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Software: ArcGIS 9.3.1

Lesson 2: How to Bring Landsat Data into ArcGIS, Mosaic and Clip Scenes

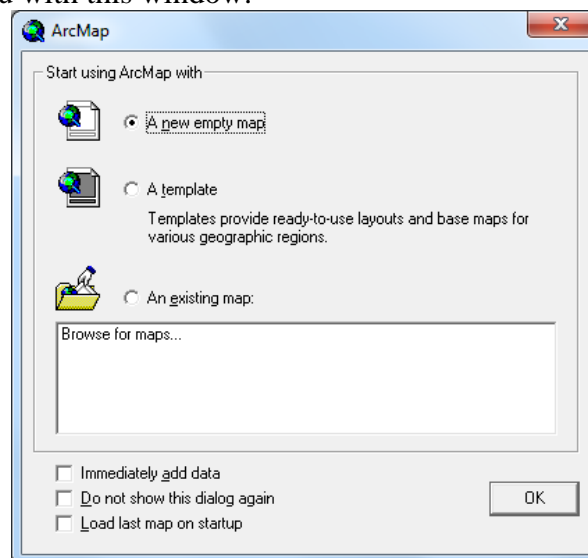
Background

By the end of this tutorial, you should be able to successfully mosaic several scenes of Landsat data together and clip them to the area you are interested in. Throughout this example, I will be using *ArcGIS version 9.3.1* to conduct all processes. Within this software package, we will be dealing primarily with *ArcMap*. Older or newer versions of the Arc software is available so there may be some variation within the processes used, but for the most part no major discrepancies should occur.

Before you can implement the steps described below, you must have already downloaded and decompressed your Landsat data into a designated workspace. If you have not done this yet, please refer to the other tutorial titled "How to Download USGS GloVis Landsat Data" before moving on to these steps. Because I downloaded Colorado Landsat data from USGS previously, I will be using those scenes throughout this process. All screen shots showing Landsat images differ slightly in regards to each unique area you are using. I will be mosaicking all scenes encompassing Colorado and clipping them to the state border.

Getting the Data into ArcMap

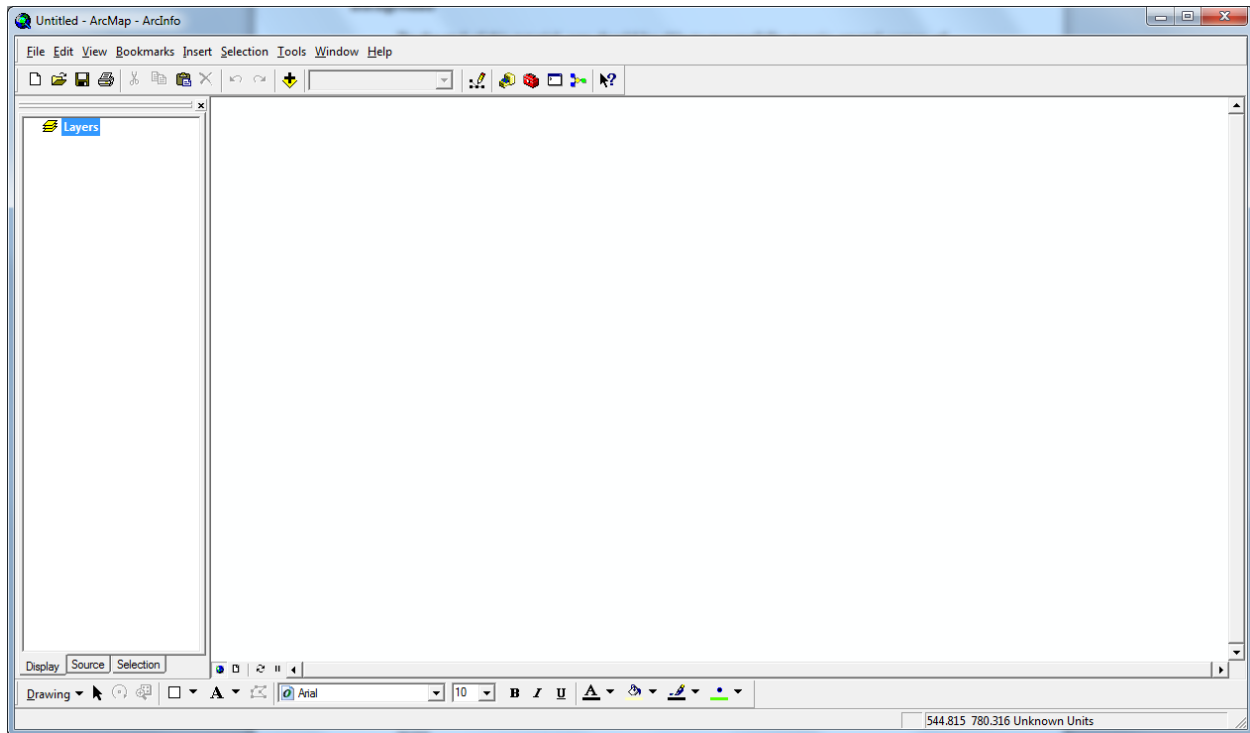
1. Open *ArcMap*- it is one of several programs within the package titled *ArcGIS*. Once the program is open it will prompt you with this window:



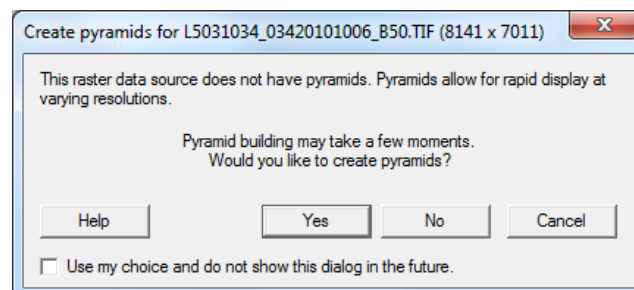
2. Make sure "A new empty map" is selected and click "Ok."

Note: For this tutorial, I am going to assume that if you are not familiar with the *ArcMap* program, then you will solely be using it as a tool to mosaic Landsat data and nothing more. If you are doing more with *ArcMap* then please reference the tutorials within *ArcHelp*.

3. Here are a few key visible features of the *ArcMap* program and a screenshot of it for those not familiar with *ArcMap* already:



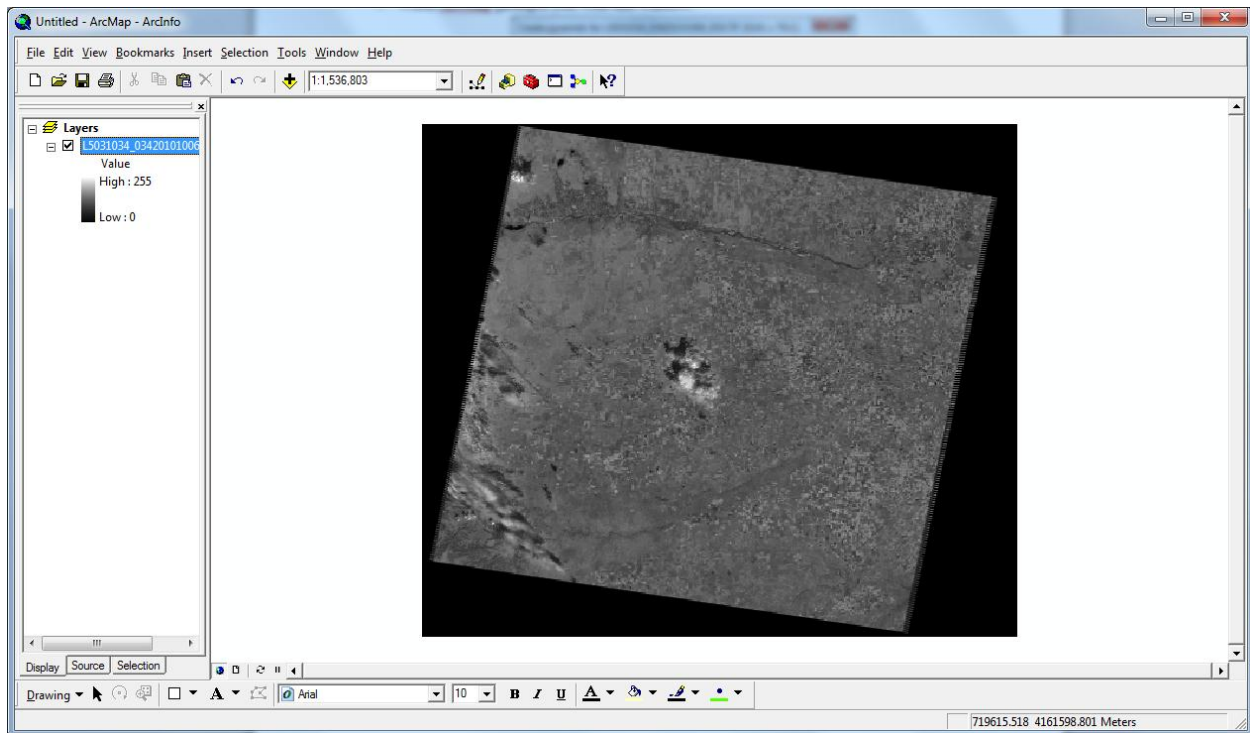
- a. *Table of Contents (TOC)* – Left side. This is where you can see each layer of data that exists within your map. You can turn the layers on and off as well.
 - b. *Spatial Data Display* – Right Side. Where the spatial data will be displayed once it is added.
 - c. *Toolbars* - The other icons that can be activated or deactivated as well.
 - d. *Add Data* - Yellow square with black plus sign over it. Or also available by right clicking on “Layers” in the TOC.
4. To add data to your map, click on the “Add Data” icon. Navigate to the folder and one of the Landsat scenes you are interested in mosaicking and click “Add.”
 5. When *ArcMap* prompts you with this window:



