Section 6: Spectral Characteristics

Section Objective

This section will introduce students to the wide range of tools available within IMAGINE for viewing, analysis and interpreting Spectral Characteristics of Images

Tools Used

• Adjust Radiometry	Adjust Image transform using common image stretches
• Band Combinations	Common RGB Band Combinations for display
• Band Group	Predefined Sensor Models i.e., Landsat 8
• Color Tables	Existing or custom Color Tables for Pseudocolor display
• Image Chain	New Dynamic Image view and editing tool
• Image Metadata	General Information including Pixel Data and Histogram
• Inquire Cursor	Inquire individual pixel values and characteristics
• Preference Editor	Define default band selection options for imagery
• Spectral Profile	Line Profile of a pixel sample over a range of bands

Class Notes

Spectral Characteristics

Objective:

Students will improve the appearance of an image by changing the band combinations and adjusting image contrast.

Task 1: Adjust Radiometry

1. Go to **File > Open > Raster Layer.**
2. Click once on ***26-jan-2014-msi.img*** and click the **Raster Options** tab.
3. Check the **No Stretch** box. By default IMAGINE applies a contrast stretch to all images. You can permanently disable this option in the Preferences if you wish.
4. Click **OK.**

A Landsat 8 image will display using the default Band Selection of 6-or-greater band images set in your preferences. By default this is; RGB 4, 3, 2 respectively

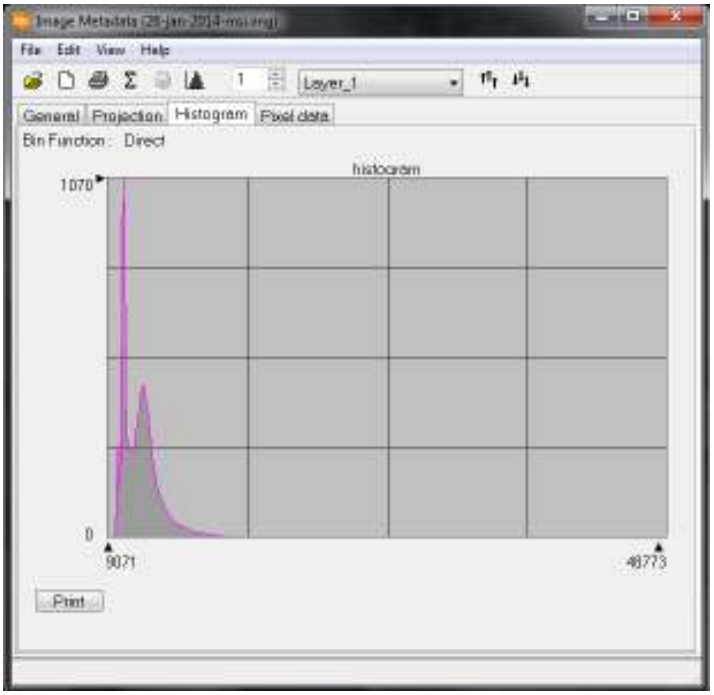
This will display an RGB image using the default band selections of 4, 3, and 2. This is IMAGINE's default band selection for images with 6-or more bands.

You may notice the image appears quite dark

By default, IMAGINE applies a Left-Right Percentage contrast stretch to an image when it is opened. As we checked the No Stretch box when opening the image, there is no stretch applied.

The Left-Right Percentage Stretch stretches the image to include the lower 2.5% and the upper 1.0% of values. This stretch is only applied to the look-up-table (LUT) and is therefore only for display purposes.

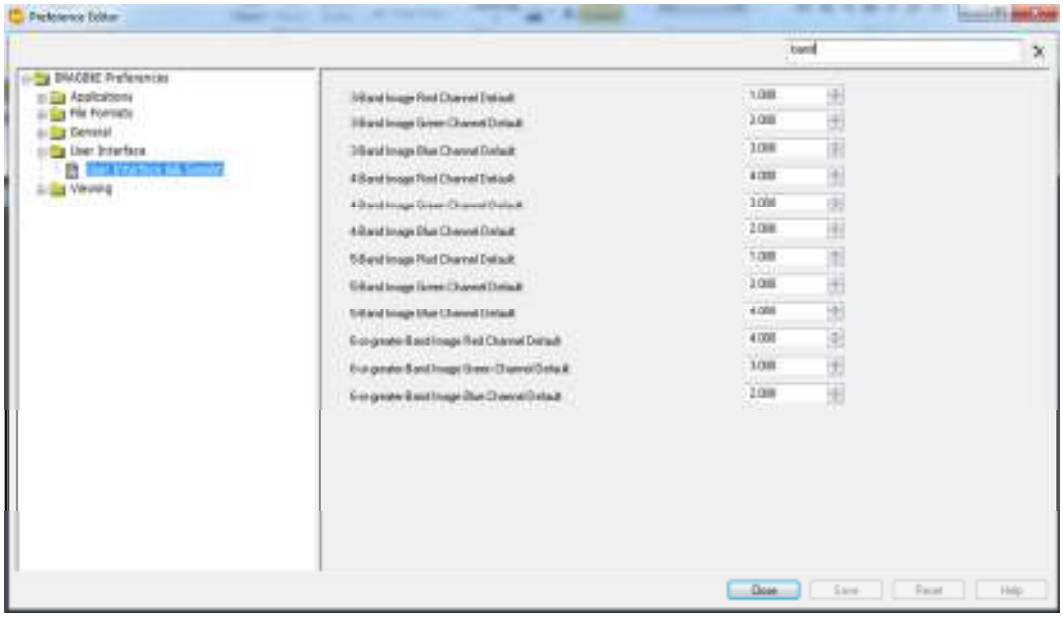
5. With ***26-jan-2014-msi.img*** selected in the contents pane click the Metadata icon in the home tab.
6. Click the Histogram tab.



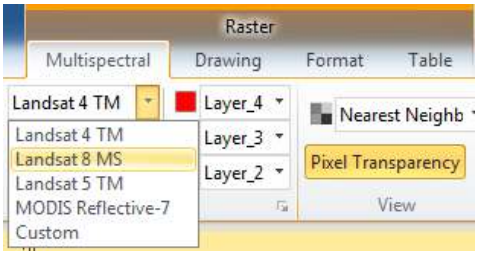
The majority of values for band 1 in this image are skewed to the left of the histogram indicating this band is quite dark.

7. The Metadata histogram tool allows us to view the histogram for every band in an image. Using the Layer tab drop-down list, assess the other bands to see if they are as dark as Layer_1/Band 1.
8. Close the Metadata tool.
9. From File Menu | Select **Preferences**
10. Keyword Search: **Band**

From the User Interface Folder | User Interface & Session Settings, you can now see default channels for Imagery. These can be changed from the default settings and also reset for easy use

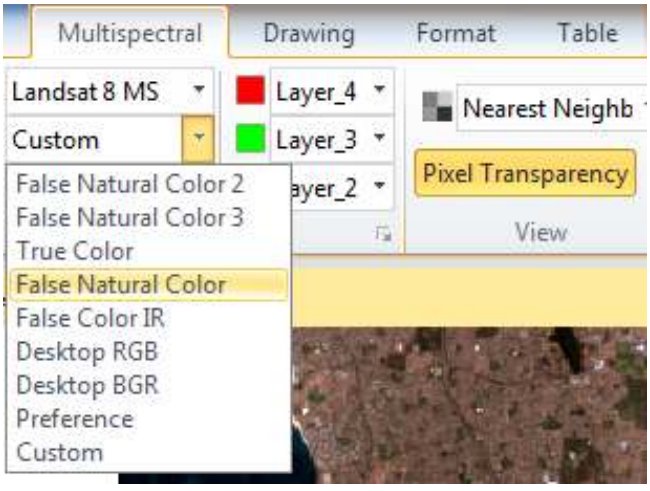


11. **Close** the Preference Editor
12. From the Multispectral Tab | Bands Group | Select Bands Group: **Landsat 8 MS**



