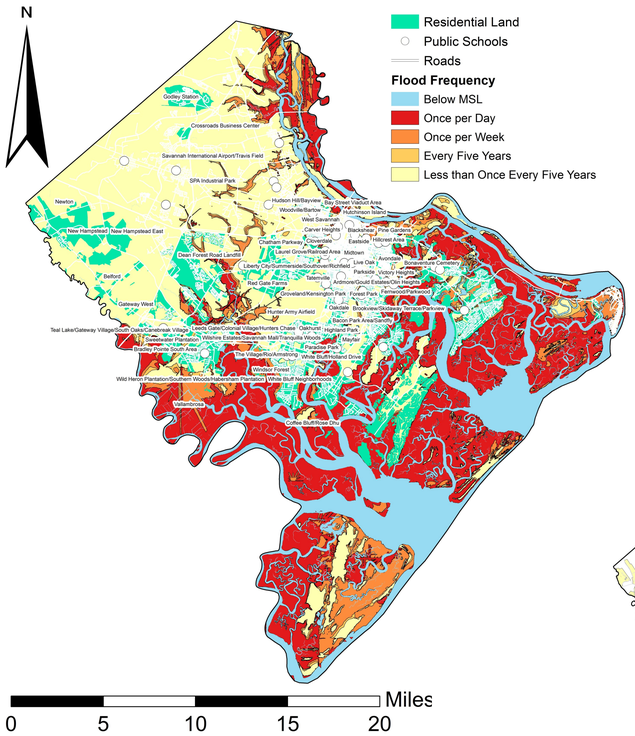
Atlantis, Georgia | Sea Level Rise and Population Displacement in Chatham County

Tufts

Introduction

Savannah, Georgia is already feeling the effects of sea level rise; US Route 80, a major highway stretching from Tybee, a barrier island, through Savannah has been closed six times due to flooding between April 2015 and April 2017(Landers, 2017) (Weingroff). Tidal flooding, combined with winds, have also led to school closures, and the influx of seawater into island marshes have left tree skeletons as harbingers of rising seas. These impacts are precursors to large and increasing threats to Savannah, home to remarkable economic, historical, and artistic significance, and its presence in a state reluctant to acknowledge or act on climate science puts its residents in all the more danger.

In this project, I quantify impacts of sea level rise on Chatham County, Georgia in terms of risk to schools, risk to roads, and population affected, broken down by race, to paint a picture of those first and most affected by sea level rise.



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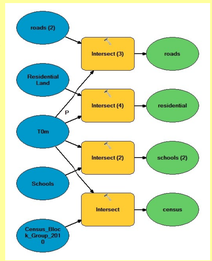
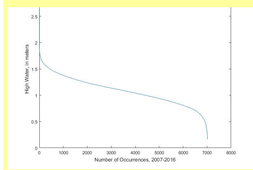
Data Sources: USGS, SAGIS, Georgia Data Clearinghouse

Methodology

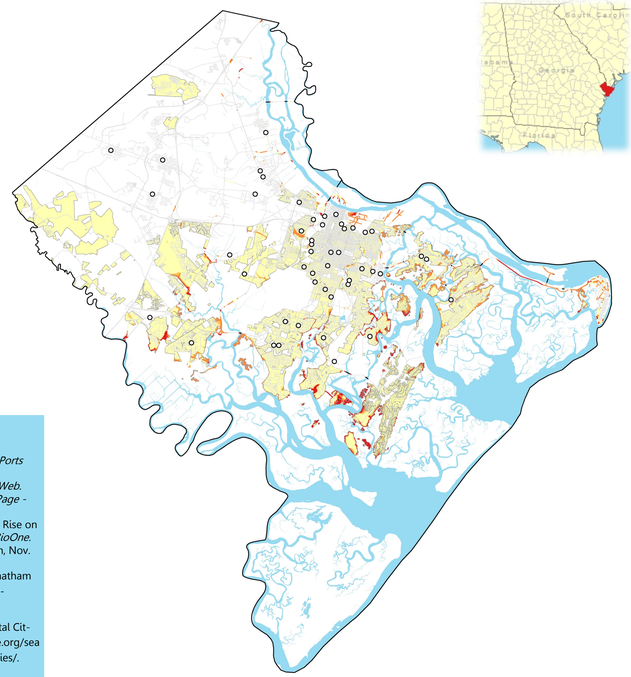
I took project inspiration from a 2016 paper, *The Impacts of Sea–Level Rise on Tidal Flooding in Boston, Massachusetts.* The author, Stephanie Kruel, uses tidal and elevation data in what she calls a "bathtub model". She based her analyses on elevation, not projected year, so they can be applied separately to different sea level rise predictions. I wanted to focus more on residential assets and population than Kruel did, to get an image of the American climate refugee, and to figure out which areas and demographics are at most risk. I chose to include race in my analysis because Georgia and Savannah are drenched in racial history, and because those least able to relocate or deal with increased flood risk are typically low-income racial minorities.

I started with a current DEM of Chatham in meters above Mean Sea Level, then created three new ones, for elevation adjusted for one half, one, and one and a half meters of sea level rise. I classed each of the DEMs into flood rates I calculated from NOAA tidal data for the years 2007-2016.





