

# Sinking Investments, Rising Seas: A GIS Analysis on the Effects of Sea Level Rise on Boston Property Values

## Background

With the effects of climate change, under a do-nothing scenario, large swathes of land along the coastline are projected to be affected (US Department of Commerce, n.d.). At the same time, there is on-going debate about heavy investment and rising property values in coastal areas, such as the Seaport District, and beachfront properties ("Rising Sea Levels Could Mean More Flooding in Boston Seaport - NECN," n.d.). Undertaking a GIS vulnerability assessment of the issue by mapping out projected sea level rise under one ft., 5ft., and 10ft. scenarios, and factoring in current property values, land usage, and whether owners reside in their properties could better inform viewers of the effects of sea level rise on their investments, and prepare cities to undertake adaptation and resilience efforts, thereby conveying that the risk of climate change is very real. This project aims to illustrate which areas of the state are projected to be underwater within the scenarios specified, and which areas are most vulnerable to sea level rise.

## Data

Table 1. Data used for analysis

Data set	Data source	Data	Fields/ attributes
Standardized Assessor's Parcels — Boston	MassGIS (Bureau of Geographic Information), Commonwealth of Massachusetts EOTSS	Vector	<ul style="list-style-type: none"> <li>AV_TOTAL (total assessed property value)</li> <li>LU (property type)</li> <li>OWN_OCC (owner)</li> </ul>
Sea level rise	Office for Coastal Management, 2019: NOAA Office for Coastal Management Sea Level Rise Data.	Vector	<ul style="list-style-type: none"> <li>1ft, 5ft, and 10ft (SLR &amp; Low)</li> </ul>
Census Block Groups	MassGIS (Bureau of Geographic Information), Commonwealth of Massachusetts EOTSS	Vector	N/A

## Results

The results (fig. 8) indicate that the areas most vulnerable to sea level rise are towards the north of Boston in the Back Bay, Beacon Hill, and Bay Village neighborhoods, with higher property values and a high concentration of residential areas.

