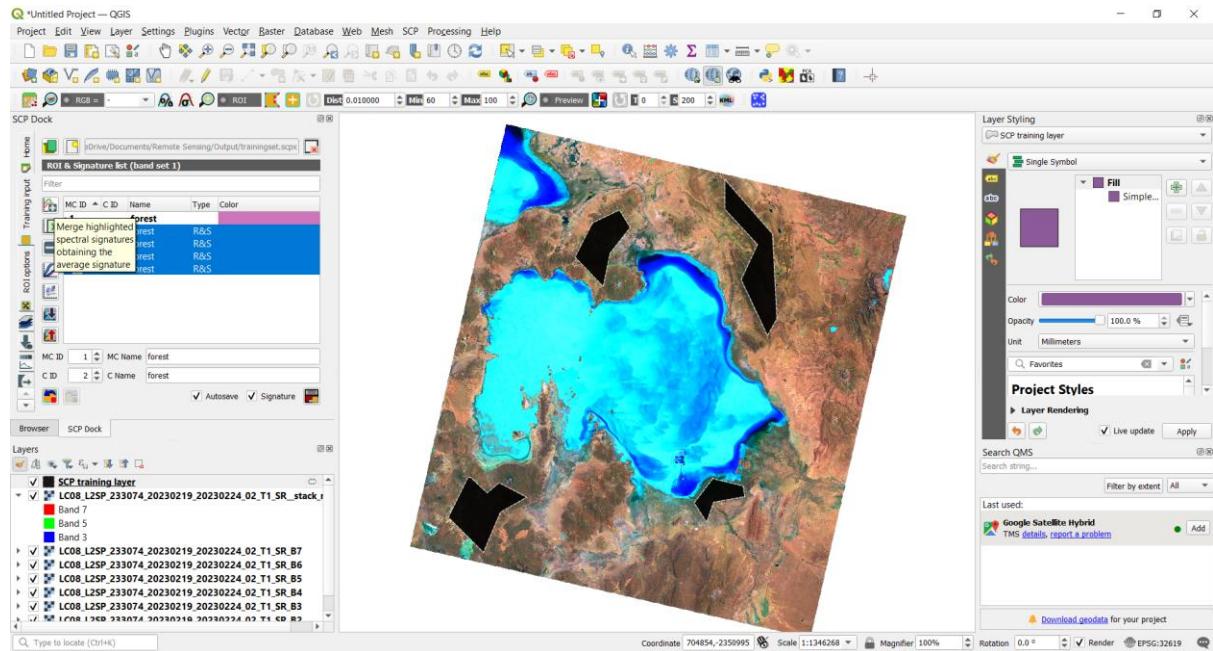


- Draw the **input on the map**. After drawing the **input**, next step is to save that input and for that we have to give **MC ID = 1**, **MC Name = Forest** and **C ID & C Name** will be same as **MC ID & MC Name** and then **Click on “save temporary ROI to training input”**, we named **MC Name forest** because we have taken the first input for forest.

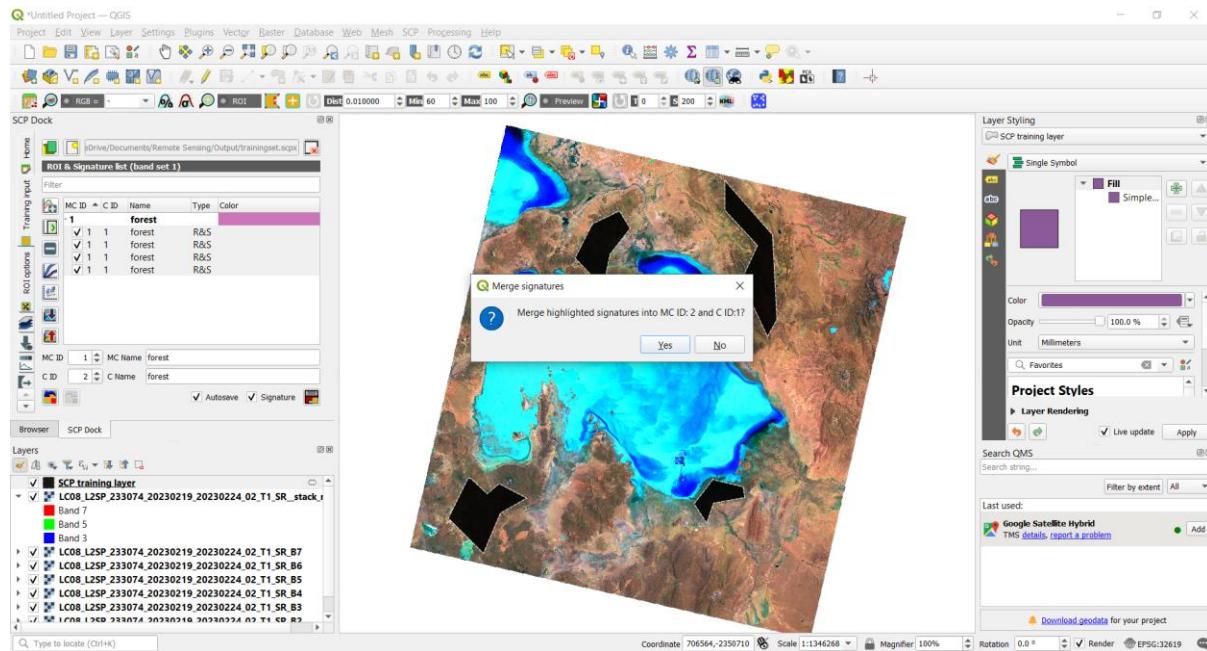




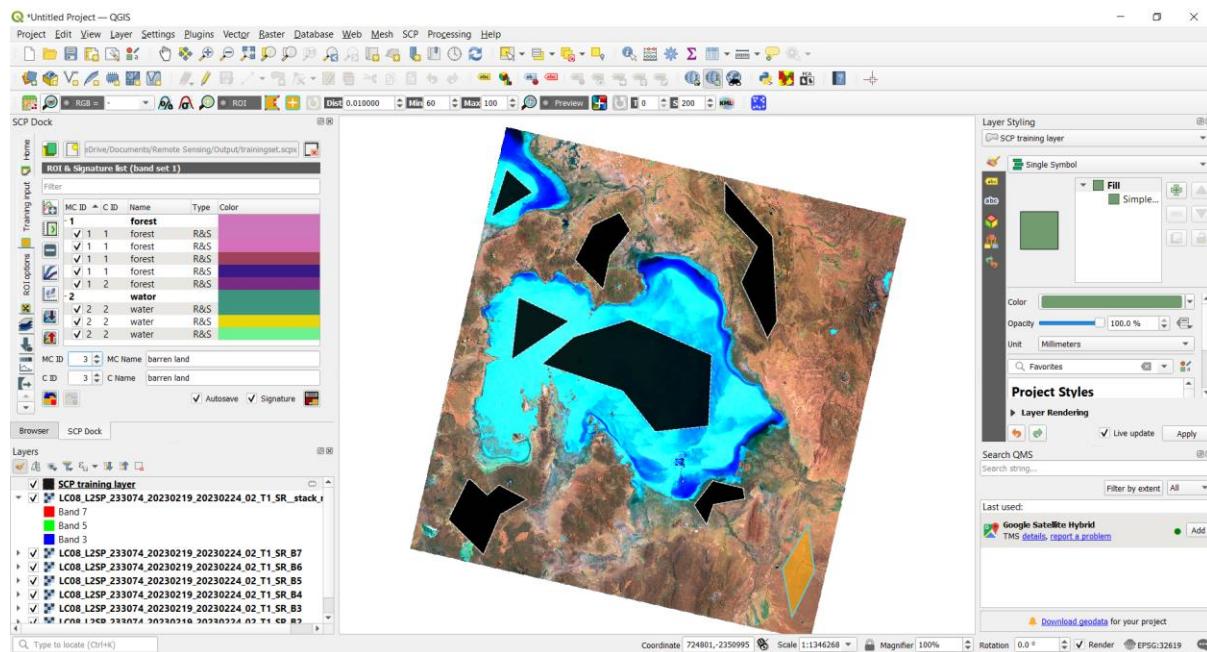
- We can take multiple inputs for single class, we took 4 inputs for forest area.
- Next step is to merge all the inputs for single class, so for that we'll select all the inputs and click on “merge highlighted spectral”.

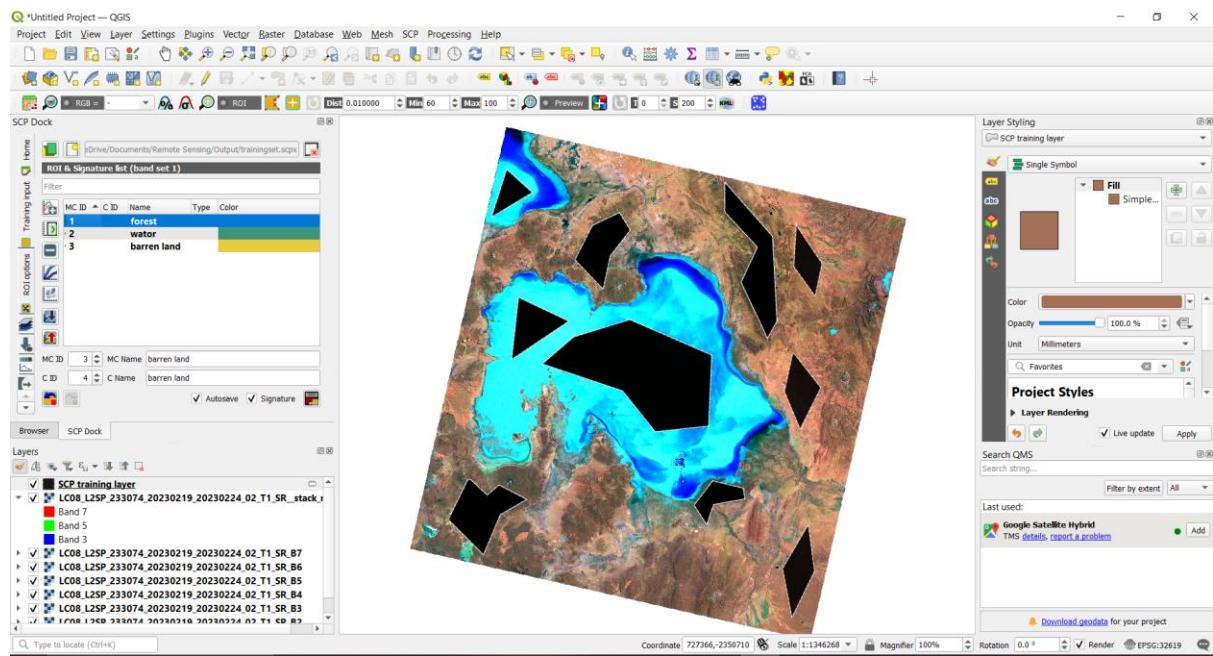


- Click on Yes

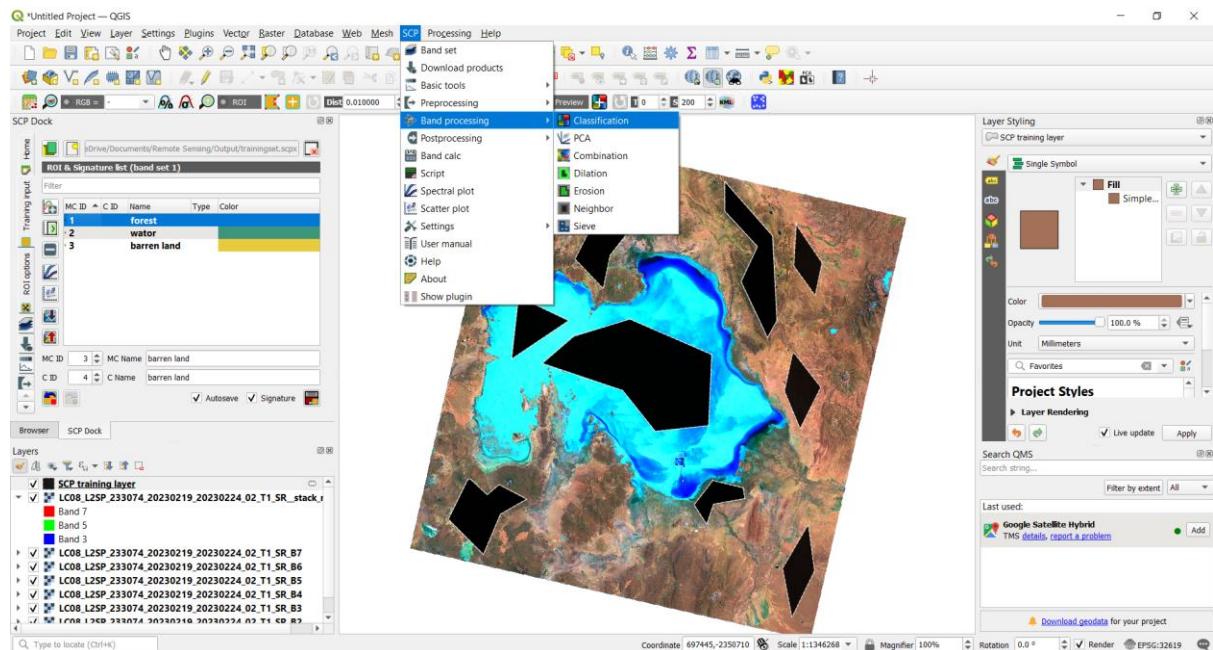


- So we took many types of inputs for training such as forest, water, barren land.

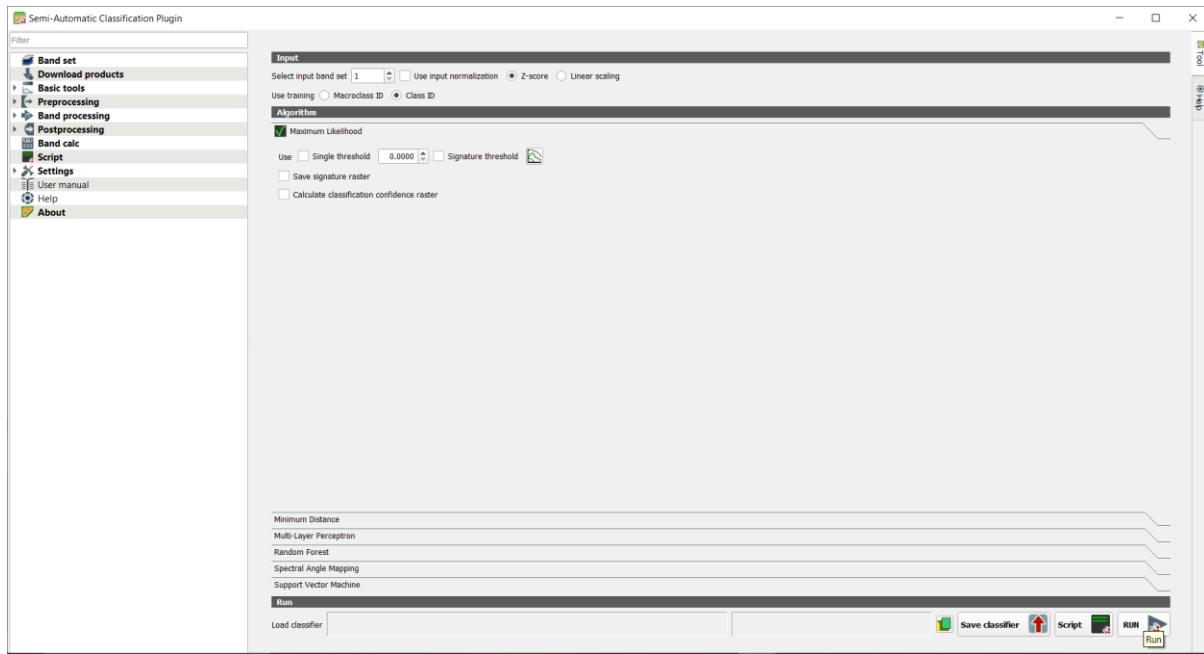




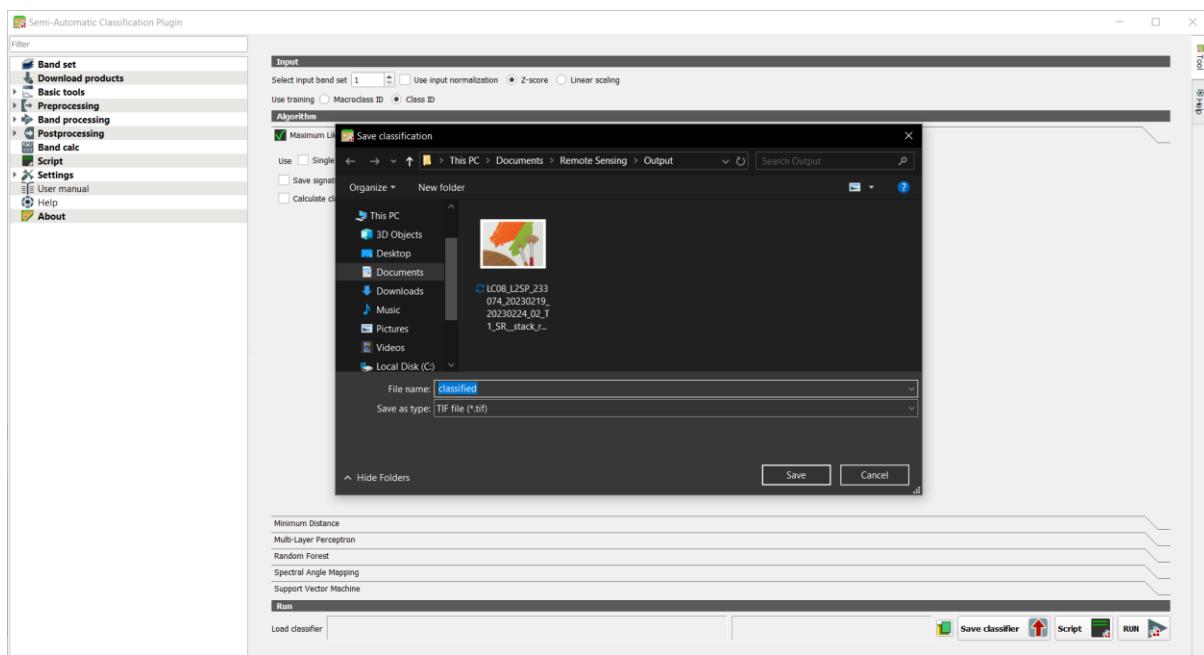
Step 10: Click on SCP Within SCP Select Band processing and then Select Classification



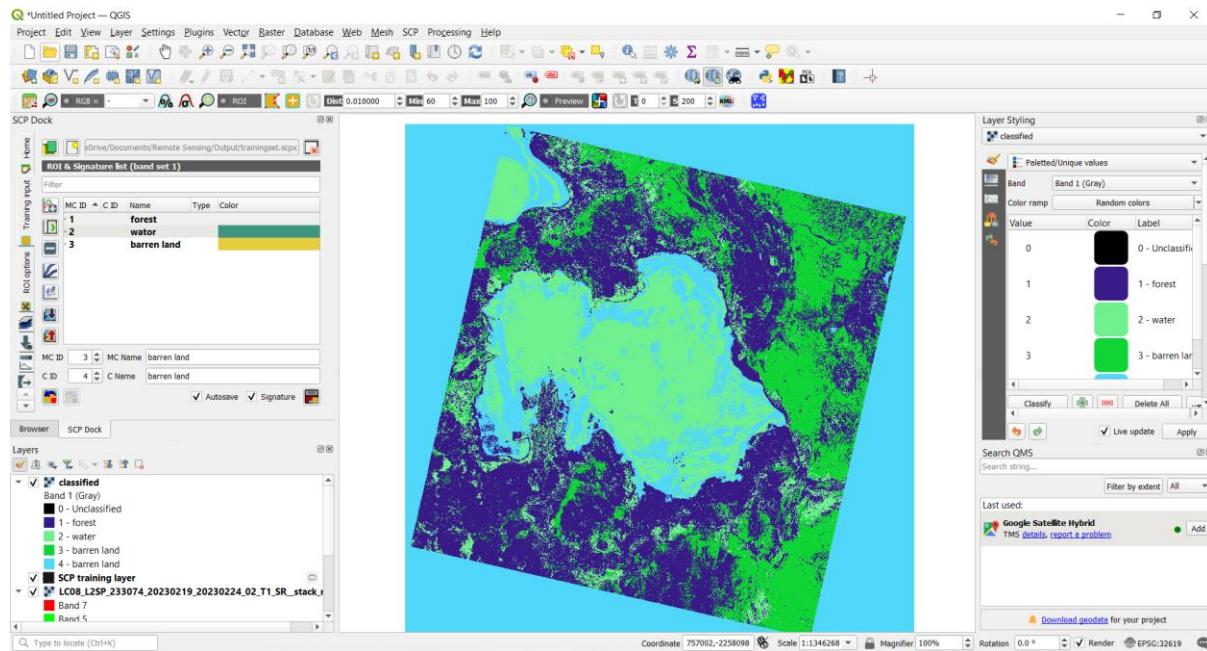
- Select Class ID and then Click on Run



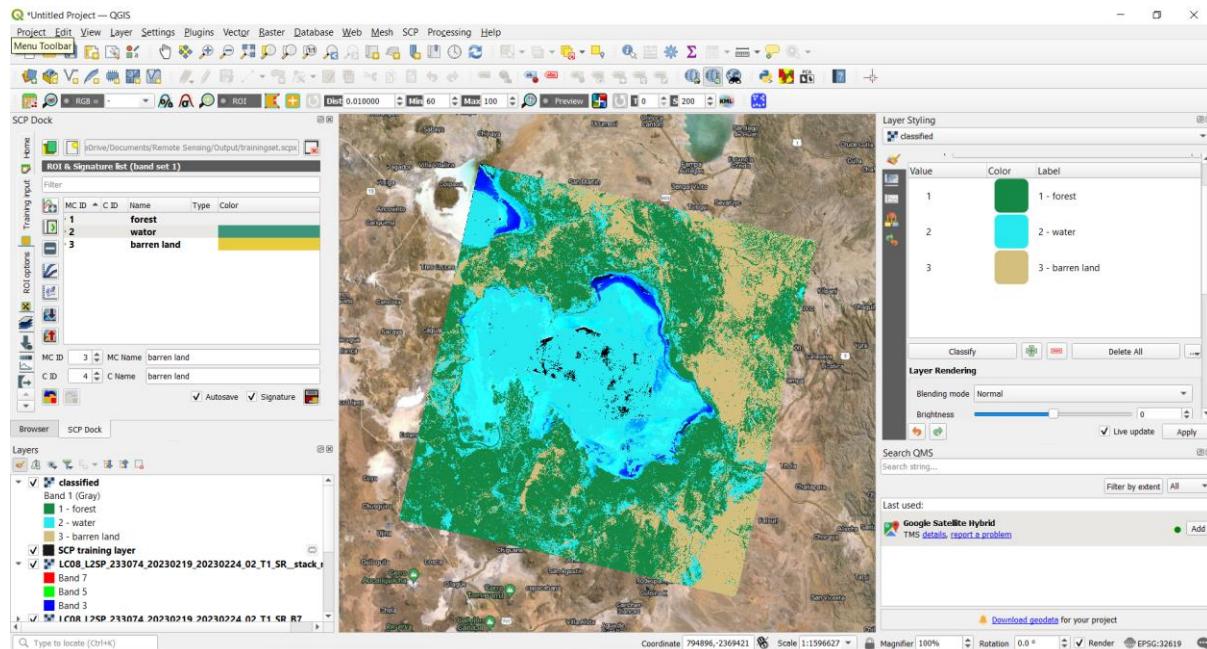
- After Clicking on RUN, you have to give a file name of “classified” then Click on Save.