Click “Yes” and wait for the few moments it takes to display the data (A progress bar usually appears in the lower right-hand corner of the screen)

6. When the image appears it will be surrounded by sets of “Null” values which are sections where there is no data because of the angle from which the data was captured.

Note: the image will not look the same as it did on the USGS GloVis viewer. It will look something like this in *ArcMap*, notice the information on your data also appears in the TOC with a gradient bar:



7. Repeat steps 6 and 7 for the other scenes you wish to mosaic together. Because they all should already have a defined geographic reference, they should be overlapping each other along the edge.

Preparing Data Scenes for Mosaicking

Notice that when one brings in several scenes into *ArcMap*, there is a section of black on all four sides as mentioned previously. This area is occupied by “Null” values that do not contain any numerical values pertinent to the satellite image. The tilted rectangle within the black square is what we are interested in. If you try to mosaic several scenes with the null values still present, the black from one scene will overlap onto the real data of another scene. Below is one of several methods to eliminate the null values. This process will need to be repeated for each individual scene.

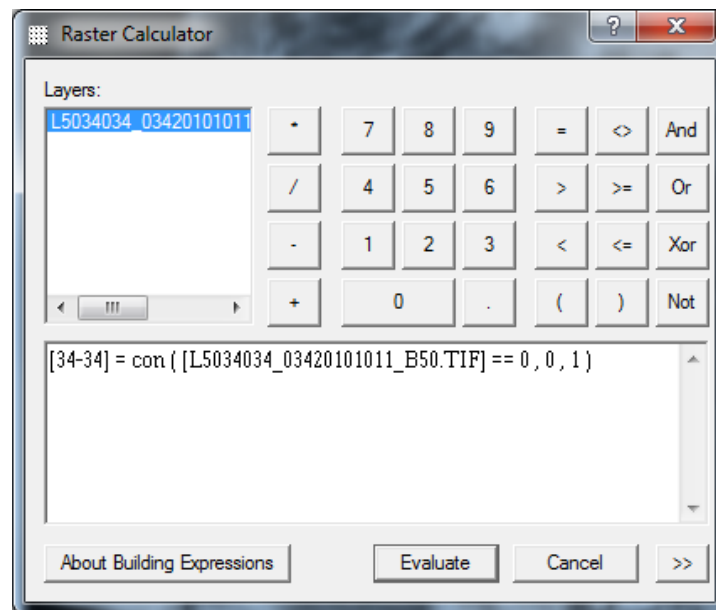
1. Load the scene into *ArcMap* as described in the process above and make sure to the *Spatial Analyst* extension is activated (Tools → Extensions... → Check Spatial Analyst) and the *Spatial Analyst Toolbar* is visible (View → Toolbars → Spatial Analyst).

2. Click on “Raster Calculator” under the “Spatial Analyst” drop-down tab. In order to remove the null values we will make a Boolean raster, reclassify it, then multiplying it by the original raster.
3. Enter into the Raster Calculator a “Con” statement as shown (be sure to include spaces before and after each entry as well as all brackets and parentheses):

[Your New Boolean Raster Name] = con ([Raster File You Are Working On] == 0 , 0 , 1)

