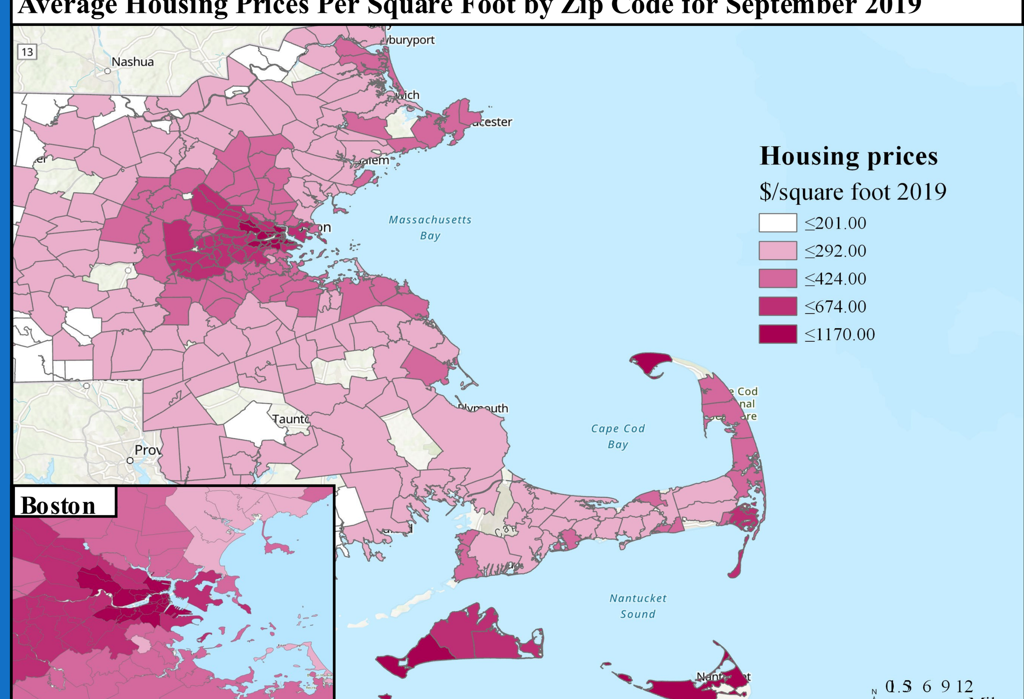
Rising Prices and Rising Tides:

The Future of Housing Prices and Sea Level Rise on the Massachusetts Coastline

Introduction

The population density in coastal cities is higher than anywhere else in the country. A substantial body of research exists on the topic of sea level rise, and economic impacts are likely to be very high in these areas. Housing costs are already on a steady increase across most coastal metropolises around the world, so it is likely that sea level rise will only exacerbate the affordable housing shortages already faced in many of these communities. Previous research indicates that unprotected properties already sell at lower rates than protected ones, while protected properties are seeing increases in value. This is a self-perpetuating cycle, in which lower income property owners cannot afford many protective measures (such as flood insurance), and thus are left more vulnerable for further property value loss when their properties are damaged.