- The classification process of our training input is complete, this is our classified product.



- Now we have to give our merged inputs their natural colors. Go to the **Layer Styling Double Click on forest** and then we get the option of “**change color**” by which we can give our inputs their natural color and then Click on Apply.
- Same for Water and barren land.
- After giving each inputs to their natural colors see real or natural colors of our landsat 8 satellite image.



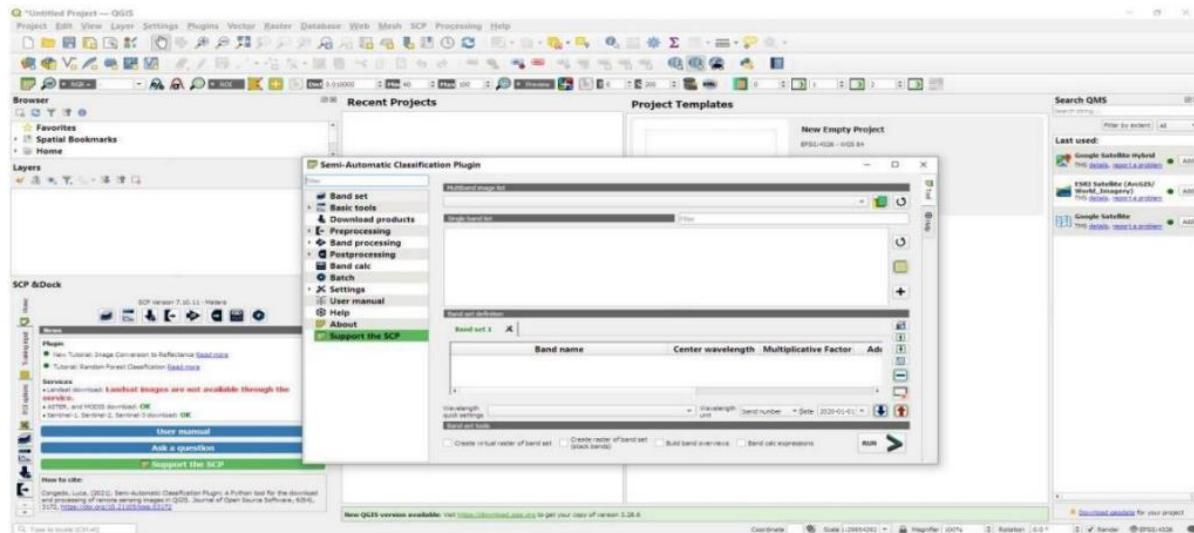
Practical: 6

Aim: Apply Different Unsupervised Classification Techniques to Classify the Satellite Image.

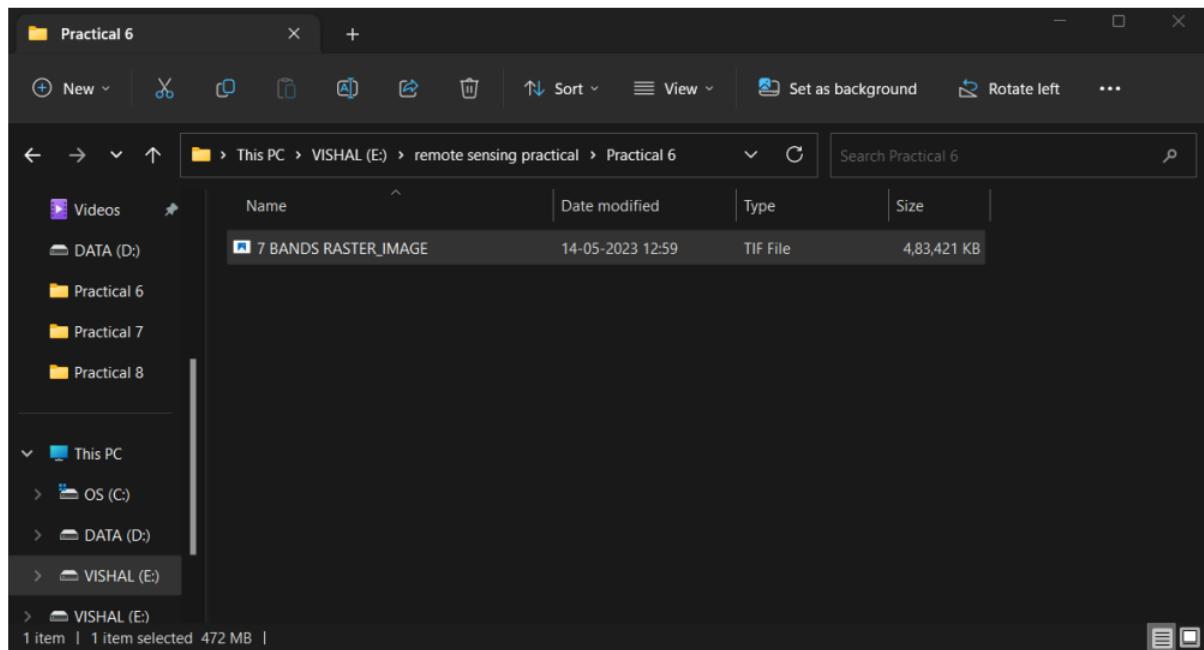
Writeup:

1) Steps with Screenshots

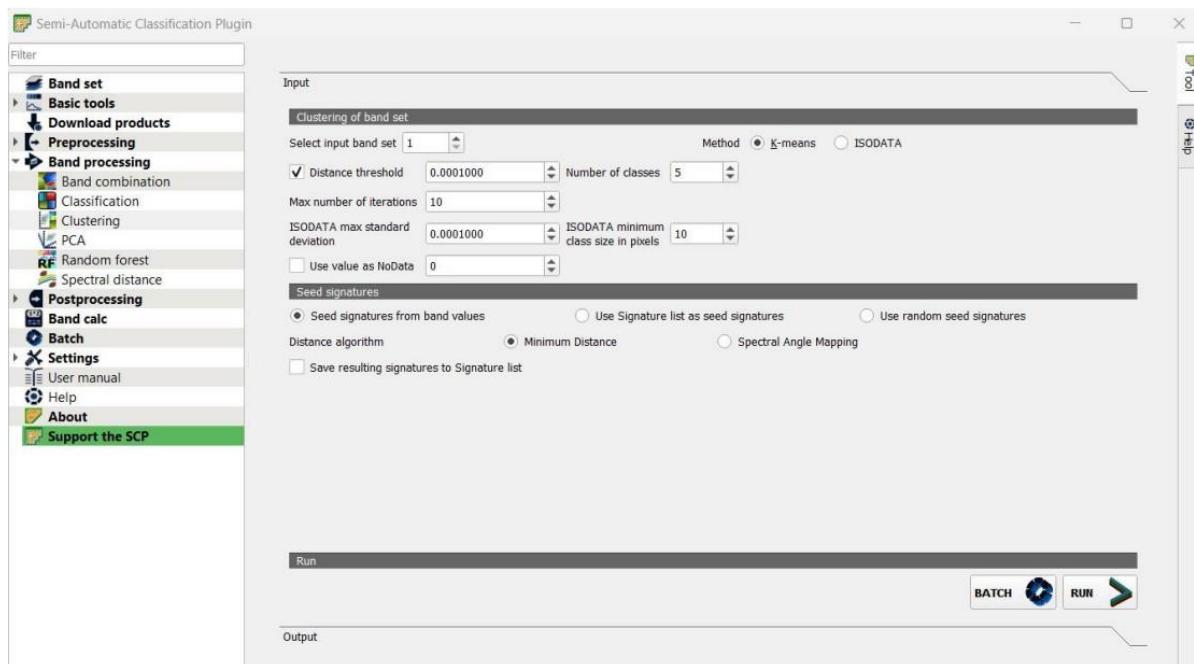
- Open QGIS and select band set from SCP & DOCK and Open a file from Multiband image list.



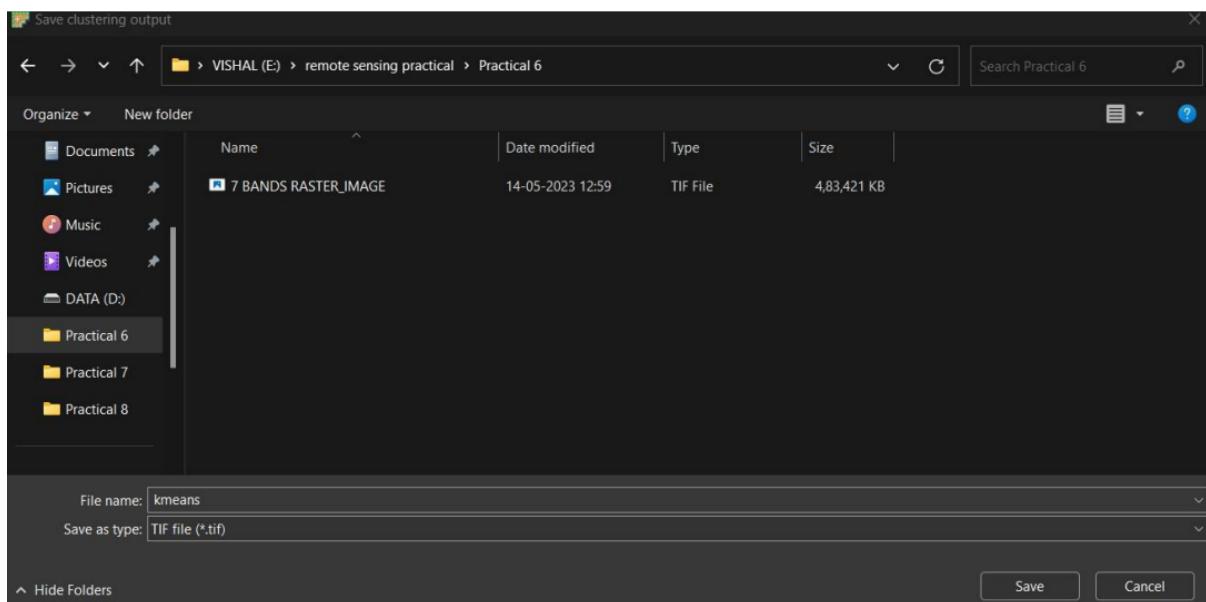
- We will select already created all 7 band color raster image.



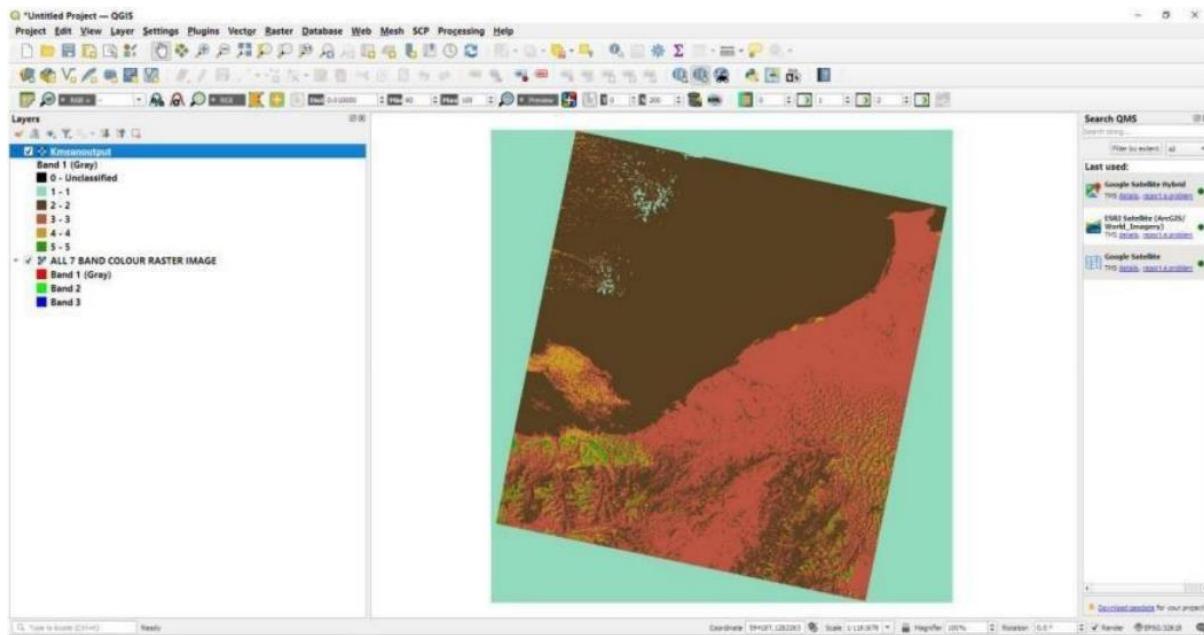
- After opening the image, we will go to Band Processing > Clustering and change Number of Classes to 5



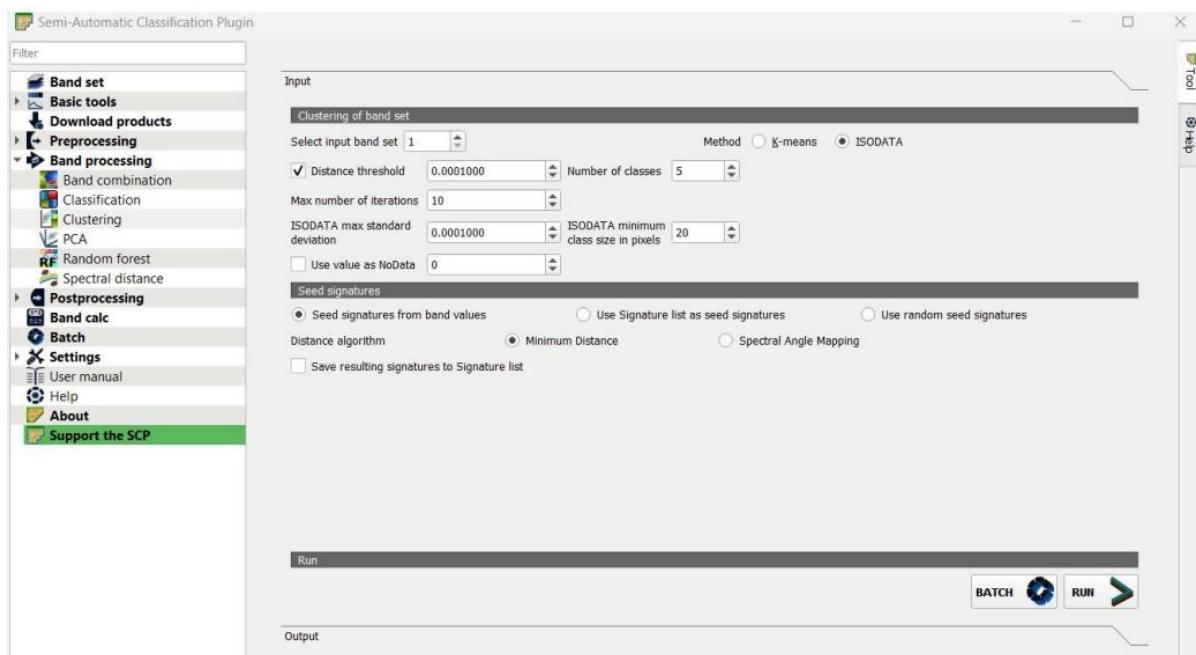
- After Click on Run you have to give the name of your output and save the file.



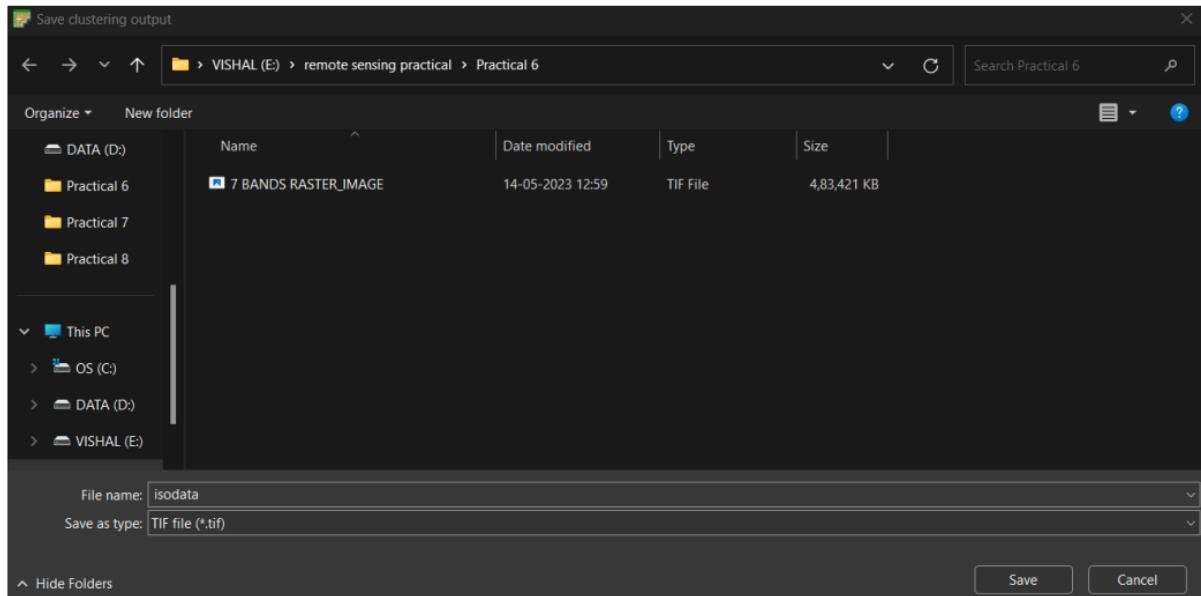
- After Running K-mean you will get the output



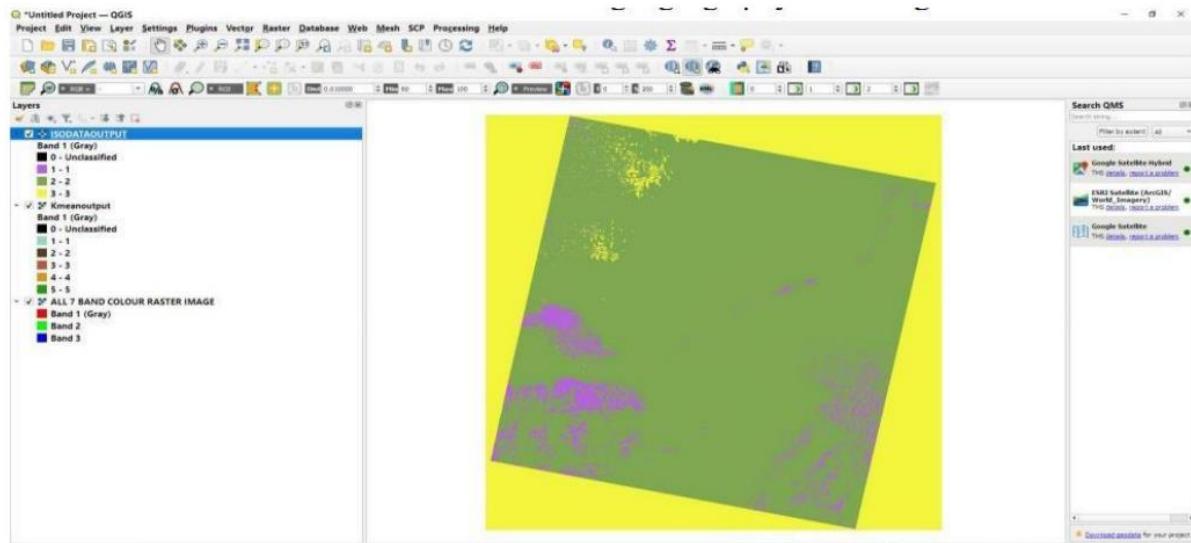
- Now again go to clustering and select ISODATA and Change ISODATA minimum class size in pixel to 20



- Then Run and give output file name and save and wait for the classification iteration.

