Handson: Multispectral Satellite Image, and FCC

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Following are the objectives of the exercise:

1. Getting familiar with raw satellite images.
2. Understanding digital Image (Pixel)
3. How to identify the channels and band combinations.
4. FCC and standard FCC preparation.
5. Plotting histogram of bands.
6. Execution on QGIS software suits.

You have been given a file "liss3_4bands". The image is a raw satellite image of Liss3 sensor, for Pontasahib region Uttarakhand.

Details: The Resourcesat-1 satellite was launched by the Indian Space Research Organisation (ISRO) on October 17, 2003, followed by Resourcesat-2 on April 20, 2011, to ensure systematic and repetitive coverage of the earth's surface. The objective of these Indian Remote Sensing (IRS) satellites is to provide data for integrated land and water resource management. A collaborative effort between ISRO and the U.S. Geological Survey (USGS) provides open access to Linear Imaging Self Scanning (LISS-3) sensor data products through EarthExplorer.

Spectral Bands and Resolution: The instruments on the Resourcesat-1 (also known as IRS-P6) and Resourcesat-2 satellites acquire four spectral bands ranging from Visible and Near-Infrared (VNIR) to Shortwave Infrared (SWIR) wavelengths. The satellite operates in a sun-synchronous orbit at an altitude of 817 km. The satellites take 101.35 minutes to complete one revolution around the earth and complete about 14 orbits per day. The entire earth is covered by 341 orbits during a 24-day cycle. The LISS-3 sensor covers a 140-km orbital swath at a spatial resolution of 24 meters with a 24-day repeat cycle.

Number of Bands: 4

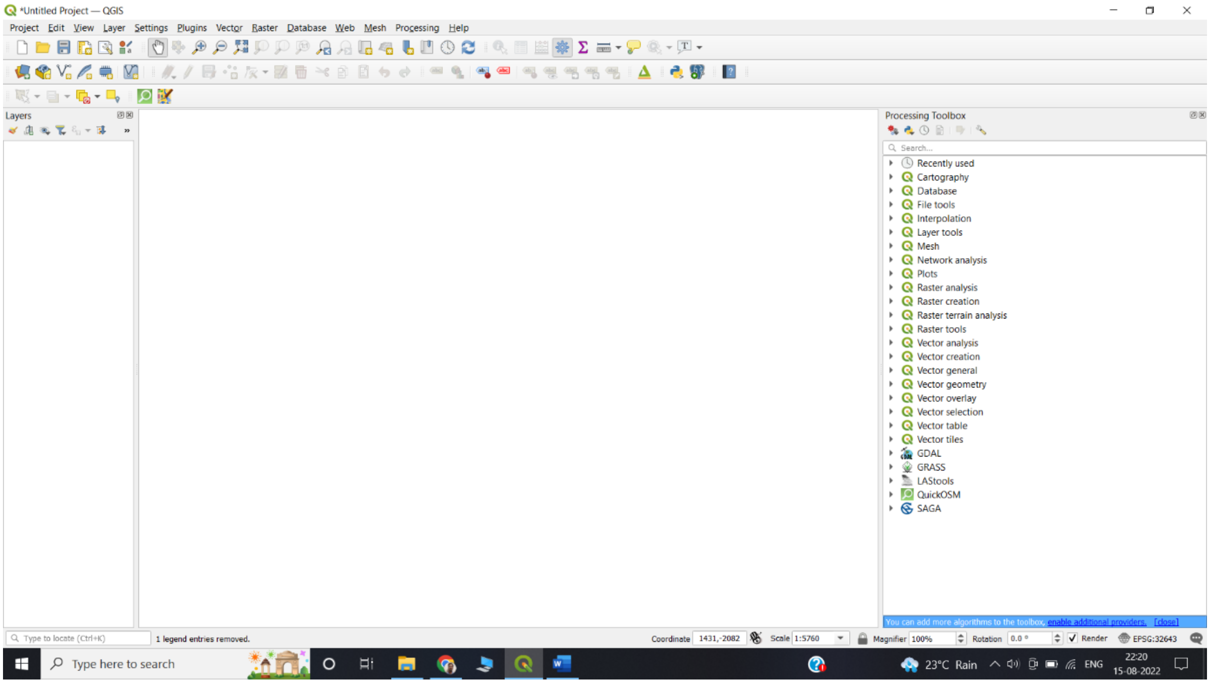
Spectral Band 1 (μ): 0.52 – 0.59 (green)-**Layer1**

