Introduction to Imagine Software and Image Data

ERDAS Imagine 2016

Description: In this lab we will start using the ERDAS Imagine version 2016 image processing software package to learn some basic operations. We will also become familiar with the data to be used in future labs as well as gain experience using the USGS browsers to download Landsat satellite imagery.

Important Note: *These lab lessons are written for ERDAS Imagine2016. The computers in Green Hall, Lab 210A and SKOK have ERDAS 2016. Student versions are available for 2016 (for 64 bit machines) or for 2015 (32 bit machines). Not all other labs have ERDAS 2016 installed and if they do they may be configured differently than those in Lab210A, especially in how downloads are managed and unzipping of downloaded files. If you are running this lab outside of Lab 210A expect to observe differences from these lessons.*

Google Chrome has been known to be incompatible with ERDAS help as well as the USGS Glovis site. Be prepared to try use of other browsers such Firefox or Internet Explorer if you experience unexplained problems.

Avoid having spaces in any input paths or output path names including the file name itself- some tools will not work properly if spaces are found. This has been known to affect ArcGIS products as well.

Introduction to Imagine Software and Course Data

Image Data

We will mainly use Landsat Enhanced Thematic Mapper (ETM+) data. The image used in this lab is a subset image cut from an entire Landsat "scene" acquired August 18, 2002 over southern Dakota County and northern Goodhue County. The subset images are roughly 666 pixels by 666 pixels, while an entire Landsat scene is about 6,500 by 6,500 pixels. The subset images are about 3 MB while a full scene is about 250 MB. These ETM+ data are 30 meter spatial resolution with six multispectral bands. The pan-sharpened ETM+ data are 15 meter spatial resolution with three multispectral bands. Later in the lab you will download another image from the USGS Glovis web site.

In addition to image data we will also use vector data in the form of shapefiles.

Projection information: All of the image and vector data are projected into the Universal Transverse Mercator projection using the following standard parameters: Projection: UTM Units: meters Zone: 15 Datum: WGS84 Spheroid: WGS84

Image Processing Software

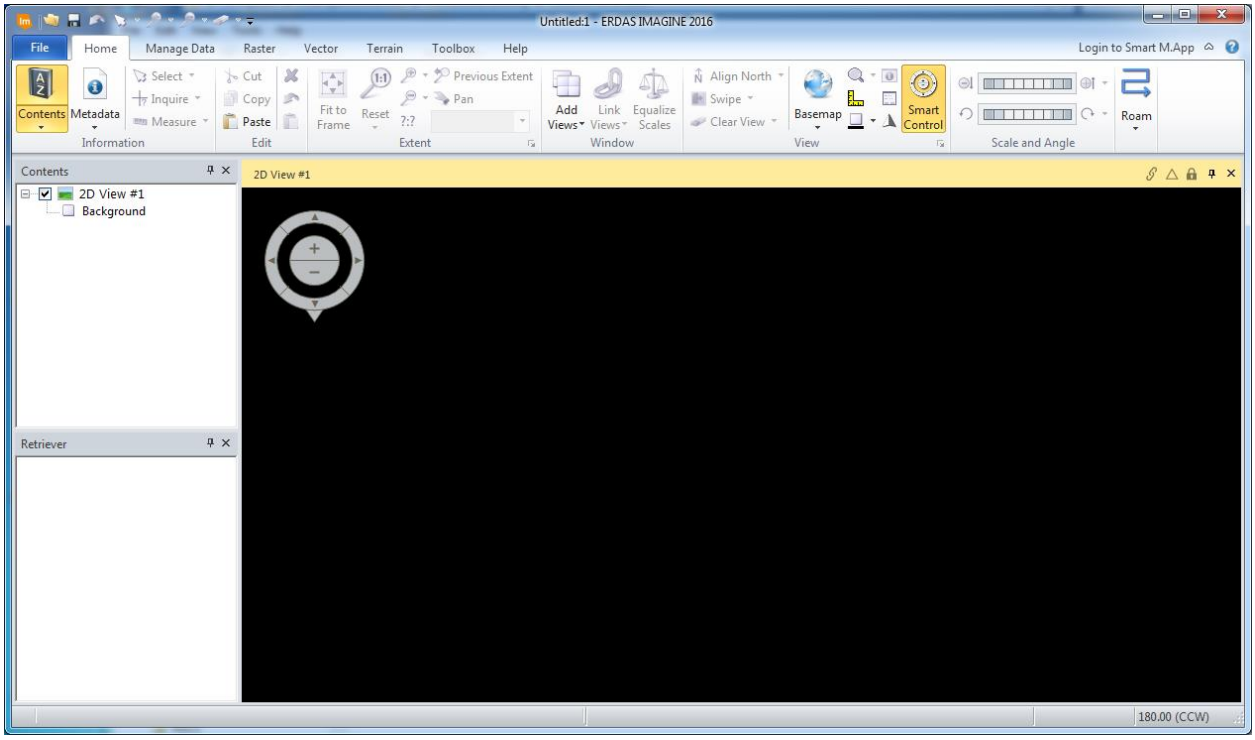
We will be using ERDAS Imagine image processing software. Image data tend to use a lot of disk space. Please delete all "test" or temporary images you create. Before you end your session, confirm that you really want to quit Imagine and answer "no" to the question whether you want to print the LOG file, if the question appears.

Note: There is on-line help in Imagine. To access it click on the "?" icon in the upper right of the ERDAS Imagine screen. For additional information, click on the Help tab on the Ribbon bar.

Starting Imagine

You start Imagine by selecting
Start > All Programs > CFANS Applications > ERDAS IMAGINE 2016> ERDAS IMAGINE 2016.
In Blegen Hall, this start procedure will be different:

Hint: You may also type *Imagine* into the Search Programs and Files box from the Start Logo

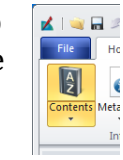


If you are having trouble, ask the lab instructor for help. Imagine will open with a screen reminiscent of the Microsoft suite with the ribbon selector across the top of the screen. You normally start Imagine in the 'Home' tab of the ribbon.

Imagine Display Procedures

You will notice that one 2D View is automatically created when Imagine loads. To start an additional Viewer, click on the "Add Views" drop down in the "Home" tab of the ribbon and select "Create new 2D View" (see figure to right). This will open a second window on the Imagine desktop. If you right click 2D View #1 (or right click anywhere inside its View), a Viewer menu bar pull-down menu will appear which depicts some Imagine operations that can be performed in the View. As an example, **Open Raster Layer…** will let you select a raster image to display. As is typical with most windows applications, there are multiple ways to do many functions. You can also load a new raster by clicking on the **File Menu** (in the upper left corner, see figure to the right) and select **Open >** 

. Either option will give you the raster dialog box below:



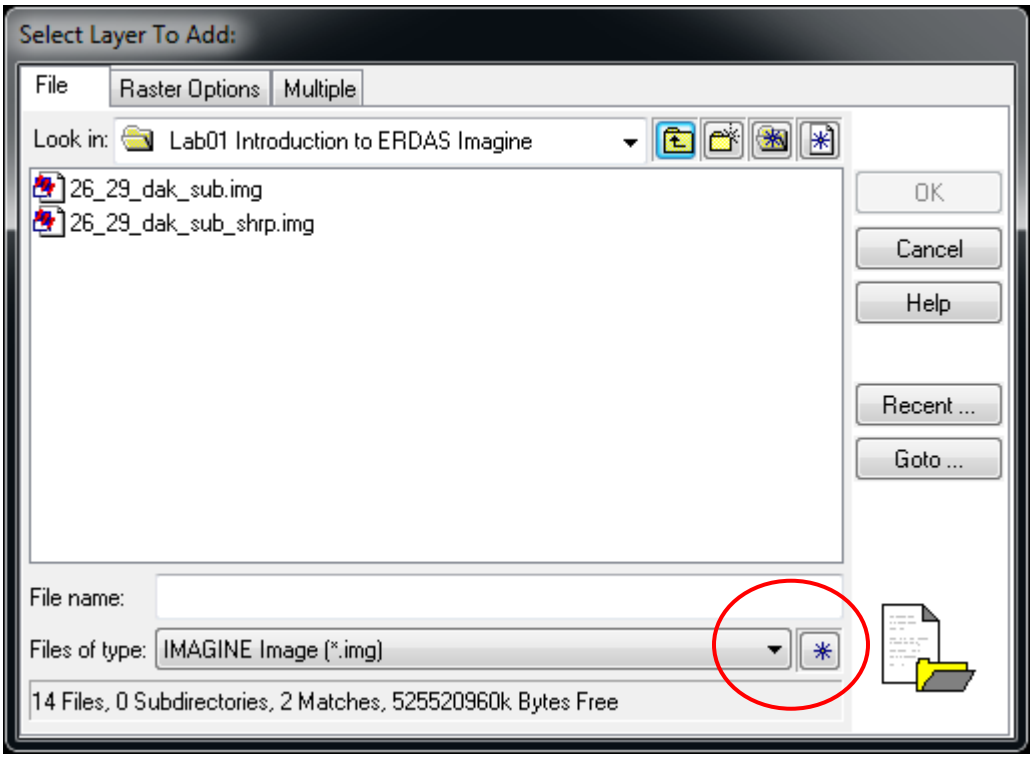
Note: All data used in the digital labs will be on S-drive in the FR3262_5262 folder. Navigation S:\ FR3262_5262. In Blegen, they are located on the Geography Courses share in the FR3262_5262 folder

Use the below dialog box to select the image and type of data display for the viewer. In the Files of Type box, Image (*.img) is the system default file type. All the files in your directory

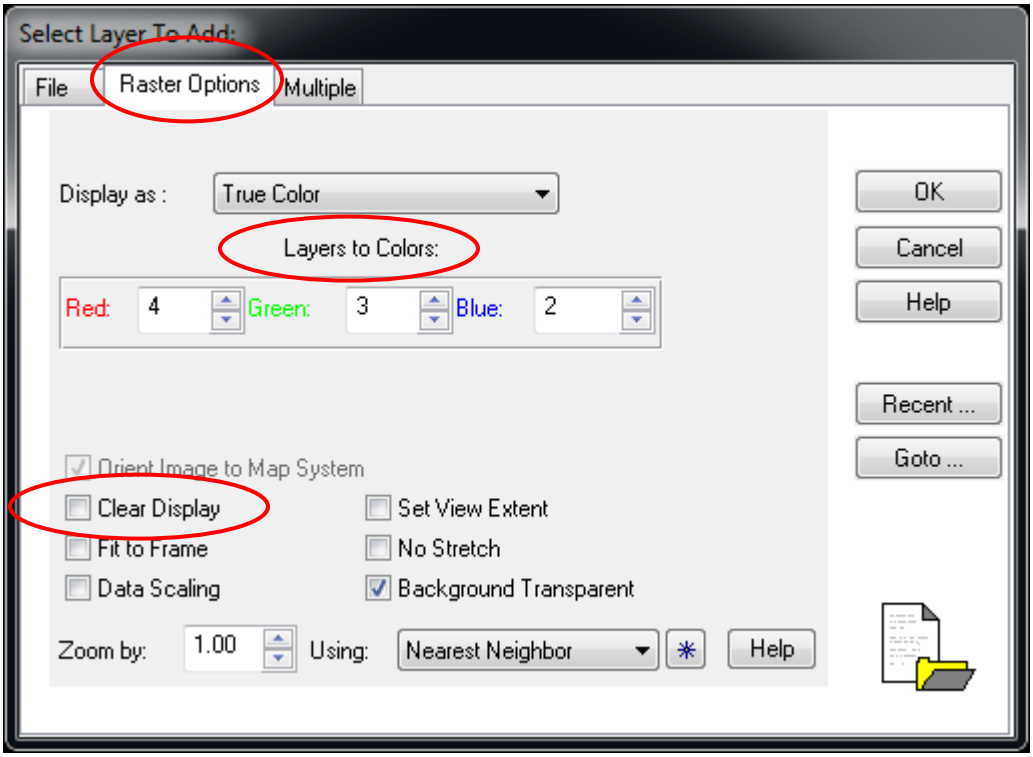
with the extension specified under **File Type** will appear in the list of files. You can **left-hold** the **Files of Type** dropdown to select a new default file type.