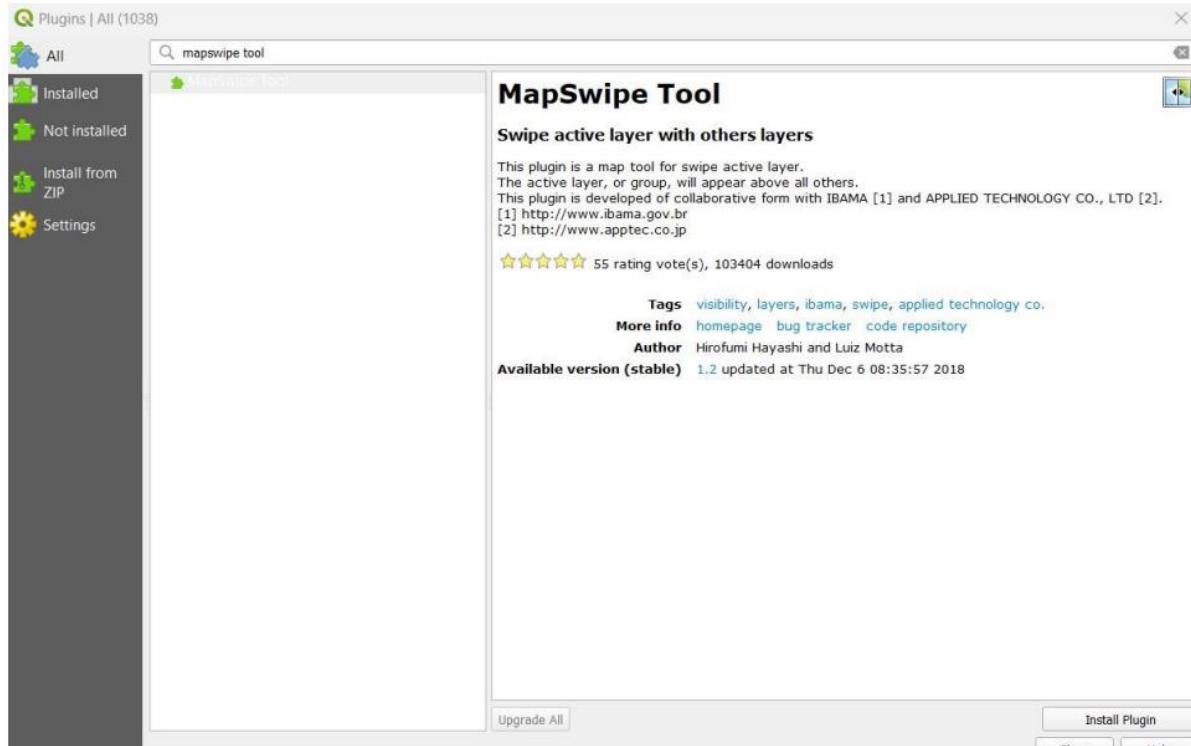


- Now both k-mean and ISODATA has done, here you can see all the bands from ISODATA and k-mean which are unlabeled not classified color according to geography of the image.

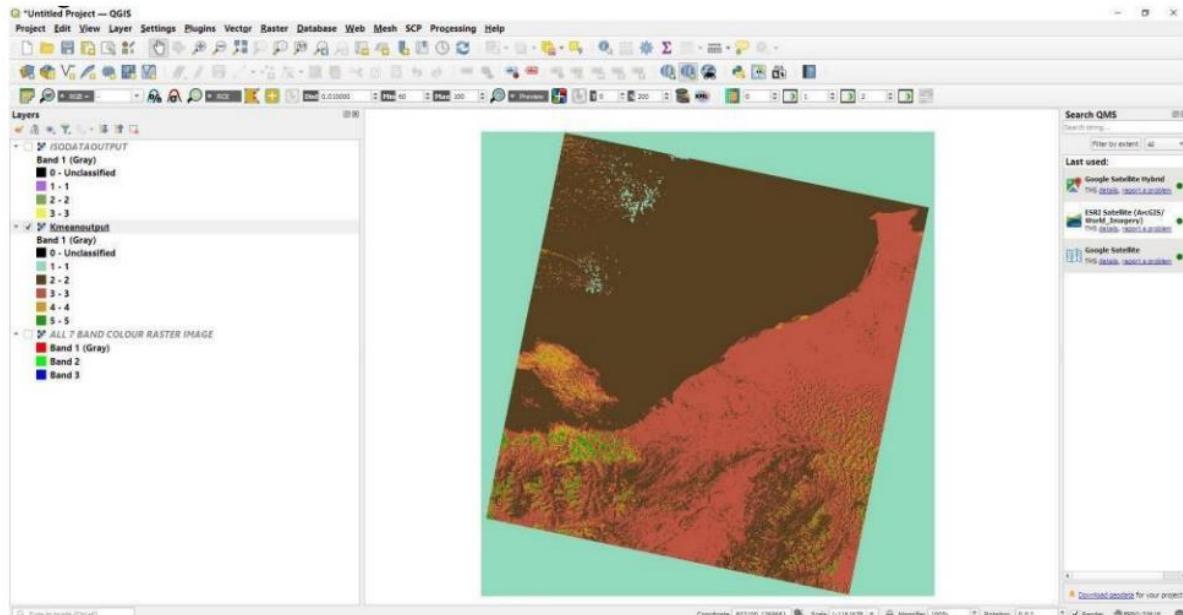


2) Steps with Screenshots

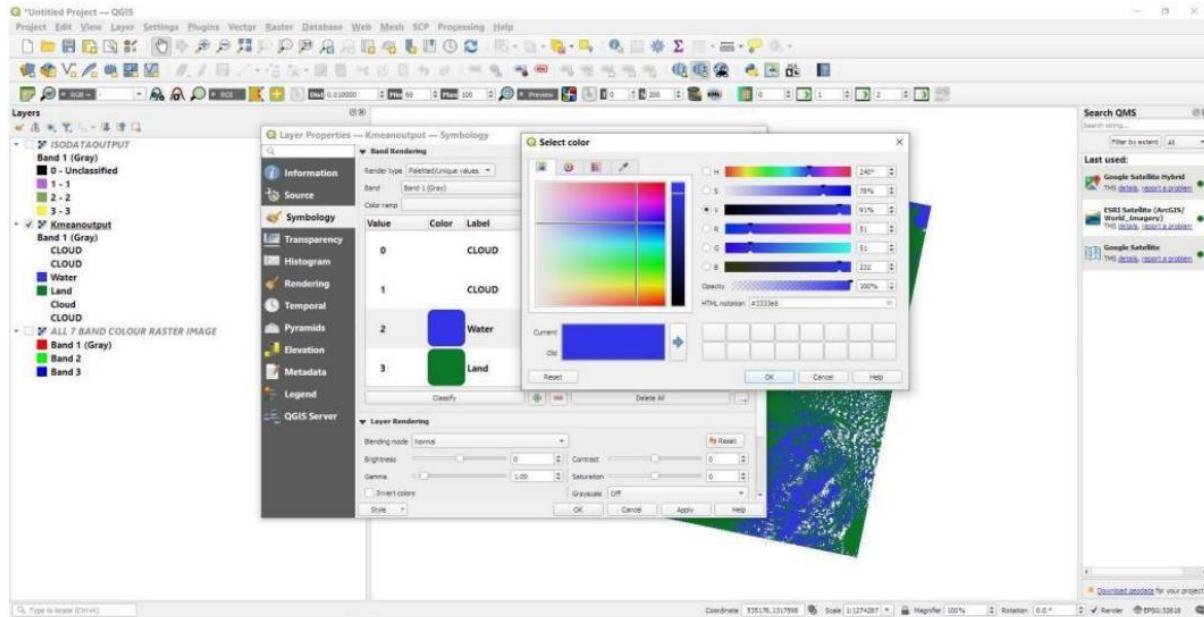
- Now go to plugin and install MapSwipe Tool.



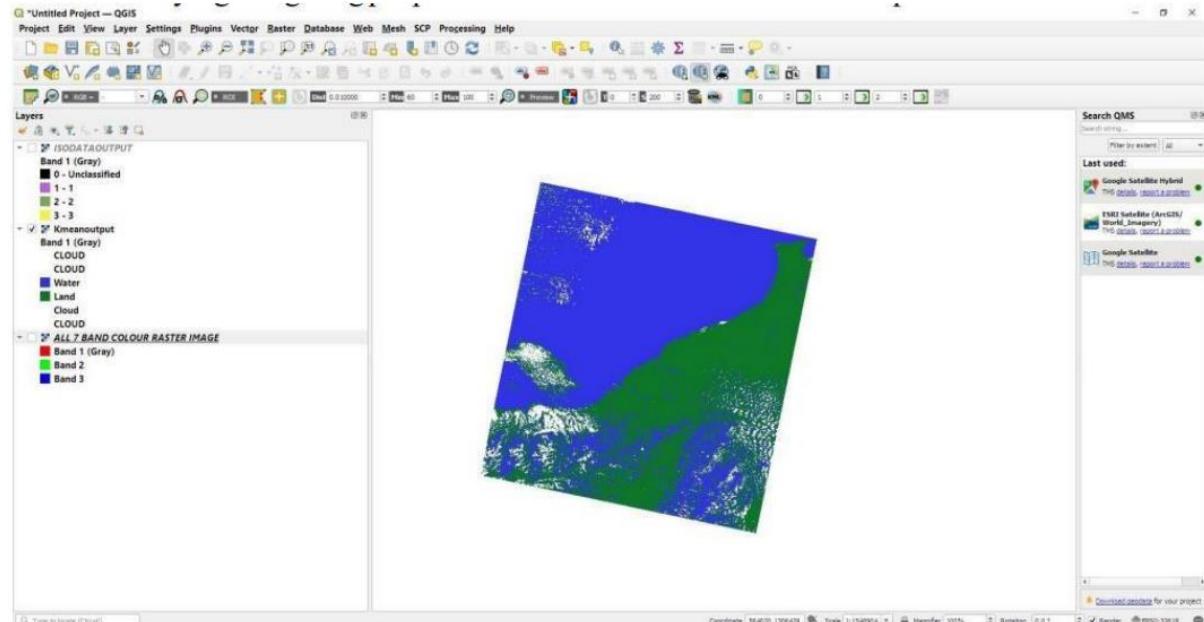
- Now we have to change labels and give proper color and names according to image geography. Here, we will select k-mean output because it has more band and color to distinguish detail in image.



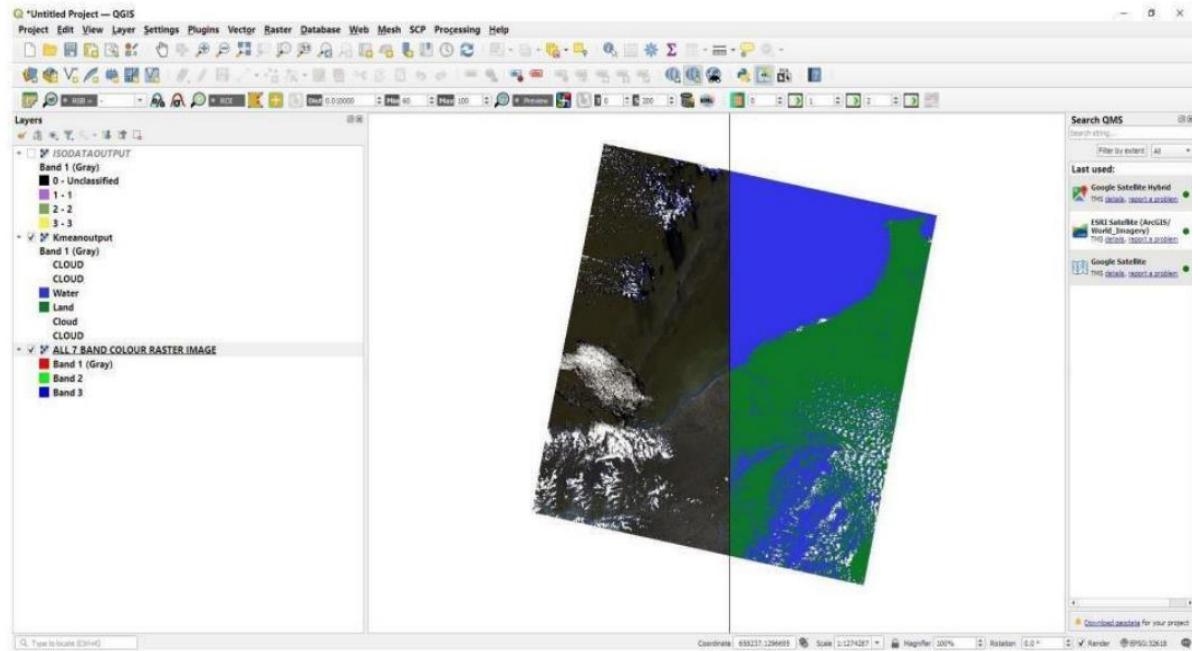
- To Change color and label just double click the band color and also change labels



- After Classifying and giving proper labels and color on k-mean band output.



- Using MapSwipe Tool We can see the difference between two images side by side

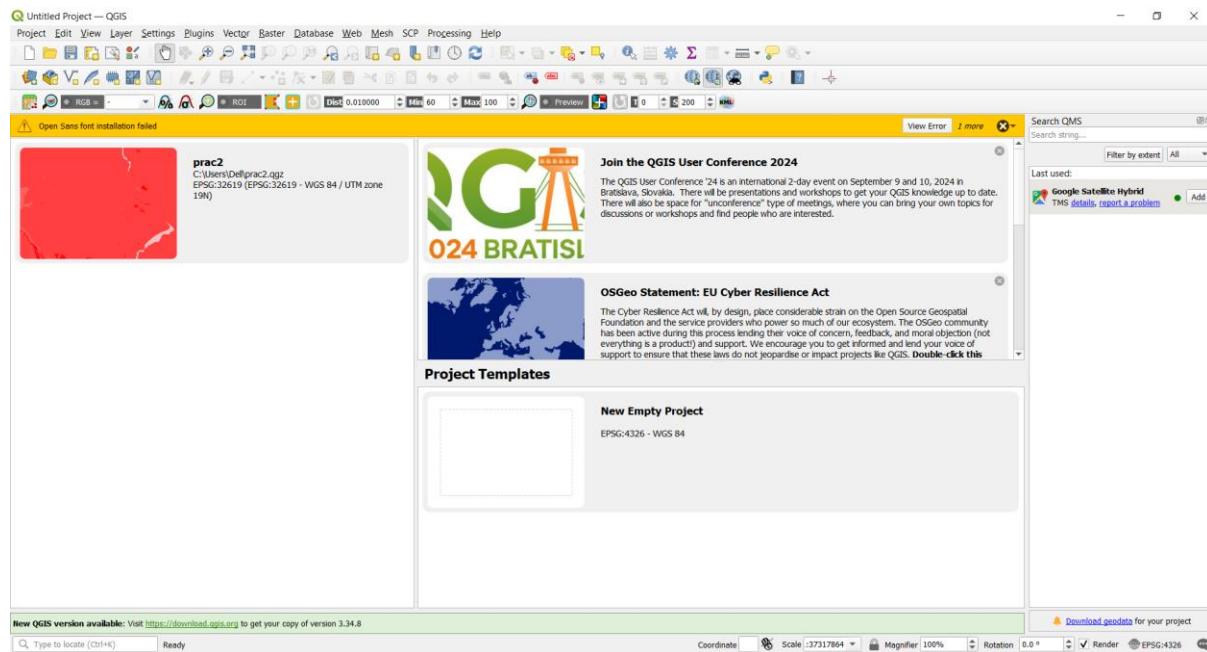


Practical: 7

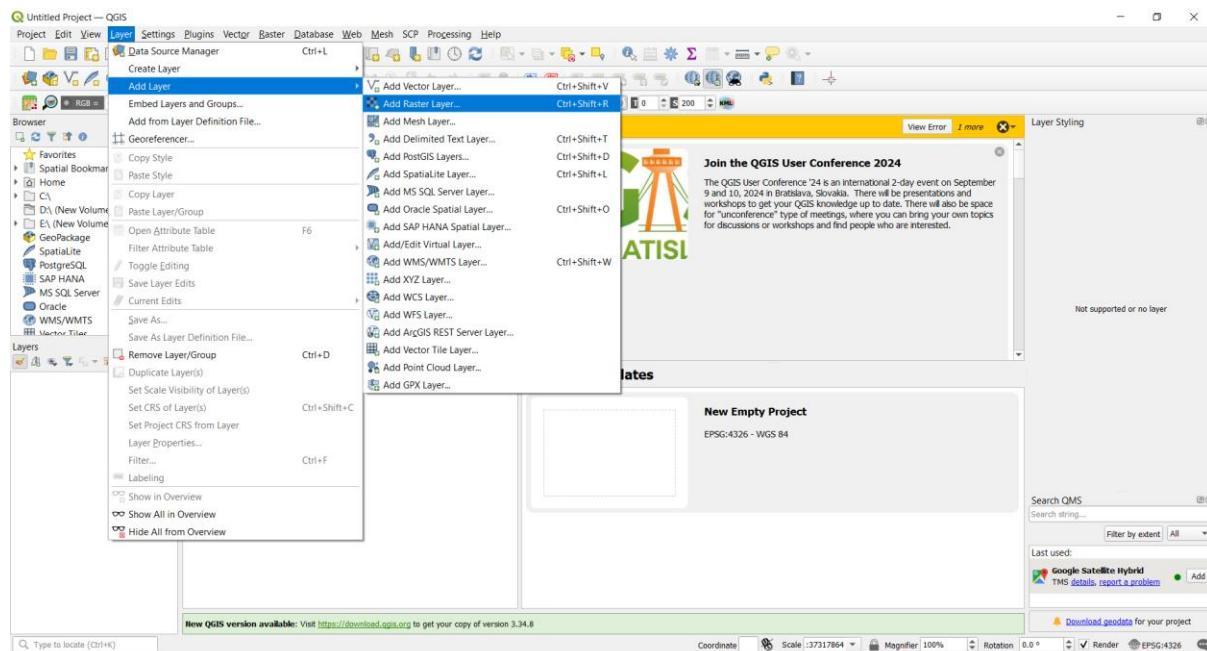
Aim: Apply principal component analysis on satellite images.