Spectral Band 2 (μ): 0.62 – 0.68 (red)-**Layer2**

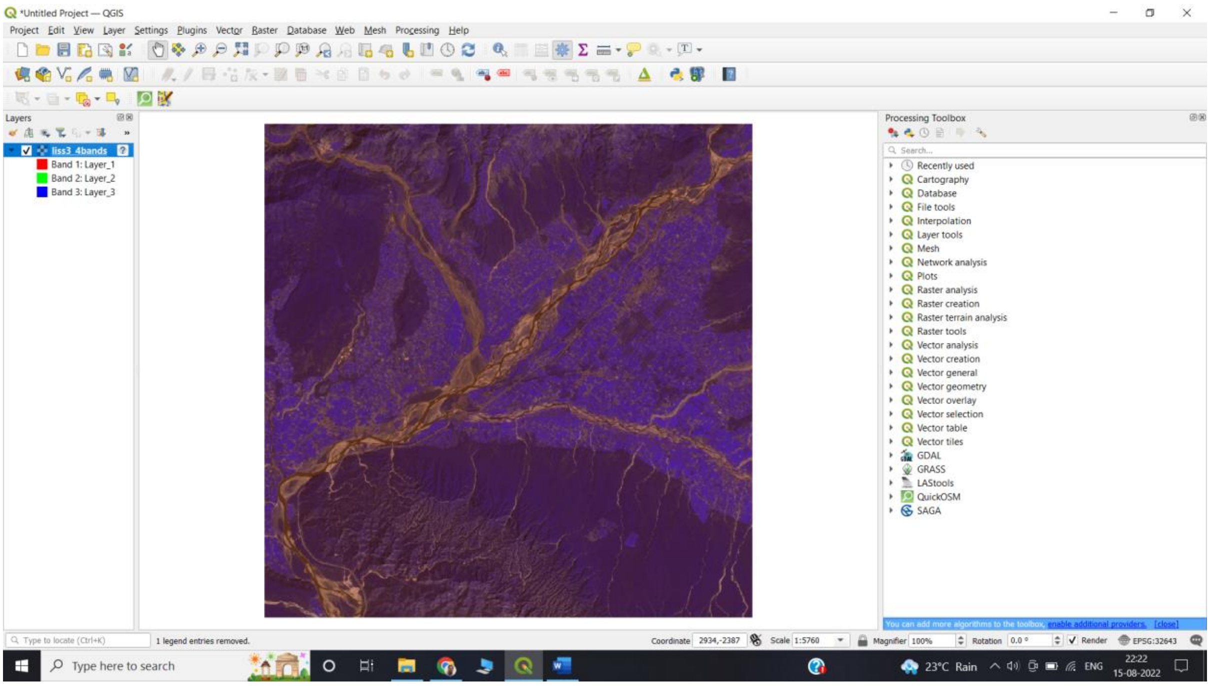
Spectral Band 3 (μ) : 0.77 – 0.86 (NIR)-**Layer3**

