UC DAVIS EXTENSION

Objectives:

- Create landcover classification of the Central Valley by:
  - Digitizing training polygons
  - Creating a signature file
  - Running a supervised classification

- Assess accuracy of the classification
- Repeat classification to improve accuracy
- Use classification to quantify and assess changes in landcover

Goal: Create classification of the Central Valley using Landsat 7 imagery from 2011 and 2014 to determine changes in landcover, particularly in active agriculture and fallowed fields, as a result of the 2014 California drought.

1. Viewing Landsat Data

Create a new ArcMap document and set it up per your usual settings (default geodatabase, save the document, etc). Add two images to ArcMap: *2011_Imagery* and *2014_Imagery*.

These images will show up, but they'll look a little weird. First, what are they? They have a stairstep to them because they're mosaiced exports of multiple Landsat 7 scenes. Second, why do the colors look like this? It sort of looks like the world under full-moon lighting? Everything has a cool-blue hue. Take a look at the colors assigned to the bands on the left. Does that seem correct?

- What band combination is best for the purposes of this lab? Remember, we're looking at changes in active agriculture and fallowed fields (ie. vegetation)
- What band combinations are best for other projects?

For reference: http://web.pdx.edu/~emch/ip1/bandcombinations.html

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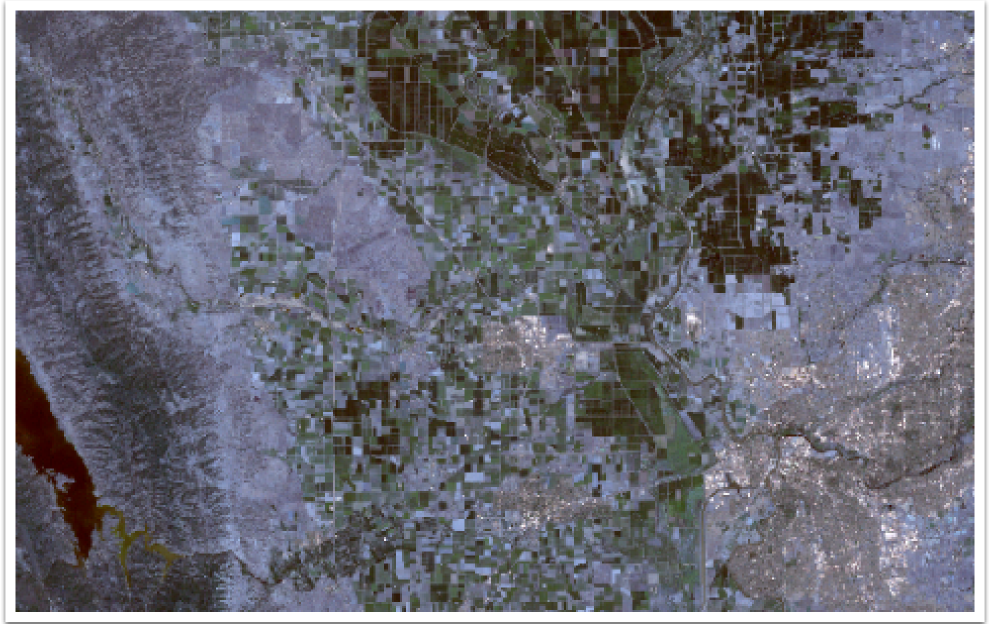
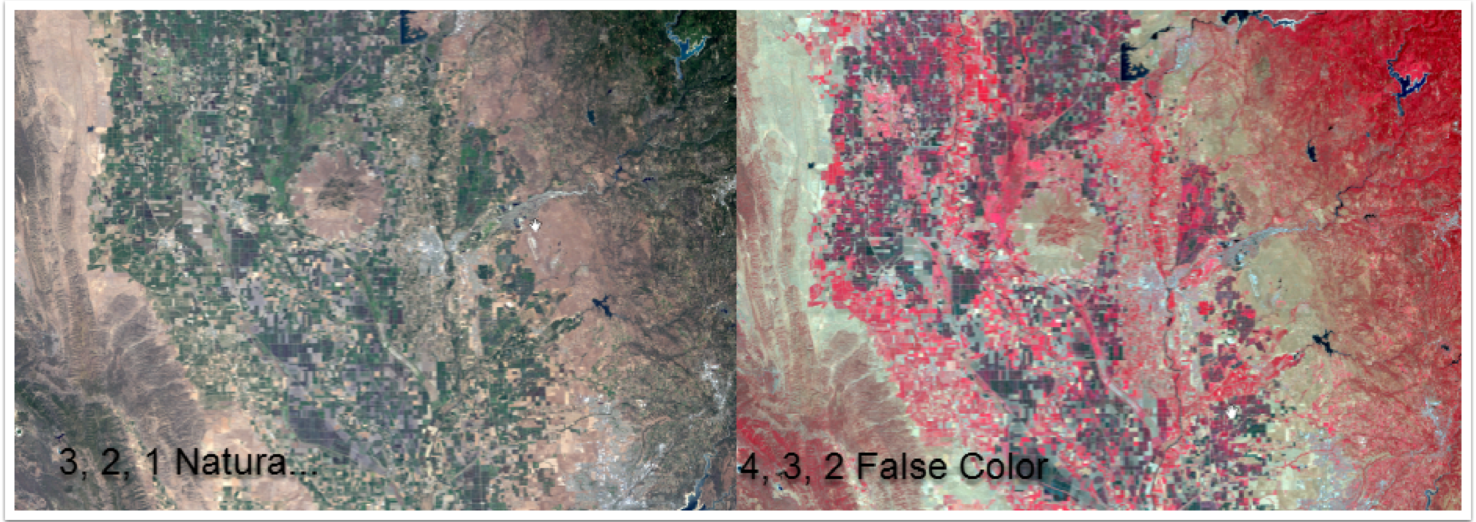


1.1 Band coloration

Well, it's not correct by default. ArcGIS assigns red to band 1, green to band 2, and blue to band 3, in the absence of other information on the image. We'll need to reassign those bands. Where do you think we do that, knowing that this deals with representing the underlying data on the screen?

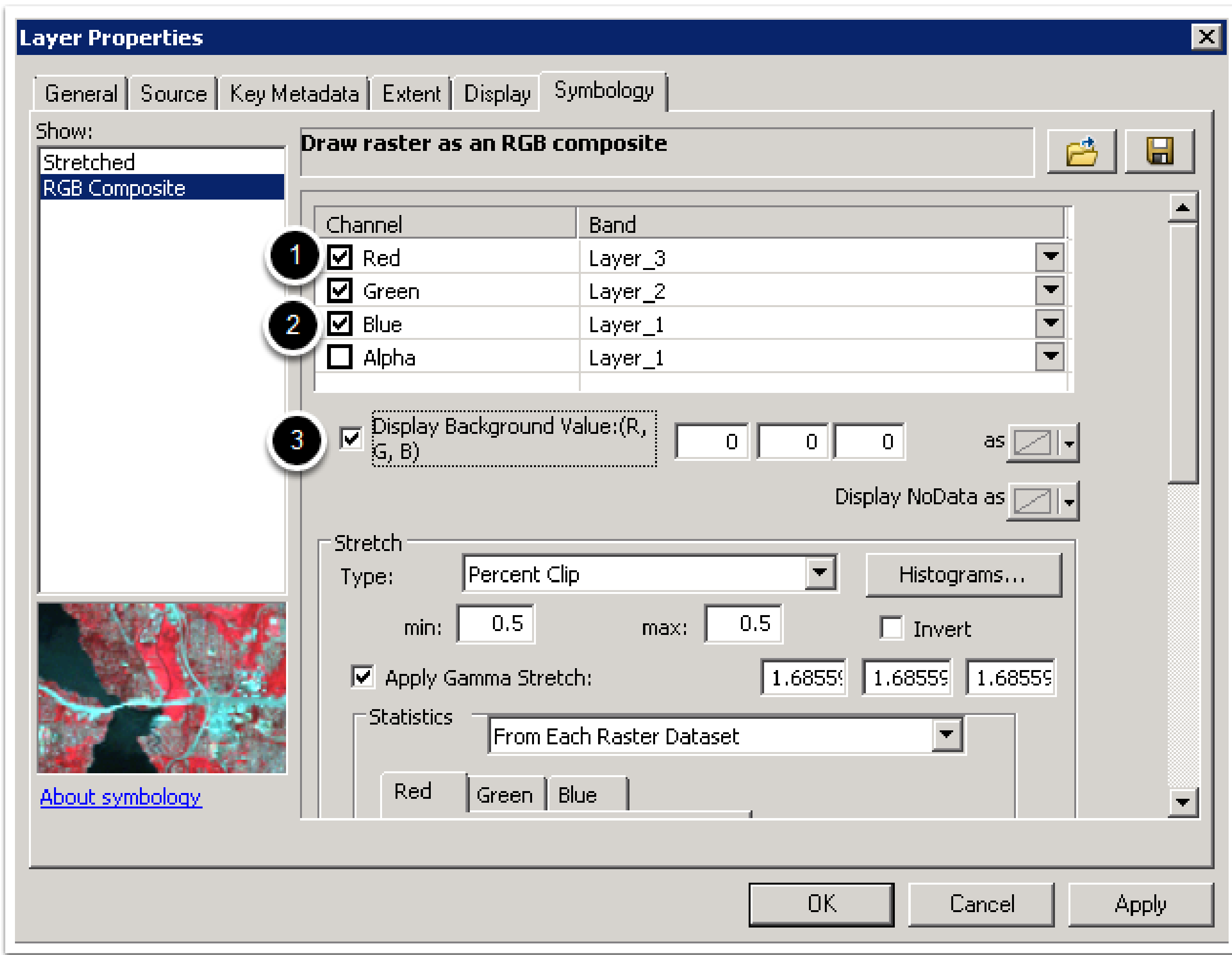


1.2 Setting the colors

That's correct! It's in symbology. Right click on your *Imagery_2011* and go to *Properties*, then go to the *Symbology* tab. Since blue is on the lower side of the electromagnetic spectrum, and red deals with longer wavelengths and Landsat bands go in order of short to long, we'll have to flip ArcGIS's default behavior.

1. Click on the *Red* channel and switch the image *Band* it is using to *Layer_3* using the dropdown menu.
2. Switch the *Blue* channel to *Layer_1*.
3. Finally, in order to get rid of the background's black color, click the checkbox next to *Display Background Value(R,G,B)*and leave it as 0,0,0 and the *as color* box as transparent.

Click OK to save your changes, then zoom out.



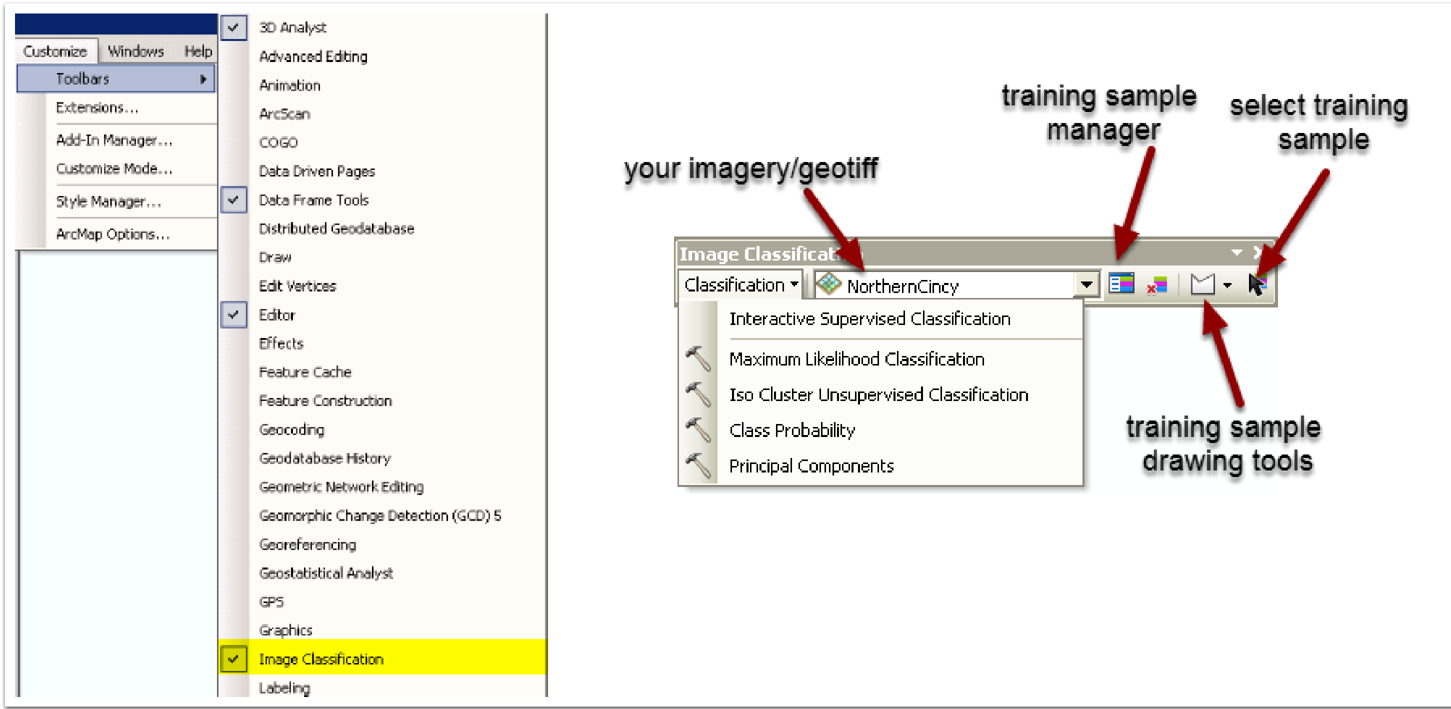
1.3 Repeat

Now that you've corrected the 2011 imagery, do the same thing for *Imagery_2014.*

Before proceeding, make sure you understand why we chose the band/channel alignments that we did - what does this information mean?

2. Introduction to the Imagery Classification Toolbar

Enable Image Classification toolbar and explore some of its features:

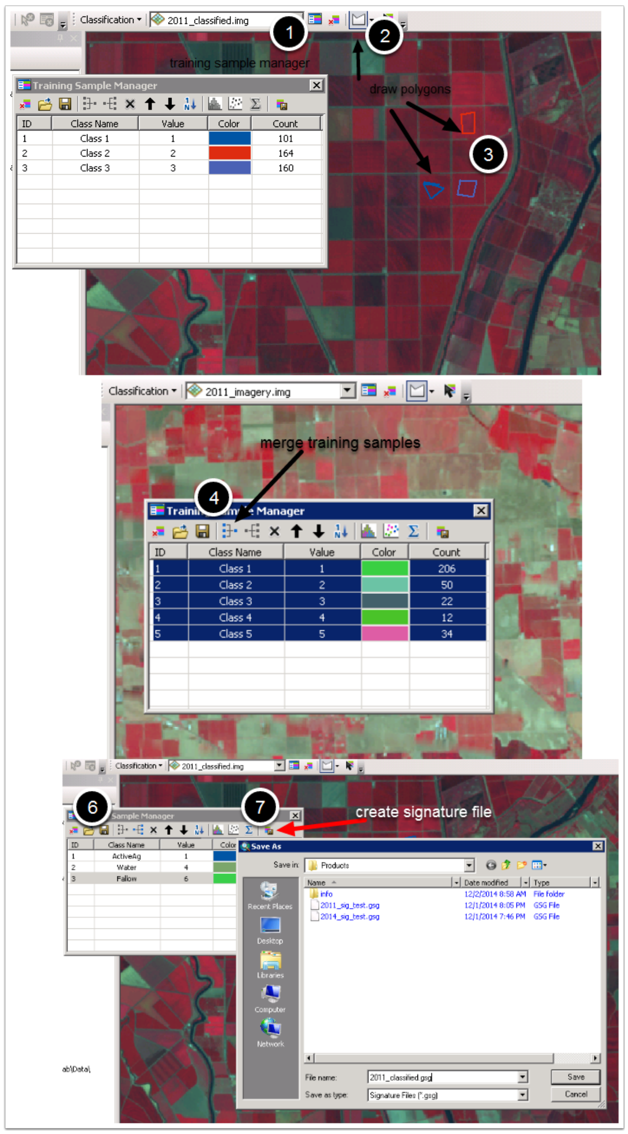


3. Digitize Training Polygons

Using the imagery, you will create polygons that represent several land classes. You will use these to tell ArcGIS which pixel values are water, active agriculture and fallowed land.

1. Open the Training Sample Manager on the Image Classification toolbar.
2. Use the Draw Polygons tool to draw a polygon in an area you know is active agriculture. This doesn't have to be an entire field, just a small, representative area.
3. Draw additional polygons that represent active agriculture. Pan around for other fields to ensure your polygons represent the all the agriculture in your imagery. Continue doing this until you feel that the active agriculture in the imagery is adequately represented in your class. What are we training ArcMap to do here?
4. Select all polygons you have created and use the Merge Training Samples tool to merge all your agriculture polygons into one class. Rename the class "ActiveAg".
5. Repeat this process for two additional land classes: water and fallowed land. Don't worry about urban areas or vegetation in the foothills, we will account for this later.

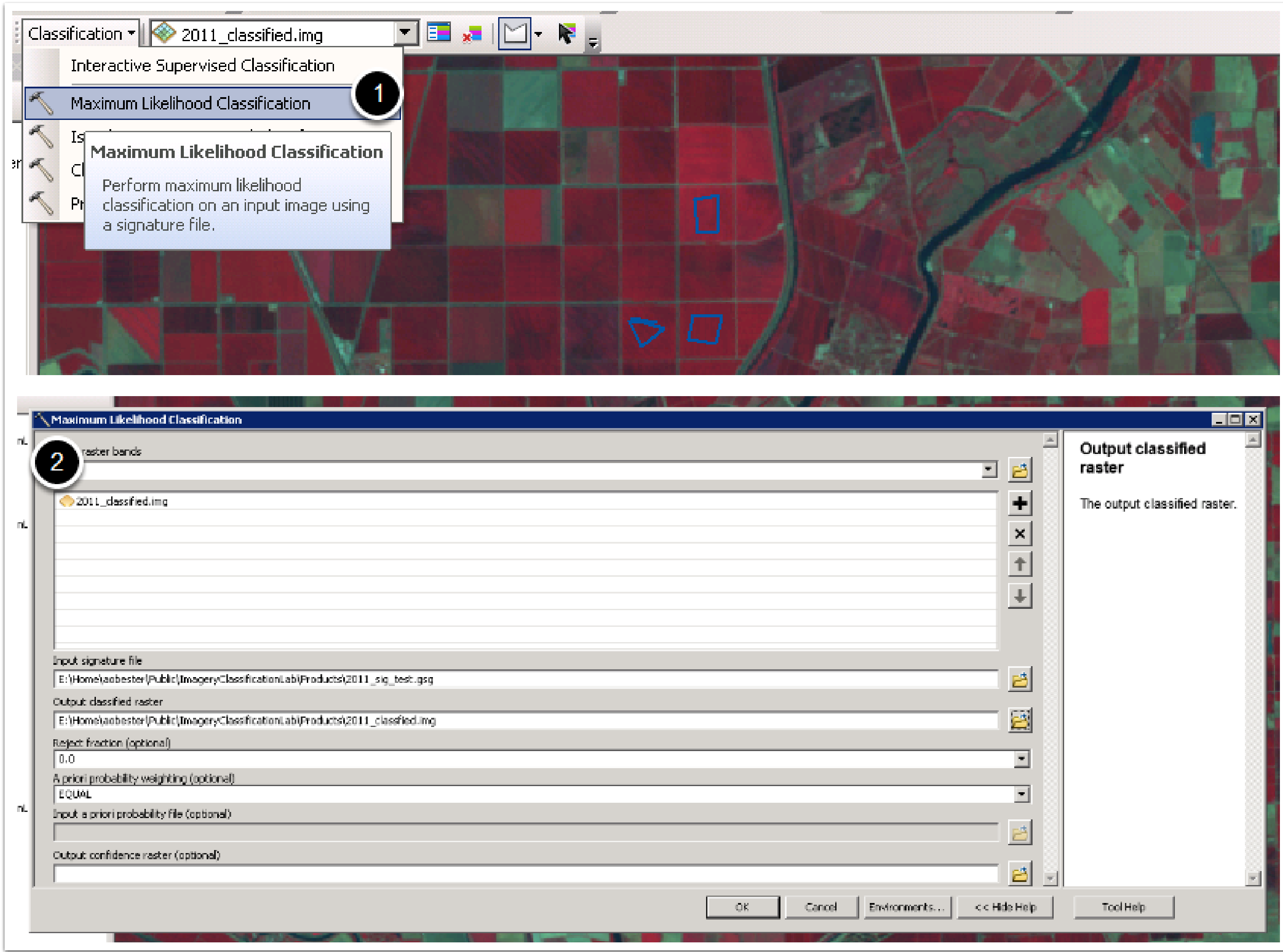
6. Select the Save Training Samples icon and save your samples as a shapefile.
7. Select the Create a Signature File icon from the Training Sample Manager and save your signature file.



4. Run Supervised Classification

ArcGIS will find all pixels that have similar reflectance characteristics and assign them to one of your classes.

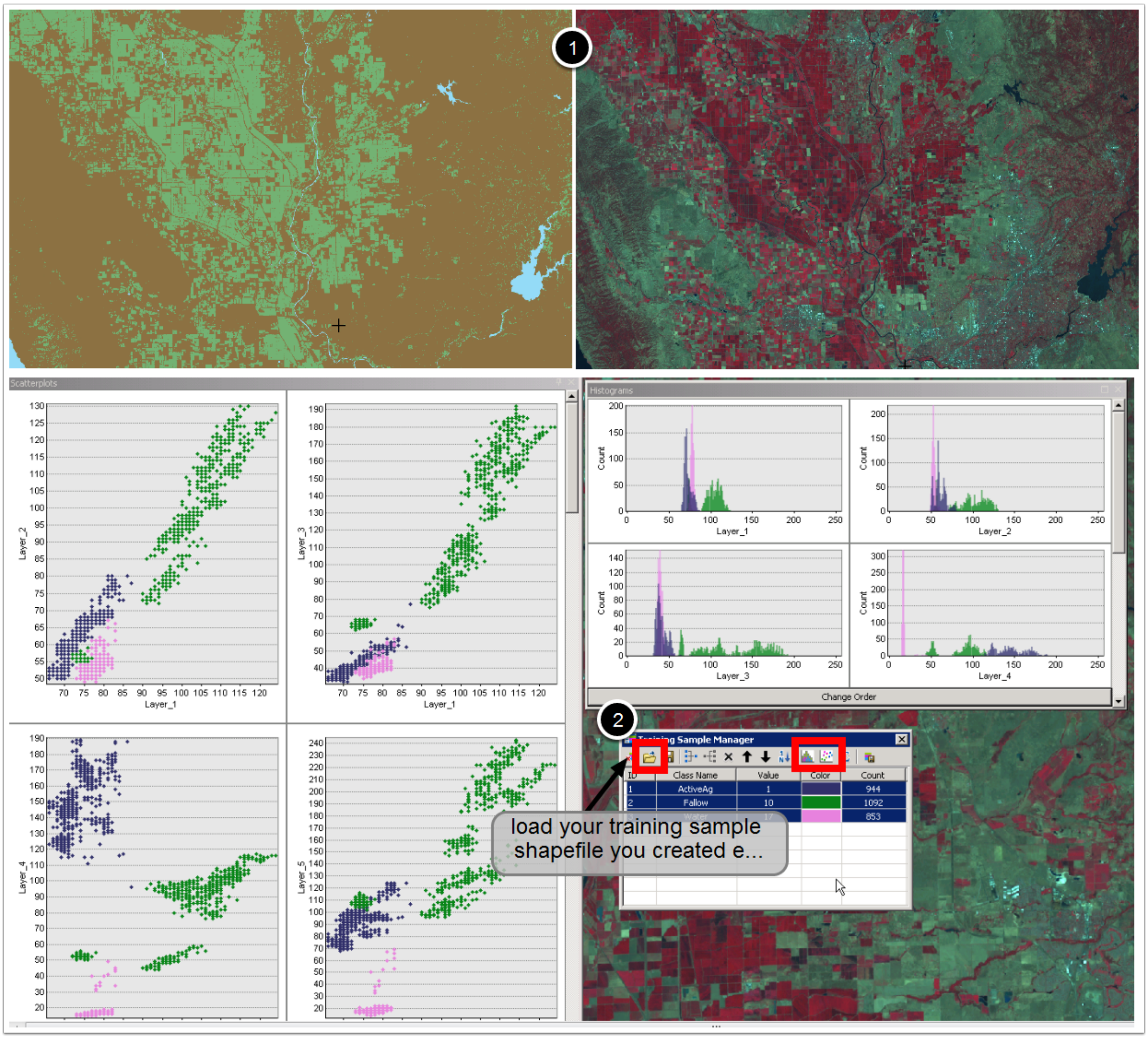
1. From the Image Classification toolbar, select Maximum Likliehood Classification tool. Your input raster bands will be your 2011 imagery and your input signature file will be what you just created. Accept the default parameters and run the tool.



5. Assess, Repeat, Analyze

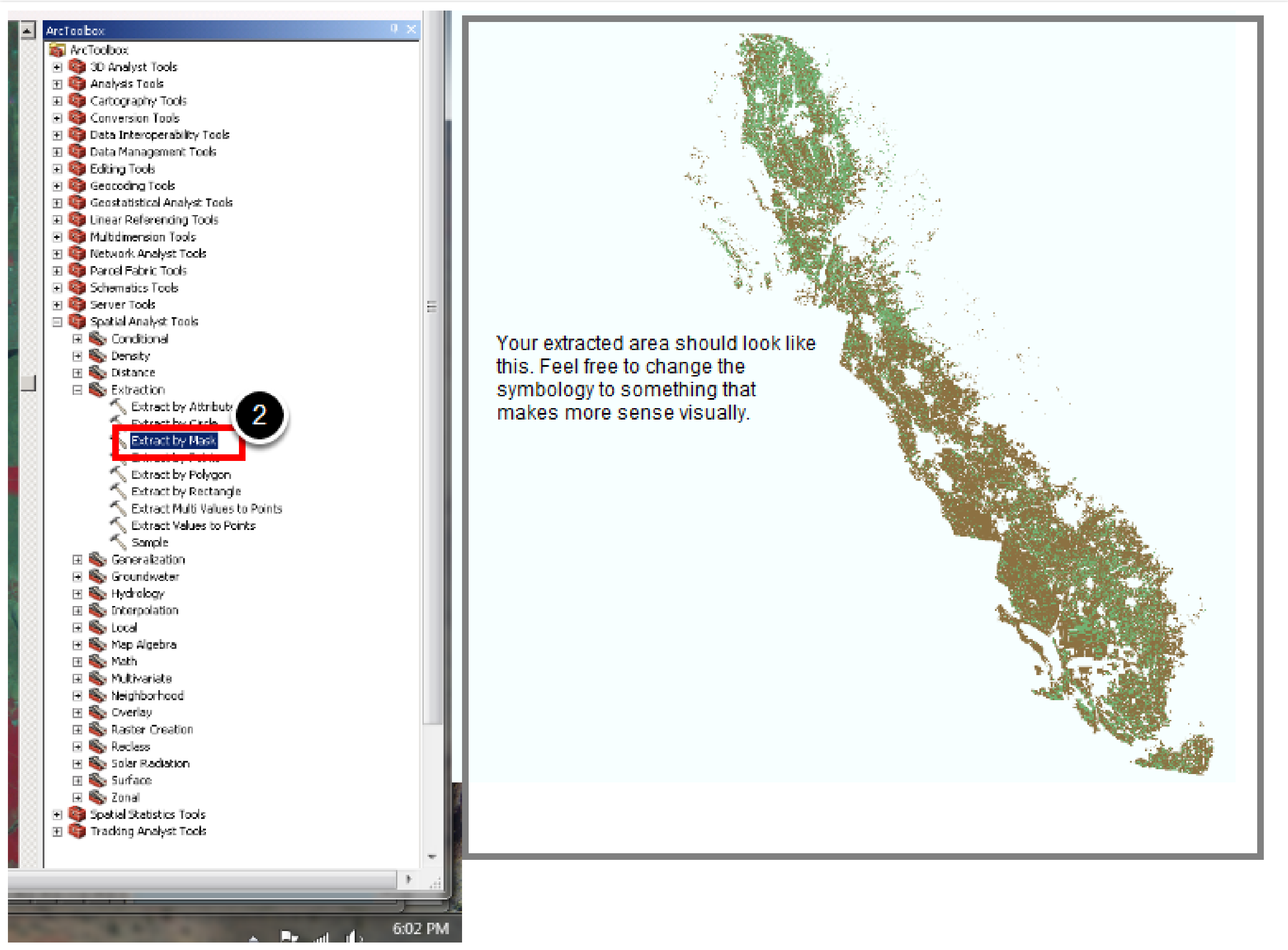
1. Visually compare results of the classifier to the original imagery. Where was the classifier inaccurate? Does it mistake fallowed land for ag land? What about urban areas? What does each pixel value represent in your classified image?
2. Reopen the training sample manager, load your training sample shapefile you created earlier, and select all of your classes. Open the historgram and scatter plots. Are there areas of overlap between the classes?

3. Given the accuracy of your results, you may want to modify your signature file by altering your classes or by creating a new signature file.
4. Repeat the process above; create a signature file and classify the 2014 imagery.



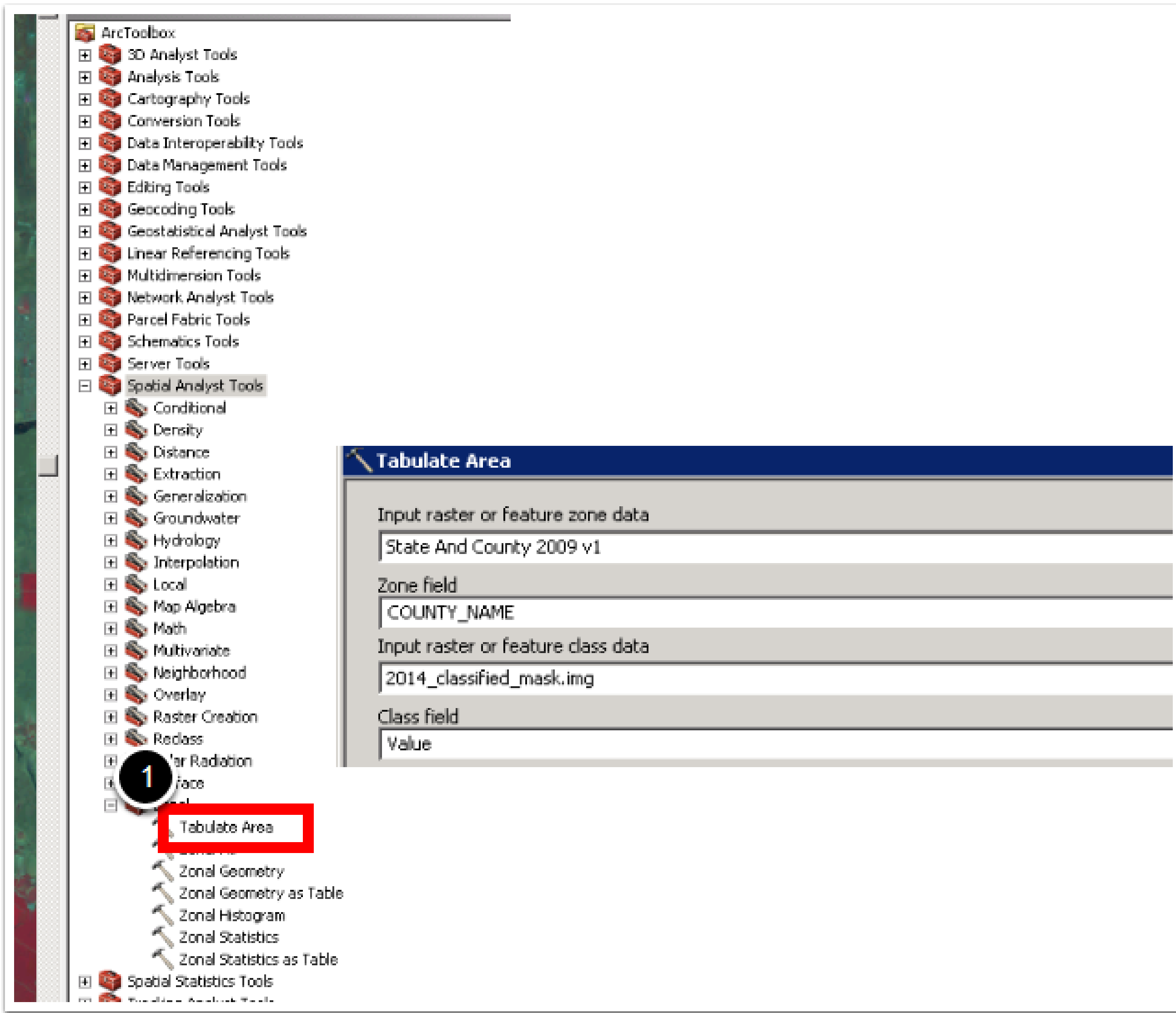
6. Mask Non-Ag Areas

1. Add DWR_Ag_Areas.shp and State_and_County.shp from the Data folder.
2. Use the Extract by Mask tool to mask out all areas of our classified 2011 image that are not agriculture. Repeat for the 2014 classified image. What is the purpose of masking out these non-ag areas?



7. Tabulate Area

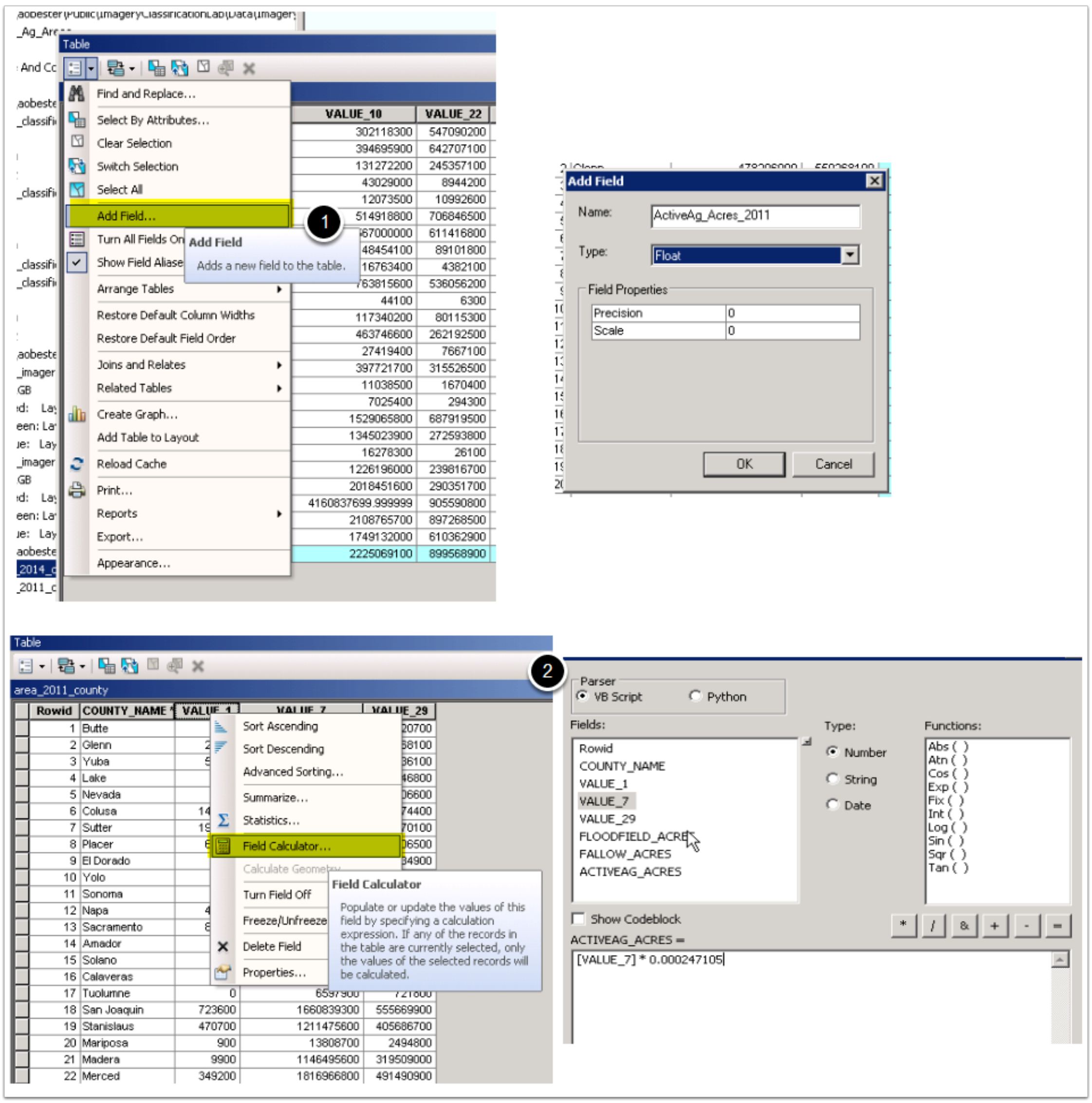
1. Use Tabulate Area tool to summarize the area of different land classes by county (in each year) for your classified mask. Use State_and_County.shp as your Feature Zone Data and COUNTY_NAME as your Zone Field.



8. Calculate Area in Acres

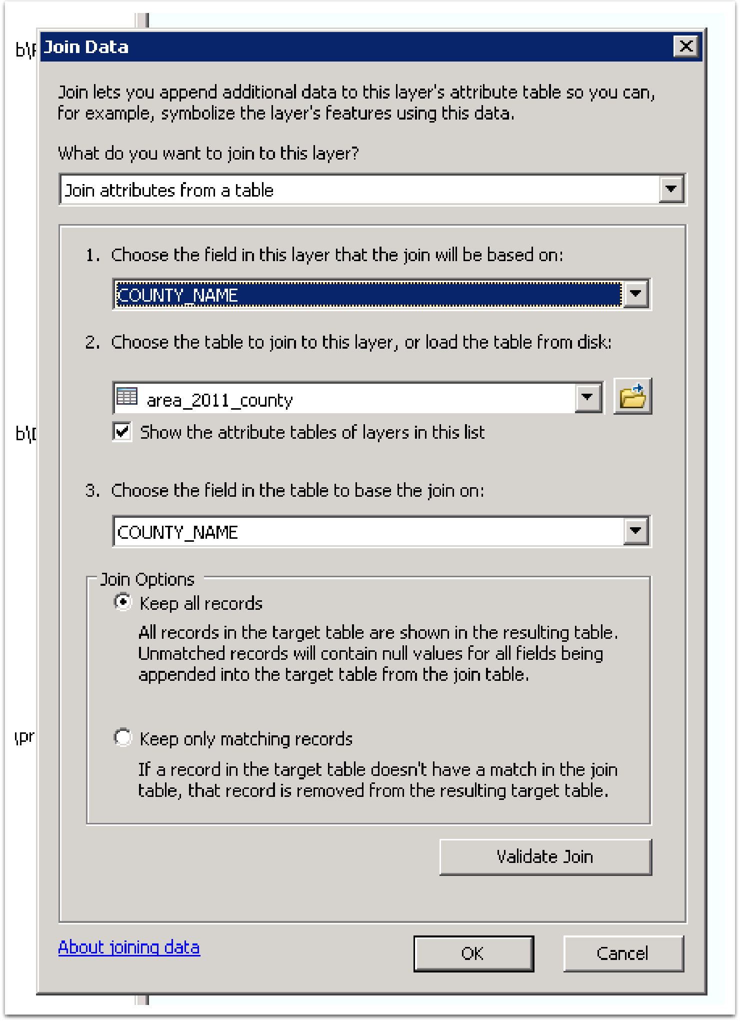
You will now use the Field Calculator to compare land cover across time in acres (alternatively, you can export your tables and do the following in Excel).

1. Open the table for the 2011 data you just created and add three new fields: ActiveAg_Acres_2011, Fallow_Acres_2011, and FloodFields_Acres_2011. Repeat this for the table with the 2014 data.
2. Open the 2011_Area table, and right click on the FloodField_Acres_2011 column you just created and select Field Calculator. Select the value in your table that corresponds to your active ag count (this should be the first column with values). Multiply this value using the "*" by 0.000247105 to convert your count from meters squared (the map units) to acres. Repeat this for the other two fields in your 2011 table, and for the data in the 2014 table.



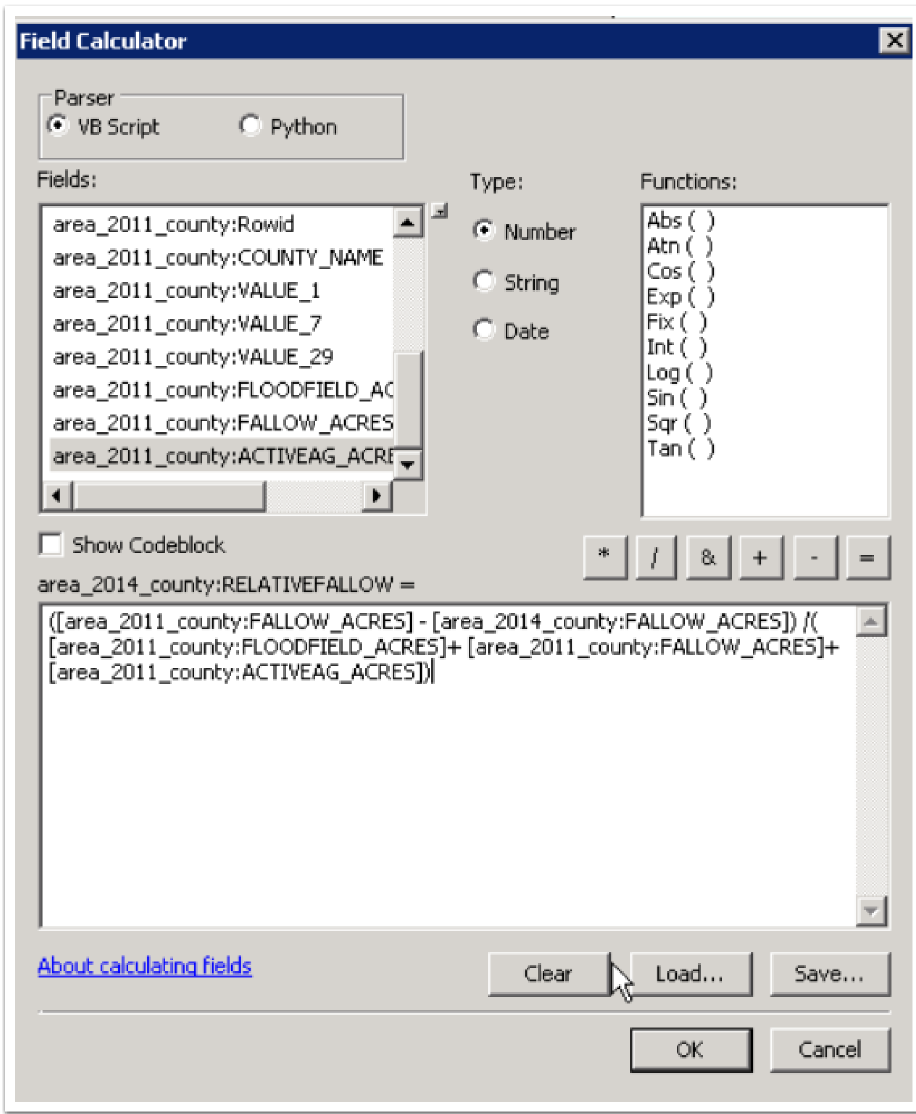
9. Join 2011 and 2014 Tables

1. Join the 2011 table to the 2014 table based on the field COUNTY_NAME.



10. Calculate Relative Fallowing from 2011 to 2014

1. Open the 2014 table and add a new field called "RelativeFallow".
2. Use the Field Calculator to determine relative land fallowed from 2011 to 2014 for each county. Relative = (2011 fallow land - 2014 fallow land) / base acreage 2011. Has a significant amount of ag land gone fallow as a result of the drought?



11. Conclusion

Limitations

- Resolution of imagery
- What about ground truthing?
- Others?

Other Methods

- Unsupervised classification
  - User only identifies number of classes and which bands should be used, ArcGIS does the rest

- Interactive supervised classification tool
  - User creates several training samples but no signature file
  - Enables user to preview classification result without having to run the Maximum Likliehood Classification tool each time

- Accuracy assessment and confusion matrices
  - Compiles error matrix to compare known values to random points in classified image to determine accuracy of classification

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