

# Sea Level Rise in Norfolk and Portsmouth Counties, Southern Virginia: Effects on Land Type Loss, Community Resiliency, and Disproportionately Affected Demographics

## Intersections of Military Preparedness, Climate, and Politics

Climate changes pose myriad challenges to policymakers, city planners, national security strategists, and individual households. A number of senior U.S. military and political leaders have called climate change the greatest security threat to the world, despite current political gridlock. Roger Sorkin, director of an organization called American Resilience Project, argues that the best way to address this challenge is to convince only an additional 5% or so of the U.S. population of the importance of climate change, and to do so through a national security lens. He focuses on center-right demographics whose livelihoods are linked to military jobs and industry, hoping this segment of the population will form a tipping point in Congress, in defense planning, and in schools. In a documentary called *Tidewater* Sorkin examines the Hampton Roads area of

Virginia, the region whose vulnerability to sea level rise most affects military readiness. The analysis shown here focuses on two counties that neighbor Hampton Roads—Norfolk and Portsmouth—which also support a particularly high proportion of military operations and livelihoods yet are particularly vulnerable to climate change. Sea level rise (SLR) in these counties also affects urban planning, community resiliency, and disadvantaged demographics.

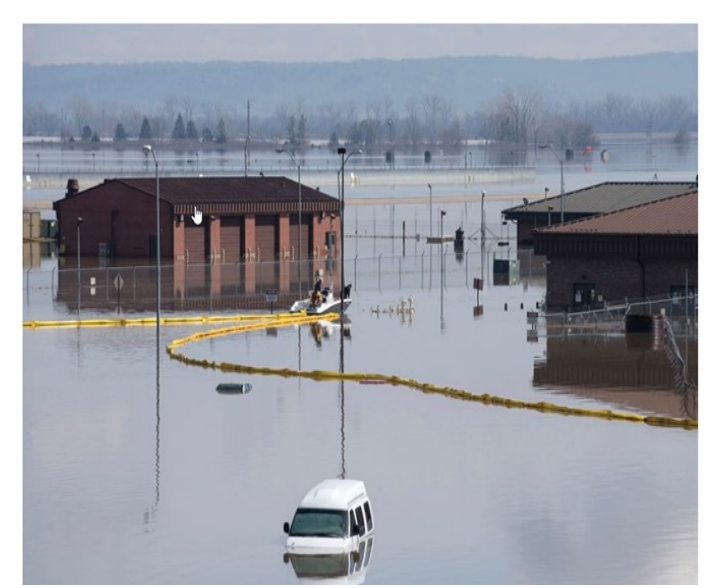
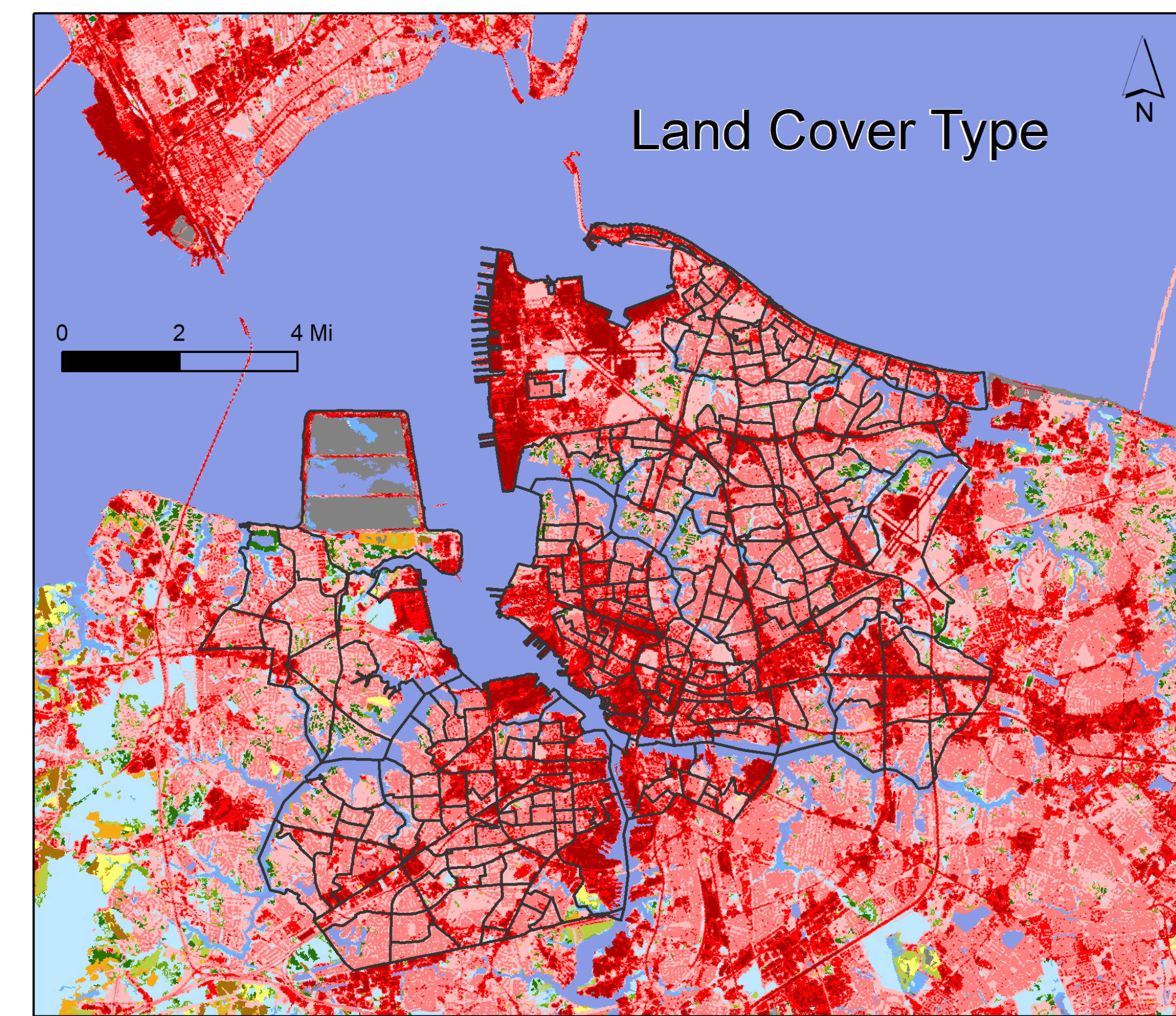
## Limitations and Recommendations for Further Study

