

# GIS and Remote Sensing

## Working with Images (2 hours)

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In this lab, you will:

- 1<sup>st</sup>. Download the LANDSAT images from internet
- 2<sup>nd</sup>. Adjust images in ENVI to emphasize the useful information  
(Using pan-sharp, band ratio, band combination function)
- 3<sup>rd</sup>. Export the image from ENVI

If your project area is in US, you will also:

- 4<sup>th</sup>. Download the aerial-photo data / Topo map / DEM from internet
  - 5<sup>th</sup>. Overlap the image in ArcGIS
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### 1<sup>st</sup>. Download the LANDSAT images from internet

- a. Landsat data is available in various places on internet. Here we use the **Earth Science Data Interface (ESDI)** to find and download the image we want. To find your data, go to <http://glcf.umiacs.umd.edu/> and click the **ESDI**.
- b. Once you connect the ESDI system, there are 3 different methods to search the available dataset. In this lab, you will use the **“Map Search”** function to access your data.
- c. Select the dataset you want in the left panel and using the **zoom / pan** tool to zoom to your interest area. Or you can input the Lat/Long to select the area if you know it's coordinate.
- d. Once you pin down the area, use the **“select”** tool to select the dataset. If any of the dataset has been selected, the **“Preview & Download”** function will show in white.
- e. Click the **“Preview & Download”** if you had done the data selection. You can preview the image when you click it's ID. If you click the **“Download”**, you will be redirect to its FTP location.
- f. Download and unzip your data, and open it in the **ENVI**.

NOTE: If you select the Landsat data, there are L1G and Ortho image you can choose usually. Both of them are ready to use, but its spatial location may have some difference due to the different level of the image correction.

If you decide to download the L1G format, open the HDF.L1G in ENVI to open your image.

## 2<sup>nd</sup>. Adjust images in ENVI to emphasize the useful information

### a. Band combination

- I. Load your data as RGB image in Display#1 (If you click the **Load RGB**, the image will load in Display#1 directly)
- II. Adjust the band combination to find the best combination for your propose. If your are using the ETM+ dataset, you can try the band combination as following list:

R,G,B	Description
3,2,1	The "Nature Color" combination. It provides the most water penetration.
4,3,2	Standard "false color" combination. Vegetation shows in Red.
7,4,2	The "Nature-like" combination. Sand, soil and minerals show in multitude of color. Fires would appear in Red. It provides clear imagery in desert region.
7,5,3	The "Nature-like" combination. Sand, soil and minerals appear in variety of color.
5,4,1	Good for agricultural studies. Healthy vegetation shows in bright green color.
7,5,4	Provides best atmospheric penetration. Vegetation shows in blue. Useful for geological study.
7,3,1	Rocks may appear in variety of color. Good for the geological study.

*You can also try 5,2,3 ; 7,5,3, 4,5,7 combination as well.*

### b. Band Ratio

Band transformation can reduce the effect of environment and highlight the spectral variations of minerals. For example, the 5/7 in Landsat enhances the rocks which are rich in Al-OH and 3/1 enhances the hydrothermal alteration.

- I. To compute the band ratio, click the "**Band Ratios**" under "**Transform**" in **main toolbar**.
- II. Select the pair of band you want to compute and click "**Enter Pair**".
- III. After you finish the selection, click the **OK** to compute the data.
- IV. The ratio [7/3, 5/2, 4/7] is good to obtain the general lithological information.

### c. Pan-Sharpning

For the Landsat-7 image (as many other satellite image), you can use the pan-sharpning function to increase its color image resolution from 30 m to 15 m.

- I. To compute the Pan-Sharpning image, click the "**Image Sharpning**" under "**Transform**" in **main toolbar**, and choose the

method you want to use. (Here, we suggest using either HSV or Color Normalized method in order to save the computing time)

- II. Select Input of color band from **“Available Bands list”**
- III. Choose the Band Combination that you want to use in RGB band.
- IV. For the High resolution Input file, choose the Landsat-7 Band 8, which is the pan data in the Landsat-7 dataset.
- V. Change the resampling method to Bilinear and click the “choose” to define the output file path and file name.
- VI. Open the pan-sharpening image in the **“New Display”** (Click the bottom next to the **“load RGB”** and choose **“New Display”**)
- VII. The image sharpening result might show different color with your original image. To match the color, we can use the **“Histogram matching”** under the Enhance function in your display toolbar.

**NOTE:** This function will match the histogram between two display, so you need to have at least two display images to use this function.

### **3<sup>rd</sup>. Export the image from ENVI**

Once you are satisfy with your image, go to **“File”** on the **Display’s toolbar** and choose the **“Save Image as..”** to save your image as a geotiff.

#### 4<sup>th</sup>. Download the aerial-photo data / Topo map / DEM from internet

There are several free on-line sources for the aerial photo data on Internet today. Here we are going to use the **The National Map Seamless Server** to access the data you need.

- a. To find your data, go to <http://seamless.usgs.gov/> and click “**View and Download US data**”
- b. The **left panel** is the tools to view and download the dataset. The **right panel** is the select-data area for view and downloads. Use the zoom tool to approach your interest area first.
- c. Click the “**Download**” panel and select the dataset you want. You can first use the “**Layer Extent**” function in the “**Display**” panel to see what kind of data is available for your area.
- d. We recommend selecting the *DOQQ B&W*, *NAIP 1m* and *24k DRG* dataset in the **Orthoimagery**. They includes the digitized aerial photos and topo-map. You can also download the *1/3” NED* dataset in **Elevation**, which is the nationwide 10-m resolution DEM.
- e. Once you finished the selection, use the Download tools in left panel to define the area you want to access the data.
- f. *The National Map Seamless Server Request Summary Page* window will jump up once you define the area. If not, turn off the pop-up blocker or allow this website to use pop-up window.
- g. Click the download bottom and receive your data. It will take a little while to let the system to extract the dataset.

#### 5<sup>th</sup>. Overlap the image in ArcGIS

- a. Add your layers into ArcMap.
- b. Check if the satellite image is matched with aerial photos well or not. If not, use the **Georeferencing** to adjust your image. (Or, you can use ENVI to do that. But it may take more time.)

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- Make the map for your interest area by using the dataset you downloaded today.
  - Make sure you had emphasized your target in this map.  
(For example: the rock unit in this area, or the road atlas for your area)