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May 18th, 9:00 AM - 12:00 PM

## Climate Implications on the Vulnerability of Populated Areas Along the Chesapeake Bay

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Scott, Stirling, "Climate Implications on the Vulnerability of Populated Areas Along the Chesapeake Bay" (2017). *Scholars Week*. 26.

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# Modelling Sea Level Rise by 2100 in Populated Areas Near the Chesapeake Bay

Stirling Scott, Huxley College of the Environment

In this study, I conducted an analysis on the vulnerability of populations living adjacent to the Chesapeake Bay to sea level rise (SLR). I used areal weighted interpolation to provide a basic analysis of the direct risk to humans posed by extreme sea level rise. In addition to the direct effects on humans due to flooding, this region could suffer extensive damage by alteration of the bay itself and destruction of habitats.

## Introduction

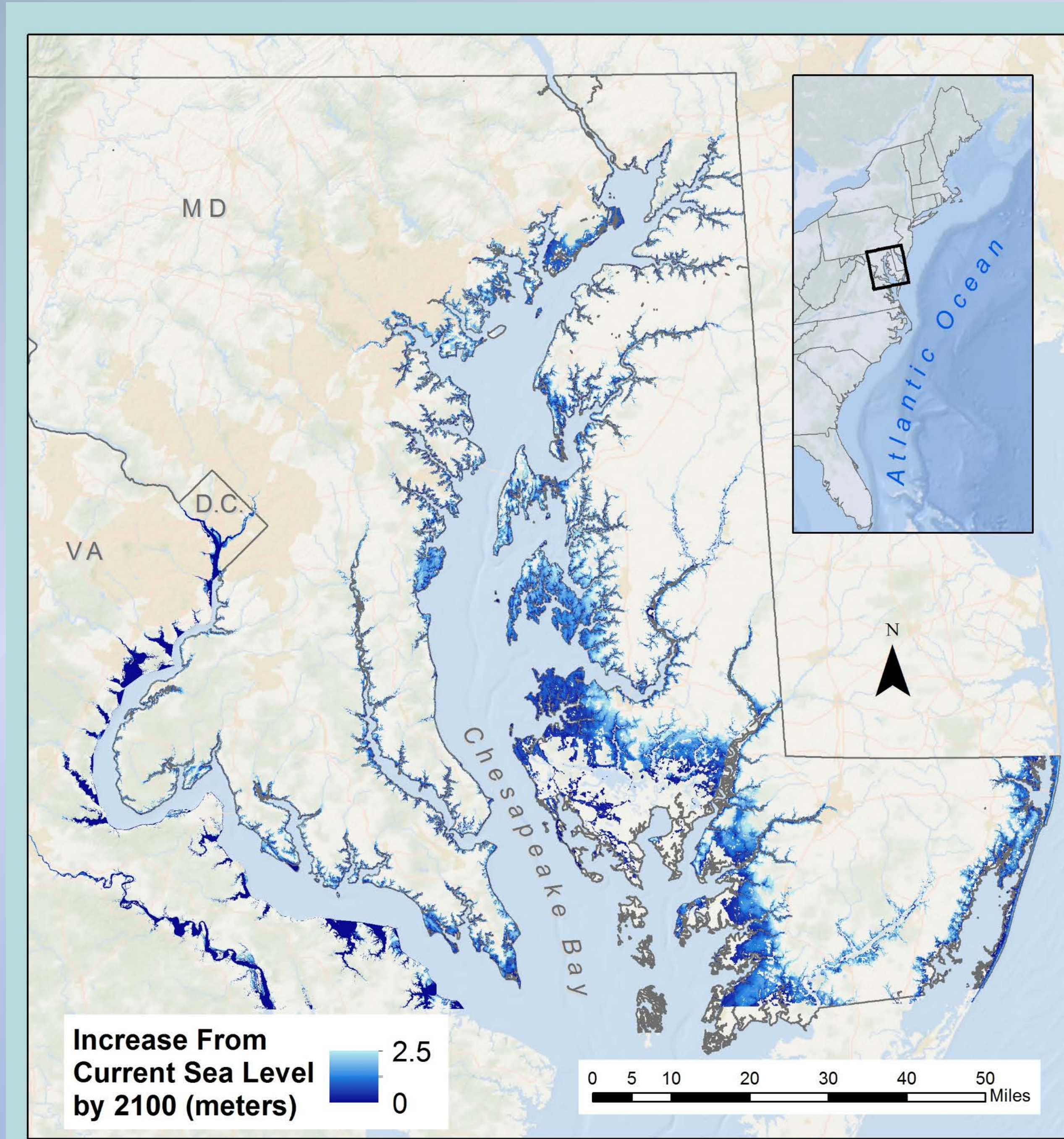
According to the latest federal report, released in the final days of Barack Obama's administration, the global average sea level rise was predicted to reach 8.2 feet (2.5 meters) by 2100 in the "extreme" scenario—a much faster rate than previously thought. 8.2 feet of sea level rise would put much of America's east coast underwater. Not only is the Chesapeake Bay adjacent to areas populated by humans, but it provides critical habitat to many plants and animals, including some of the largest populations of shorebirds in the Western Hemisphere.