Climate change is complex and multifaceted, and cannot be distilled to a single indicator or set of variables. Nevertheless, this analysis focuses on different projections of sea level rise in Norfolk and Portsmouth counties. The effects of sea level rise should be further examined in conjunction with the effects of global temperature rise, warming permafrost and Arctic ice sheets, increased severity and frequency of major storms, increased likelihood of

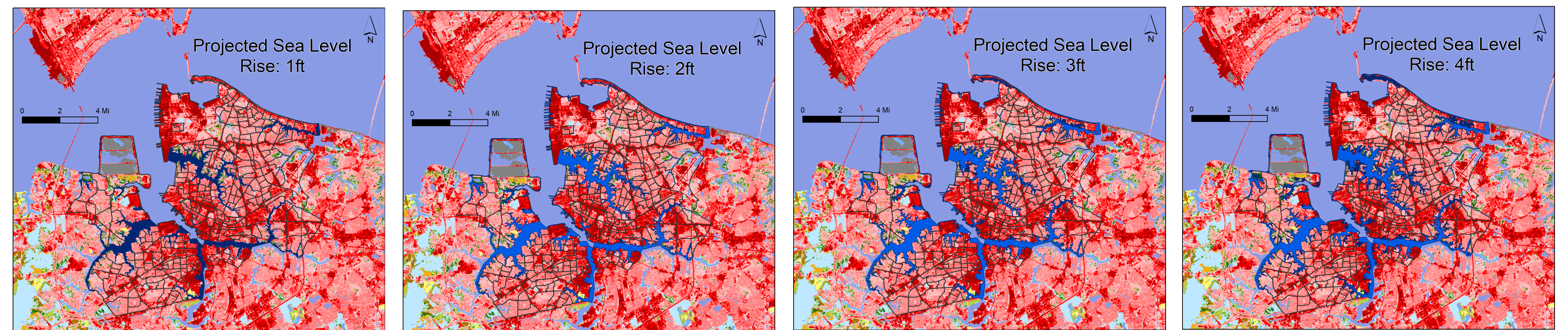
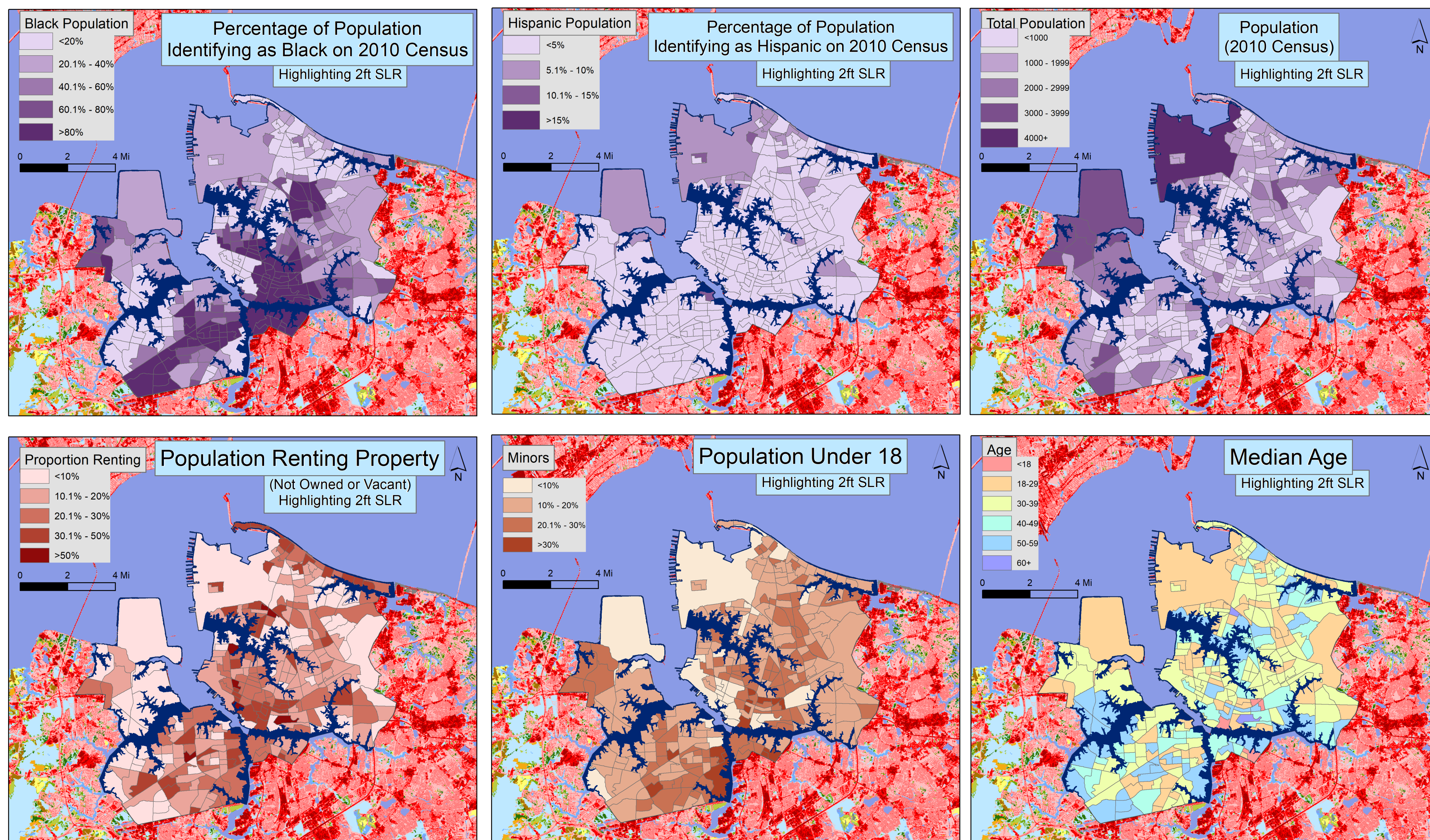
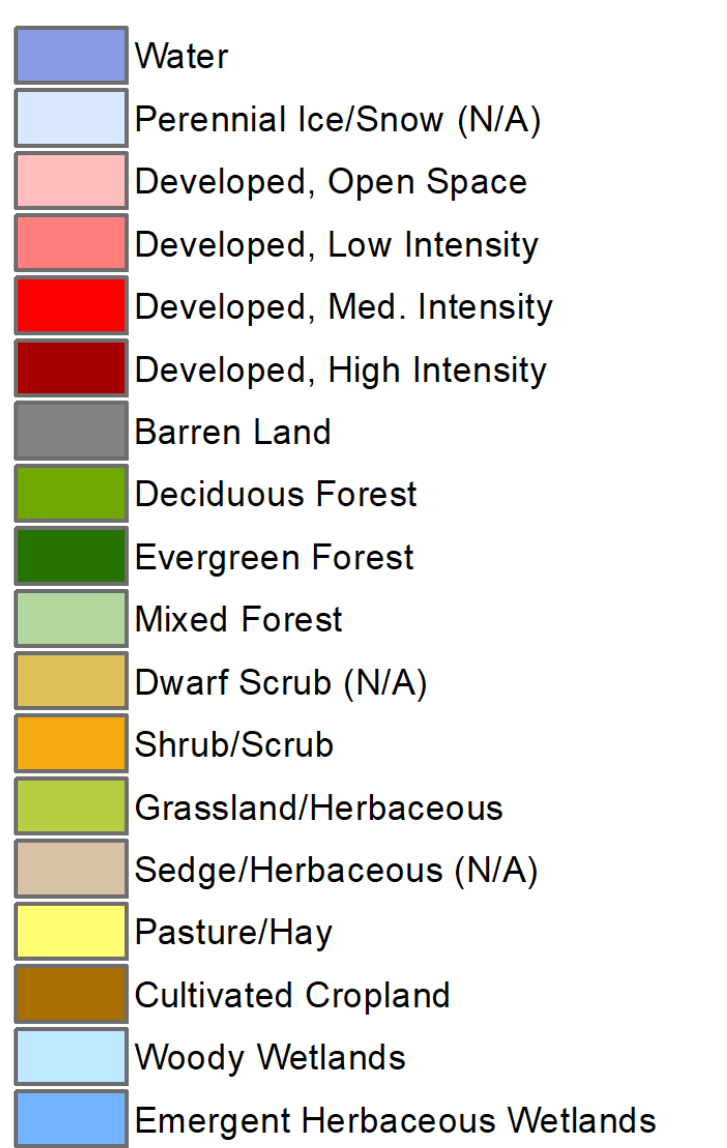
coastal and inland flooding exacerbated by sea level rise, erosion of wetlands and soil resiliency, and other evolving environmental factors.

