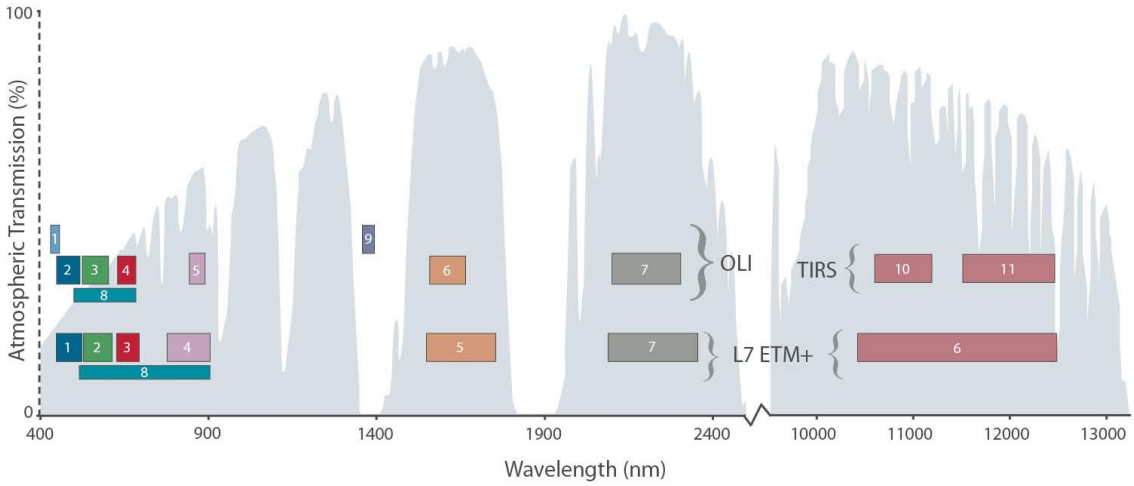
Lab 7: Color Composition and Unsupervised Classification

Tran Quang Bao

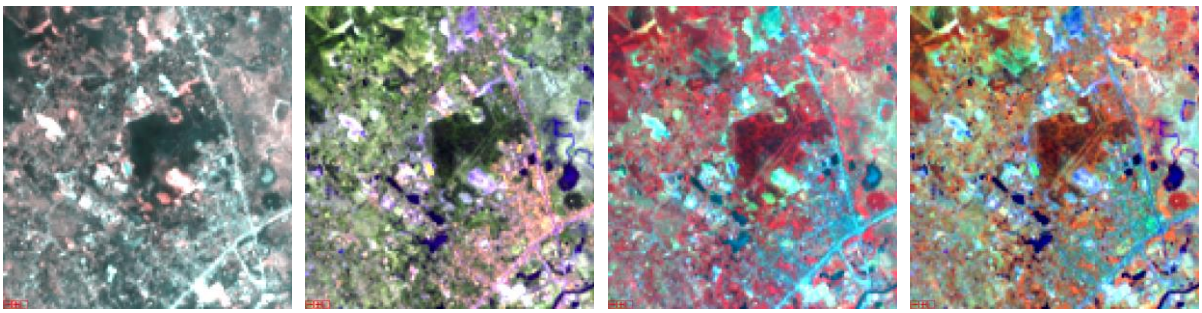
1. Band Combination for Landsat 8

Landsat 8

Band Name	Bandwidth (µm)	Resolution (m)
Band 1 Coastal	0.43 – 0.45	30
Band 2 Blue	0.45 – 0.51	30
Band 3 Green	0.53 – 0.59	30
Band 4 Red	0.64 – 0.67	30
Band 5 NIR	0.85 – 0.88	30
Band 6 SWIR 1	1.57 – 1.65	30
Band 7 SWIR 2	2.11 – 2.29	30
Band 8 Pan	0.50 – 0.68	15
Band 9 Cirrus	1.36 – 1.38	30
Band 10 TIRS 1	10.6 – 11.19	100
Band 11 TIRS 2	11.5 – 12.51	100