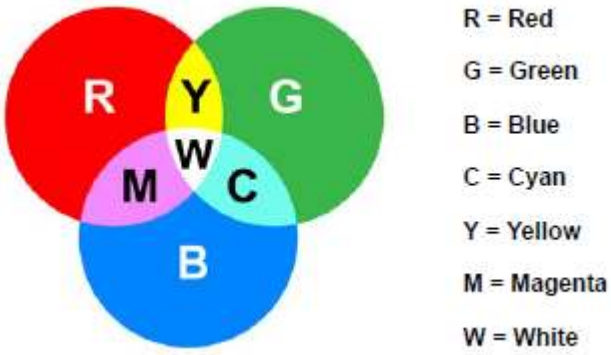
Note how IMAGINE can interpret the number of bands in your imagery and display a shortened list of sensors likely applicable

13. From the Common Band Combinations, Select: **False Natural Color**



The image will display using the band combinations you have set. It is important here to understand the fundamentals of the R-G-B display.

This is illustrative in the following diagram:



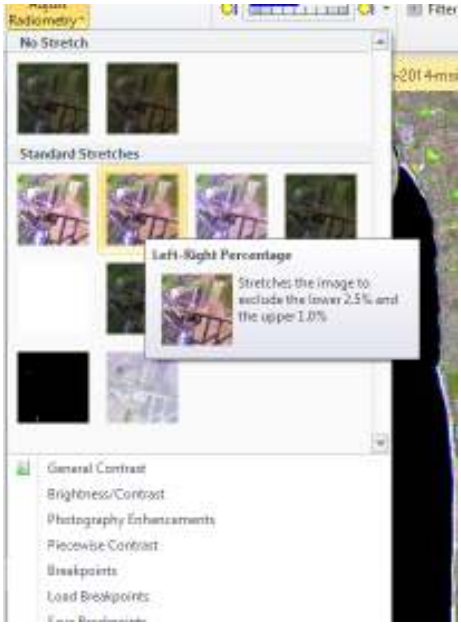
14. We are currently displaying a 654 band combination in the Red, Green and Blue channels respectively.

We will now apply a number of preset contrast stretched to this image.

15. From the Multispectral tab click **Adjust Radiometry**.
16. Hover your mouse over the different tiles, each stretch will be dynamically applied to the dataset currently selected in the viewer.
17. Select **Equal Percentage** Adjust Radiometry Options

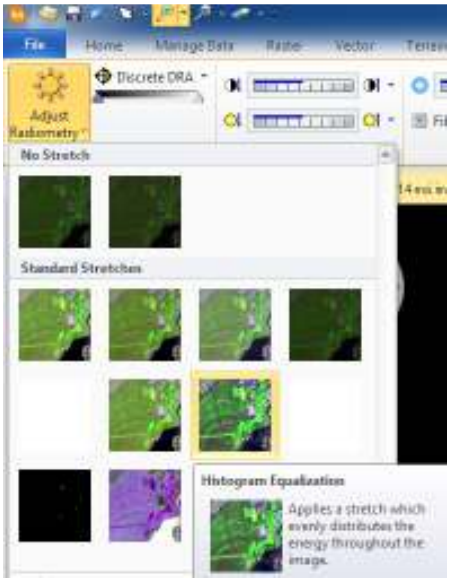
Your image will display with an equal percentage clip of 2.5% of either side. Otherwise also known as a 95% clip.

18. Select **Left-Right Percentage** from the list.



This is the default stretch which IMAGINE usually applies upon opening an image.

19. Now final, select **Histogram Equalization** from the Multispectral Tab | Adjust Radiometry



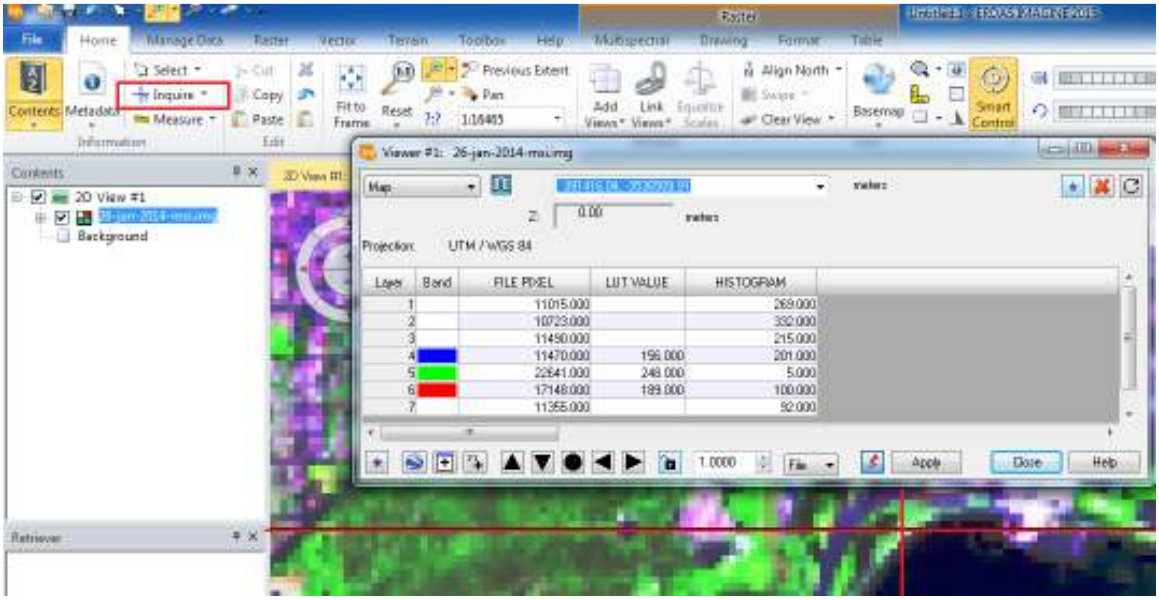
Your image will now render with a Histogram Equalization stretch

20. Leave the image open with the **Histogram Equalization** stretch applied open in the 2D View for the next task.

Task 2: Viewing Pixel Values

1. With the ***26-jan-2014-msi.img*** still in the 2DView, **Zoom In** to the image so you can distinguish between pixels

2. From the Home Tab | Information Group select **Inquire Cursor**



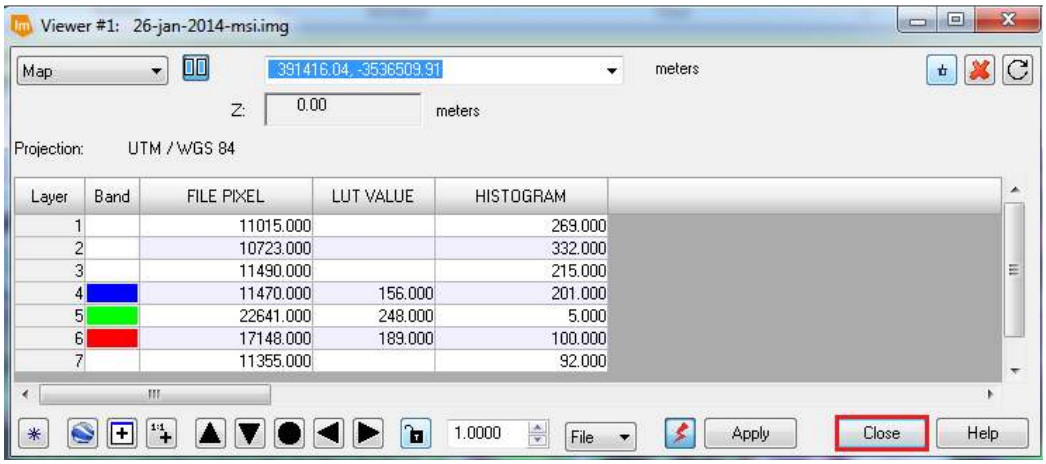
The Inquire Viewer will display showing the pixel values of the highlighted point (the cross bars shown on screen)