Certain portions of the population tend to be disproportionately affected by environmental changes. Some of these challenges are illustrated below, such as the effects of sea level rise on certain neighborhoods and disadvantaged populations. Mean household income is recommended as an additional metric for examining neighborhoods disproportionately affected by sea level rise in these counties.

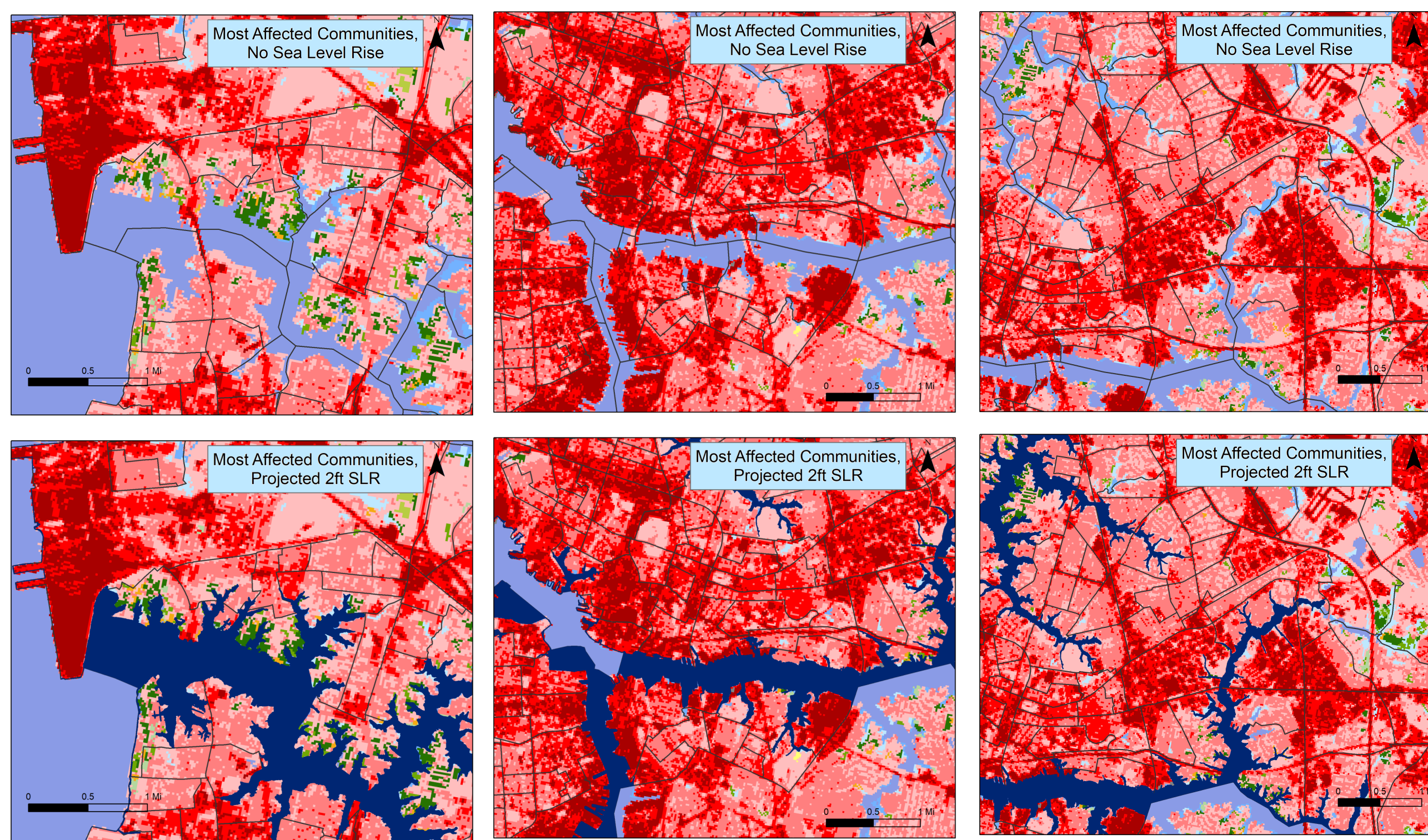
