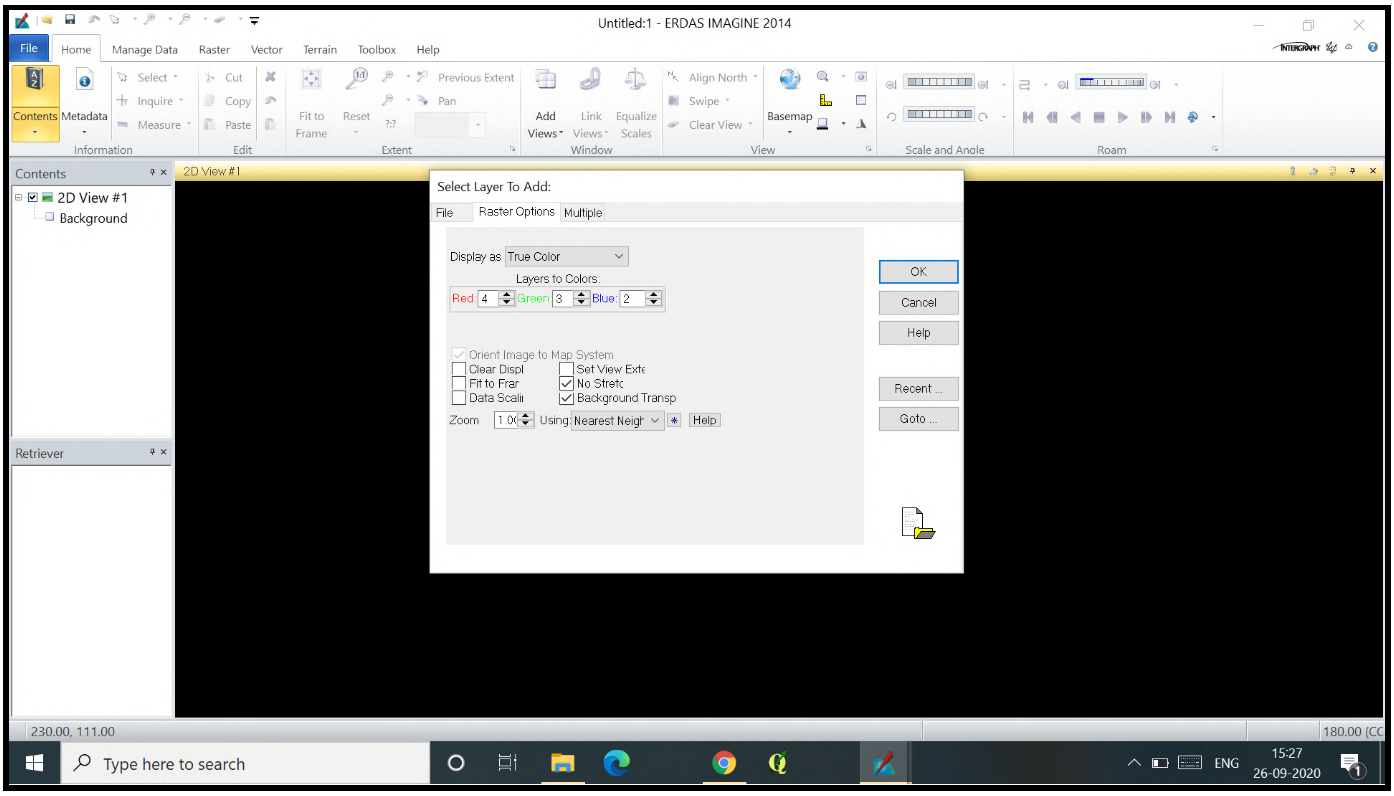
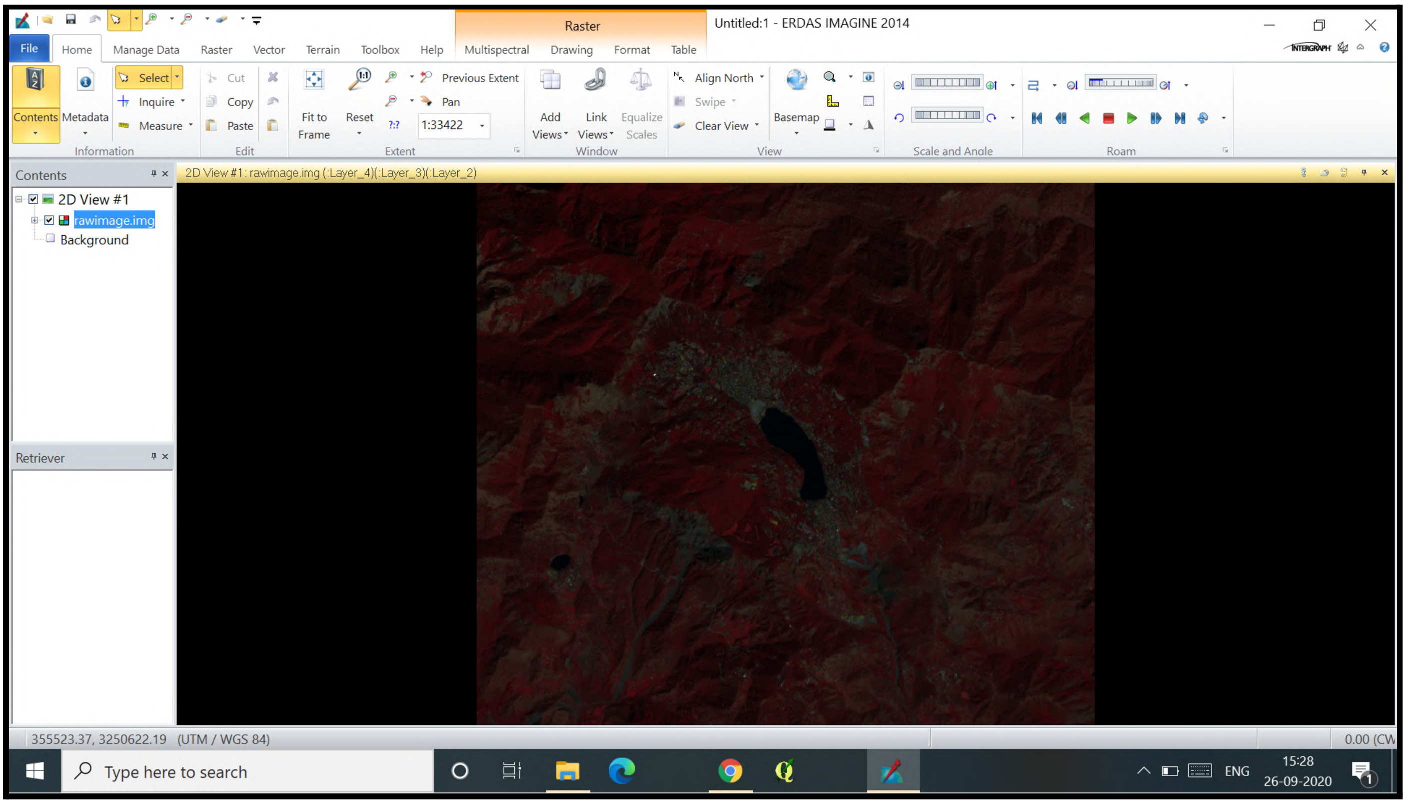
IMAGE CONTRASTING TECHNIQUES