Wavelength of Landsat 7 and Landsat 8

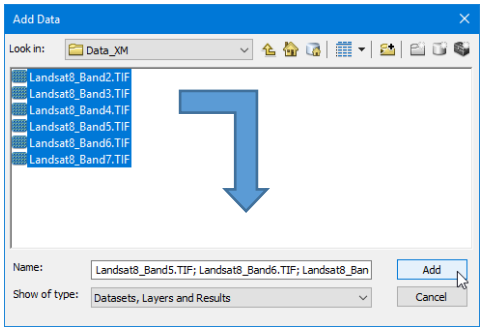


Natural Color (4-3-2) | False Color (urban) (7-6-4) | Color Infrared (Vegetation) (5-4-3) | Land/water (5-6-4)

	Landsat Band
Natural Color	4 3 2
False Color (urban)	7 6 4
Color Infrared (vegetation)	5 4 3
Agriculture	6 5 2
Atmospheric Penetration	7 6 5
Healthy Vegetation	5 6 2
Land/Water	5 6 4
Natural With Atmospheric Removal	7 5 3
Shortwave Infrared	7 5 4
Vegetation Analysis	6 5 4

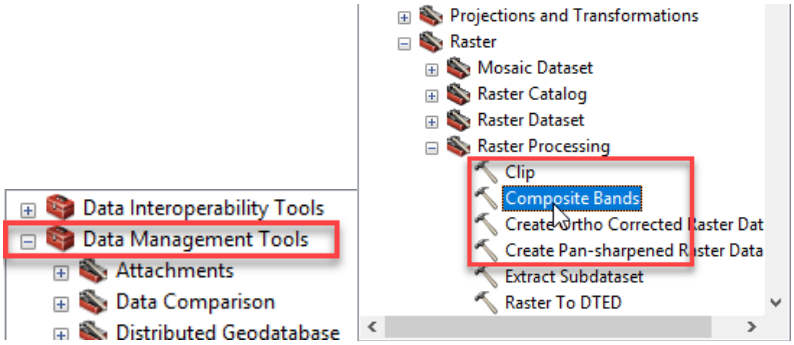
Band Composition in ArcGIS

1) Add Data in ArcMap



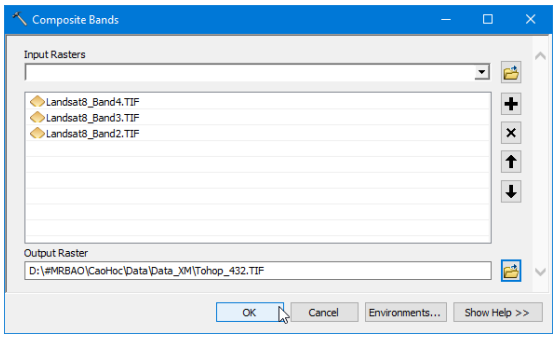
2) Open ArcToolbox

Data management tool → Raster → Composite Bands



3) Choose bands to Composite

- **Note:** Typing **".tif"** for Output Raster file



2. Unsupervised Classification in ArcGIS

Unsupervised classification finds spectral classes (or clusters) in a multiband image without the analyst's intervention.

The following are the steps to execute the Iso Cluster Unsupervised Classification tool:

1. On the **Image Classification** toolbar, click **Classification > Iso Cluster Unsupervised Classification**. The Iso Cluster Unsupervised Classification tool is opened.
2. In the tool dialog box, specify values for **Input raster bands**, **Number of classes**, and **Output classified raster**. You may accept default values for other parameters.
3. Click **OK** to run the tool.

The output classified raster will be automatically added to ArcMap when the tool finishes.

3. Post-classification processing

In the classified output, some misclassified isolated pixels or small regions of pixels may exist. This gives the output a "salt and pepper" or speckled appearance. Post-classification processing refers to the process of removing the noise and improving the quality of the classified output.