My categories are flooding once per day, once per week, and once every five years. I then intersected these categories with residential land, roads, schools, and census data, then analyzed the data manually to come up with my final table.



Results

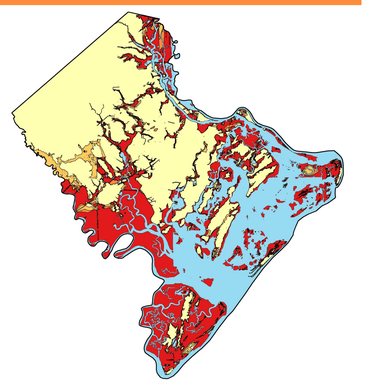
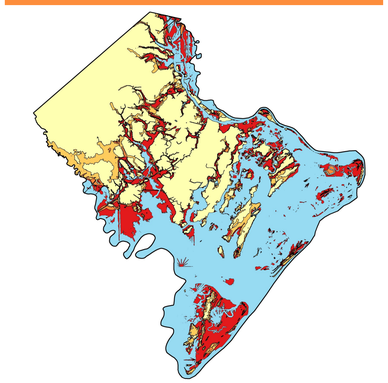
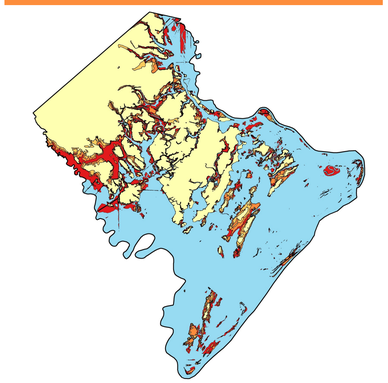
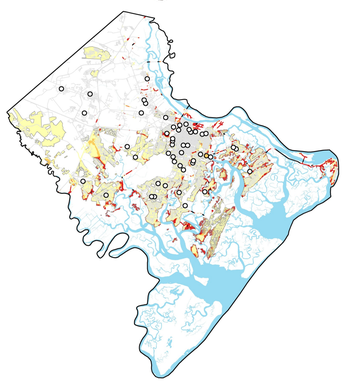
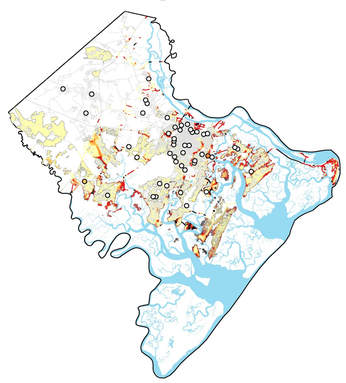
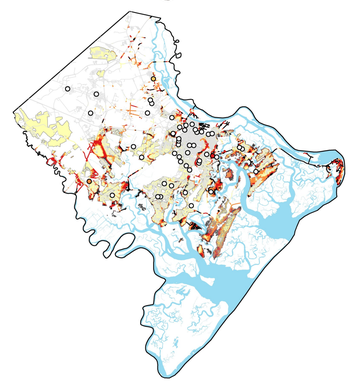
I found my own results quite surprising. I was worried that primarily black areas would be affected first, which is not the case. It seems that the first areas affected are suburban, and predominantly white, neighborhoods close to the coast and rivers. There are some confusing points in my results: are thirteen thousand people in Savannah already amphibious? The data turned out that way because I did my population analysis in census block population density. Though imprecise, the data are telling; the risk to roads is clearly already present and slated to get worse. Savannah's meticulous city planning made this project difficult, but they planned for current flood patterns. As those patterns change, Savannah will have some hard decisions to make.

It's likely that the first victims in wealthy, coastal neighborhoods will be able to adapt and survive, but, as Savannah's climate victim comes to better represent its whole population, the city will face a humanitarian crisis. Keep in mind that I assumed extreme weather frequency would stay the same, not because the science says that, but because I can only include so many factors in my analysis. Today's projections often list 1.5 meters of sea level rise as an upper bound for the year 2100; that means that Savannah has 83 years to figure out how to mitigate the effects of climate change, or relocate over 20% of its population.

Sea Level Rise		Area (sq. miles)	Population	% White	% Black	Students	Road (miles)
0m	survey area	521	265,128	53	40	34,214	1778
	at risk	198	55,787	67	26	0	102
	inundated	82	13,257	80	15	0	3
.5m	at risk	158	51,539	61	32	1620	159
	inundated	144	28,605	81	14	0	7
1m	at risk	122	56,660	60	33	3,242	279
	inundated	210	42,395	76	19	0	16
1.5m	at risk	86	50,794	59	34	3,757	317
	inundated	265	60,986	71	23	0	69

Solutions

In her article, Kruel suggests that, as sea level continues to rise, disaster relief will be less effective due to its case-by-case operation; flooding will be less of a series of singular emergencies, and more a continuous emergency. I think this is the fate of Savannah, which must address the problem well in advance and with a loose wallet to keep the financial burden off of the citizens. The Climate Institute suggests protecting barrier islands, shoring up levees, and educating community on emergency protocol. All three of these solutions are feasible for Savannah, leaving it up to the city to decide how much to invest, and how quickly. Mitigation also involves urban planning, as Savannah should promote development in areas which are at lower risk.

	0.5 m Rise	1.0 m Rise	1.5 m Rise
Flood Frequency Map			
Data Intersect Map			

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