Where is the Line?

A Gentrification Vulnerability Analysis of Boston, Historically Contextualized By 1940s HOLC Redlining Maps

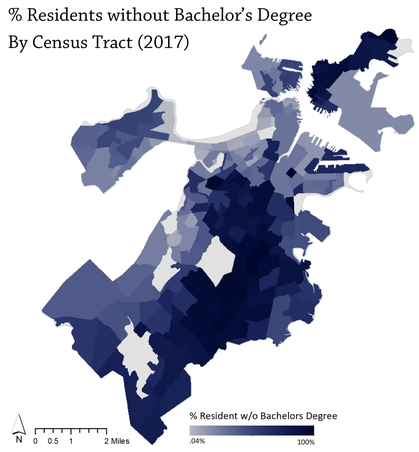
Questions

Which census tracts in Boston are most vulnerable to the process of gentrification?

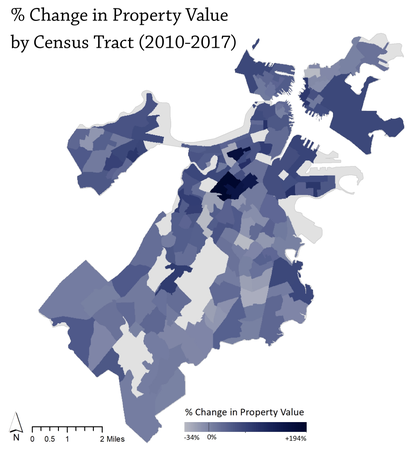
Which census tracts are "gentrifiable?"

Are there observable patterns or connections between the analysis variables and a census tract's HOLC grade?

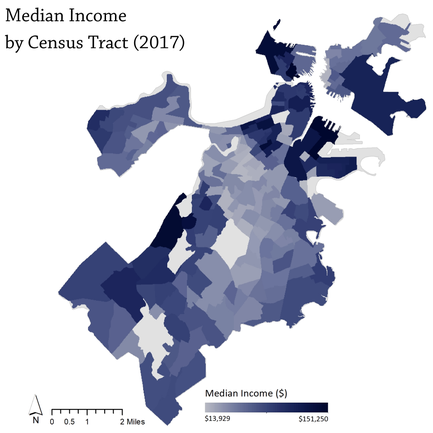
% Residents without Bachelor's Degree
By Census Tract (2017)



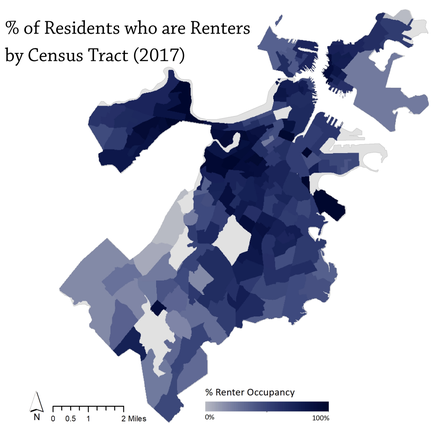
% Change in Property Value
by Census Tract (2010-2017)



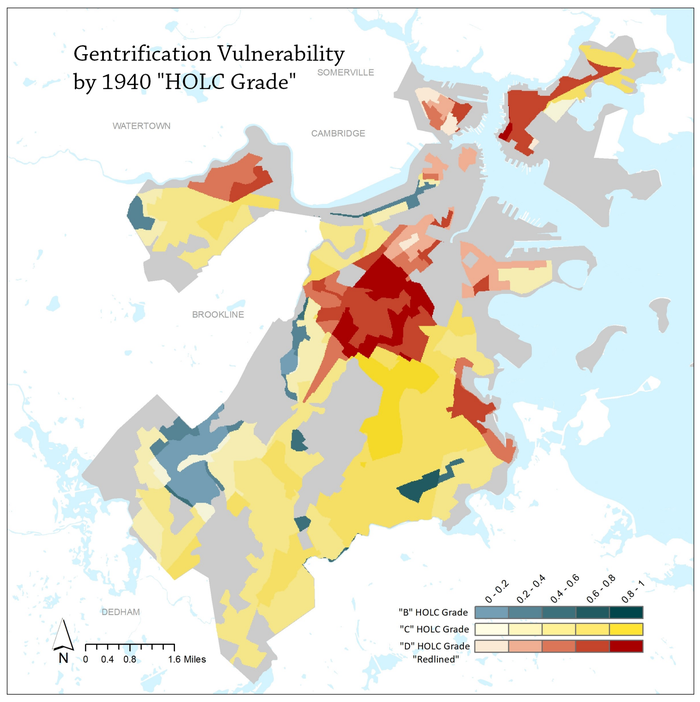
Median Income
by Census Tract (2017)