3.1. Filtering the classified output

This filtering process removes isolated pixels, or noise, from the classification output. The Majority Filter tool is used to accomplish this task.:

1. ArcToolbox => Spatial Analysis Tools => Generalization => **Majority Filter.**
2. On the tool dialog box, set the classified image as **Input raster**. Accept default settings for other parameters.
3. Click **OK** to run the tool.

Image before filtering:

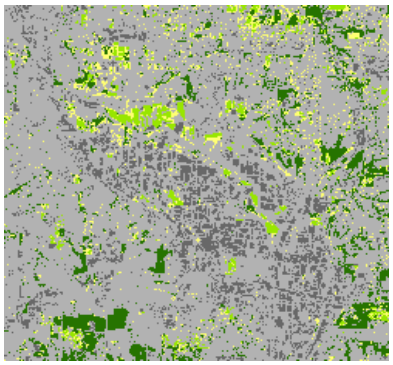
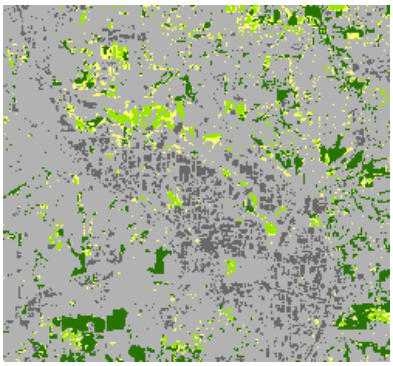


Image after filtering:



3.2. Smoothing class boundaries clumping classified output

The Boundary Clean tool will smooth the ragged edges of class boundaries and clump the classes. This operation increases the spatial coherency in the classes. Regions that are adjacent and belong to the same class may become connected.

1. ArcToolbox => Spatial Analysis Tools => Generalization => **Boundary Clean**
2. On the tool dialog box, set the filtered output (or the output from any other processing) as the **Input raster**. For the **Sorting technique**, choose **Ascending**. Uncheck the optional parameter **Run expansion and shrinking twice**.
3. Click **OK** to run the tool.

Image before boundary cleaning

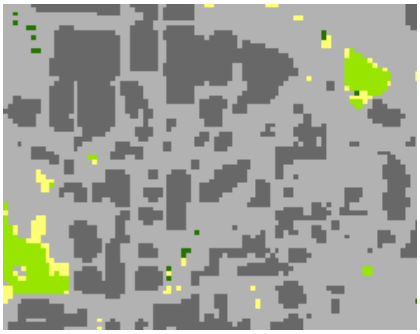
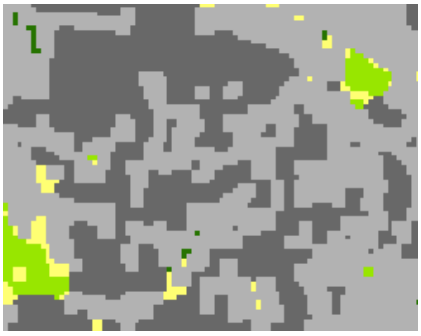


Image after boundary cleaning



3.3. Removing small isolated regions

This process removes small isolated regions from a classified image. Regions that are larger than a certain number of pixels will remain on the image

1. ArcToolbox => Spatial Analysis Tools => Generalization => **Region Group**

In ArcMap, open the attribute table of the output from the Region Group tool. Examine the Count field and try to identify any regions with a relatively small number of pixels and make note of the counts. These regions will be removed when all the steps are finished.

2. ArcToolbox => Spatial Analysis Tools => Conditional => **Set Null.**
3. In the tool dialog box, set the output from Step 1 as the **Input conditional raster**. In the **Expression** box, type an expression identifying the threshold, such as **Count < 40** (where the number 40 in this example represents the minimum count of pixels; you can specify a different number). Type the value **1** in the **False raster** parameter. Give the output an appropriate name. Click **OK** to run the tool.
4. ArcToolbox => Spatial Analysis Tools => Generalization => **Nibble**
5. In the tool dialog box, specify the classified image as the **Input raster** (Section 3.2). Specify the output from Step 3 as the **Input mask raster**. Accept the default values for the other parameters.
6. Click **OK** to run the tool.