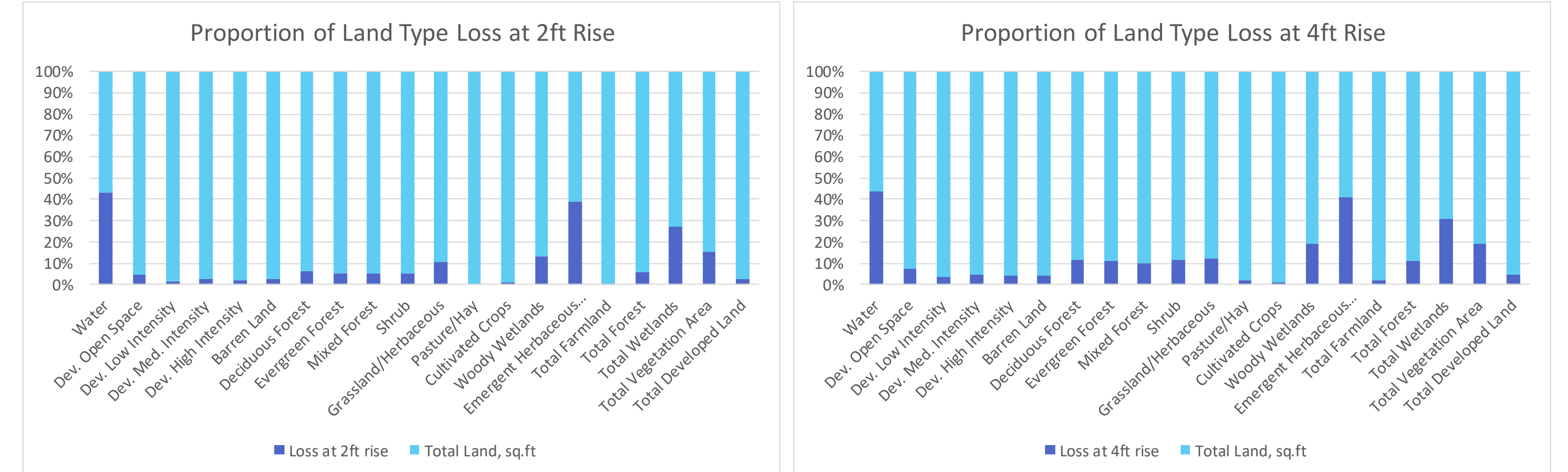
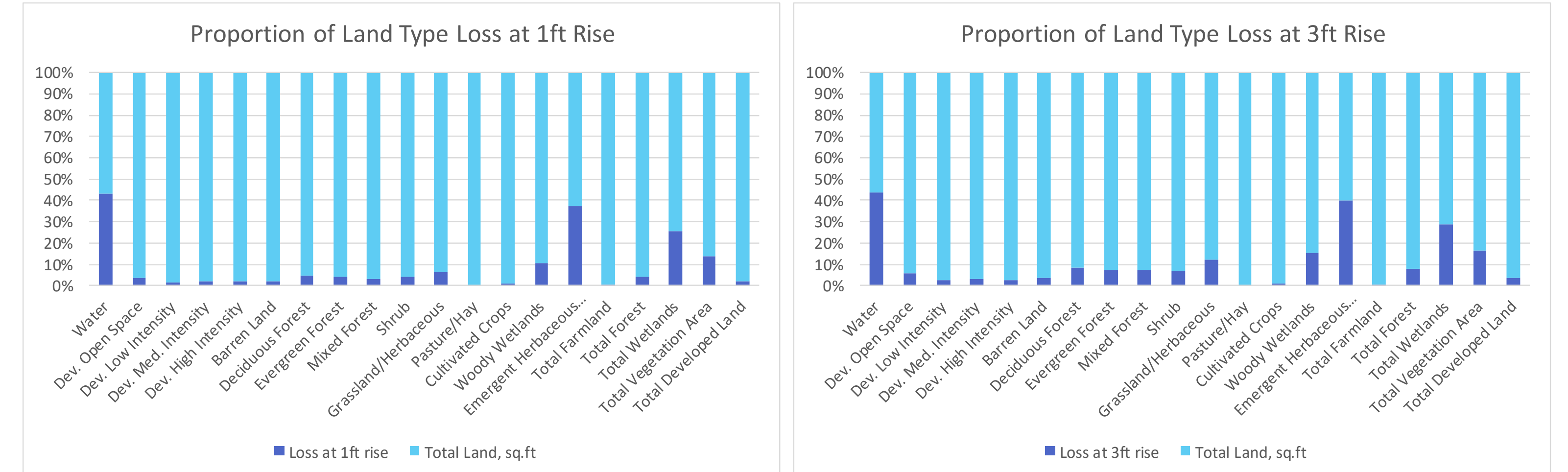
Ideally, this study forms a basis for further analyses of how climate change, including sea level rise and other interrelated, exponentially correlated elements of climate change, affect local communities, socioeconomically disadvantaged groups, national security preparedness and resiliency, land cover and biodiversity of vulnerable areas.



