Section 8: Unsupervised Classification

Section Objective

Familiarize students with the different methods of unsupervised classification as well as the post-processing steps to categorize and recode different types of terrain.

Tools Used

Unsupervised Classification	A process to derive thematic information from remotely sensed data.
Recode Tool	Allows you to combine different classes into one

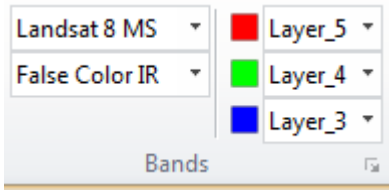
Class Notes

Unsupervised Classification

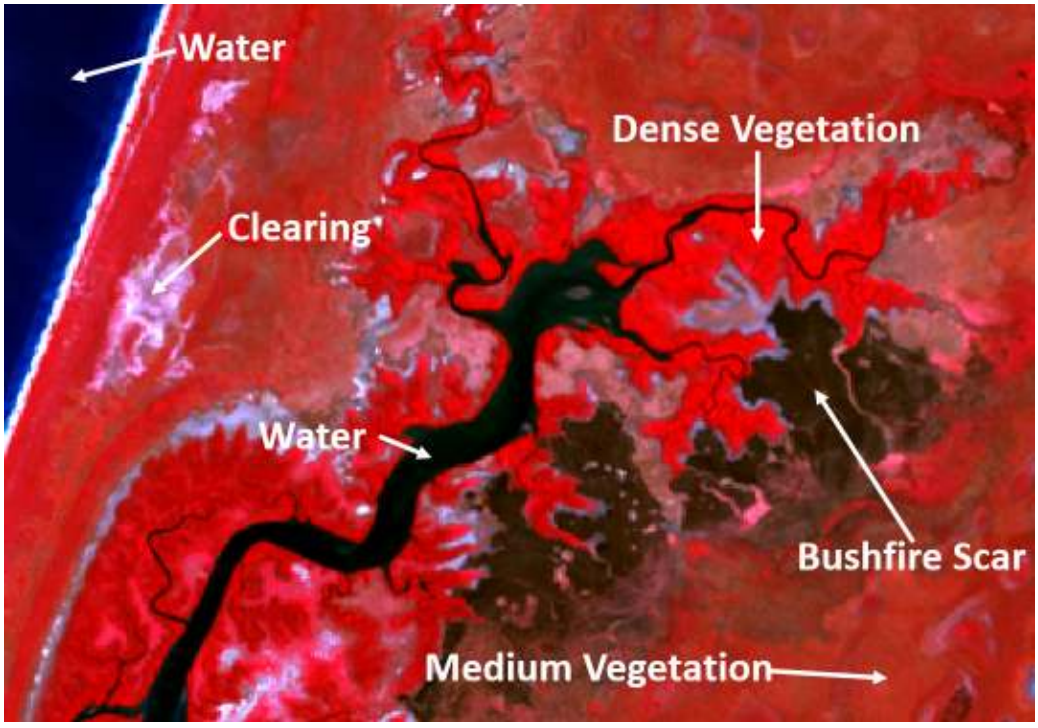
Task 1: Unsupervised K Means Classification

Students will complete an Unsupervised Classification of a Landsat 8 dataset using the K Means method.

1. Go to File > Open > Raster Layer. Select ***landsat8.img***.
2. From the Multispectral tab select **Landsat 8 MS** as the sensor type and display as **False Color IR.** This is a simple 5,4,3 band combination.

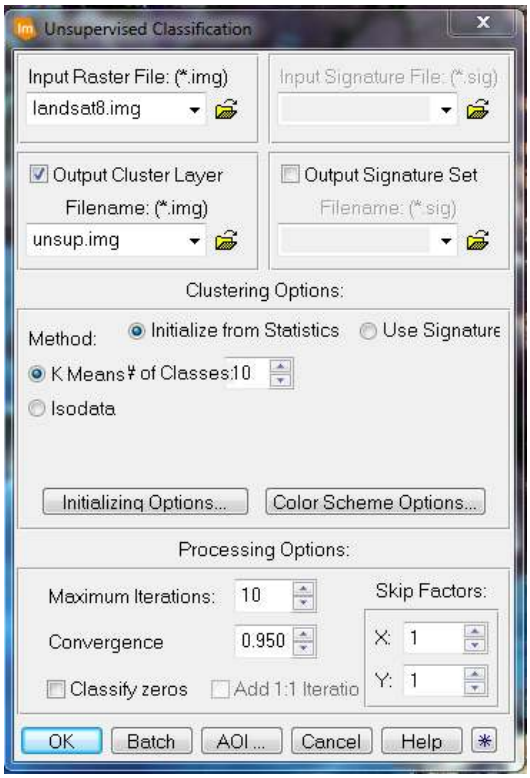


3. Assess the image for the different terrain types. You will notice there is different vegetation densities, clear-cut areas and bushfire scarred areas.