We will work mainly with IMG and SHP files. Use the file list to select the input file. We will first work with the file:

26_29_dak_sub.img. This file is in the ***Lab01*** subfolder in the ***FR3262_5262*** folder.



Left-click <u>once</u> on the file name to select that file. Now click the **Raster Options** tab. You will see a dialog box like this: (Notice the OK button is clickable now)



Notice that certain default parameters are automatically set when you select a file. If the image to be displayed is a multilayer file (spectral data with more than one band), you can choose any three bands to display in any order. Usually, Imagine will recognize the scanner type (TM, SPOT, MSS, etc.) and default to display a standard composite. You can change the bands displayed by using the up/down arrows next to the **Layers to Colors**: Red Green and Blue channel displays. Note, these settings can easily be changed again once the image is loaded.

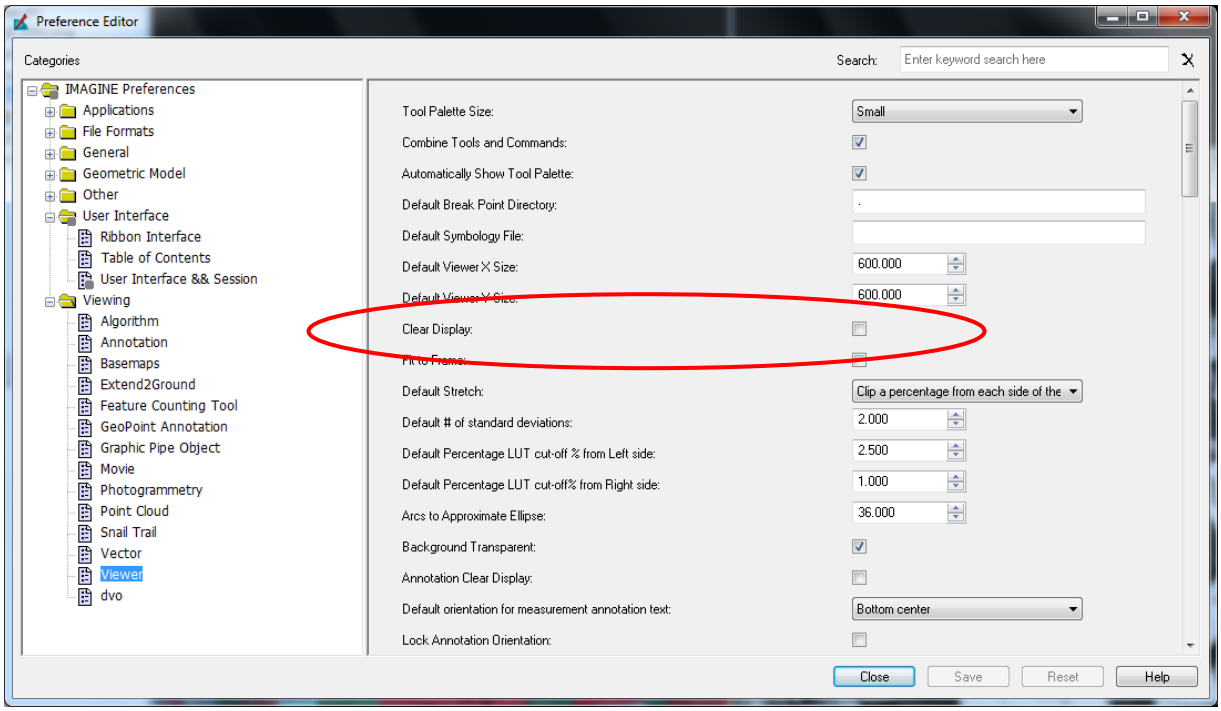
Other default parameters can also be changed before displaying the image. For example, change the following display options to get an image or a desired portion of an image displayed at a different zoom ratio.

Set View Extent allows you to specify the upper left and lower right coordinates of the portion of the image you want to display. When **Set View Extent** and **Fit to Frame** are off, you can enter a **zoom by** ratio (enlargement or reduction) for the data (the default is 1, meaning every pixel of the image is displayed in one picture element of the Viewer). When the image is reduced, the magnification factor is less than 1.000, and when the image is enlarged, the magnification is greater than 1.000.

If you are adding a layer to a view that already has other raster layers to it and you want to maintain those layers in the view, be sure to check off the **Clear Display**.

Left-click on the OK button to display the image (which will automatically close the Open Raster Layer dialog box). You should see a false color infra-red image near Cannon Falls, MN.

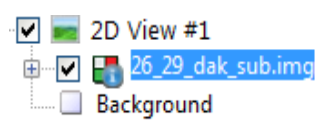
TIP: If you would like to change the Clear Display 'default' setting, go to File > Preferences. Navigate to the Viewing > Viewer category in the left pane. In the right pane, check off the 'Clear Display' option:



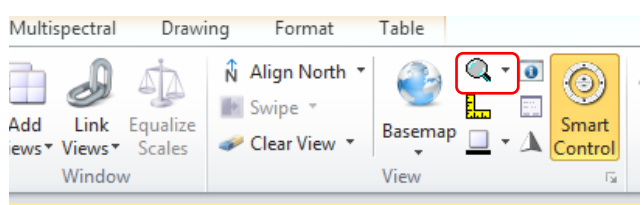
Other Imagine Viewer Functions

1. Magnifying a portion of an image which is already being displayed

Left click in the Imagine View in which you would like to add a magnifier. In the Table of Contents (TOC) on the left-hand side of the Imagine desktop, that image name should be highlighted.



Make sure the "Home" tab is selected in the ribbon and click on the magnifier icon:



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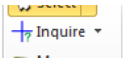
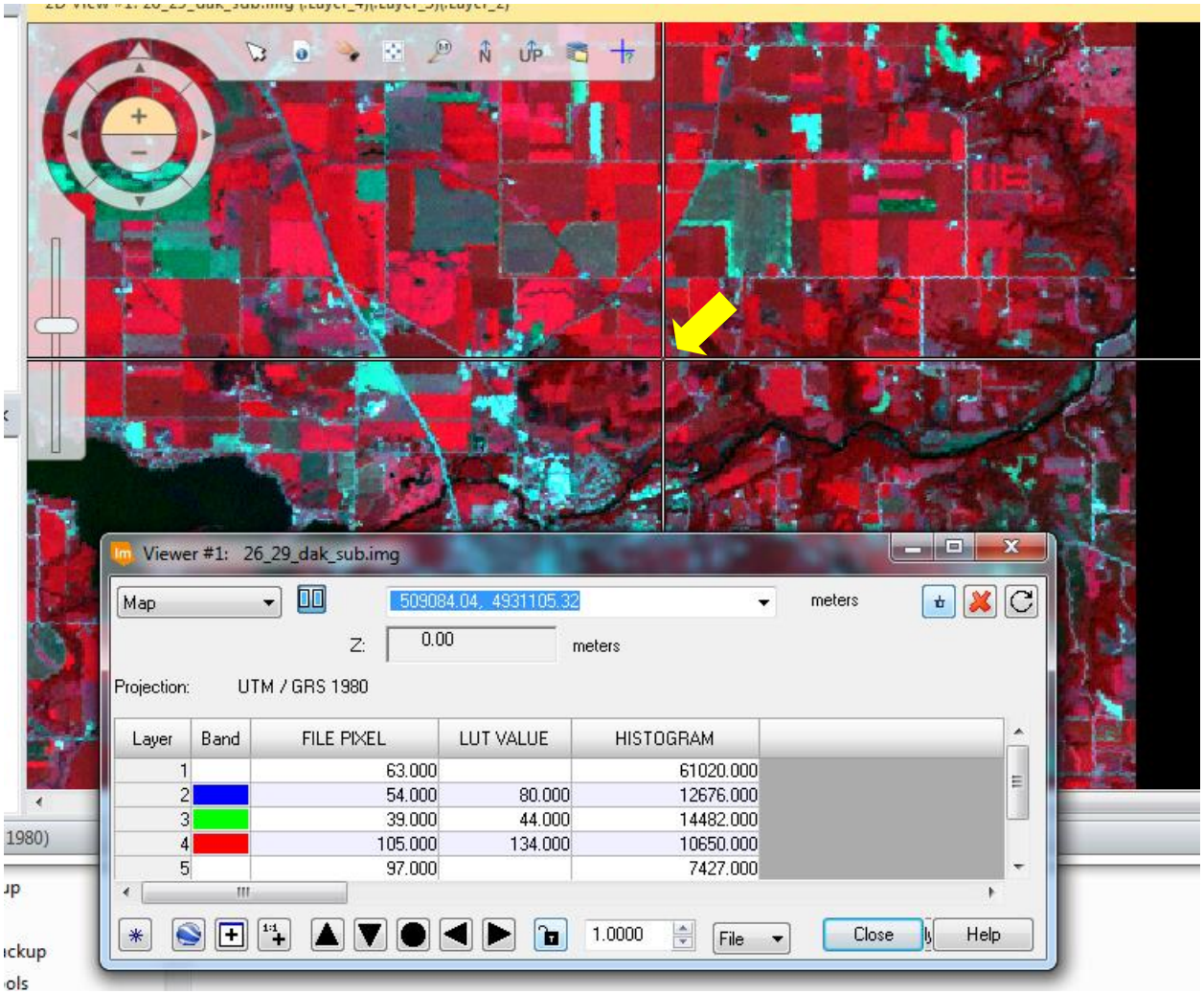
The Drop down to the right of the magnifier sets its mode, a common behavior for many of

the tools in Imagine. Select the In-View Magnifier. The 'In View Magnifier' will create a magnifier bubble with slightly distorted edges will appear in the View. You can left click hold and drag this magnifying bubble around your image. Right clicking on the Inset in the table of contents will let you set a higher or lower zoom level for the bubble. Try right clicking on a part of the image that is not in the bubble and change the **zoom options**. You will notice that the zoom level is changed both for the image and the bubble. Notice the red colored corners that are on either side of the bubble. You can increase or decrease the bubble size by clicking on one of these and dragging it in the desired direction. To turn the bubble off, simply click again on the In View Magnifier choice in the magnifier icon in the ribbon bar. The magnifier icon has other settings beside In View Magnifier. Take some time to explore them. The 'New Inset Viewer' choice by the magnifier will create a slightly different magnifier. The choice will create an Inset layer name in the table of contents where you can control zoom levels. To close this Inset, right click on the layer and at the bottom of the menu, choose Close Inset.

2. Inquire Cursor

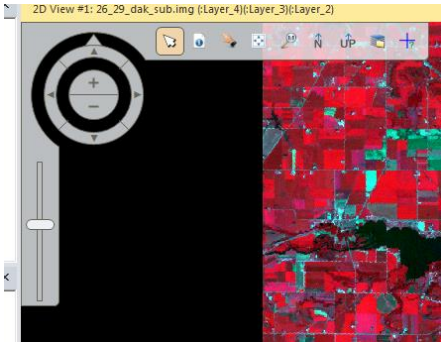
The **Inquire** cursor dialog box gives information about individual pixels by using a cursor which is displayed as a cross-hair in the Viewer window. An image must be displayed and selected in the View before you can request an **inquire cursor**. Left-click on the Inquire Cursor box (**not** the down arrow, see figure to the right) under the "Home" tab in the ribbon. The View window which is under inquiry will be listed in the **Inquire Cursor** dialog title bar when it opens.





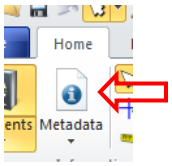
To move the cursor (cross hairs indicated by the yellow arrow above), you can either left-hold the intersection of the cross-hairs and drag it to the desired location, or enter the desired coordinates in the Inquire Cursor dialog box, or use the **4-way "nudgers"** (arrows) at the bottom of the Inquire Cursor dialog box to move the cursor in any direction. The inquire cursor dialog box shows a lot of information about that particular point, including the coordinates related to where the cursor is positioned, the digital numbers for the three bands selected to be displayed ("File Pixel"), and the RGB values being displayed by your monitor ("LUT Value"). To close the cursor, simply click on Close.