The small regions with counts of pixels fewer than the selected threshold (40 in this example) should disappear, being essentially dissolved away based on the closest surrounding cell values.

Image before generalization:

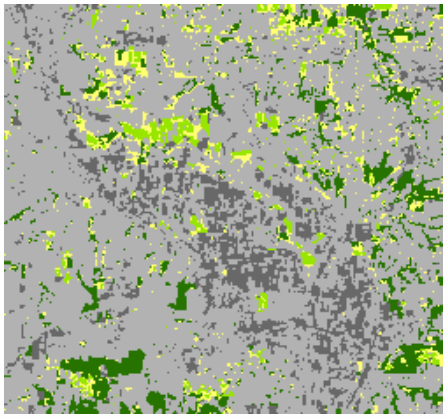
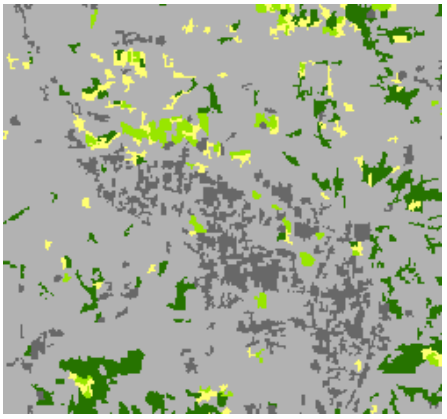


Image after generalization:

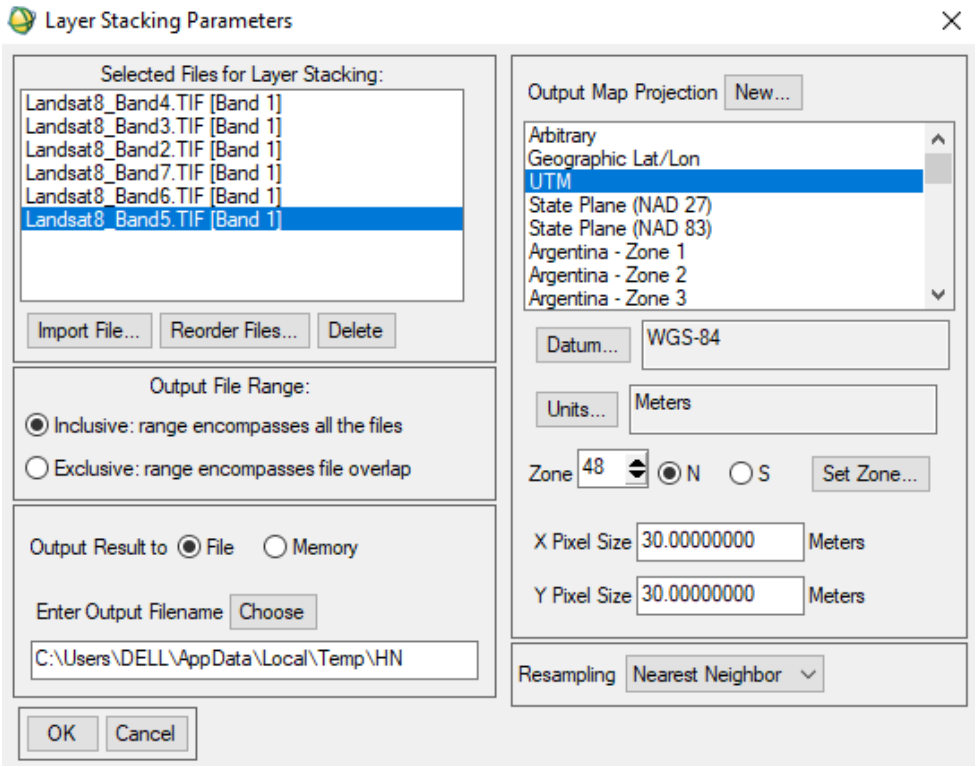


4. Unsupervised Classification in ENVI

Unsupervised classification uses statistical techniques to group n-dimensional data into their natural spectral classes.