Writeup:

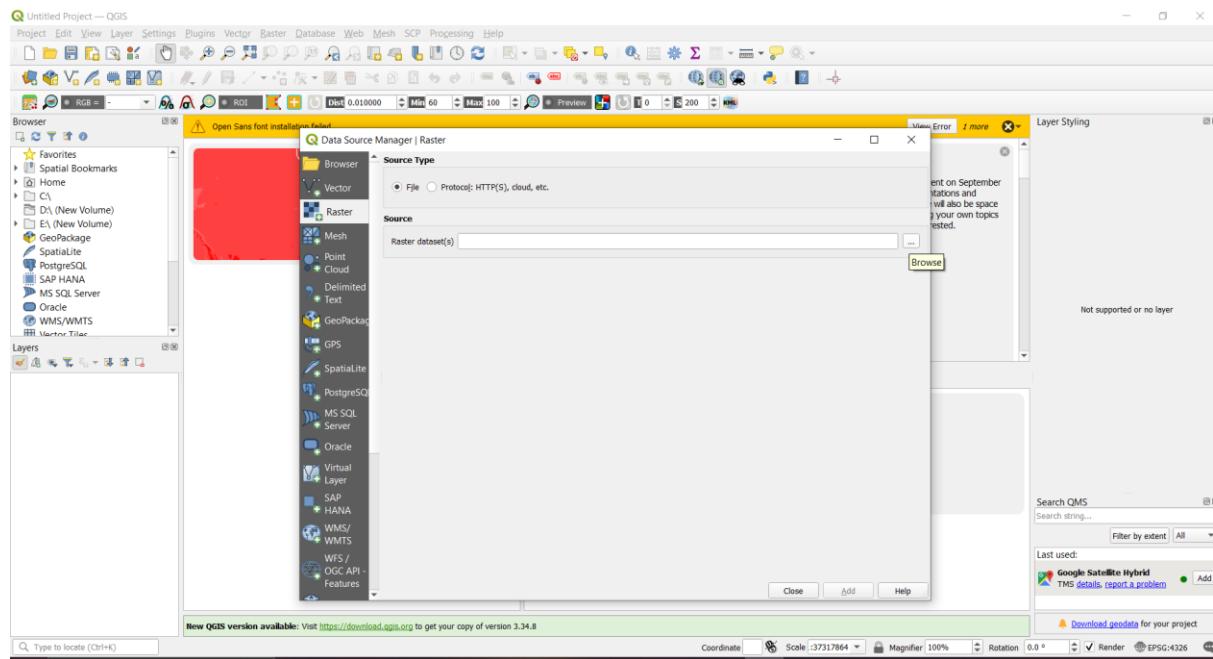
Step 1: Open QGIS



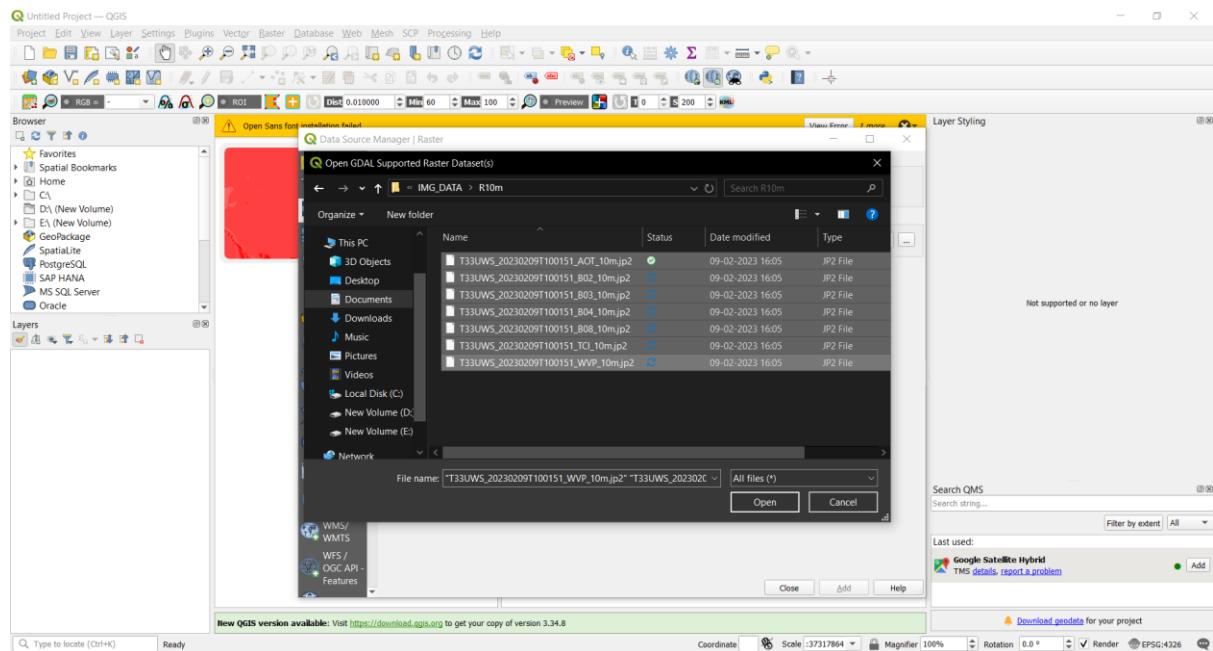
Step 2: Click on and Select Add Layer and then Select Add Raster Layer



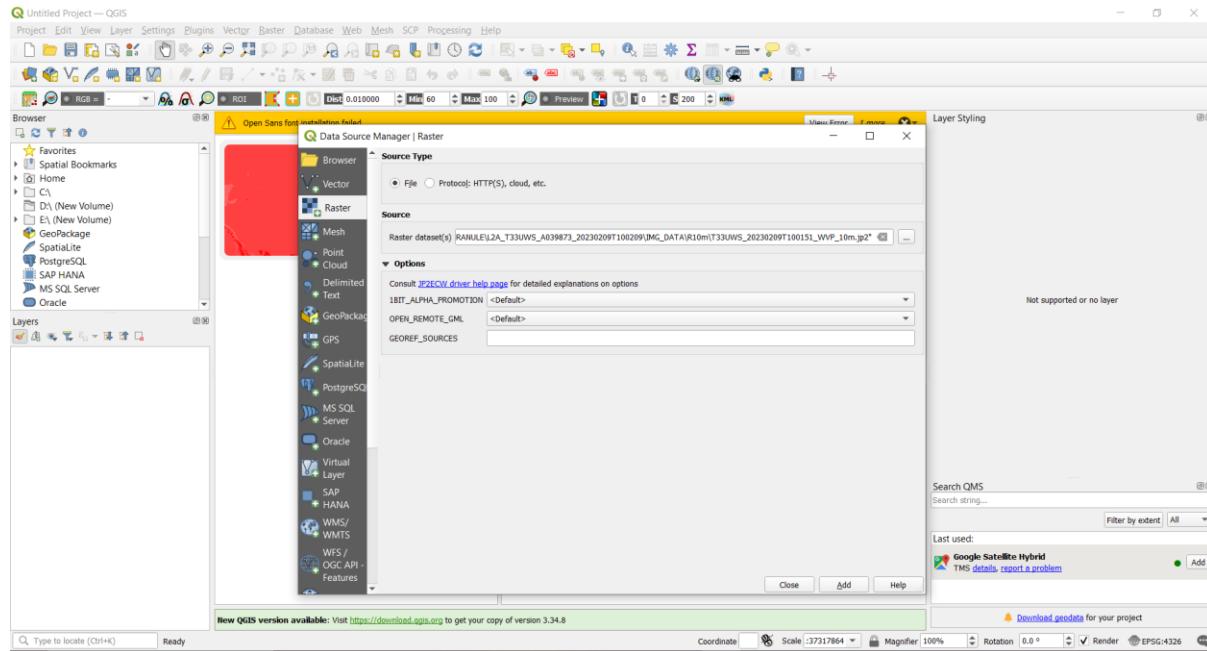
Step 3: Select Source Type File and then Click on Browse



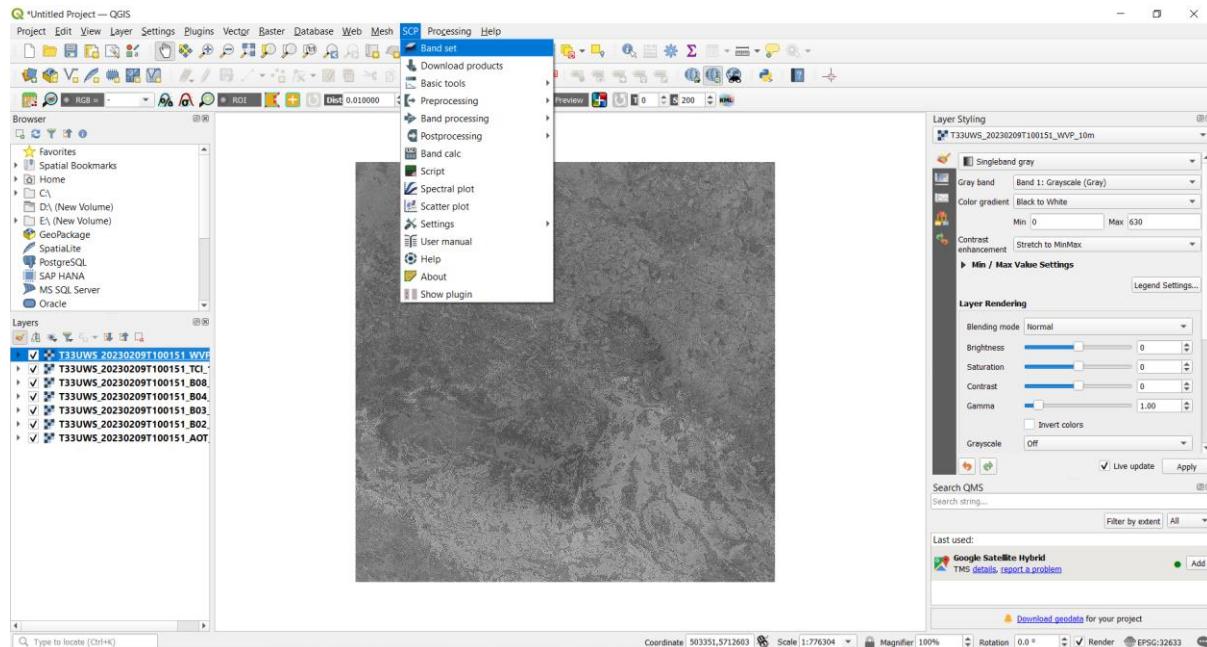
Step 4: Select jp2 images and then Click on Open



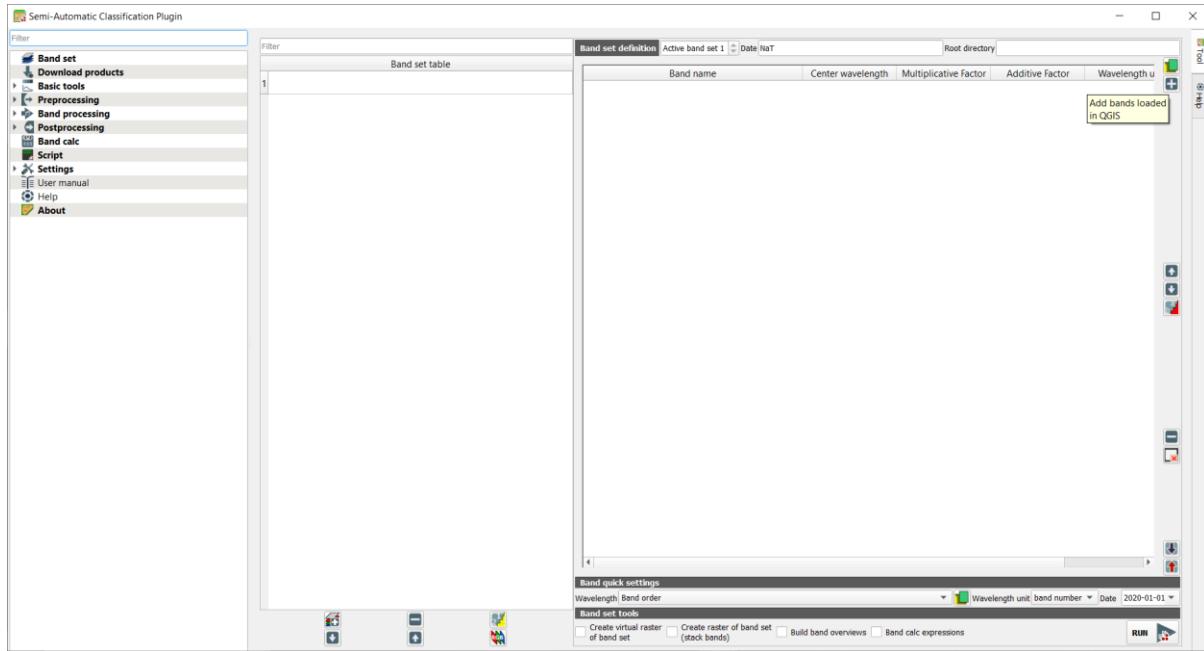
- Click on Add



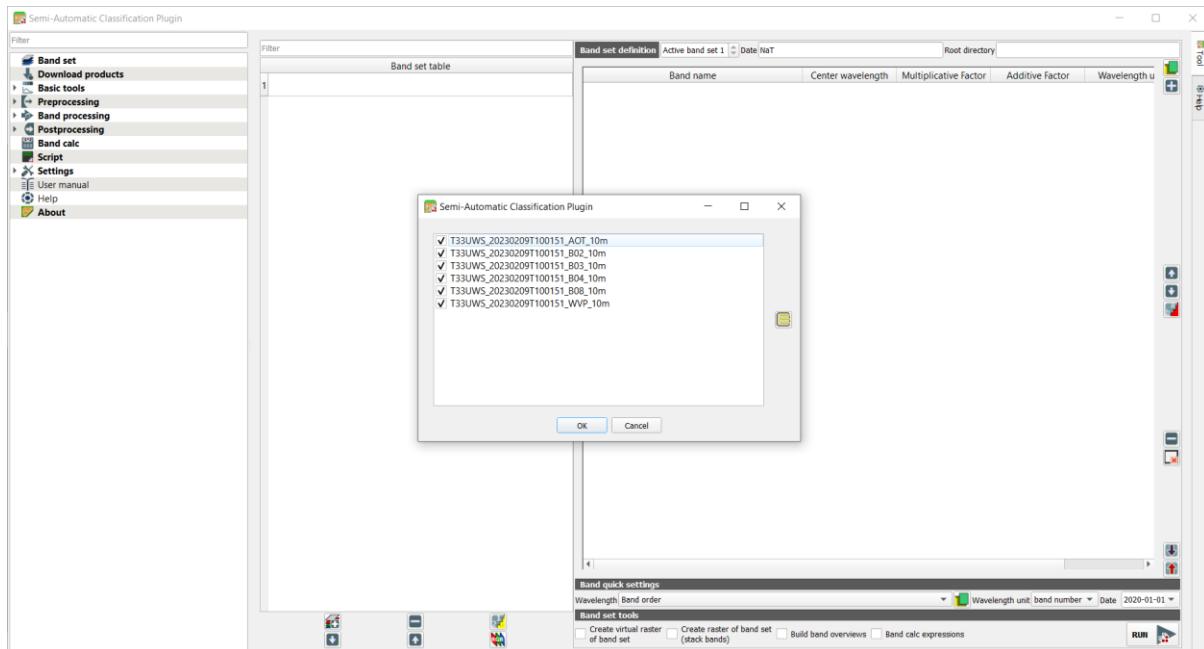
Step 5: Click on SCP and Select Band set



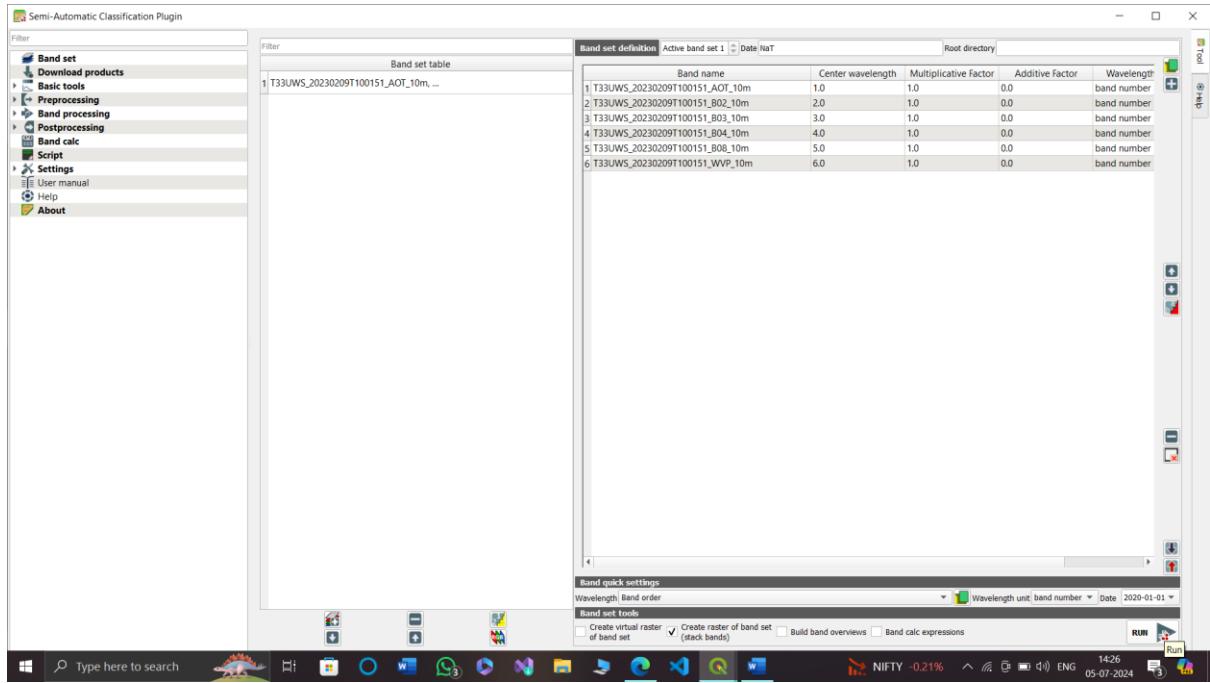
- Click on Add bands loaded in QGIS



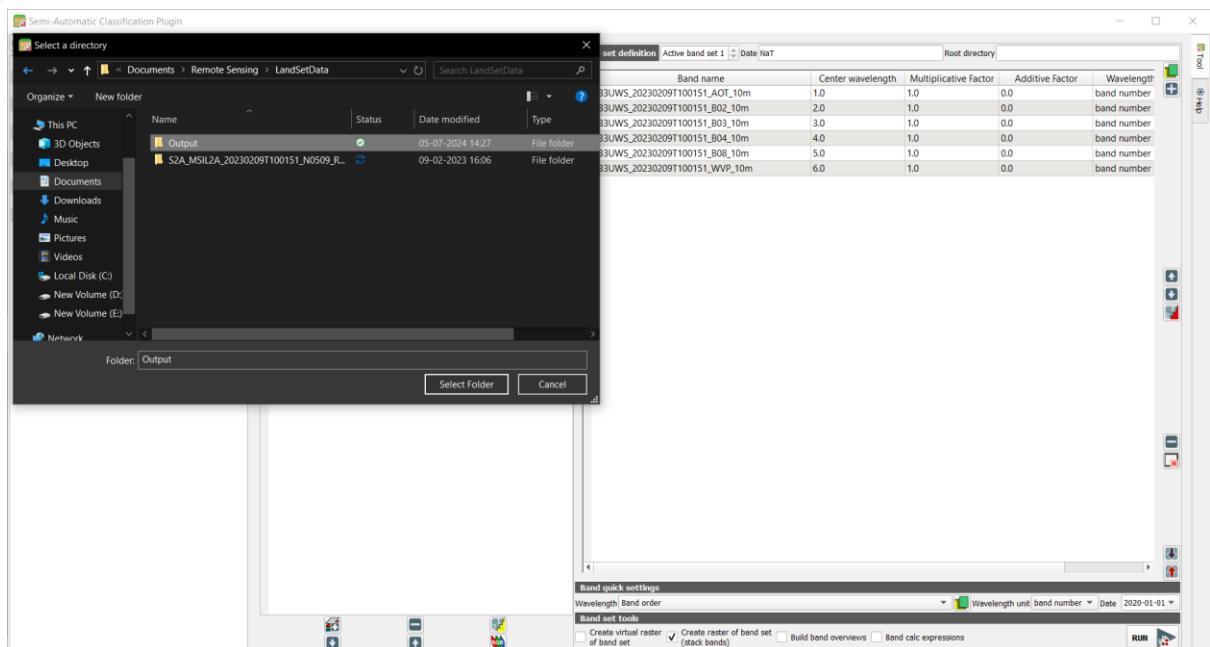
- Select all images and then Click on OK

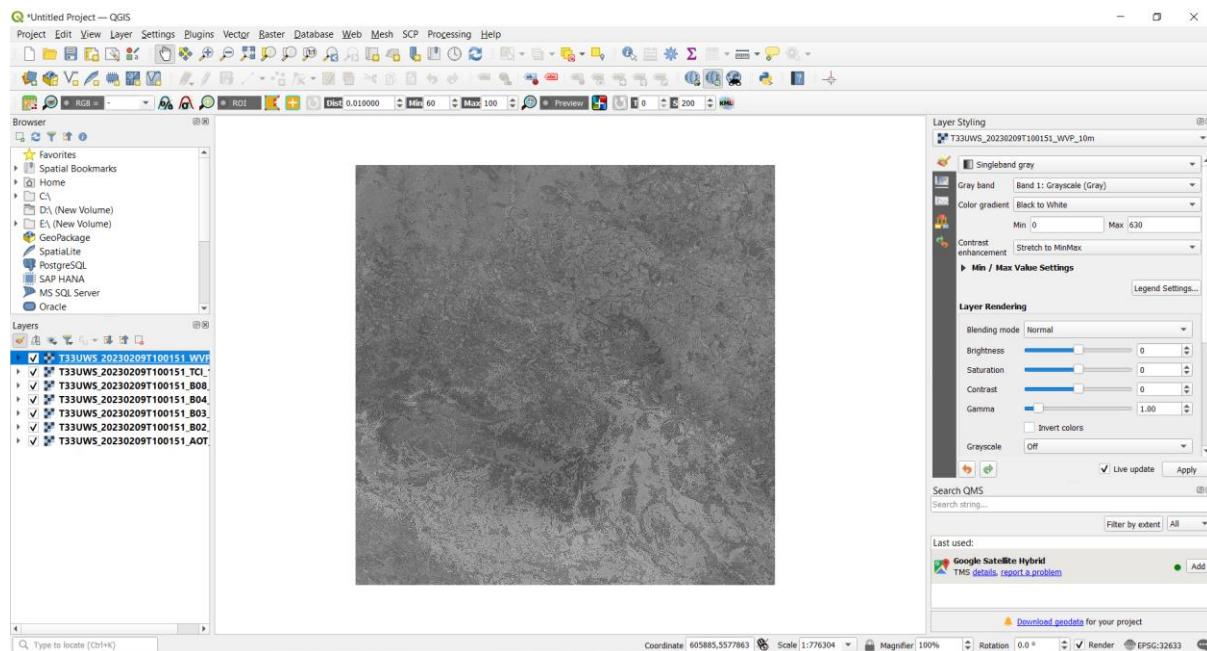


- Check **Create raster of band set (stack bands)** and **Click on Run**

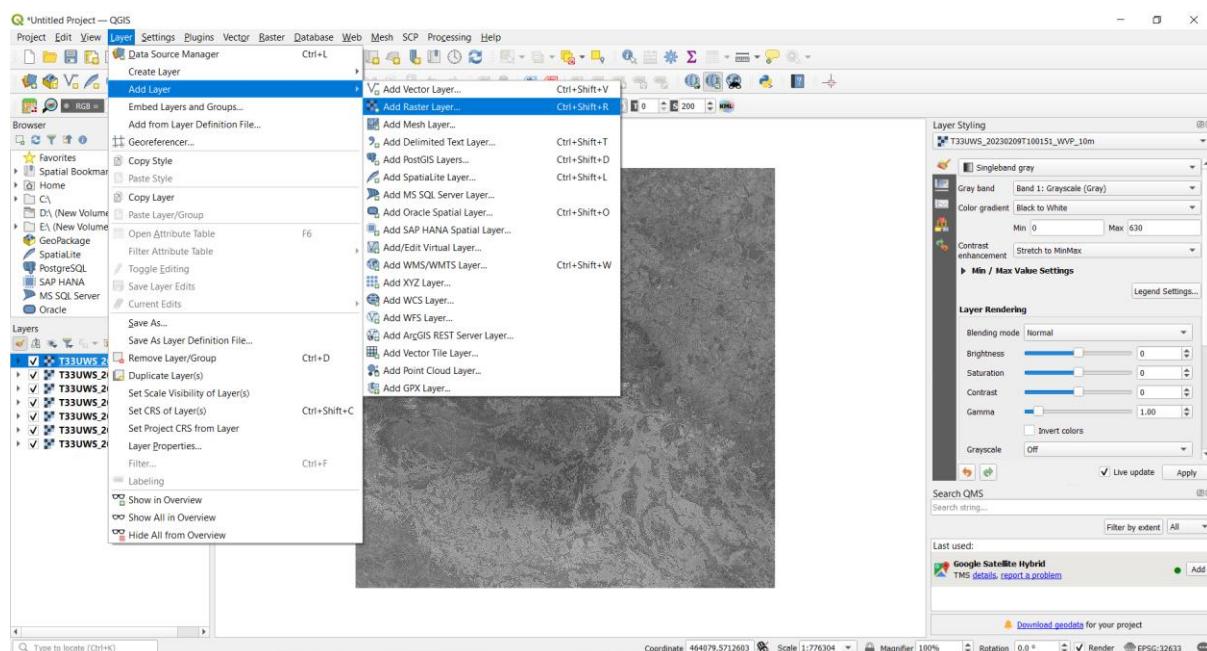


- After **Click on Run** Pop-up Open and **Select a directory** Under Select a directory **Create New Folder** and **Give Name Output** and then **Click on Select Folder**