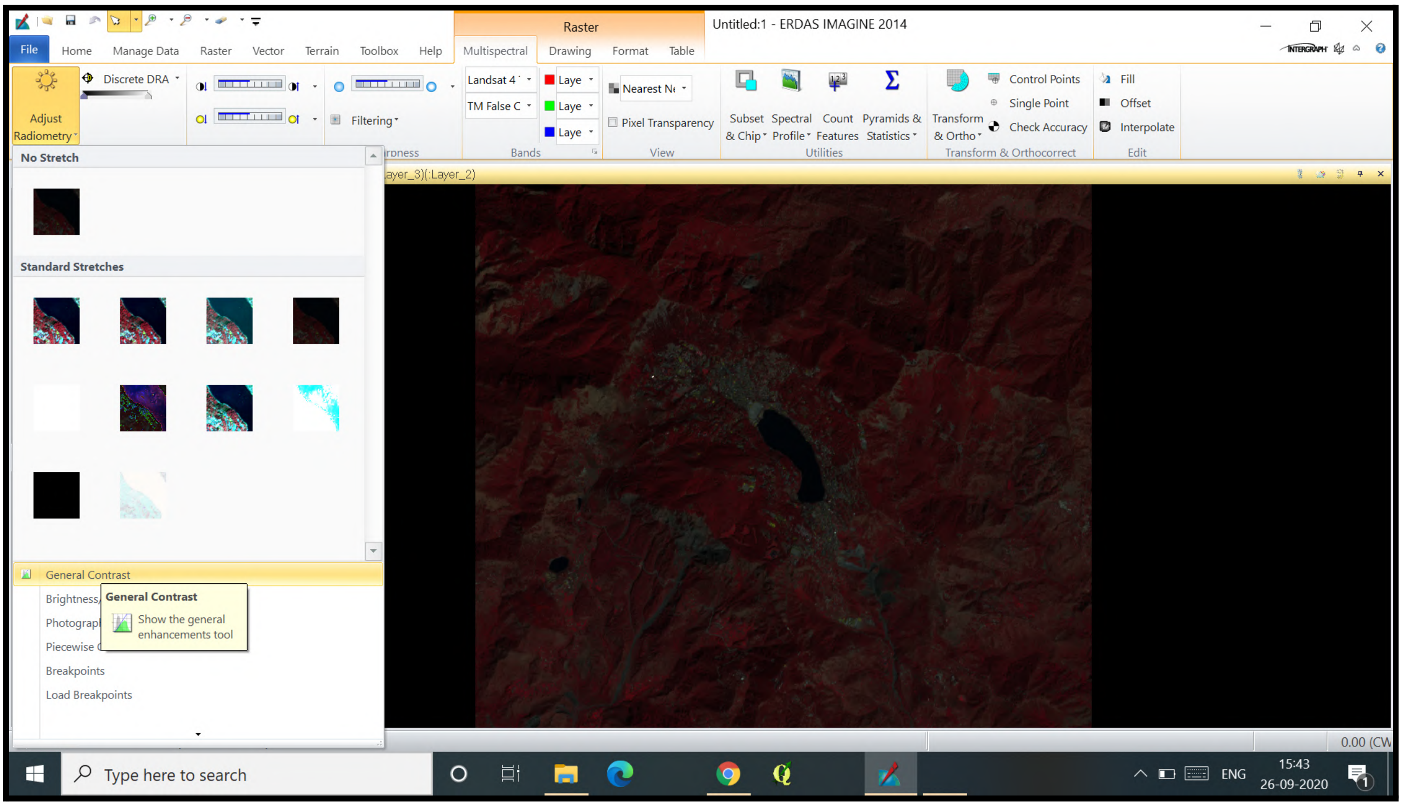
<u>Step-1</u> Open the raw image, **without any stretch.** Go to Raster option > No stretch.



Display raw image.

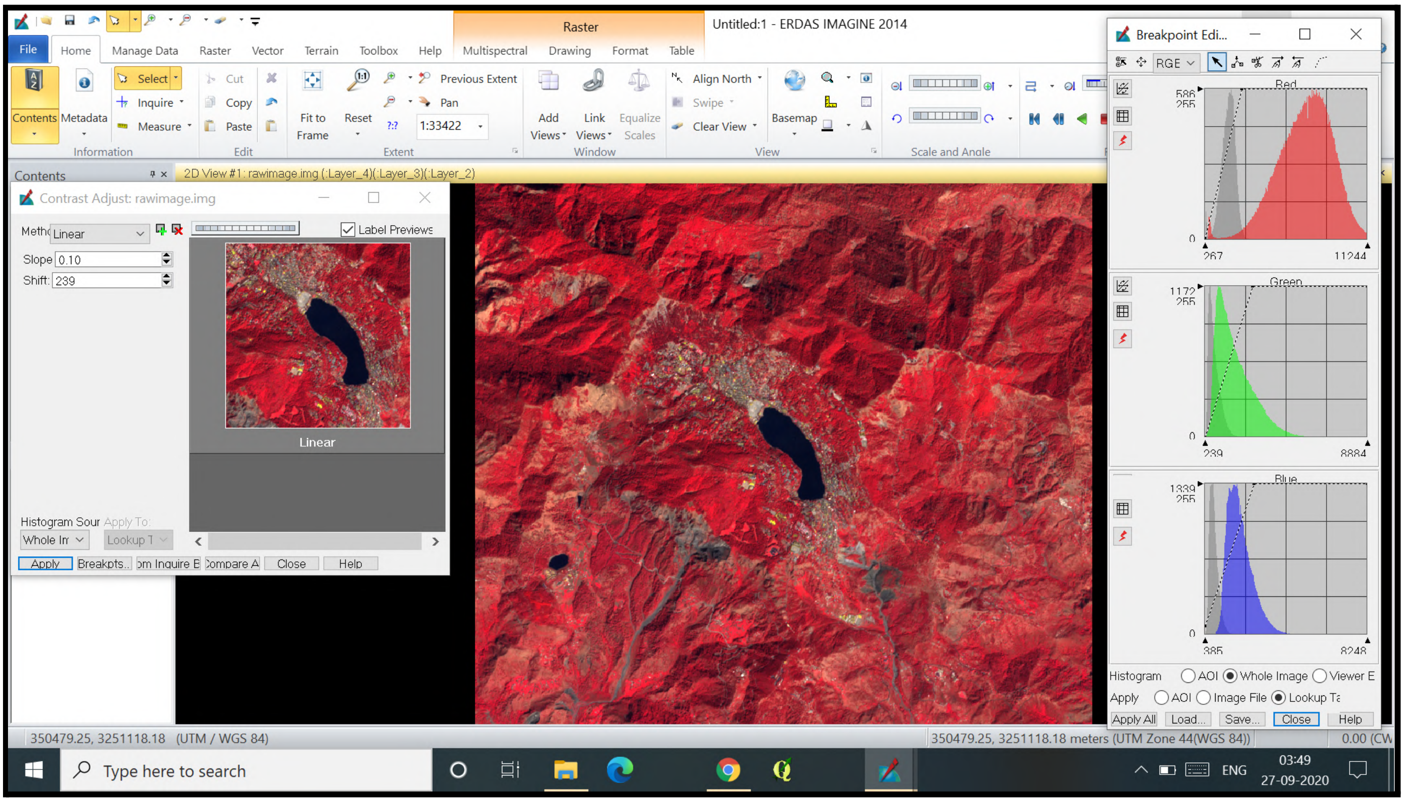


Step-2 Go to **Raster > Multispectral > Adjust Radiometry > General Contrast**

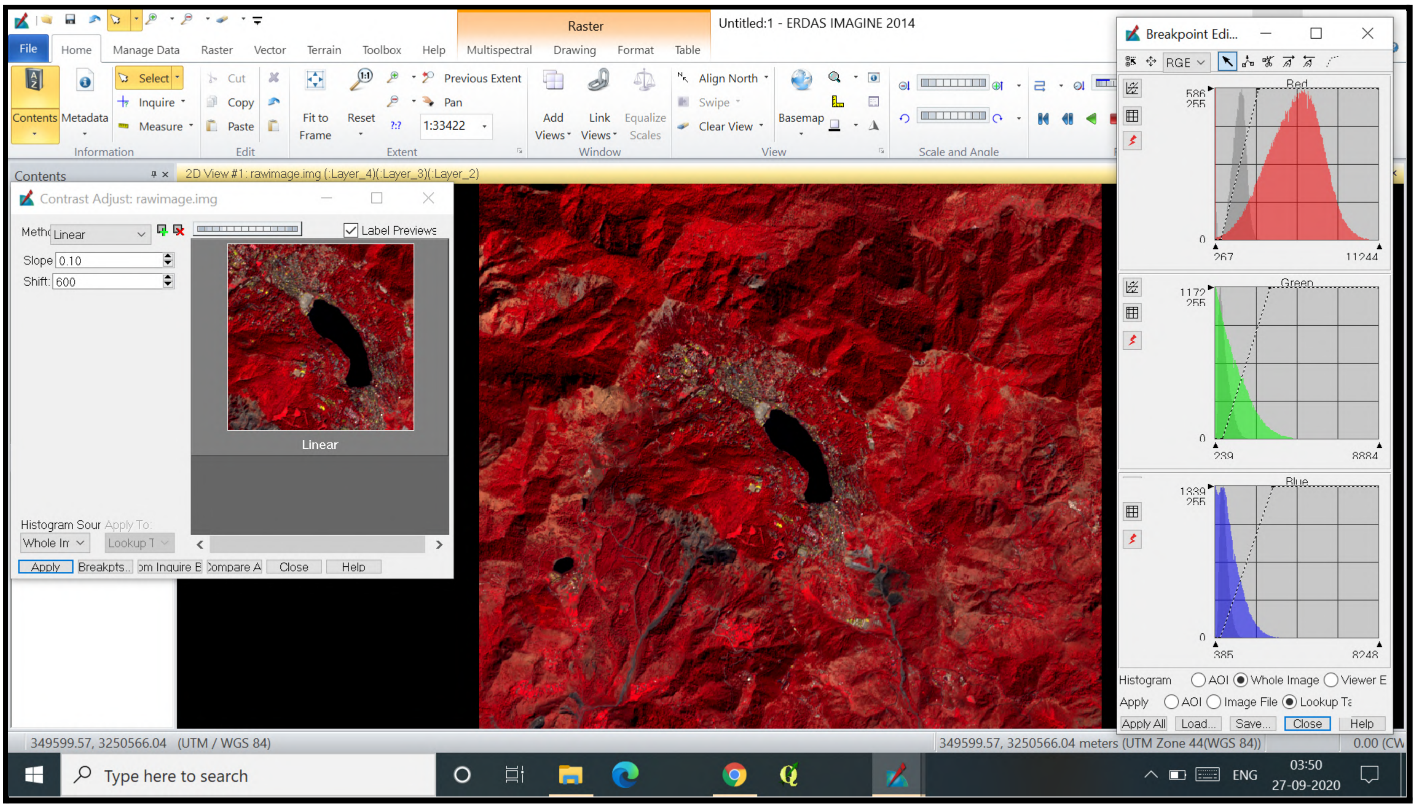


(Note- By default, standard deviation stretch is displayed.)