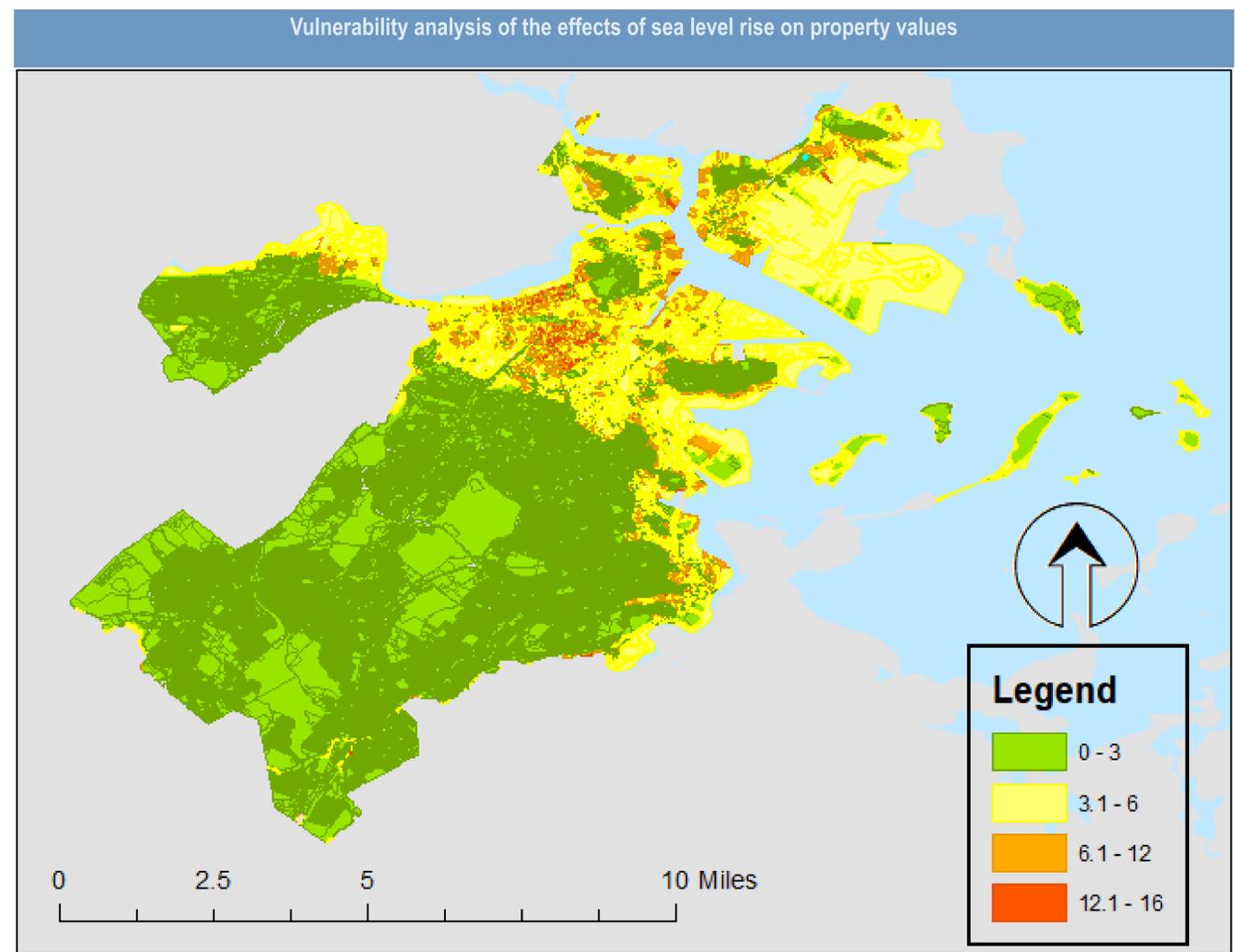


Figure 8: Effects of sea level rise on Boston properties

## Methods

A vulnerability analysis was conducted using ArcMaps 10.6.1, for different scenarios of sea level rise; 1ft, 5ft, and 10 ft., for regular and low-lying areas. Sea level rise layers were intersected with the layer depicting Boston property data, to identify just the areas of the city that would be affected by each scenario. Layers (for sea level rise and low lying areas) for each scenario were merged to identify the full extent of affected area. Rankings were then assigned, with the creation of new fields on the attribute tables, using attribute queries based on the following attributes; whether or not the property was owner occupied (fig.1), property type (fig.2), and property value (fig.3). Rankings were then weighted by risk of damage from sea level rise (figures 4-7), to obtain a weighted vulnerability score. Symbology was adjusted manually based on the weighted vulnerability score for each layer of sea level rise as well as for the base map, to obtain a final overview (fig.8), of the areas in which property damage due to sea level rise would likely be the most severe.

Table 2. Vulnerability scores for each attribute measured

Attribute	Vulnerability ranking				Weighted Score	
	0	1	2	3	Sea level rise	Weighting
Property Value (USD)	<= 251200	251201-395200	395201-590600	>= 590601	1	x 1.75
Property Type	Residential	Mixed use	Commercial/Industrial	Other	5	x 1.50
Owner occupied	No	-	-	Yes	10	x 1.25
					Unaffected	x 0