Smart Control Navigation Pane (New to ERDAS Imagine 2015)

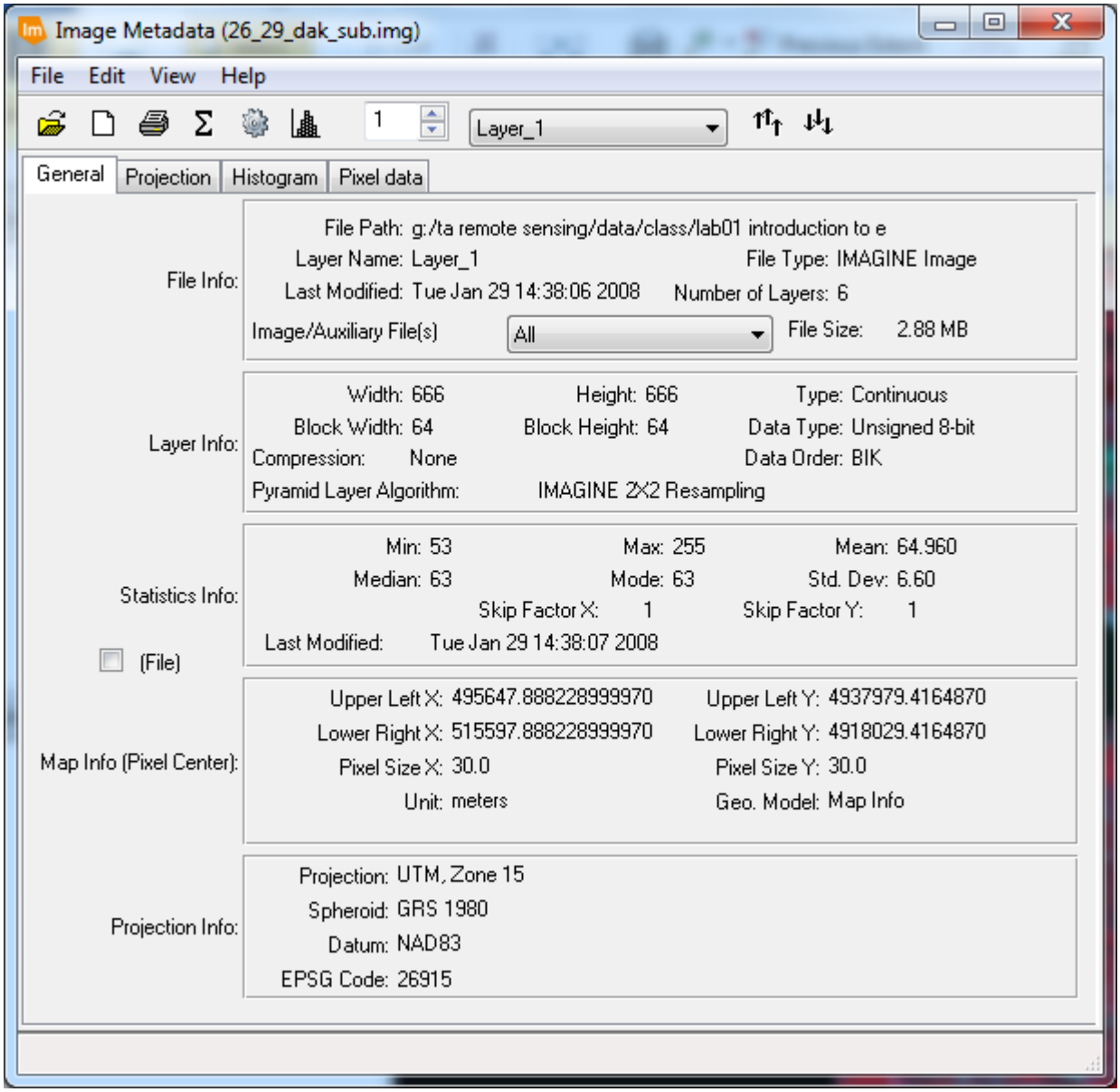


Take a moment to get acquainted with the functionality of the navigation pane controls. The controls on this pane can generally be found on other menu choices but the navigation pane collects many of the more common tools such as pan, zoom and nudge arrows and puts them all in one convenient spot. This can be toggled on and off with the Smart Control in the Utility tab.

Accessing Global Image Information

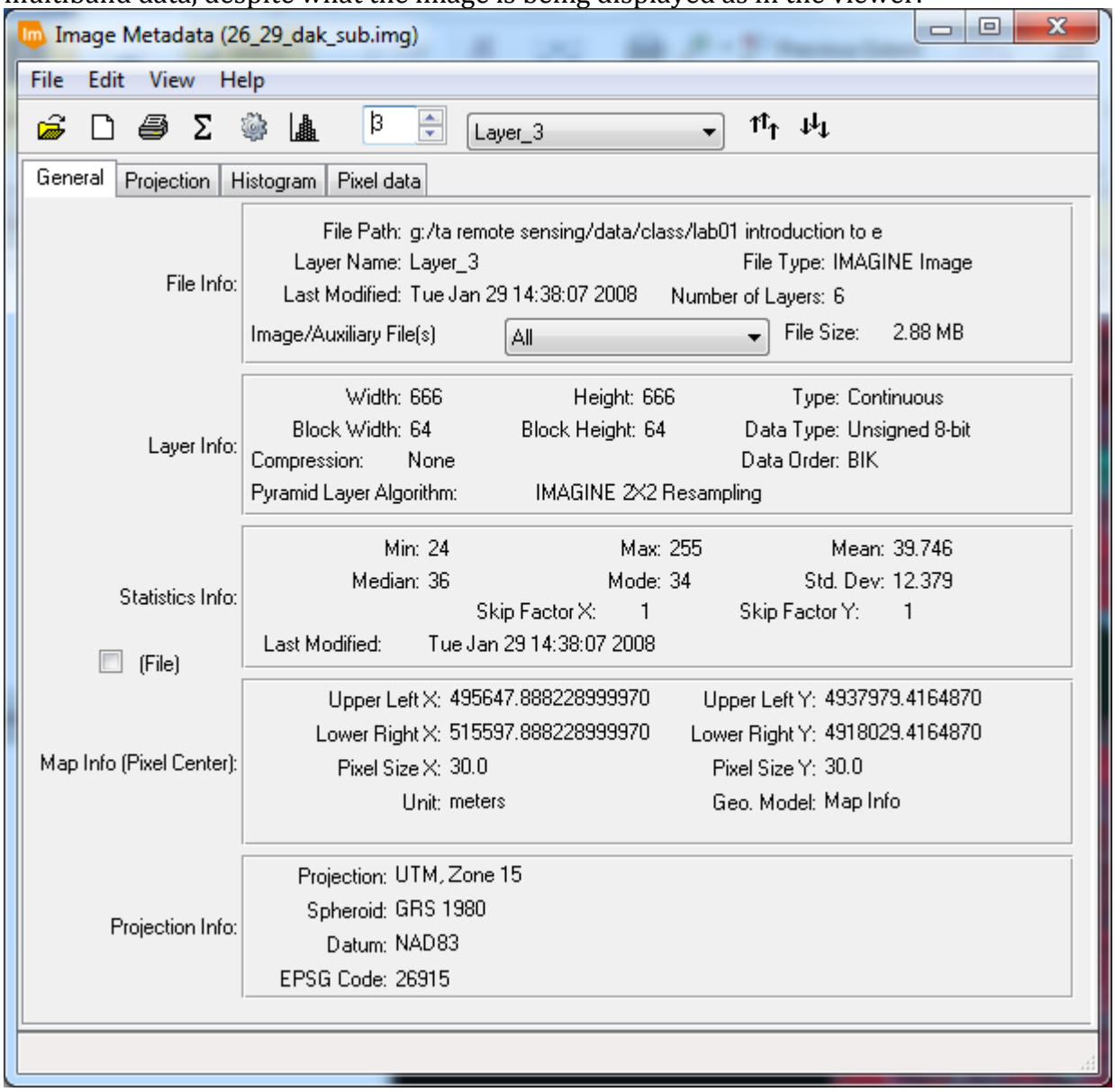


By "Global" information, we mean information related to the entire image as opposed to any particular pixel location. Be sure to have the "Home" tab selected in the ribbon and click on the "I" icon on the "Metadata" button (see figure to the right). The Image Metadata dialog box (below) will be displayed: The set of tools in "Image Metadata" allows you to view, edit, and print most of the information of an image file (.img file). Caution: the information in this dialog should not be modified in this class, except as directed in subsequent exercises, because Imagine uses this information as input data.



Information is displayed for a default data layer (layer #1, i.e., band #1). You can change the layer number to get the information for a different data layer if your data is

multiband data, despite what the image is being displayed as in the viewer.



Note that layer numbering is sequential in an IMG file and may not coincide with band numbers for a sensor (e.g., an IMG file may contain TM bands 2, 3, and 4 which, in the file, would be layers 1, 2, and 3, respectively).

In the image information dialog box you can see the statistics related to the selected band. These statistics pertain to the entire image. For example, the "mean" refers to the mean of all the pixel values in the image for the given band.

Use **View > Histogram** from the Image Metadata window menu bar to view the histogram for the current data layer whose information is displayed in the Image Info dialog box. You can also select the Histogram tab in the Image Metadata viewer or by clicking on


Explore other band information about the *26_29_dak_sub.img* image file. The histogram gives additional detail beyond the global statistics. It shows the spread and shape of the how the pixel values are distributed over all of the possible values for that

particular band. The x-axis represents the digital number and the y-axis shows how many pixels in the image have that particular digital number.

Explore the layers of this image and use the histogram to see how the digital number values of one band might or might not overlap with another band. This analysis is essential in classification of imagery, which will be discussed at a later date. If you are having trouble understanding the information contained in the histograms, please ask the lab instructor for assistance.

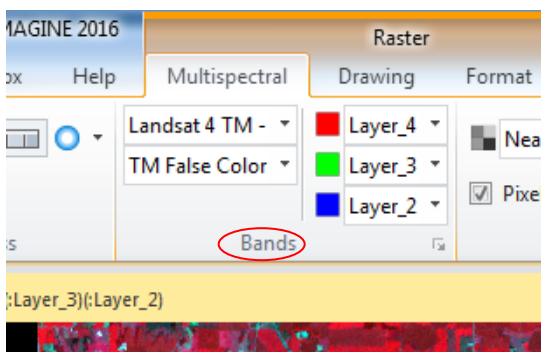
Some things to try...

1. Layer Info

Use Metadata utility to obtain mean and standard deviation for bands 1 - 6 from the ***26_29_dak_sub.img*** file. Close the Image Metadata view by clicking File > Close or clicking on the large X in the upper right of the window.

2. Display different false color composites

If you already have the image loaded in to the viewer, navigate to the "Multispectral" tab on the ribbon. In the 'Bands' category the bands displayed by each layer (display channel) can be changed.



Try some of these common composites:

a. Standard false color composite (4,3,2) [from top to bottom]
(for Landsat 8 this will be 5,4,3 because of the new violet band 1)

b. True color composite (3,2,1)

c. False color composite (4,5,3)

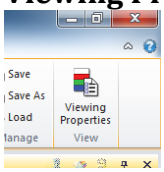
Be prepared to briefly discuss at least one of the composites which you display. Factors to consider include: what bands were used (and in which display channel), the appearance of specific ground features in each composite (e.g. what color is vegetation?), or whether the composite appears to enhance any particular

feature.

