The Rising Tide:

Effects of Sea Level Rise on Wilmington, NC
Identifying Vulnerable Populations and Areas

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Introduction

Sea Level Rise (SLR) is likely to be the first global catastrophe humans will experience due to global climate change (Bennet, 2018). In North Carolina the sea level has risen 11 inches since 1950 and shows no sign of slowing down. All evidence points to the contrary, an exponential increase in the rate of sea level rise (Bennet, 2018; Kern, 2018). This will provide a monumental challenge to NC as it is the third most susceptible area on the east coast to sea level rise, behind South Florida and Norfolk, VA (Parker, 2016). The most populous city on NC's coast is Wilmington, it is also the economic center of NC coast. For these reasons SLR is likely to have a disproportionate effect on the city (Overton et. al., 2010). This analysis will attempt to project the impacts of SLR and its effect on 100 year floods plains. Projections are created for best and worst case scenarios in 2050 and 2100 as well as a map of the current conditions in Wilmington.

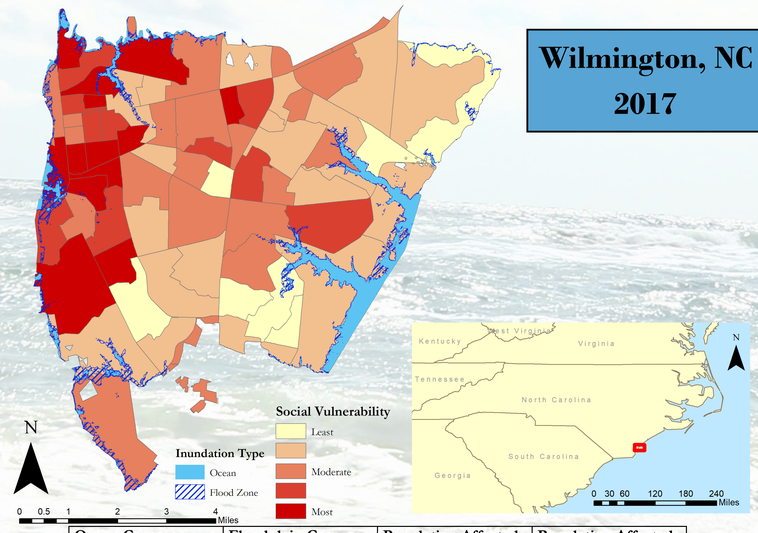
Methodology

Predicting a change in regional sea level requires assumptions about changes in Global Median Sea Level (GMSL). This analysis will assume a change in GMSL of 2.5m. A change in GMSL of 2.5m was considered implausible in 2012. Previous projections had a high end increase of 2.0m. However, when NOAA created new projections in 2017, recently published evidence of increased instability in polar ice sheets necessitated changes to previous models. NOAA settled on a new plausible range of 2.0m to 2.7m of change in GMSL (Sweet et al., 2017).

Using updated flood models from Climate Central, changes in the height of 100 year floods were predicted. By adding these heights, measured in meters above sea level, to the new sea levels from NOAA, new floodplains could be mapped.

Social Vulnerability was estimated using seven factors identified by Climate Central using data provided by the US Census's American Community Survey. Each census block group was ranked on a scale of 1 to 5 based on the percentage of its population that fell into the following categories, over 65, under 18, limited English proficiency, access to a vehicle, disability status income, and people of color. These scores were then added together to create a final scale, with scores ranging from 7 to 35.

Wilmington, NC 2017



Ocean Coverage Within City Limits	Floodplain Coverage Within City Limits	Population Affected (Ocean)	Population Affected (Flood)
4.36%	6.33%	2.47%	3.48%

Sources:

Bennett, A. (2018) "NC beach homes and coast are 'doomed' and residents need to get out, scientist says" *News & Observer.*

Durkin, E. (2018) "North Carolina didn't like science on sea levels … so passed a law against it" *The Guardian.*

Kern, J. (2018) "OVERVIEW North Carolina's Sea Level Has Risen 11" Since 1950 And It's Costing Over $2 Billion" *Sea Level Rise.*

Overton, M., Benton, S., Birkemeier, W., Cleary, W., Jarrett, T., Mallinson, D.J., … Skrabal, T. (2010) "North Carolina Sea-Level Rise Assessment Report" *N.C. Coastal Resources Commission's Science Panel on Coastal Hazards.*

Sweet, W.V., R.E. Kopp, C. P. Weaver, J. Obeysekera, R. M. Horton, E.R. Thieler and C. Zervas (2017), Global and Regional Sea Level Rise Scenarios for the United States. NOAA Tech. Rep. NOS CO-OPS 83.