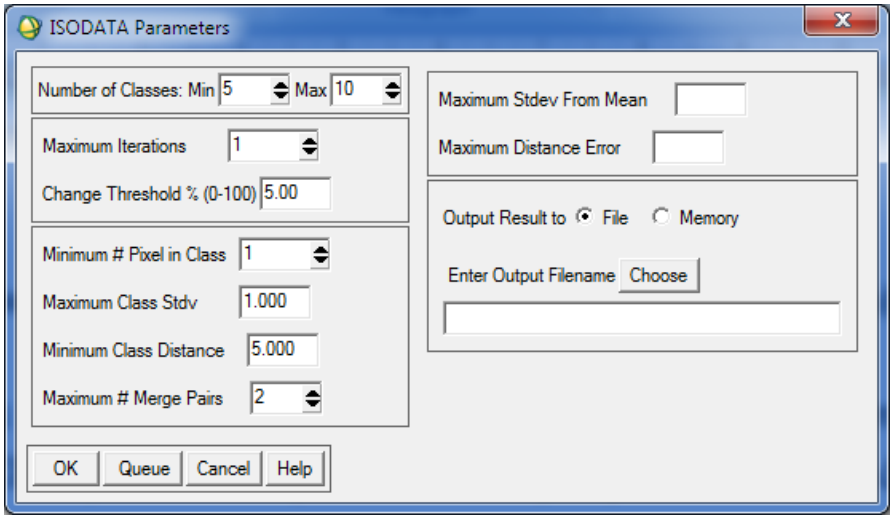
From main menu of ***ENVI***

1) **Band composition**: Basic Tools => Layer Stacking => Import file

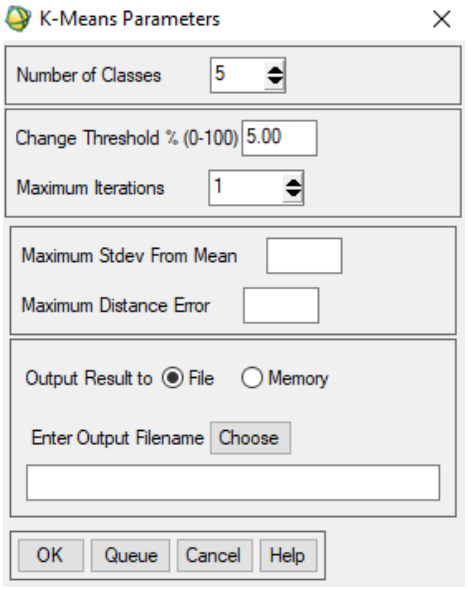


2) Unsupervised Classification*:* Classification => Unsupervised => Isodata/K-Means

- **ISODATA:** IsoData unsupervised classification calculates class means evenly distributed in the data space and then iteratively clusters the remaining pixels using minimum distance techniques. Each iteration recalculates means and reclassifies pixels with respect to the new means. This process continues until the number of pixels in each class changes by less than the selected pixel change threshold or the maximum number of iterations is reached



- **K-Means:** The K-Means unsupervised classifier uses a cluster analysis approach which requires the analyst to select the number of clusters to be located in the data, arbitrarily locates this number of cluster centers, then iteratively repositions them until optimal spectral separability is achieved



3) **Create a Quick Map in ENVI**

- **File => QuickMap => New QuickMap**

<u>Submission:</u>

- Layout of Unsupervised Classifcation in ArcGIS
- Quick Map of Unsupervised Classifcation in ENVI

<u>Due Date</u>: One week after having instruction