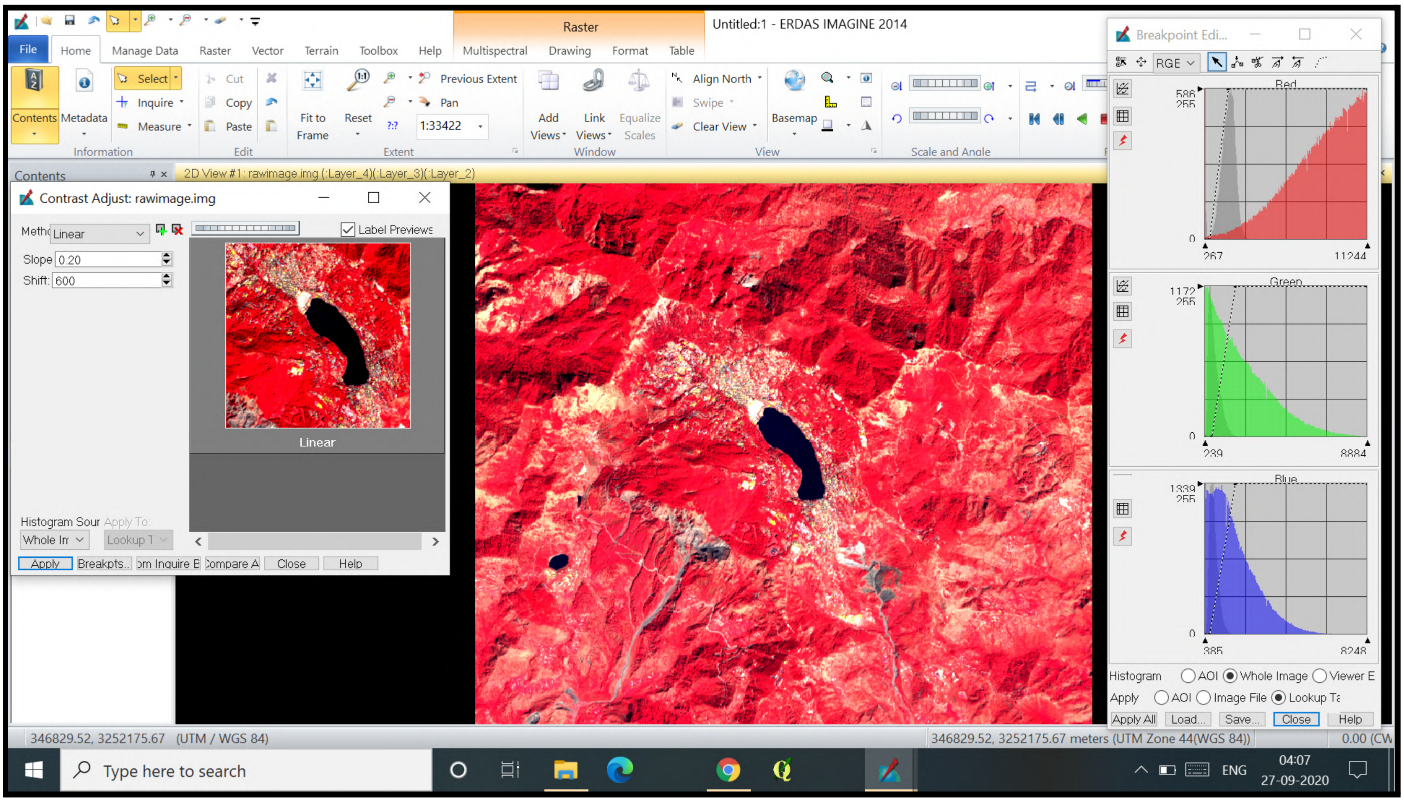
1. **Linear stretch**



When **expanding the original brightness value to use the full dynamic range available** (visible in histogram), by changing the slope value, contrast in image will automatically increase and interpretability will increase.

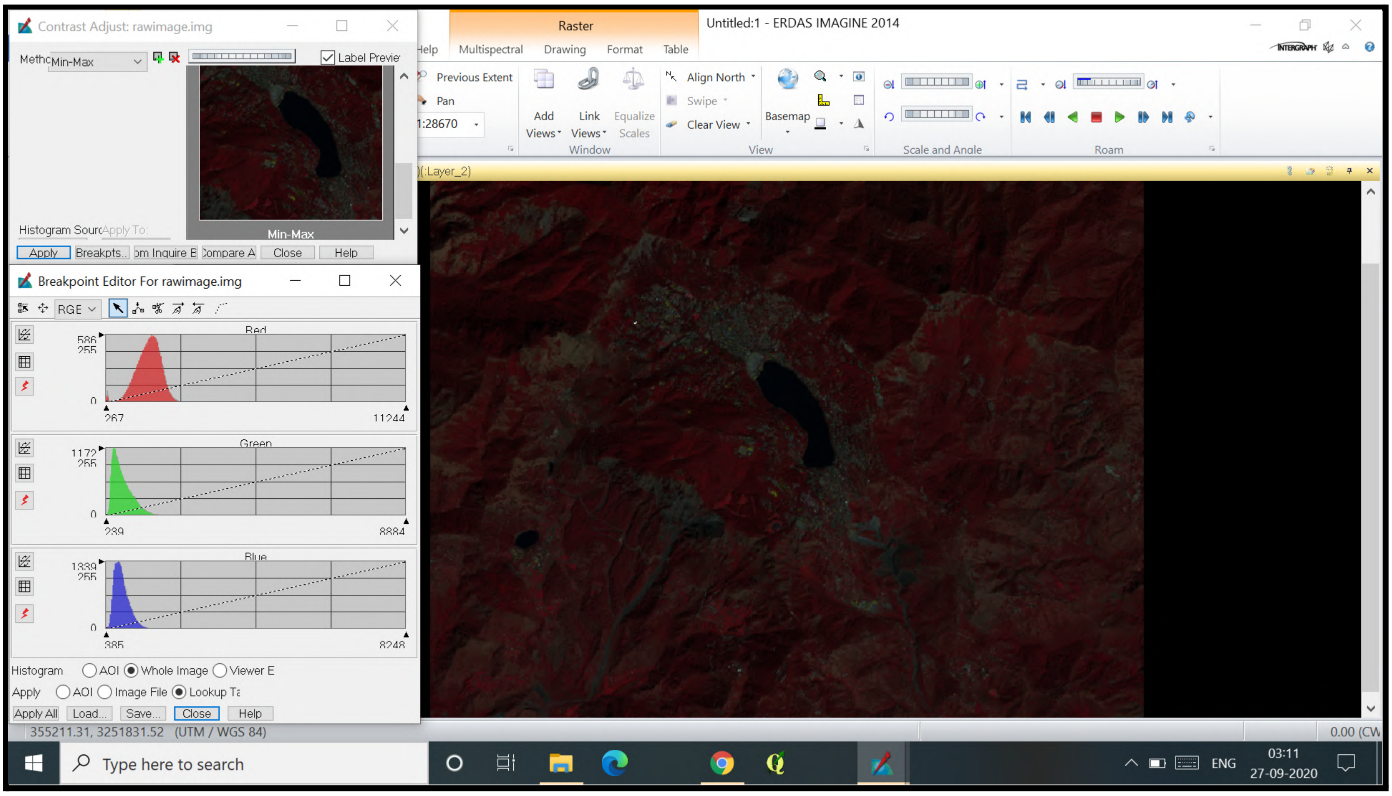


By increasing the **shift value** in linear stretch, the **image darkness increases** in linear stretch. In the histogram, after changing shift value to 600 (earlier 239) the values will truncate and the image will get darker.