National Land Cover Database



Photos of Muir Glacier, AK



## Methods of Analysis and Conclusions

Combining census data, land cover data, and different iterations of projected sea level rise from NOAA Digital Elevation Model (DEM) data, this analysis provides insights into urban planning and land type loss, community resiliency, and disproportionately affected demographics. The DEM allows for iterating sea level rise across different levels, though further analysis might allow for viewing combinations of SLR and projections of additional climate change indicators. These iterations provide a baseline for SLR projections, which does not account for additional damage caused by wetlands erosion, increased vulnerability to flooding, etc. This analysis does allow for viewing different types of land that would be lost to SLR, and the charts show the proportions of land that would be lost in these counties to SLR. The maps to the left show neighborhoods of these counties that appear particularly vulnerable to projected SLR of 2ft, and additional conclusions may be drawn from the demographic makeup of

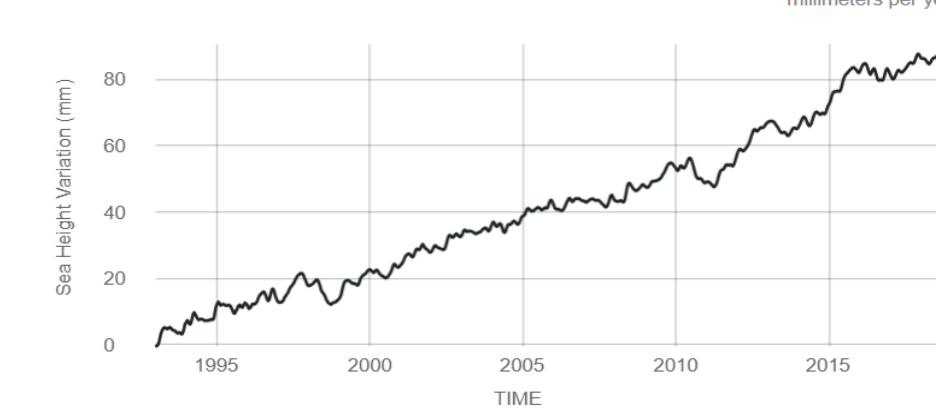
these communities. The first column of most affected communities, for instance, has particular relevance to military preparedness, resiliency of Naval Station Norfolk, and transportation access between multiple naval bases and the surrounding community. The neighborhood in the second column, for example, shows that SLR disproportionately affects both black and young populations in this area, among other observations. It would also have high impact on developed urban areas here; buildings here are especially vulnerable to flooding. Sea level rise would have a particularly destructive effect on wetlands near the neighborhood shown in the third column, as well as on elderly populations in some block groups.



Digital Elevation Model

- Data Sources:**
- National Land Cover Database (2011, edition 2014/10/10)
  - Norfolk Census; Portsmouth Census; US Census Bureau (2010)
  - World Population Review
  - Natural Terrain Base; NOAA; NASA; FEMA; ESRI
- References:**
- NOAA; NASA; FEMA; USGS
  - Stefan Rahmstorf, "Modeling Sea Level Rise," *Nature*, 2012
  - Roger Sorkin, *Tidewater*, American Resilience Project, 2017
  - DOD, "Climate Change Adaptation Roadmap," 2014
  - UNFCCC-DOD, "Climate Change Threats to National Security," 2013
  - DOD, "National Security Implications of Climate-Related Risks and a Changing Climate," 2015
  - Anatol Lieven, "The Only Force that can Beat Climate Change is the U.S. Army," *Foreign Policy*, 9 Jan 2018
  - Umair Ifan, "Extreme Weather has Again Damaged a Major Military Base," *Vox*, 25 March 2019
  - Ariel Patterson, "Impacts of Sea Level Rise in Norfolk, VA," Tufts UEP 2016
  - ESRI and ArcGIS forums

SATELLITE DATA: 1993-PRESENT  
Data source: Satellite and land observations. Credit: NASA/Cosmos Space Flight Center



Projection: Lambert\_Conformal\_Conic  
Coordinate System: NAD\_1983  
StatePlane\_Virginia\_South\_FIPS\_4502\_Feet  
Cartographer: Hiram Reynolds  
Advanced Geospatial Modeling  
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