These are a just a few examples of some vegetation types, you may also identify classes for buildings, sparse vegetation etc.

4. From the **Raster** tab Classification group select **Unsupervised > Unsupervised Classification.** The Unsupervised Classification dialog appears.



5. In the Output Cluster layer type ***unsup.img***

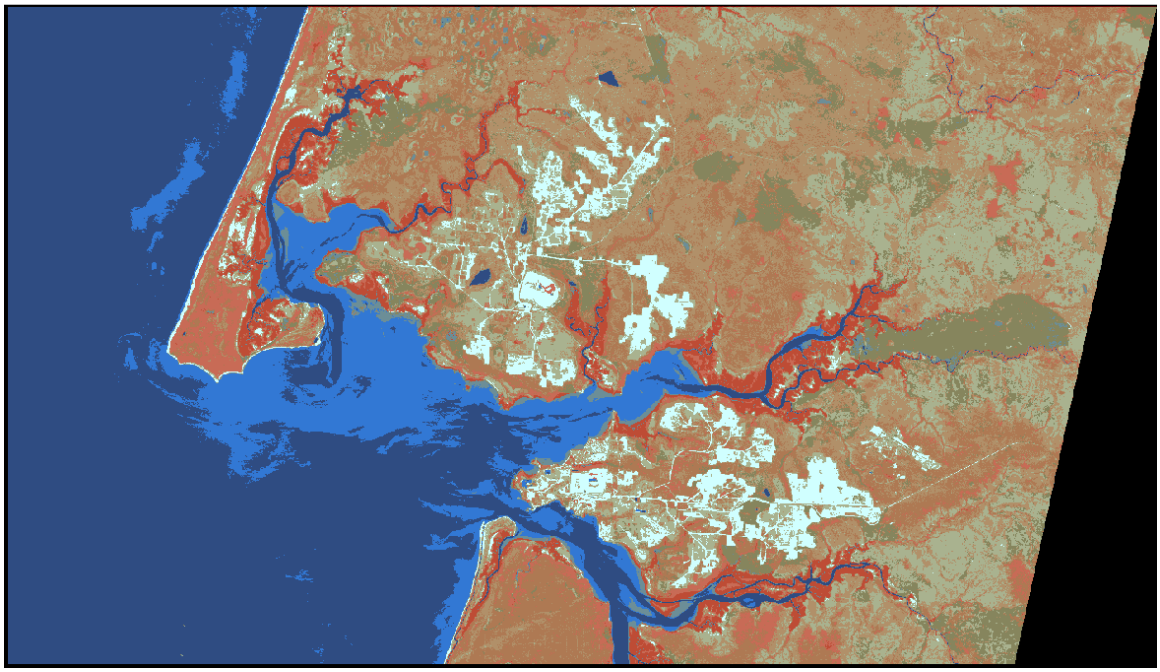
There are two options for Unsupervised classification, K Means and ISODATA. In this exercise we will use the K means techniques which is an iterative clustering algorithm. The technique only requires the user to input a number of classes.

However, you should also be aware of ISODATA which stands for Iterative Self-Organizing Data Analysis Technique. It is iterative in that it repeatedly performs an entire classification (outputting a thematic raster layer) and recalculates statistics. Self-Organizing refers to the way in which it locates the clusters that are inherent in the data.

6. Ensure the radial button next to **K Means** is selected.
7. Ensure the **Number of Classes** is set to **10.**
8. Click **Color Scheme Options**. This allows us to select a band combination which will assign colors to the output classes.

9. Select the **5,4,3** combination which matches the image currently displayed.
10. Click OK, to run the unsupervised classification.

