

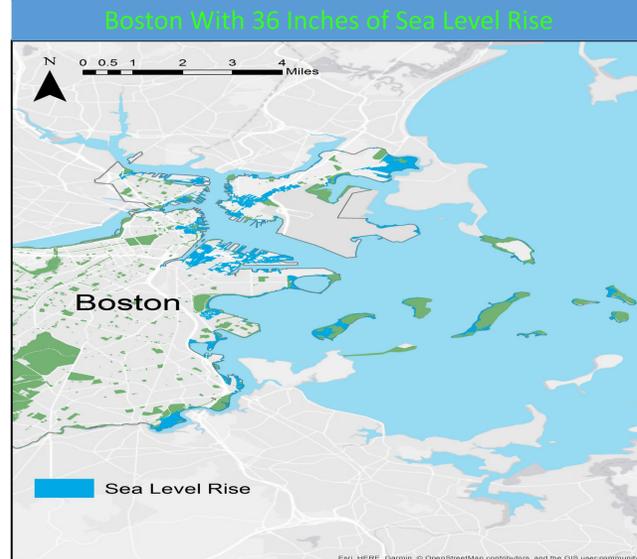
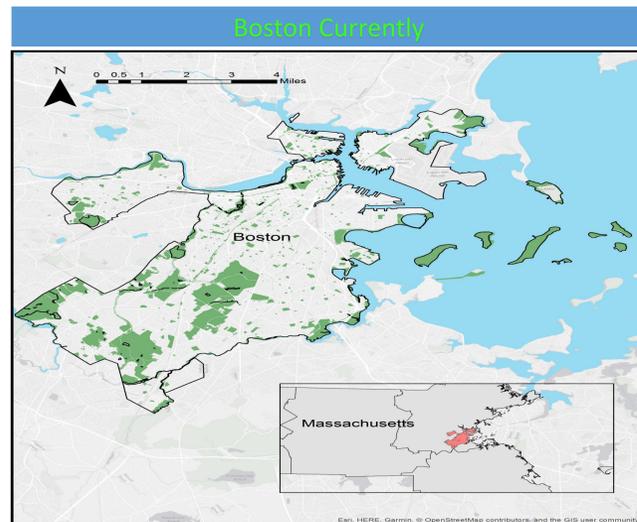
# A (disgustingly) Rough Estimate To Tax Revenue Lost From Sea Level Rise

## Introduction

With climate change becoming an increasingly worrying problem that could affect Boston in the coming years, the low lying waterfront that Boston, and the neighboring towns have, could be devastated by impacts of sea level rise. To examine the impact climate change could have the city of Boston, tax revenue lost may be a growing issue that could raise alarms in the minds of many policy makers. The city of Boston should try and estimate this loss as soon as possible, to try and mitigate some/all of the loss. There are several different scenarios of sea level rise (9 inches, 21 inches, and 36 inches), in varying years, that could be tabulated to assess the tax revenue lost due to sea level rise. However, the objective of this project is to find values that will have an impact on those reading it, so I chose to assess the economic loss at 36 inches of sea level rise.

While 36 inches is the most extreme case, it is needed to show what the year 2100 could look like given the "business as usual" approach. If nothing is done to mitigate the impacts of climate change, the city of Boston could face devastating losses, not only in tax revenue, but in property value, natural resource loss and residents migrating to other cities. If this issue is addressed now, the city of Boston will be able to tackle this problem in the early stages and significantly reduce its risk.

The final product of this project will show the neighborhoods of Boston that will be most impacted by sea level rise. Those neighborhoods are where the city of Boston should focus its efforts, and make necessary accommodations in the following years. Sea level rise does not simply occur one day, it gradually increases. So, the quicker the city of Boston addresses this issue the better. If sea level rise were to be ignored until the year 2100, the economic loss could be estimated with three different criteria (as well as many more not assessed here).



## Methods

To obtain a rough estimate of the tax revenue lost to sea level rise for the city of Boston, three criteria were focused on: parcel tax revenue, commercial company tax revenue, and open space revenue. Starting with the first criterion, parcel tax revenue, I obtained a spreadsheet of all the parcels in Massachusetts for 2016. The parcels were divided into residential, commercial, industrial, mixed use, and exempt parcels. Within that spreadsheet, a column identified the gross tax on each parcel in Massachusetts. With that column I had the value of tax revenue that could be intersected with sea level rise. My next step was to spatially join the parcel data to the shape file Boston Neighborhoods. The gross tax value was used in the spatial join, and the output was a value assigned to each Boston neighborhood based on the total amount of gross tax revenue that would be lost.

Next, a similar method was developed for tax revenue lost by Boston for companies. ReferenceUSA.com has data on all the companies in Boston, and filters can be applied to narrow down the search. Since there is over 34,000 companies in Boston, a filter was applied to only show companies with over 200 employees. All smaller companies were not used in the analysis. Reference USA also allows for sales volume to be searched for. With companies exceeding 200 employees and their sales volume in a year the tax revenue lost could be found. The corporate sales tax in Massachusetts is 8%. With that percent applied to the sales volume for each company, the tax revenue lost was calculated. This data was spatially joined to the Boston Neighborhoods shape file to give a total amount of tax revenue lost due to sea level rise.

Finally, the loss of tax revenue for open space due to sea level rise was calculated. This method was developed differently than the previous two, but was still spatially joined so all of the criteria were segmented by Boston neighborhoods. The first step was to find the tax revenue value on open space for Boston. To find this, a report by the Trust for Public Land estimated the total amount of tax revenue brought in each year to Massachusetts to be \$739,000,000. With that value I could find the estimated value of tax revenue for open space in Boston. The open space shape file for all of Massachusetts was applied, and within the attribute table the amount of acres for open space is given. The total was calculated, and the same was done for Boston open space to give the total open space for Boston. Open space and sea level rise were intersected to give the amount of open space that would be impacted by sea level rise. Given the ratio of tax revenue to open space for Massachusetts and Boston, the amount of tax revenue brought in by Boston could be calculated. This value was \$3,684,021.95. With 2665.51 acres affected by sea level rise out of the total acreage of 7341.25, that gave a percentage of 36.32% of acres underwater. With 36.32% acres of open space in Boston impacted, multiplied by \$3,684,021.95, the amount of tax revenue lost is \$1,337,620.47. Now acres impacted divided by tax revenue lost gave me a value per acre of \$501.82. Now, by adding a field to the open space shape file, with the intersected open space lands highlighted, the acreage value of \$501.82 multiplied by the acres per open space gave me the value of each piece of open space. This final value per open space was spatially joined to the Boston Neighborhood shape file to give a value per neighborhood.

These three maps were all spatially joined to produce one final map that gave the aggregate total per neighborhood with all three criteria.

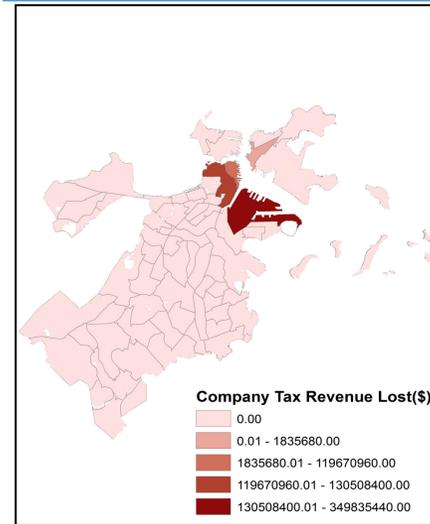
### Citations:

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- Orel, Linda. *The Return on Investment in Parks and Open Space in Massachusetts*. The Trust for Public Land, [communitypreservation.org/TPL-MA-ROI.pdf](http://communitypreservation.org/TPL-MA-ROI.pdf).
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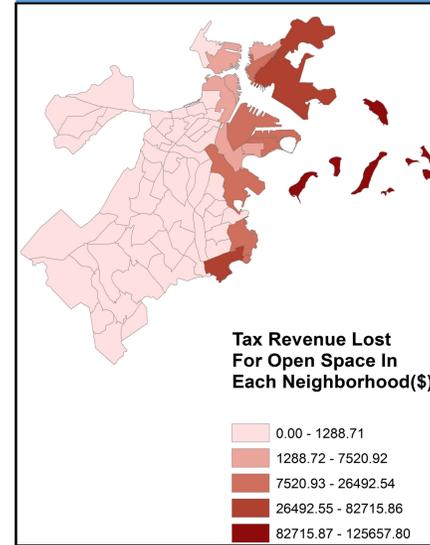
### Projection:

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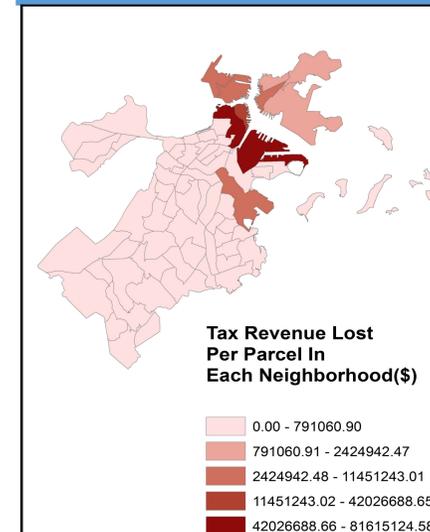
## Company Tax Rev. Lost By Neighborhood



## Open Space Lost By Neighborhood



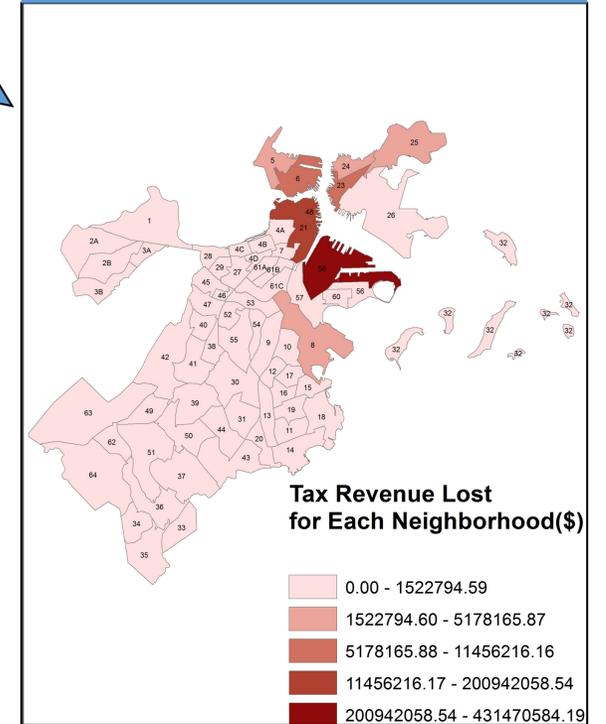
## Parcel Tax Rev. Lost By Neighborhood



## Conclusion

The final map produced shows that there are 8 Boston neighborhoods that will be impacted by sea level rise. Each with varying degrees of tax revenue lost. The table below helps quantify just how much money each neighborhood will lose within each criteria, as well as a total amount. If Boston were to be interested in finding an area to focus sea level rise mitigation efforts, based off of my data, one likely place they could start is with the South Boston neighborhood waterfront. From there the financial district, North End and Charlestown could also be potential areas to focus on. If Boston were to continue with their sea wall project, they may be able to reduce cost by exclusively building it around these neighborhoods instead of building it from Hull to Deer Island. It is my hope this loss of tax revenue will create a sense of urgency that sea level rise will do damage that will be irreversible, unless action is taken now.

## Final Map



	Open Space	Company	Parcel	Total
South Boston(58)	\$20,019.61	\$349,835,440	\$81,615,124	\$431,470,584.19
Financial District(21)	\$3,374.16	\$130,508,400	\$70,430,284	\$200,942,058.53
North End(48)	\$5,026.67	\$119,670,960	\$42,026,688	\$161,702,675.32
Charlestown(6)	\$4,973.14	\$0	\$11,451,243	\$11,456,216.15
East Boston(23)	\$13,104.70	\$1,835,680	\$4,752,268	\$6,601,053.60
Charlestown(5)	\$1,057.66	\$0	\$5,177,108	\$5,178,165.86
East Boston(25)	\$82,715.85	\$0	\$2,424,942	\$2,507,658.32
East Boston(24)	\$7,134.84	\$0	\$2,013,059	\$2,020,194.37

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