3. Using the **Select** tool navigate around the image viewing the Spectral Characteristics of the Pixels

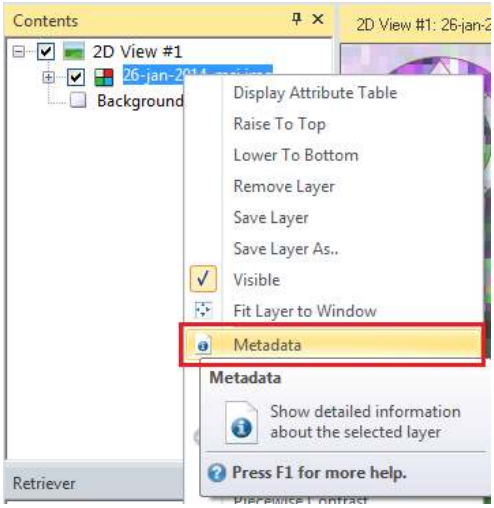
The Inquire Cursor will update the pixel referenced in the inquire display. The Pixel Values of all the bands and also the LUT value of the current bands displayed in RGB

This tool can be used to investigate pixel level detail for many Q+A tasks

4. **Close** the inquire box



5. **Right click** on the image in Contents Panel and select **Open Metadata**

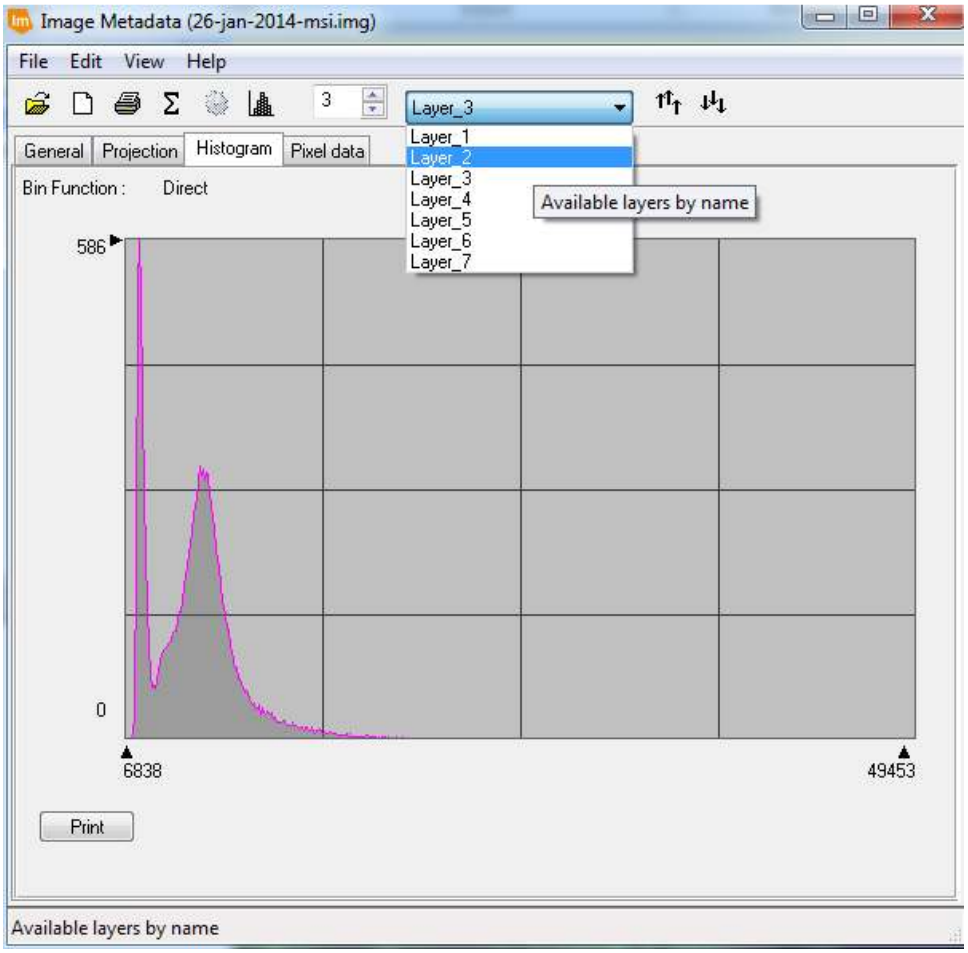


The Image Metadata will display with the information of the 26-jan-2014-msi.img image. Another tool when analyzing Spectral Characteristics is to view the Histogram and Pixel Data

6. In the Image Metadata window select the **Histogram** tab

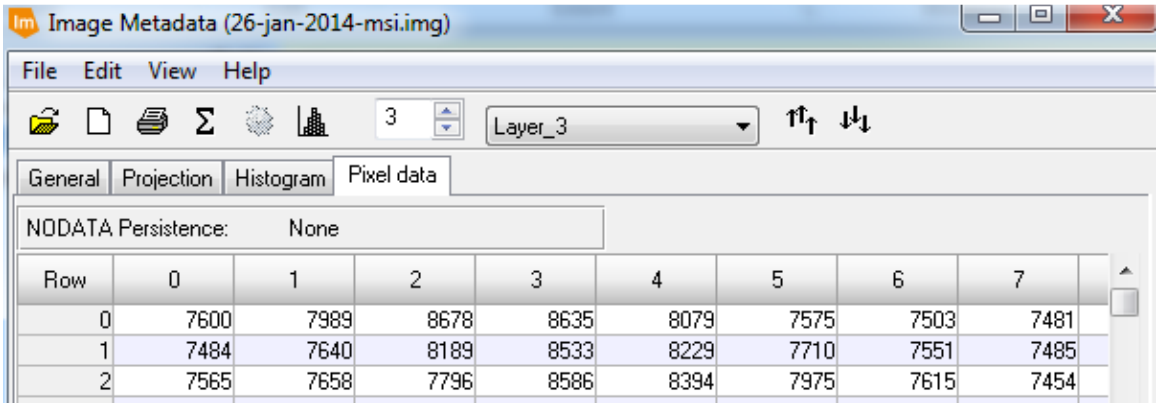
   The histogram spread of the selected band will display

7. From the Layer Pull-down list, select various other bands to view the trend in the pixel values of the image



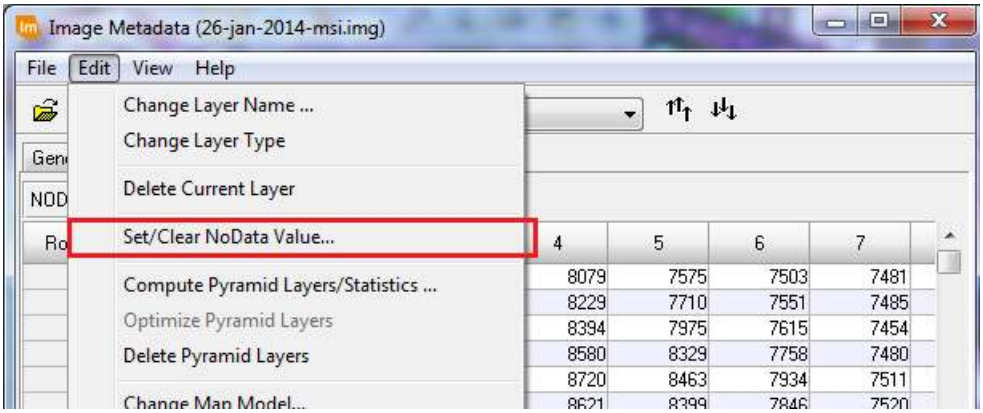
Now with many datasets it may also be important to know and understand if it has a NODATA value set, and if so what it is

8. In the **Image Metadata** window select the **Pixel Data** tab



Note for this particular image, NODATA value is not set.