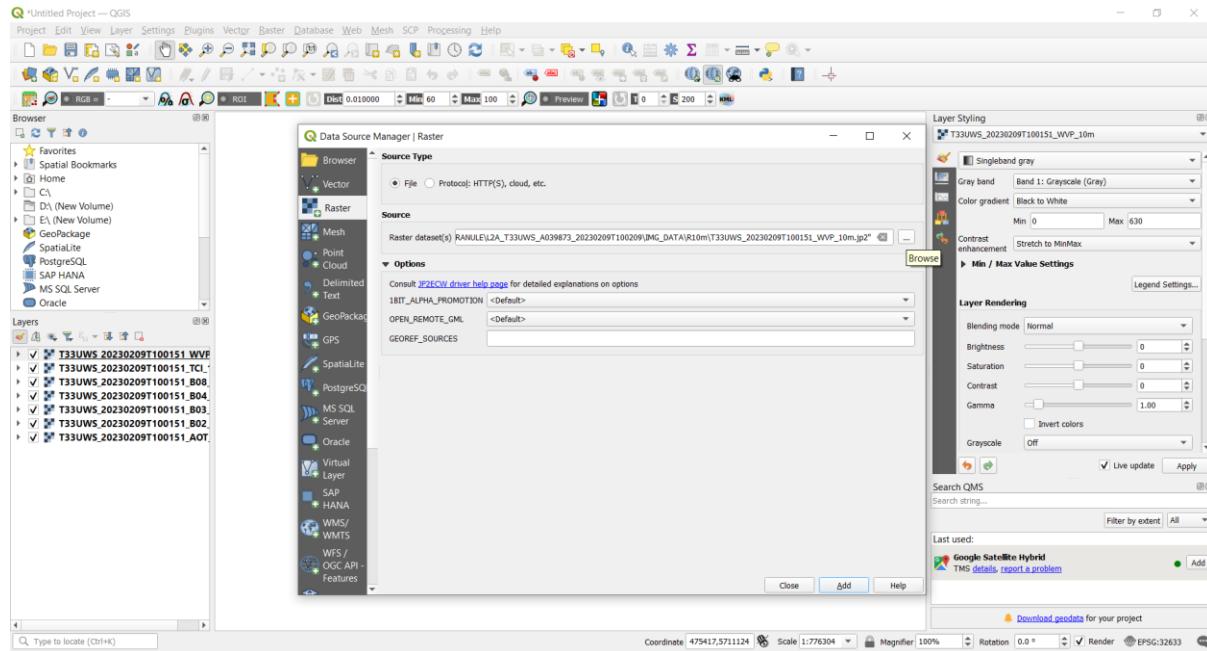




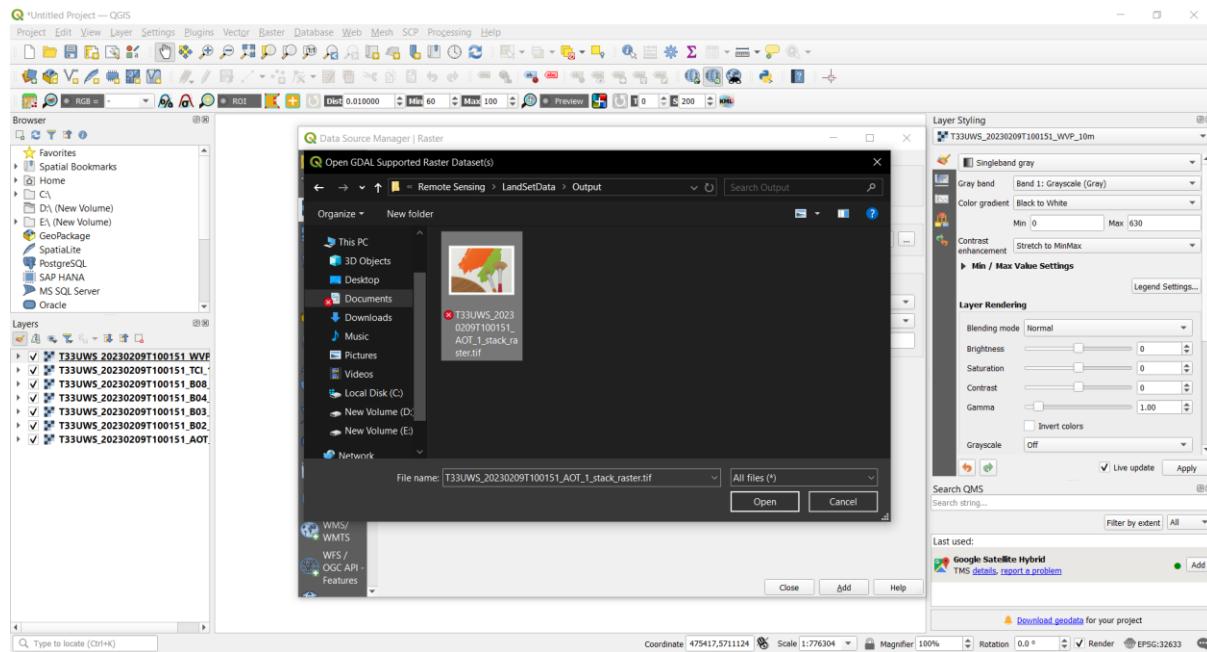
Step 6: Go to the Add Layer and then Select Raster Layer



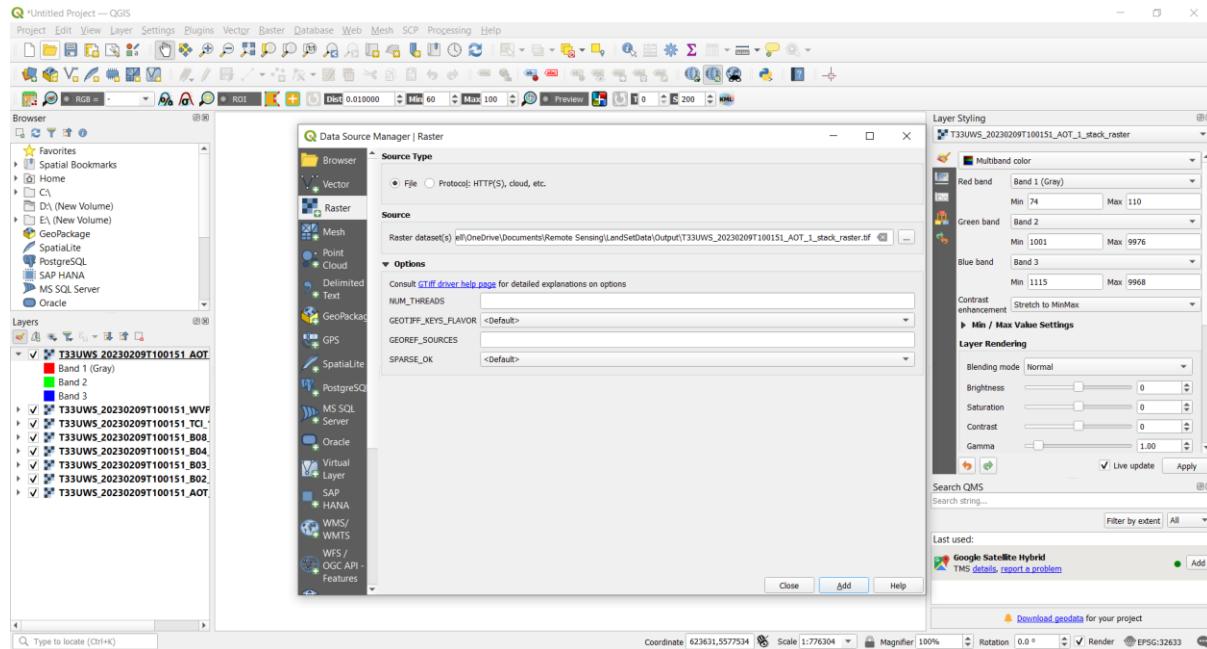
- Click on Browse



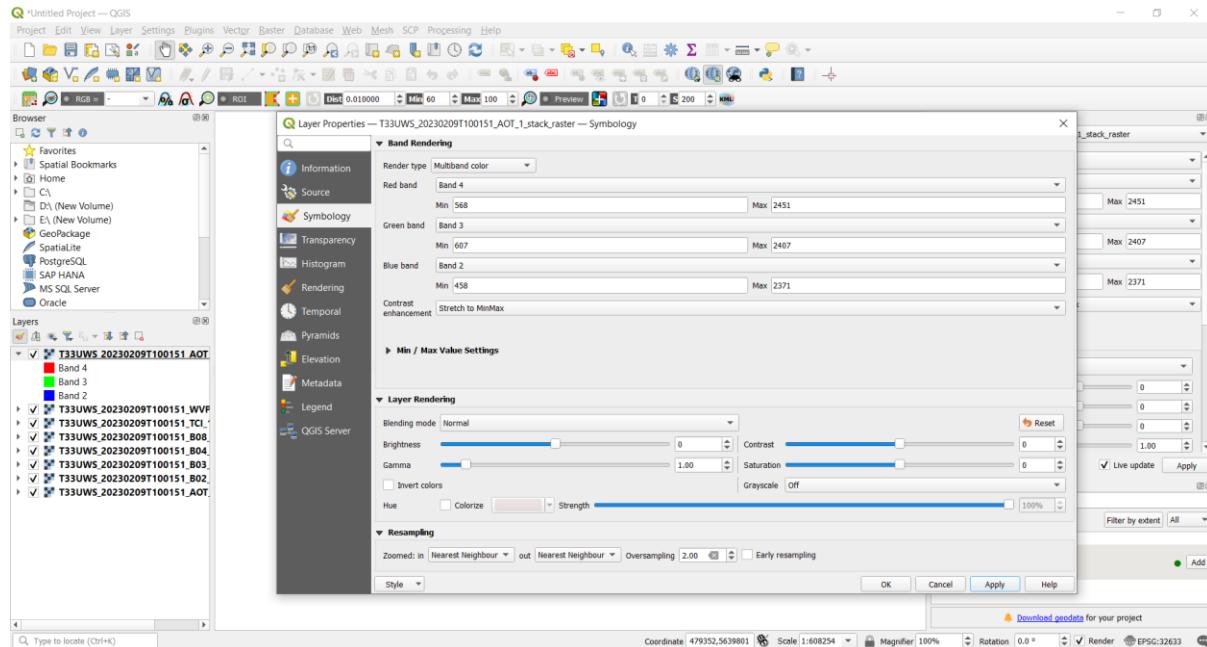
- Select T33UWS_20230209T100151_AOT_1_stack_raster.tif and then Click on Open

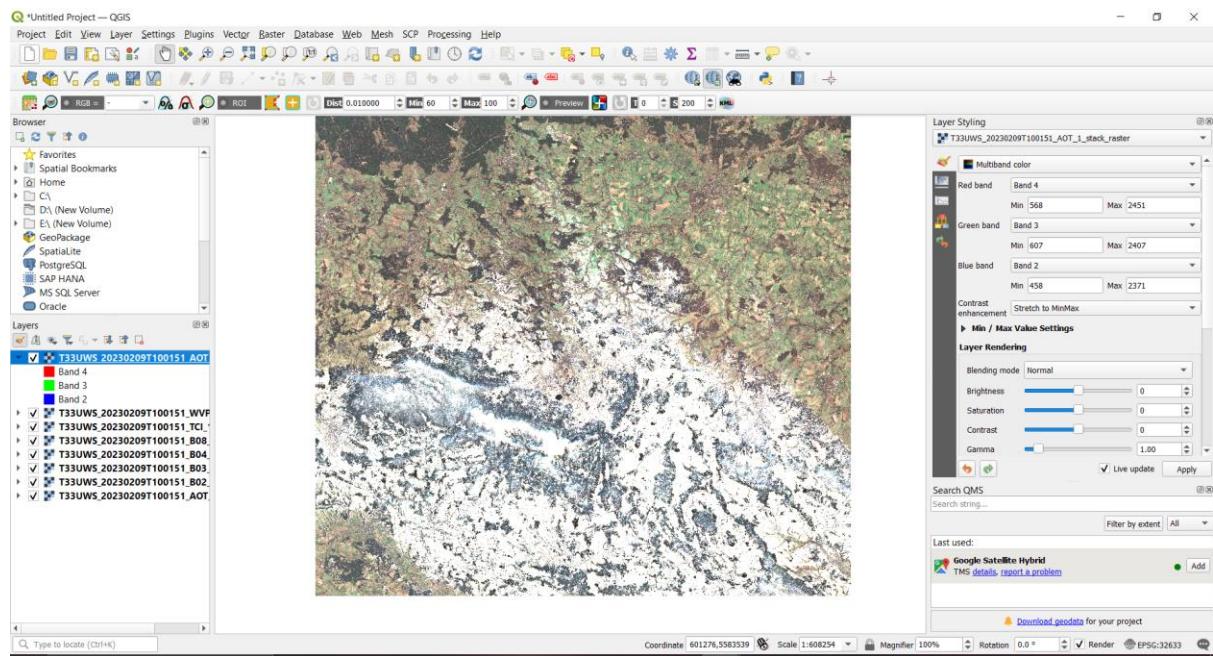


- Click on Add

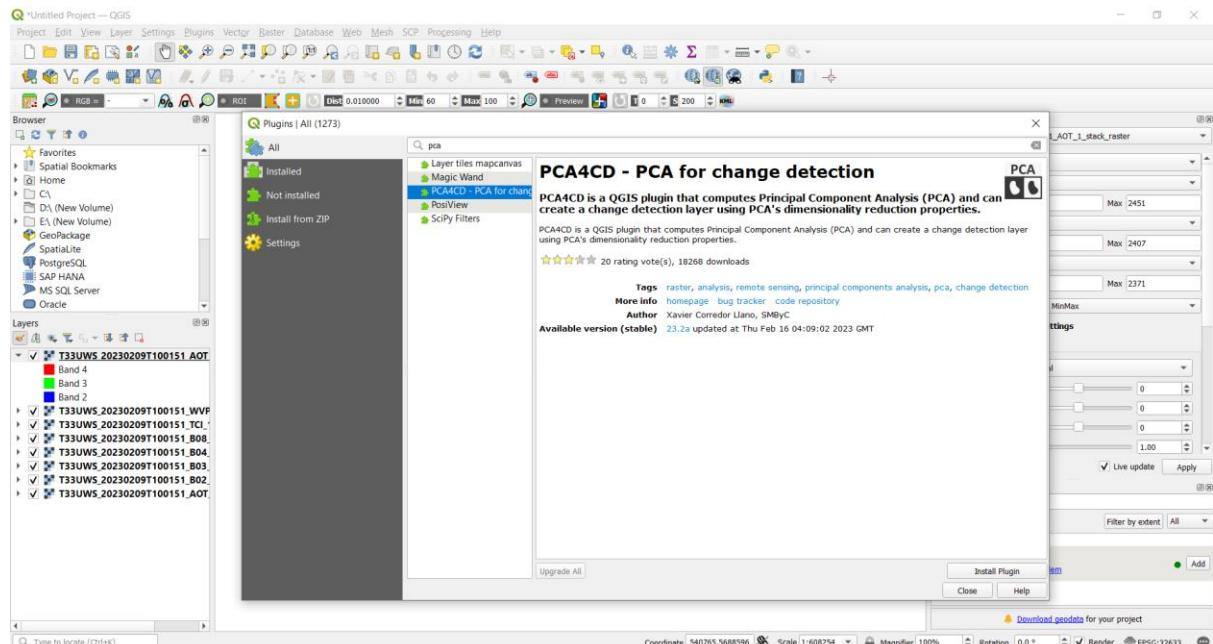


- After adding the raster image go to **layer properties > Symbology** and change render type to **Multiband color** and Select **RED BAND** to Band 4, **GREEN BAND** to Band 3, **BLUE BAND** to Band 2.

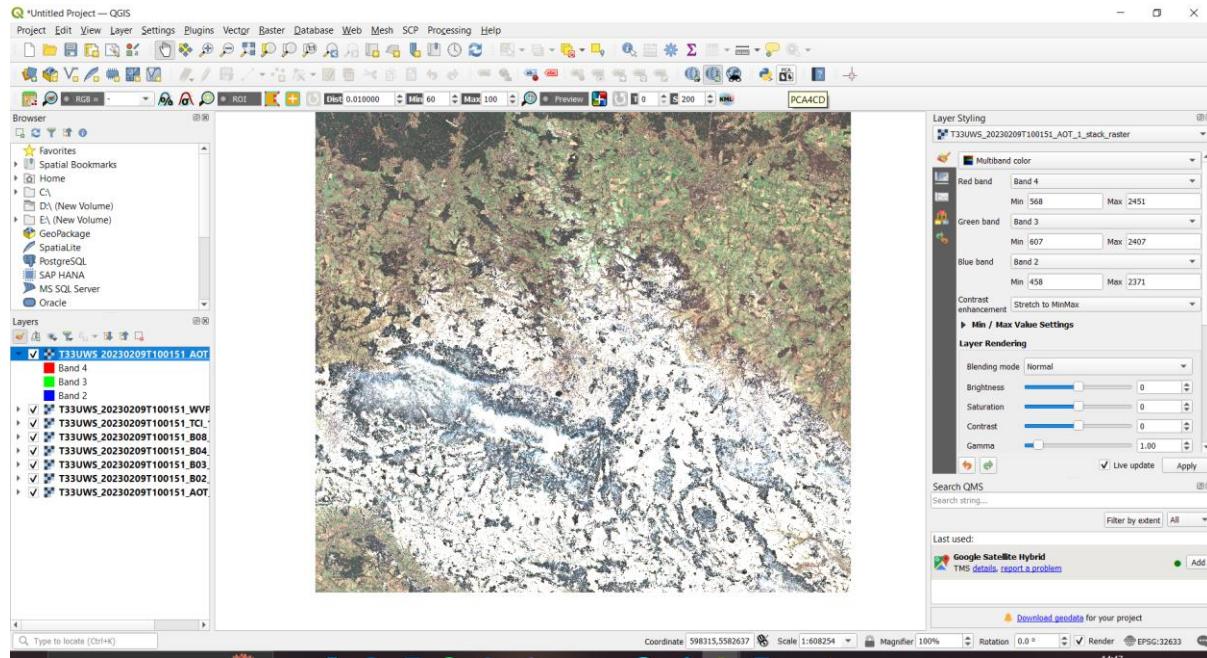




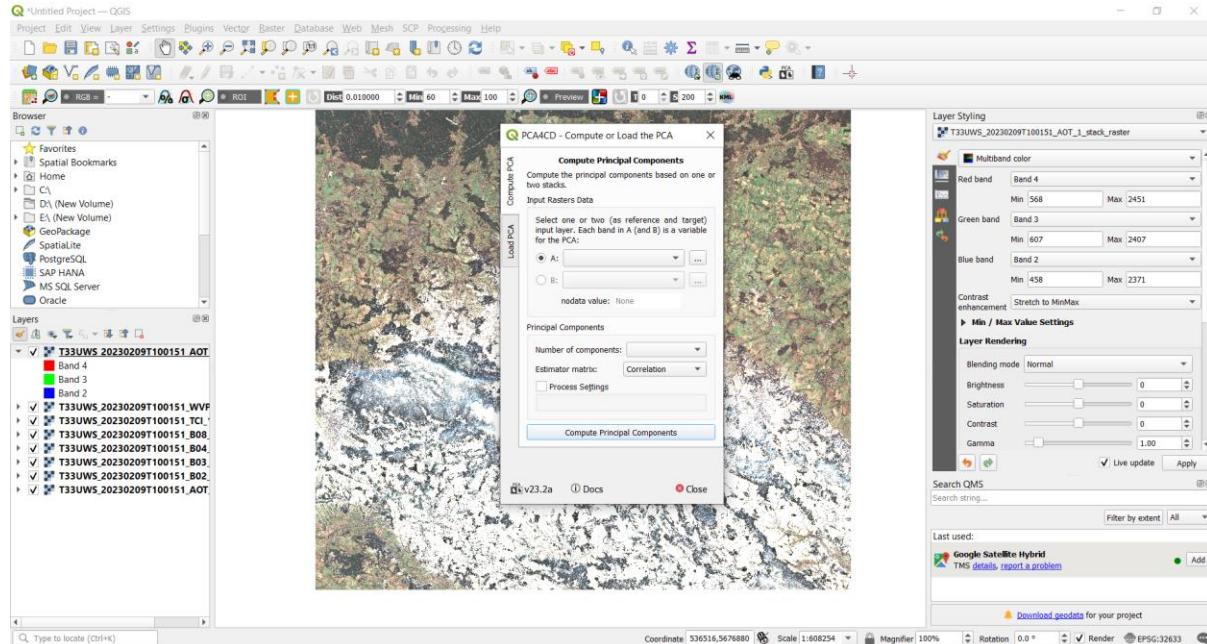
Step 7: Now install plugin PCA4CD -PCA for change detection.