Brian Froeb

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Projection: NC State Plane, Lambert Conformal Conic

Coordinate System: NAD 1983, NC FIPS 3200, Meters

Data From:

USGS, DEM; US Census, American Community Survey; Climate Central, Risk Finder; Tufts M Drive; and NOAA, Regional Sea Level Rise Assessment

Background From:

https://www.pexels.com/photo/atlantic-beach-coast-north-carolina-1139763/

Results

The results show a consistent increase in the flood plains and ocean area within the city limits. Exact numbers can be found in the tables below each map, however the two most interesting results are summarized here. First, in 2050 the percentage of the population living in flood plains is higher in the best case scenario than the worst case scenario, 7.05% to 6.60% respectively. However, this is explained by an increase in the percentage of population that lives in areas that will be inundated by the rising ride, 4.36% vs 8.82% respectively. Secondly, there was no significant difference between the scenarios in terms of Social Vulnerability. Mean scores ranged from 18.7 to 19, the standard deviations ranging from 4.2 to 4.5.

Conclusion

This analysis makes apparent the threat of SLR and increased flooding to Wilmington and the necessity of serious action on global climate change. The stark difference between the best and worst case scenarios, in an already extreme projection, highlights this. Unfortunately the current political climate in NC makes action on climate change seem unlikely. Recently the state outlawed the use of any climate projections in drafting policy (Durkin, 2018).

There are some limitations to this analysis:

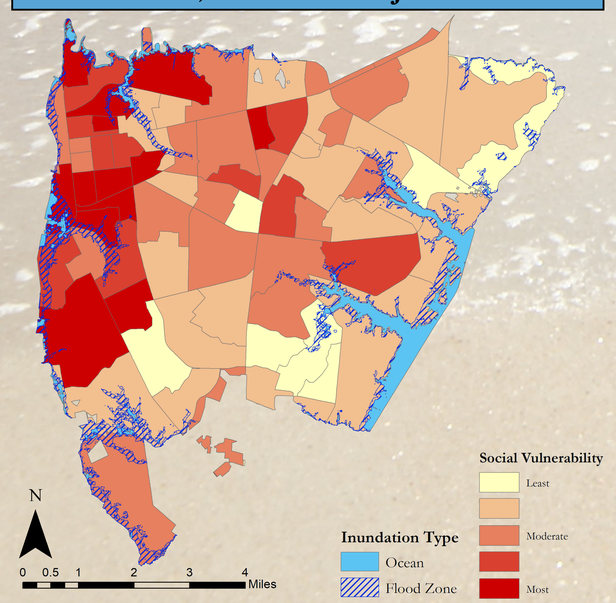
First predicting the future is difficult, but it is especially difficult for SLR because of the high number of factors. Additionally the worlds governments have shown major swings when it comes to their responses to climate change. Changes to any one factor, the discovery of new factors, or government action could drastically alter the amount of SLR.

Additionally, this analysis is based high end projections of change in GMSL. It is possible that a lower change in GSML could occur. However, when planning for a disaster over estimation of the affected area is always better than the alternative.

Because ArcMap assumes the population is equally distributed there is always some error in estimating the population in an area. To account for this inaccuracy, the proportion of the population that "lives" in the ocean was calculated for current conditions, it is 2.47%.