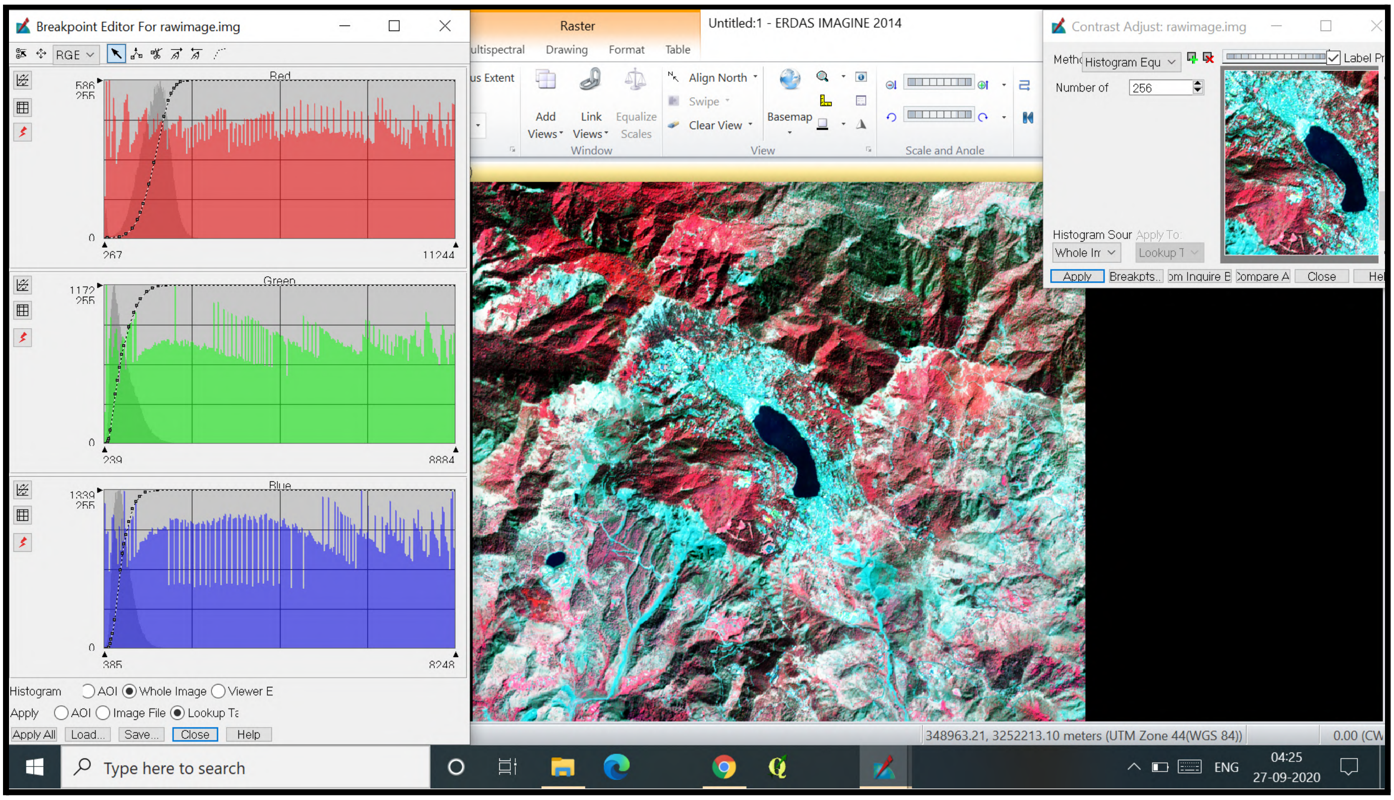
If both slope and shift are increased, there is a **lot of stretch in the red band** and it becomes **difficult to identify variation in the vegetation.**

2. Min-max stretch



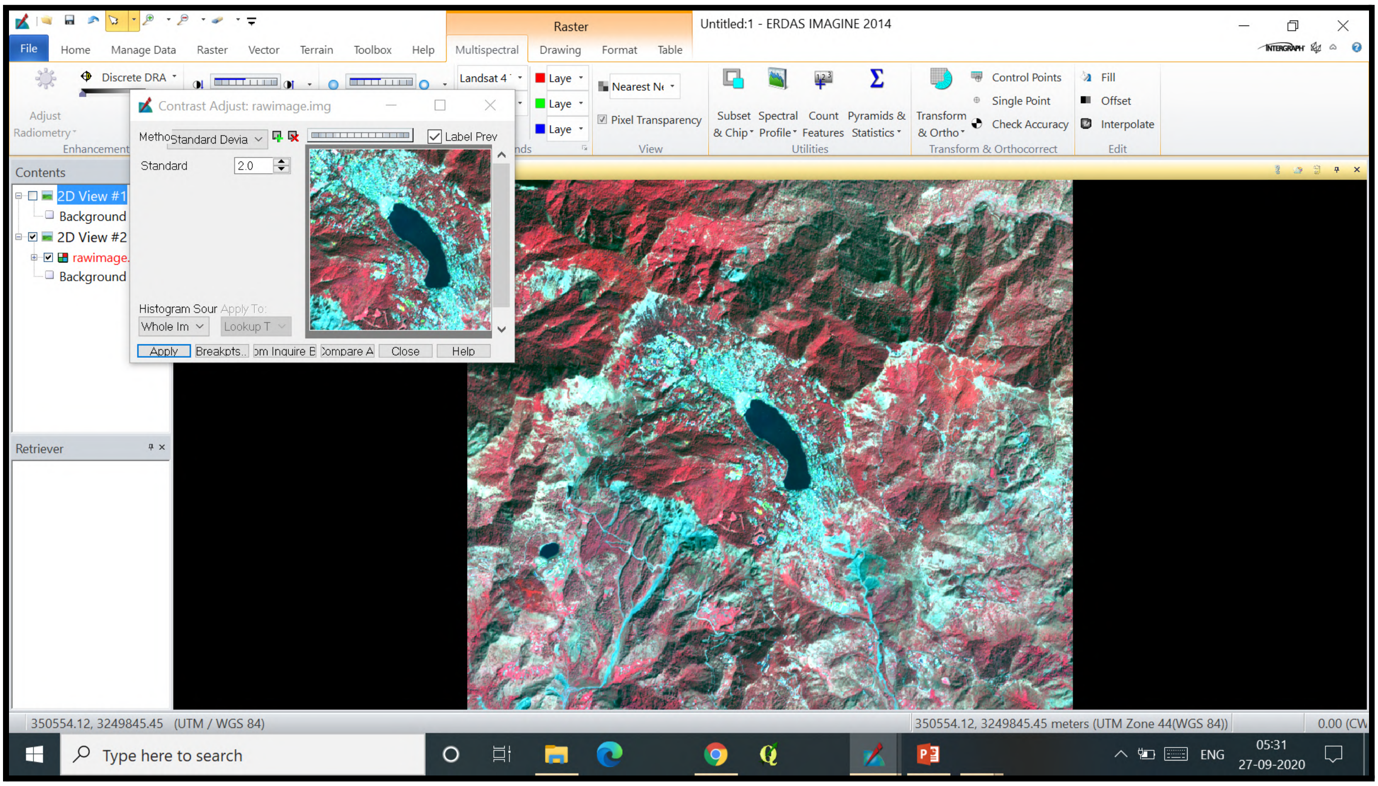
Min-max stretch has very poor contrast, almost similar to raw image as it **stretches the image evenly between its minimum and maximum values.** Therefore, it is **not an effective technique** to increase the interpretability of image here. From the histogram also, it is very clear that this is not an effective technique as a **very small portion of available dynamic range is utilised, thus resulting in poor contrast.**

3. Histogram Equalization



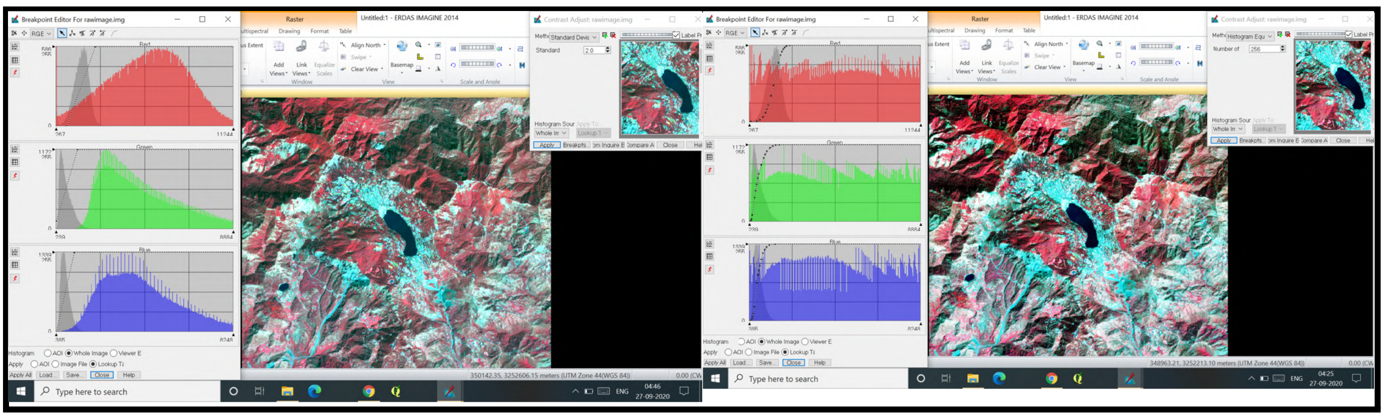
Histogram equalization stretch produces a **balanced image** because the original image is redistributed to produce **unique population density.** The contrast is increased at the most populated range of brightness value of histogram i.e. the middle value is substantially expanded and made to occupy a larger range of DN values in the new grey scale. Thus the **overall stretch in image is subsequently increased.** Not suitable for images, having very dark and very bright areas like **hilly regions.** Also, not possible to extract texture and biophysical information as it alters the relationship between brightness value and image structure. It is a non-linear contrast stretch.