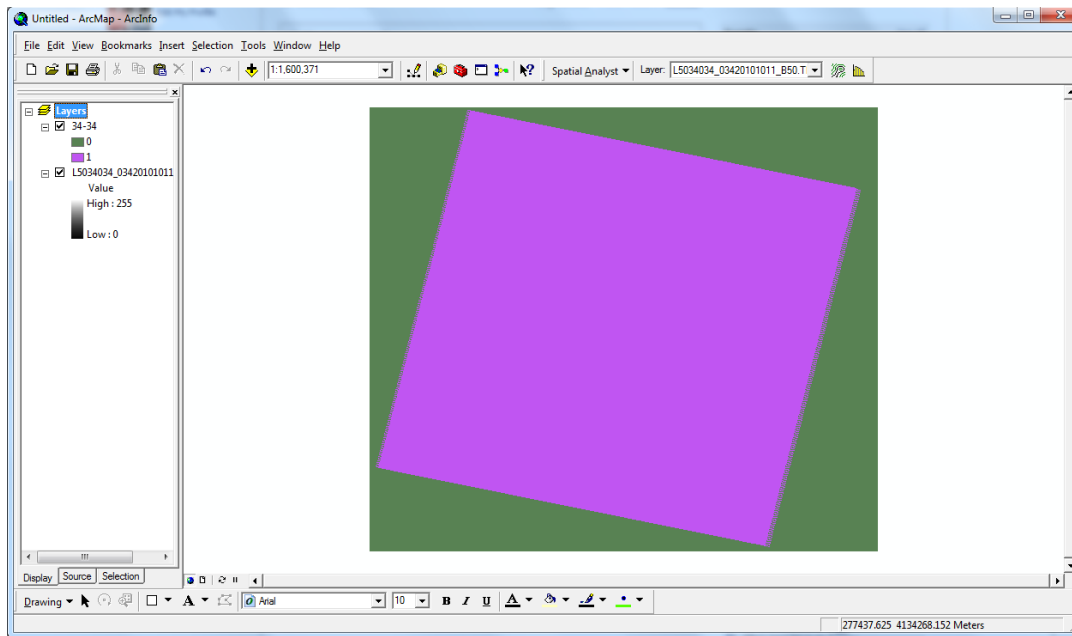
Mine will look something like this for the Colorado example:

[34-34] = con ([L5034034_03420101011_B30] == 0 , 0 , 1)

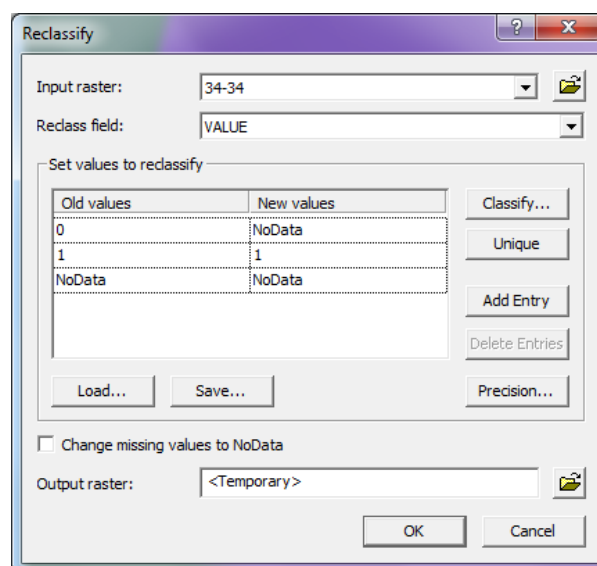


Again, make sure you are including the necessary spaces, brackets and parentheses otherwise you may get an error message from Arc.

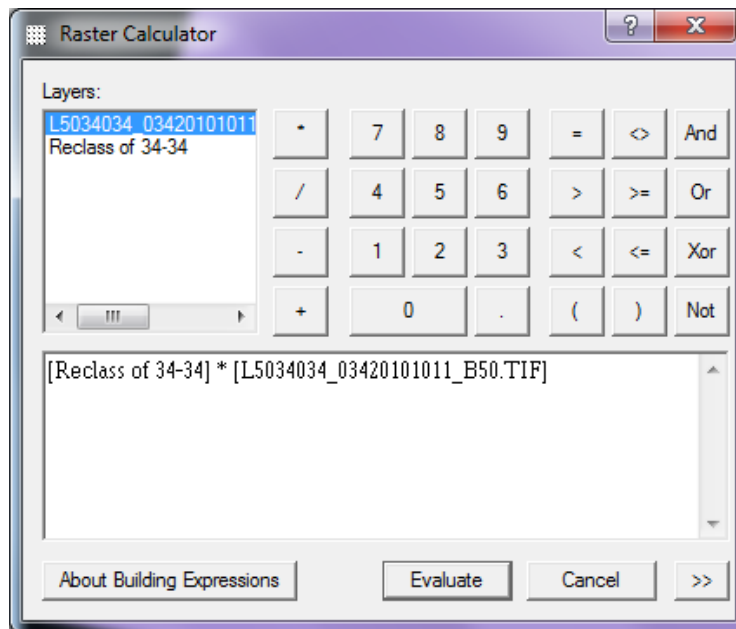
4. Click “Evaluate” and notice the bi-colored layer that appears in your TOC and your display. It should have the same name you specified in the Raster Calculator.