11. Open the resulting ***unsup.img*** image and assess the results.

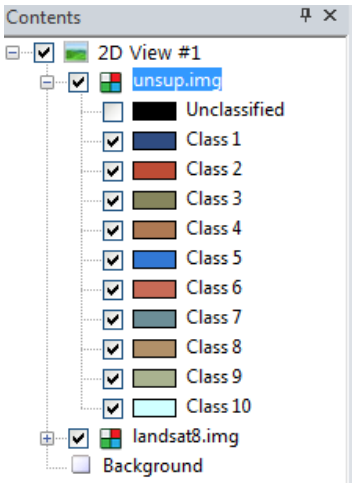


You will notice the resulting classification looks similar to the input image however it now comprises only 10 colors (classes).

12. Leave the image open in the 2D View for the next exercise.

Task 2: Renaming Classes

1. Click the Table tab and select Attribute table. We will now rename some of the classes to match their respective categories.
2. Ensure that ***unsup.img*** is opened on top of ***landsat8.img***. Click the **plus** icon next to ***unsup.img*** to see the individual classes.



3. You can now toggle the classes on or off to identify what type of terrain lies beneath.
4. Start by toggling Class 5 and Class 1.
5. These represent water. In the Attribute Table, change the name for Class 1 and Class 5 to Water.
6. The light-blue Class 10 represents clearing areas. Rename it to Clearing.
7. Class 3 Represents Fire Scarring, rename it to Fire Scarring.
8. Using your own intuition, rename the remaining classes. You may notice that many classes belong to one landcover type.

You may want to use the table below as a guide.

Row	Histogram	Color	Red	Green	Blue	Opacity	
0	376020		0	0	0	0	Unclassified
1	1271098		0.184	0.298	0.51	1	Water
2	162589		0.745	0.298	0.208	1	Dense Vegetation
3	250569		0.525	0.522	0.365	1	Fire Scarring
4	466972		0.682	0.475	0.325	1	Medium Vegetation
5	290168		0.196	0.471	0.831	1	Water
6	170698		0.784	0.42	0.337	1	Dense Vegetation
7	56585		0.424	0.557	0.592	1	Water
8	878193		0.694	0.565	0.412	1	Dense Vegetation
9	558205		0.663	0.698	0.561	1	Sparse Vegetation
10	157539		0.816	1	1	1	Clearing

9. When complete, right-click ***unsup.img*** in the Contents pane and select Save Layer.
10. Leave the dataset open in the 2D View for the next exercise.

Task 3: Recoding Classes

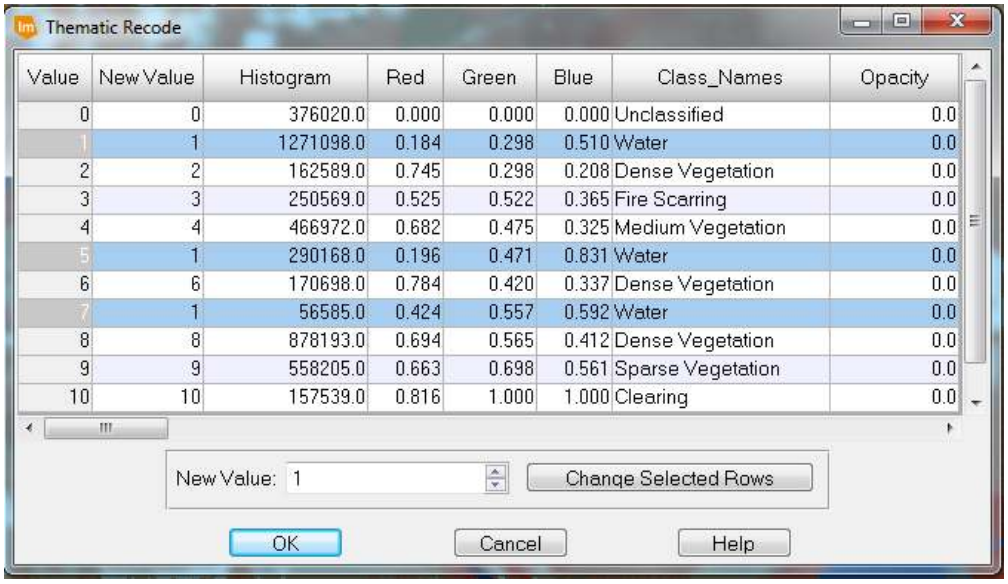
The previous exercise focused on naming each of the classes. The next exercise will show the user how to recode each class.