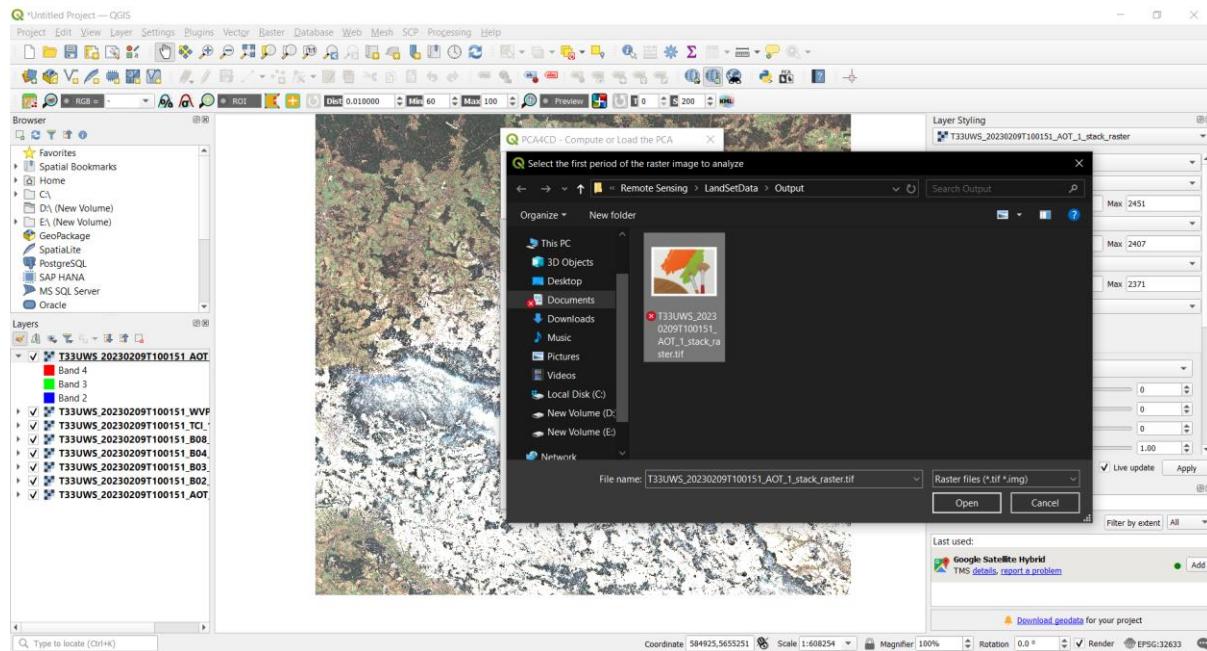
- Click on PCA4CD



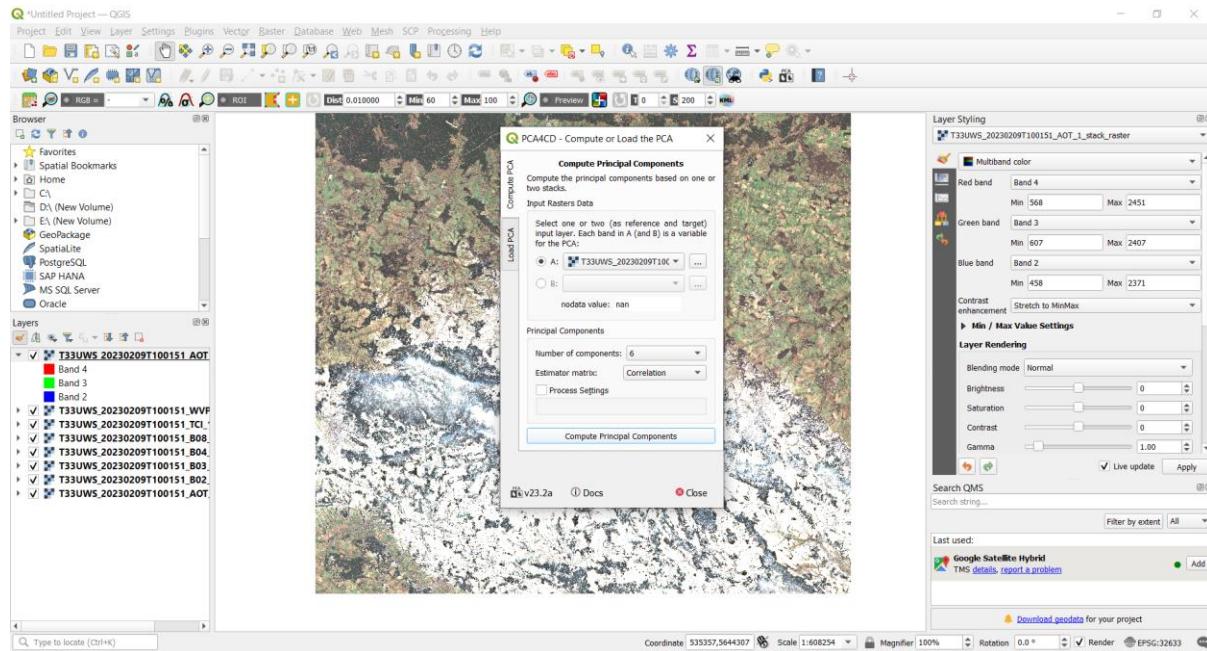
- Under PCA4CD-Compute or Load the PCA Select Variable A and Click on Browse



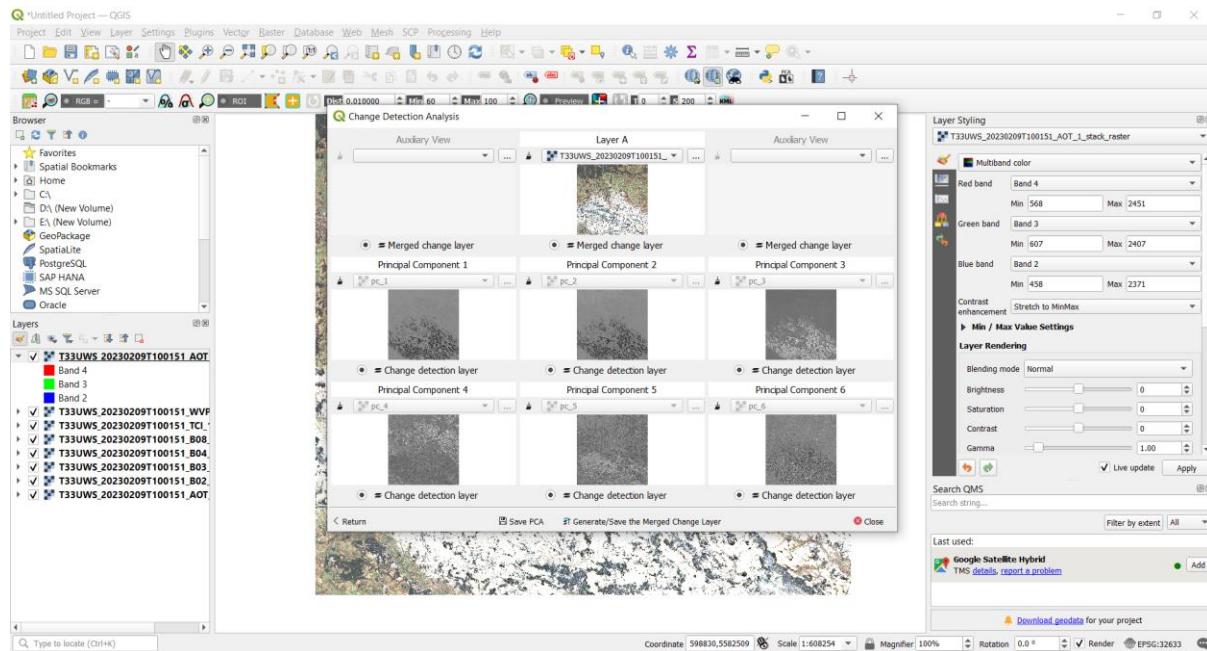
- Select T33UWS_20230209T100151_AOT_1_stack_raster.tif and then Click on Open



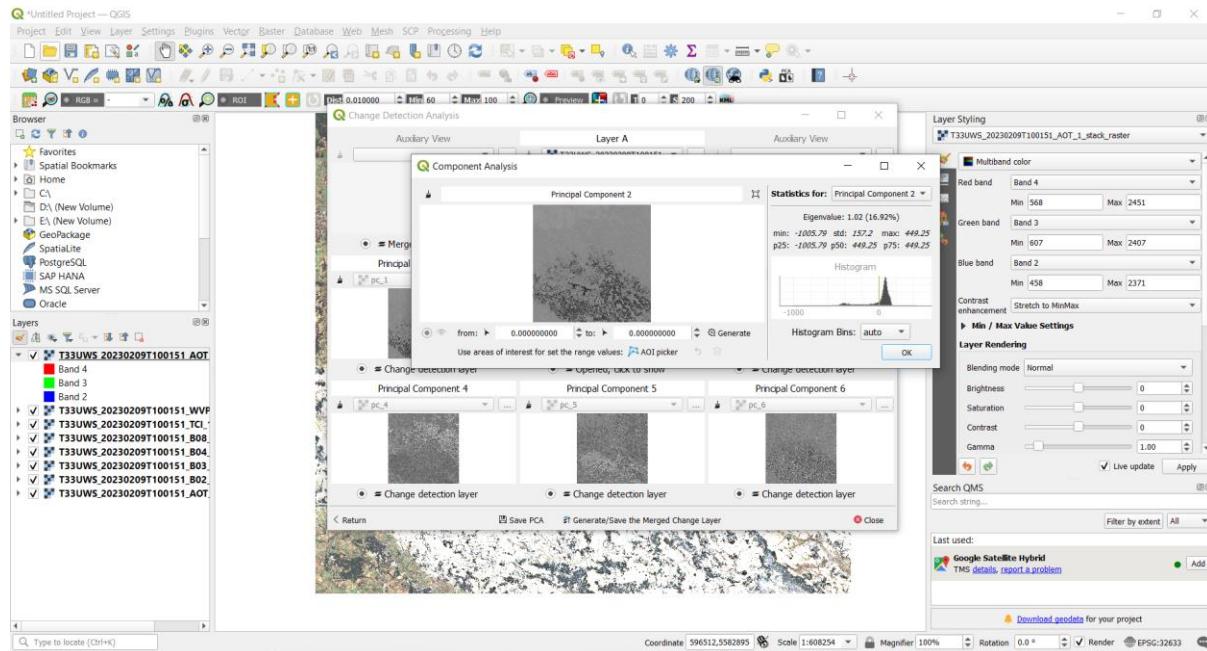
- Click on Compute Principal Components



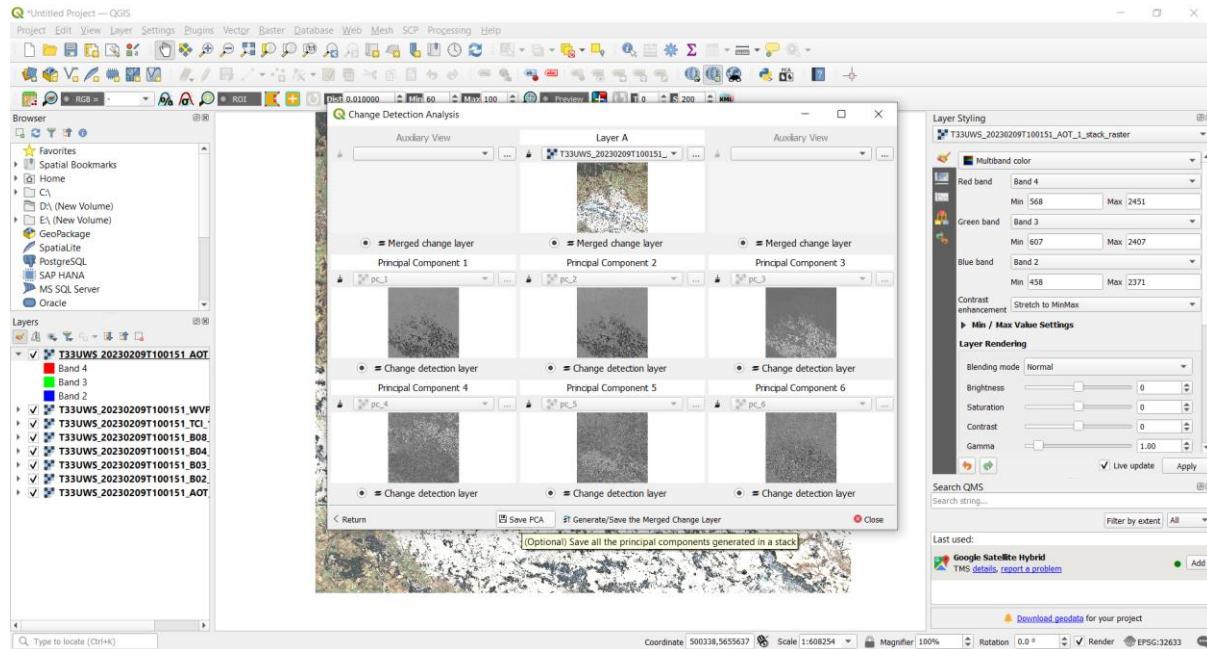
- After Computing we will get 7 separate images



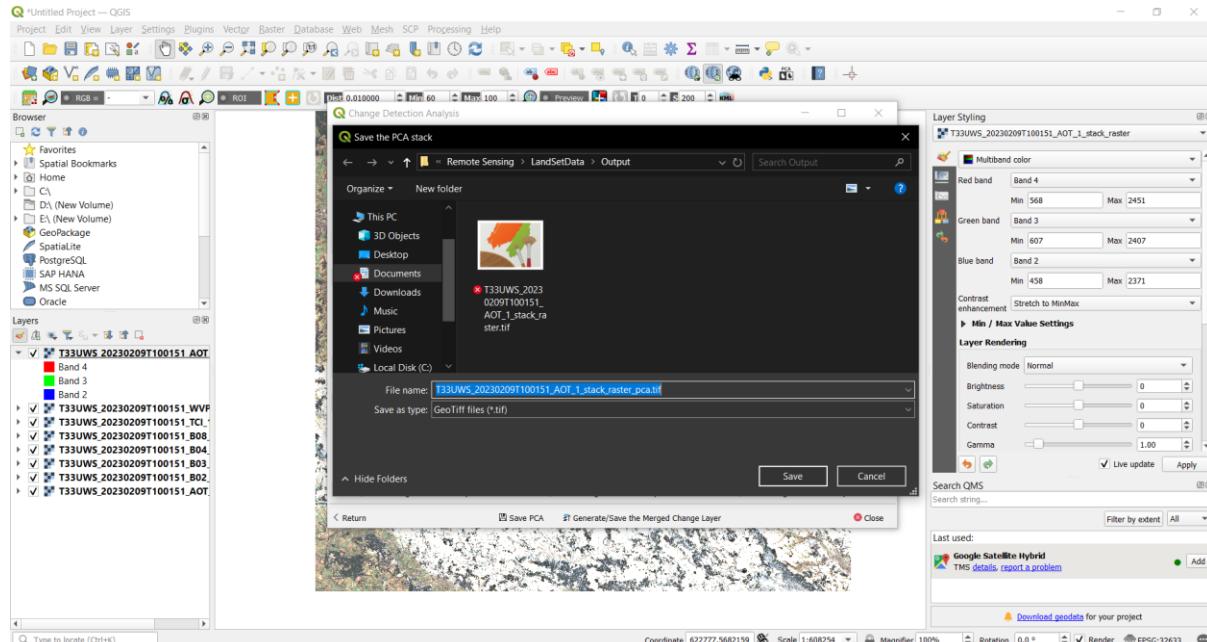
- here you can Click on Change detection layer and view the component analysis along with histogram details of particular image



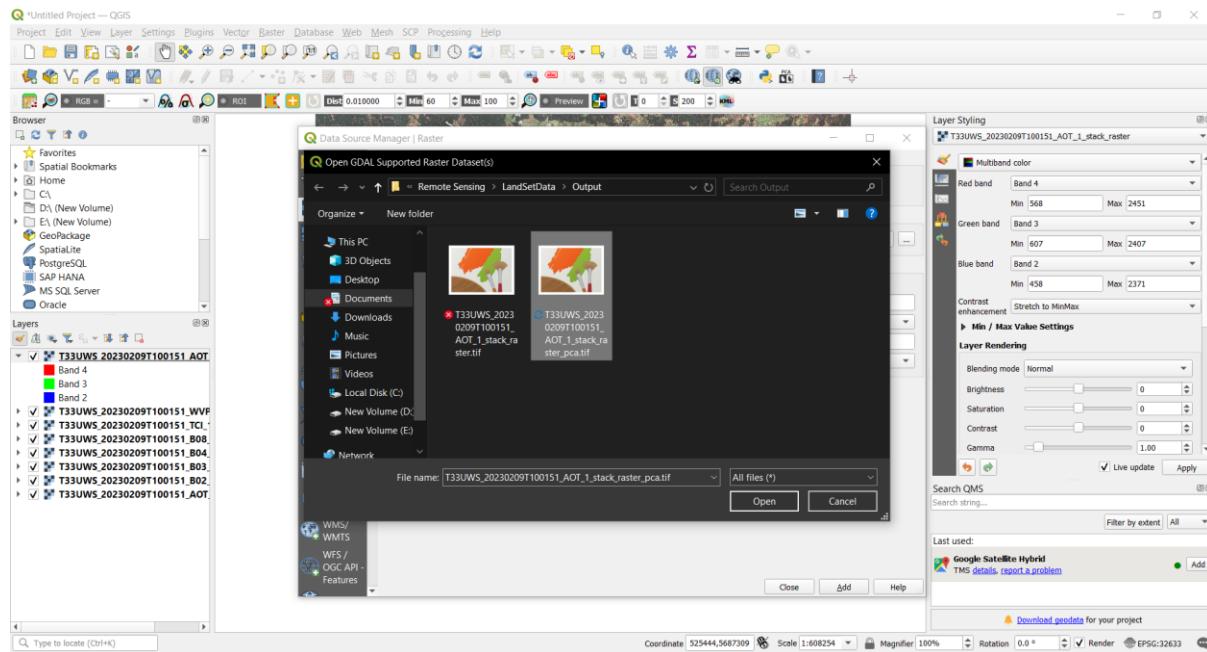
- Click on Save PCA File



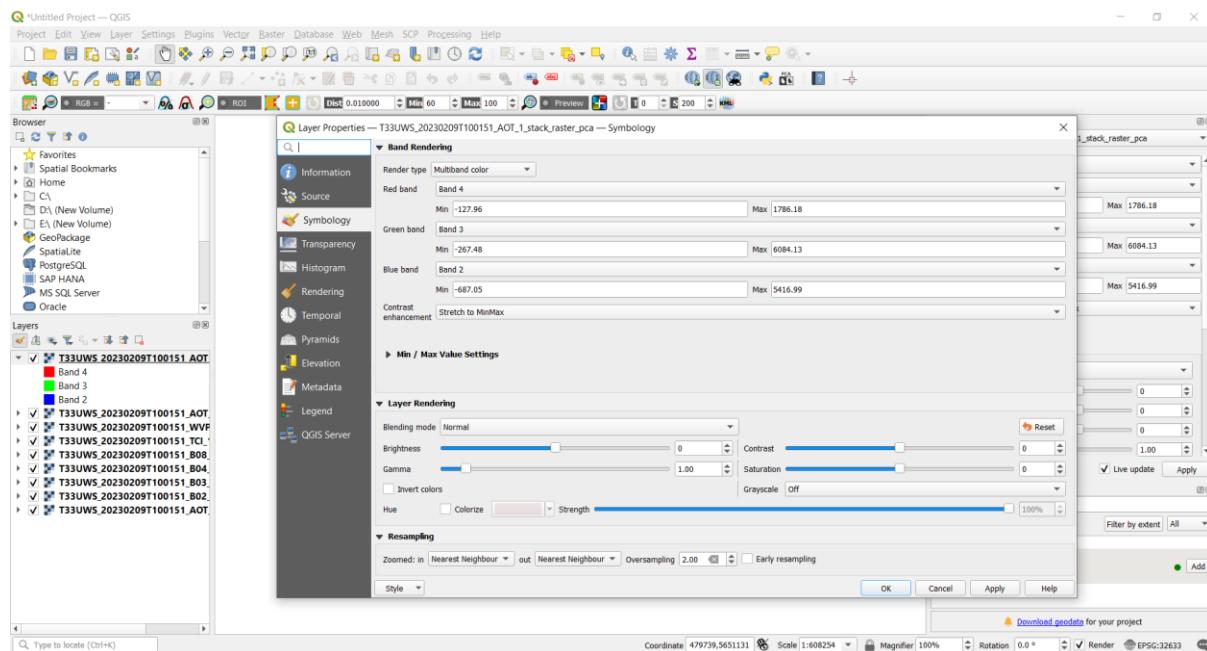
- Click on Save



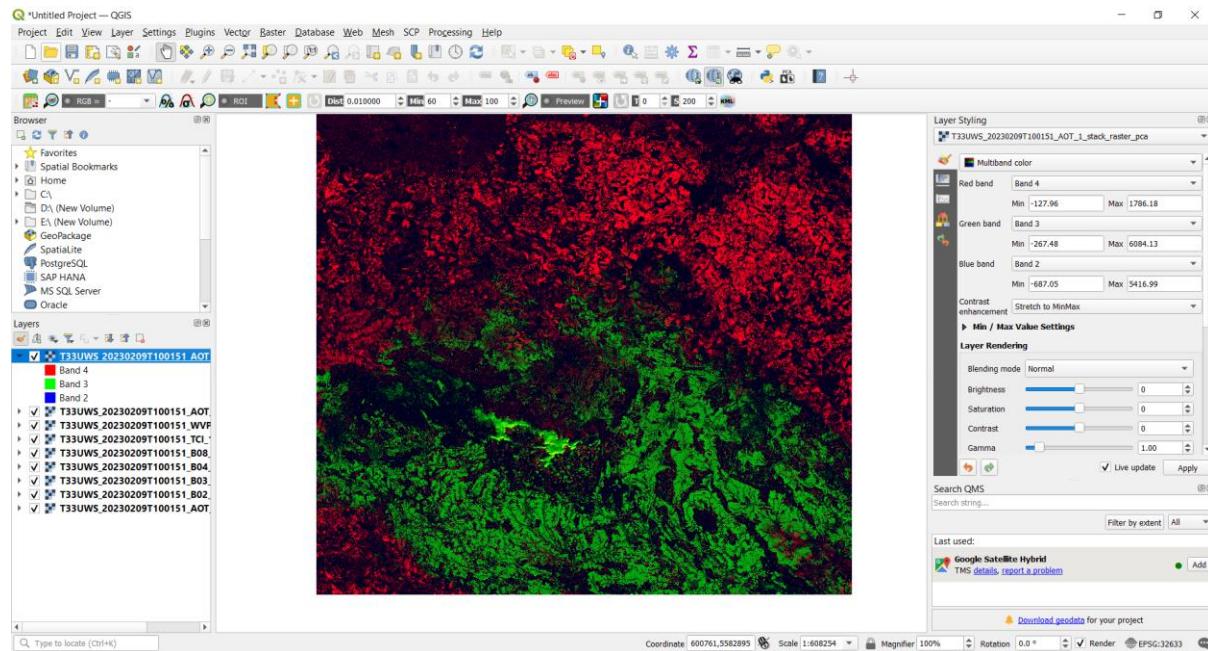
- Again, Go to Layer > Add layer > Add raster layer, then in raster dataset(s) and this select saved pca file and Click on add.