4. Standard Deviation



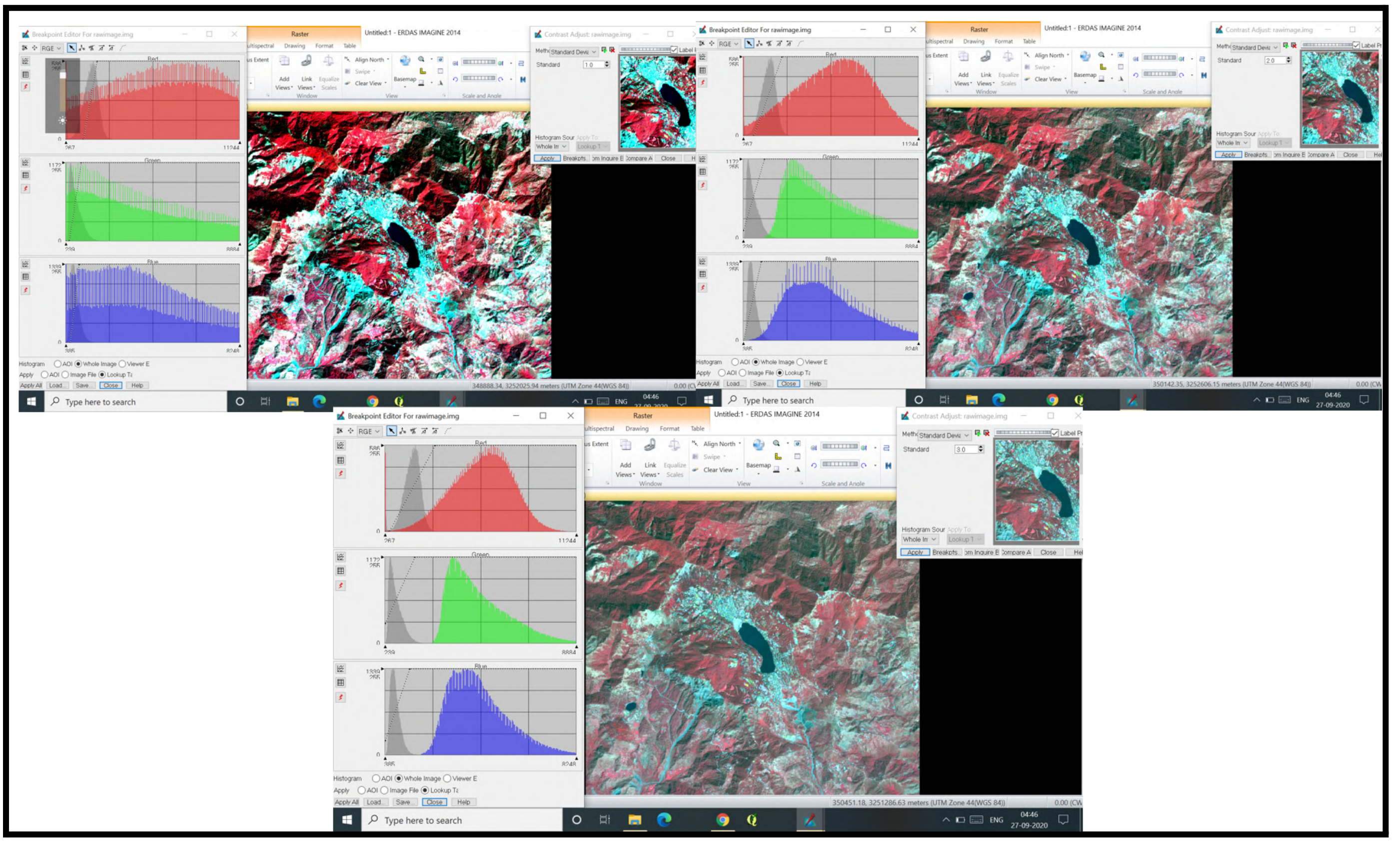
Similar to min-max linear contrast stretch, except this technique uses a specified min-max value that lies outside a certain SD of pixels from the mean of histogram.

<u>Comparing SD and Histogram EqualizationTechniques</u>



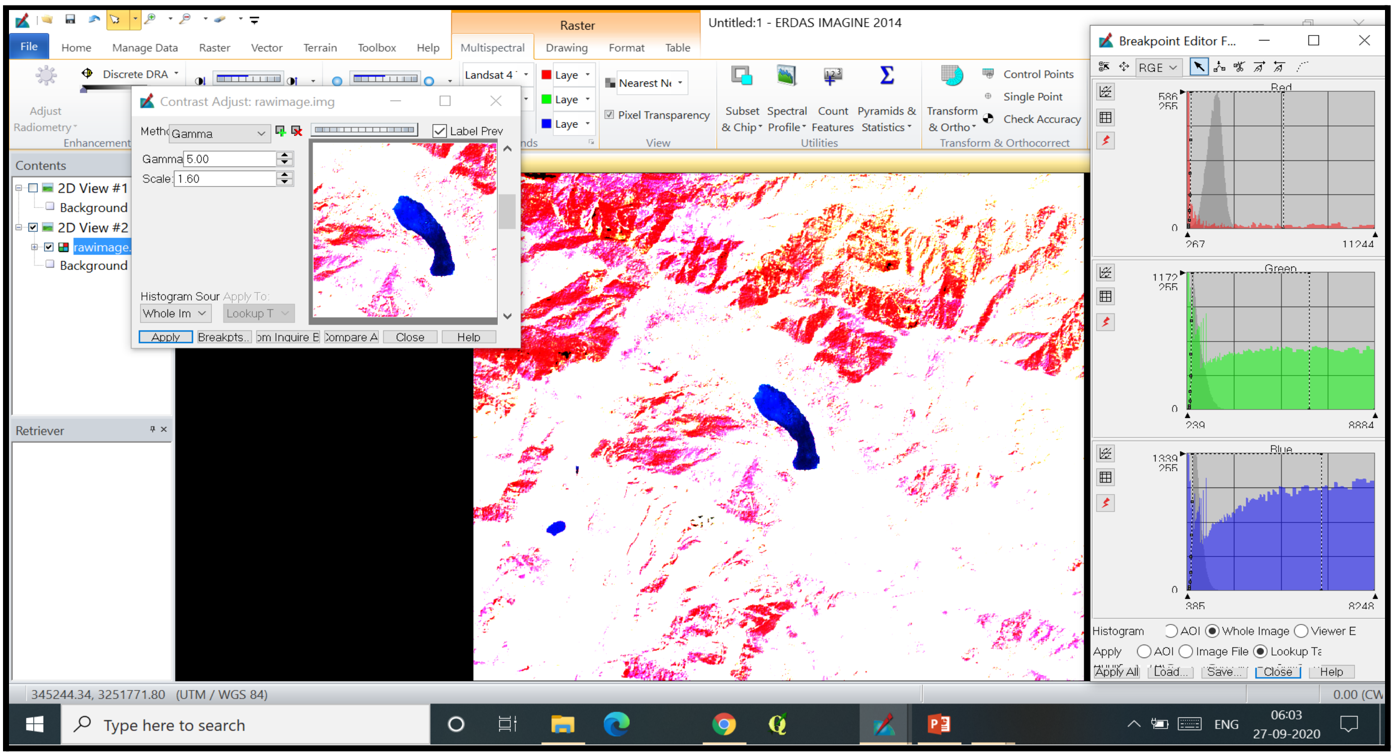
For this image, contrast between Standard Deviation (at 2)and histogram technique images are almost the same and there is **not much visual difference** between the two.