## Methods

I began by creating a mosaic of several Digital Elevation Models (DEMs) from USGS, and selecting all the areas out of this mosaic that were under 3.4 meters in elevation. The number 3.4 was determined by adding the 2.5 meters predicted by NOAA to 0.9 meters—the average of highest high tide levels from 2016 from multiple tidal gage stations along the Chesapeake Bay. Once I had a map layer for the inundation, I used the 'Intersect' tool to combine this with a census tracts layer, and used areal weighted interpolation (multiplying the population density of the tract by the area of the tract that would be flooded) to calculate the approximate population that could be directly affected by the sea level rise. I repeated this process to analyze multiple themes in multiple states, including census data in Maryland, Virginia, and D. C., as well as land use in Maryland.

## Results

Based on this model, I found that, should sea level in this region reach the 2.5 meter mark predicted by NOAA, about 4 percent of the state of Maryland could end up underwater.



Potential Sea Level Rise by 2100

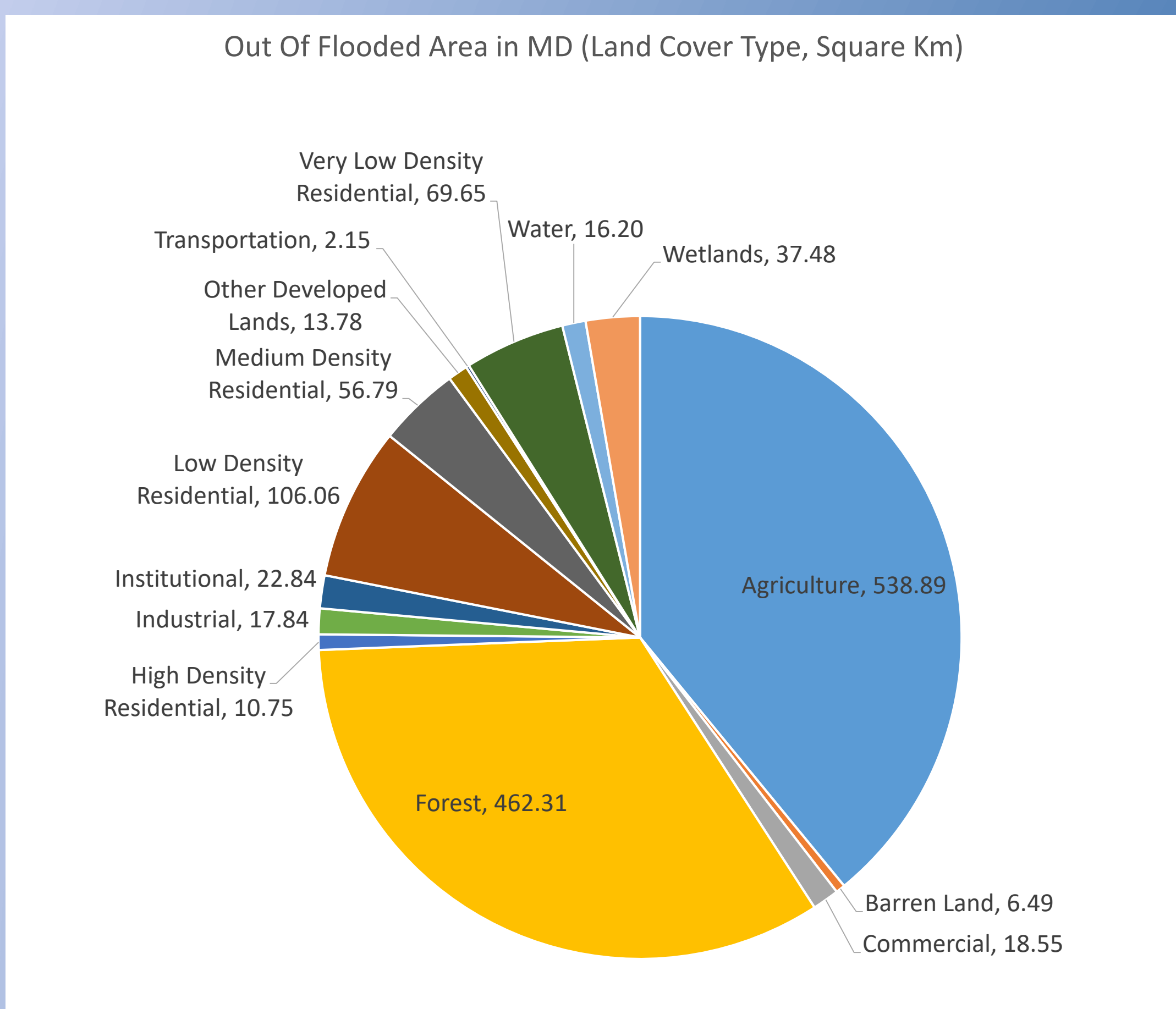
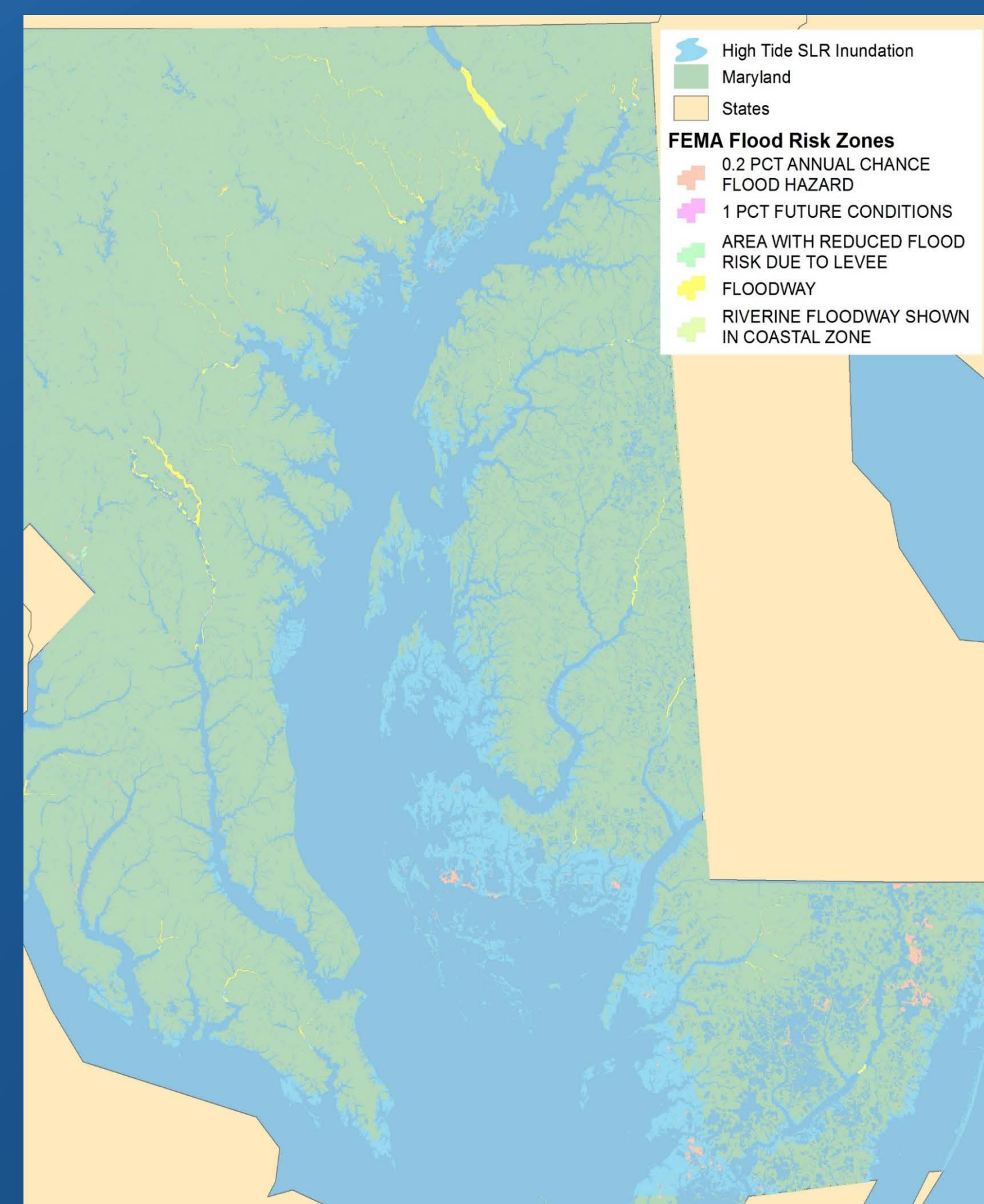
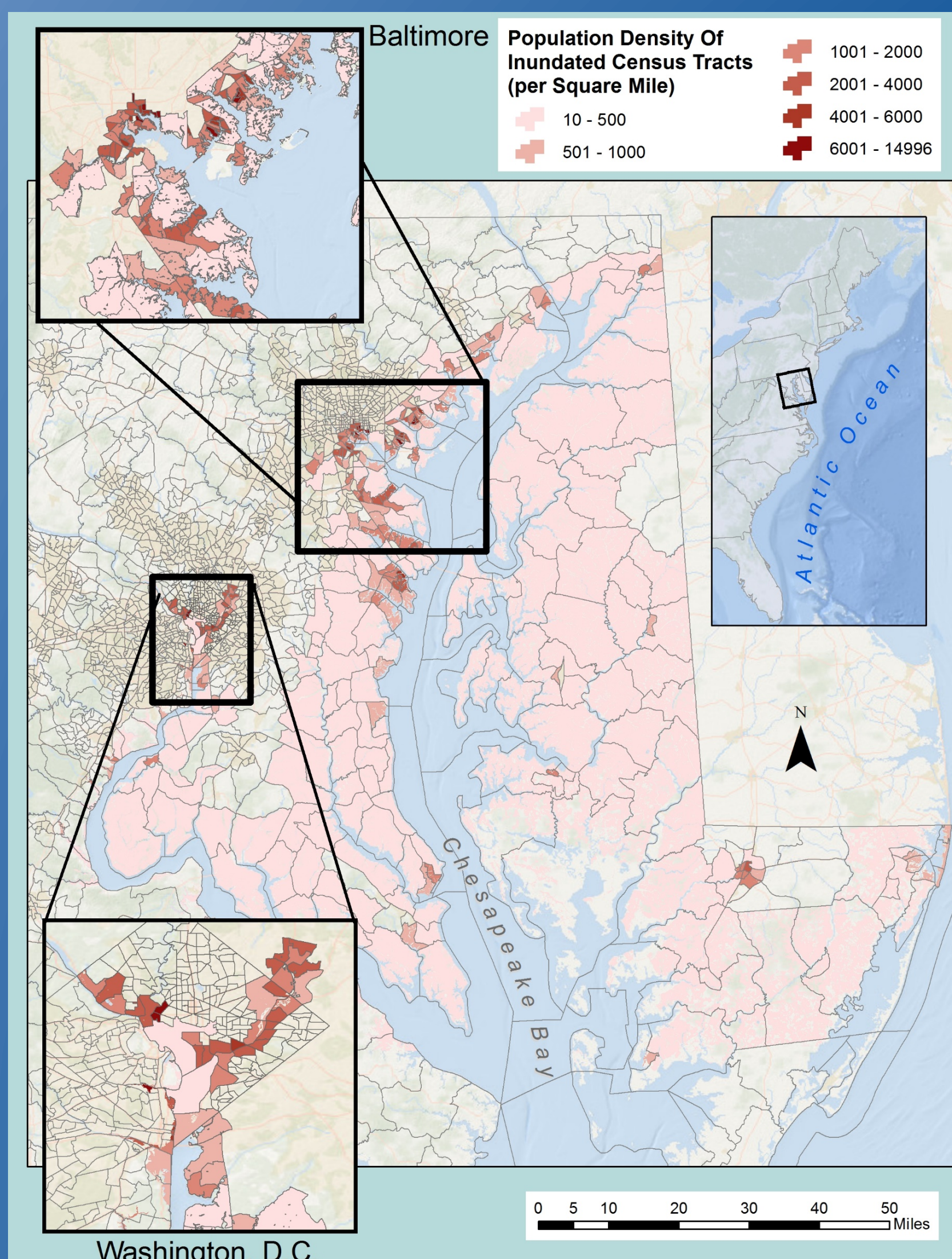
State	Increase in Sea Level (m)	Potentially Displaced Population	Potentially Flooded Housing Units	Total Area Flooded (km)	% of State Underwater
MD	1	72,199	49,038	740.56	-
	2.5	167,301	99,648	1,366.83	4.25%
VA	1	17,258	7,640	286	-
	2.5	41,386	18,723	342.53	0.31%
DC	1	17,258	7,640	19.93	-
	2.5	6,343	2,103	3.65	13.32%