- After opening the pca image, now you can change the band from layer properties > Symbology > Render Type > Multiband Color here you can set the RGB TO B1,B2,B3 OR RGB TO B5,B6,B7 and Click on Apply.



- Final Output of Principal Component Analysis on Satellite Images.

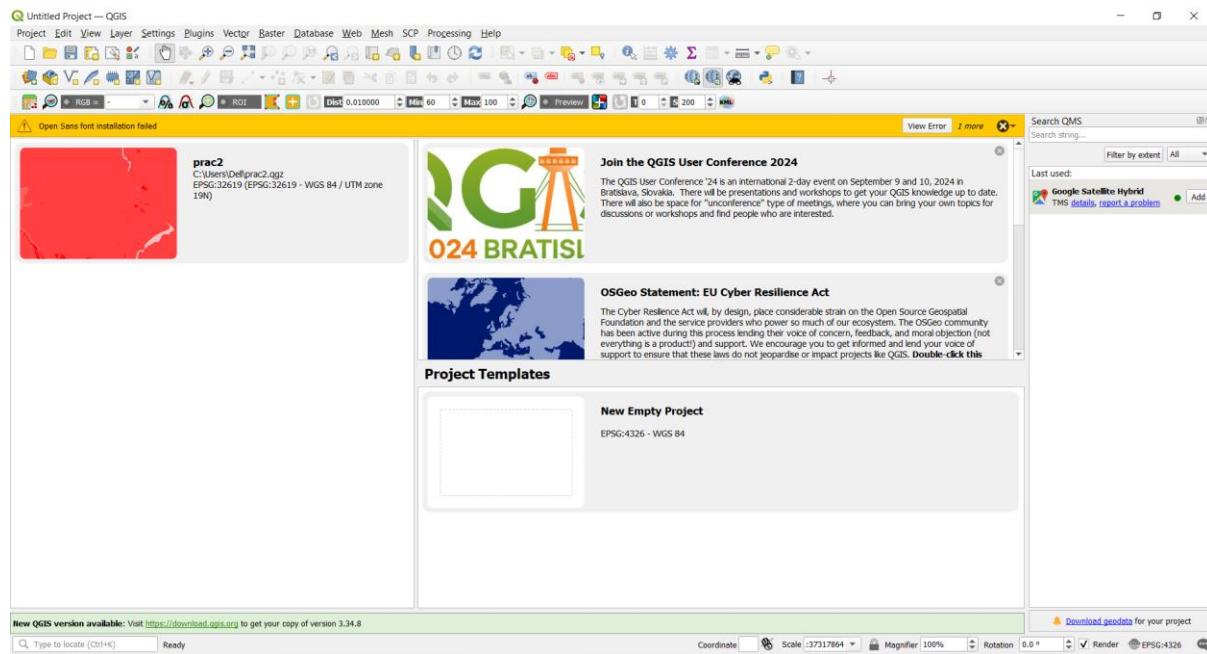


Practical: 8

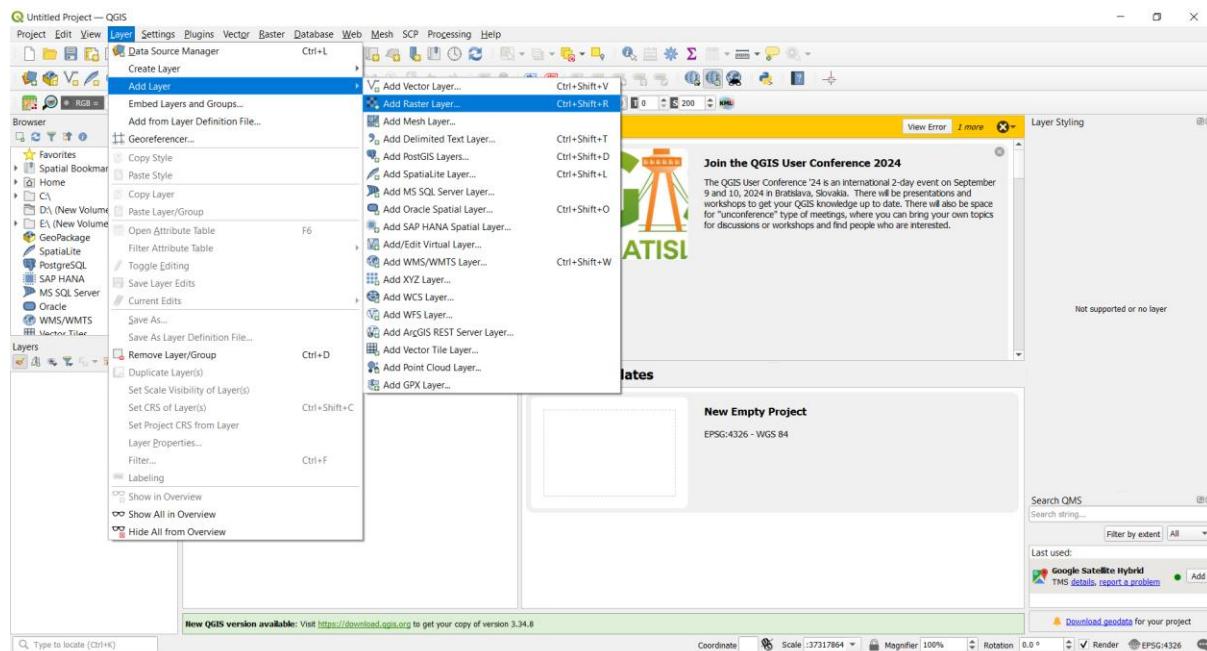
Aim: Apply Raster analysis on satellite images.

Writeup:

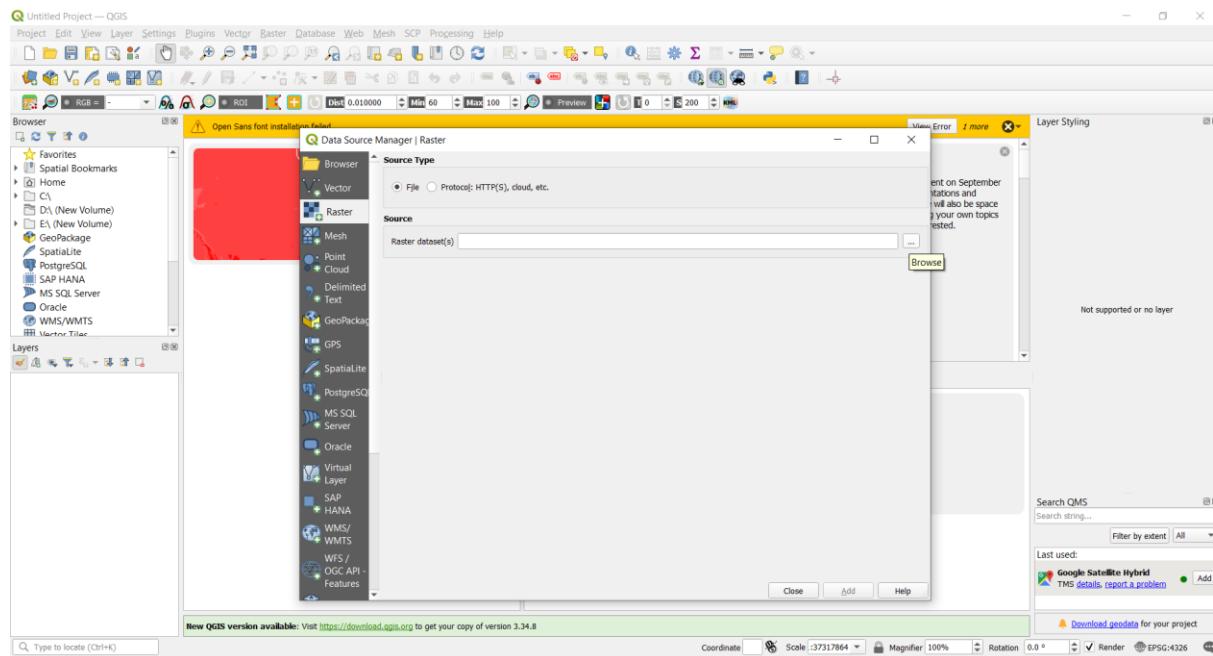
Step 1: Open QGIS



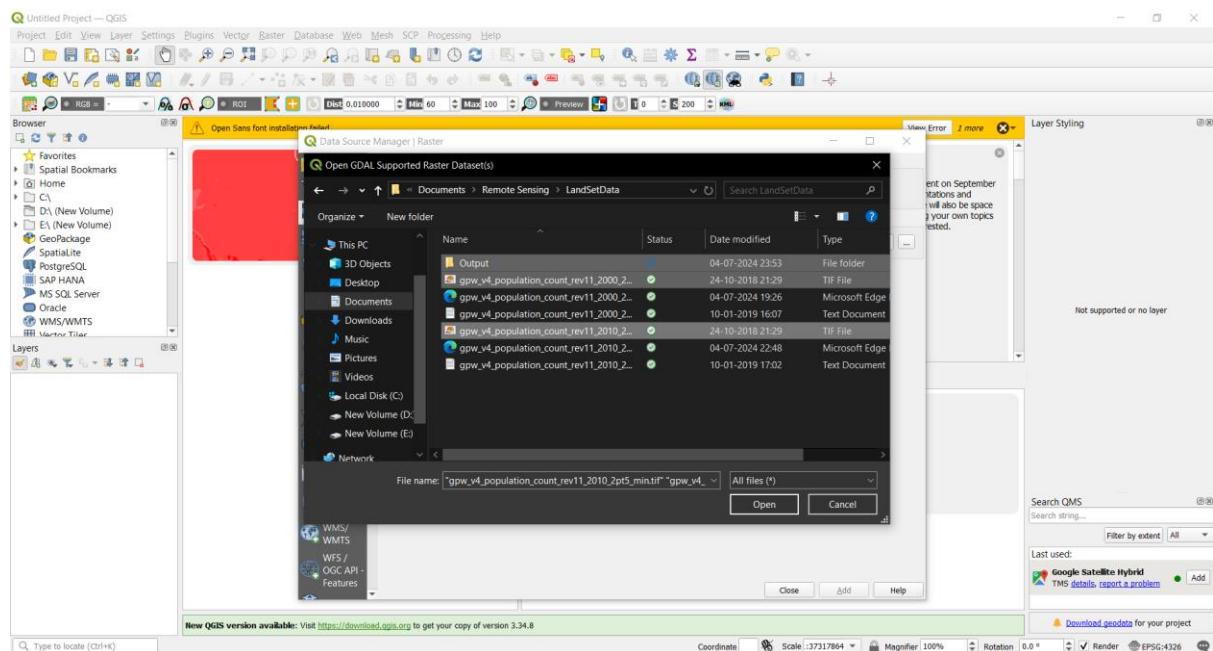
Step 2: Click on and Select Add Layer and then Select Add Raster Layer



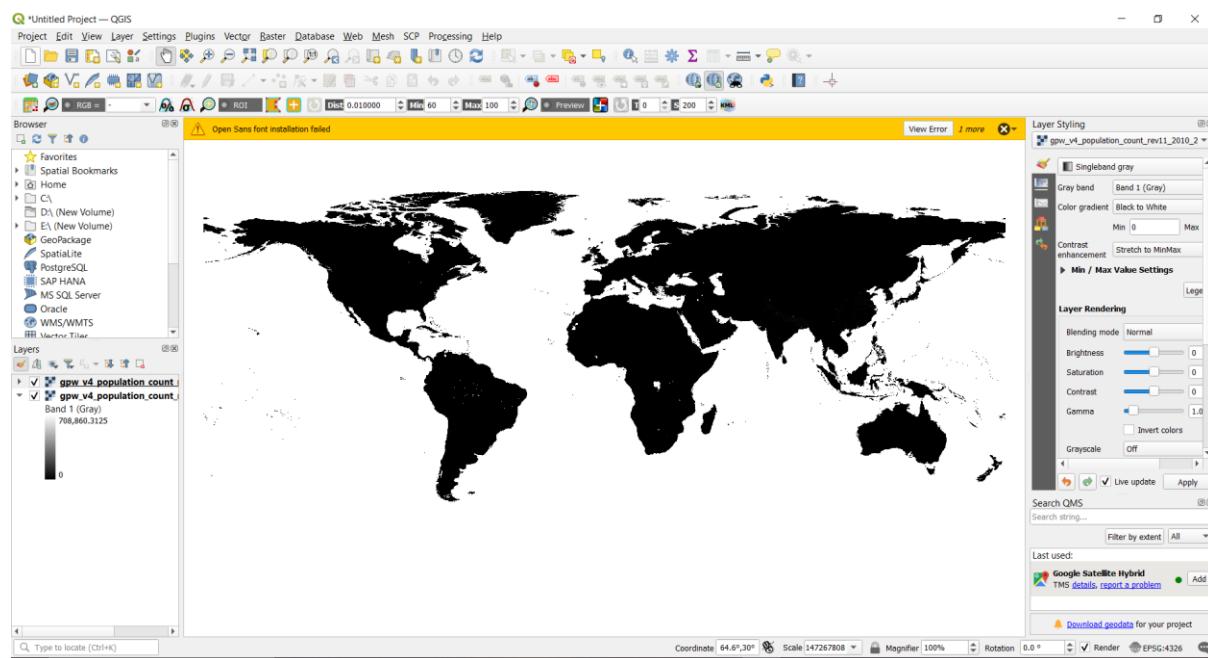
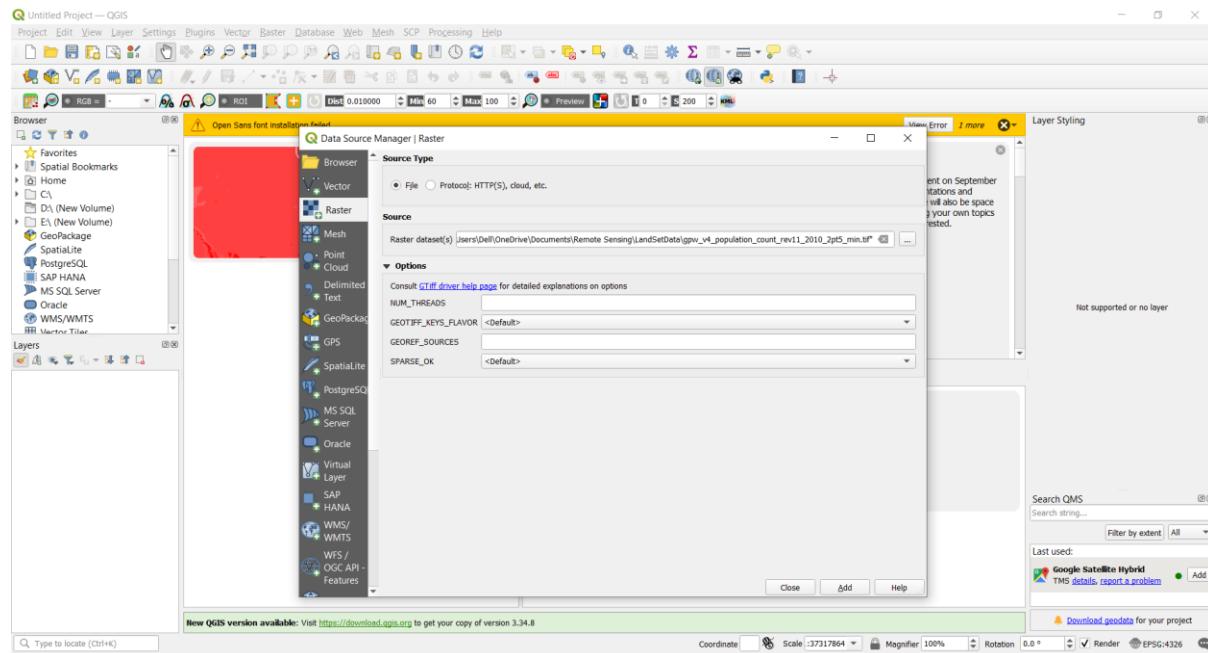
Step 3: Select Source Type File and then Click on Browse



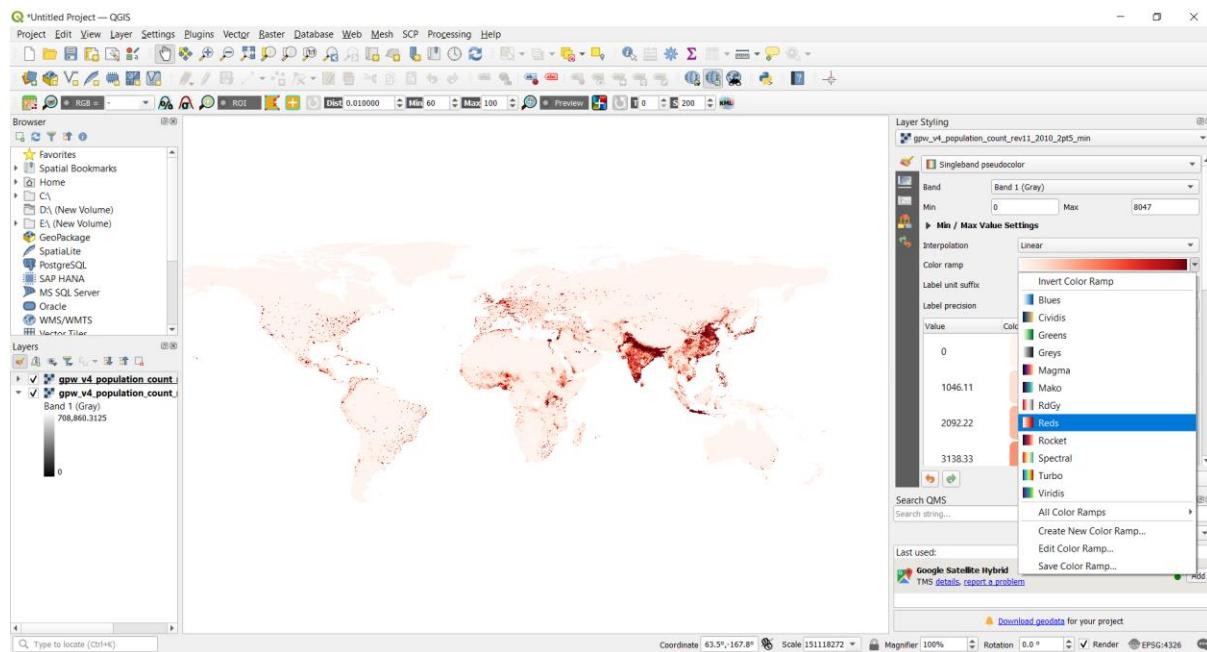
Step 4: Select 2000 MIN TIFF File and Select 2010 MIN TIFF File and then Click on OK