Comparison among different Standards



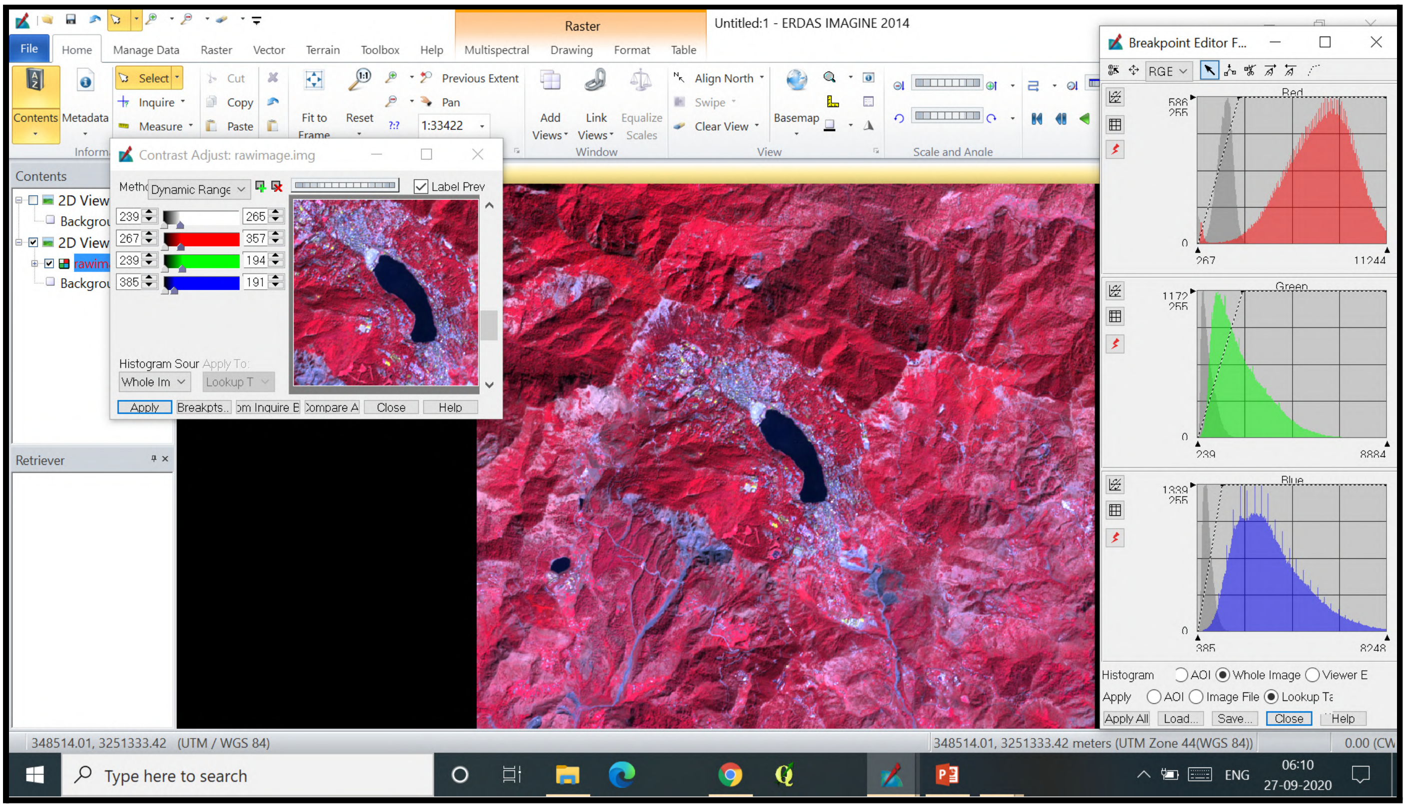
SD from mean is often used to push the tails of histogram beyond original minimum and maximum values. Basically, **changes the tail of histogram.** The **Further away you go from SD, the more contrast it will create in the output** i.e. SD-1 has low contrast in comparison to SD-3. In SD-1, some features got more stretched and some got merged as seen in histogram. In **SD-2, more variation is visible.**

5. Gamma stretch



By applying gamma stretch, one can **control the overall brightness of the image.** It darkens the image without saturating dark or light areas because it does not touch extreme values. In this case, it can be used to **identify the water body** and **difference within the water body** can also be seen here. Also, it has better contrast than min-max linear stretch.

6. Dynamic range adjustment



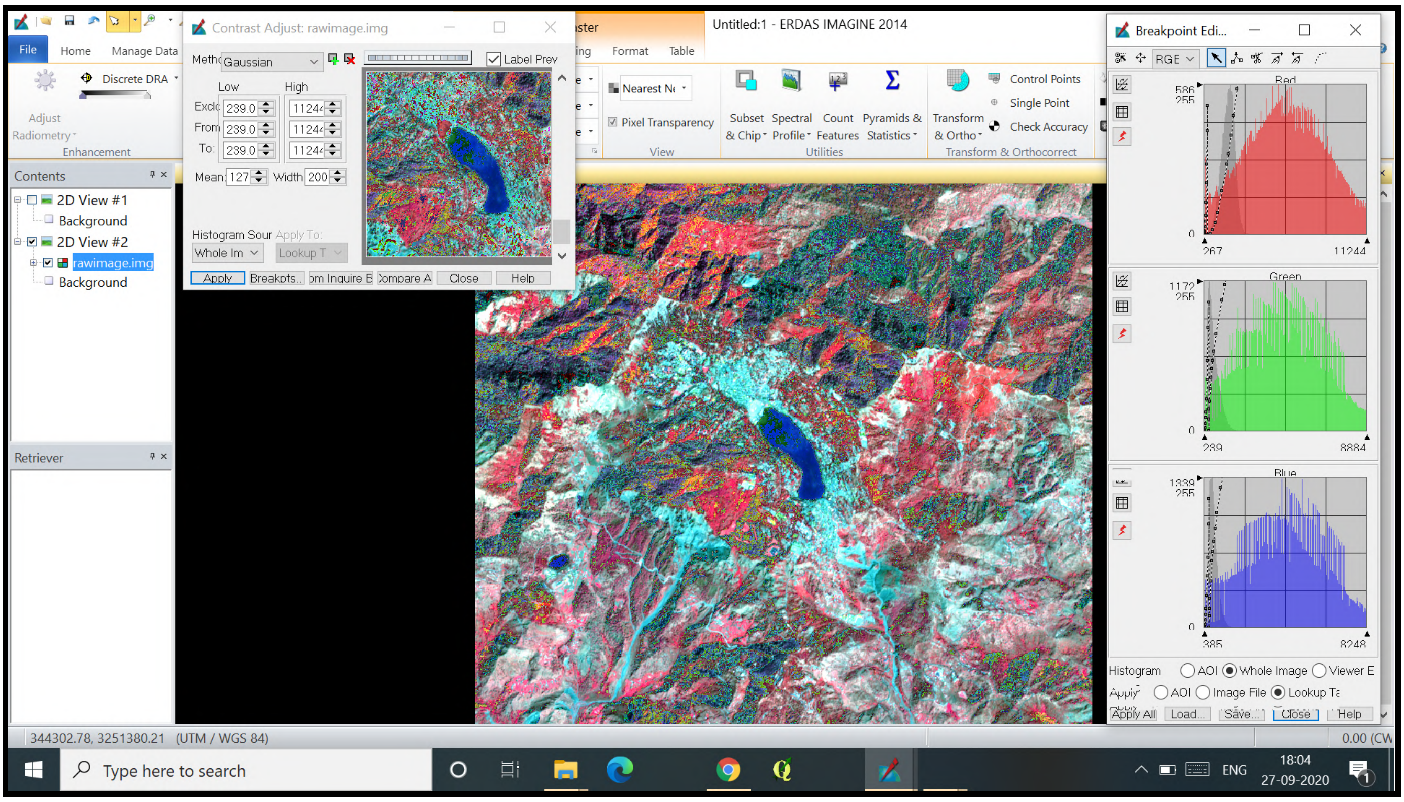
It is **completely customized** and can apply different values in different bands. Can change brightness value, redness, greenness and blueness in image accordingly. It has **different slopes** in different bands (can be seen in histogram).

In the above image, there is pinkish red and red vegetation, therefore can be used to see the **variation in the vegetation.** Depending on our purpose, we can change the values and identify the particular feature in a better manner.