9. We will not set a NODATA Value for this image, but to Set/Clear this if it is needed Select the **Edit** Pull-Down List and then **Set/Clear NoData Value**



10. **Close** the Image Metadata window

Task 3: Spectral Profile

1. Ensure the ***26-jan-2014-msi.img*** Image is still in a 2DView
2. From the Multispectral Tab | Utilities Group select **Spectral Profile**

The Spectral Profile window will display

3. Select the “Create New Profile Point in Viewer Icon”
4. Click on an area of **Water**
5. Repeat to create a profile point for:

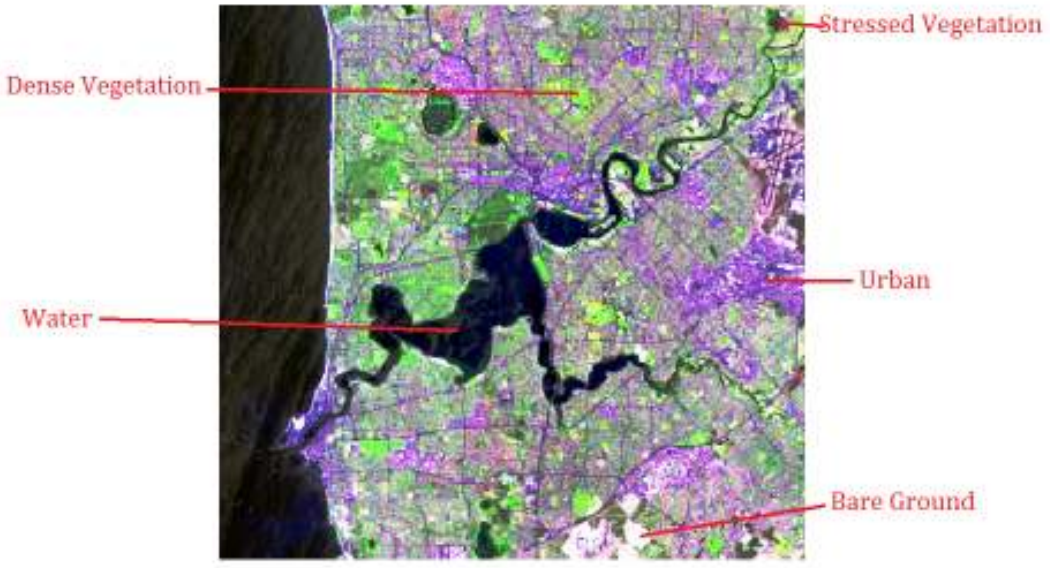
Dense Vegetation

Stressed Vegetation

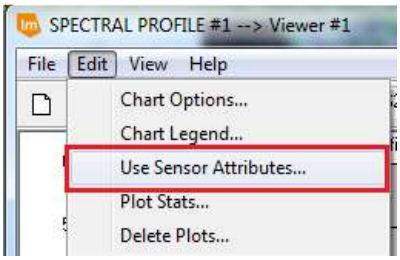
Bare Ground

Urban Area

You can use the following example

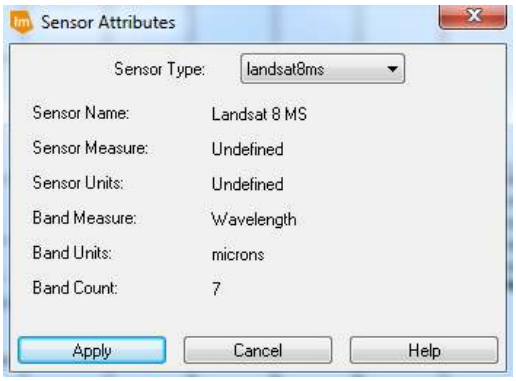


6. Once all 5 Profiles are collect select **Use Sensor Attributes** from the Edit Menu

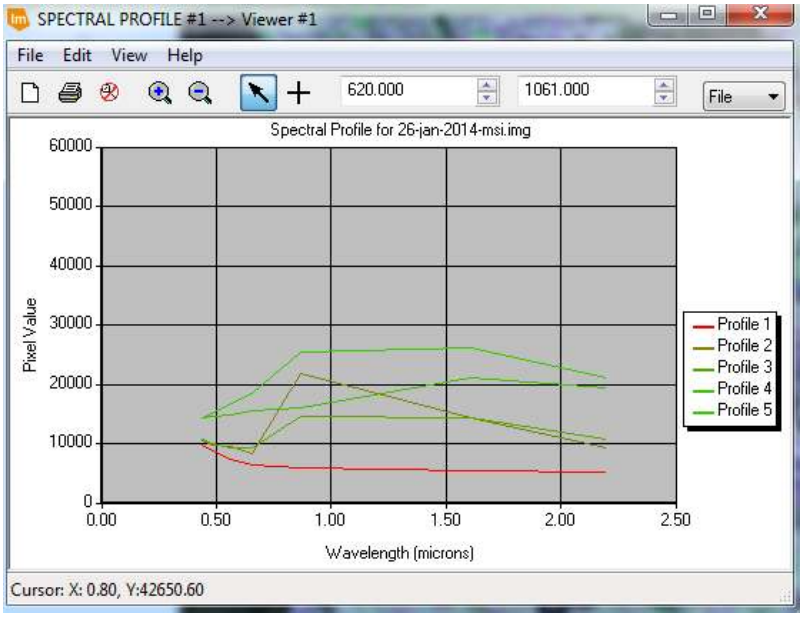


Using Sensor Attributes will allow for a plot against actual Wavelength (microns) instead of a vague band number. This is particularly useful when using a range of sensor models. Spectral Characteristics will tend to remain the same for a given spectral range, however may drastically change between band references.

