



GST 105: Introduction to Remote Sensing Lab Series

Lab 3.1a: Image Composite

Document Version: **2013-09-24 (Beta)**

Organization: American River College
Author: Nathan Jennings

Copyright © National Information Security, Geospatial Technologies Consortium (NISGTC)

The development of this document is funded by the Department of Labor (DOL) Trade Adjustment Assistance Community College and Career Training (TAACCT) Grant No. TC-22525-11-60-A-48; The National Information Security, Geospatial Technologies Consortium (NISGTC) is an entity of Collin College of Texas, Bellevue College of Washington, Bunker Hill Community College of Massachusetts, Del Mar College of Texas, Moraine Valley Community College of Illinois, Rio Salado College of Arizona, and Salt Lake Community College of Utah. This work is licensed under the Creative Commons Attribution 3.0 Unported License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/3.0/> or send a letter to Creative Commons, 444 Castro Street, Suite 900, Mountain View, California, 94041, USA.



The Center for Systems Security and Information Assurance (CSSIA), in partnership with the Network Development Group (NDG) is given a perpetual worldwide waiver to distribute per US Law this lab and future derivatives of these works.

Contents

Introduction	3
Objective: Image Analysis Window and Creating Image Composites	5
Lab Settings	5
1 Create a 3-band Image Composite using Bands 1, 2, and 3	6
2 Create a 3-band Image Composite using Bands 4, 5, and 7	11
3 Create a Full 6-band Image of all Landsat Bands	12
Conclusion	13
Review Exercises	14

Introduction

This lab will provide an introduction and overview of some of the basic functionality of ArcGIS, for working with raw image data. This lab specifically provides practice with adding and viewing image datasets. Students are also encouraged to become familiar working with and finding information on ArcGIS Help topics.

Your instructor may require that you provide screen captures, exported files and/or responses to review exercises. The review exercises included throughout the lab can also be found in the Review Exercises section. Please check with your instructor for the requirements specific to your class.

Prerequisite Knowledge

Students should already be familiar with the basic functionality of ArcGIS. These skills and knowledge can be obtained by completing earlier courses in this series.

Concepts Covered

- Open ArcMap
- Add Image Data
- Data Navigation tools (zoom in/out, pan, etc) – Tools toolbar
- Image Analysis Window
- Image Classification Toolbar
- Feature Analyst Toolbar
- Raster and Spatial Analyst tools in ArcToolbox
- Changing Band Combinations
- Add full images and single bands

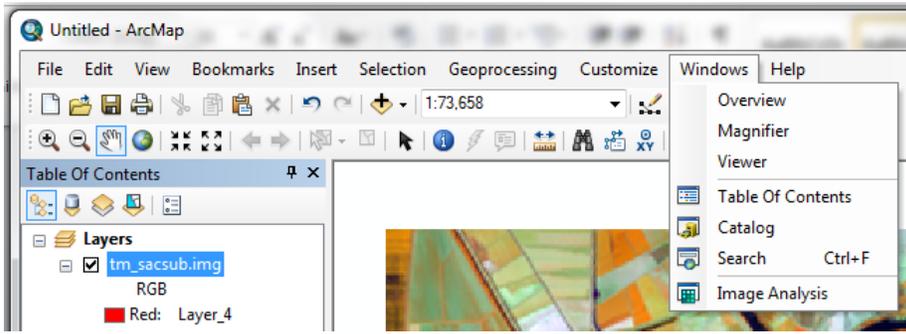
Use and Refer to the ArcGIS Help Topics by doing searches on key terms:

- Image Analysis Window
- Raster Calculator
- Image Classification Toolbar

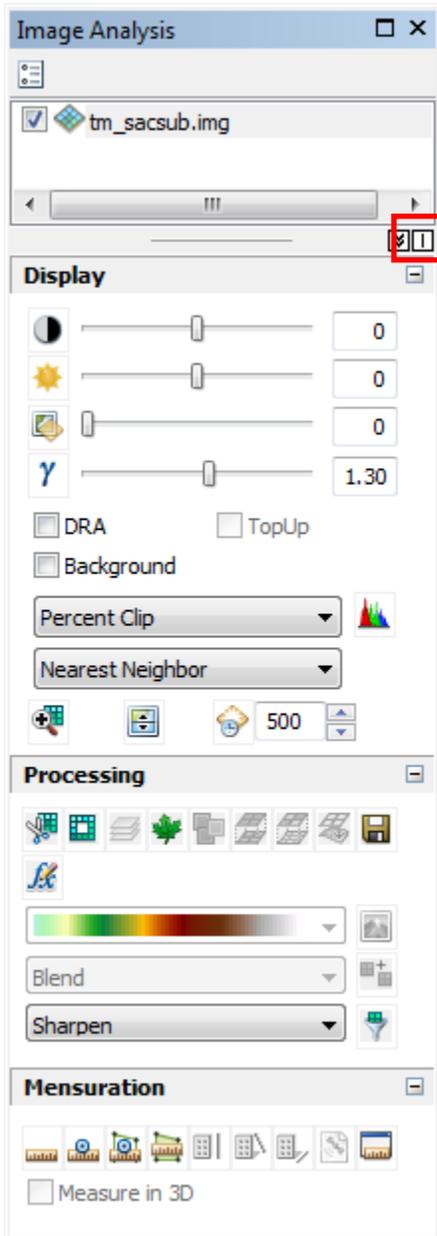
Introduction to the Image Analysis Window

The Image Analysis window provides a number of tools that can be used to perform some image pre-processing (image subset, compose a multi-band image from individual bands, image mosaic, NDVI, etc.).

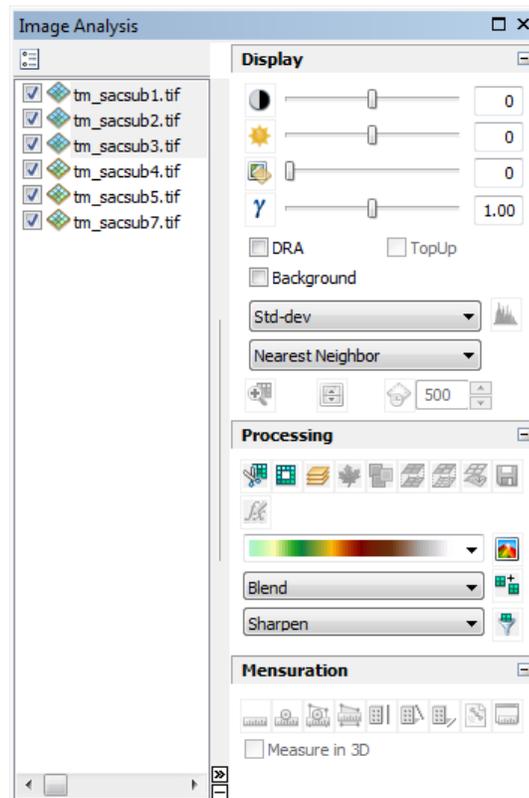
The Image Analysis window can be launched by clicking on **Windows -> Image Analysis Window** from the main ArcMap Window. See the images below for reference.



The Image Analysis window is shown below.



NOTE: Click this button to dock the tools to the right of the list of images
See the illustration below.



Objective: Image Analysis Window and Creating Image Composites

Most students will be already be familiar with the vector-based GIS functions found within ArcGIS (ArcMap and ArcToolbox). This lab introduces the student to the Image Analysis window by creating some simple multi-band image composites from existing remotely sensed imagery.

This lab includes the following tasks:

1. Use the Image Analysis window to create a 3-band image of a small portion of a Landsat TM satellite image for the true color bands
2. Use the Image Analysis window to create a 3-band image for Landsat TM bands 4,5, and 7
3. Create a 6-band image of the Landsat TM image bands

Students will become familiar with changing image band combinations and saving new image datasets to an image file.

Lab Settings

Required Virtual Machines and Applications

Windows Machine User Account	Train
Windows Machine User Password	Train1ng\$

1 Create a 3-band Image Composite using Bands 1, 2, and 3

An image composite is created by taking individual bands and combining them into a single multi-band image dataset. In many cases, image data that is downloaded is provided in such a way that the end-user will need the ability to put the imagery together.