1. From the **Raster** tab, choose **Thematic > Recode**. The Thematic Recode dialog displays.

   You will notice a columned called Value and New Value. The objective is to recode classes with multiple entries into a new value.

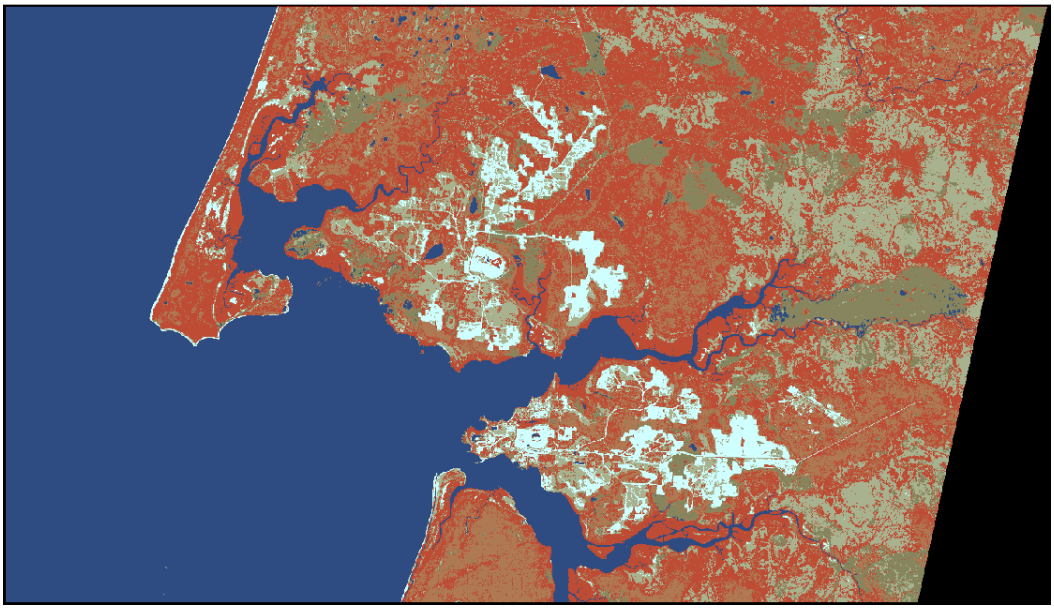
*The **Recode** dialog allows you to "combine" different classes into one. For example, if Classes 1, 2 and 3 were respectively Forest 1, 2, 3 you could combine the into one Forest class with value 1.*

2. Holding the **Shift key**, select any classes you have identified as ***Water***.
3. Click the **Change Selected Rows** button. You will a New Value of **1** assigned to the Water classes.



4. Select any classes identified as **Dense Vegetation**.
5. Change the New Value to **2** and click Change Selected Rows. You will see a New Value of **2** assigned to all **Dense Vegetation** classes.
6. Work through any remaining classes until each one has its own value. You may want to sort the New Value column from Low to High. (Sort A…Z)

7. When complete click **OK** in the Thematic Recode dialog box.
8. In the Recode dialog input ***unsup_recode.img*** as the Output File name.
9. Click **OK** to run the recode.
10. Assess the resulting image.



You will notice that some areas which previously contained multiple classes now only contain one class.

11. From the **Table** tab open the **Attribute Table.** There are now fewer classes than before as you have successfully recoded the multiples.

Task 4: Cleaning Up A Classification

The objective of this task is to generalize a classification by cleaning up and eliminating single pixels. We will accomplish this using statistical filtering which applies neighborhood which applies neighborhood functions and can be one means of eliminating single pixels.

1. From the Viewer of your recoded classification, select **Thematic** tab > **Statistical Filtering**  . The Focal Function dialog displays.