Spectral Band 4 (µ): 1.55 – 1.70 (SWIR)-**Layer4**

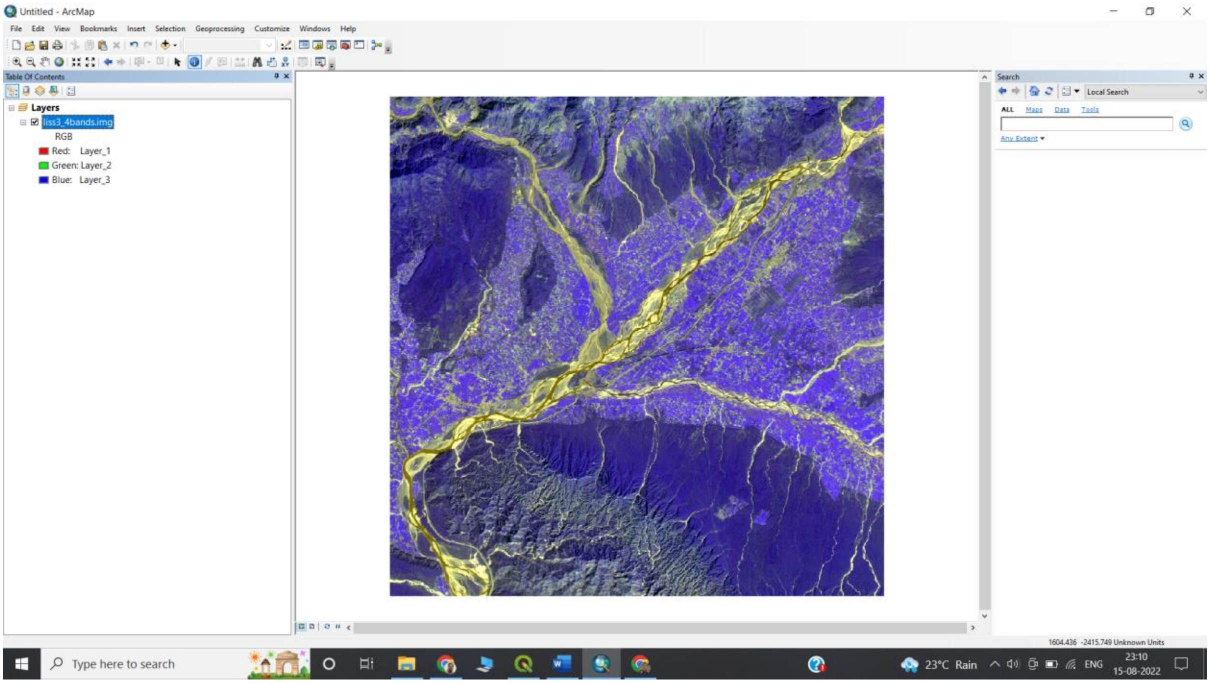
1. Open QGIS/ArcGIS software tool, QGIS will look like this:



2. Drag and drop the given image to the window you should see the following in QGIS



In ArcGIS you will see the window like this:

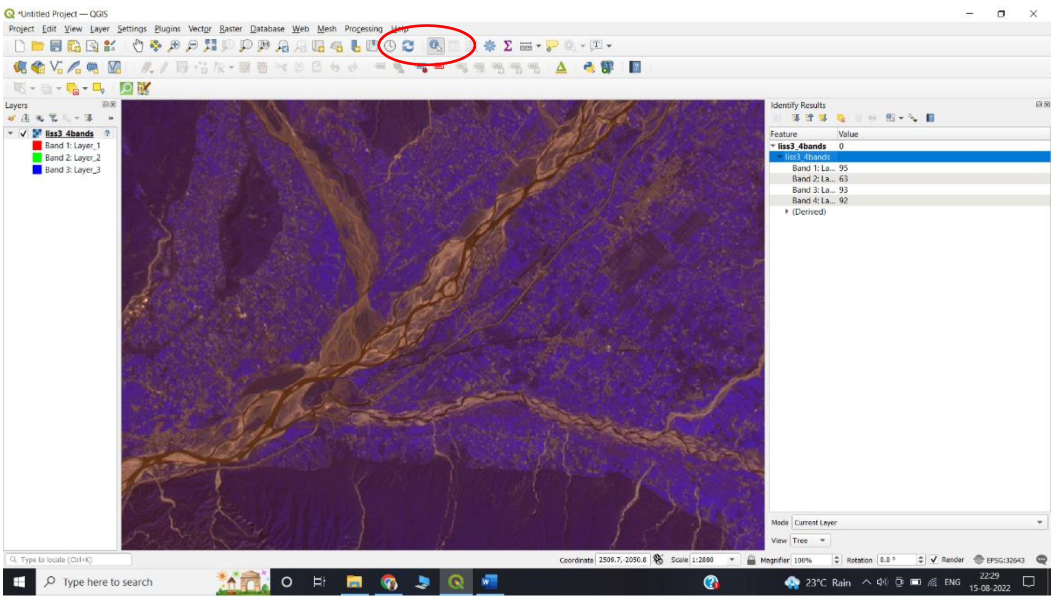


If you see a message is regarding no spatial reference found. This means the data has no location information or it has not been registered. We will look into registration part in next lab.

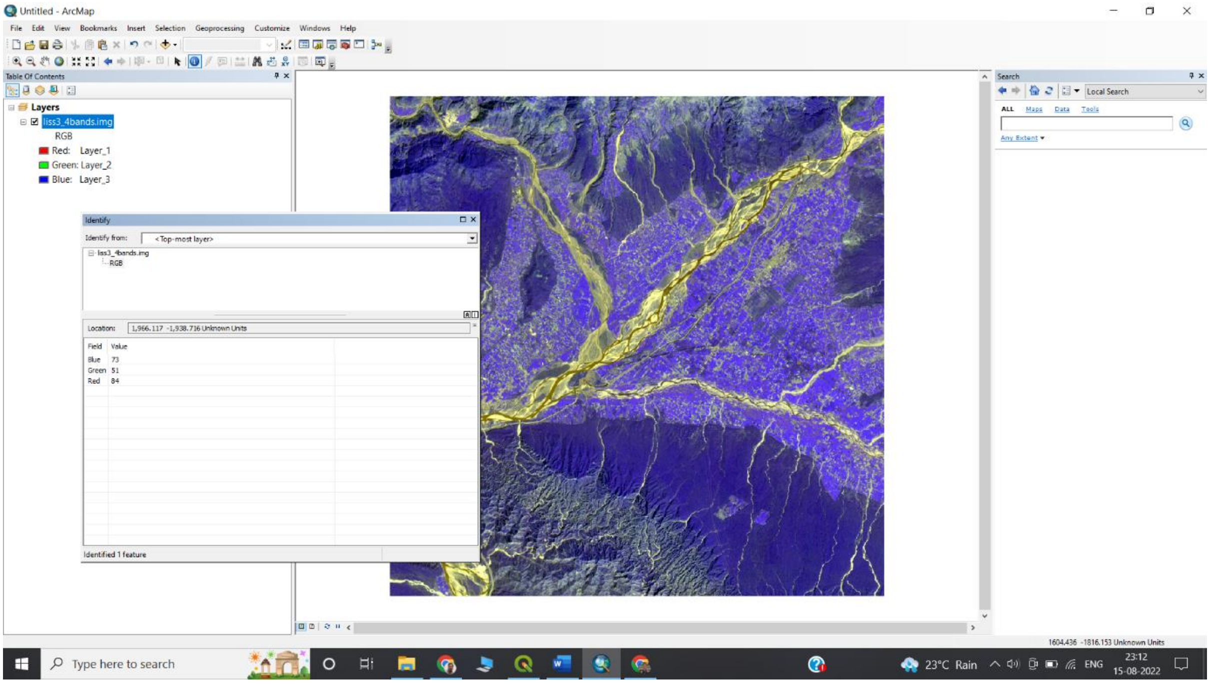
3. Right click the image to get the properties, note down the following information under the source tab: Image dimensions. The data type is 8 bit unsigned integer. The radiometric resolution is defined as the maximum number of brightness levels available depends on the number of bits used in representing the energy recorded. Thus, if a sensor used 8 bits to record the data, there would be 2^8=256 digital values available, ranging from 0 to 255.