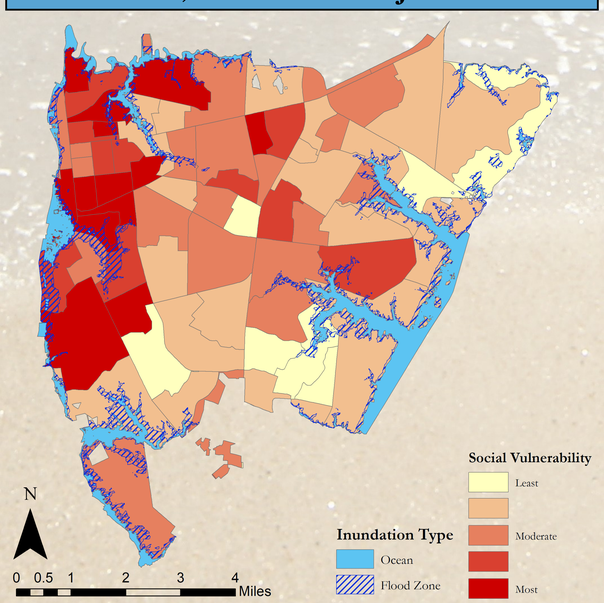
These projections for SLR and changes to flood plains are based purely on elevation, with data provided by the USGS. This provides a less accurate projection than an analysis taking into account hydrological factors, which would likely shrink the floodplains (Overton et al, 2010).

2050, Best Case Projection



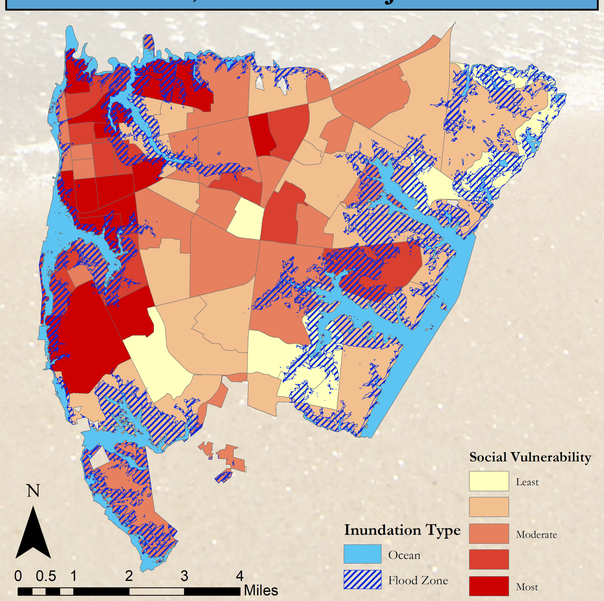
Ocean Coverage Within City Limits	Floodplain Coverage Within City Limits	Population Affected (Ocean)	Population Affected (Flood)
4.36%	7.05%	2.47%	9.61%

2050, Worst Case Projection



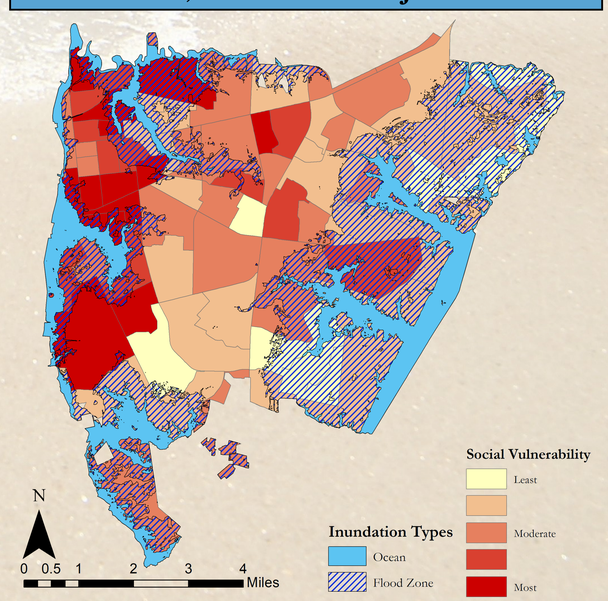
Ocean Coverage Within City Limits	Floodplain Coverage Within City Limits	Population Affected (Ocean)	Population Affected (Flood)
7.87%	7.56%	8.82%	6.60%

2100, Best Case Projection



Ocean Coverage Within City Limits	Floodplain Coverage Within City Limits	Population Affected (Ocean)	Population Affected (Flood)
11.41%	21.66%	12.09%	17.40%

2100, Worst Case Projection



Ocean Coverage Within City Limits	Floodplain Coverage Within City Limits	Population Affected (Ocean)	Population Affected (Flood)
15.43%	40.81%	15.41%	37.75%