

Could Baton Rouge Become the Next Atlantis in the Near Future?



Rey Cabrera
rc34597

GIS Semester Project
Due Date: December 1, 2016

Problem

Due to the effects of global warming, such as the thermal expansion of the oceans and the melting of glaciers and the polar ice caps, the Global Mean Sea Level (GMSL) has risen 10-20 centimeters in the past 100 years and, for the past 20 years, the sea level has been rising at a rate of 3.2 millimeters per year, which is approximately twice the rate of sea level rise for the preceding 80 years.¹ Being that the Baton Rouge currently lies at an average of 17 meters above sea level, how long would it take for the second most populated city in Louisiana to be completely under water?

Assumptions

This report takes on a current-state perspective meaning that the assumption is made that the rate of sea level rise will remain at 3.2 millimeters per year throughout time.

Current State of Louisiana

To display the potential effects of continued global warming, a map displaying the current sea level of Louisiana and its bathymetry, the measurement of depth of water in oceans, must first be generated with ArcMap. The 2013 Louisiana county subdivision zip file was extracted from Data.gov. To extract the data, the zipped file was opened and then the “Extract All” icon in File Explorer (Figure 1). After this icon was selected, the desired output destination was designated (Figure 2).

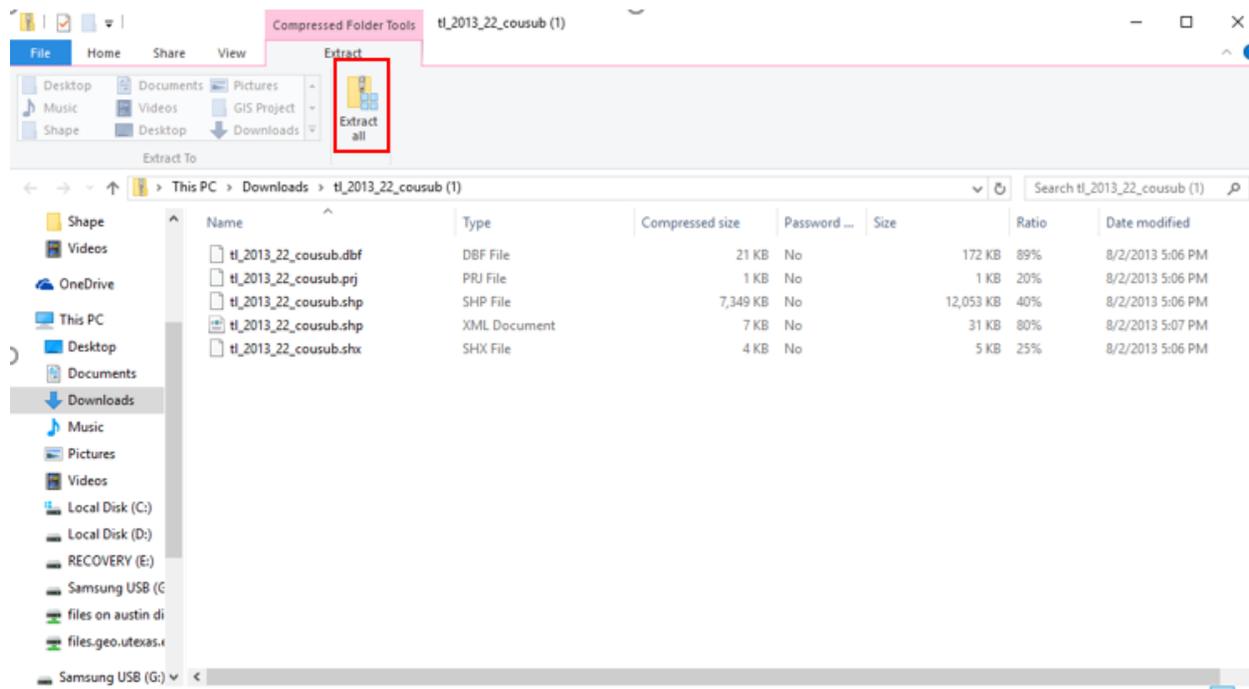


Figure 1: Extraction of online zipped files. “Extract All” icon located within red box.

¹ Society, National Geographic. "Sea Level Rise -- National Geographic." National Geographic. N.p., n.d. Web. 28 Nov. 2016.

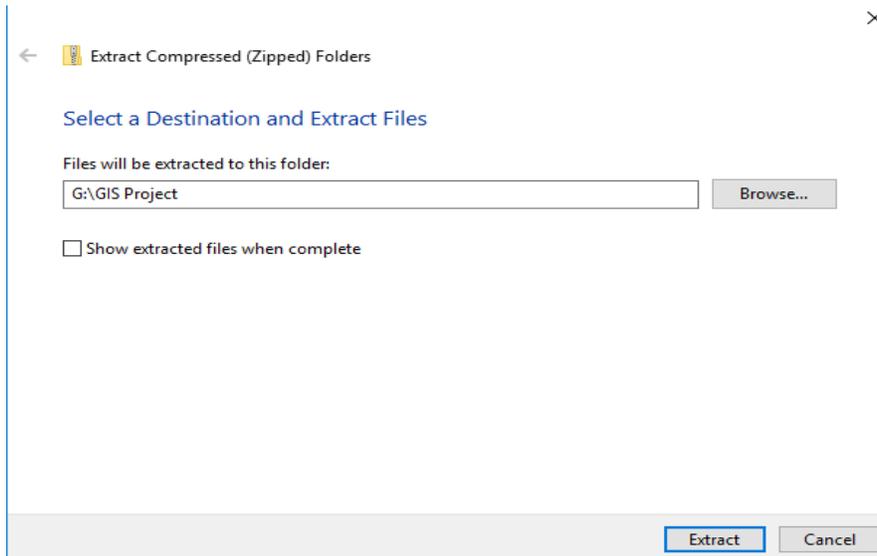


Figure 2: Selected destination of downloaded Internet datasets

Once the data was saved into the desired location, the shapefile containing the Louisiana county subdivisions within the now downloaded folder was dragged from the ArcCatalog tab on the right side of screen to the Table of Contents on the left side of the screen to produce the following image (Figure 3):

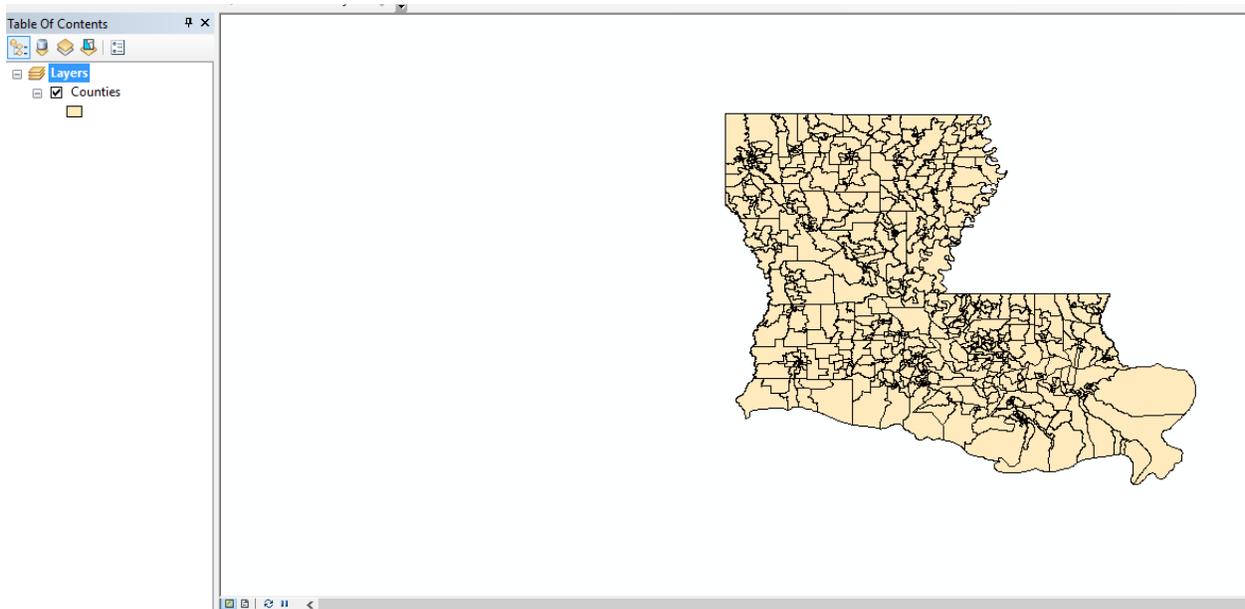


Figure 3: ArcMap document displaying Louisiana county subdivisions

The same data extraction process was utilized to download the shapefiles containing the bathymetry of Louisiana and the state’s urban areas from Data.gov and Arcgis.com, respectively. The following figure was produced after inserting these shapefiles into the ArcMap Table of Contents (Figure 4):

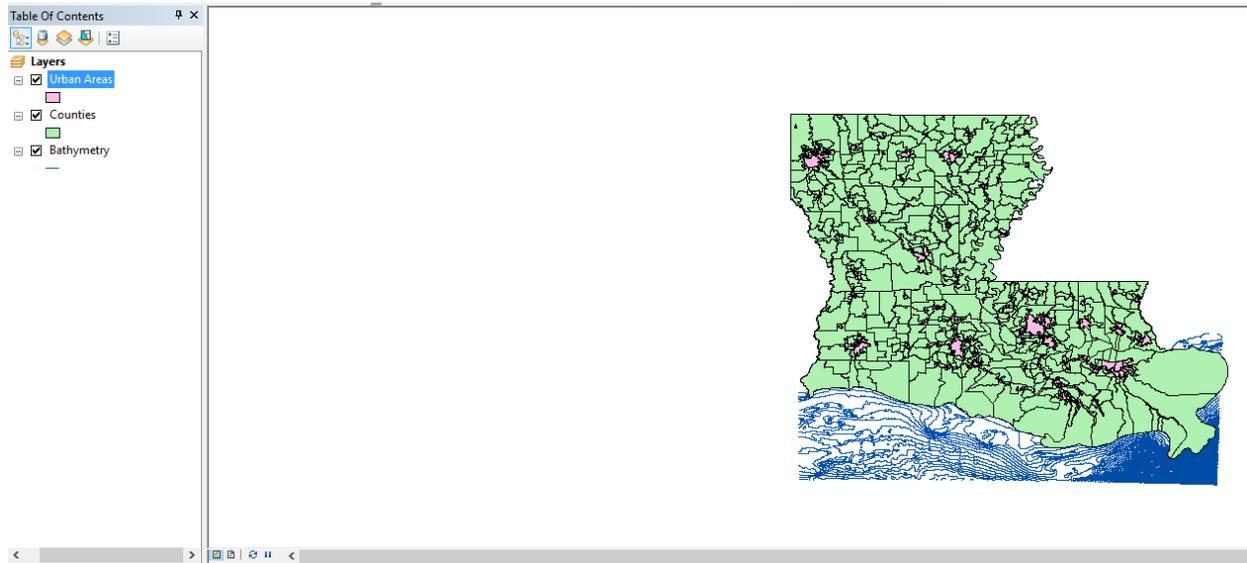


Figure 4: ArcMap document displaying the urban areas, counties, and bathymetry of Louisiana

Since Baton Rouge is currently standing at an elevation of approximately 17 meters above sea level, not all of the contours seen in bathymetry shapefile are necessary. This downloaded shapefile contains bathymetry depths up to 1180 meters, so in order to clean up the appearance of the bathymetry shapefile, some of the contours had to be deleted.

To do so, the bathymetry layer within the Table of Contents was right-clicked and the “Properties” option was selected. With the Layer Properties window displayed, the “Symbology” tab was selected (Figure 5).

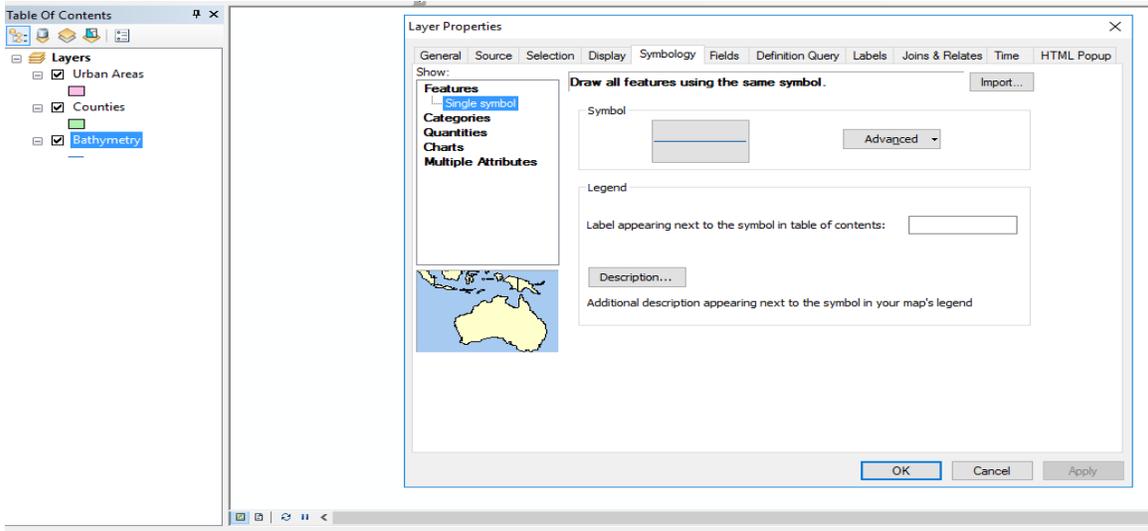


Figure 5: Symbology tab within the layer properties window of bathymetry layer

Within the “Show” column displayed on left hand side of Figure 5, the “Categories” option was then selected and then, with the Value Field set on “DEPTH_M,” the “Add All Values” option was selected to display all bathymetry contours within the layer (Figure 6).

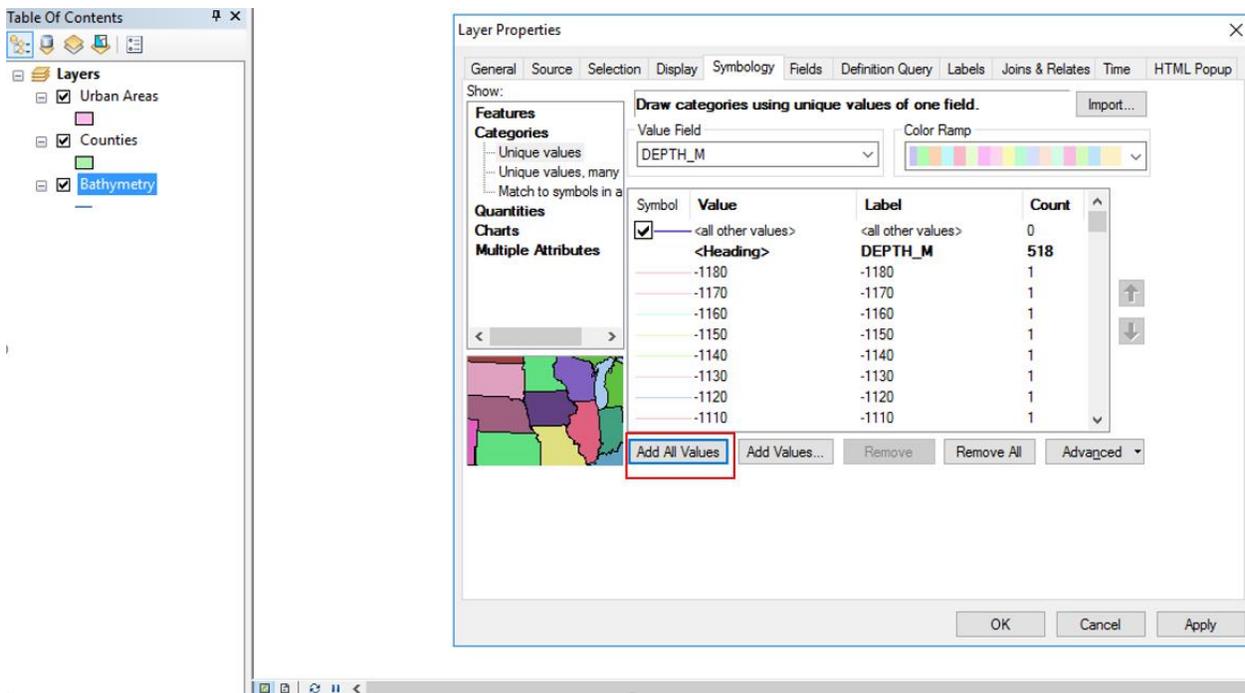


Figure 6: All bathymetry contour values displayed in symbology tab after selecting “Add All Values” option (in red box)

After manually selecting the undesired contour intervals, the “Remove” was utilized along with unselecting the “add all other values” option to delete the contour intervals from -1180 meters to -62 meters and make it so that the desired contour intervals, which are -60 meters to -2 meters, increased by 4 meters. The following figure (Figure 7) displays the current sea level and bathymetry of Louisiana:

Sea Level and Bathymetry of Louisiana

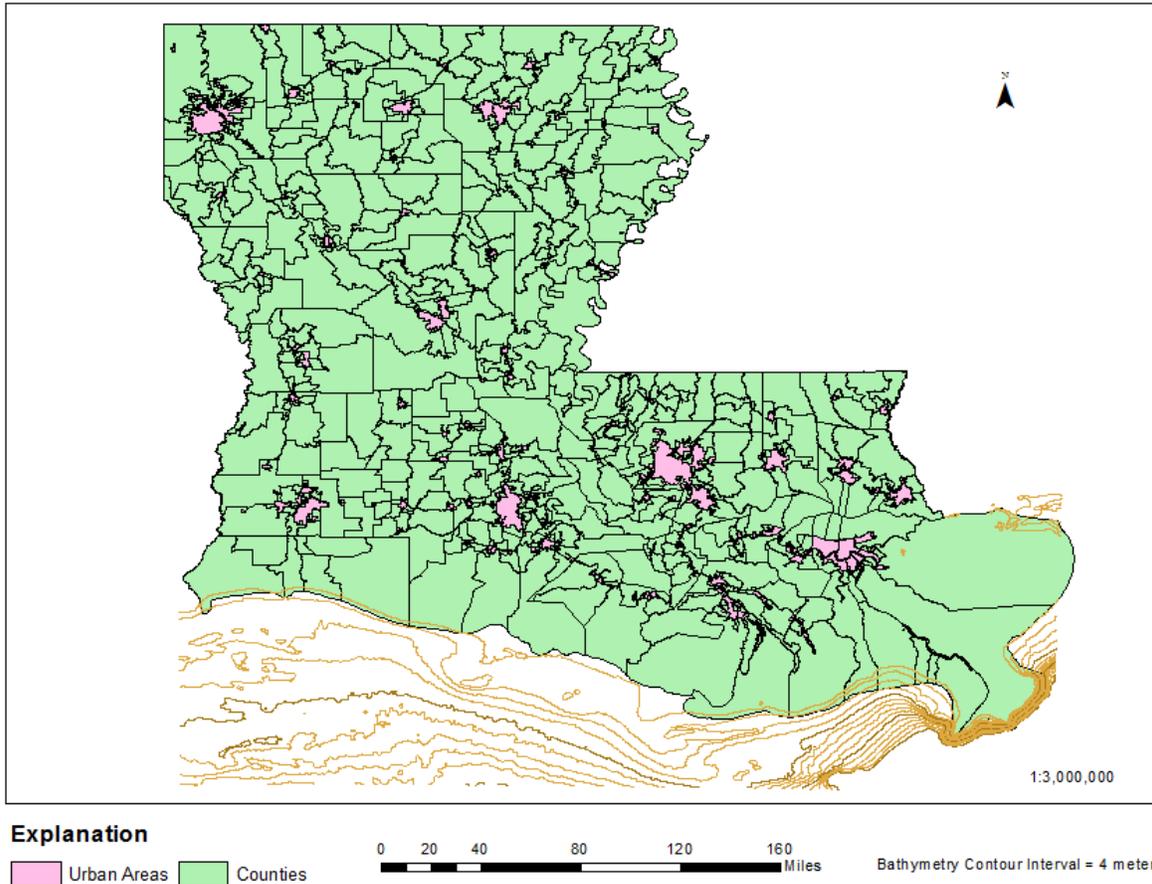


Figure 7: Current Sea Level and Bathymetry of Louisiana

Elevation of Baton Rouge

In order to see the effects of sea level rise, the topography of Baton Rouge must first be determined. To do so, within the USGS 3DEP website (Figure 8), the DEM file for the Baton Rouge Area.

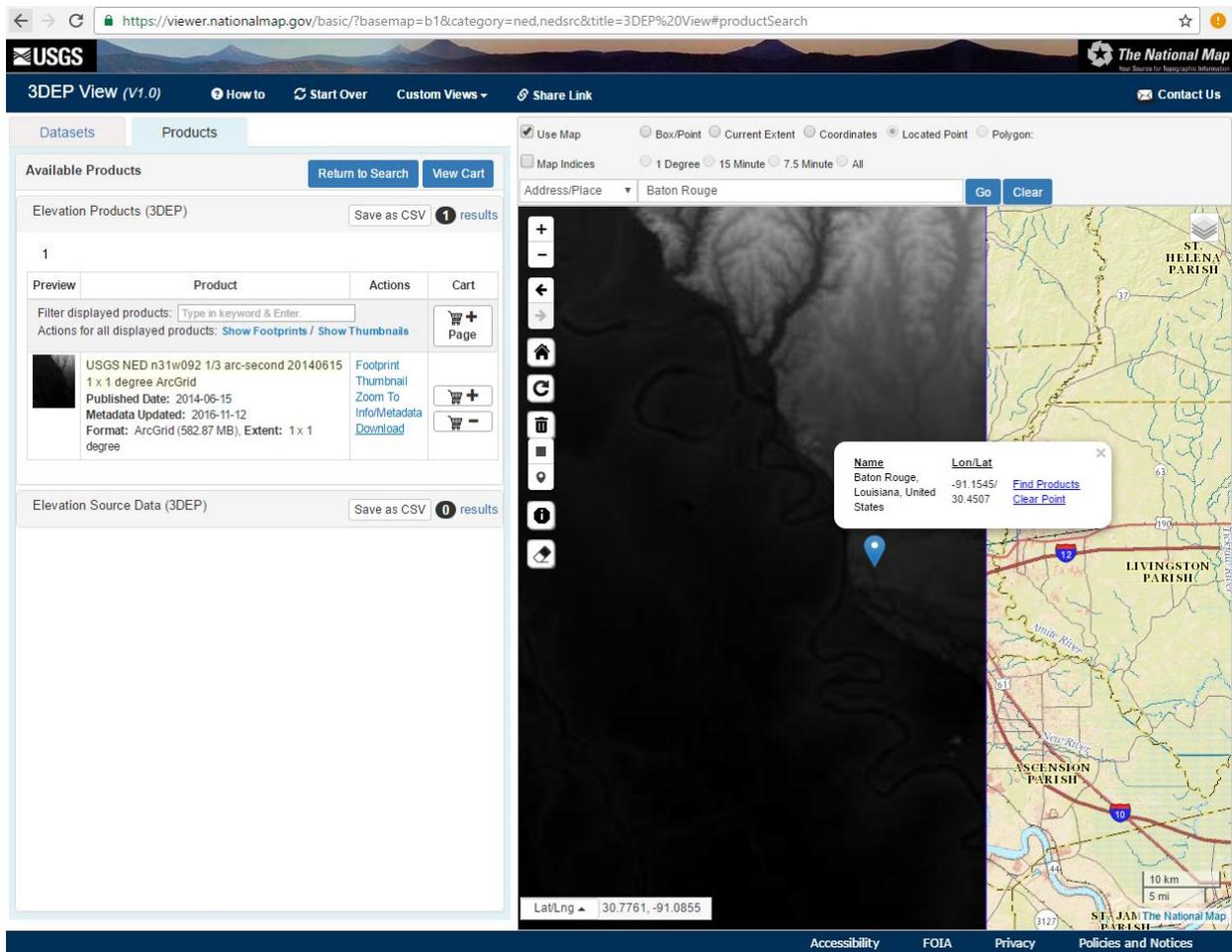


Figure 8: USGS 3DEP search for Baton Rouge DEM file

Due to technical difficulties, the extraction process of was not exactly the same as that discussed in the previous section. After the DEM zipfile was downloaded, it was selected within the “Downloads” tab of file explorer (Figure 9) and extracted into the desired destination using the “Extract All” option like before.

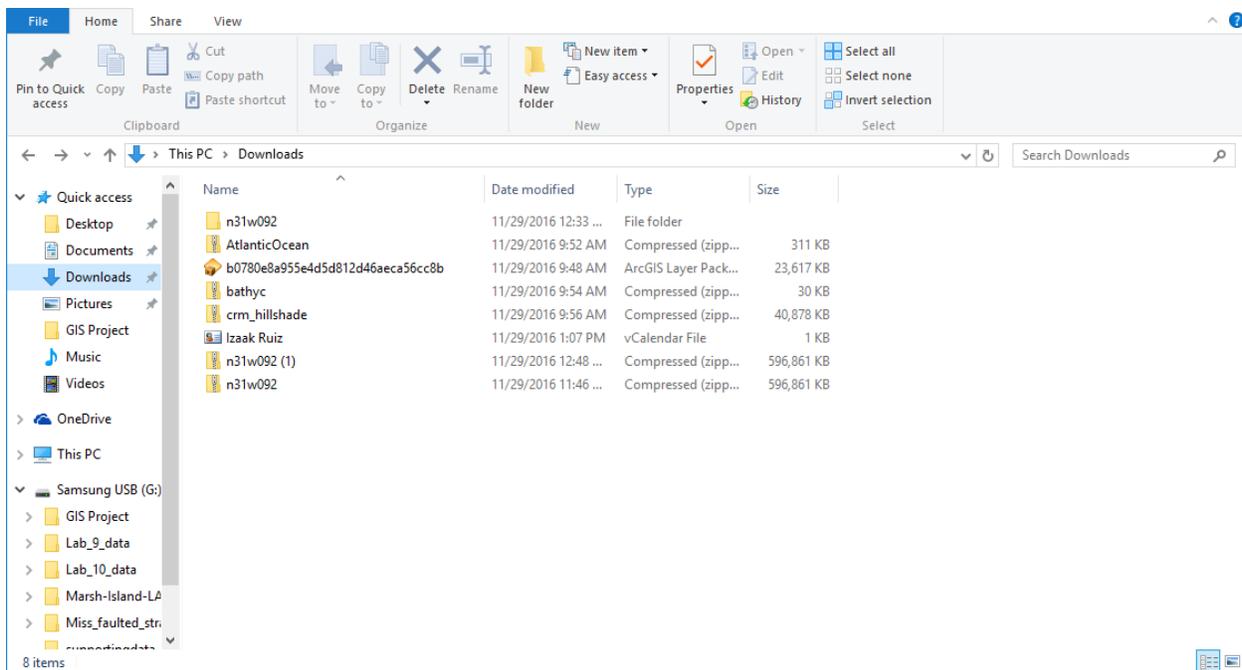


Figure 9: Extracting DEM zipped file entitled n31w092

With the extracted Internet data now in its desired location, the raster data displaying the elevation of Baton Rouge was moved into the Table of Contents (Figure 10).

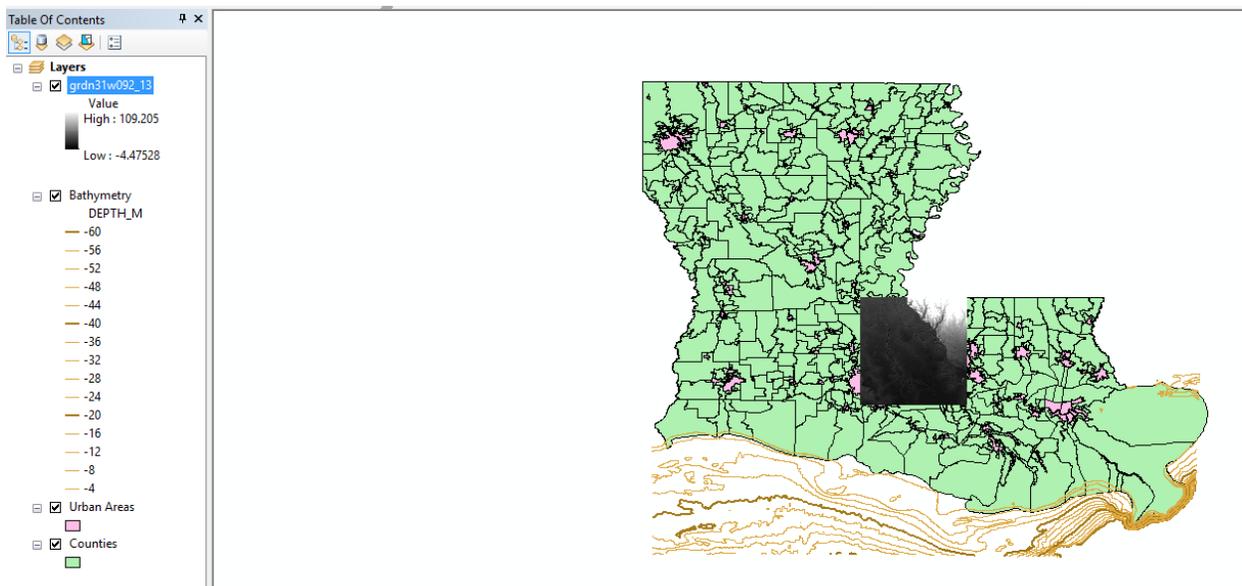


Figure 10: Implemented DEM of Baton Rouge

Since this study will be analyzing new geometries of the Louisiana shoreline, the bathymetry file will no longer be used in the proceeding maps.

To narrow down the area of interest to Baton Rouge, the Urban Areas and Counties shapefiles must be clipped to the extent of the DEM raster. Within the extracted online files, there is a shapefile that merely displays the extent of the DEM file (Figure 11).

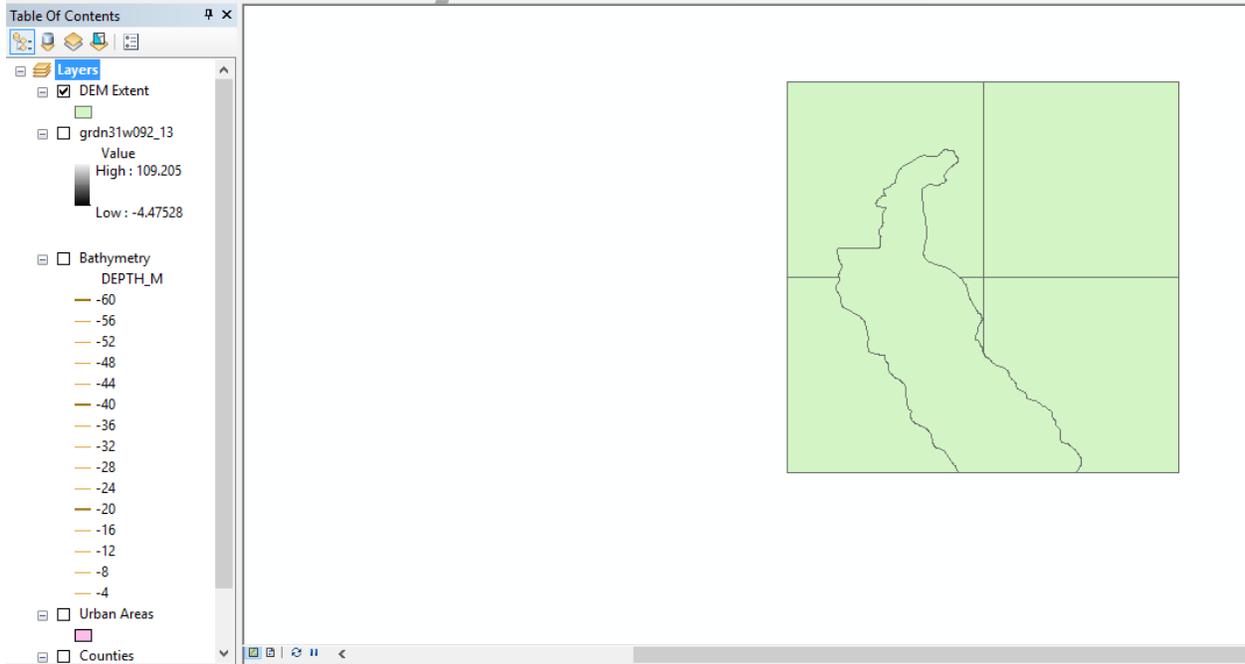


Figure 11: Shapefile containing displaying of DEM

To clip the shapefile containing all the Louisiana count subdivisions to just those in the area near Baton Rouge, within the “Search” tab on the right side of the ArcMap Data View Screen, “clip” was typed into the search bar and the “Clip Analysis Tool” was selected (Figure 12).

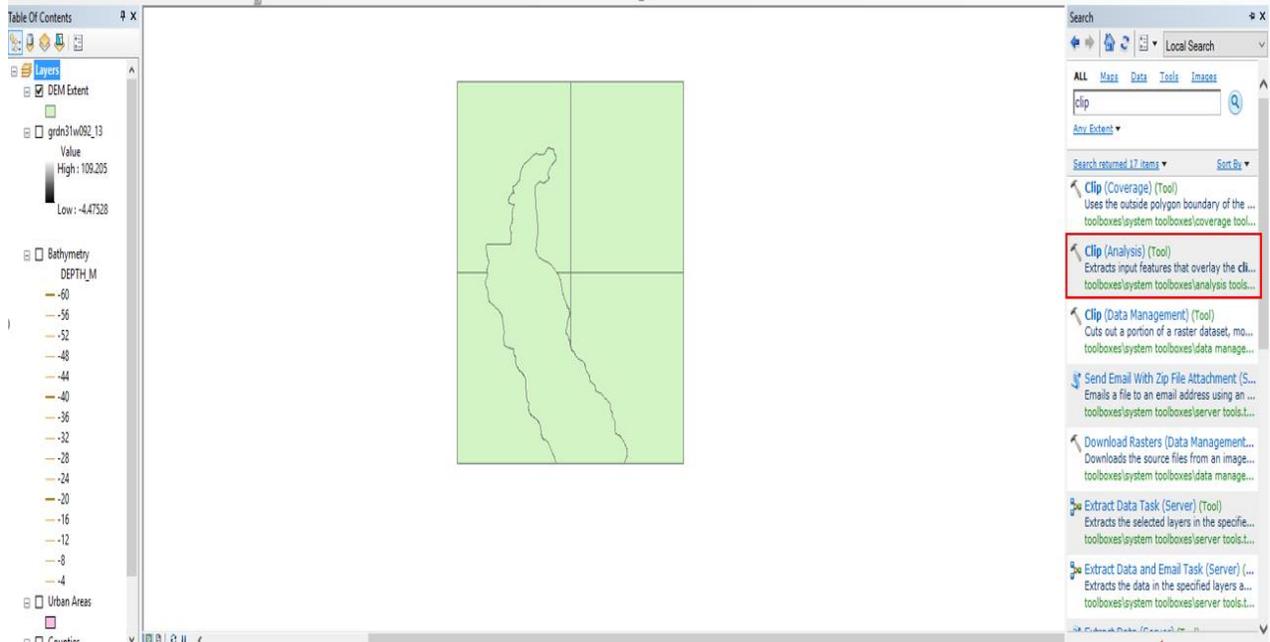


Figure 12: Location of clip analysis tool

The following figure (Figure 13) displays the information inserted into the clipping tool in order to clip the Louisiana county subdivisions to specifically those near Baton Rouge. To clip the Urban Area shapefile, only the input feature was changed.

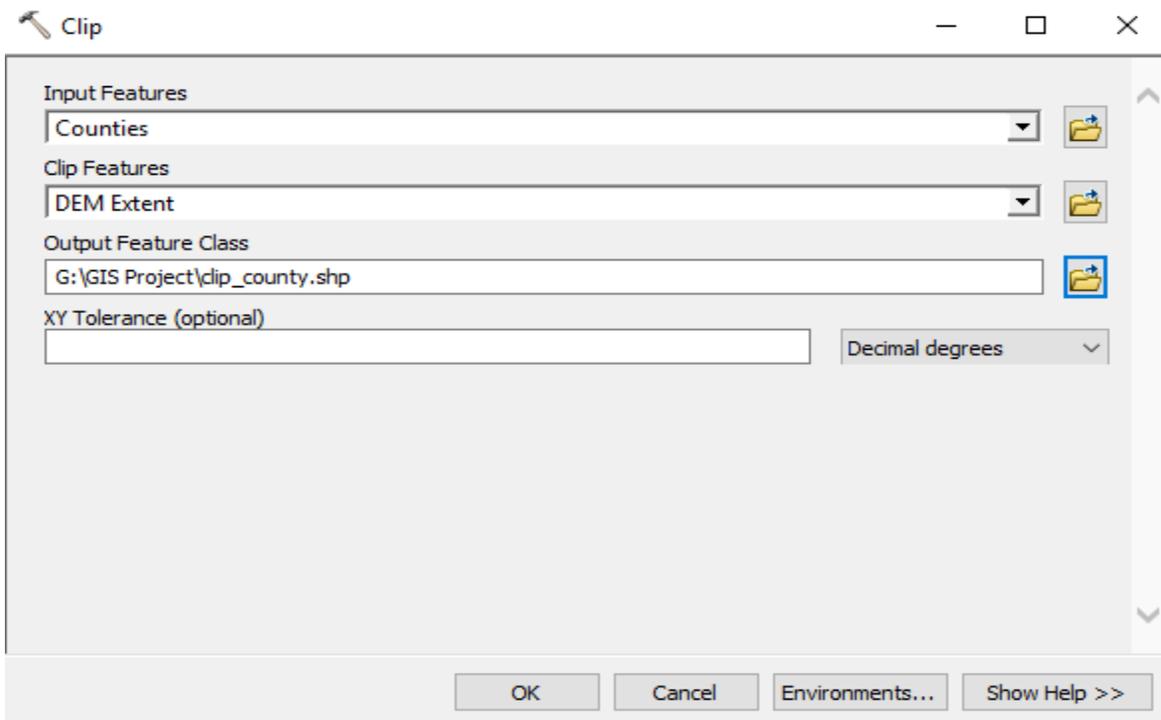


Figure 13: Clipping process of Louisiana county subdivision shapefile

After both shapefiles were clipped, the color representing the “Clipped Counties” shapefile was made hollow and the color scheme used to represent the DEM file was changed to “Elevation #1,” which resulted in the following figure (Figure 14) displaying the current elevation of Baton Rouge and its surrounding areas.

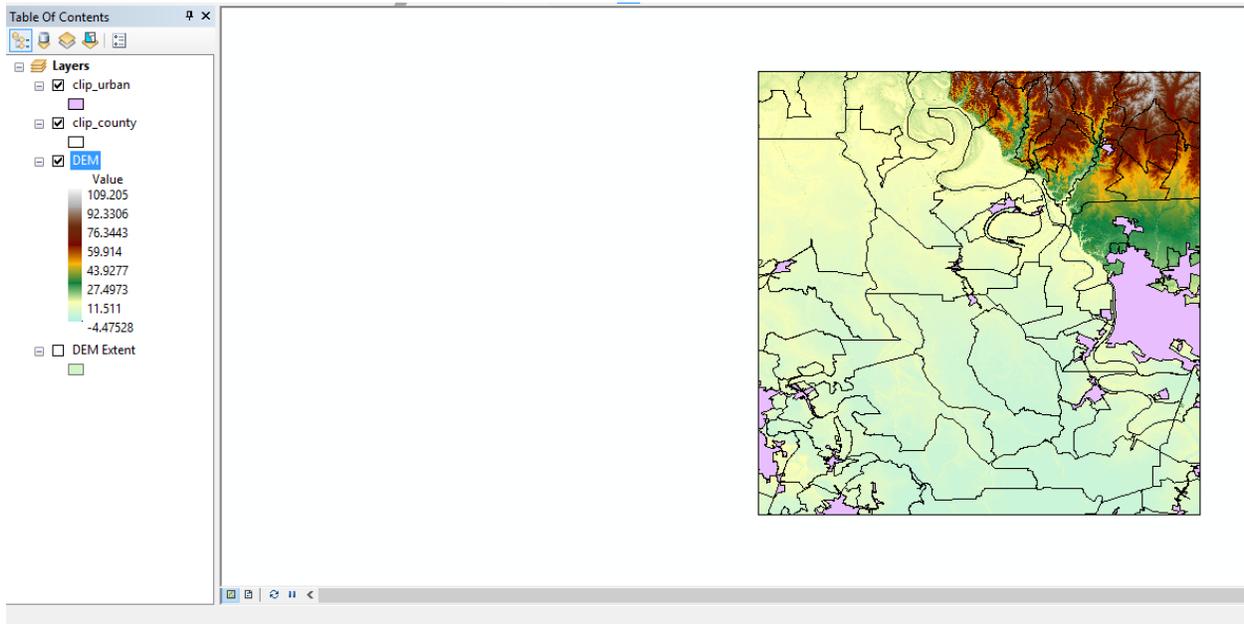


Figure 14: Topography of area near Baton Rouge, Louisiana

To make this map look more realistic, a hillshade was generated. To do so, in the search tab on the right side, “hillshade” was typed into the search bar and the spatial analyst option was selected (Figure 15). With this option selected, the input raster was set as the DEM file and the output raster, due to technical issues, had to be saved to the computer desktop (Figure 16).

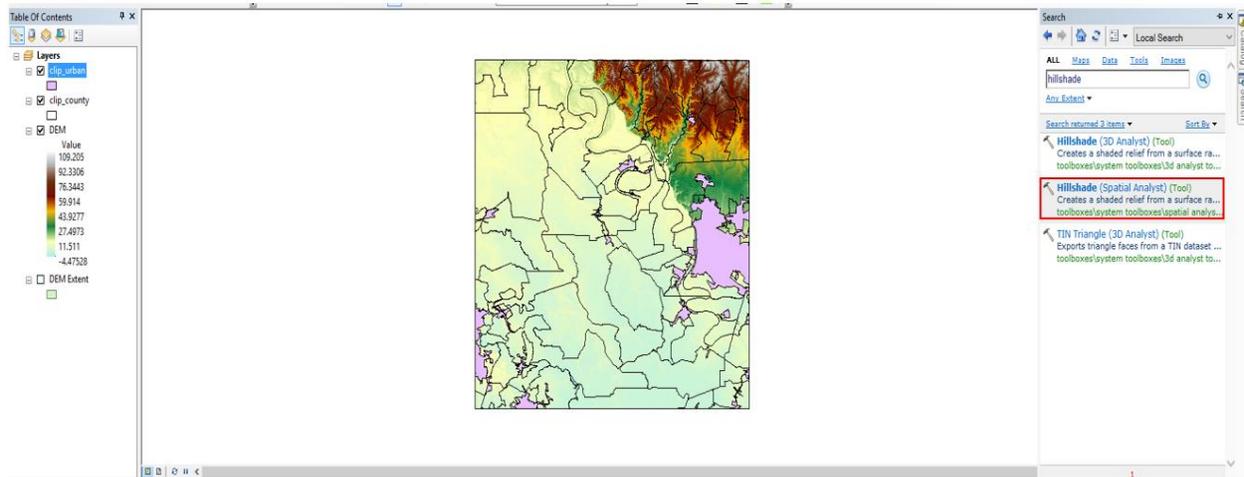


Figure 15: Hillshade spatial analyst option

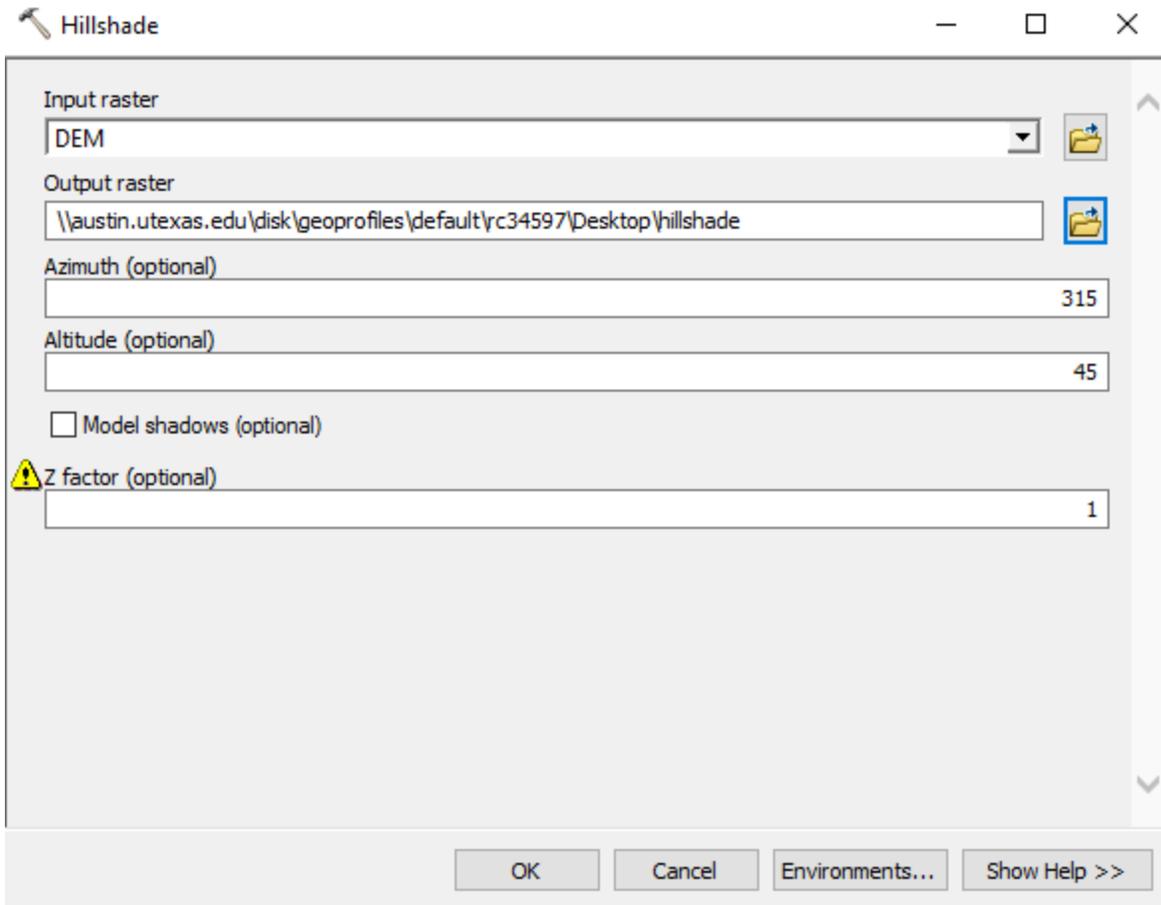


Figure 16: Hillshade of Louisiana development

After changing the transparency of the DEM file to 40% and placing the newly created hillshade below the DEM file in the Table of Contents, a more realistic elevation map was generated of the area near Baton Rouge, Louisiana (Figure 17).

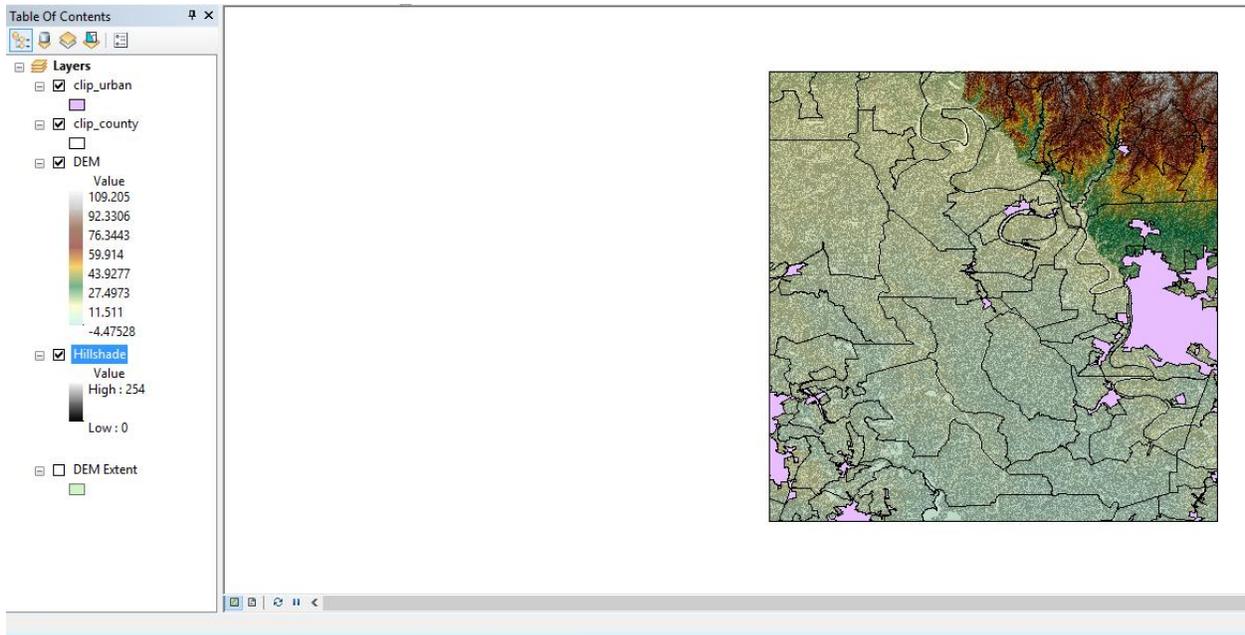


Figure 17: Elevation map of area near Baton Rouge, Louisiana

Analysis of Sea Level Rise

To make calculations for this report more simplistic, it is assumed that the rate of sea-level rise will remain at the current rate of 3.2 millimeters per year.

To determine the current elevation of Baton Rouge, the location of Baton Rouge had to first be determined. To do so, the "Drawing" Toolbar was utilized. After the Urban Areas shapefile was made 40% transparent, within the "Drawing" Toolbar, the label icon was selected in order to determine the location of Baton Rouge and other major Louisiana cities on the map (Figure 18).

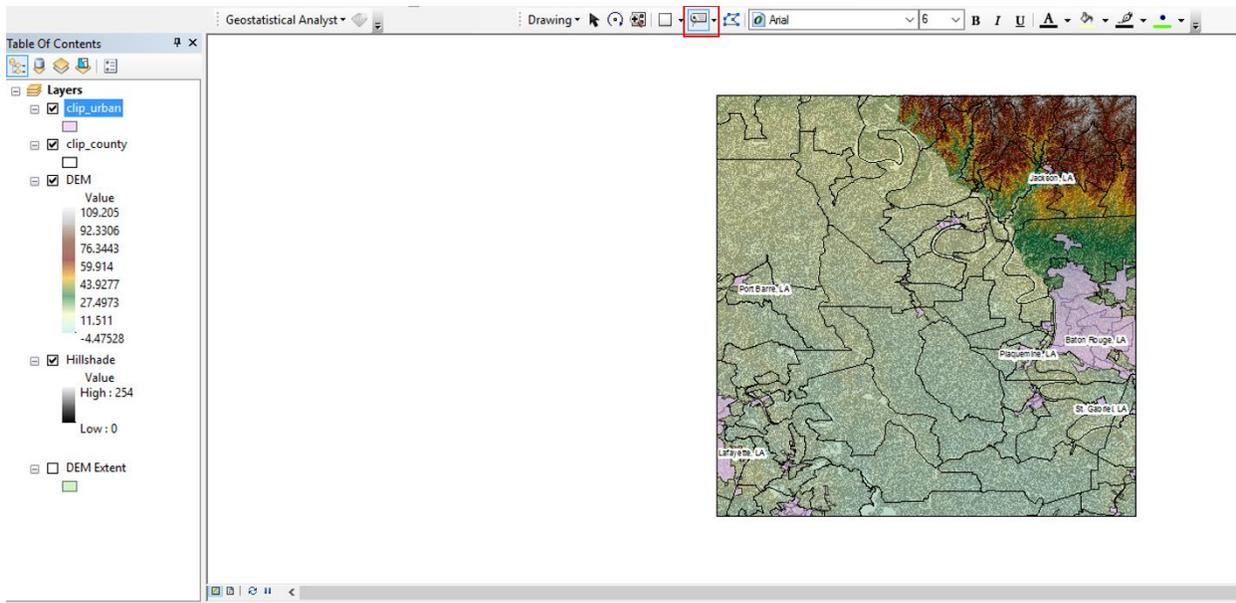


Figure 18: Elevation map of major urban areas in Louisiana. Label icon within red box

Based off the above figure, the elevation range for the Baton Rouge area is from approximately 5 to 30 meters. To display how much of Baton Rouge would be covered if sea level were to rise up to 5, 10, 20 and 30 meters, the raster calculator tool was utilized.

After selecting the spatial analyst raster calculator option in the Search Tab, to determine where the elevation is less than or equal to 20 meters, the equation inserted within the raster calculator is given as follows (Figure 19):

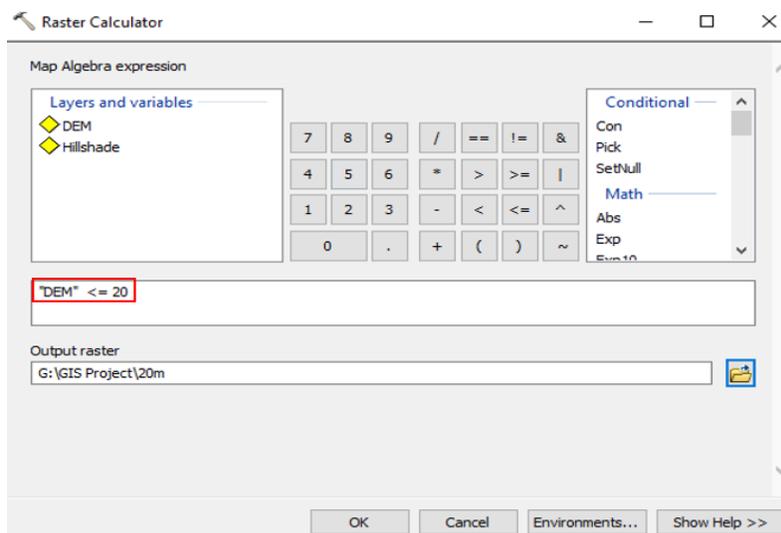


Figure 19: Raster calculator equation for elevations less than or equal to 20 meters on DEM file

After typing the equation for each measure of sea level rise, the following figures were generated (Figures 20-23):

Baton Rouge, Louisiana after Sea Level Rise of 5m

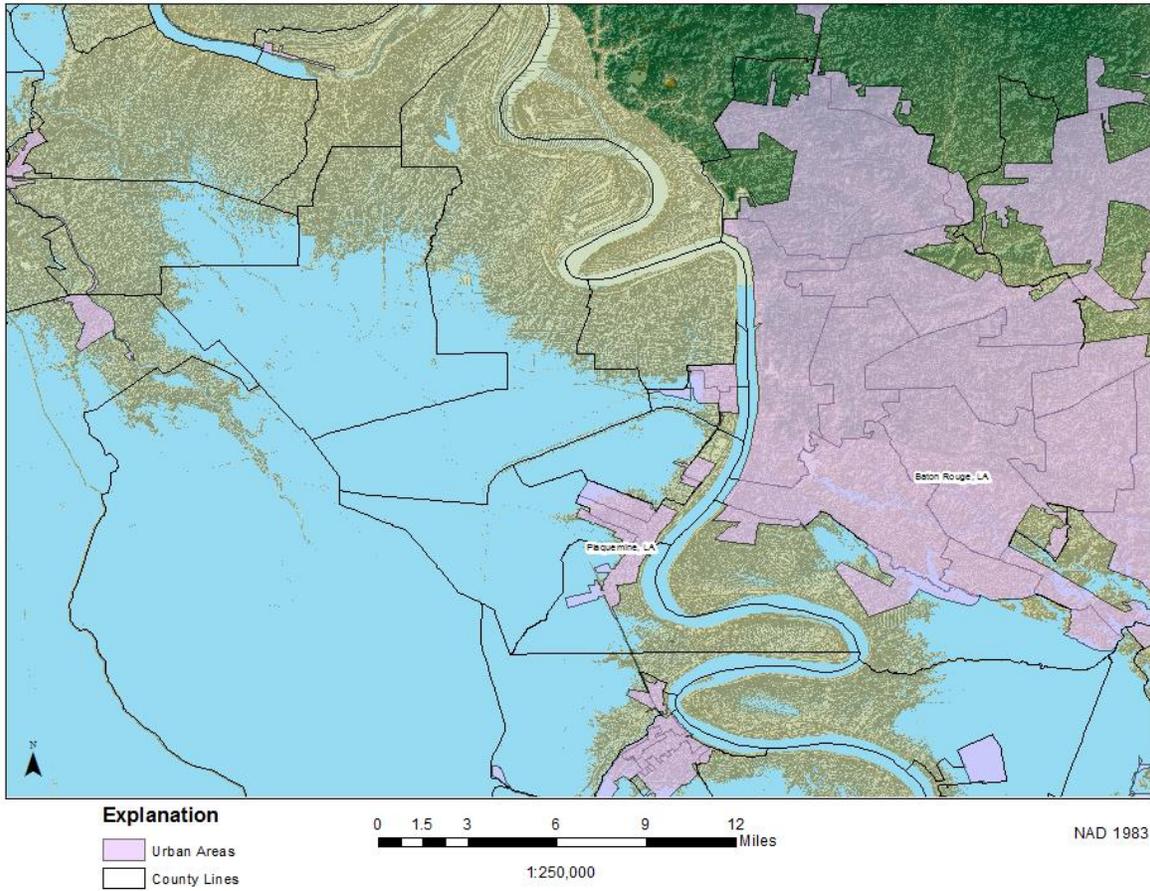


Figure 20: Percentage of Baton Rouge covered with sea level rise 5m

Baton Rouge, Louisiana after Sea Level Rise of 10m

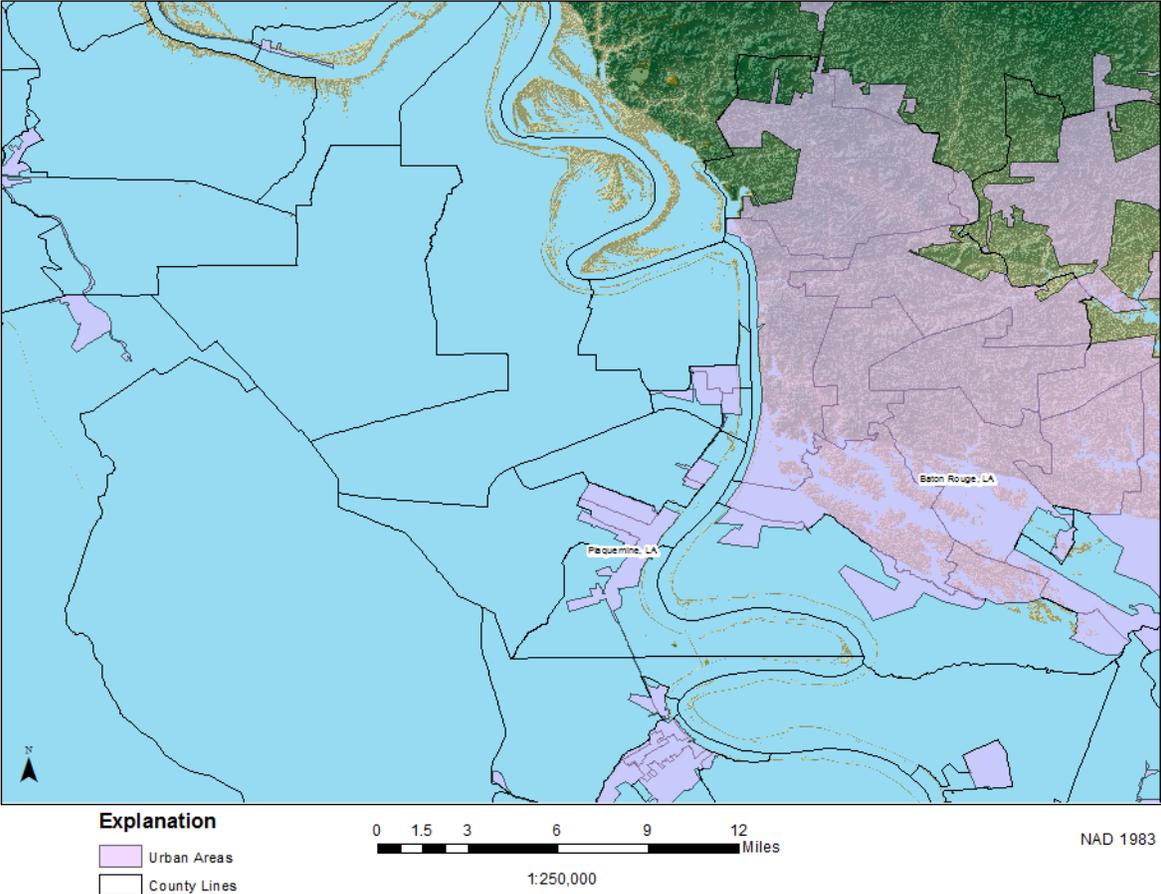


Figure 21: Percentage of Baton Rouge covered with sea level rise 10m

Baton Rouge, Louisiana after Sea Level Rise of 20m

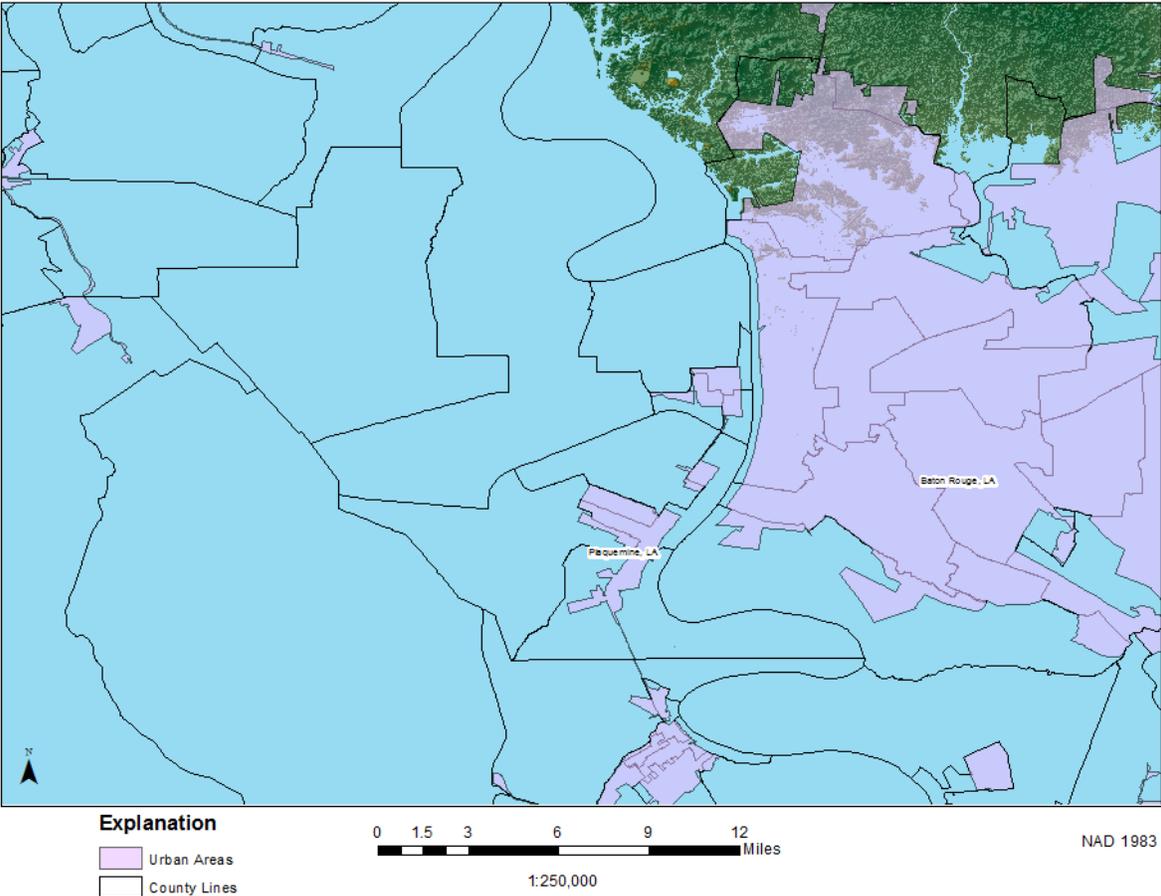


Figure 22: Percentage of Baton Rouge covered with sea level rise 20m