## Conclusion

Not only should we try to stop causing such accelerated climate change, but we need to consider the extreme changes that are already bound to occur into our long-term planning. We need to protect the assets that already exist in vulnerable areas, and try to focus development outside of vulnerable areas.

There are many factors I left out of my analysis here that could further exacerbate the effects of sea level rise on this region. Due to natural land subsidence as well as storm surge associated with the hurricanes to which this region is susceptible, it is possible that areas along the Chesapeake Bay could see more inundation from sea level rise and frequent flooding than shown here. Below is a map showing areas identified by FEMA as being susceptible to flooding which fall outside of the inundation zone, with a higher sea level, it is likely that these flood-prone areas will expand inland.

In addition to the direct physical and economic effects on humans, sea level rise will drastically change the conditions that make parts of this region suitable habitat to hundreds of species of fish, invertebrates, and birds. As humans move away from the coast, they also will need to consider making room for wildlife to take over new suitable habitat areas.



References  
 Data:  
 FEMA, USGS, U.S. Census Bureau, NOAA, WWU, State of Maryland  
 Literature:  
 Glick, Patty, Jonathan Clough, and Brad Nunley. 2008. *Sea-Level Rise and Coastal Habitats in the Chesapeake Bay Region*. Technical Report, National Wildlife Federation.  
 Sweet, William, Robert Kopp, Christopher Weaver, Jayantha Obeysekera, Radley Horton, E. Robert Thieler, and Chris Zervas. 2017. *Global and Regional Sea Level Rise Scenarios for the United States*. Technical Report, Silver Spring, Maryland: National Oceanic and Atmospheric Administration.