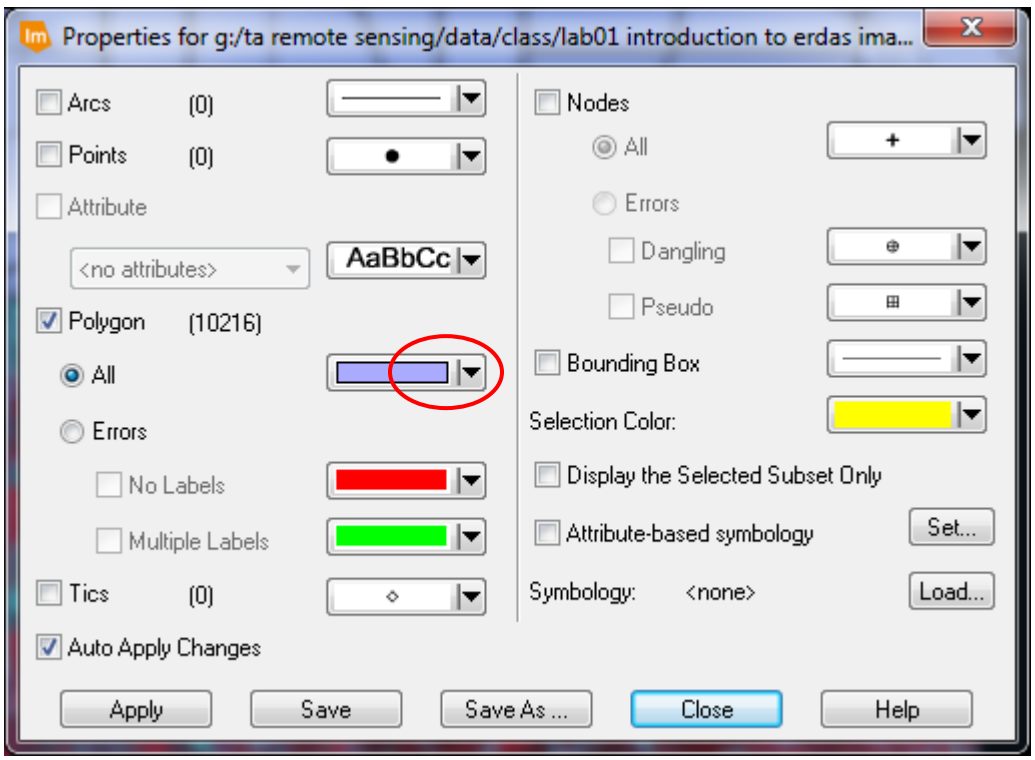
3. Vector Layers

With the *26_29_dak_sub.img* image open in a viewer, select **File > Open > Vector Layer**. Open the Shapefile called *dak_co_lc.shp* in the same folder as the imagery. Click on this file and click Ok (make sure "Clear Display" under the Vector Options tab is NOT ON, otherwise it will close your raster layer and only open the vector layer.

When the vector file opens, select the “Styles” tab on the ribbon bar and click on the **Viewing Properties** choice.



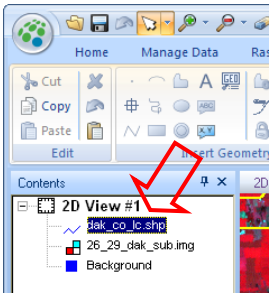
This will give you the following Dialog Box:



Left-click on the small button to the right of the "Polygon" “All” Radio button.

This will give you an options box. Check off the box for the solid color and choose Yellow for outline.

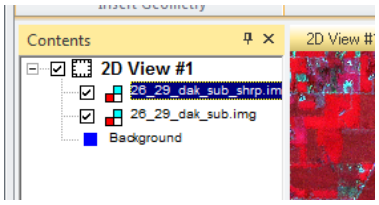
You should see yellow lines displayed over your image. **Close** the "Properties" box.



Now we will remove vector coverage. In the Table of Contents for the view, right click on the vector layer and select **Remove Layer**. You will be asked if you want to save your symbology change, select No.

This should bring the viewer back to just the *26_29_dak_sub.img* image.

Now with the view containing *26_29_dak_sub.img*, select **File > Open > Raster Layer...** and select the *26_29_dak_sub_shrp.img* file. In the Raster options tab, choose the same "Layers to Colors" arrangement so they match the image currently displayed and be sure to turn off the "Clear Display" box. Hint: (This image has only 3 bands, not 4) Click on OK to load the image.



Both images are now currently in your View Table of Contents. Notice how in this new version of ERDAS there are check marks to turn layers on and off similar to ArcGIS.

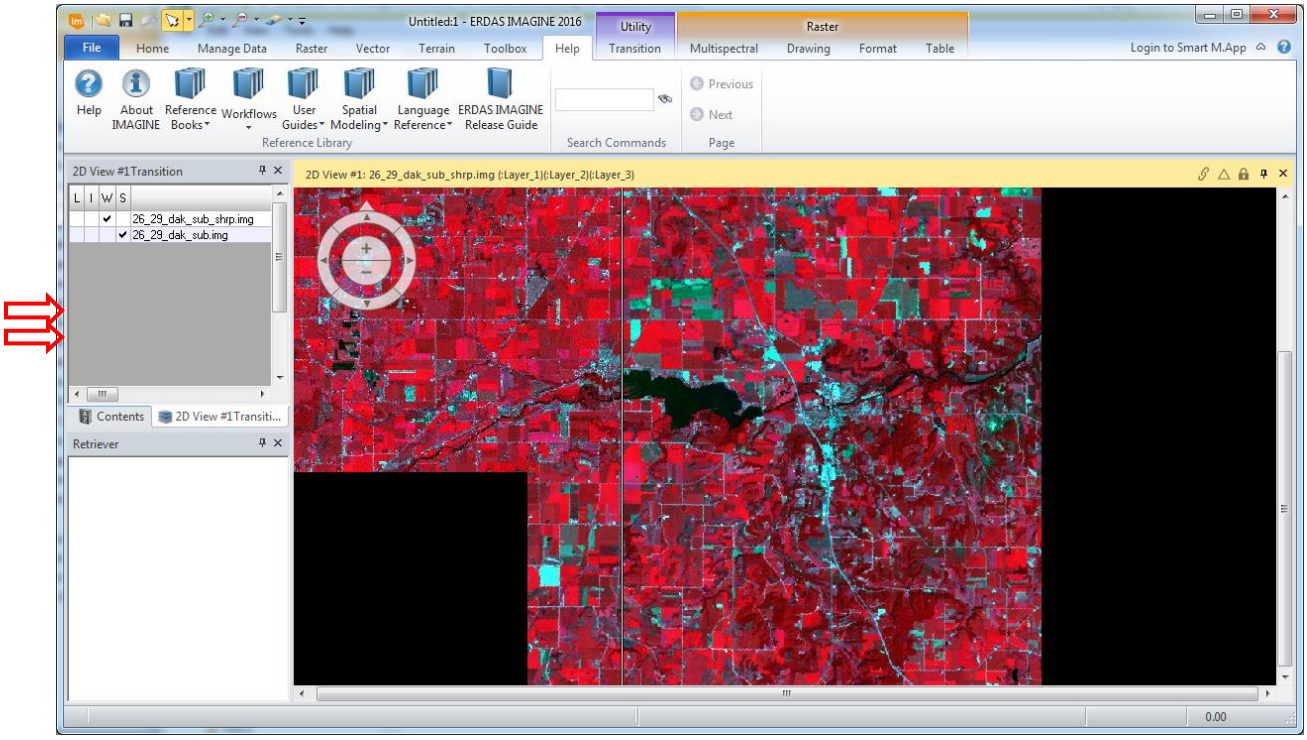
Right click in **2D View #1** and Select **Flicker...** To activate the Utility menu tab and start the flicker, click on the **Start/Stop** button. What happens on the screen?

Adjust the slider in the **Automatic** box. Try changing the speed.
Now experiment with **Blend** button found in the Transition Type box next to Flicker. There is also a **Swipe Line** control which can be activated and dragged back and forth across the image. How do you change the direction of the line to be up and down?

All of these can be quite useful when you are comparing two images for subtle differences. Close the Transition tab when you are done.

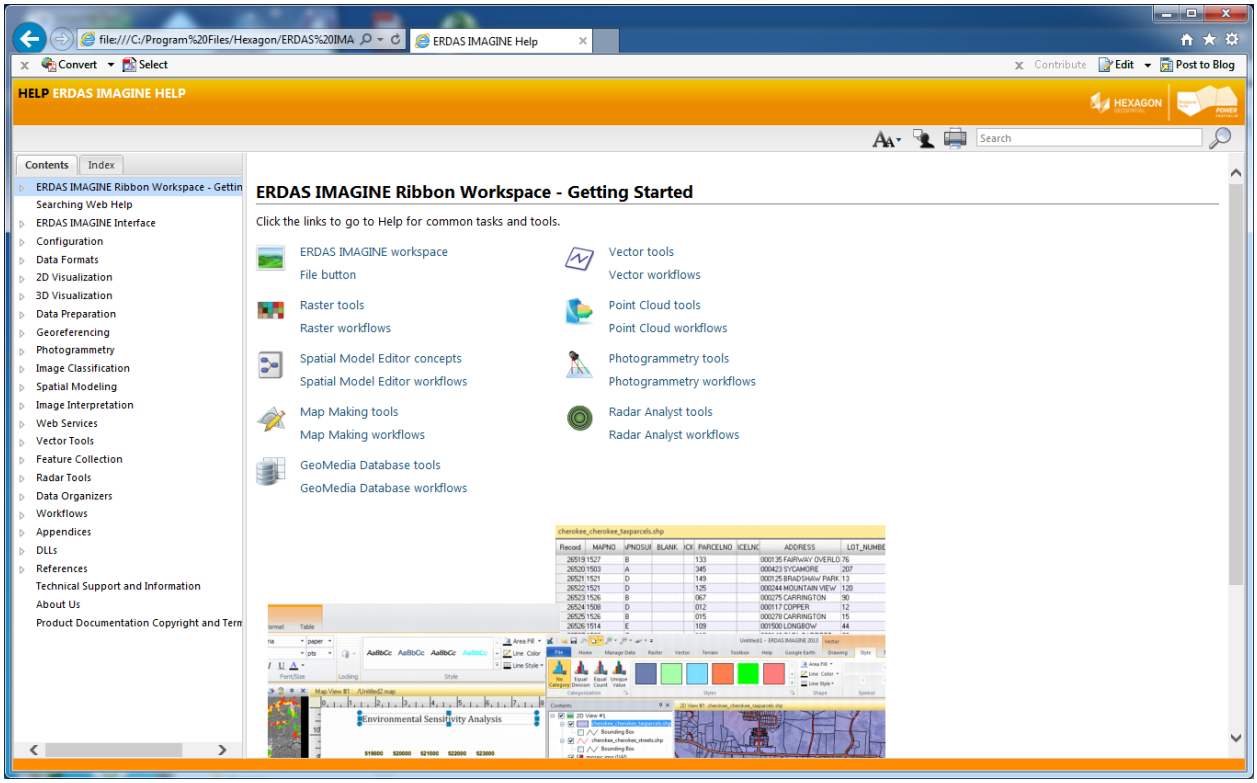
The Help System

There are several ways to get help with ERDAS Imagine. We will take a look at a few approaches. To access the online help, select **Help** tab.



The first choice is to click on the

This will display the general help interface that allows quick links to common help items as well as a contents oriented navigation area with full searching.

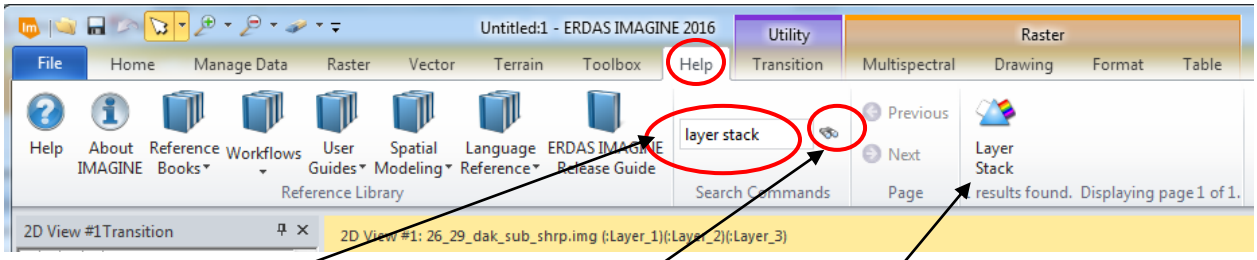


Spend some time with this interface. As an example, use the help to determine what pyramid layers do. Use the Common Workflows guide to read about creating a shoebox, which conceptually is like a ArcGIS map document (mxd).

You WILL need help with ERDAS Imagine. Take some time to understand the help system by browsing the Help on Help section in the content! Also examine the IMAGINE Ribbon Workspace entries in the IMAGINE Interface content.