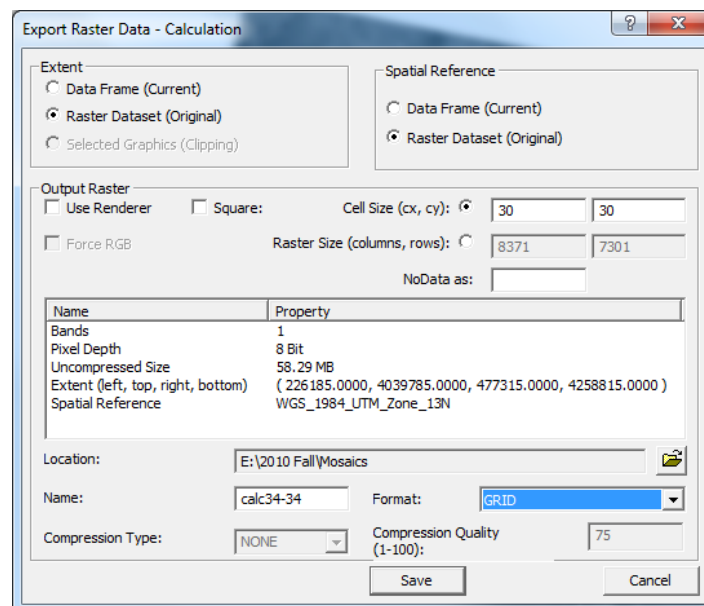
5. Next, click on “Reclassify...” under the “Spatial Analyst” drop-down tab.
6. At the top of the window displayed, select your newly acquired Boolean Raster layer just calculated.
7. There will be two columns of numbers and/or text. Click on the right column value that matches up with “0” on the left hand side. Change this to match the right hand value that is across from the “NoData” on the left. In my case, it is in fact “NoData.” It should look something like this before you click “Ok”:



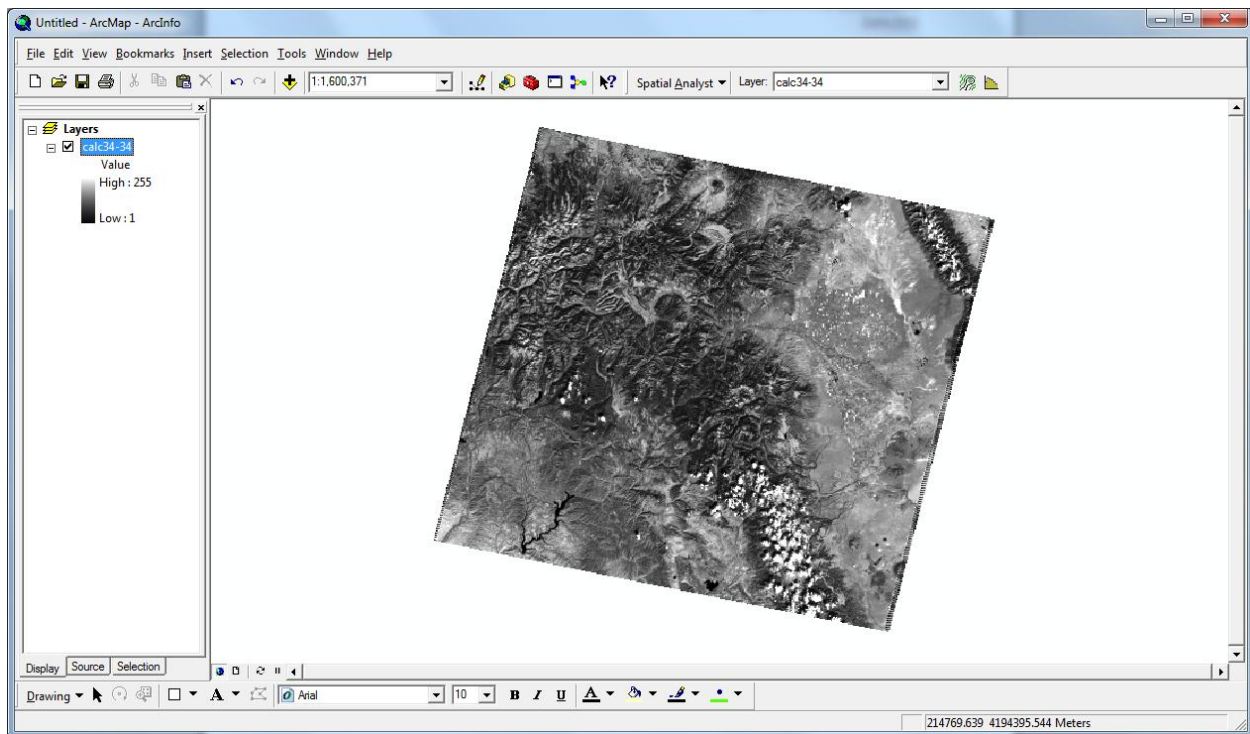
8. This reclassification will create another layer within your TOC. To make things simpler, remove the last layer you created (the one you made from the Raster Calculator) by right clicking on the layer and selecting “Remove.”
9. Now, go back into Raster Calculator and multiply the original raster by the new reclassified layer. Click “Evaluate” and a new “Calculation” will appear in the TOC and display. Remove all other layers related to that particular scene except the “Calculation” layer.



