New Mexico Pan Evaporation
CE 547 | Assignment 2 | Writeup
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Inserting data, symbols, and labels

After beginning a new map, naming it and editing the metadata, importing the PanEvap and CountyData shapefiles, I chose a base map (Add data button – Add basemap…). Though I changed the basemap several times through the assignment, I settled on one that showed some landscape features but was not too distracting. By ungrouping the basemap layer (Right click – ungroup), I was able to identify and hide the default labels and wordage that accompanied the basemap.

Opening the PanEvap layer properties and clicking the Symbology tab allowed me to create a graduated symbol for each data point (Fig 1). Because heat and solar radiation are some of the factors causing evaporation, I chose an orange circle as the symbol. This also served as a base for the color scheme used throughout the assignment. I created 6 classes, with equal breaks of evaporation values 10 inches apart, as I felt this was easiest to interpret by a reader. With the symbols graduated linearly, the breaks of 10 inches apart is mainly for the viewer's benefit as it does not actually alter the points themselves. I ended up choosing a symbol size range of 10 pts – 20 pts, as this gave the symbols enough distinction to be interpretable, while maintaining a similar ratio to their actual values. One issue that arises is that the area of a circle grows at the square of the symbol size, potentially resulting in a misleading display, but I did not address this in this exercise.
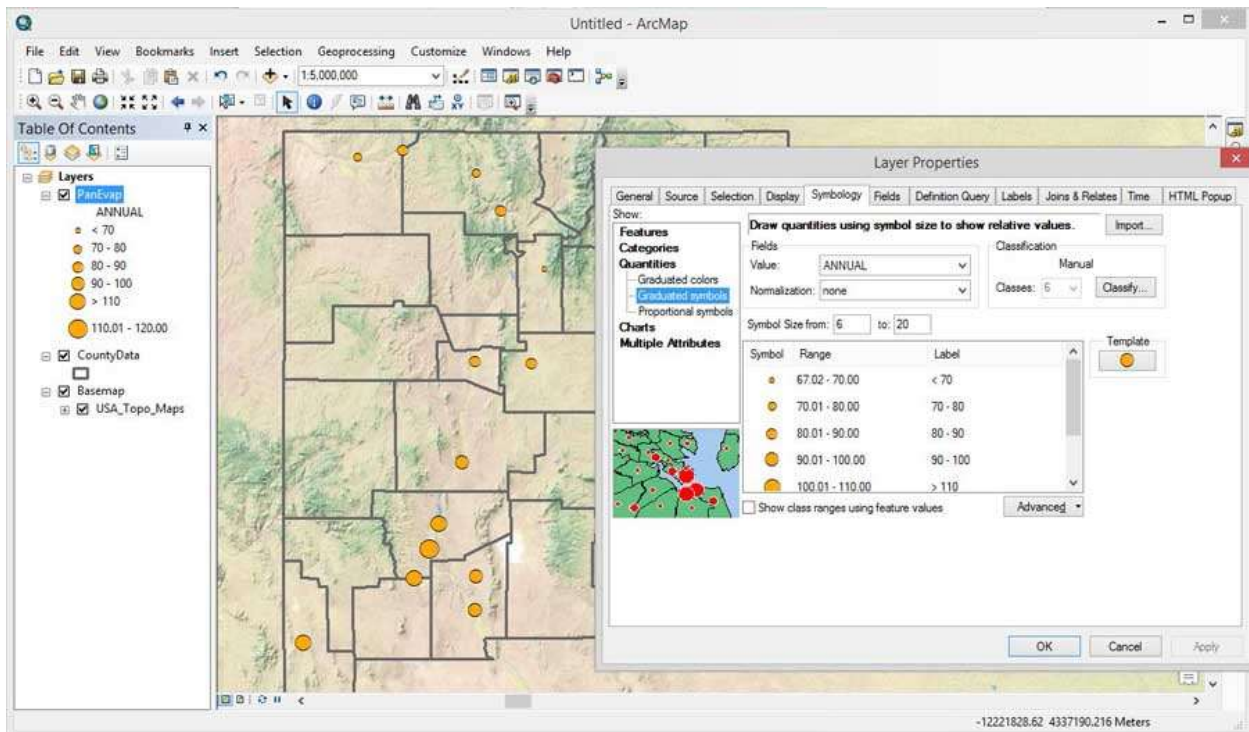

Figure 1. Symbology of PanEvap data points

Using the Labels tab, and using STAIOn_NAM as the label field, I inserted Station Name labels with a desired typeface and size, and created a 2 pt halo around the text for legibility. I experimented with the placement rules (Placement Properties…), but I could not find a rule that was desirable. In order to manually place the labels, I right clicked on the PanEvaporation data layer, and chose Convert Labels to Annotation, and selected "in the map." This converted the labels to graphical objects on the map, but decoupled them from the label properties (Fig 2). While this allowed me to

manually move each label, in the end it was a frustration as their placement in data view did not correlate well to layout view, and each label had to be manually selected in order to change its size and font.

By right clicking on the CountyData layer and opening its properties, I created simple outlines of the New Mexico counties.
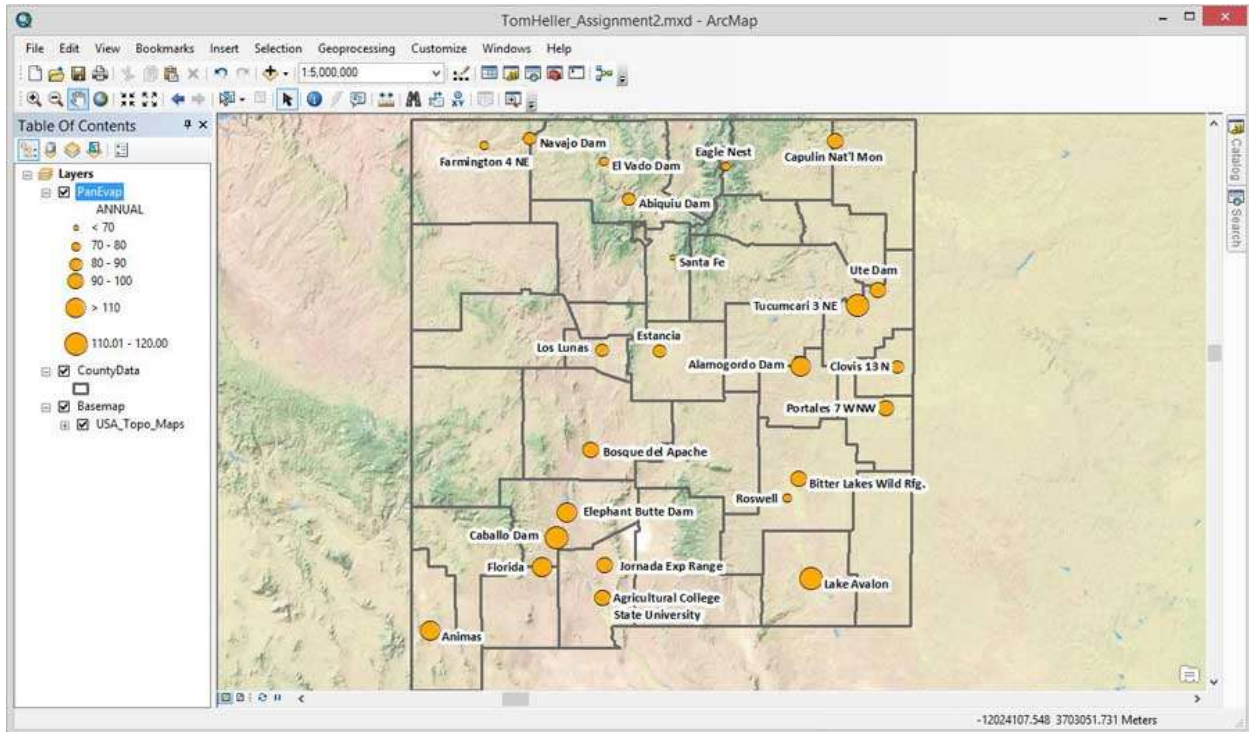

Figure 2. Map with labels added

Creating map items

In layout view, selecting Insert > Legend… opened the legend wizard, where I selected PanEvap as the dataset to be used. Once the legend was inserted, right clicking on the legend allows me to open its properties to change its appearance and wording (Fig 3).
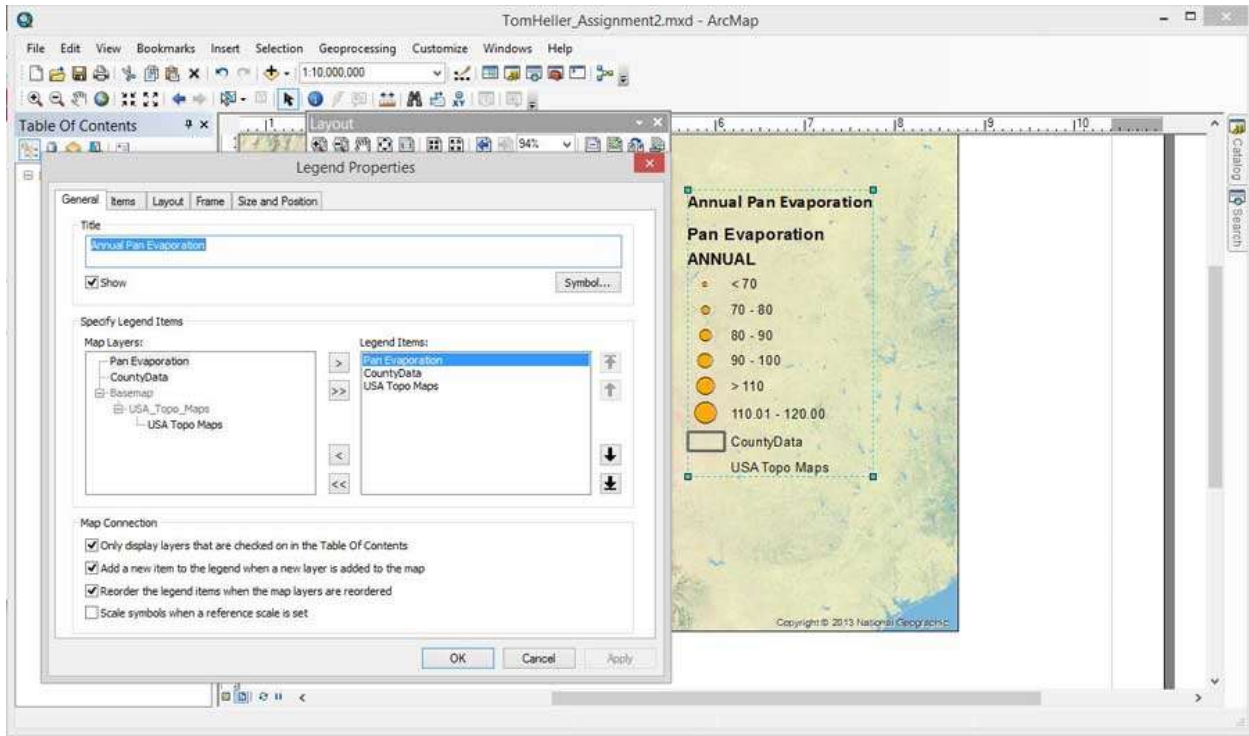
Figure 3. Legend properties window

The same dropdown menu allowed me to insert a scale bar and north arrow, with plans to rearrange and edit these items later for the final layout.

To create an area of extent map, I needed a suitable map of the United States. For the map, I created a new data frame which I called USA, positioned the frame in layout view, activated it, and added the USstates.shp shapefile from a textbook training exercise (Fig 4).
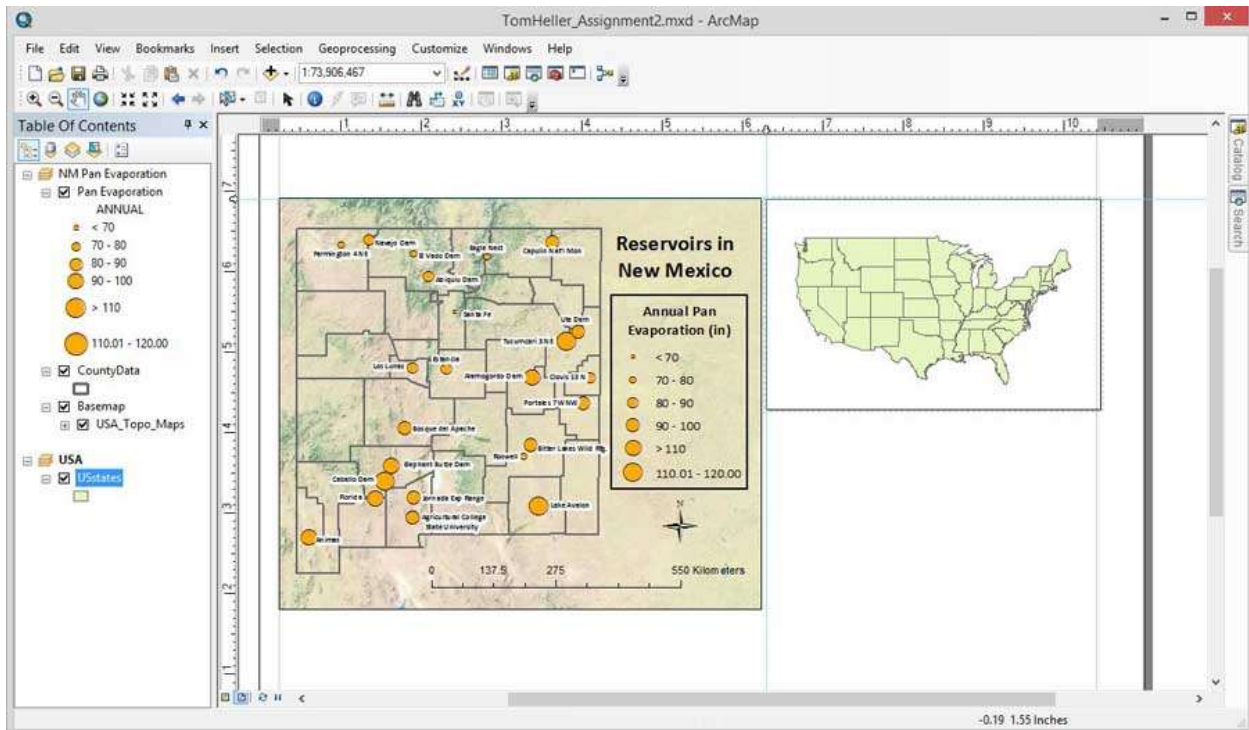

Fig 4. Data frame and map to be used as an area of extent map.

I opened the attribute table by right clicking on the USstates layer, and selected New Mexico. With the state still selected, I right clicked on the layer again, and selected Selection > Create Layer From Selected Features (Fig 5). This created a new layer consisting of the shape of New Mexico, and placed it above the USstates layer. This allowed me to color and highlight the state of New Mexico to distinguish it from the USA. Afterwards, I changed the shape, color, and outline of the data frame so I could use it as a background to the map legend.
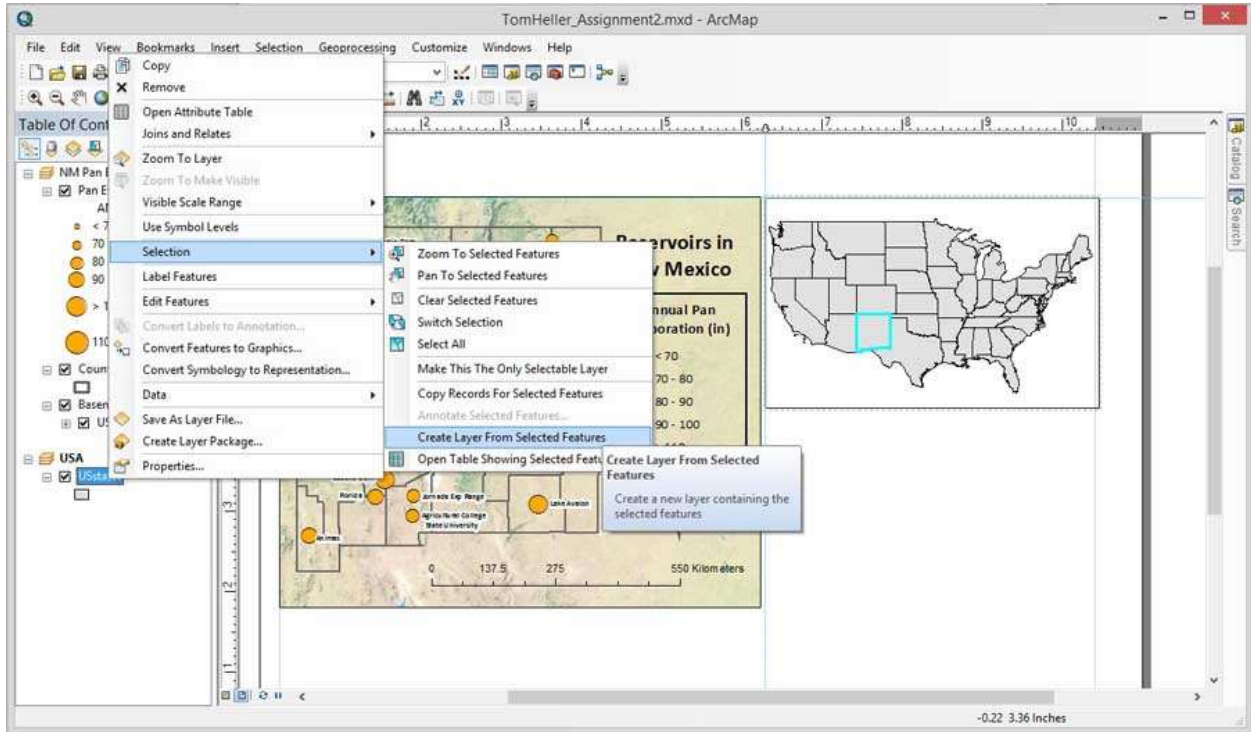

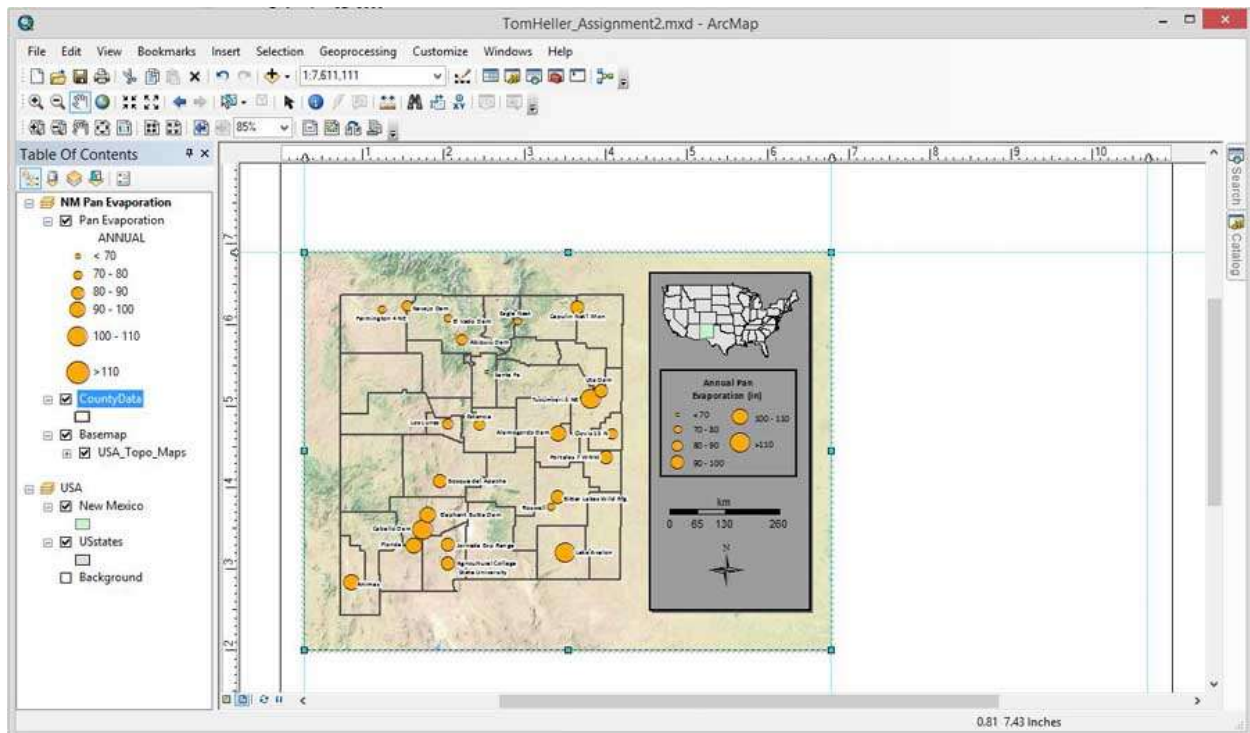Figure 5. Creating the Area of Extent map by bringing the state of New Mexico to a new layer.

Figure 6. Adjusting the size, background, and layout of the USA data frame to create a legend box

Adding Graphs

I wanted to add a series of graphs showing the monthly pan evaporation in a histogram for several different sites. However, the data in the PanEvap shapefile seemed to not be organized in a way to allow this. I'm sure the data could be manipulated, so that monthly data could be used in this manner, but I am as of now unaware of how to do that. Instead, from the layer's attribute table, I copied the data for specific sites, and pasted it into an Excel spreadsheet. I chose four sites that have a good range of annual evaporation, landscape, and geography across the state.   Inside Excel, I was able to create histograms for these four sites (Fig 7) and copy-paste them into the layout view in ArcMap (Fig 8). By keeping all the graph sizes consistent in both Excel and ArcMap, the axis bars collectively lined up so I only had to use one vertical axis label, both to save space and make it look cleaner. In ArcMap, ruler guides were used to assist with consistent layout of the objects. By selecting all the graphs, right clicking, and selecting Distribute > Distribute Horizontally, they were placed at equal intervals from each other.
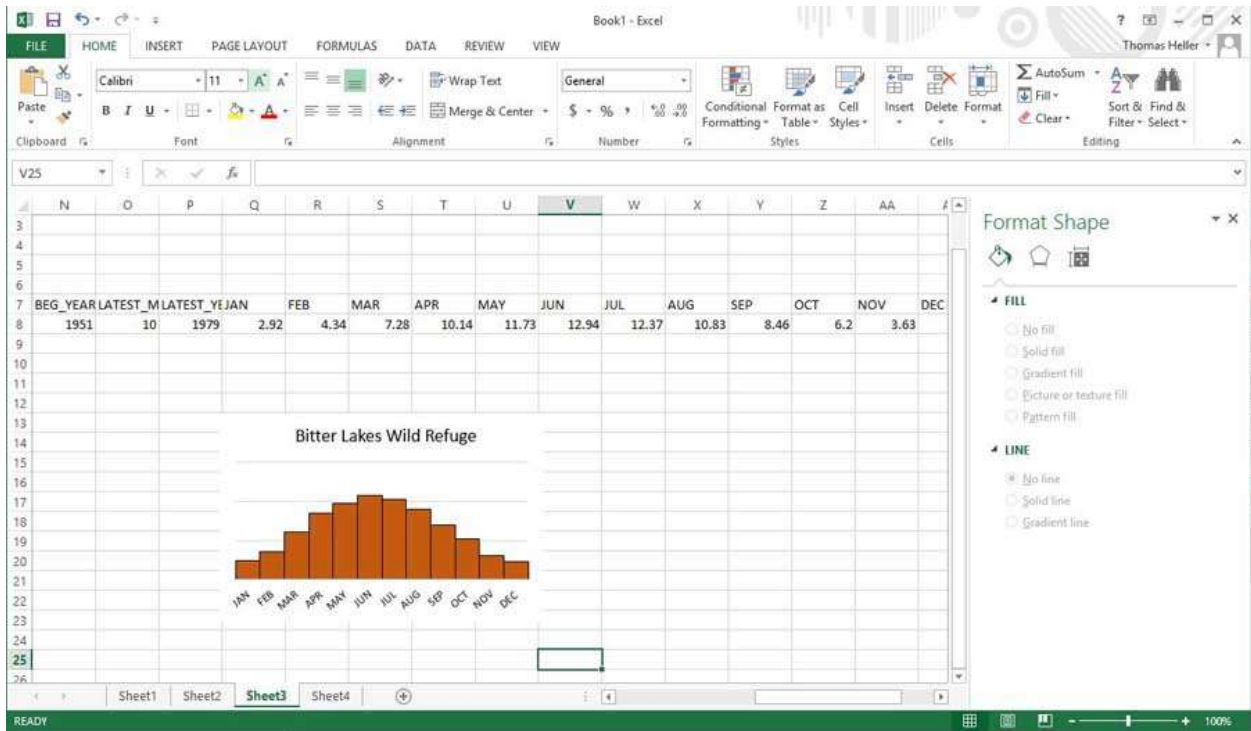
Figure 7. Importing data into Microsoft Excel to create monthly evaporation histograms
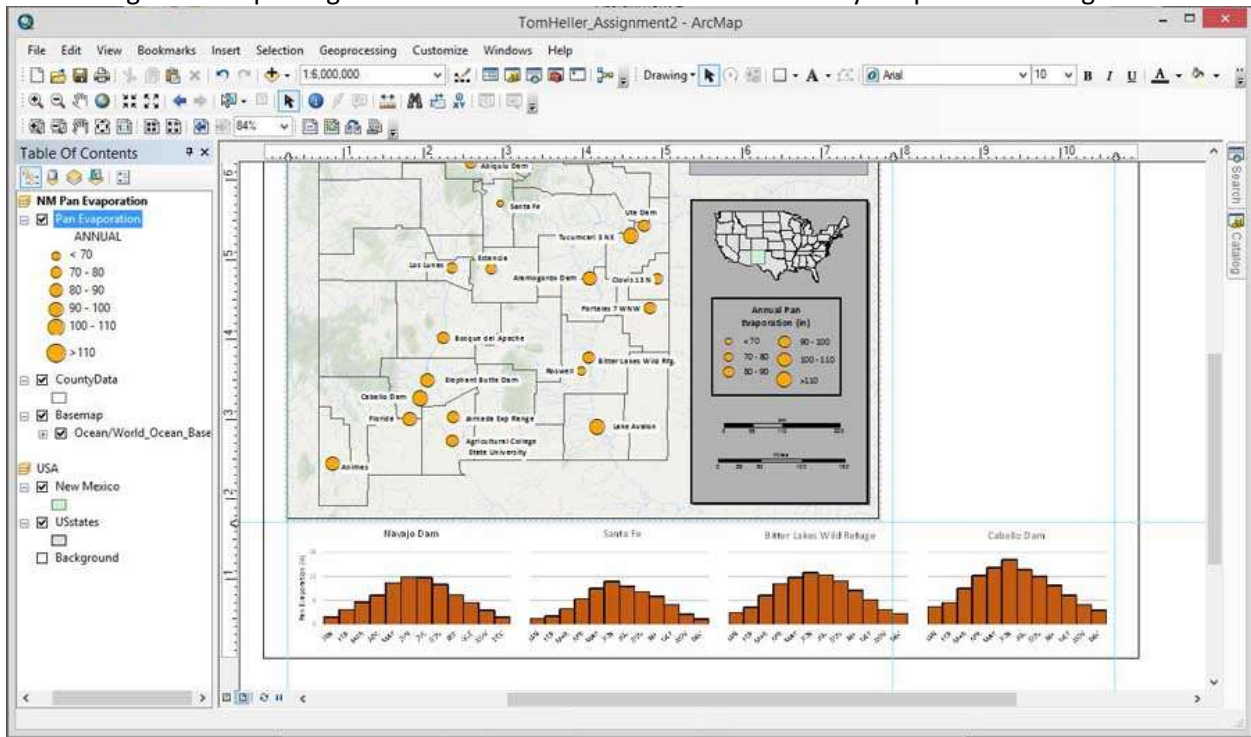

Figure 8. Pasting and arranging the histograms into ArcMap

I also wanted a graph that would show seasonal totals of evaporation for each site, as well as relative latitude so any north-south trends could be visually estimated. This was done inside ArcMap. View > Graphs > Create Graph brought up the Create Graph Wizard. I selected horizontal graph as the graph type, and using Pan Evaporation as the Layer the data is taken from. Since I wanted to show two series of data (winter and summer), I added a series by clicking Add > New Series… There is an attribute for summer data (MAY_OCT) but no attribute for winter. But, by using the total annual evaporation (ANNUAL), and overlaying it with the summer evaporation (MAY_OCT), the same effect can be accomplished, as the area of the annual total not covered by summer total will represent winter totals. So for the first series (horizontal bar 1), I chose ANNUAL for the value field, and MAY_OCT for the second series (horizontal bar 2). The

Y field for both is y_coord ascending, so that the entries will be sorted by their latitude (Fig 9). I experimented with having the bars be placed exactly by their latitude value (this would involve changing the y field sorting option to "Value"), but this caused the bars to be clumped illegibly, as they were placed by their absolute latitude. It may have been more accurate, but would not have been readable. I figured that if all I wanted to show was a general trend by latitude, then having the bars spaced evenly would suffice, as the stations are generally placed fairly evenly.
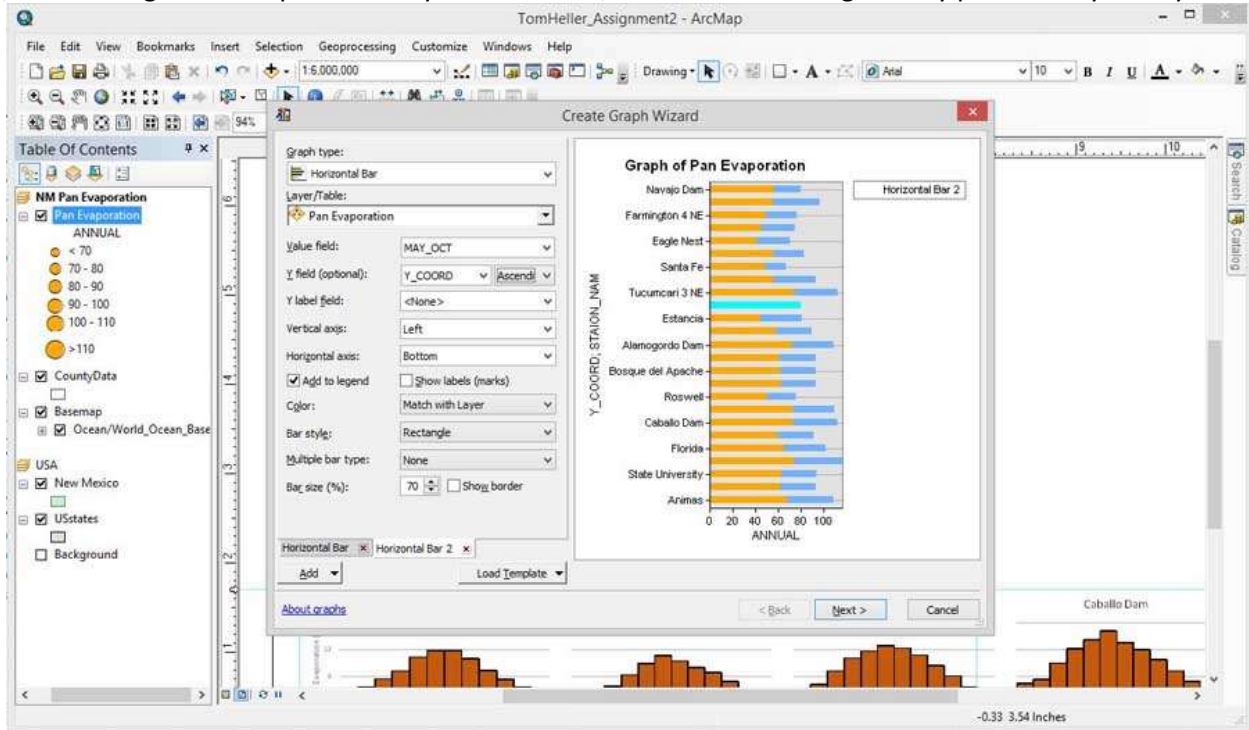

Figure 9. Creating a bar graph in ArcMap showing summer and winter evaporation, as well as relative latitude

After creating the graph using the wizard, I right clicked on the graph display to open Graph Properties (Fig 10) in order to change legend and axis labels, as well as Advanced Properties to fine tune the appearance of the graph (Fig 11).
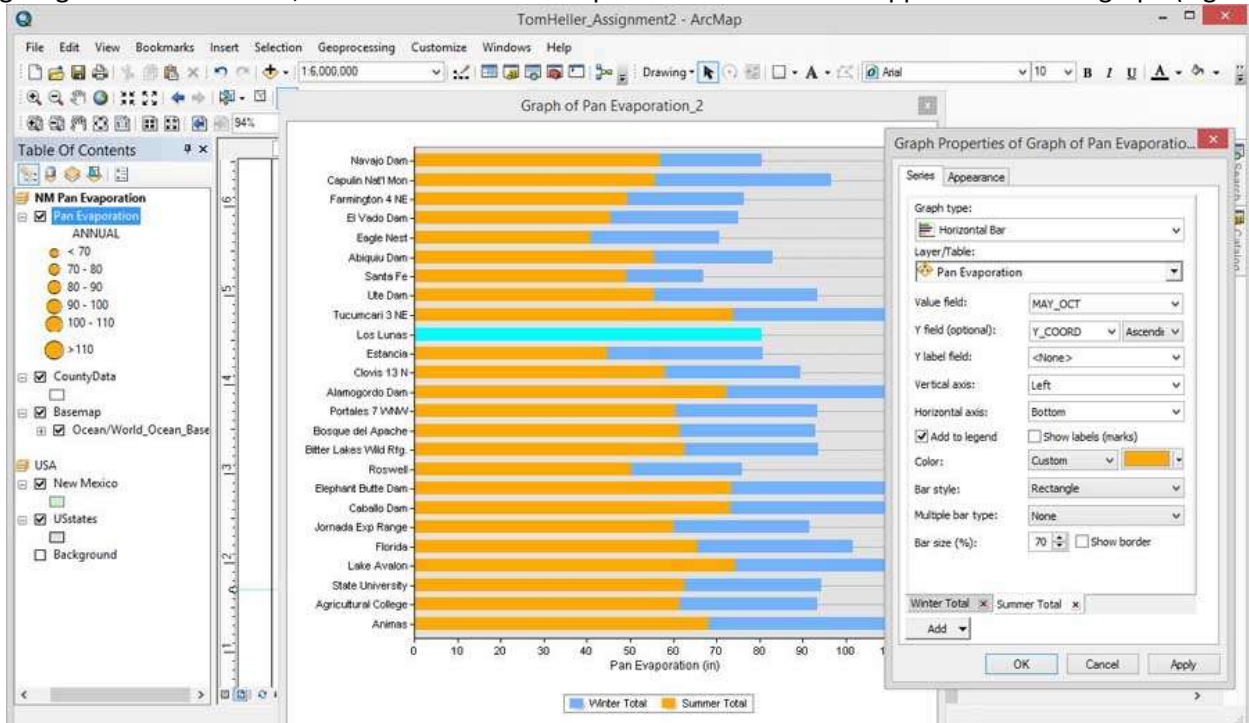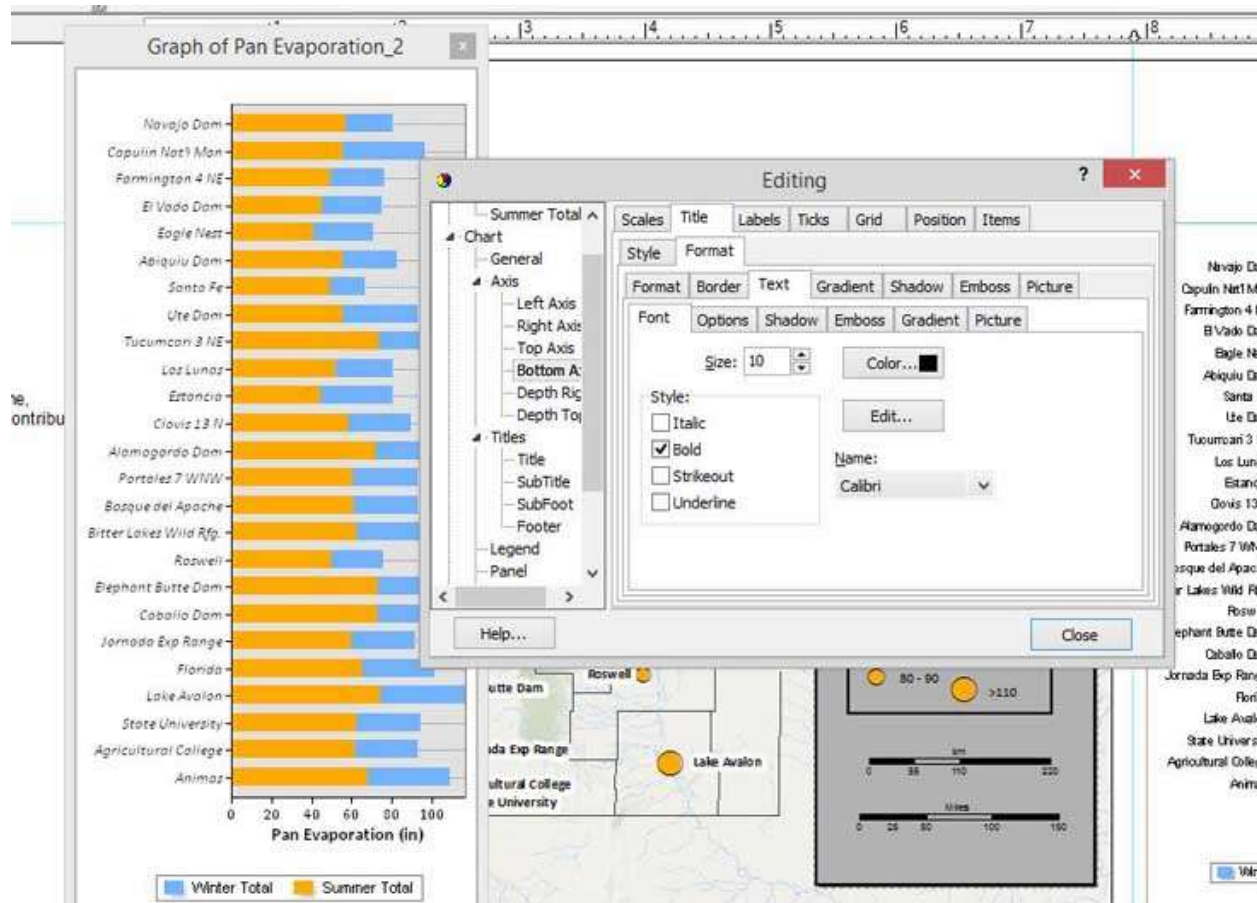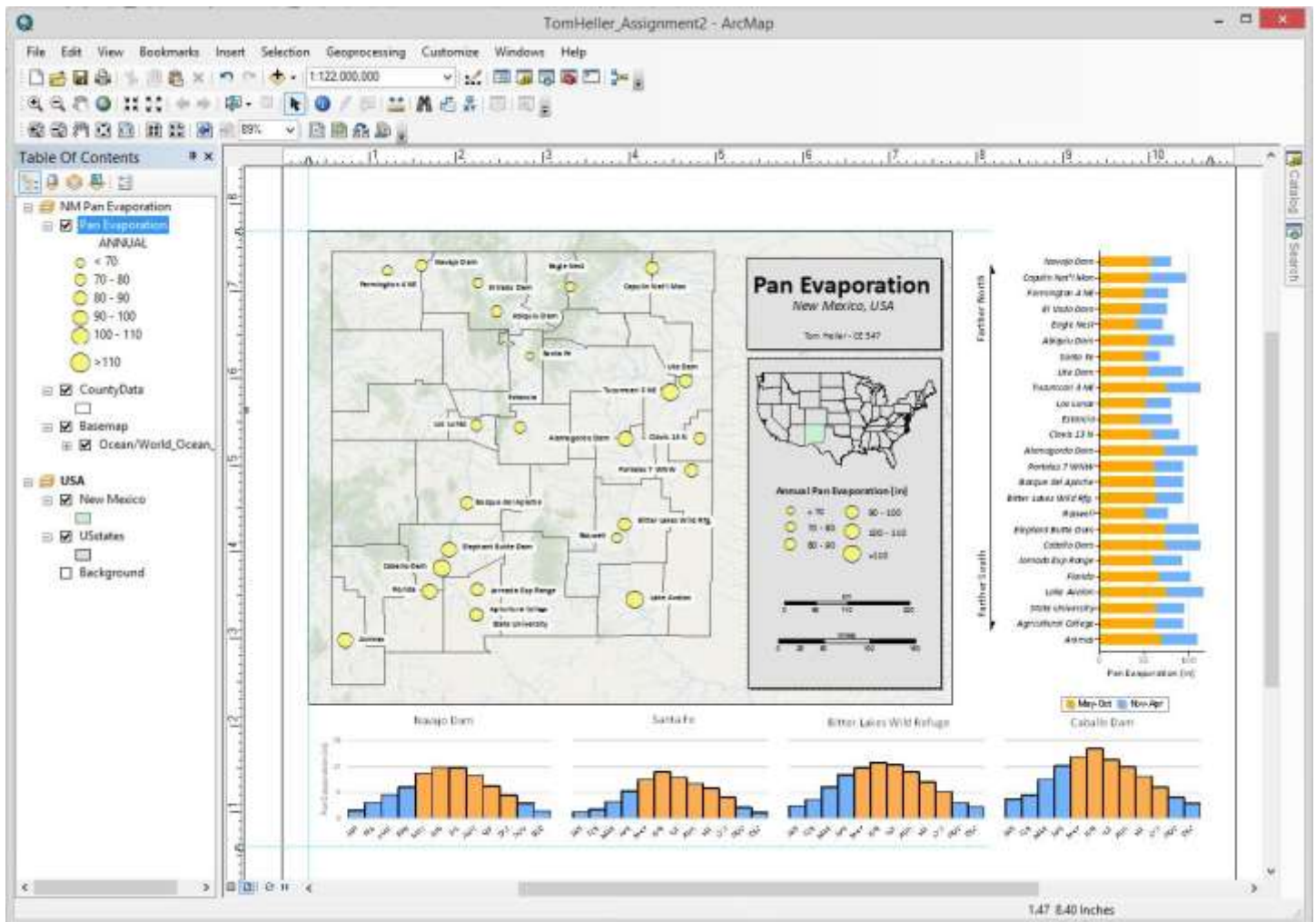

Figure 10. Graph Properties

Figure 11. Advanced Properties of the graph, changing its appearance

After right clicking upon the graph and selecting "Copy as Graphic", I inserted the graph into the layout view by pasting. This was to preserve the desired shape of the graph, as selecting "Add to Layout" seemed to insert the graph only in a predetermined aspect ratio.

Final Layout
Using the Draw toolbar, I created an arrow and labels to indicate the relative latitude of the entries on the graph. By drawing a rectangle from the same toolbar, I created a new title area to place on the map, and inserted text to create the title. At this time I also adjusted the final colors of the elements, and altered the scale bars and legend box, both by changing their bounding boxes, and adjusting their properties by right clicking.

I also realized that the color of data sites on the map and the summer total bar on the graph was very similar, and this might create confusion to the reader. I changed the map site color to a lighter shade of yellow to create distinction. Also to keep the color scheme the same, I edited the monthly evaporation histograms to maintain the same colors of seasonal evaporation.

Final layout in Arcmap