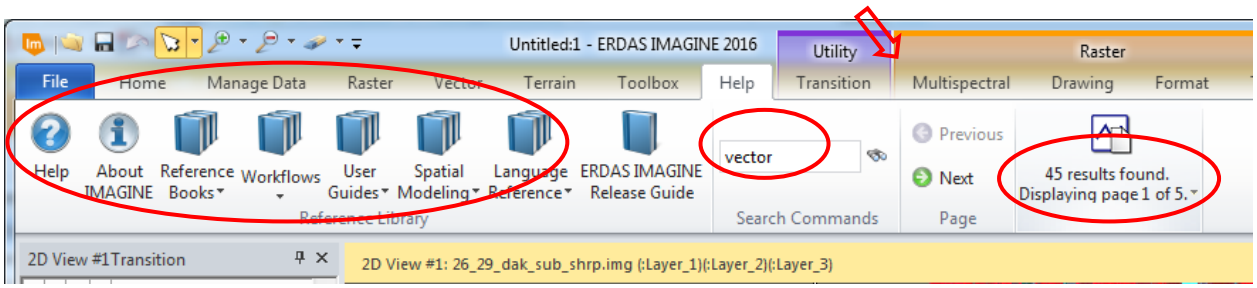
The Field Guide contains background information on what ERDAS is actually doing to the data when you select various features. It can often times help you better understand a topic covered in your text, but is really not meant to be a 'How To' guide that shows you what buttons to click.

New since Imagine 2010, and most helpful, is the "Help" tab on the ribbon bar. It has been slightly reconfigured in Imagine 2016. Click on the Help tab and your screen should look something like this:



Enter a search string here and click on the spyglasses; get results here

Let's try another search on the term 'vector'. Once you enter a search string your screen will look like this:



In this case, the system found 45 results, The first set of results will be displayed when you click on the arrow next to page 1 of 5.and the 'Next' button will display the next set of ten. Click on the appropriate result to view the help. Alternatively, you can hover over each result to get a summary of where the suggested tool is located in the ribbon bar. This feature is extremely helpful when getting to know the software and the ins-and-outs of where all of the tools are located. You also can easily access any of the tour guides or field guides by clicking on the appropriate book ellipse above and on the left.

Downloading your own Landsat data

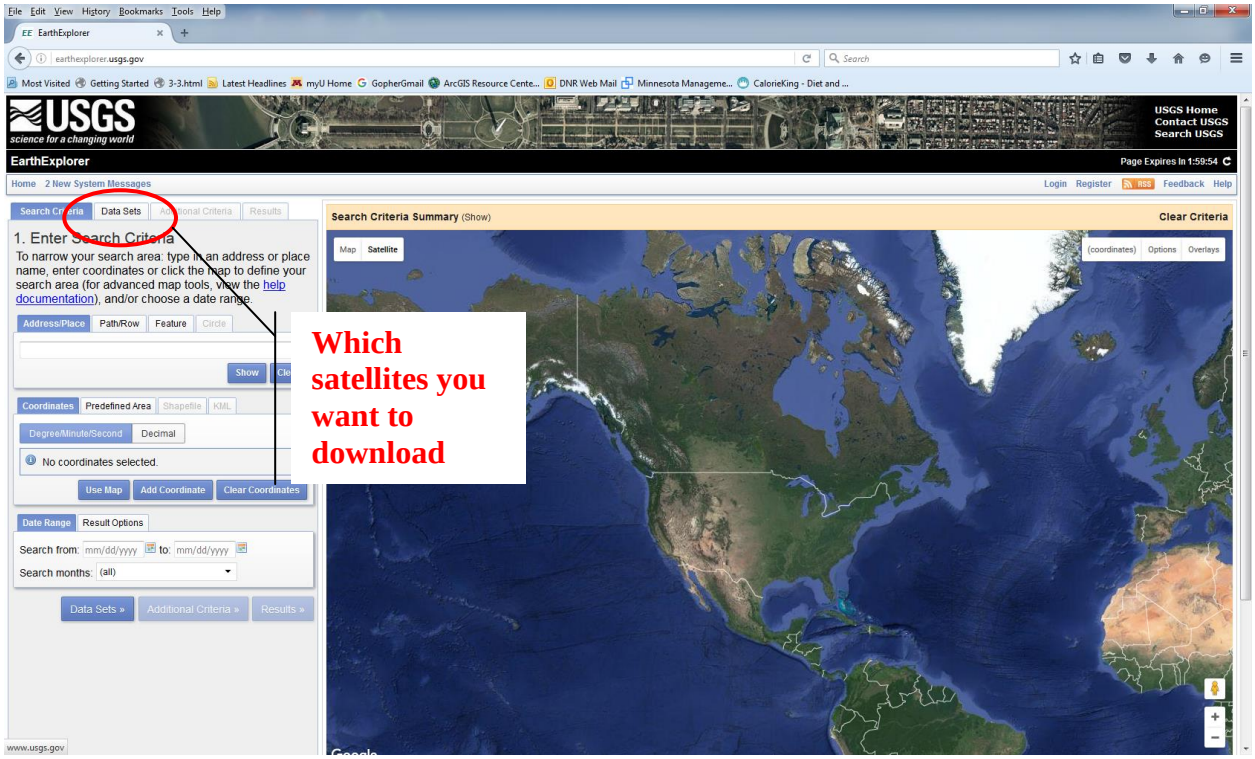
EROS data center provides two approaches to downloading data, Earth Explorer http://earthexplorer.usgs.gov/ and Global Visualization http://glovis.usgs.gov/ viewer. This USGS Newsletter talks about the differences (http://search.yahoo.com/r/_ylt=A0oG7mGA0wlP8ygApDNXNyoA;_ylu=X3oDMTE1ZGh1bTA4BHNlYwNzcgRwb3MDMQRjb2xvA2FjMgR2dGlkA1NNRTA0MV8yMTY-/SIG=12agu8cnm/EXP=1326072832/**http%3a//landsat.usgs.gov/documents/LU_Vol_2_Issue_1.pdf)
Both viewers include the Landsat library but the Earth Explorer includes other assets not in Glo Vis. For this lab we will demonstrate Earth Explorer (Glo Vis requires Java which is not always available on university lab computers).

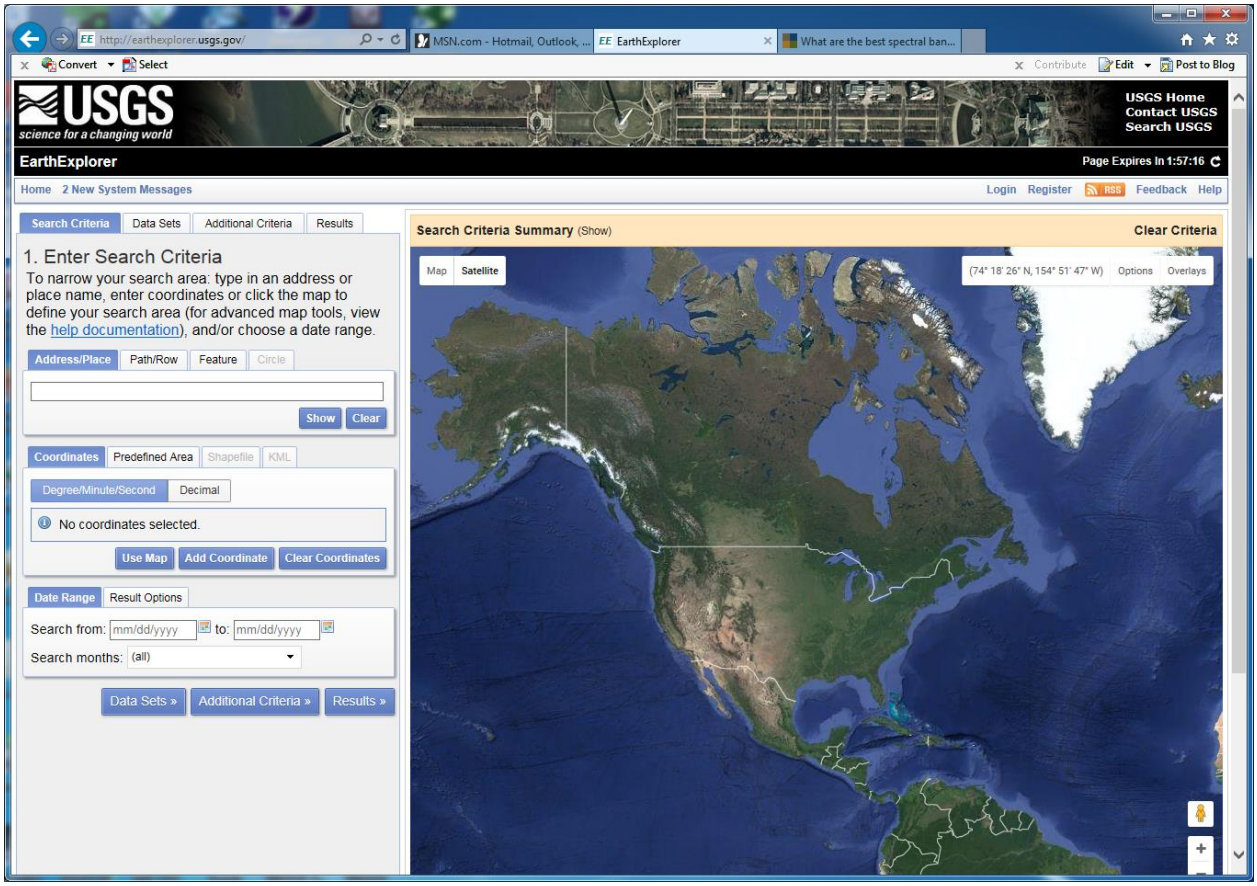
Other less user friendly viewers are available for additional satellites and sensors such as Modis, Terra and Suomi NPP at the following links (be prepared to read tutorials):

http://ladsweb.nascom.nasa.gov/
http://earthdata.nasa.gov/
http://reverb.echo.nasa.gov/reverb/#utf8=%E2%9C%93&spatial_map=satellite&spatial_type=rectangle

USGS Earth Explorer Browser

Enter earthexplorer.usgs.gov into your browser and press Enter

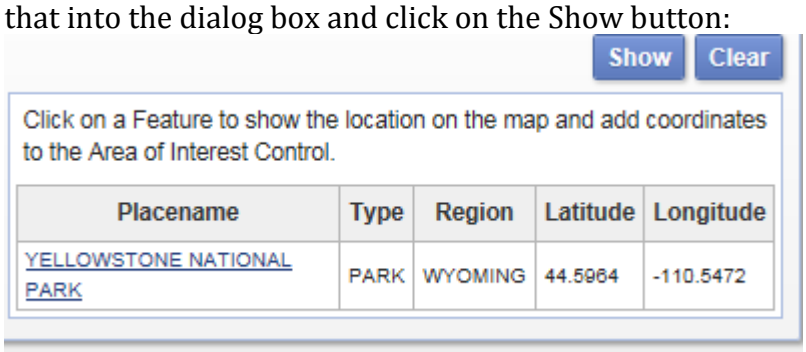




Earth Explorer gives you several methods to search for imagery:

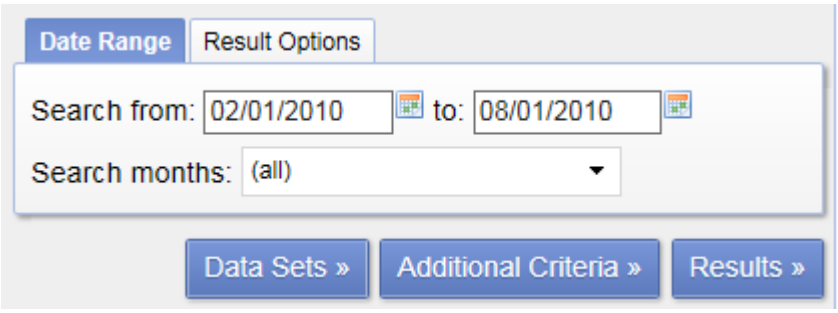
- Address/Place – allows you to enter a street address
- Path/Row – allows you to enter the orbital description of the imagery
- Feature – the feature name of an object, up to 100 characters
- Coordinates – latitude and longitude of the desired location
- Uploading a shapefile of a predefined area
- Use Map- a rather clumsy interface where you drag the corners of a predisplayed selection rectangle to include your desired areas

For our exercise we will select a feature, Yelllowstone National Park in Wyoming. Enter that into the dialog box and click on the Show button:

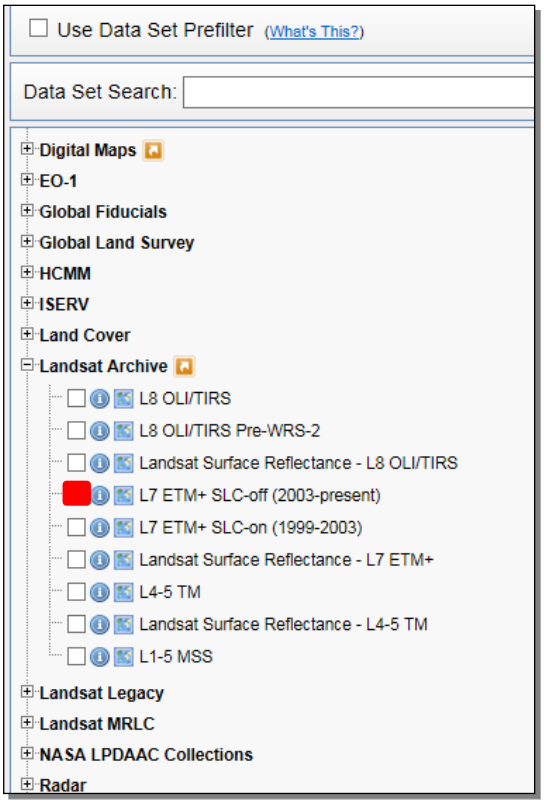


Now click on the Placename link. The latitude and longitude of Yellowstone will be displayed.