7. Define Sensor Type as **Landsat8ms** and click **Apply** and **Close**

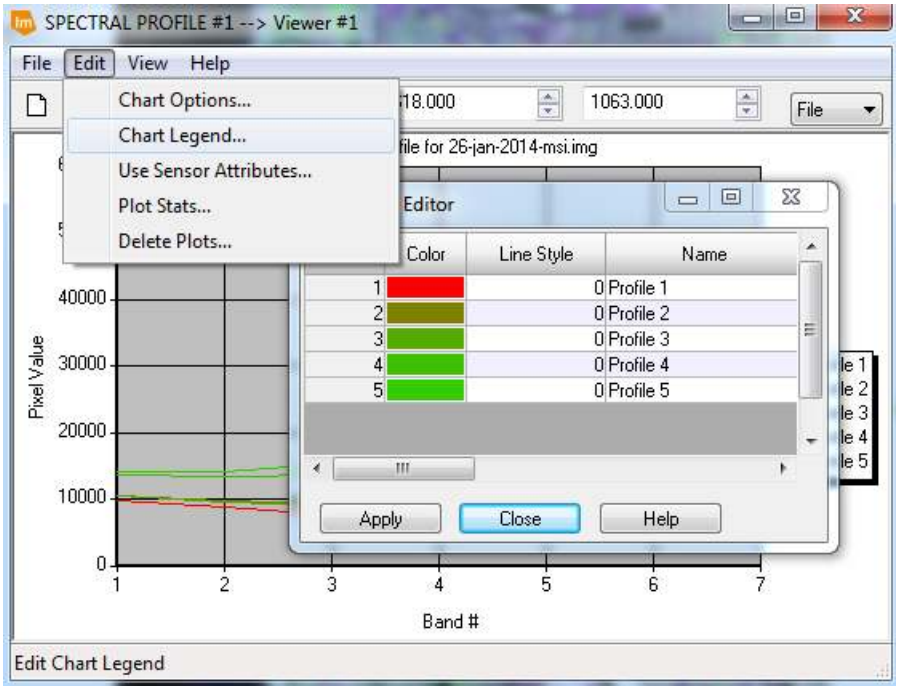


8. You should now have a Spectral Profile with 5 Profiles and a Wavelength X-Axis displayed



9. Now we will edit the Legend Display to names and colors more useful. Select **Edit > Chart Legend** from the Menu

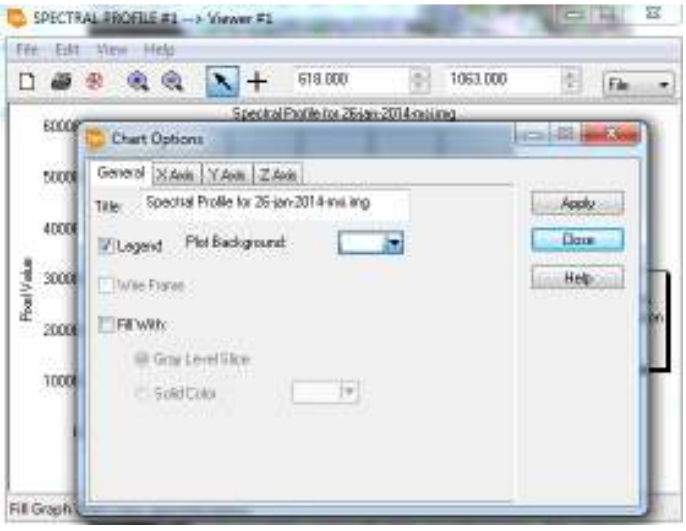
10. The Legend Editor will open. **Rename** and **Change Color** to the associated classes you identified



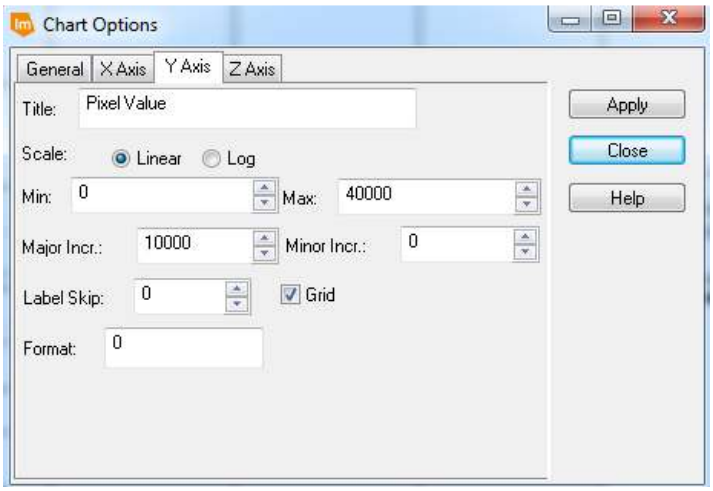
11. Once complete select **Apply** and **Close**

12. To change the Chart Display options click **Chart Options** from the Edit Menu

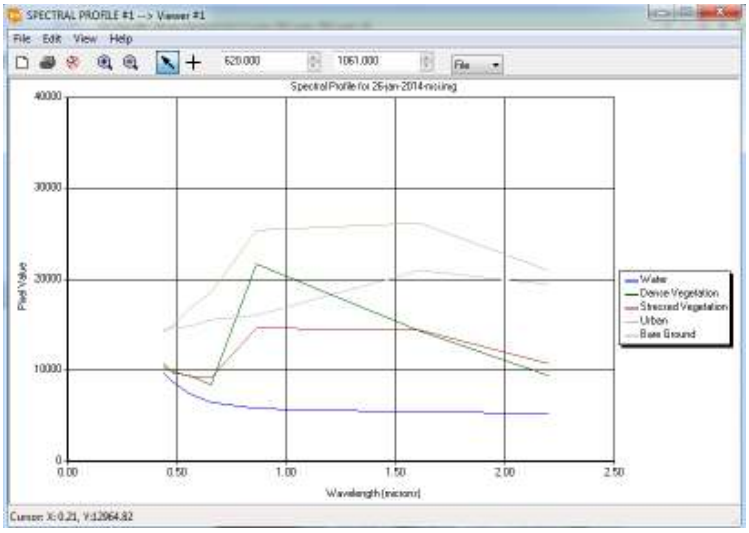
13. From the General Tab, Set the Plot Background to **White**



14. From the Y-Axis Tab, Set the Max Value to **40000**
15. Click **Apply** and **Close**



You have now created a basic Spectral Profile Graph of 5 Land Covers of a Landsat 8 Scene. Similar plots can be used for future reference or to help compare between different scenes. The Relative pattern of classes should remain the same. Use this theory to also improve upon Supervised Classification Techniques.



16. File – **Save As – Annotation**

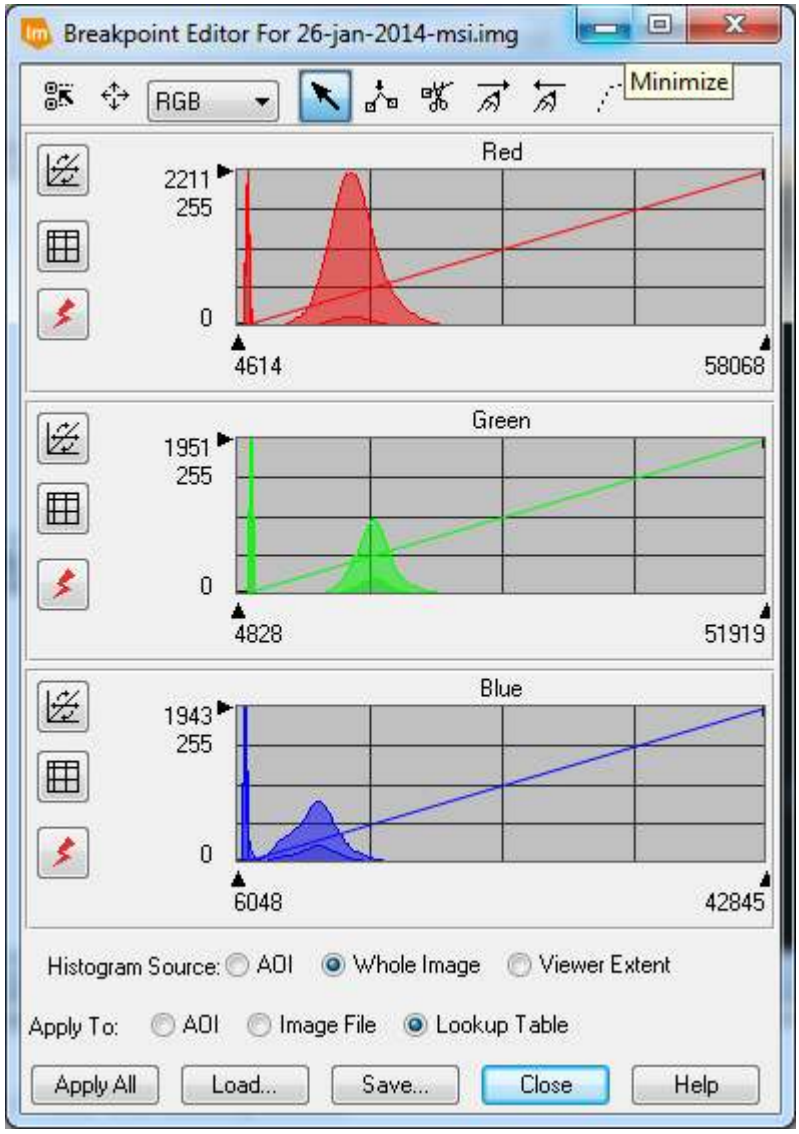
17. Navigate to your TrainingData\Output Folder and Save As ***spectral-profile.ovr***