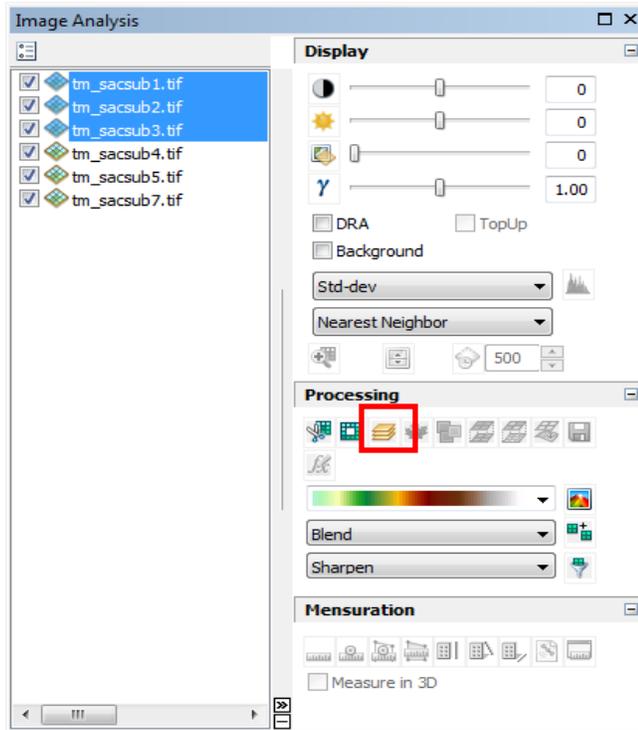
1. Log into the computer, using the information provided in the Lab Settings section.
2. From the *Shared Drive\GST 105\Lab3\Data* folder, **Add** the 6 image band files listed in the table below into **ArcMap**. The bands are from a Landsat TM satellite subset and the band number is contained in the file name (e.g. tm_sacsub3.tif is Band 3).
3. Note the wavelengths for these bands in the table below. You may also search the Internet for more information on this particular Landsat sensor.

Exercise A: Complete the table.

Sensor Image Band	Wavelength (nanometers)
tm_sacsub1.tif	
tm_sacsub2.tif	
tm_sacsub3.tif	
tm_sacsub4.tif	
tm_sacsub5.tif	
tm_sacsub7.tif	

4. Open the Image Analysis Window.
5. Highlight bands 1, 2, and 3 (tm_sacsub1.tif, tm_sacsub2.tif and tm_sacsub3.tif).

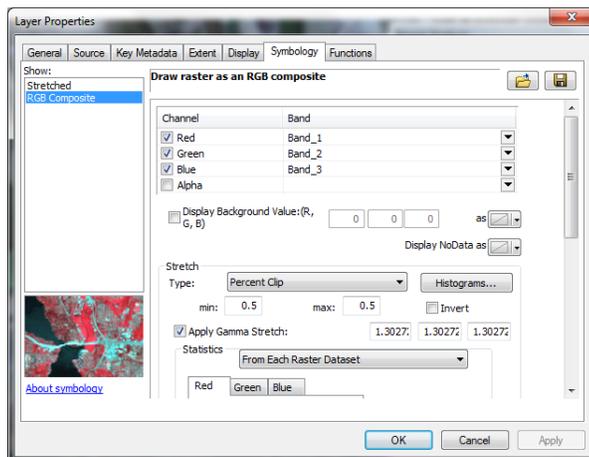
6. Select the **Composite** tool (indicated in the screenshot below).



A 3-band image will automatically be created and added to the Image Analysis window as well as the Table of Contents.

Exercise B: What “color assignment” are Bands 1, 2, and 3 assigned to? (I.e. what display color are Bands 1, 2, and 3 assigned to by default)?