Enter a date range as shown below:



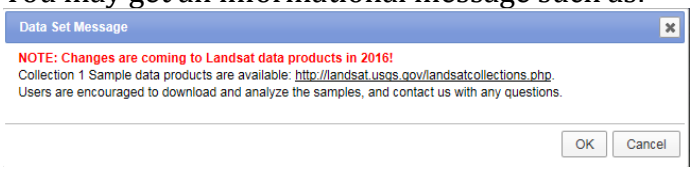
Now pick the Data Sets >> choice:



The Data Sets window gives a listing of the various imagery which is available on this site. We will be using the Landsat Archives. Click on the Related Links arrow by the archive and spend some time familiarizing yourself with information about the various Landsat satellites and spectral bands available from them.

For now, pick the Landsat Archive choice, L7 ETM+ SLC-off (2003-present)

You may get an informational message such as:



Click OK

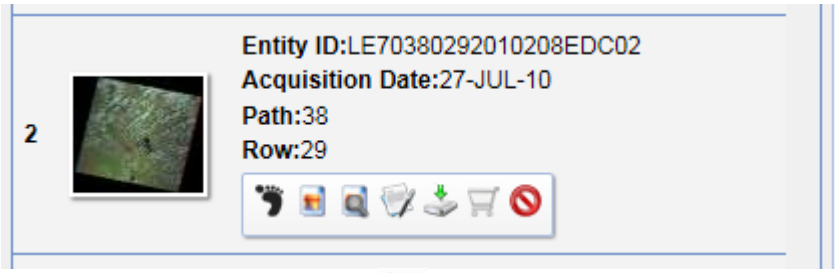
Now click on the Search Criteria tab:

Next we will look at Additional Criteria at the bottom left of the screen. For now we will use the defaults on this page, but take the time to familiarize yourself with options available.

Click the Results button

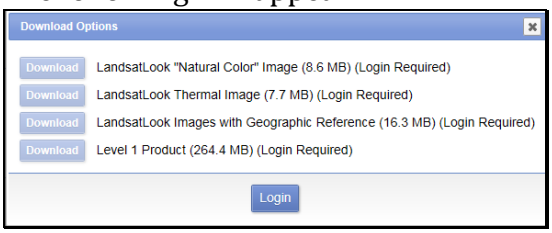
A searching pop up message will appear followed by your results.

We will download image number 2



Click on the download icon 

The following will appear

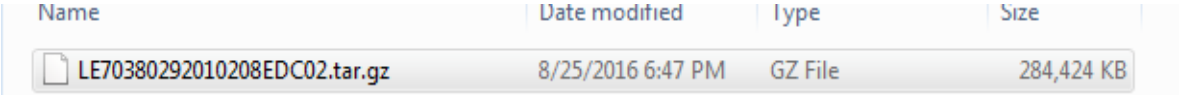


You wil need to login. Go ahead and set up an account with USGS, which, in theory can be used other on any USGS site. They do not send spam to your account

After logging in you will want to download the Level 1 Product. This is the fully georeferenced multilayer tiff files. Save the file…and wait…

> *A word about the images: they are not the images you are used to uploading into social media. They are very large files and include a separate image for each spectral band captured by the satellite. Landsat 8 images can be on the order of 6Gb. Be sure to download these images at a location with excellent bandwidth!*

After downloading the file, open the folder and locate the downloaded image:



A GZ file is a wrapper file which needs to be unzipped to see its components. Right click on the file and extract it to a location on your student drive for this lab. Then extract that file into its components until you have something like:

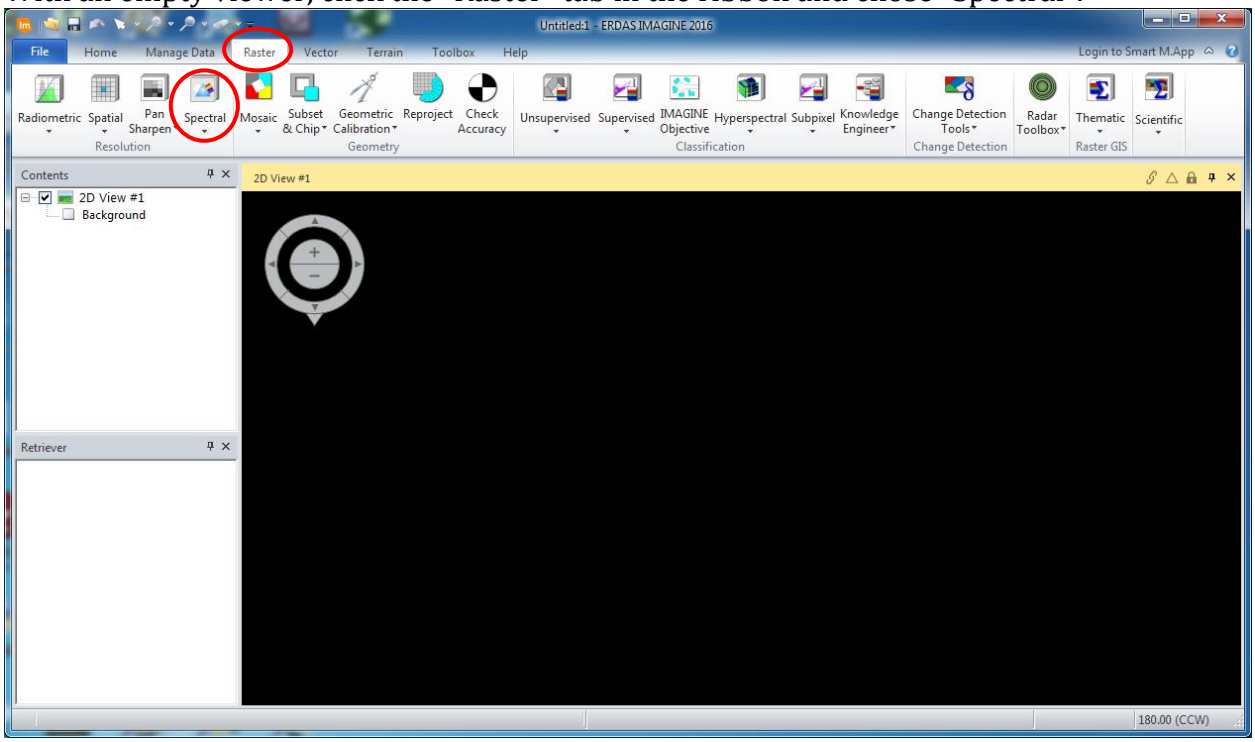
Name	Size	Packed Size	Modified	User
gap_mask	8 572 972	8 574 976	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B1.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B2.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B3.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B4.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B5.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B6_VCID_1.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B6_VCID_2.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B7.TIF	58 853 458	58 853 888	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_B8.TIF	235 266 358	235 266 560	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_GCP.txt	4 395	4 608	2014-08-27 11:23	lpgs_ops
LE70380292010208EDC02_MTL.txt	65 535	65 536	2014-08-27 11:23	lpgs_ops
README.GTF	9 201	9 216	2014-08-27 11:23	lpgs_ops

The B1 thru B8 tif images represent each of the landsat spectral bands. Note B8 is a high definition panchromatic band, the other represent other spectral ranges such as Blue, Green, red, infrared, etc. You can view any of these tif files individually and they will all appear to be just black and white images. Out next step is to stack them into a package using ERDAS Imagine.

Stacking images in ERDAS Imagine

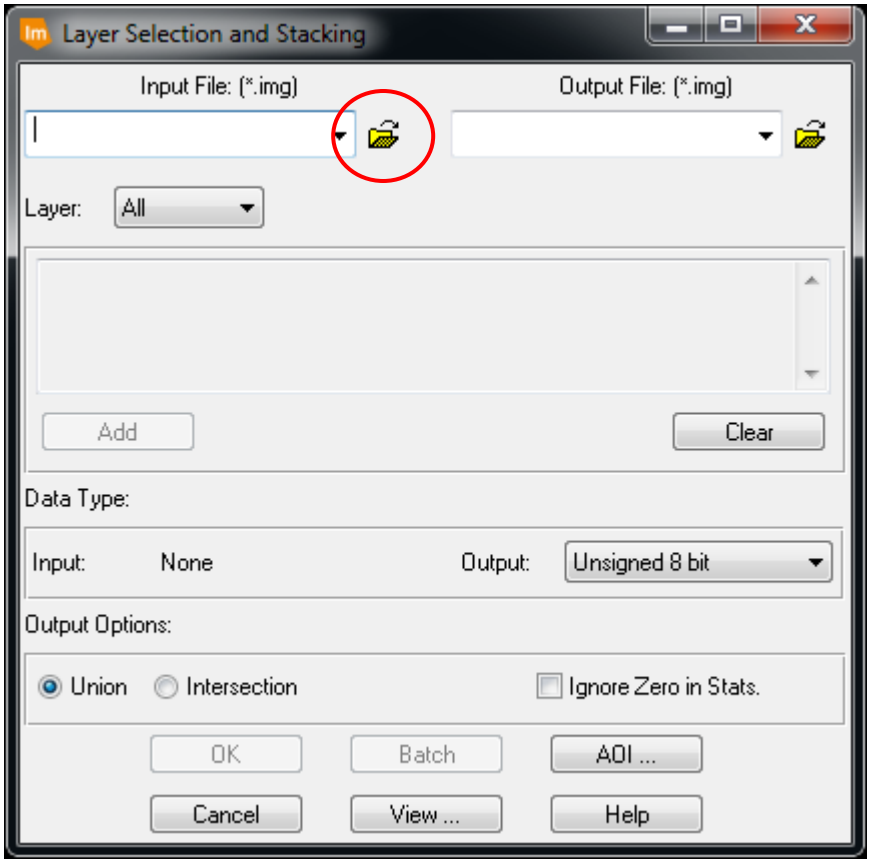
Open ERDAS 2016 if it is not already running.

With an empty viewer, click the “Raster” tab in the ribbon and chose “Spectral”.

