**AppLCC Workshop**

**Cave and Karst Resources Case Study**

**Theme:** Given our limited resources, how can I make the best investment now, to protect resources into the future?

**Question:**

What cave-limited species habitat areas in the Southeastern United States are at highest risk due to potential ground water contamination from agricultural sources, namely from pesticides, herbicides, and fertilizers? (For this exercise, we will be looking at predicted Amphipod habitat.)

**Data Layers:**

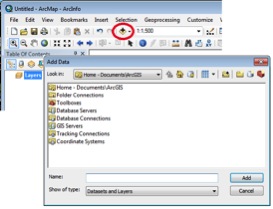
1. Cave and Karst Biota Modeling in the Appalachian LCC - Predicted Amphipods in all 20km grid cells in karst
2. EnviroAtlas - Percent Agricultural Land Cover for the Southeastern United States
3. EnviroAtlas - Manure application to agricultural lands from confined animal feeding operations by 12-digit HUC for the Southeastern United States, 2006

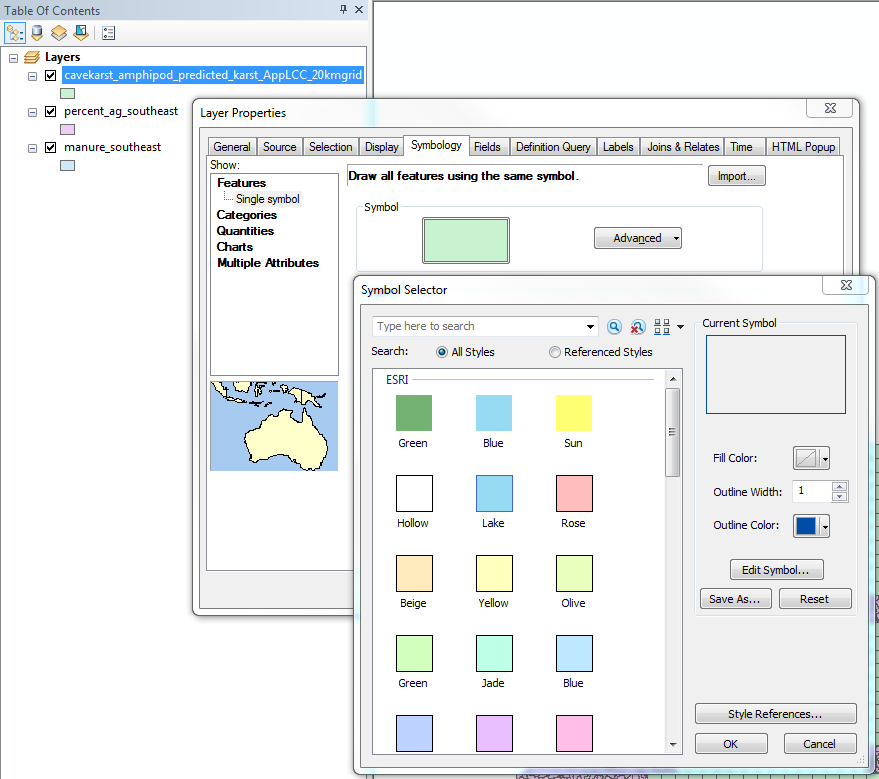
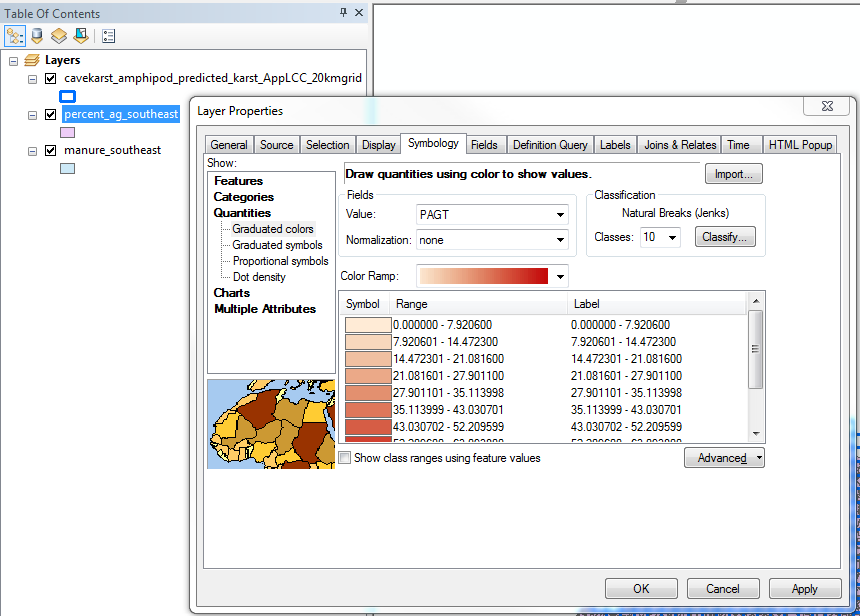
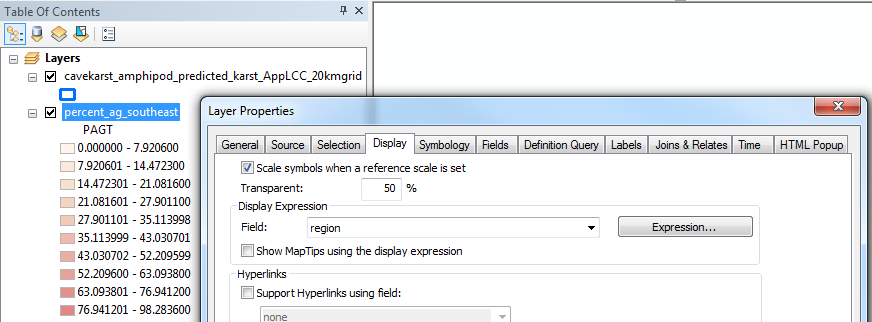
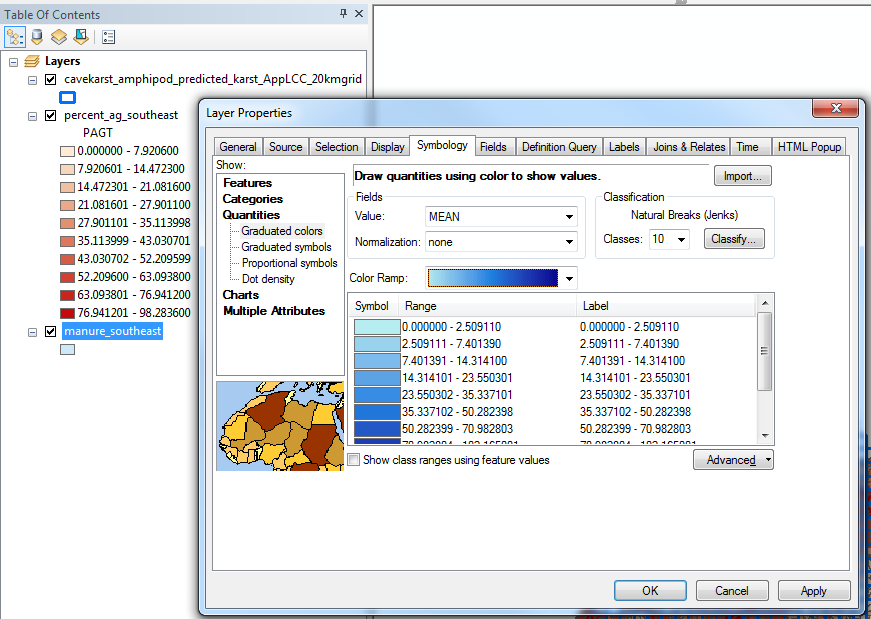
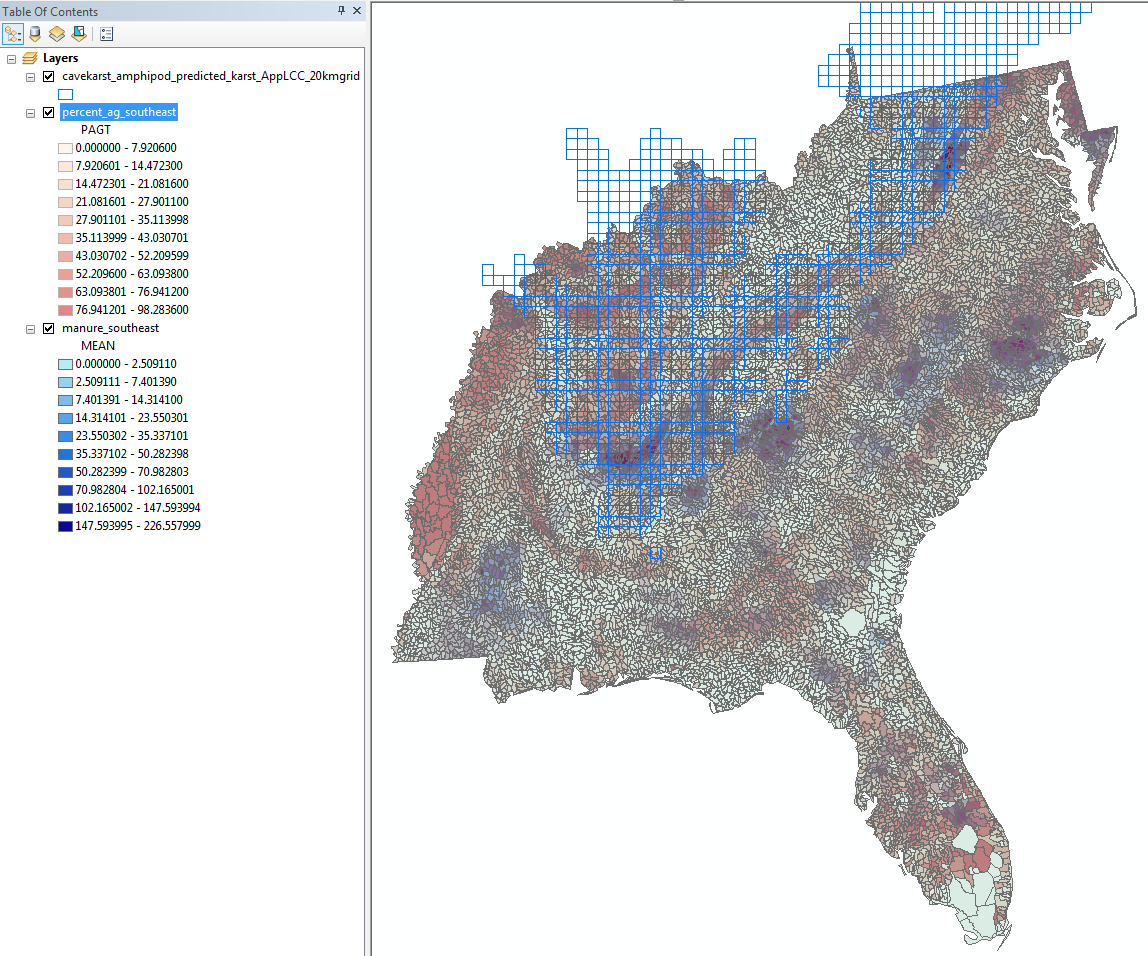
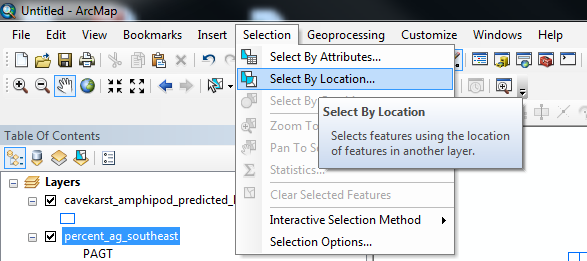