    Note: An annotation layer can easily be incorporated in to a Map Design in just a few clicks of the mouse. Refer to Training Documentation for Map Design for further information

18. **Close** the Spectral Profile
19. From the **Multispectral** tab select **Adjust Radiometry > Save Breakpoints.**
20. Name the datasets ***equalize.cbp.*** We will use this file for the next exercise.
21. **Clear** the **2D View**.

Task 4: Breakpoints

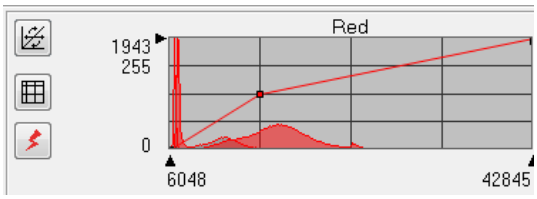
1. Go to **File** > **Open > Raster Layer** and select ***26-Jan-2014.img***.
2. Click the **Raster Options** tab and enable **No Stretch**.
3. Display the image as a **6, 5, 4** combination.
4. Click **Multispectral** tab **Adjust Radiometry > Breakpoints.**



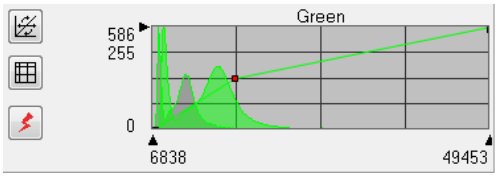
The Breakpoints tool allows us to view, edit, and rescale the histograms and lookup table graphs for the red, green, and blue lookup tables.

The Breakpoints tool is currently display the histograms for the red green and blue channel.

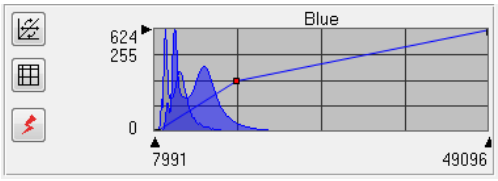
5. Click the Histogram Edit Tools button to start editing a histogram  .
6. From the Red channel click the red line and move it to the location below.



7. Ensure the Histogram Option is set to **Whole Image**
8. Ensure the Histogram Option is set to **Lookup Table**.
9. Click **Apply All** and assess the difference.
10. From the Green channel click green line and move it to the location below.



11. Click **Apply All** and assess the difference.
12. From the Blue channel click the blue line and move it to the location below.



Does the image look better?

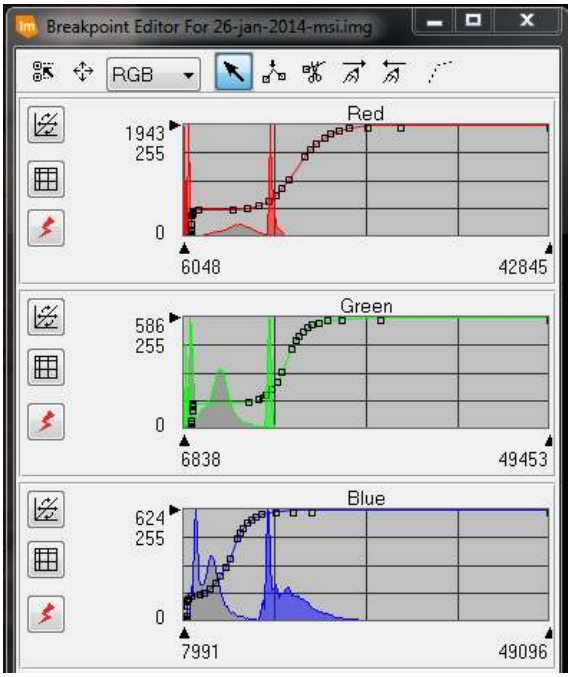
13. Experiment by manually stretching the breakpoints to see their effects.

Is this an effective method of image stretching?

We can also load a pre-made set of breakpoints. Such as the ***equalize.cbp*** file we saved in the previous exercise.

14. From the Breakpoint Editor tool click **Load.**
15. Navigate to the ***equalize.cbp*** file you saved previously. Click Ok.

The breakpoints will automatically overlay a line over your current histograms.



16. Click **Apply All**.

The pre-saved equalize stretch has been applied to the Lookup table.

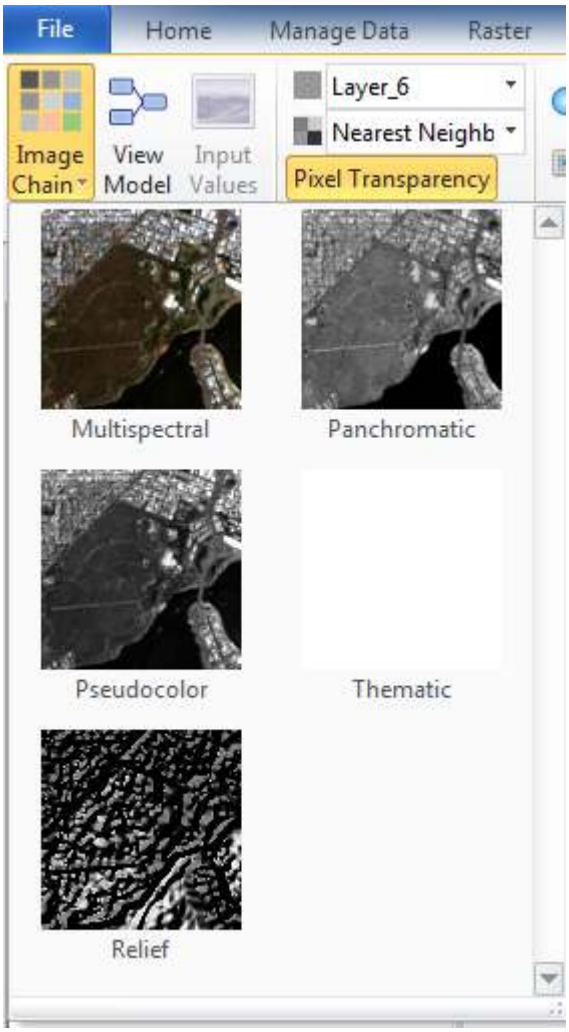
If we wanted to permanently save this stretch to the image, we could enable the Image File Radial box and click Apply All.