5. Let's explore the image furthermore. Select the information tab marked by sign "i". Click on anywhere on the image to get the DN values of the available pixels for each band.

QGIS:

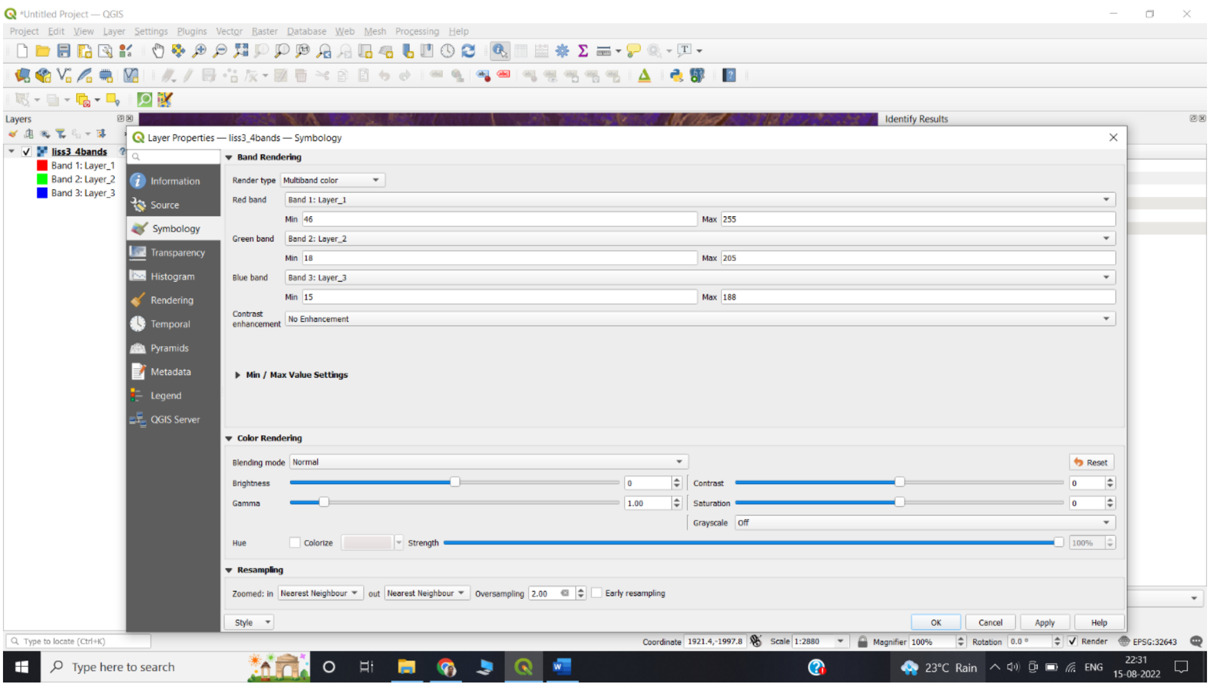


ArcGIS:

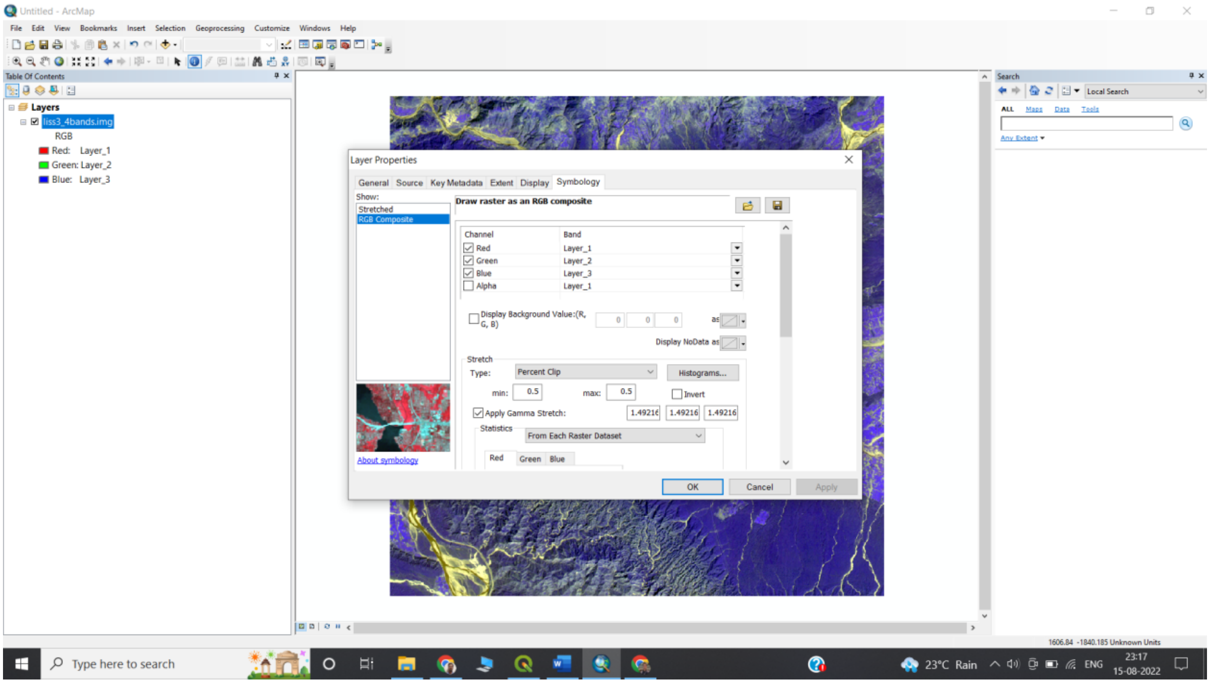


We will now understand the false color composite images and try to analyse the benefits. Go to Symbology tab under Properties. You must get a window with various drop downs. As, our data is a multiband data we will select Multiband color in render type. You will see drop down for color guns (Red band, Green band, Blue Band). Selected layer number means you are assigning that layer to one of the three bands. You will also see min and max values of the layers.

QGIS:



ArcGIS:



Trivia: Can you generate true color composite image.

Hint: A true color composite is an RGB image.

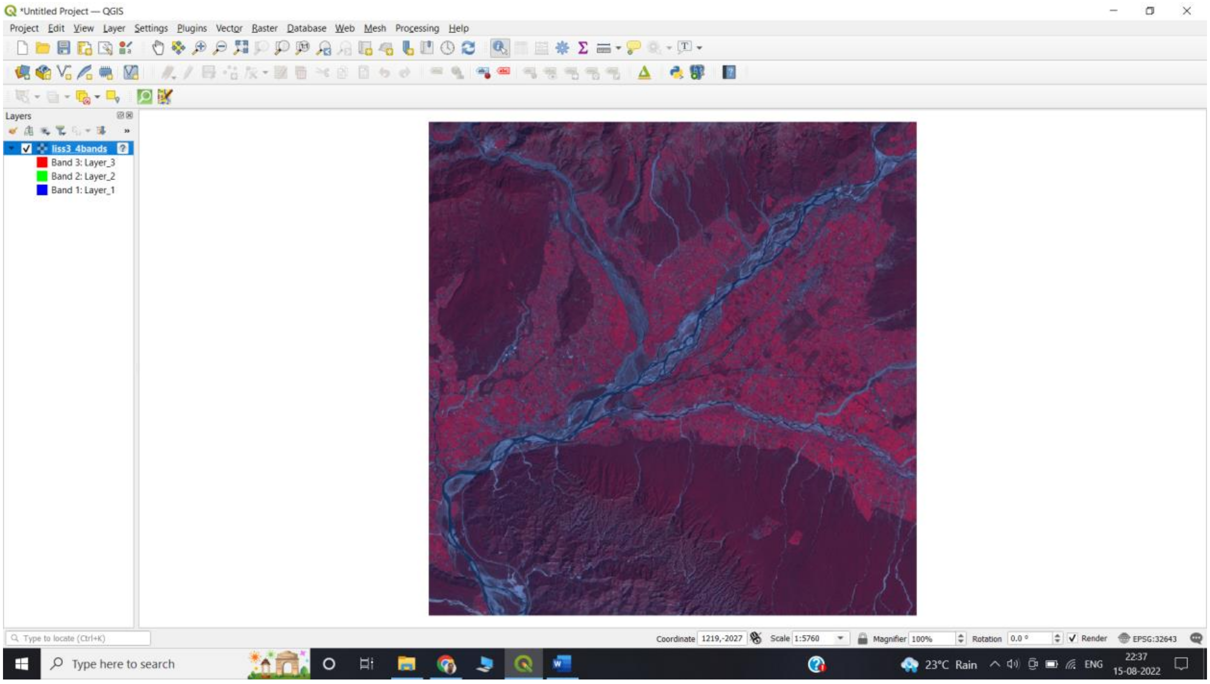
8. We will now create a standard false color composite image (SFCC): SFCC is a special case of FCC which is focussed on identifying green regions. As, leaves reflect highest in the Near Infrared Region (NIR) region, we direct NIR layer to Red gun {think of gun as a projector which beams light, refer to class ppt}. This will show reflected energy in NIR region in red color.