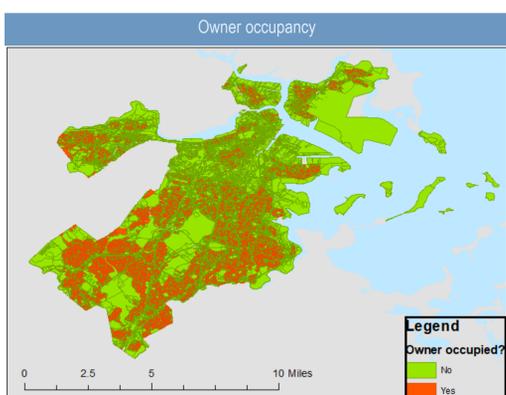


Figure 1. Owner occupancy status

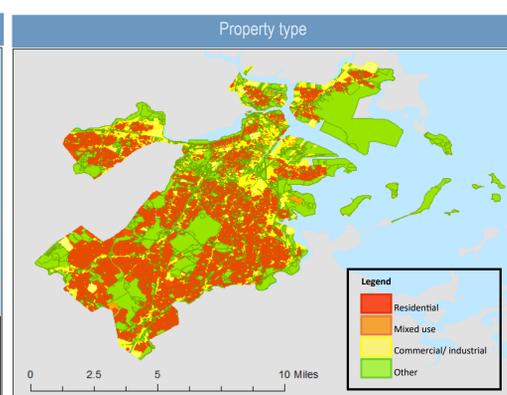


Figure 2. Property type

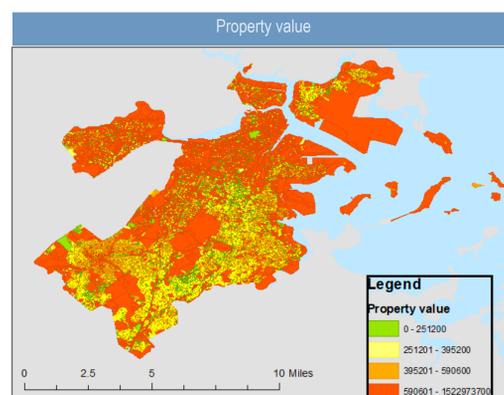


Figure 3. Property value

## Discussion

Surprisingly, while there is a large area of the city that is vulnerable to sea level rise, there was an over all lower concentration of the highest vulnerability scores, once the analysis was completed, potentially due to a lower variation between scores than would have been expected.

While sea level rise will affect all areas along the coast, the areas that would be most vulnerable are towards the north of the city due to the other factors being considered. In general, it is also the wealthier areas of the city that would be affected by rising sea levels, potentially because the high desirability of residing close to the ocean has driven property prices up in these areas.

Future studies along these lines could potentially investigate property ownership, to ascertain if it would primarily be individuals, corporate investors, or the government/ public sector that would be the most affected.

## References

Rising Sea Levels Could Mean More Flooding in Boston Seaport - NECN. (n.d.). Retrieved May 5, 2019, from <https://www.necn.com/news/new-england/Winter-Storms-Boston-Flooding-Issue-Climate-Change-478767543.html>

US Department of Commerce, N. O. and A. A. (n.d.). Is sea level rising? Retrieved May 5, 2019, from <https://oceanservice.noaa.gov/facts/sealevel.html>

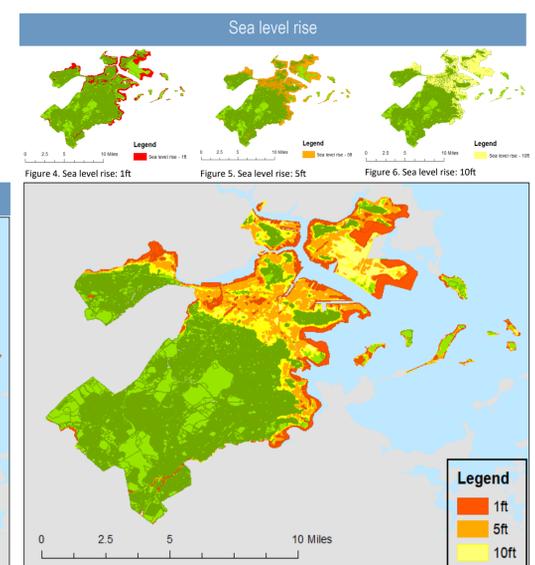


Figure 7. Sea level rise: composite