17. **Clear** the **2D View.**

Task 5: Image Chain: Color Tables

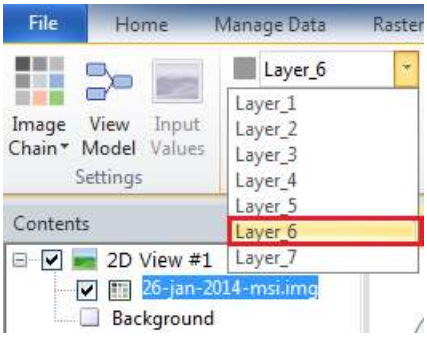
1. In a clear session of IMAGINE select **File** > **Open** > **Raster as Image Chain**

2. Load the dataset from TrainingData***26-jan-2014-msi.img***
3. From the **Multispectral** tab > Image Chain Pull-down list select **Pseudocolor**



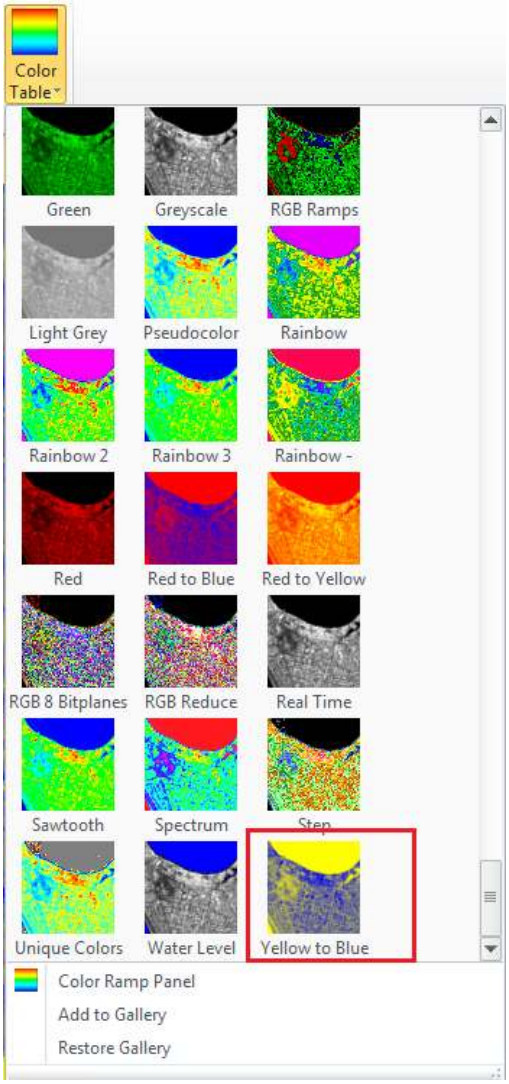
IMAGINE has improved dynamic thumbnails. This means the thumbnail (preview) you see is the center of the current view of your actual dataset. Try to zoom into different areas in your image before reopening the Image Chain Display in the following step.

4. From the Psuedocolor Tab | View Group select **Band 6**



5. Now select **Yellow to Blue** from the Color Table Pull-down list

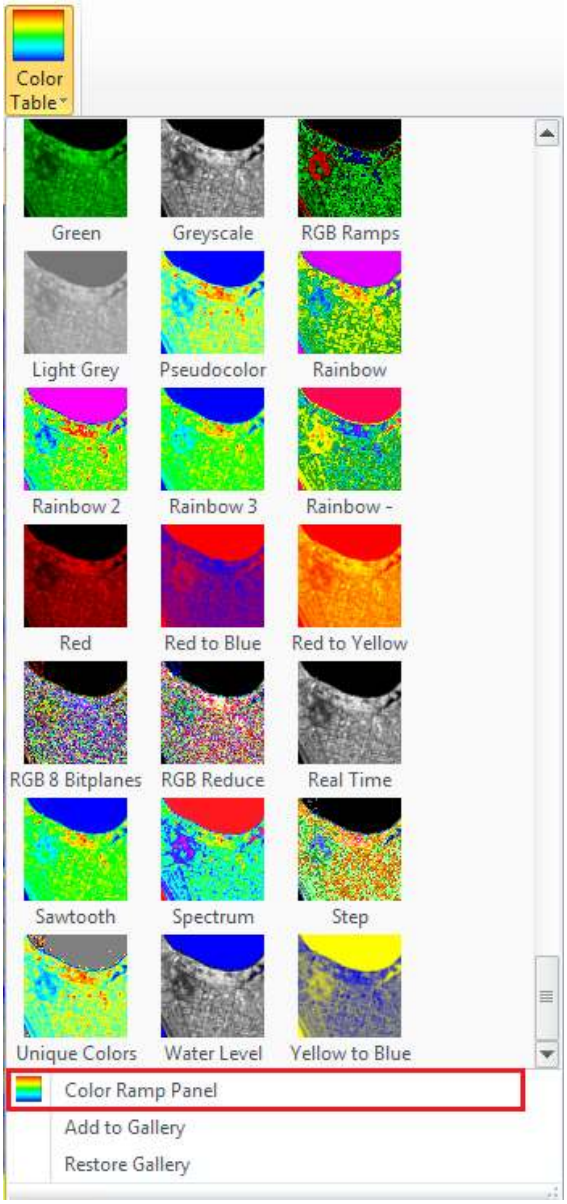
   This particular Color Table is under the ER Mapper Group



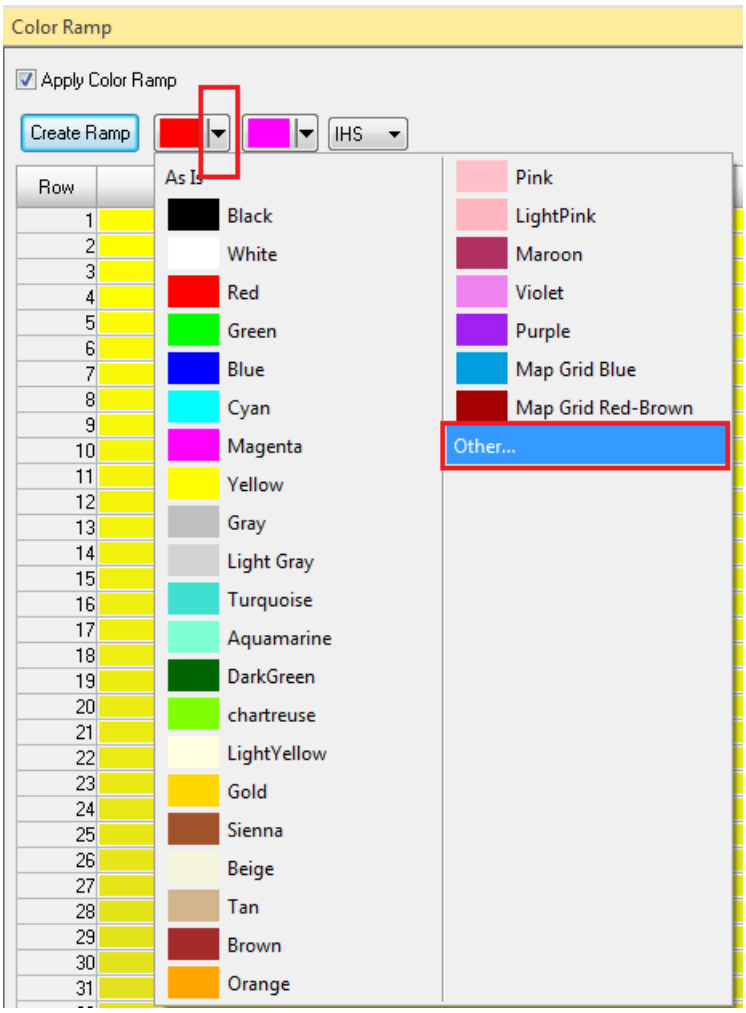
To better understand the spectral characteristics of the image you have displayed. This display is of Band 6, Low values in Band 6 will display in bright yellow and high values in Band 6 will display in dark blue.