Go to symbology

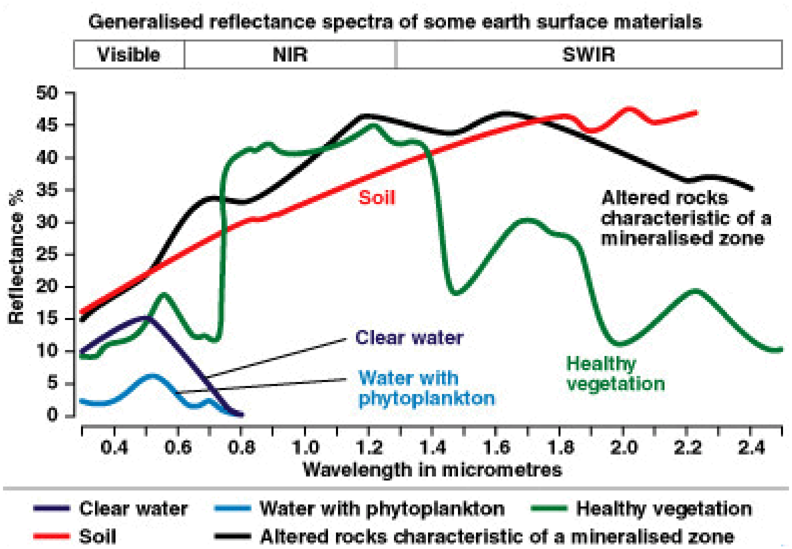
Select Red gun: Layer3 {reflectance in NIR region will be shown by red color}

Select Green gun: Layer2{reflectance in red region will be shown by green color}

Select Blue gun: Layer1{reflectance in green region will be shown by blue color}



7. Play around with the band combinations to generate various false composite images, single band images (by keeping one layer in one gun and rest guns empty). Analyse which features are better visible in various band combinations or single band. Don't do it arbitrarily or hit or trial way. Observe the Spectral signature diagram given below, look which features reflect more in which wavelength region and select the bands accordingly.

