Analyzing storm surge and sea level rise in Brunswick and Harpswell

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INTRODUCTION & GOALS

•Sea level rise and storm surge in Maine threaten coastal homes and businesses as well as coastal infrastructure and wetlands. Developed to pilot the implementation of the State of Maine's Climate Adaptation Plan, this project evaluated the vulnerability of coastal structures to global sea level rise.

•As the project is intended for replication in other planning settings, the methodology developed is based on widely available data and common spatial analyses.

•Our sea level rise scenarios, projected for the year 2100, included 0.61 meters (2 feet), 1 meter, and 2 meters. Maine is currently planning for a 0.61 meter scenario, and the EPA suggests 1 and 2 meter scenarios for planning purposes. Storm surge scenarios are based on historical frequency data. According to Portland tide data, a 0.91 meter (3 foot) storm surge is expected every 4.5-7 years and a 1.31 meter (4.3 foot) storm surge is expected every 22-49 years.

•The study analyzed five principle categories: land, buildings, piers, roads, and marshes. The results are intended for planning purposes in Brunswick and Harpswell, Maine.

METHODS

•Current sea level elevation data is based on 2006 FEMA LiDAR maps.
• **Sea level rise (SLR)** scenarios that do not account for storm surge are based on the 2009 **highest annual tide (HAT)** level. HAT is expected once per year, but is often reached on multiple occasions.
• Scenarios that account for sea level rise and historically-based storm surge heights are based on the 2009 **mean higher high water (MHHW)**. MHHW is expected to be reached every day. There is a greater likelihood that a severe storm will occur at MHHW than HAT.
• All scenarios were modeled using ArcGIS software for spatial analysis.

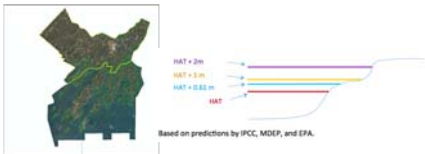

Figure 1. Map of study area. Yellow line indicates the border between Brunswick, ME (21,172 residents) and Harpswell, ME (5,239 residents).

Figure 2. Side-view representation of sea level rise scenarios above 2009 HAT.

RESULTS

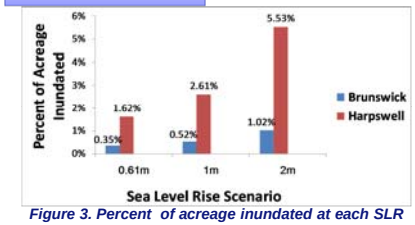

Figure 3. Percent of acreage inundated at each SLR scenario at HAT.

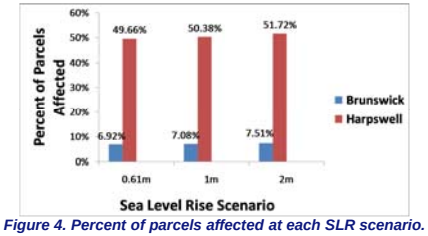

Figure 4. Percent of parcels affected at each SLR scenario. Affected parcels are those touched by water at HAT.

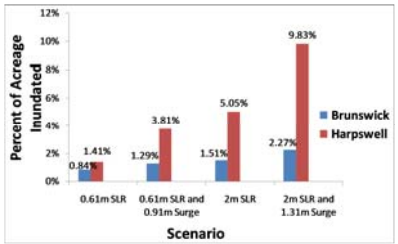

Figure 5. Percent of acreage inundated by SLR and SLR with storm surge. Affected parcels are those touched by water at MHHW.

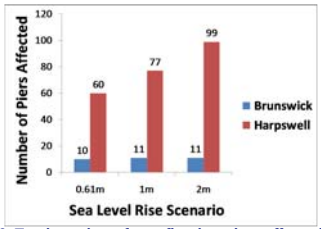

Figure 6. Total number of non-floating piers affected at HAT by each SLR scenario. Affected piers are inundated above the deck elevation. Pier data is from the Island Institute; Brunswick has 18 total non-floating piers and Harpswell 136.

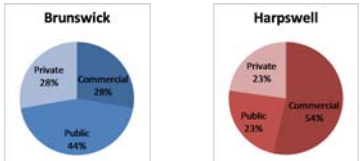

Figure 7. Percentage of affected piers by use type at HAT under 0.61m SLR scenario.

RESULTS

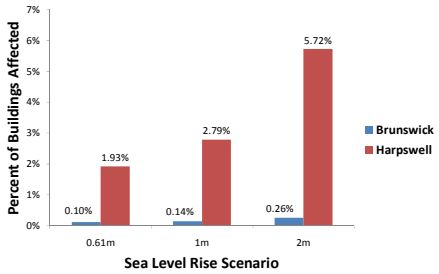

Figure 8. Percent of buildings affected at each SLR scenario. Affected buildings are those touched by water at HAT.

Figure 9. Map of road accessibility at HAT in Harpswell at 0.61m SLR scenario. E911 road data includes both state and municipal roads.

Figure 10. Map of a section of Route 123 (Harpswell Neck Road) at HAT at each SLR scenario.

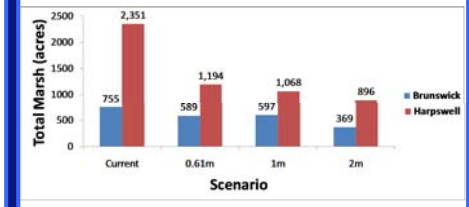

Figure 11. Total current marsh acreage and total acreage at each SLR scenario. Marsh is defined as all land between mean sea level and HAT.

RESULTS

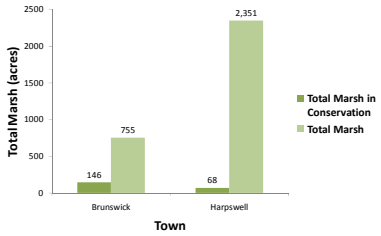

Figure 12. Total current marsh acreage in Brunswick and Harpswell according to conservation designation. Marsh is defined as all land between mean sea level and HAT.

CONCLUSIONS

•SLR will impact town economies differently depending on coastline extent and proximity of infrastructure to the coastline.
•As SLR increases, the percentage of land inundated increases and the number of land parcels affected does not increase as rapidly. This indicates that many of the same parcels are more severely affected as sea level rise scenarios become more extreme.
•Storm surge will result in a notable increase in the percentage of parcels affected, as compared to the percentage affected by SLR alone.
•Although a greater number of piers will be affected in Harpswell, a greater percentage of Brunswick's piers will be affected by SLR. In both towns approximately 75% of the affected piers are either commercial or public, indicating potential impacts on working waterfronts.
•SLR will obstruct roads, which is a particularly important consideration for communities with islands and peninsulas connected by single roads and bridges, such as Harpswell.
•Marsh acreage, as defined by tidal zones, will decrease under each SLR scenario due to coastal topography.

ACKNOWLEDGEMENTS

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