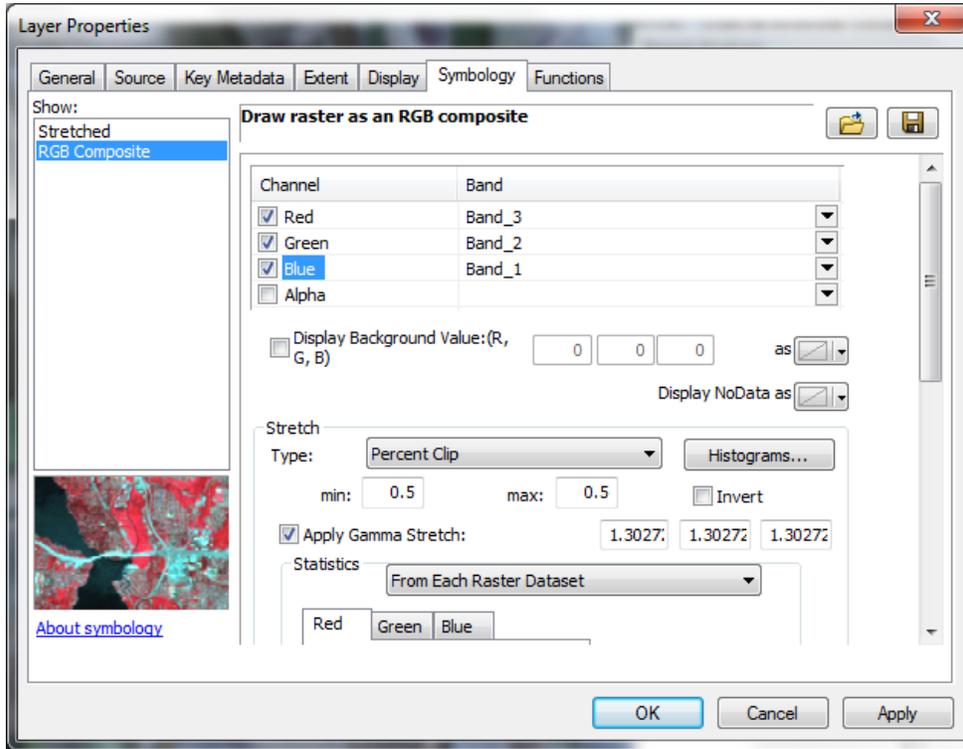
7. Next, we will change the display colors. To do this, right-click on the new 3-band image layer and select **Properties**. Click on the **Symbology** tab.



- Click on the down arrow for each of the Red, Green, and Blue channels and select the bands as shown in the table below.

Channel	Band
Red	Band 3
Green	Band 2
Blue	Band 1

The Symbology tab should now look like the following image:



- Click **OK**.

Exercise C: Compare (the results above) with the band combination originally displayed when the image was created. Which display band combination creates the most “natural looking” image for a “true color” display? (You may need to switch Red to Band 1 and Blue to Band 3 and review this band combination).

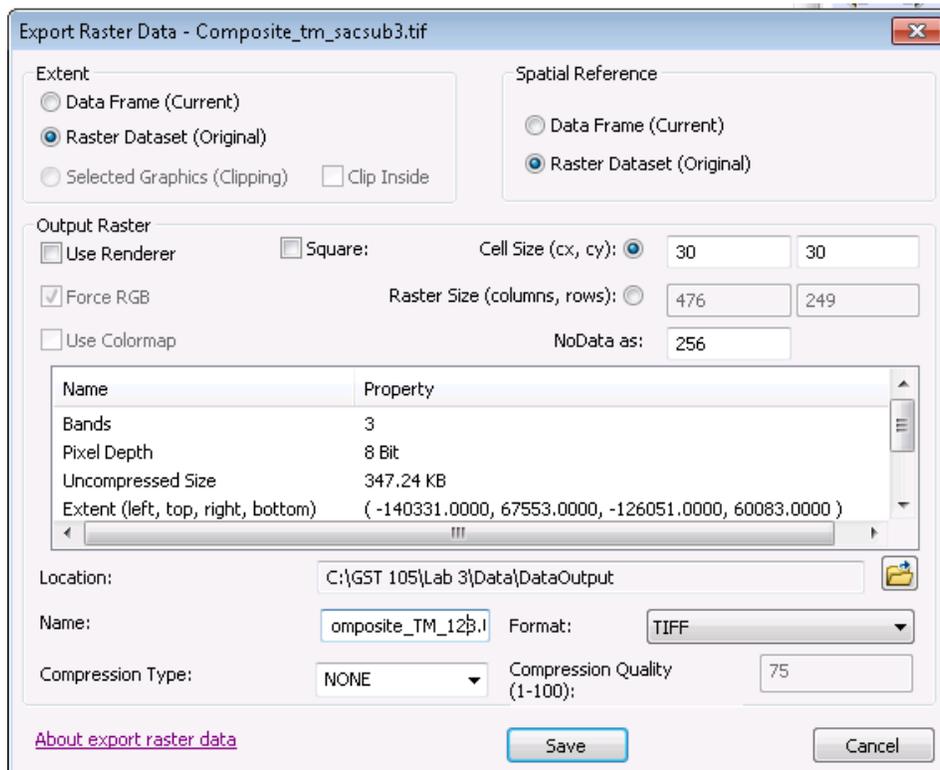
- Bring up the **Properties** on the new composite image. Click on the **Source** tab. Look through the specific properties in this tab. Enter the value for each property in the table below.