Majority: *Output the majority pixel value of the moving window*

Max: *Output the maximum pixel value of the moving window*

Mean: *Output the mean pixel value of the moving window*

Median: *Output the median pixel value of the moving window*

Min: *Output the minimum pixel value of the moving window*

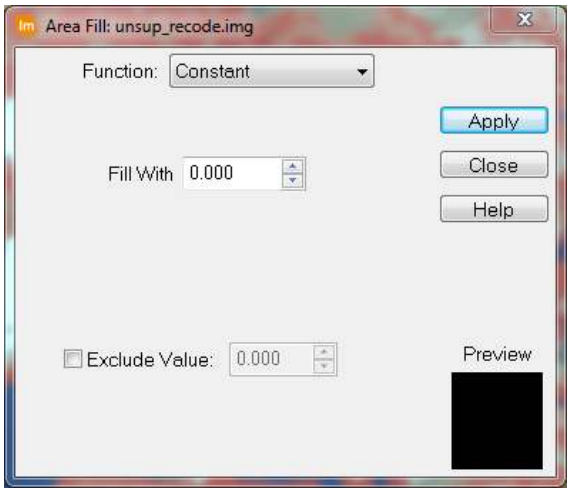
Minority: *Output the minority pixel value of the moving window*

2. For the function select **Majority** and for the Window Size, use **3x3.** Check the Preview window, click **Apply** and watch the image change.
3. Click **Close** in the Focal Function dialog.

Changes in the Viewer are for display only. You can save the changes to the file, or use Raster tab > resolution group > Spatial menu > Focal Analysis to apply the changes to a new output file.

Next, we will use the AOI (Area of Interest) tools and the function for Area file in order to manually edit the classification, by reassigning pixels from one class to another. In particular, we will identify any areas that are water, but are not classified as such.

4. On the Thematic tab, select **Edit** group >  **Fill**. The Area Fill dialog displays.



The functions available depend on if you are working with thematic or continuous data. Our discussion will focus on thematic. The available functions include:

Constant: *Click to fill the area with a specified constant value*

Majority: *Output the most common pixel value*

Max: *Output the largest pixel value*

Median: *Output the most frequent pixel value*

Min: *Output the smallest pixel value*

Minority: *Output the least common pixel value*

5. For the Function, select **Constant**. When Constant is chosen, a Fill With option becomes available within the dialog.

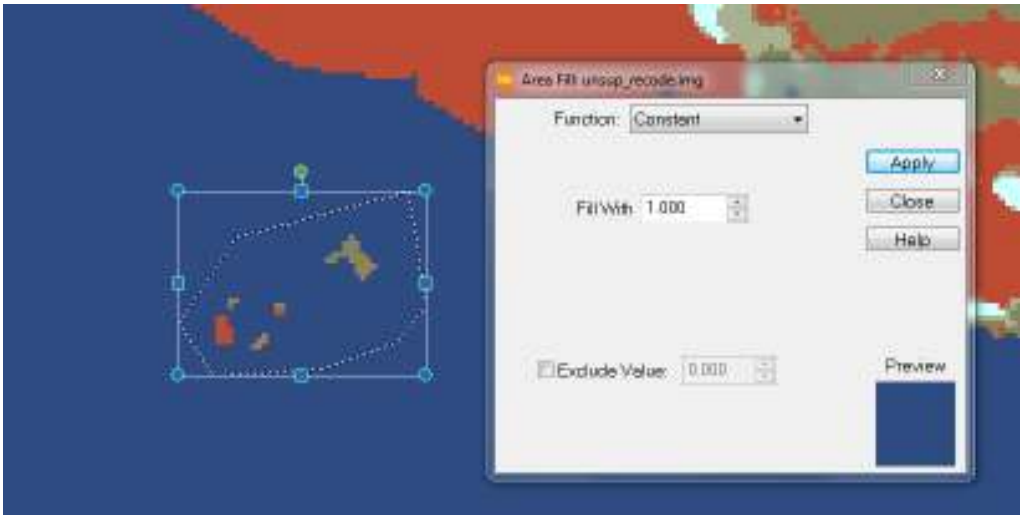
This option is not availabe for any of the other Function options.

6. In the **Fill With** field, input the class value for the class which you are using to fill.

This value can be found in the Raster Attributes as the row number. The preview box should show the same color the class is in your Raster Attribute Editor.

7. Open the Drawing Tools dialog by changing to the Drawing tab.

8. Using the **Polygon** icon in the **Insert Geometry** group, digitize a polygon around an area in the classification that should be classified as water, but is not. (Zoom if necessary).



9. Click **Apply** in the Area Fill dialog to fill the AOI you just created with the new value. Continue to change other misclassified areas, drawing as many AOIs as necessary.

The Fill function will only be applied to the AOI that is selected.

10. **Clear** the image, and when prompted to **Save** changes select **Yes.**

Class Notes