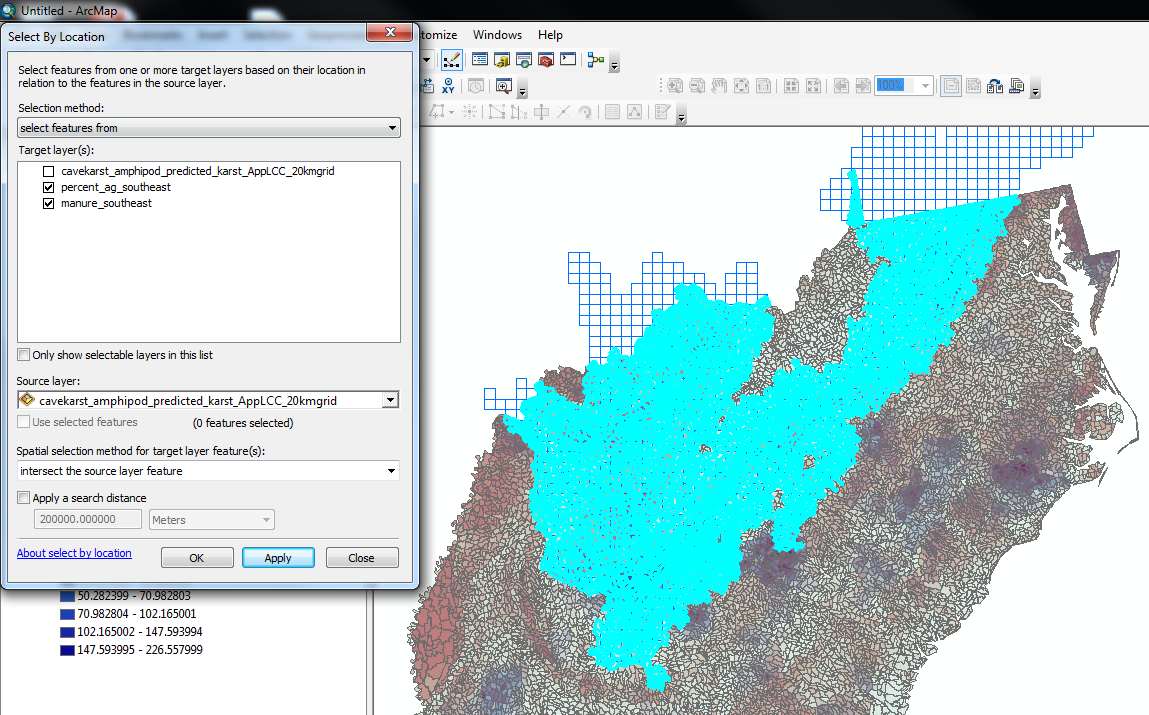
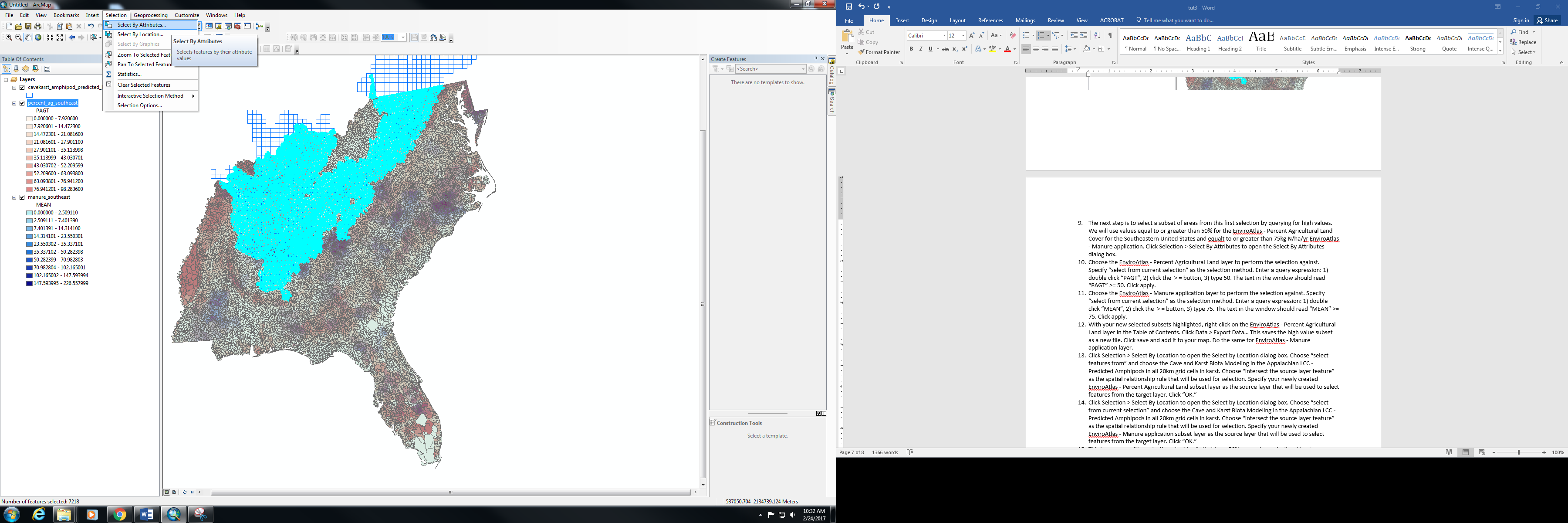
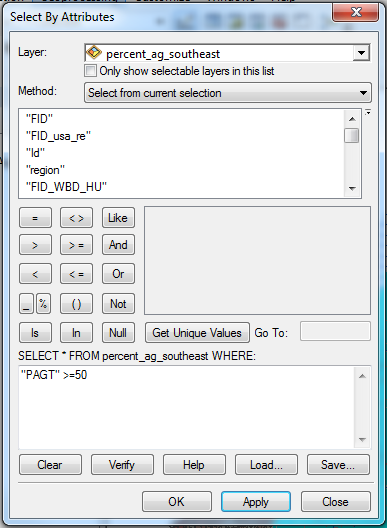
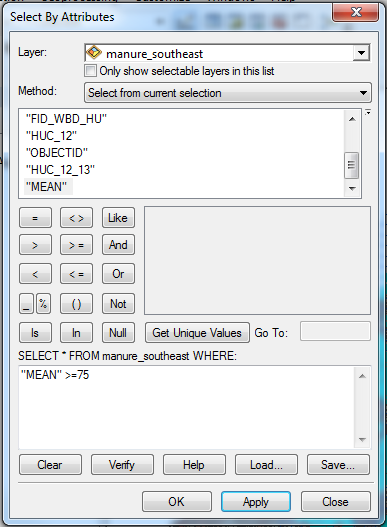
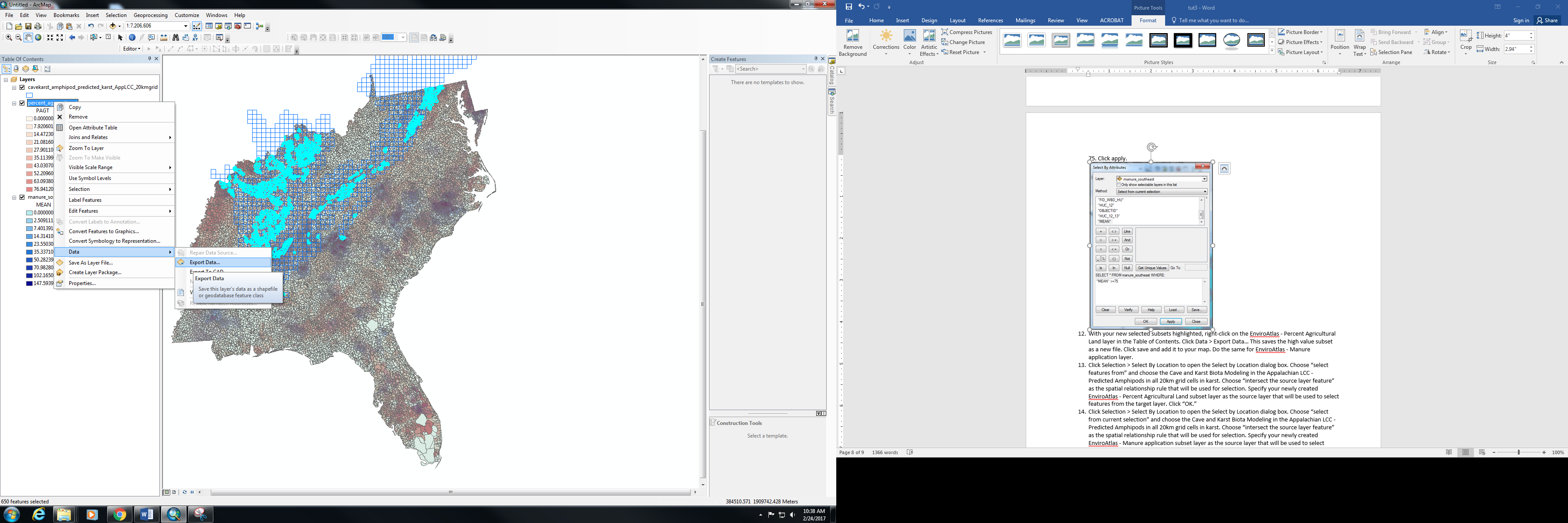