For many reasons, a custom or standardized Color Table may be needed. This next task will illustrate how you can create and save a customized Color Table to the Gallery.

6. From the Color Table Pull-down list select **Color Ramp Panel**



7. From the Color Ramp dialog, select the Color Options Pull-down option in the first color box and select **Other..**



This will open the advanced color chooser

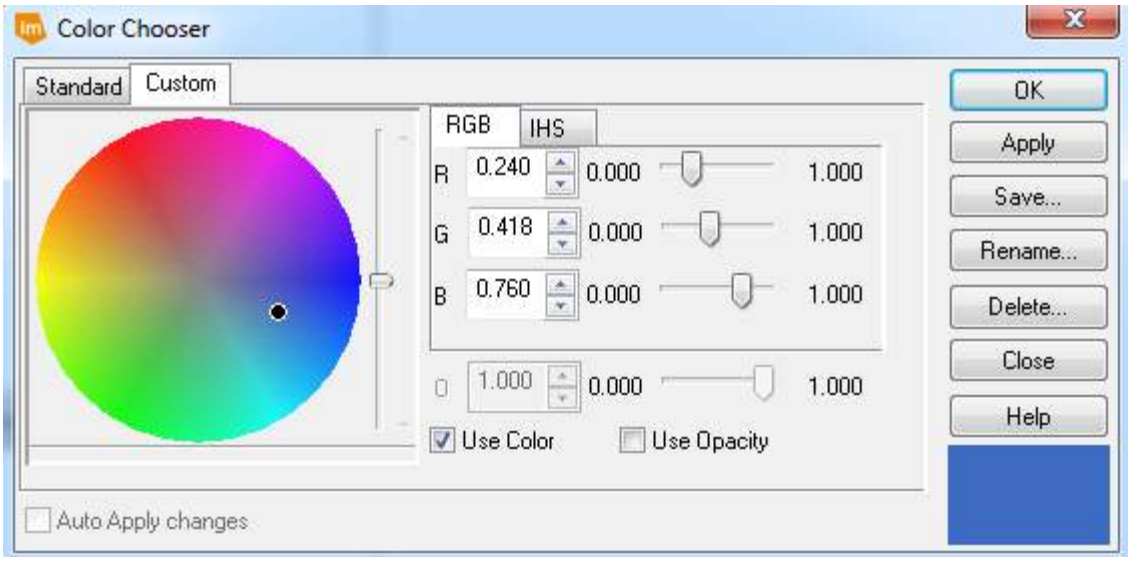
8. Define the first color of the color ramp as:

   R: **0.240**

   G: **0.418**

   B: **0.760**

   Note you can dynamically scroll around the display to select another custom color if you would like. The Set RGB values are given to illustrate how you can replicate existing color Tables with a defined RGB Value

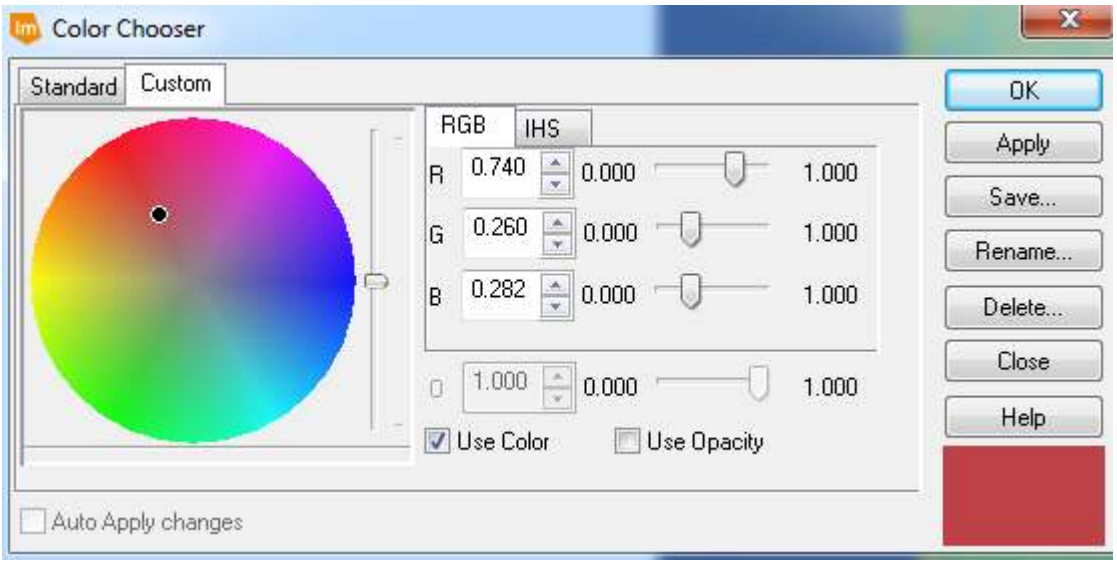


9. Click **Apply** and **OK** to close the Color Chooser
10. From the Color Ramp dialog, select the Color Options Pull-down option in the second color box and select **Other.**
11. Define the second color of the color ramp as:

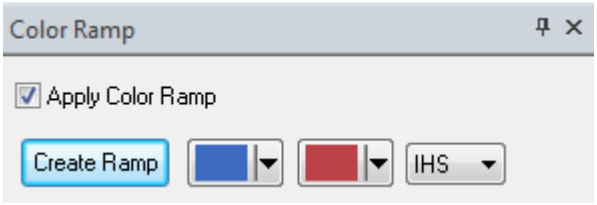
    R: **0.740**

    G: **0.260**

    B: **0.282**

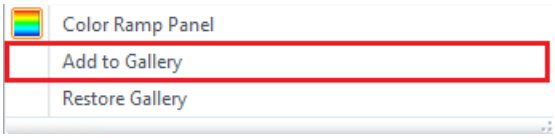


12. Click **Apply** and **OK** to close the Color Chooser
13. To apply this new Color Ramp to your image on display click **Create Ramp**



Now we will save your Color Ramp to the Gallery for easy access in the future

14. From the Color Table Pull-down list select **Add to Gallery**

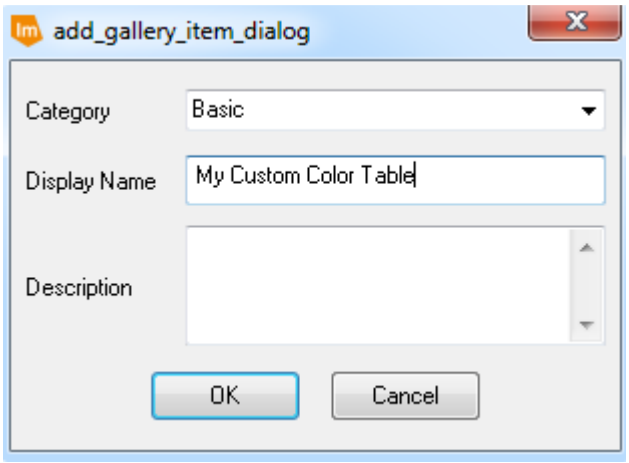


15. Define the follow settings:

    Category: **Basic**

    Display Name: **My Custom Color Table**

    And click **OK**



This will be saved to your User Default Layout File so will be visible in future sessions of IMAGINE

Class Notes