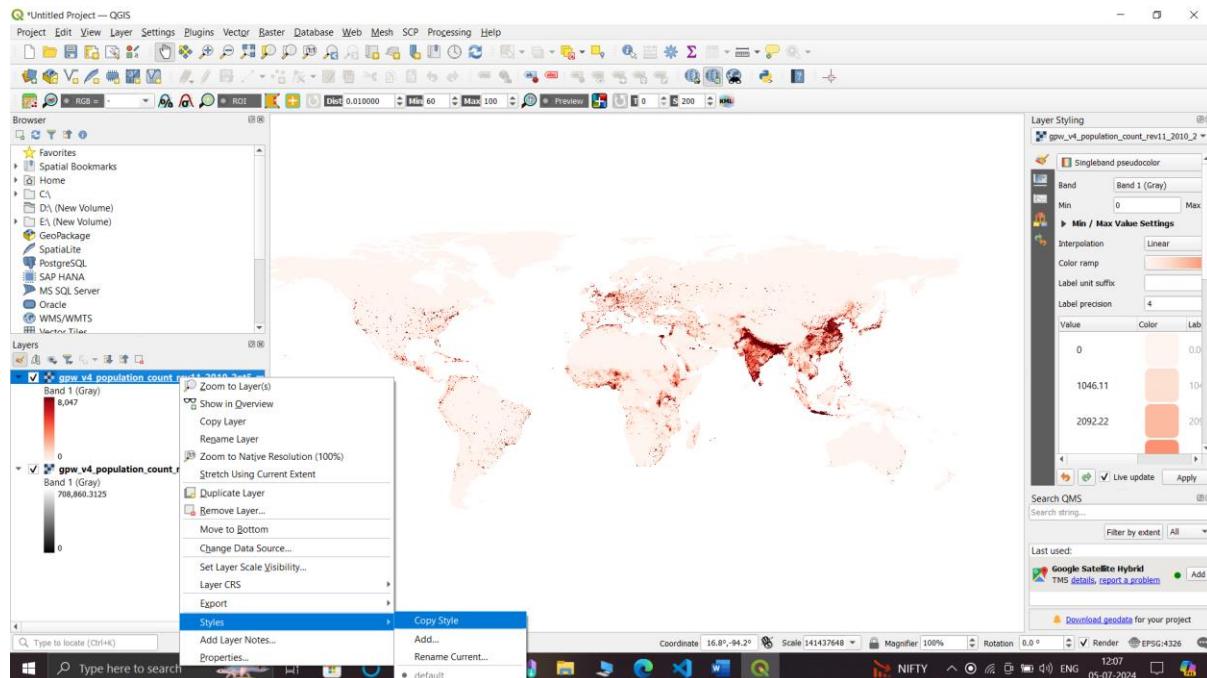
- Click on Add



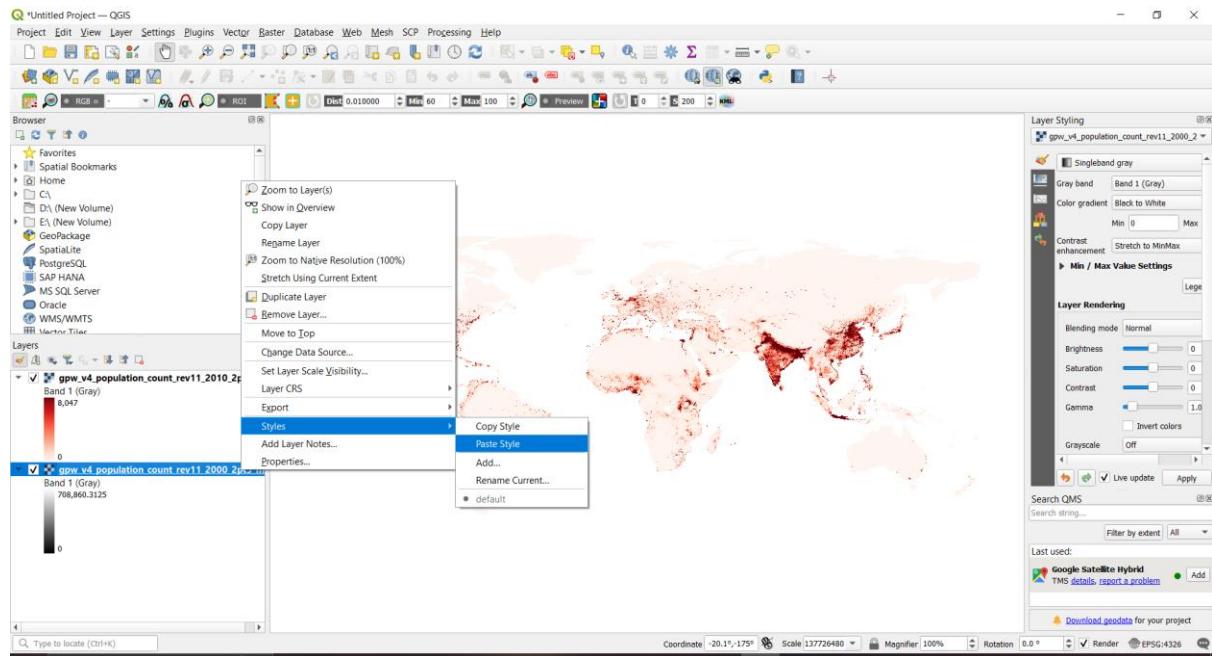
Step 5: Go To Layer Styling and Select Singleband Pseudocolor and Set Color Ramp to Reds and Set Max to 8047.



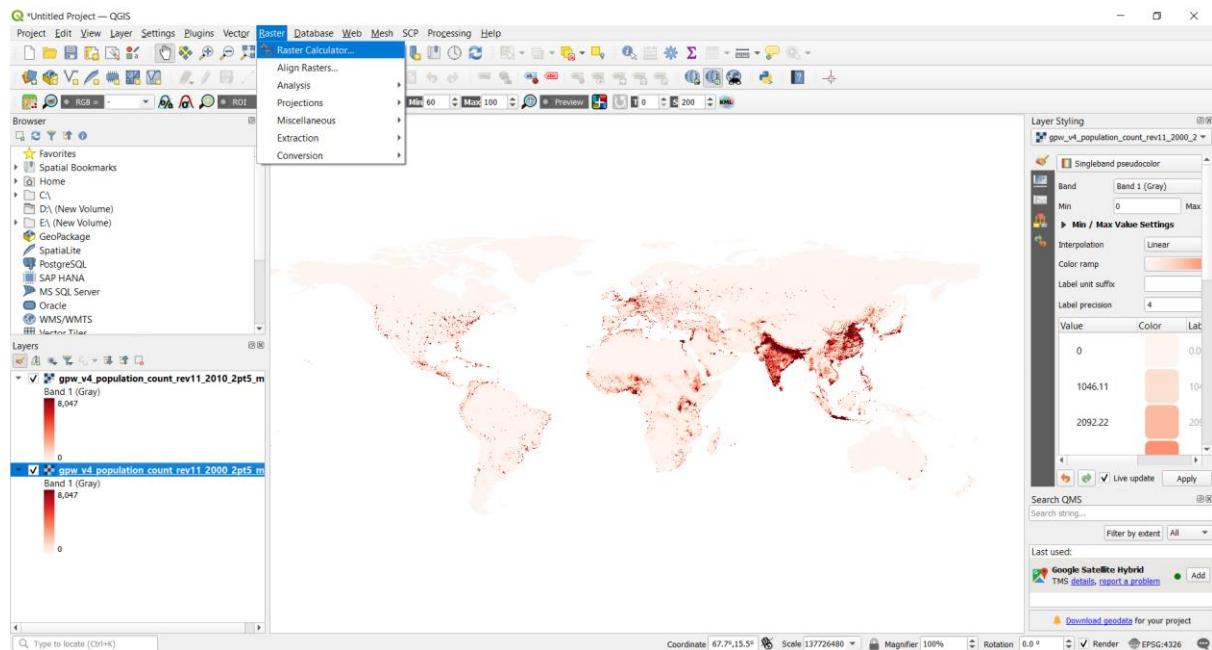
- Here you can **copy and paste the style of one layer to another layer. Right Click on `gpw_v4_population_count_rev11_2010_2pt5_min` and Select Style and then Select Copy Style**



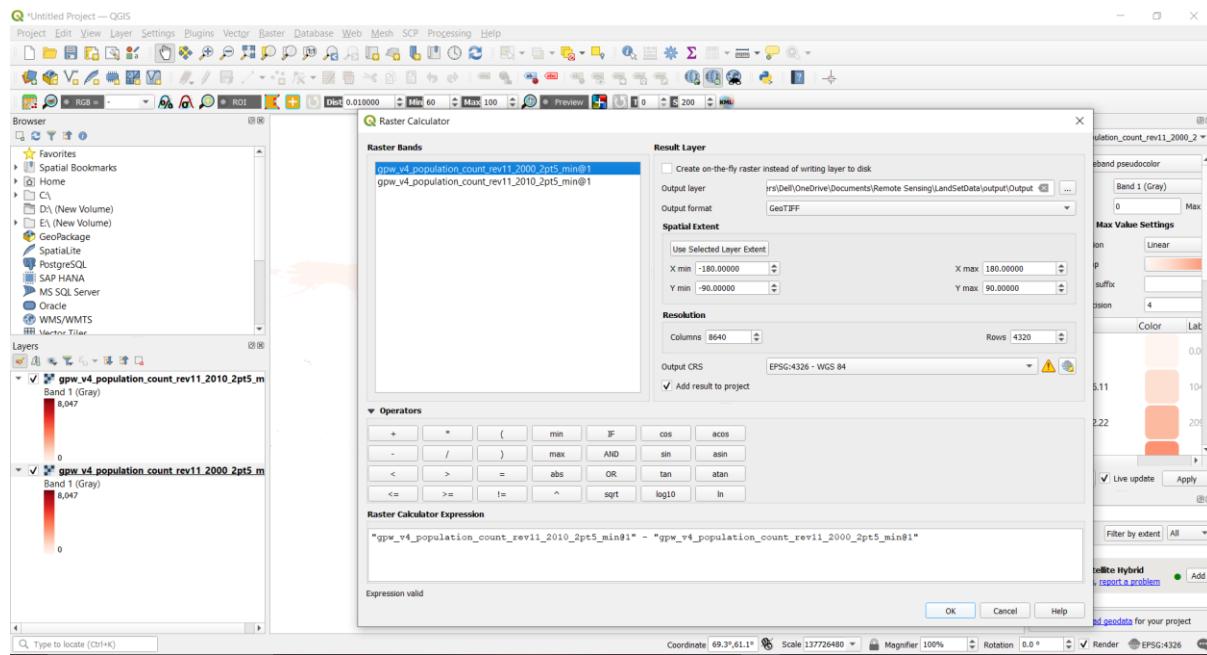
- Right Click on **gpw_v4_population_count_rev11_2000_2pt5_min** and Select Style and then Select Paste Style



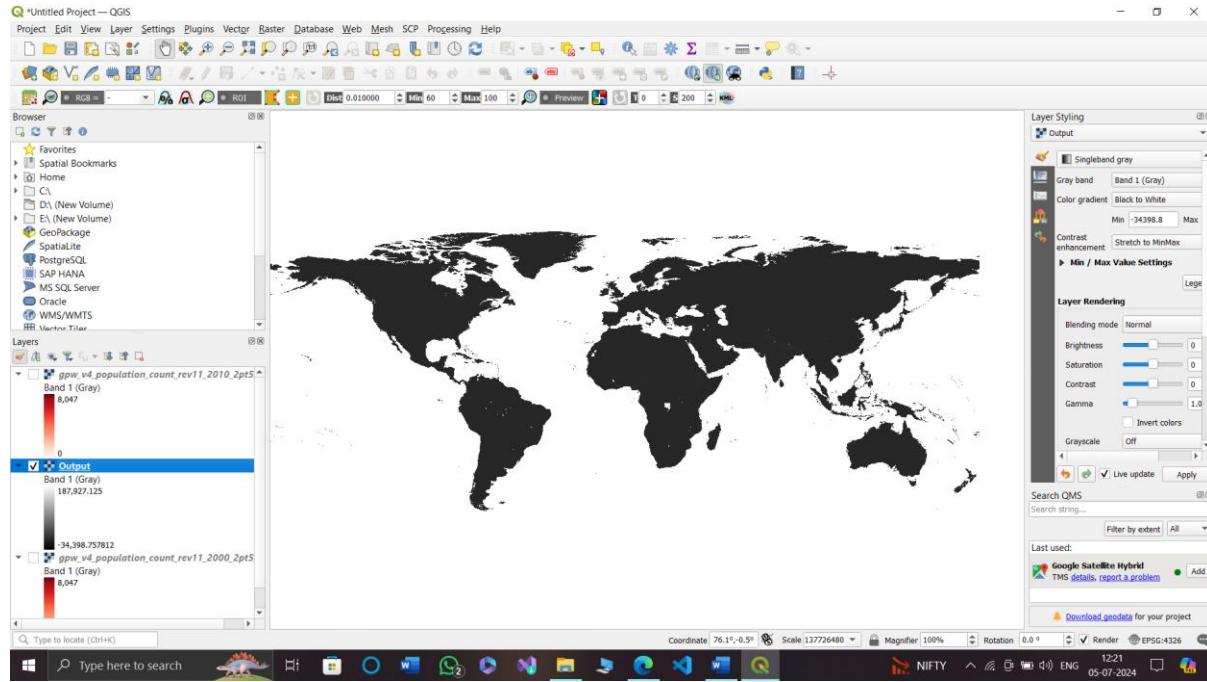
Step 6: Now go to Raster and Select Raster Calculator.



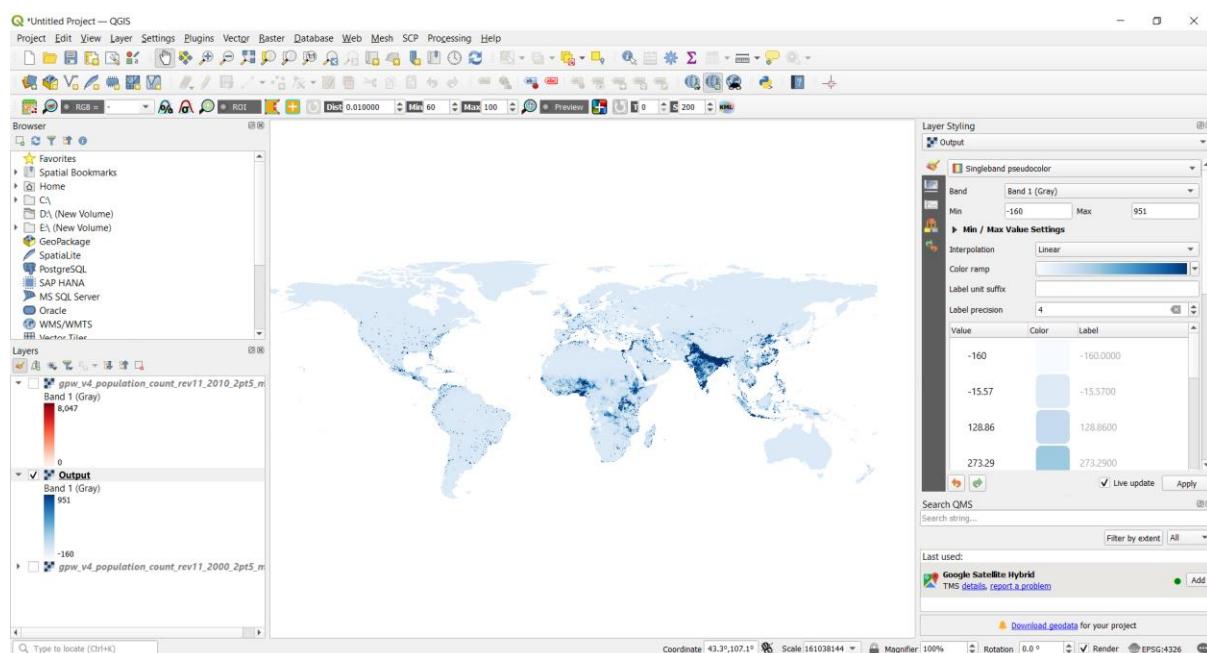
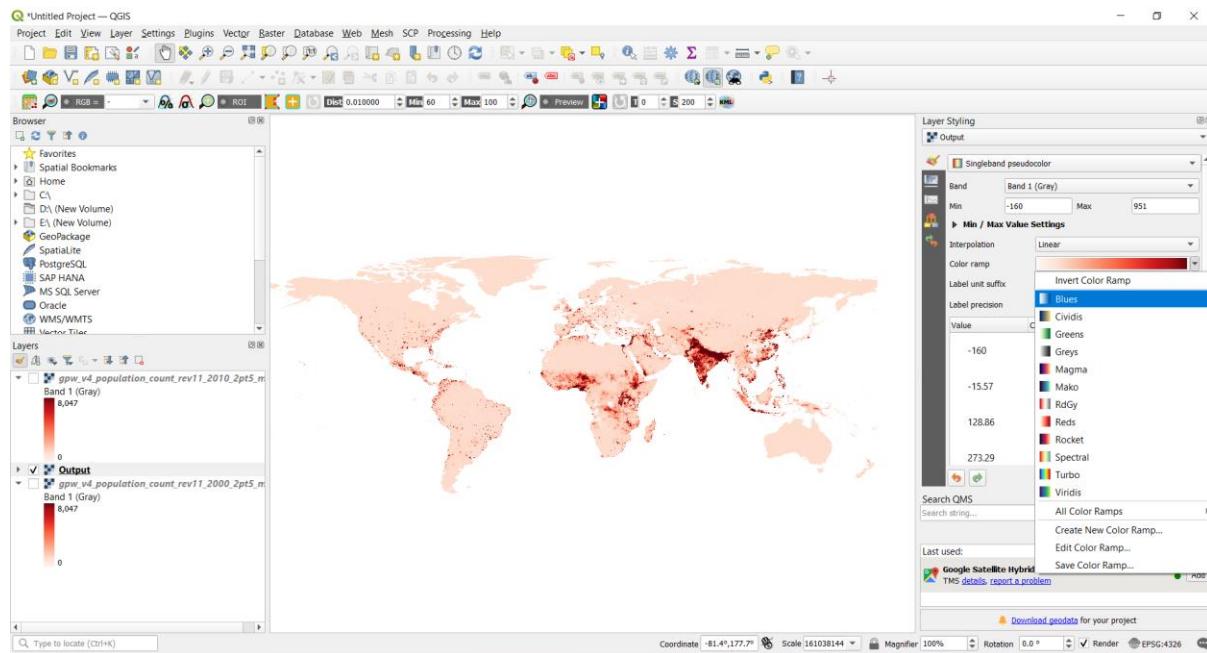
- In Raster Calculator Double Click First 2010 Population then Select minus (-) from the operators and then Double Click 2000 Population and give the Output Layer Name and Set the path and Click on Ok.



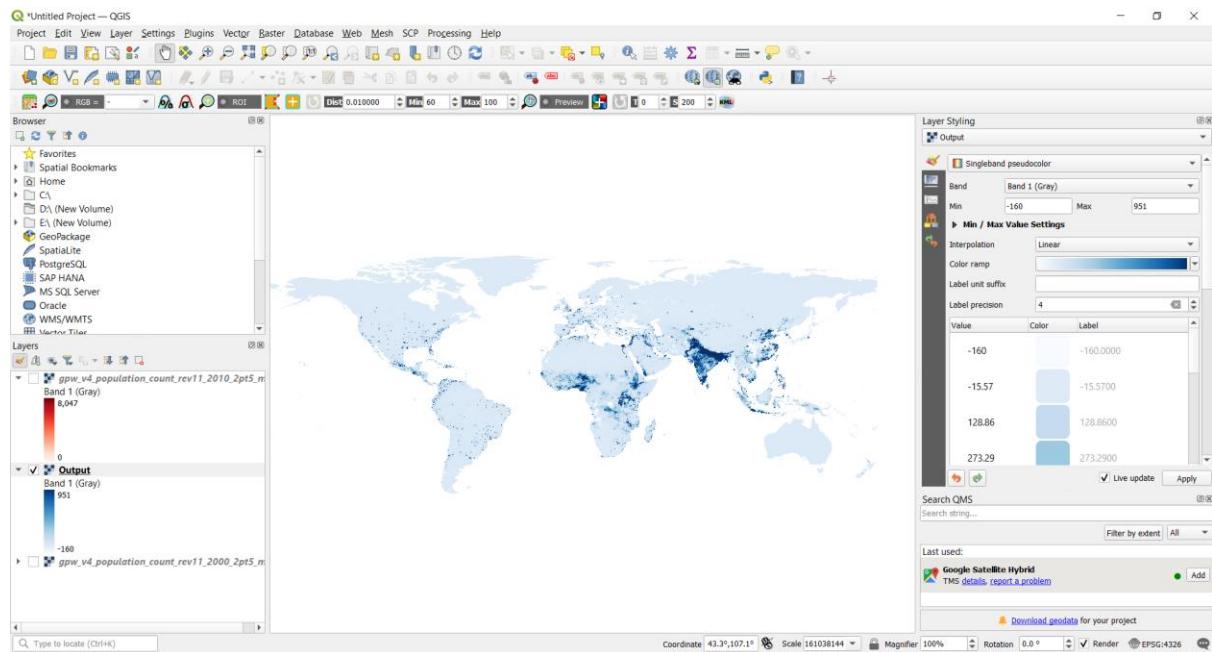
Step 7: Now Uncheck both the population layer and Select your new output layer.



- Now go to **layer styling** and Set **Symbology** to **Singleband Pseudocolor** and **Color Ramp** to **Blues** and Set **Min** and **Max** to **-160** to **951**



Step 8: Now Remove All the values.



- Now Add 5 Values Naming Label and Values, Discrete = -100, Neutral = 100, Growth = 1000, Medium Growth = 5000, High Growth = 10000 and give each value different color.
- Here is the Final Output