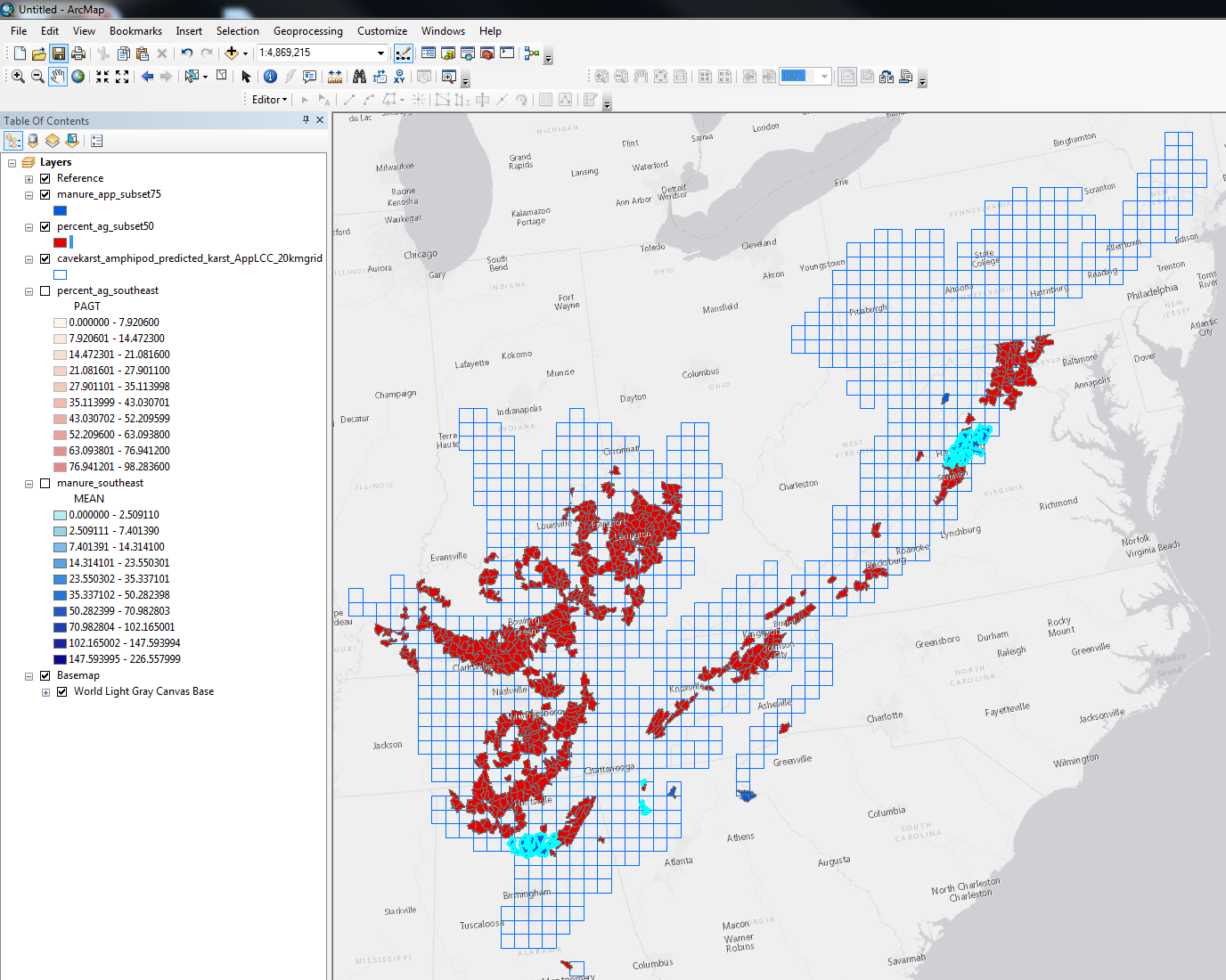
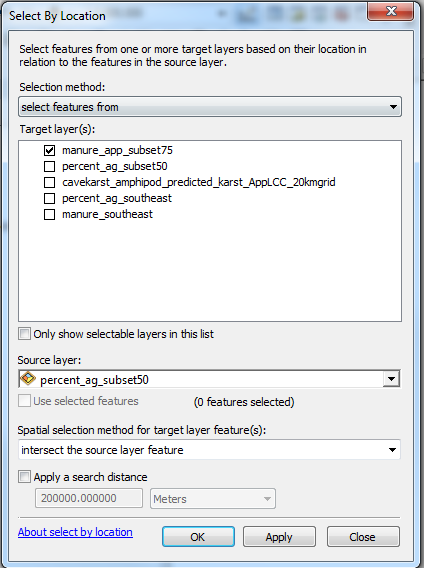
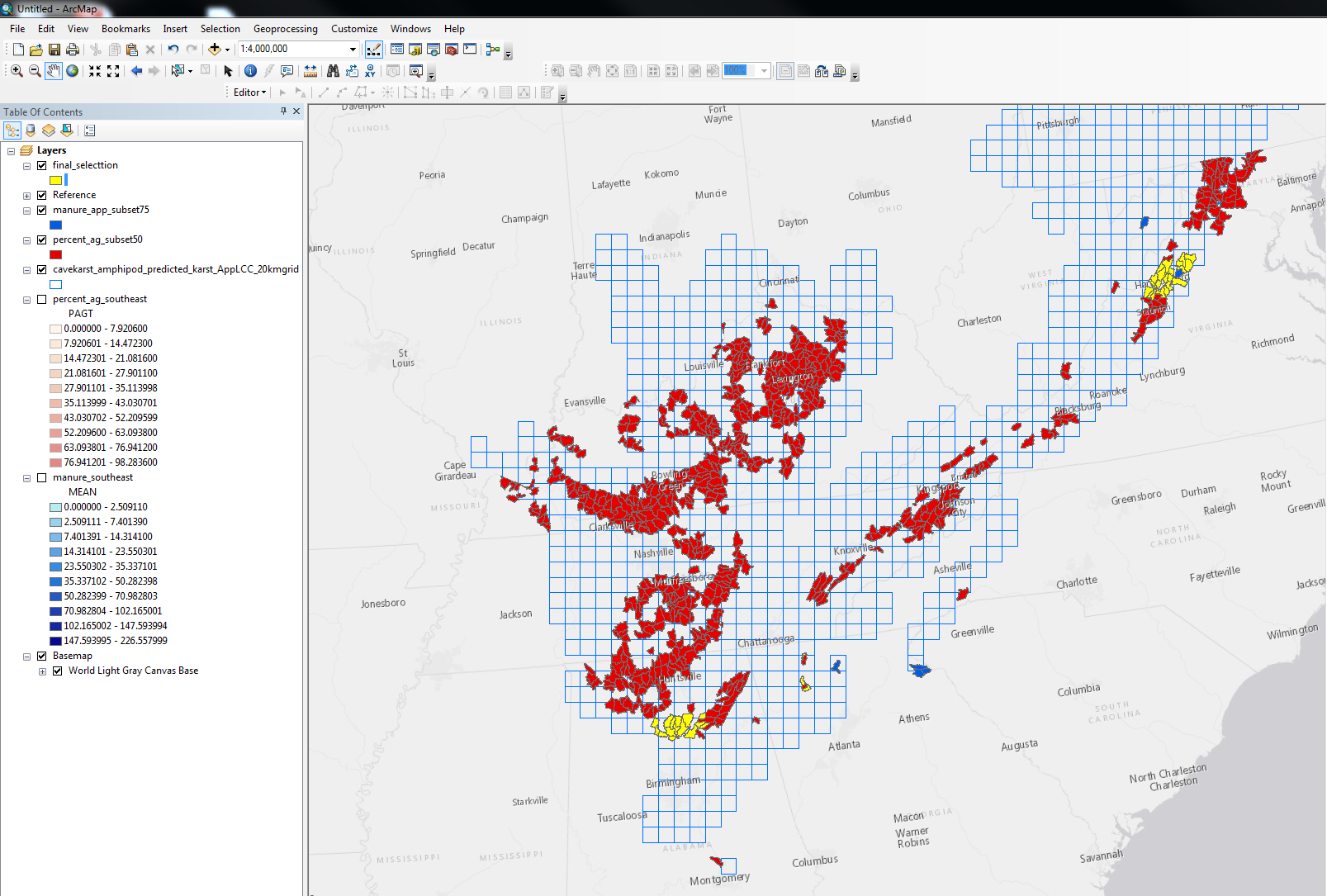
Data layers can be downloaded here: <https://applcc.databasin.org/datasets/> and searching by keyword.