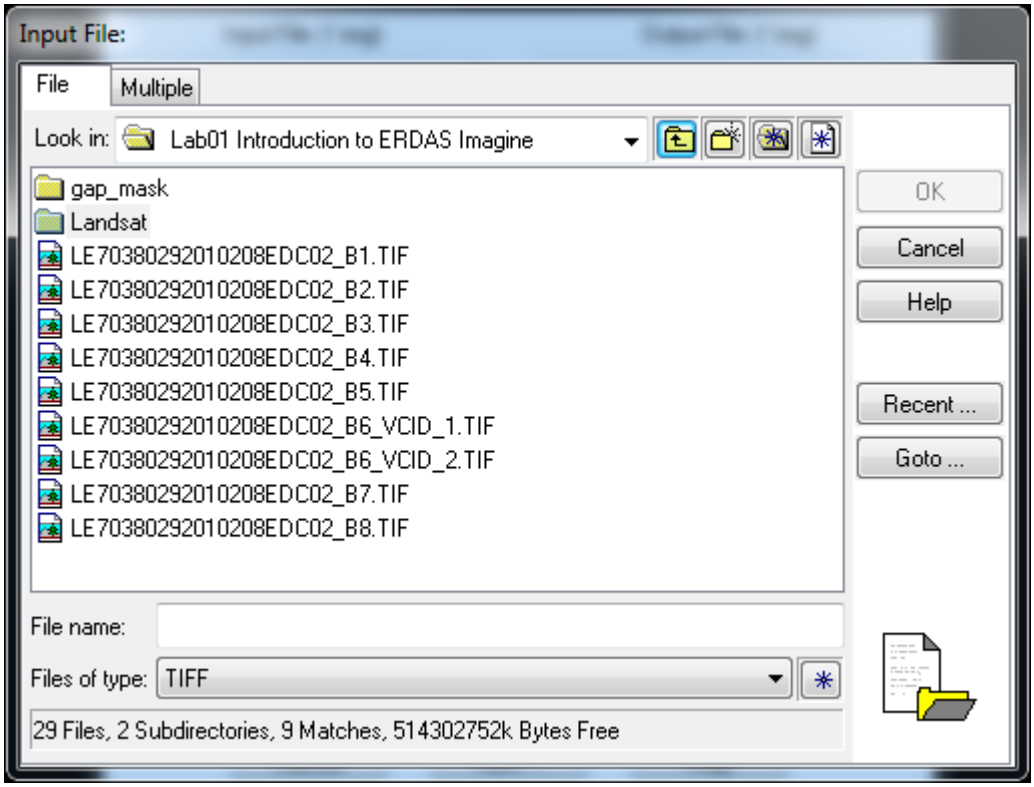


In the Spectral drop down menu click on and “Layer Stack”. The following dialog box opens:

In the Spectral drop down menu click on and “Layer Stack”.

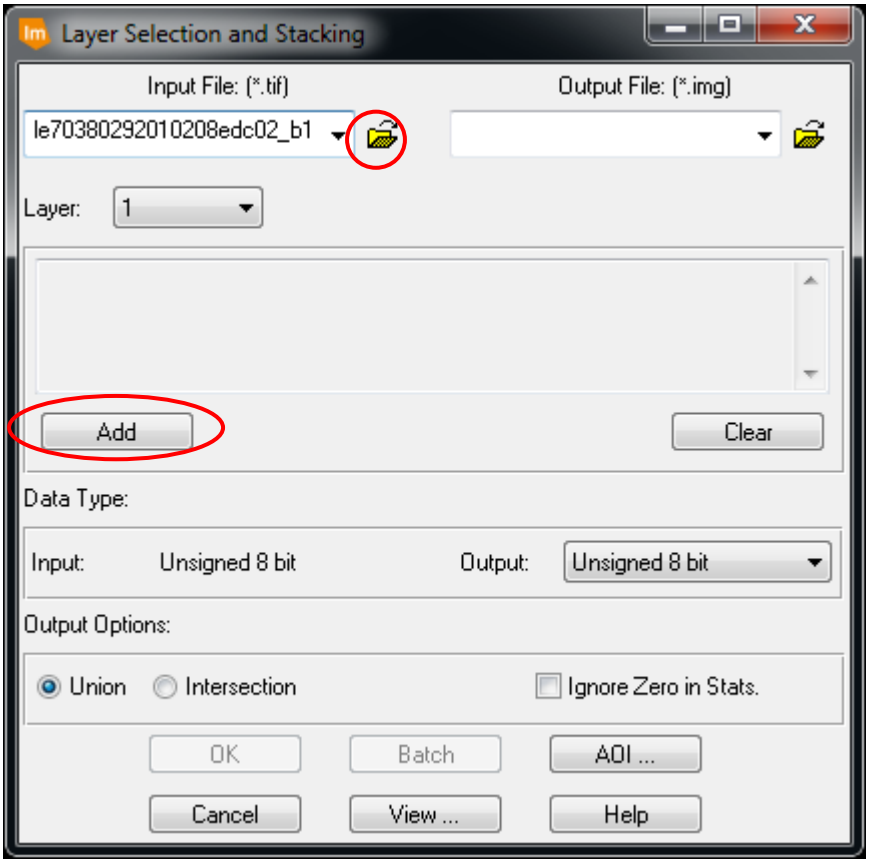


Browse to the folder which contains your copied downloaded files. Your screen should look something like this but the number of layers may be different from what is shown depending on the image source and satellite.

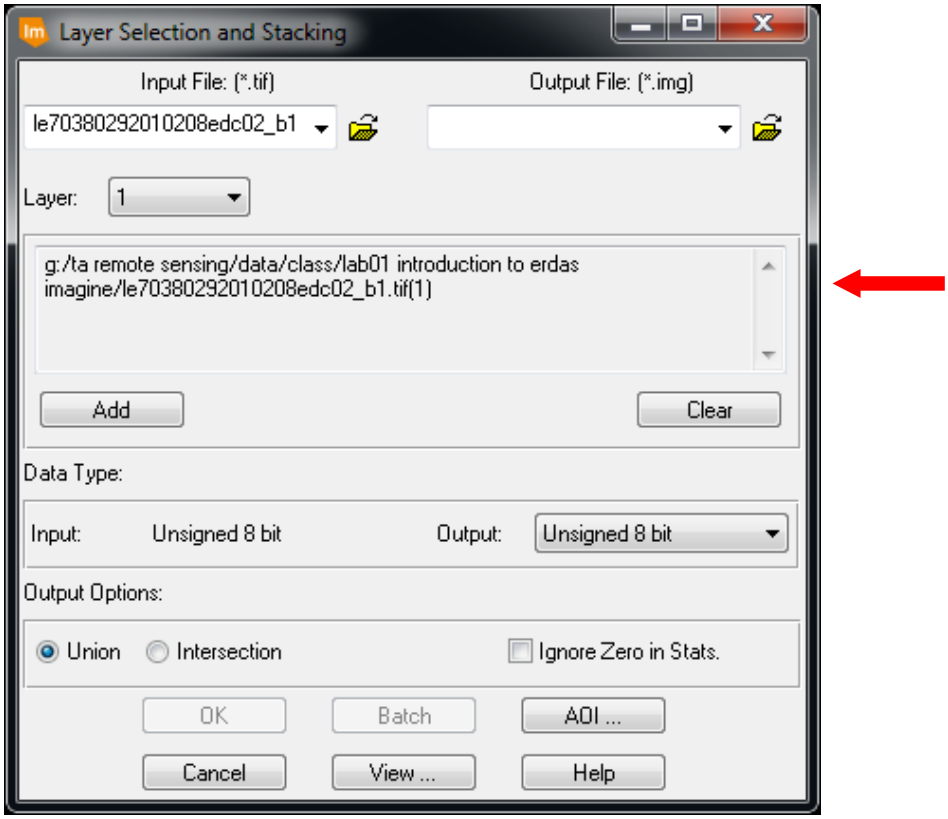


Be sure to select **TIFF** as a 'Files of type:' choice or no data will appear. ← **!Important!**

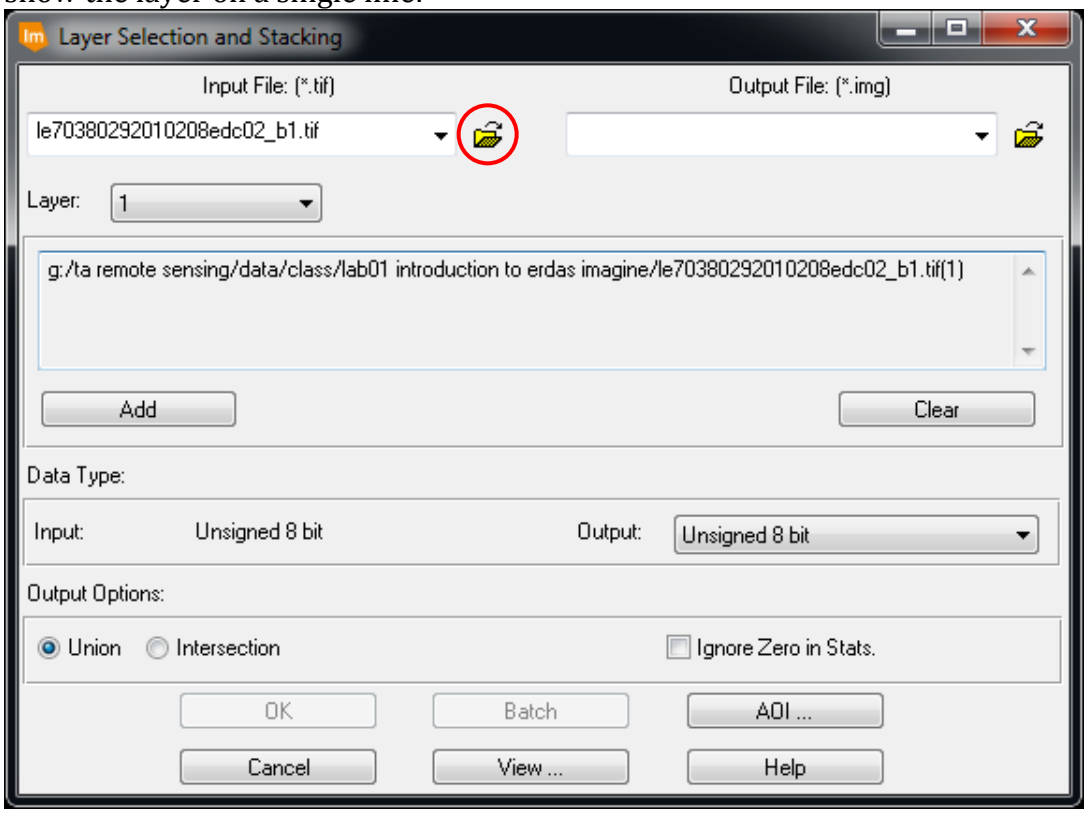
Select the ……..**B1** image and click **OK**.



Then click ADD.
Note how B1 is added as the first layer in your stack in the following screen

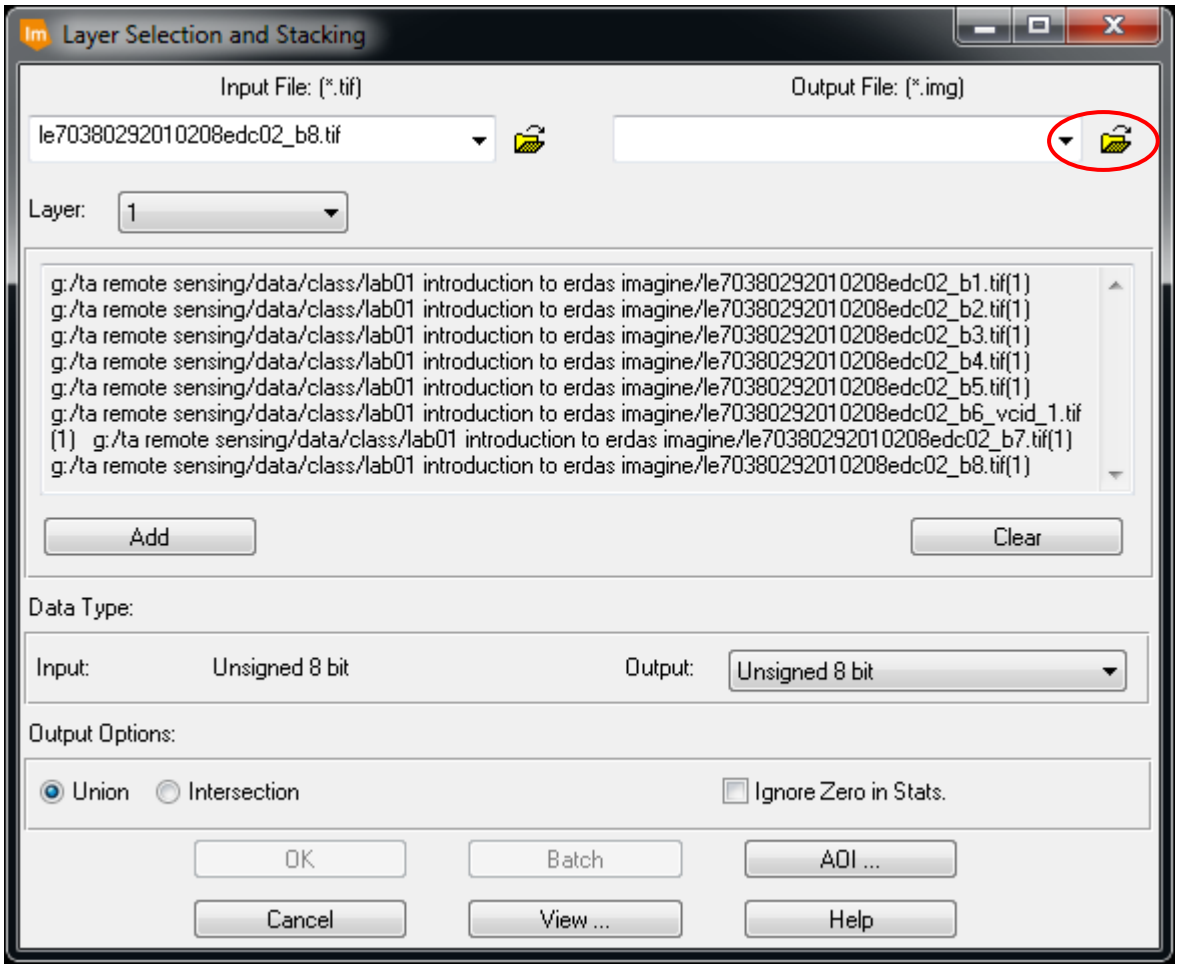


This is the first band or Blue spectral data in Landsat 4-7. You will return to the Layer Selection and Stacking dialog box. Drag the right edge of the dialog box until it widens to show the layer on a single line:



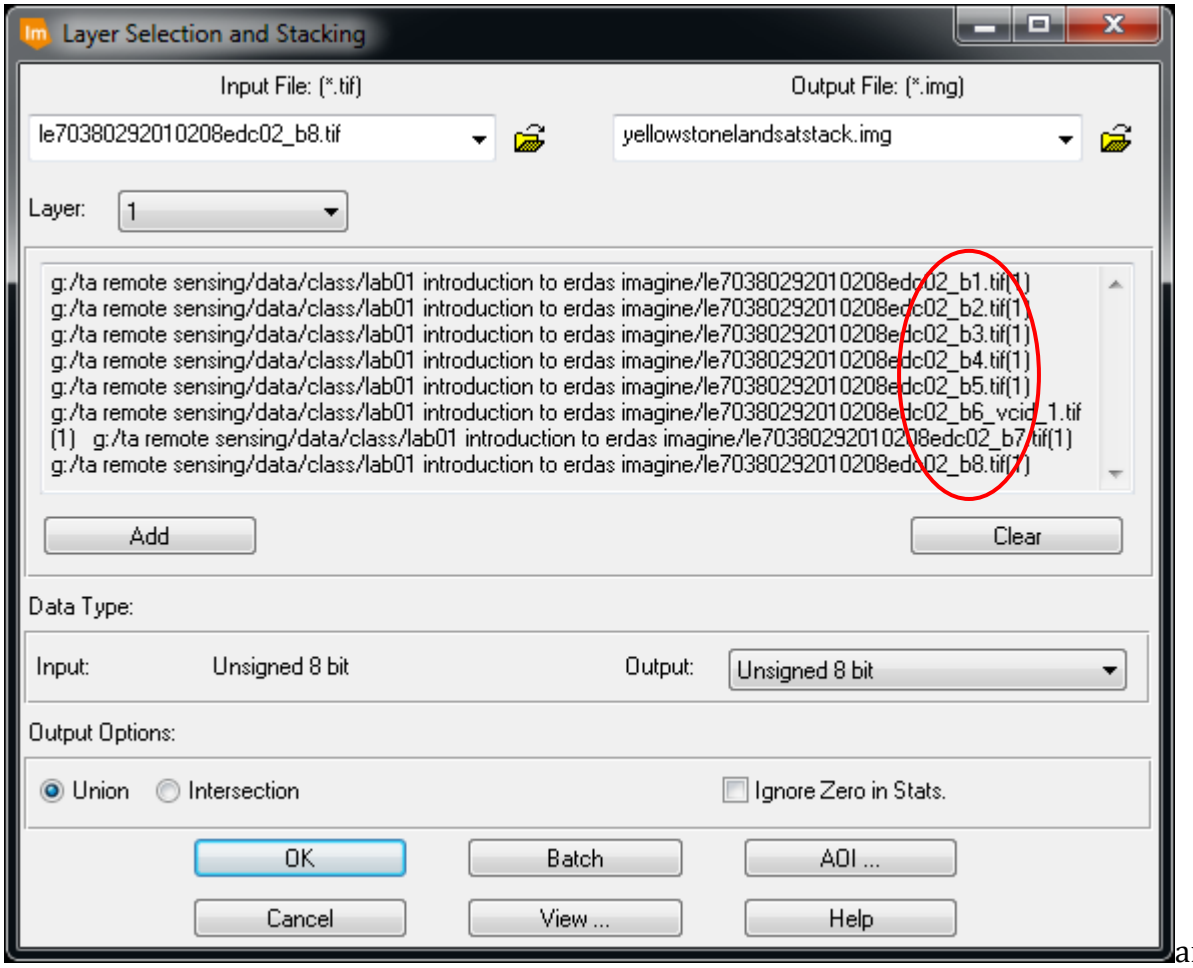
Click on the red circled Browse folder again and repeat the above steps, this time Double clicking on B2. The layer stack window will update with the output file (notice the Add button has become clickable…go ahead and Add it to the screen.

Continue this process until all desired bands have been added. Remember Landsat 4 thru 7 have bands B1thru B7 and Landsat 8 has B1 thru B11. With Landsat 8 you generally do not want to include metadata or QA bands in your image. In each case you will leave the Layer setting at 1 since all of your input TIF files have only one layer. Your final screen should look something like:



We only loaded one of the B6 images. Look at the EarthExplorer Qand As and determine what the two layer 6 files are and how they differ.

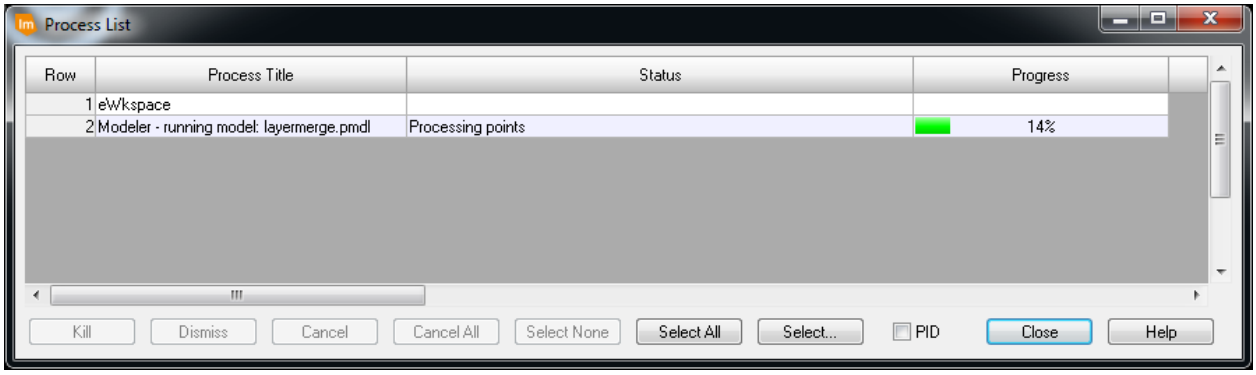
Click the browse icon by the output file and browse to the download folder to insert the output stacked image into the same folder. Select a meaningful **Output File** name, leave the other options at set default values, **OK** on the browse window.



and

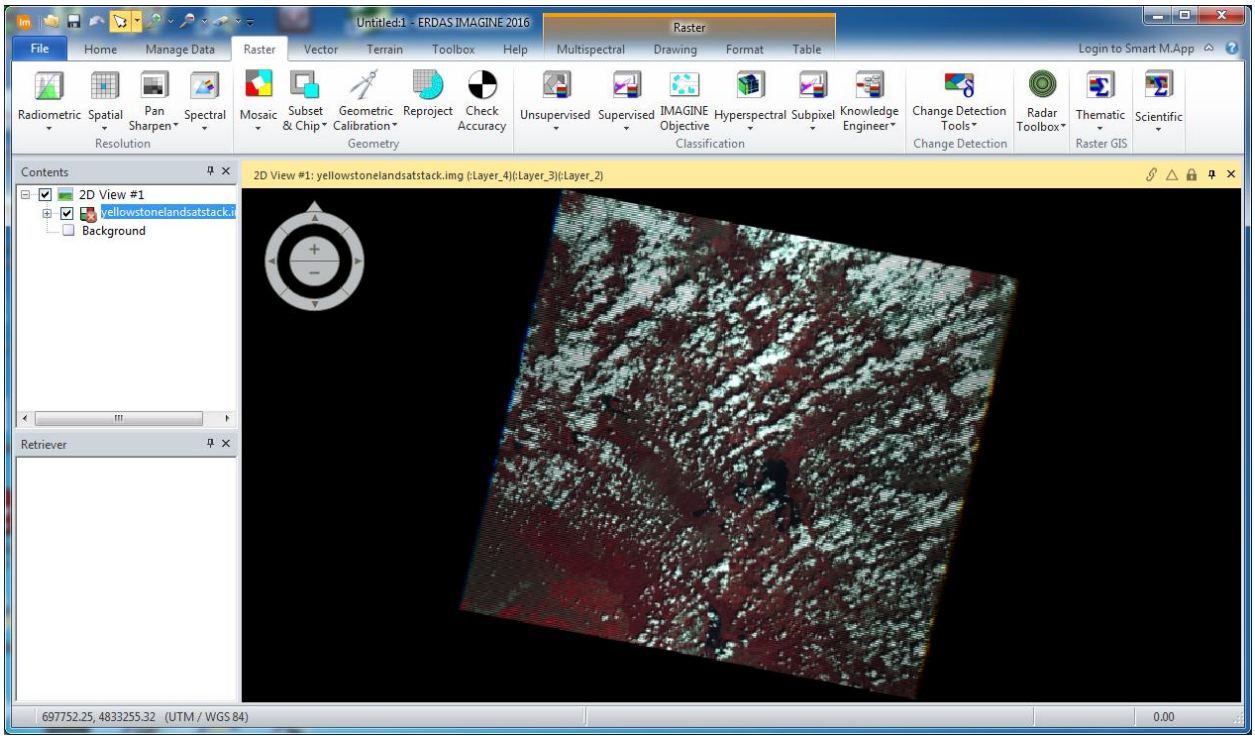
Be sure to check the file names in the Red circled area to make certain you didn't get a layer twice or miss a layer—it's easy to do.

Click **OK** to begin the layer stack process. A process List window will give you status:



After creating the stack, new pyramid layers will be created. Not sure what pyramid layers are? Be sure to look this up in your text book or in the ERDAS Help menu to learn more (you will likely see this again, *hint, hint*). When the process is complete, Close the window. You now have a single image with all the individual spectral Layers registered and stacked into it.

Now load the raster into ERDAS 2016 by right clicking in the **2D View #1** and select **Open Raster Layer** and navigate to your newly created output image and click **OK**. If no image appears, right click on **2D View #1** and select **Fit to Frame.** You should see your image. If you downloaded a Landsat ETM+ (Landsat 7) image, do you have scan line errors?



Remember to log out when you are finished – otherwise the next person to sit at your machine will have access to all of your personal files!!

Review Questions to Ask Yourself:

1. Why do trees appear red in "standard false color composite" in ETM+ images?

2. What band combination in a TM or ETM+ image could you use to make trees appear blue?

3. The **Histogram** tab in **Image Metadata** shows a histogram (number of pixels per bin) of the digital numbers of the individual bands in an image. Causing certain ranges of digital numbers to be hidden when an image is displayed is called “thresholding.” Conceptually, how would you threshold the ETM+ image *26_29_dak_sub.img* so that no clear, deep water is displayed? In other words, which digital number value(s) (high, medium, or low) of which band(s) would you hide so that no clear, deep water shows up?

4. Select an Enhanced Thematic Mapper image of your choice. In the "Raster Options" menu of the Open dialog box, check "No Stretch". Why does the image look different? (Hint: Use the **Inquire Cursor** tool and examine the difference between the "File Pixel" vs. "LUT Value" with and without the "stretch". Note: LUT stands for "Look Up Table").

5. Use the Imagine Help system to briefly explain what a "pyramid layer" does.