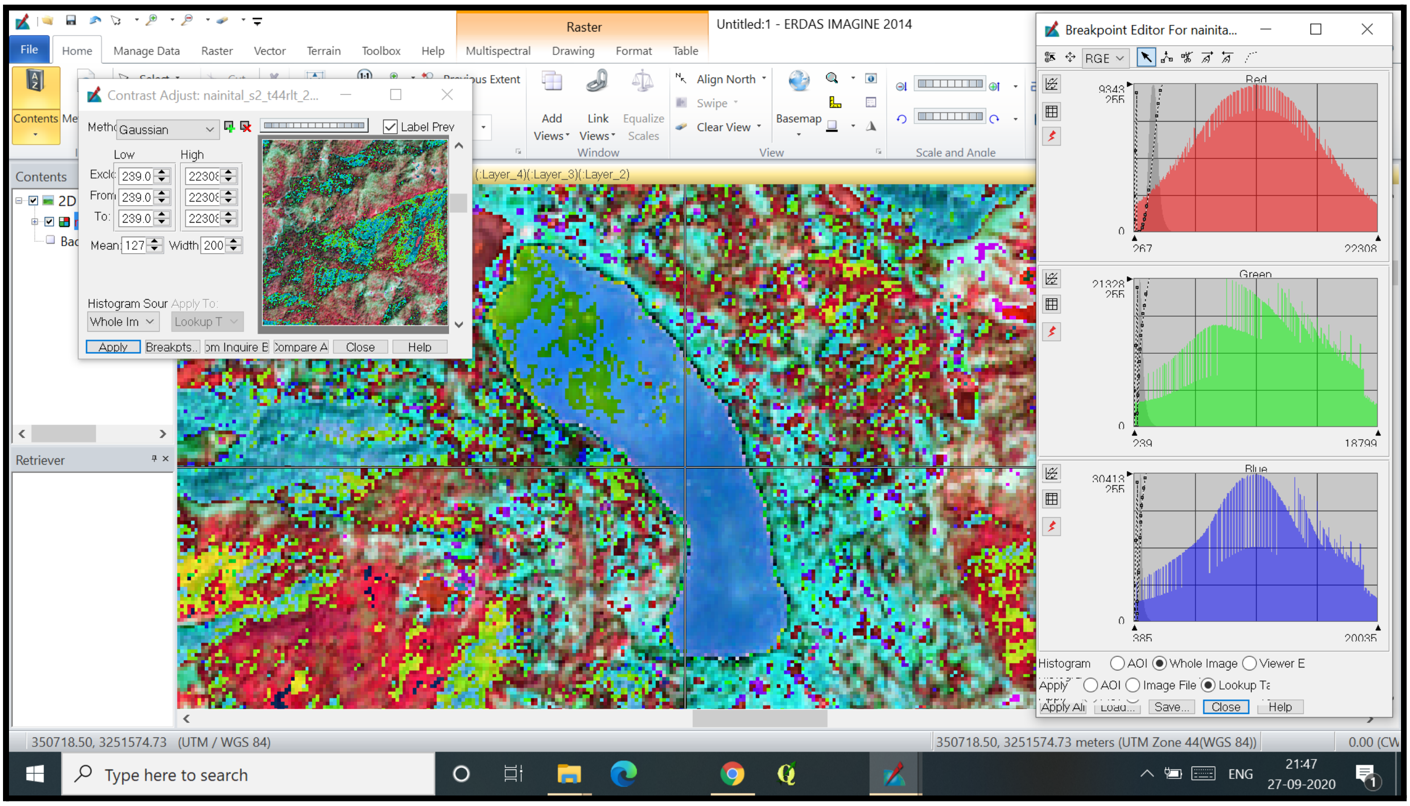
7. Gaussian stretch

In this grey-scale manipulation, a new grey level is computed by **fitting the original histogram into a normal distribution curve.** It renders **greater contrast preferentially in the tails of old histogram**, which means a cut off limit in the old histogram becomes highly critical. It adjusts the range of LUT so that output histogram approximately normal distribution.

The gaussian probability distribution is a function of **Probability density function.** (PDF)

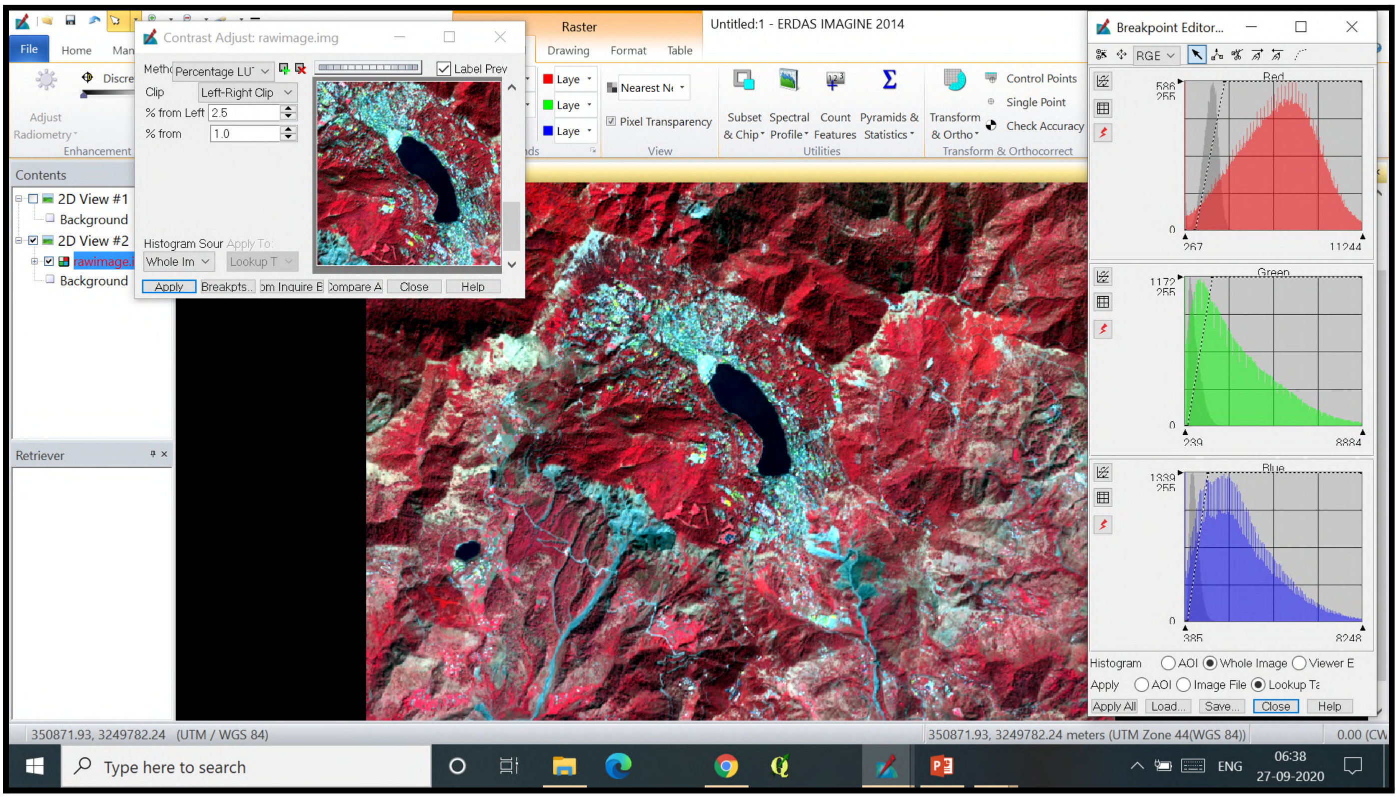


In this filter, there are **speckles of noise** in the entire image as seen in image above. The water body is clearly identified and variation is also visible within the water body.



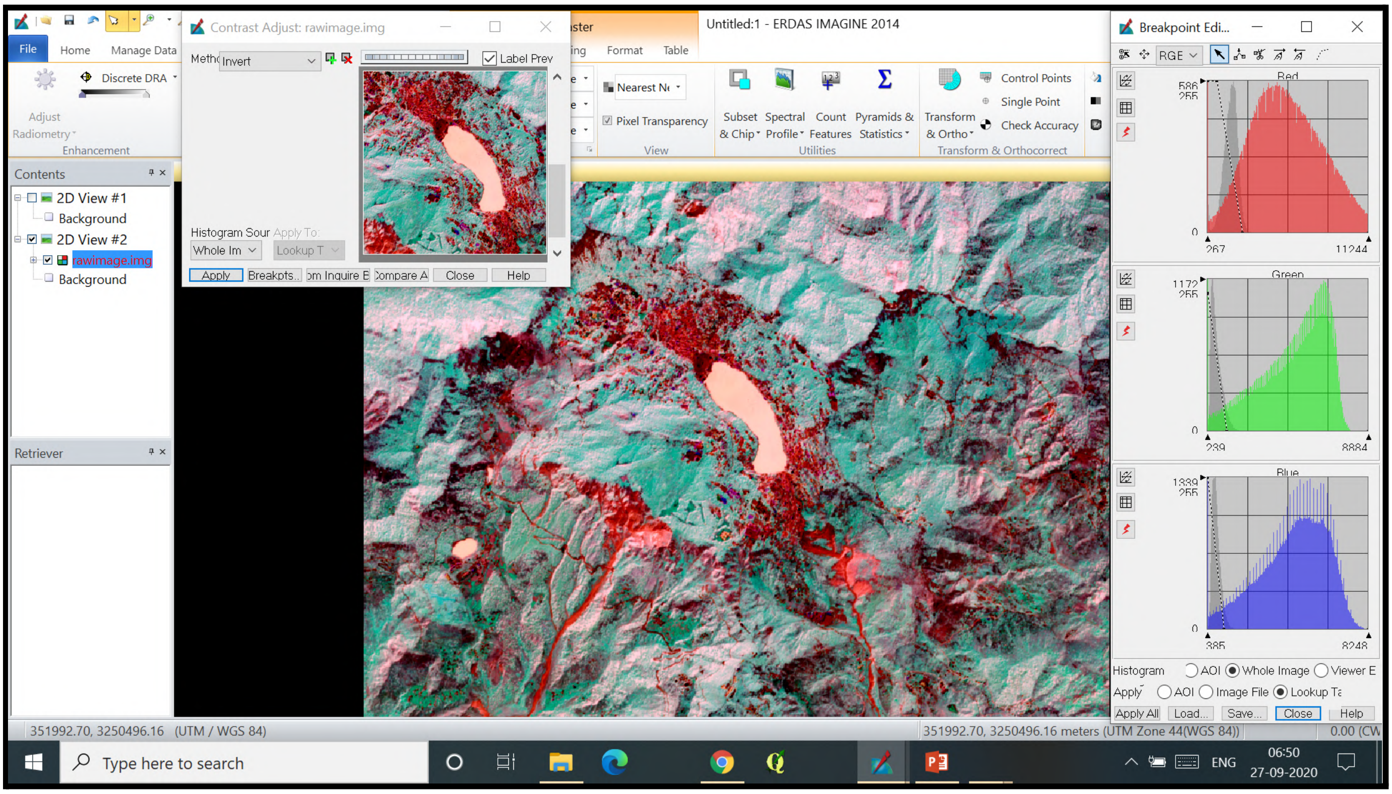
Using this stretch, one can also see **vegetation present in the lake.**