**Potential Solution:**

This analysis can be completed by using ArcGIS (or other compatible GIS software). The instructions provided below are for ArcGIS.

1. Download data layers. Unzip the compressed file. It may be necessary to unzip the ArcGIS Layer Package, also, if the data is compressed in that format.
2. Open ArcGIS
3. Add the data layers by clicking File > Add Data… and navigating to the location you saved the data layers. Select the files individually, or all at once by holding down the control key and clicking all three layers. Alternatively, you can add data using the Add Data icon.



1. Organize your layers to that the amphipod grid is the top layer. Double-click on the Amphipod layer and change the symbology so that it has no fill and the lines in color. 
2. Change the symbology of the percent\_ag layer so that it displays **quantities** as **graduated colors** using the “PAGT” value as a red color ramp with 10 classes. Set the transparency to 50%. Setting transparency allows us to see the values of the layer(s) beneath it.   
     
   
3. Change the symbology of the manure layer so that it displays **quantities** as **graduated colors** using the “MEAN” value as a red color ramp with 10 classes. 
4. Your map should look like this: Note that the darker blue areas (high values) of the manure application layer show through the percent agriculture layer. This gives a rough idea of where high-high values of percent agriculture and manure application are.
5. The next step is to refine the prioritization. For this example, the objective is to identify habitat areas which are more at risk to prioritize conservation efforts. To do this we will find the habitat grid cells that have high percentages of agricultural land cover and high rates of manure application. Note that the data sets do not overlap completely, as the karst region extends farther north than the EnviroAtlas data., so our analysis is confined to the Southeastern U.S.
6. Click Selection > Select By Location to open the Select by Location dialog box. Choose “select features from” and choose the EnviroAtlas - Percent Agricultural Land Cover for the Southeastern United States and EnviroAtlas - Manure application to agricultural lands from confined animal feeding operations. Choose “intersect the source layer feature” as the spatial relationship rule that will be used for selection. Specify “Predicted Amphipods in all 20km grid cells in karst” as the source layer that will be used to select features from the target layer. Click “OK.” 
7. The next step is to select a subset of areas from this first selection by querying for high values. We will use values equal to or greater than 50% for the EnviroAtlas - Percent Agricultural Land Cover for the Southeastern United States and equal to or greater than 75kg N/ha/yr EnviroAtlas - Manure application. Click Selection > Select By Attributes to open the Select By Attributes dialog box.  
    
8. Choose the EnviroAtlas - Percent Agricultural Land layer to perform the selection against. Specify “select from current selection” as the selection method. Enter a query expression: 1) double click “PAGT”, 2) click the > = button, 3) type 50. The text in the window should read “PAGT” >= 50. Click apply.  
    
9. Choose the EnviroAtlas - Manure application layer to perform the selection against. Specify “select from current selection” as the selection method. Enter a query expression: 1) double click “MEAN”, 2) click the > = button, 3) type 75. The text in the window should read “MEAN” >= 75. Click apply.  
    
10. With your new selected subsets highlighted, right-click on the EnviroAtlas - Percent Agricultural Land layer in the Table of Contents. Click Data > Export Data… This saves the high value subset as a new file. Click save and add it to your map. Do the same for EnviroAtlas - Manure application layer. You can add a base map for spatial reference.  
    
11. Click Selection > Select by Location to open the Select by Location dialog box. Choose “select features from” and choose the newly created manure application subset. Choose “intersect the source layer feature” as the spatial relationship rule that will be used for selection. Specify your newly created percent agriculture land subset layer as the source layer that will be used to select features from the target layer. Click “OK.” Right-click on the newly created manure application subset file, choose Data > Export Data… and save these selected watersheds as the final high-high values selection.  
    
12. This leaves you with a selection of watersheds that have 50% or greater agricultural land cover AND 75kg N/ha/yr or greater manure application. 

These resulting watersheds (and thus amphipod habitat) are at higher risk to groundwater contamination from agricultural sources.

**Summary**

In this case study activity, we have incorporated three data layers and have significantly reduced the areas being considered to identify the highest priority areas for potential groundwater contamination due to agricultural practices. Other areas not identified may still be at risk, but are not considered the highest priority. This is just one example of how data for the Conservation Planning Atlas can be used to prioritize areas for conservation. Based on organization priorities, different layers may be incorporated using a similar approach.