10. Right click on “Calculation” in the TOC, select “Data,” then “Export Data.” The window that appears will look like this:



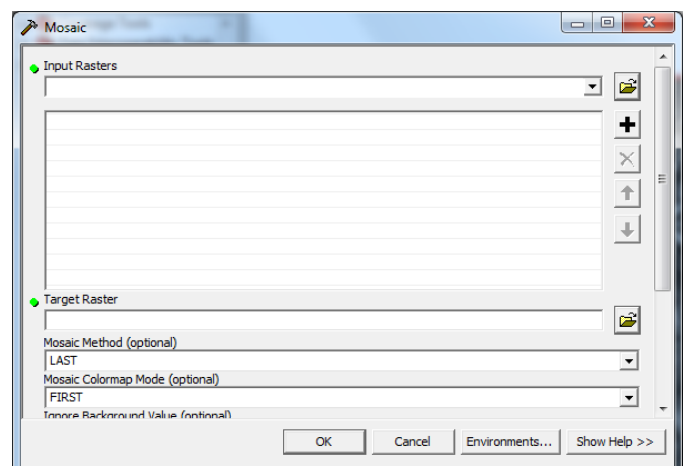
11. Only change the Location and Name within this window- both are near the bottom. Select the location of where you would like the new raster to be saved, create a name for the file, and finally select the format. Notice, in mine I chose the folder in which the raster belongs, changed the name to “calc34-34,” and chose the format GRID.
12. After you export the data which may take a few moments, *ArcMap* will prompt you asking whether you would like to add the file as a layer to your map. Decide accordingly. Now whether you decided to add the file as a layer or use the calculation already in your TOC, now the Raster is in a file ready to be mosaicked together with others. This is what each file should look like by the end of this process:



Mosaicking Processed Landsat Scenes

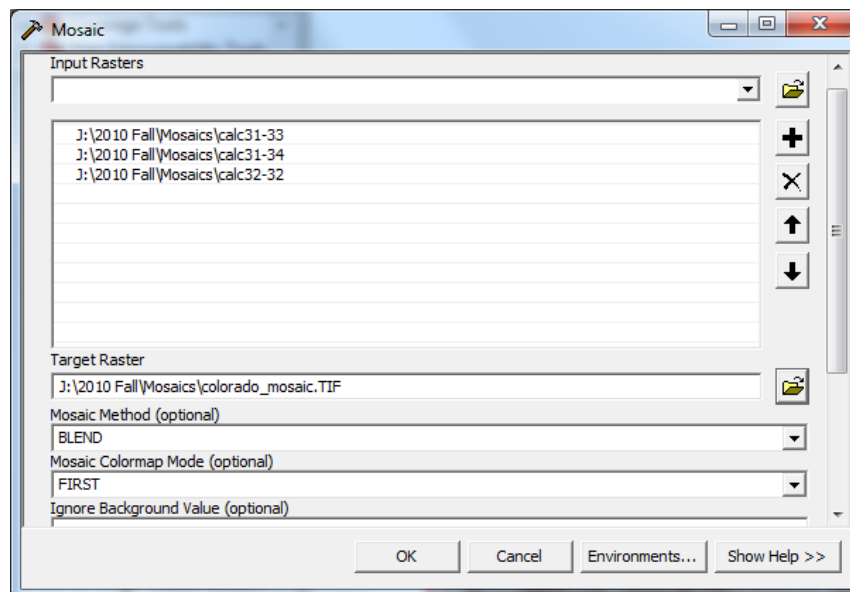
In order to mosaic several Landsat scenes together, we will be using the Mosaic Tool within ArcToolbox. This tool can be found by opening the toolbox (red box icon) and navigating to Data Management Tools → Raster → Raster Dataset → Mosaic.