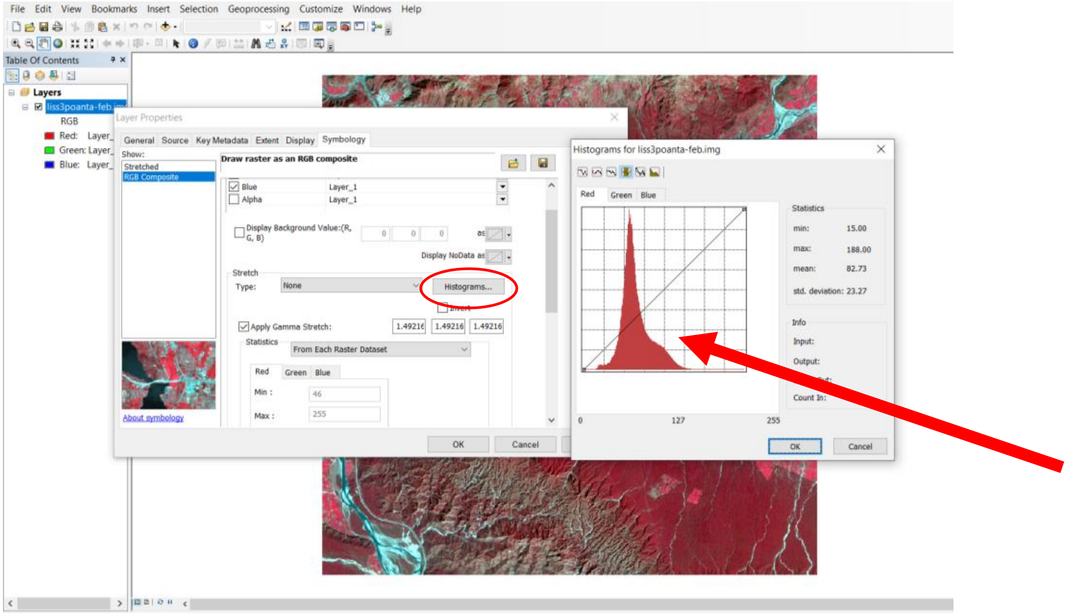


Homework: Find the best band combination to identify built-up regions, rivers, and dam water. Please provide the analogy behind the selection.

8. Its time to dig in how DN values are distributed. We will use histogram to plot the range of DN values. The DN ranges will further highlight the discussed concepts.

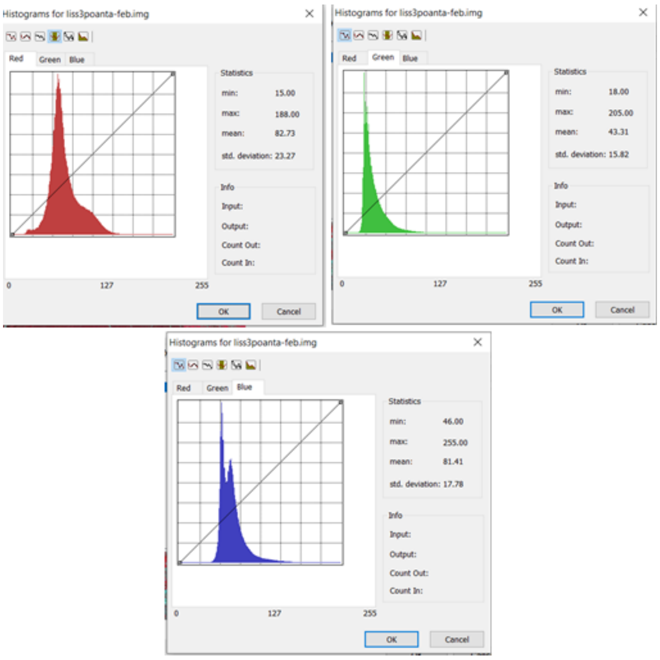
Under the Properties select Histogram, click on compute Histogram (QGIS)

In ARCGIS, there is a button named histogram on the right side of the stretch dropdown click on it. You must get something like this image.



The chart that is shown is the histogram. It shows the distribution of DN values of the image pixels. You can see three tabs Red, Green, and Blue. These tabs correspond to DN values of data in the color guns. As our NIR band is in the Red gun, thus, the DN value distribution correspond to NIR data. Observe the histograms of bands assigned to Red, Green, and Blue guns.

Interpretation: Can by simply looking at the image with certain pre-knowledge and histogram you can you say which band should be a better fit to analyse maximum features in the image.



Question: Why layer in blue gun has a large number of DN values near to 127. This is very similar to Red Gun. Explain why?

Answer: