Effects of Florida Under a 10 Meter Sea Level Rise

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I. Goal

Assess the effects a 10 meter sea level rise would have on Florida.

Mission:

- Determine the length of Florida's coastline and change in length after rise.
- Determine the total land area not affected by the rise.
- Estimate the population affected/not affected by the rise.

II. Data

Questions will be obtained by using raster data and shapefiles.

- Digital Elevation Model with the file name USGSDEM downloaded from Florida Geographic Data Library.
- 2000 ArcGIS census data shapefile

III. Procedure

1. Download USGSDEM
2. Create contour lines around the entire state and area not affected by 10 meter sea level rise.
3. Use editing tool to create a closed line for both contours
4. Create a polygon for affected and not affected areas.
5. Upload 2000 census data

By visiting www.fgdl.org (Florida Geographic Data Library) a Digital Elevation Model of Florida with content title USGS 1:250,000 and file name USGSDEM can be downloaded. Open ArcMap and create a new map. Load the DEM. Change the symbology from Stretched to Classified in order to obtain different ranges of elevation.

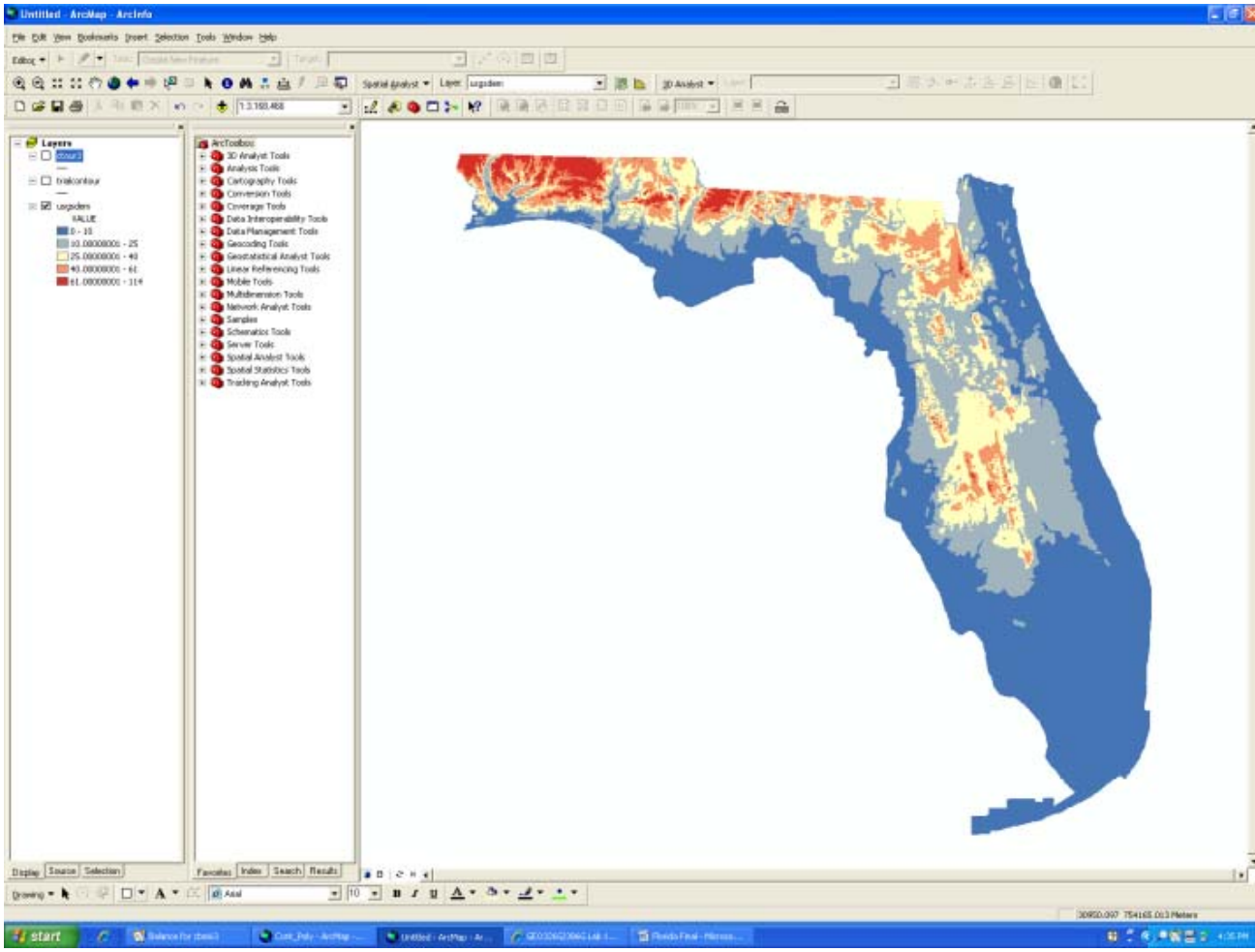

Fig. 1 (DEM)

The great thing about this DEM is that it contains a zero elevation. By changing the class number ranges of (3) 0-24, (4) 0-15 and (5) 0-10 can be achieved. Our question is to figure out a 10 meter sea level rise so a class number of 5 is chosen. This step alone immediately gives us a view of the effects of a 10 meter rise in sea level on Florida.

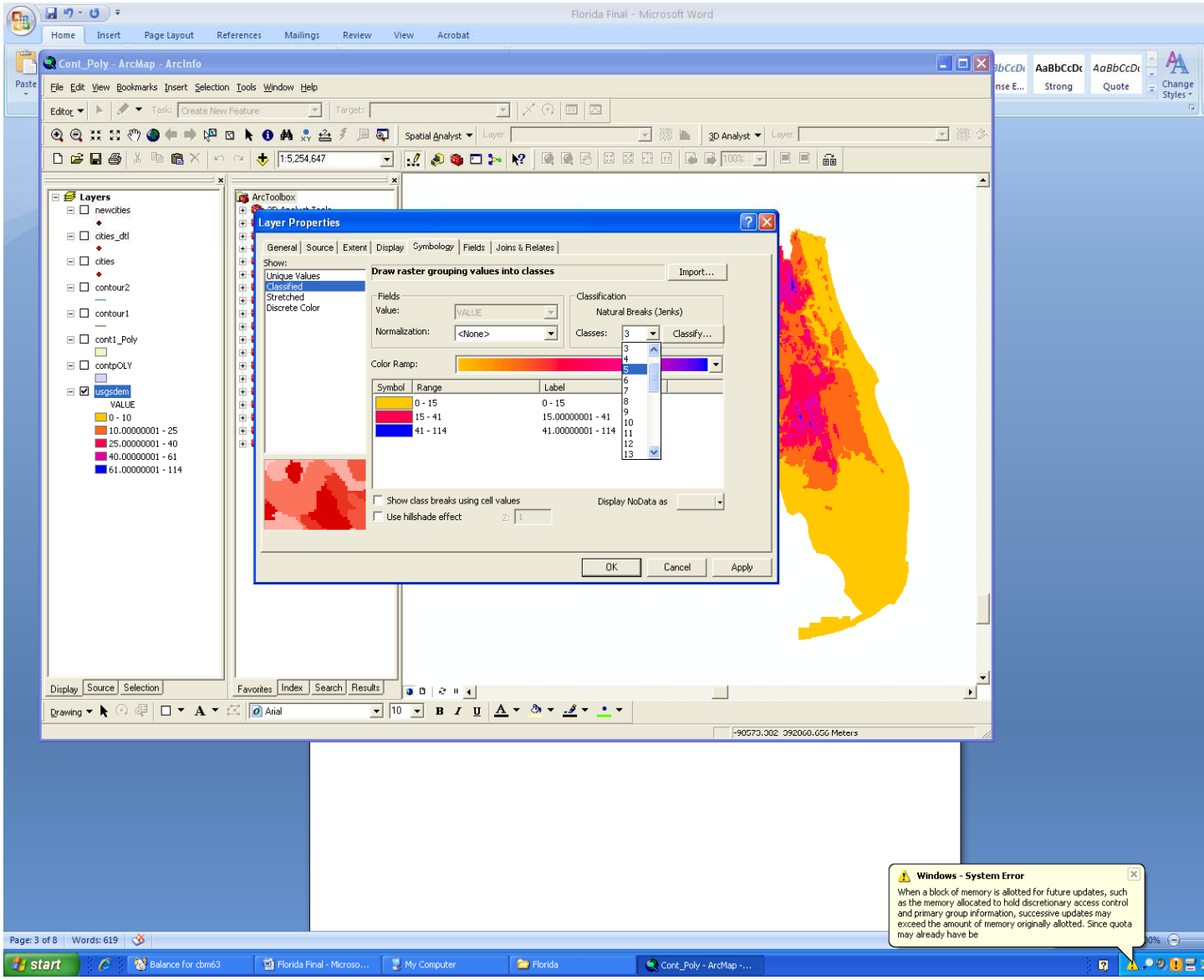

Fig. 2 (Classification)

With the elevation ranges set we can now create contours to include ranges from 0 to 114 meters which will create a contour around the entire state and a contour around 10.0001 to 114 meters. The contours allow us to see the old and new coastlines and the ability to calculate their lengths.

Open the attributes table for the new contour and create a new field with name length and type double. Calculate Geometry and set units to miles. Export the data to Excel to sum the results. The original length of the coastline is about 6,143.339 miles and the length of the new coastline after a 10 meter sea level rise is about 4,733.045 miles.

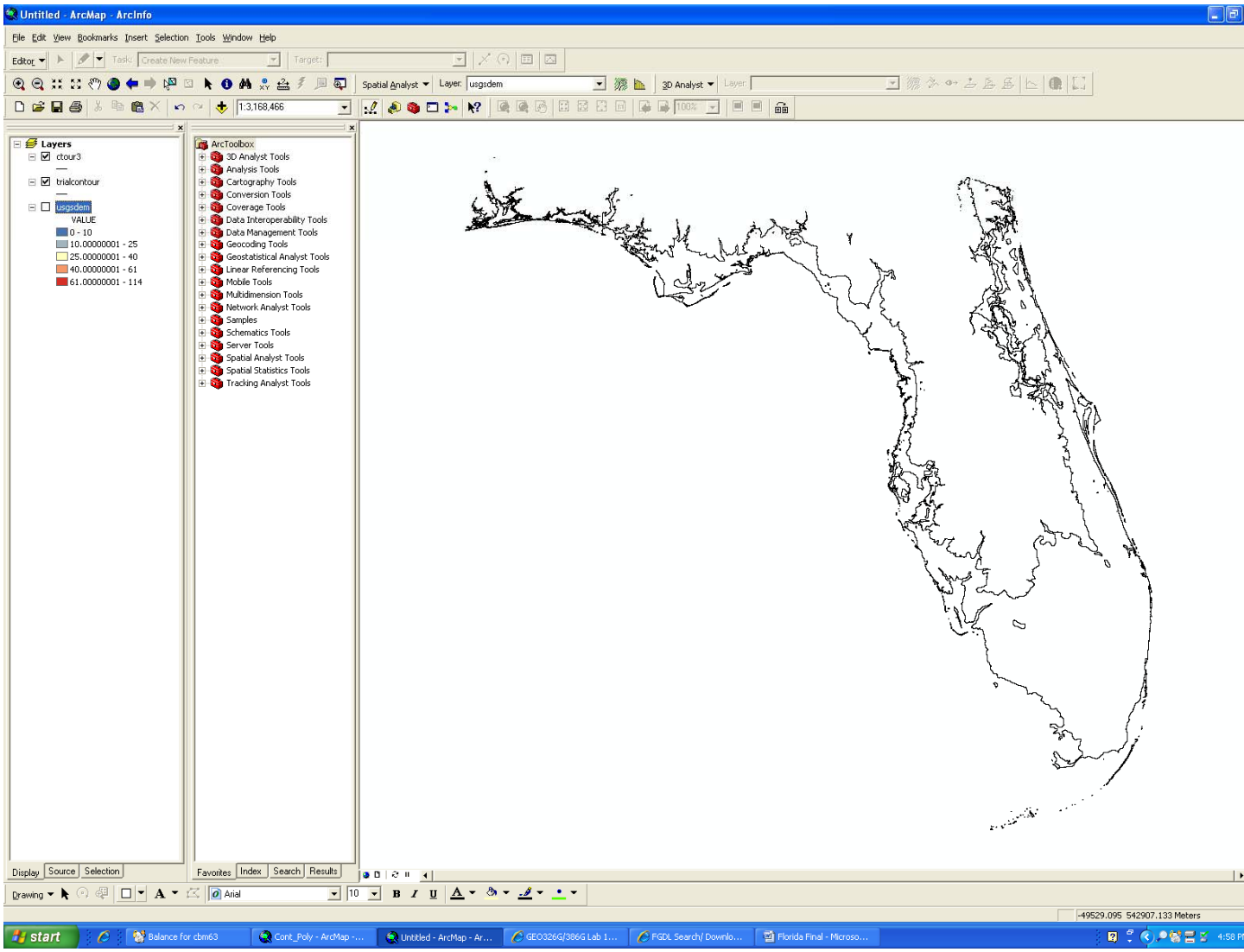

Fig. 3 (Contours)

When the contours are created they are open at the top where they would be connected to the U.S. In order to answer the next question we need to create a closed contour. By using the editing tool, zooming in and traveling around the contour it can be closed. At the top of the state the contour line length should be equal. After one contour is finished, lay the other on top of it and trace the line giving the same length.

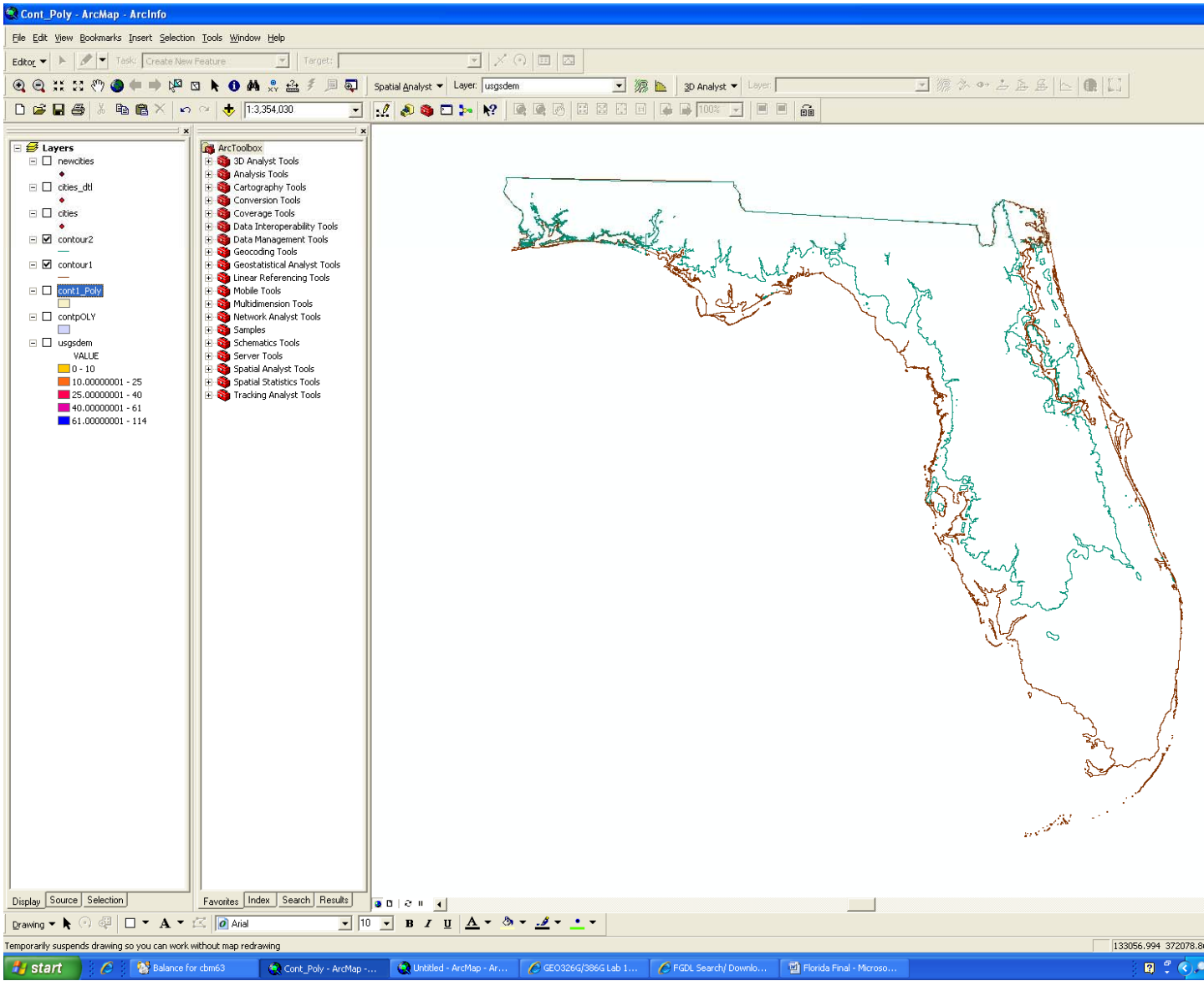

Fig. 4 (Edited)

With the contours closed polygons are created in order to calculate the new area of Florida after a 10 meter rise in sea level. In data management tool select Features and then Features to Polygons. Input Feature equal the inner contour. XY Tolerance equals 1000. Rename the Output Feature Class. Go to new layer attribute table and create a new field for area, type long, calculate geometry and set units in square miles. Export the data to Excel to sum results. The new area of Florida will be about 31,877 square miles. Florida's total area is listed at 65,759 square miles. This equates to a 48% reduction in size after a 10 meter sea level rise.

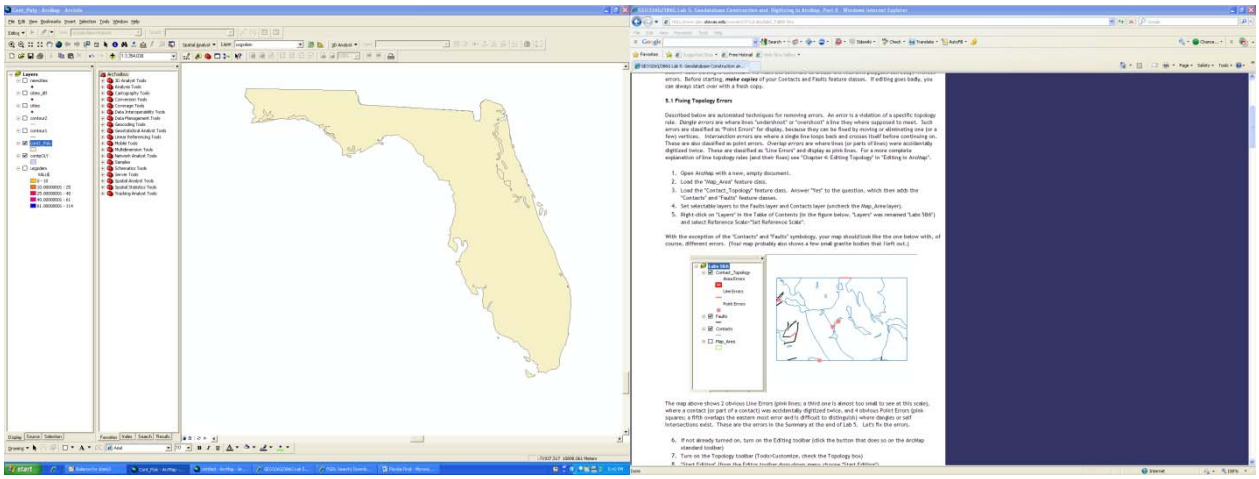

Fig. 5 (Outer Polygon)

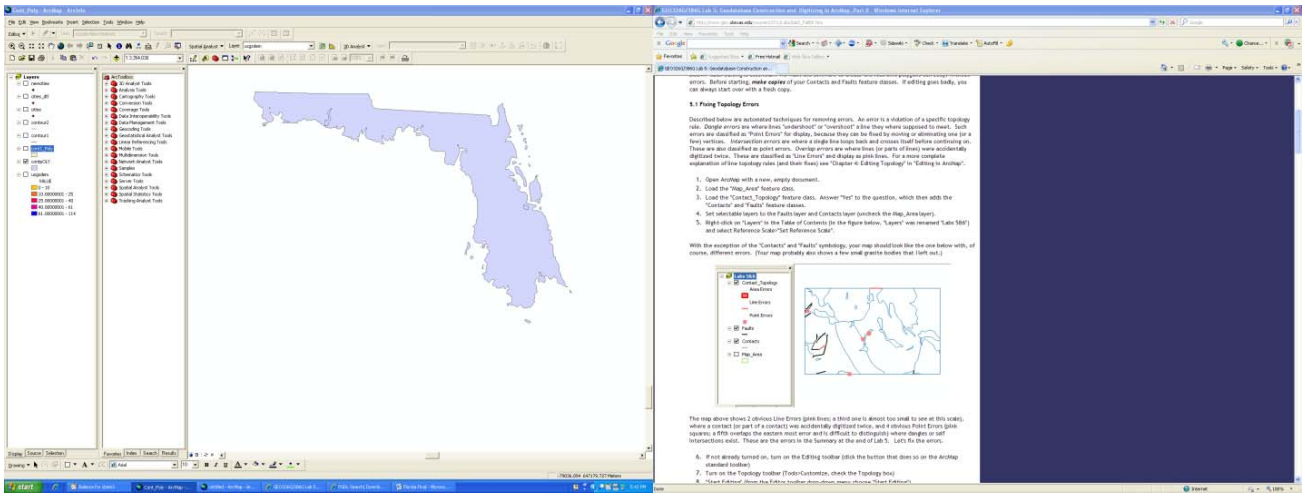

Fig. 6 (Inner Polygon)

Now that polygons have been formed the census data can be uploaded. ArcGIS 2000 census data is used although any census data for Florida will work. The ArcGIS 2000 data contains two feature classes of data named cities and cities_dtl. Cities_dtl contains many no data fields with -99999 entered into the population column. This no data information must be removed from the calculations in order to obtain a true value. The data can be removed by using Select by Attribute. Population 2000 > 0 will fix the problem by eliminating the negative numbers. A new shapefile can now be created that contains no negative numbers by exporting the data. Name it new_ cities.

With the census data corrected the number of cities not affected by the rise in water can be calculated by using the Select by location tool. This will allow us to search within the inner polygon that represents the area not affected by the rise. Choose both city feature classes, are within, the inner polygon. From the attribute table for each shapefile use selected data and sum population to gets a total number. An estimated 4,183,759 people are not affected. Florida's 2000 census estimates a 15,982,378 population meaning only 26.2% will not be affected by the rise.

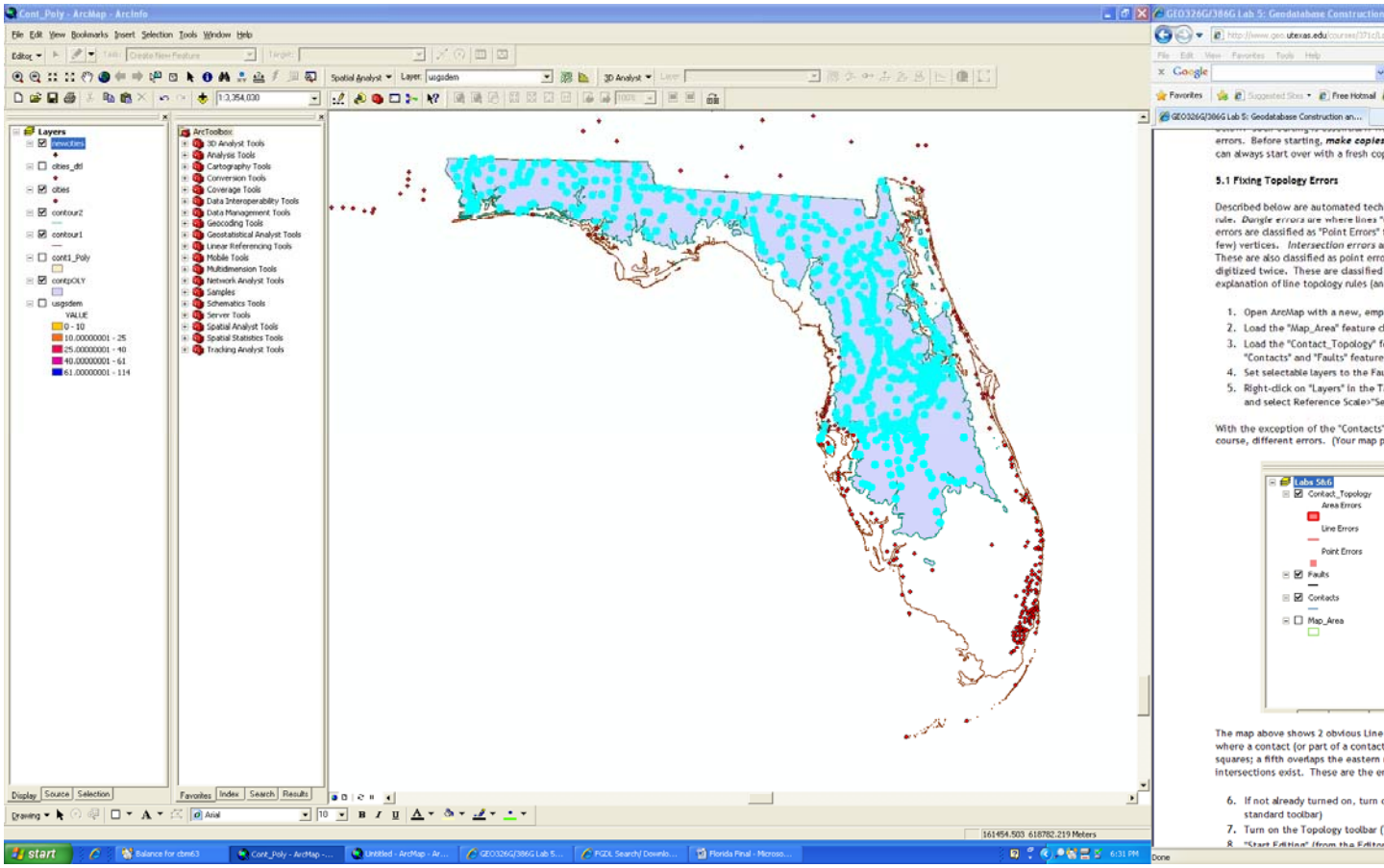

Fig. 7 (Population)

From the analysis of this project it is easy to see that almost 50 percent of Florida is at an elevation of less than 10 meters. Even though 10 meters is a substantial increase in sea level rise this numbers will be achieved in the future as the ice caps continue to melt, releasing water into the oceans. By changing the classification as seen in Fig. 2 one can obtain small values of 0-2 meters. From this one can see that a substantial amount of Florida is within this elevation also. Sea level rise will always be a factor in Florida's future. If global warming continues at the rates present today most of Florida will not have a long future. Tourism makes up the largest sector of Florida's economy. People come to Florida for its beach activities. From Fig. 3 one can see the decrease in the amount of shoreline and the total area from Fig. 6. A decrease of both of these will greatly affect Florida's largest economic sector as well as population. The majority of Florida's population lives on or near the coast. Future sea level rise will have a huge economic and social effect on Floridians. A 10 meter sea level rise will force more than 70 percent of Floridians to move inland or out of Florida entirely.