Average Housing Prices Per Square Foot by Zip Code for September 2019

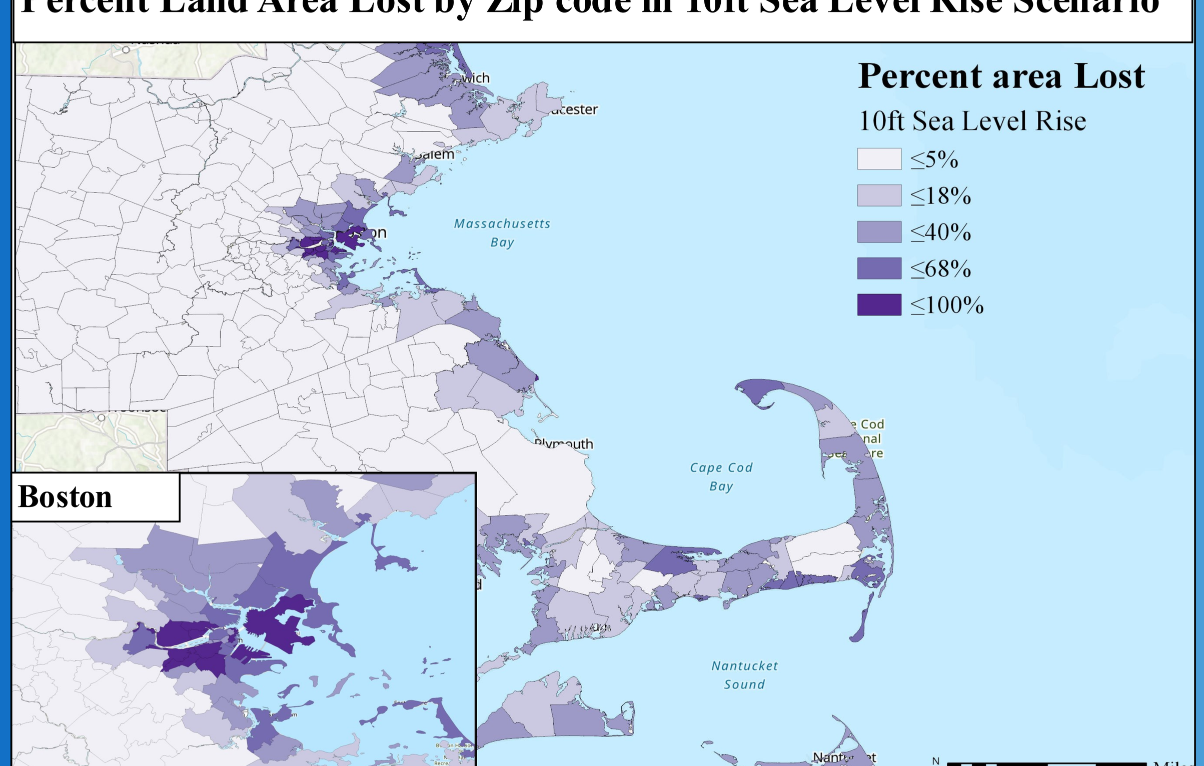


Housing prices in the Boston area have been rising rapidly as the city has developed as tech center over the past several years. Much development has taken place on the waterfront, the areas most likely to be hit first by sea level rise. As a low-lying coastal city with development focused on the waterfront, Boston makes an exemplary case study. Previous studies have used spatial regressions to study relationships involving housing prices. One study in particular conducted in Massachusetts concluded that these types of spatial analyses are a useful tool for identifying relationships and influences surrounding housing prices, so I have chosen to do a similar analysis.

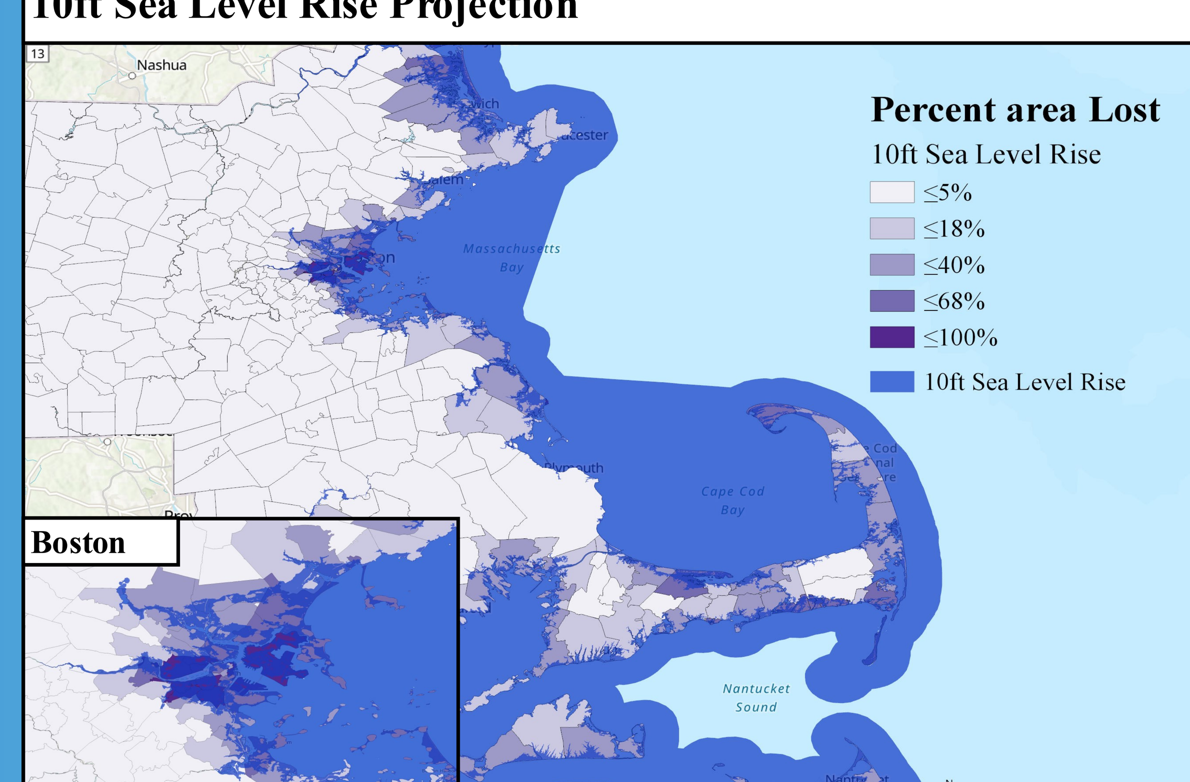
Methods

All analyses was conducted in ArcGIS Pro. Data on housing prices was obtained from Zillow. The data used for my analyses is the average home price per square foot by zip code in September 2019. This data was joined to a zip codes shapefile from MassGIS. Sea level rise data was obtained from the NOAA website with shapefiles for a 10ft rise scenario and a 5ft rise scenario. These shapefiles were joined to the Zillow data zip code shapefile and calculated to determine the area of each zip code lost in each sea level rise scenario. This was done by using the Summarize within tool, and then by creating new fields in the table and calculating for the area of the 5ft or 10ft sea level rise within each zip code divided by the total area of the zip code. These areas are represented as percentages. I then conducted a generalized linear regression on the price per square foot variable and the 5ft and 10ft area lost variables to explore the relationship between the two. In this presentation only the 10ft scenario is displayed because the 5ft scenario included a much more limited selection of zip codes, and was therefore much less visibly conclusive.

Percent Land Area Lost by Zip code in 10ft Sea Level Rise Scenario



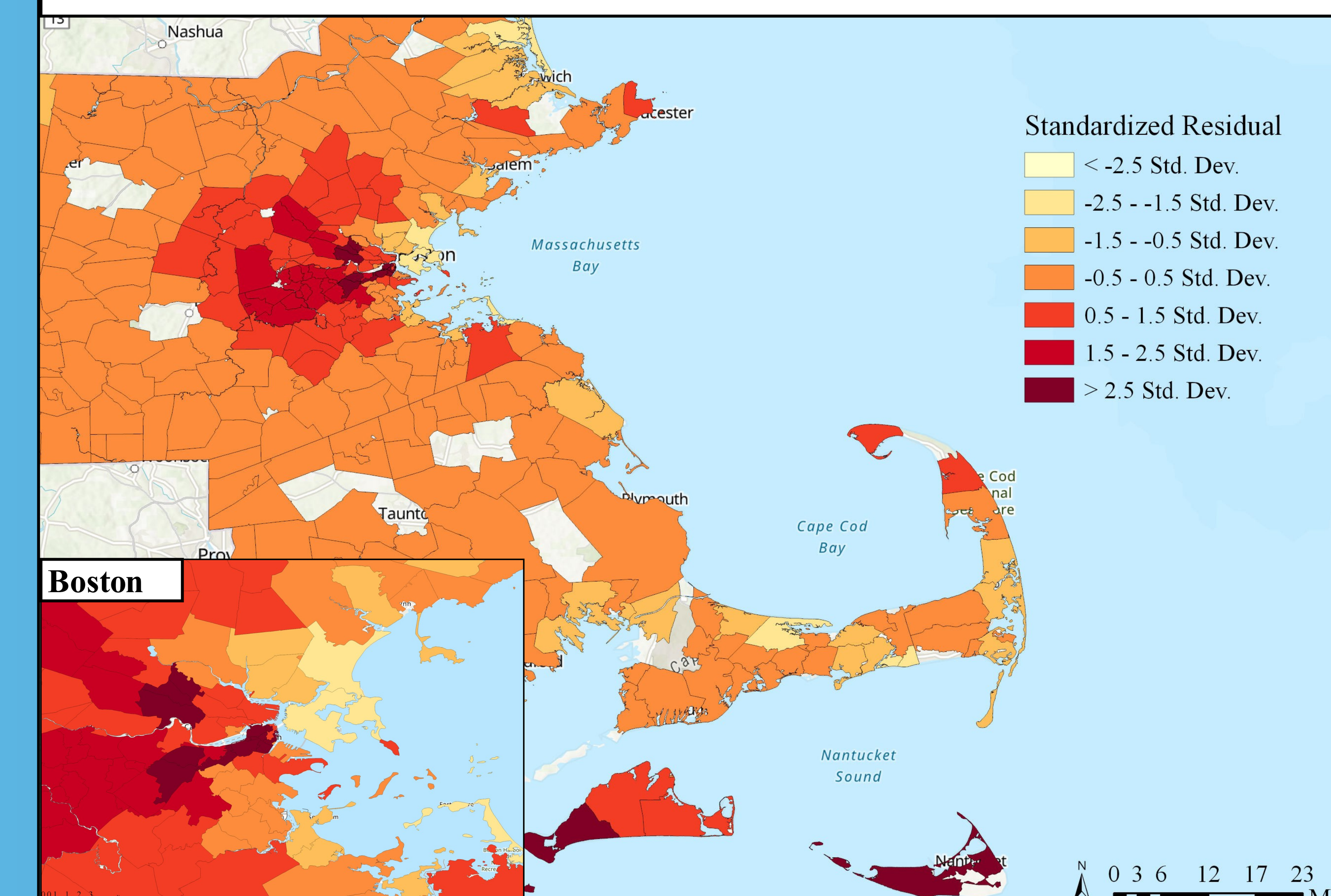
10ft Sea Level Rise Projection



Results

For every square meter lost in 10ft sea level rise, we would expect $616.04 increase in housing price per square foot. This is a very steep increase, and a strong relationship with an R-squared value 0f 0.4. The map to the left displays this relationship using standardized residuals, showing how far each zip code differs from the projection of the model seen below.

Relationship between Housing Prices & Area Lost to 10ft Sea Level Rise



Some notable outliers are Martha's Vineyard and Nantucket. These islands already have extremely high housing prices, so they have very high positive residuals. Interestingly, this is also due to a low projection on land area loss in these areas. This could possibly be due to the fact that these islands comprise of only one or two zip codes each, making the area lost a less significant percentage than in smaller zip codes. More research is needed to determine the specific case studies of these areas.

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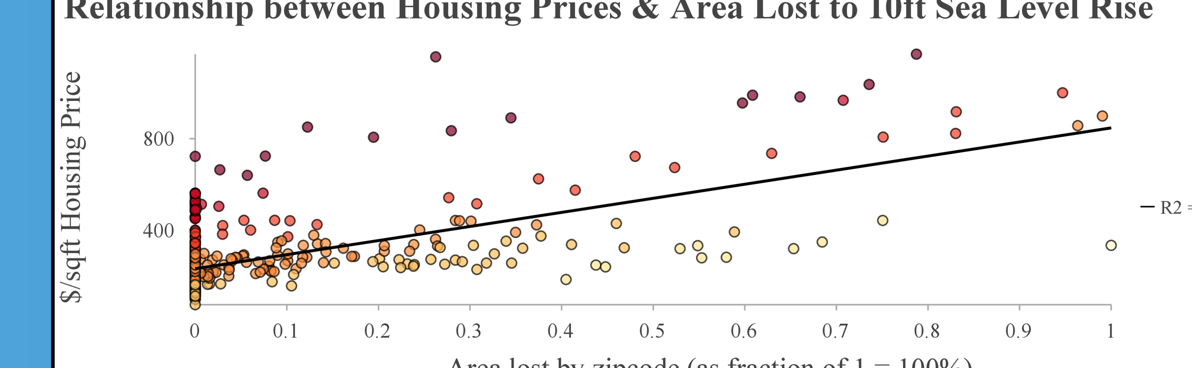

From my case study in Boston, other notable outliers are Revere and the Logan Airport area. These areas have high negative residuals, showing that they have low housing prices and very high land area lost to sea level rise. Logan Airport is an international transportation hub, so large land area lost there could cause major disruptions for Boston. The Revere area near the airport can be identified as a vulnerable population because it's low housing prices are generally associated with higher rates of poverty in the area. Homeowners in this area are at a higher risk for damages they may not be able to afford to repair, and rental property owners may be less incentivized to make necessary home protections and adaptations for low-income tenants.

The results of these analyses have important implications for the future of land-use planning and climate-change preparedness in the future for Boston. While a 10ft sea level rise scenario may be several decades or centuries into the future, storm surges reaching these levels could be anticipated much sooner, thus actions should be taken as soon as possible.

References

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Cartographer: Rachel Herman

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