Exercise D: Complete the table.

Property	Value
Status	
Pixel Type	
Linear Units	
Pixel Depth	
Rows, Columns	
Number of Bands	
Spatial Reference	

As noted in the properties of this layer, the Composite tool in the Image Analysis window creates only a temporary image and adds it to the Table of Contents. To keep the image for future use, the user must save the image to make sure it exists after ArcMap closes.

- To save the composite image we have created, right-click on the **composite image** and click **Data->Export Data**. Make sure the output **Location** destination is the *Lab 3\Data* folder or a subfolder under the *Data* folder. The **Format** should be a **TIFF** file type and under **Name** type: **Composite_TM_123.TIF**. Accept the rest of the defaults. If prompted, add the new layer to the Table of Contents. The Export dialog box should look similar to the following screenshot.



The location may show a folder that is different from the one displayed in the image above. Just make sure the folder is set to **\Data** or some folder you created under the **\Data** folder.)

Complete the table below, using the information from the **Export Raster Data** window:

Exercise E: Complete the table.

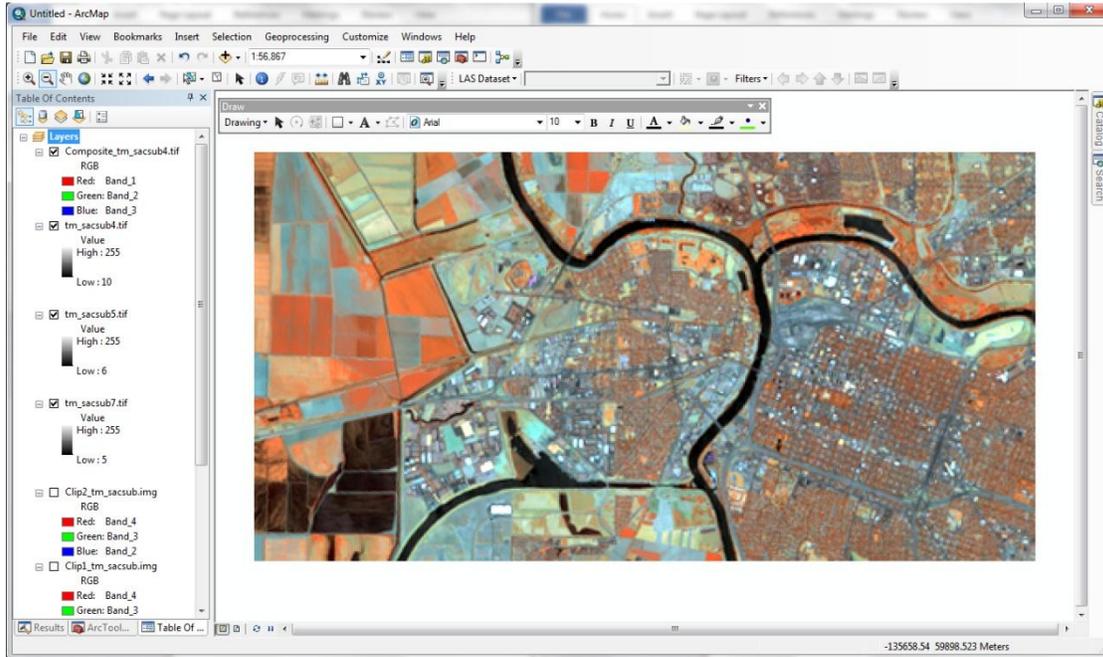
Spatial reference	
Cell Size (displayed in meters)	
Number of Bands	

12. Click **Save**. If prompted, Promote Pixel Depth.
13. Right-click on the **new image** and select **Properties** and the **Source** tab.