8. Percentage LUT Stretch



It clips a percentage of the LookUp Table from the side of the histogram. It can be used to identify the variation in vegetation as visible above (red and pink red)

9. Invert stretch

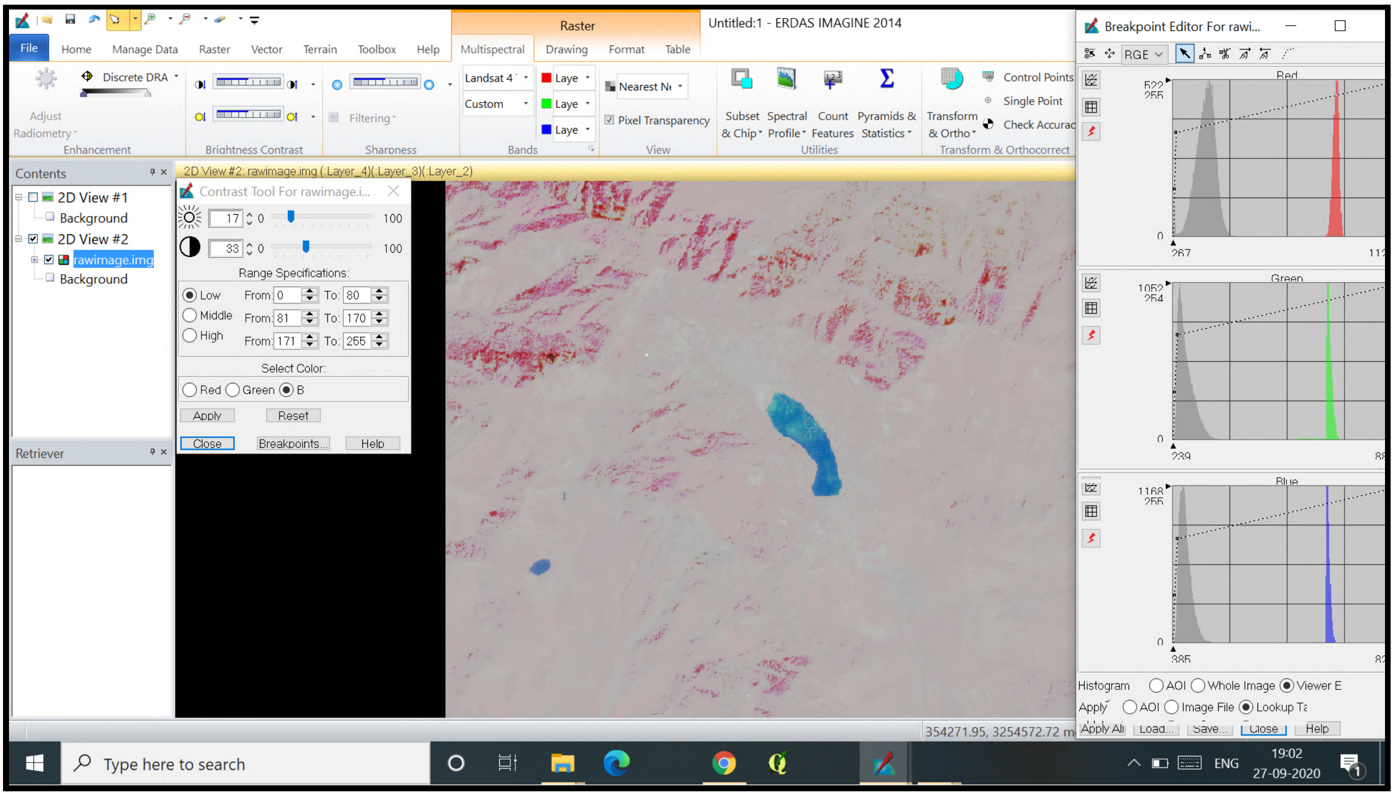


This has the effect of producing a “**photographic negative**” of the image. In the histogram, one can see stretching is happening in the opposite direction. In this, apart from the water body, it's difficult to identify anything.

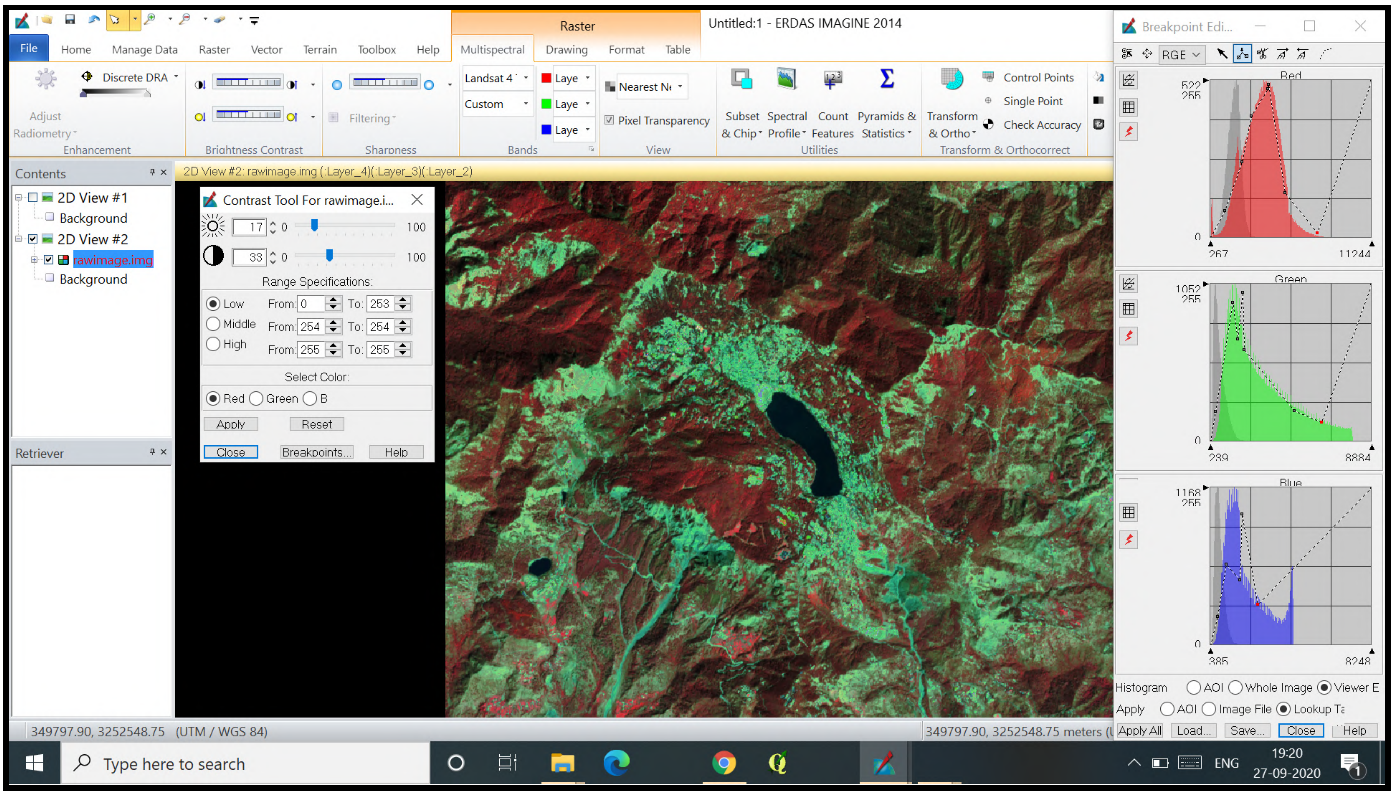
10. Piecewise contrast and Breakpoint editor

Go to **Raster > Multispectral > Adjust Radiometry > Piecewise Contrast**

This type of stretch is used when the histogram is not gaussian type. In this one have the **full freedom** to highlight a particular portion depending upon their purpose. It has different ranges for different bands- low, medium and high which one can specify. We can **enhance a particular range of pixel value** using this stretch.



Using ***piecewise contrast, the water body*** has been highlighted.



Using a breakpoint editor, we can do **customized stretching**. Different ranges of slope can be provided.