1. Open the Mosaic Tool which will bring up a window like this:
2. In this case, *ArcMap* tends to work a little more smoothly when the input rasters are inserted by their file path instead of the drop down selection of items in the TOC. Select the rasters which you would like to mosaic together by clicking on the top

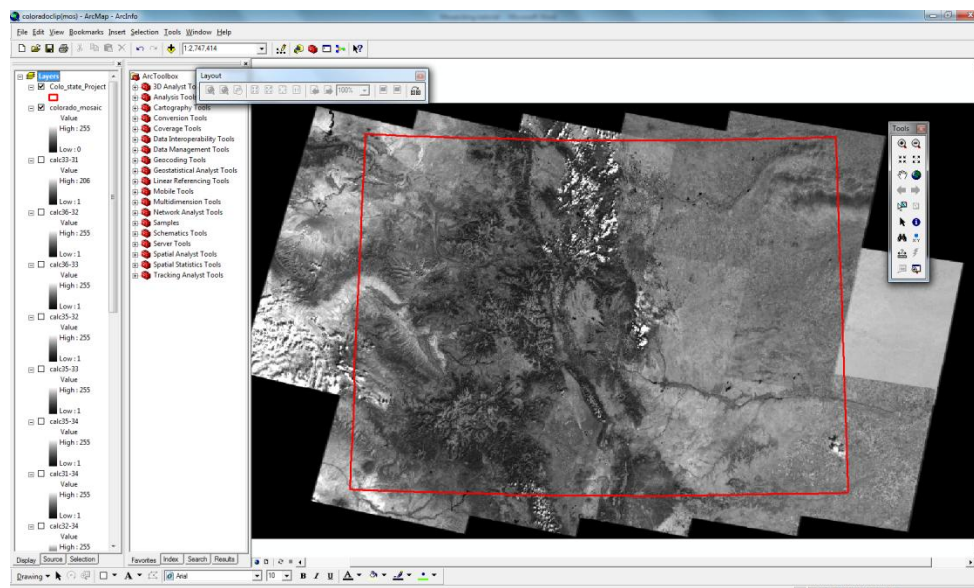


yellow folder and navigating to each one. Depending on the machine being used, many rasters can be mosaicked together at the same time, but it will take longer for the program to complete the objective.

- Next, select the target raster to which you intend the mosaicked image to be saved. You will need to have an existing raster already in mind; you cannot create a new one using this tool.
- Finally, select the mosaic method you intend to use. These are labeled as LAST, FIRST, BLEND, MEAN, MINIMUM, and MAXIMUM. Each choice has its own way of joining the data; please reference the tutorial within *ArcMap* on the mosaic tool to learn what each choice will do. The window should look something like this:

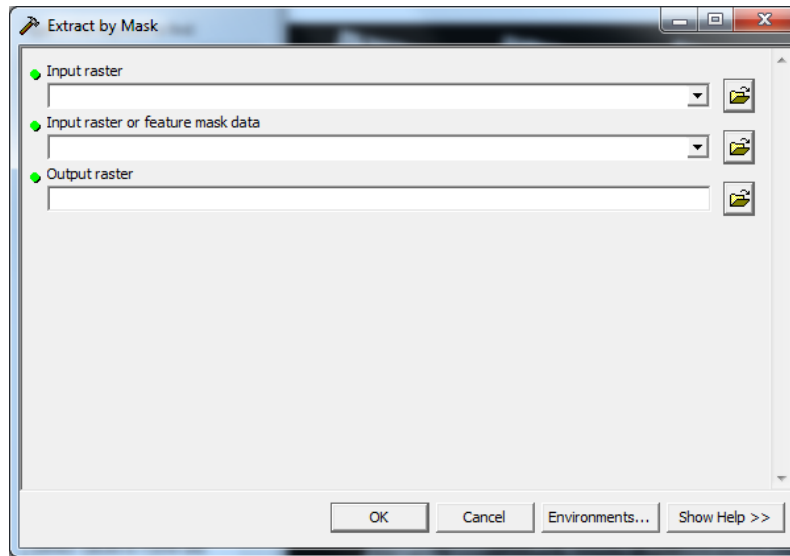


- The other defaults should be fine for these Landsat scenes – click “Ok.” (Do not be surprised if this tool takes quite a while to process)
- For the Colorado data I am dealing with, this is the mosaic that resulted:

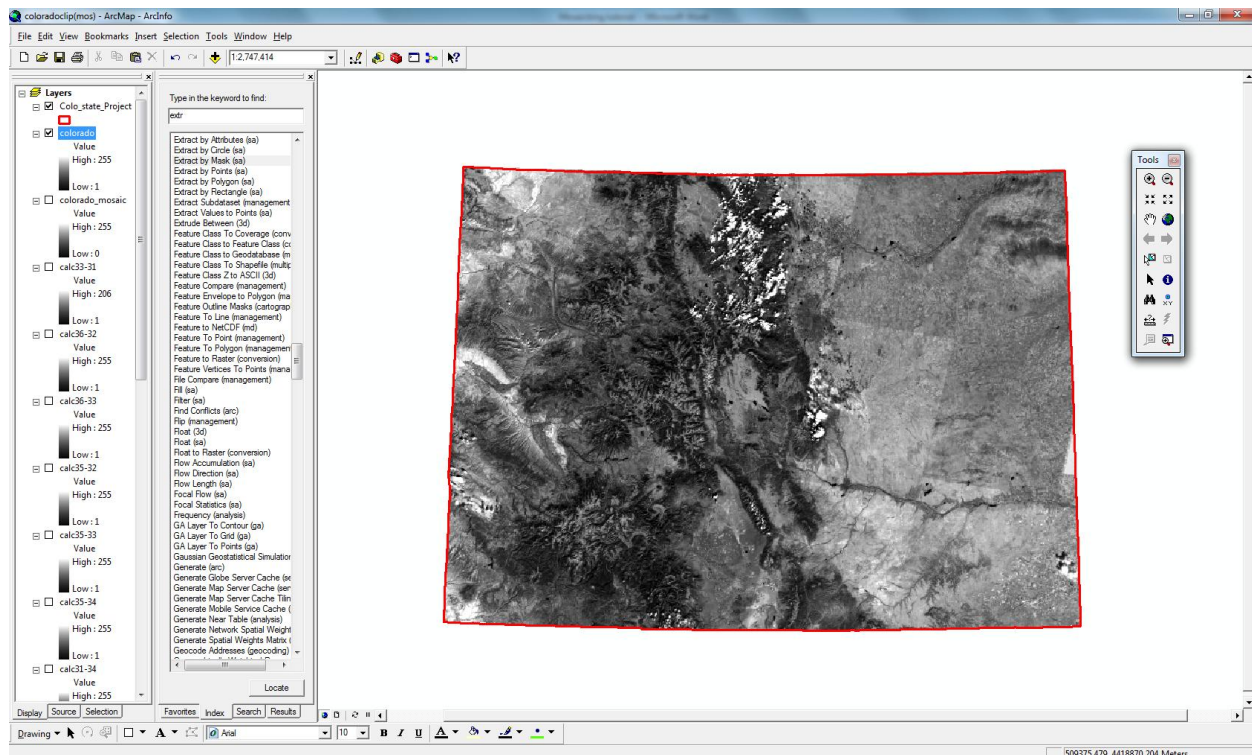


Clipping the Mosaic to a shapefile

1. Notice above, once I bring in the Colorado border, it obviously does not fit the Landsat data. To solve this problem, we will clip the raster data to an existing shapefile.
2. Click “Add Data” in order to navigate to the shapefile you would like to clip your raster to.
3. Once it is in your TOC, go to ArcToolbox and navigate to “Extract by Mask.” The window will look like this:



4. For the “Input raster,” select your mosaic from the drop-down. For the “Input raster or feature mask data” select the shapefile you intend to clip to. In this case it is the Colorado border. Then under “output raster” navigate to where the new raster will be saved. Click “Ok.”
5. This will add the new clipped raster into your TOC. The Landsat images should now only be visible within the shapefile you used. Colorado’s looks like this:



You have successfully brought Landsat data into *ArcMap*, mosaicked multiple scenes together, and clipped them to an existing shapefile.