Exercise F: What is the current “status” of the image?

2 Create a 3-band Image Composite using Bands 4, 5, and 7

1. Turn off the previous composite image (or images) created in the previous task.
2. Use the same procedure (as described in the previous task) to generate another 3 band image using only bands 4, 5, and 7. You do not have to create a permanent file (unless you want some extra practice). If the bands are layered in ascending order in the Table of Contents, the image should look similar to this:



Exercise G: How many bands is the resulting image?

Exercise H: What sensor wavelengths are assigned to the following output image bands in the image just created.

Sensor Image Band	Wavelength (nanometers)
Band 4	
Band 5	
Band 7	

Exercise I: Why are these colors displayed vs. showing a true color type display? Explain.

3 Create a Full 6-band Image of all Landsat Bands

1. Turn off the previous image.
2. Using the same procedure as the previous tasks, create the composite image, but this time, choose all of the bands from the list (this should include bands 1, 2, 3, 4, 5, and 7) in this order.

Exercise J: How many bands, rows, and columns are in this image?

Using this 6-band composite image, do the following.

Exercise K: Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.

Channel	Band
Red	Band 3
Green	Band 2
Blue	Band 1

Exercise L: Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.

Channel	Band
Red	Band 4
Green	Band 3
Blue	Band 2

Exercise M: Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.

Channel	Band
Red	Band 4
Green	Band 5
Blue	Band 6

Conclusion

In this lab, you have been introduced to the Image Analysis window and learned how to make several composite images from individual bands. This is a common activity an analyst is required to do when obtaining imagery from public online sources or if imagery is delivered as separate image files. The second and third parts of this lab focused on image subsetting and image mosaicing, two other common tasks that may be required of an image analyst.

Review Exercises

The review exercises included throughout the lab are listed in this section. You may click the name of each exercise to link to the exercise's location within the lab.

Exercise A: Complete the table.

Sensor Image Band	Wavelength (nanometers)
tm_sacsub1.tif	
tm_sacsub2.tif	
tm_sacsub3.tif	
tm_sacsub4.tif	
tm_sacsub5.tif	
tm_sacsub7.tif	

Exercise B: What “color assignment” are Bands 1, 2, and 3 assigned to? (I.e. what display color are Bands 1, 2, and 3 assigned to by default)?

Exercise C: Compare (the results above) with the band combination originally displayed when the image was created. Which display band combination creates the most “natural looking” image for a “true color” display? (You may need to switch Red to Band 1 and Blue to Band 3 and review this band combination).

Exercise D: Complete the table.

Property	Value
Status	
Pixel Type	
Linear Units	
Pixel Depth	
Rows, Columns	
Number of Bands	
Spatial Reference	

Exercise E: Complete the table.

Spatial reference	
Cell Size (displayed in meters)	
Number of Bands	

Exercise F: *What is the current “status” of the image?*

Exercise G: *How many bands is the resulting image?*

Exercise H: *What sensor wavelengths are assigned to the following output image bands in the image just created*

Exercise I: *Why are these colors displayed vs. showing a true color type display? Explain.*

Exercise J: *How many bands, rows, and columns are in this image?*

Exercise K: *Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.*

Channel	Band
Red	Band 3
Green	Band 2
Blue	Band 1

Exercise L: *Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.*

Channel	Band
Red	Band 4
Green	Band 3
Blue	Band 2

Exercise M: *Change the display to show a true color band combination (use settings in the table below). Describe what you see and the colors of the features. Explain why the features appear as these colors in the color display.*

Channel	Band
Red	Band 4
Green	Band 5
Blue	Band 6