% of Residents who are Renters
by Census Tract (2017)



Gentrification Vulnerability
by 1940 "HOLC Grade"



HOLC Mortgage Security Grade (1940)	# Census Tracts w/ Given Grade	% Residents over 25 without Bachelors Degree	% Residents who are Renters	Avg Median Income	Avg Increase in Property Value (2010-2017)
B	37	42%	48%	$81,809	17%
C	88	57%	69%	$56,913	13%
D	46	50%	69%	$71,104	30%

Background

For many, gentrification summons images of new condos, coffee shops, and a change in the demographics of a neighborhood. While the realities and impacts of gentrification are a daily experience for many, there is debate in existing literature about how to define the concept. A recent paper by Jackelyn Hwang and Jeffrey Lin defines it as "the process in which neighborhoods with low SES [socio-economic status] experience increased investment and an influx of new residents of higher SES" (Hwang and Lin, 2016). Put another way, gentrifying neighborhoods see an increase in both its median income and property values. Some scholars have identified a phenomenon in which the anticipated neighborhood change causes house prices to appreciate before the influx of investment or wealthier residents occurs (Aron-Dine and Bunten 2018).

This analysis attempts to identify which census tracts in Boston are most vulnerable to the process of gentrification. The analysis is situated in historical context by further analyzing the results in relation to the census tract's "mortgage security grade," a classification which was assigned in 1940 by the Home Owners Loan Corporation (HOLC). HOLC created color-coded maps to classify these grades, giving rise to the term "redlining."

The Federal Housing Administration (FHA), established by the National Housing Act of 1934, created a national financial mortgaging system, making homeownership possible for certain groups of Americans. The FHA insured home mortgage loans, and created very strict lending guidelines to determine which loans it would insure. In that same era, the Home Owners' Loan Corporation (HOLC), an agency under the Federal Home Loan Bank Board, created residential security maps, to show the level of risk or security for real-estate investment in each area. The grades ranged from "Type A" (secure and desirable), to "Type D" (most risky and undesirable). These maps, and the beliefs that underscored them, determined whether prospective homeowners would be granted a loan or insurance for that loan. The grades on the maps roughly correlated to racial maps of cities, which resulted in the systematic denial of home loans to black communities.

Methods

To create a gentrification vulnerability index for Boston's census tracts, a raster calculator was used to combine data on demographics (% renter, median income, education level) and neighborhood characteristics (% change in property value 2010-2017, and proximity to MBTA stops). To generate each variable layer, the relevant data was rasterized and a fuzzy membership was applied to smooth out arbitrarily abrupt value differences between proximate cells. For "distance from MBTA," the Euclidean distance tool was used; areas closer to stations were classified as more vulnerable. For % Renter, % without Bachelor's Degree, and % Property value growth, high values were classified as high vulnerability in the fuzzification. For Median Income, low values were classified as more vulnerable. All of the fuzzified rasters were put through a raster calculator with the following weights:

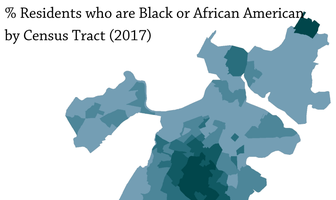
(.15)*(%Renter) + (.3)*(Median Income) +(.15)*(% Change in Property Value) + (.3)*(%Residents without Bachelor's Degree) + (.1)*(Distance from MBTA Station)

Because the process of gentrification is defined as a change from low SES to high SES, a sub-study area was created of "gentrifiable" census tracts. Gentrifiable* was defined as census tracts with the following characteristics: 1) Median income below 60% Area Median Income for a family of four ($64,700), and 2) Educational attainment below the citywide 40 % average; the variable was therefore census tracts for which 60% or more adult (over age 25) residents did not have a Bachelor's Degree. Finally, a summary table was generated, filtered by HOLC grade (B, C, or D).

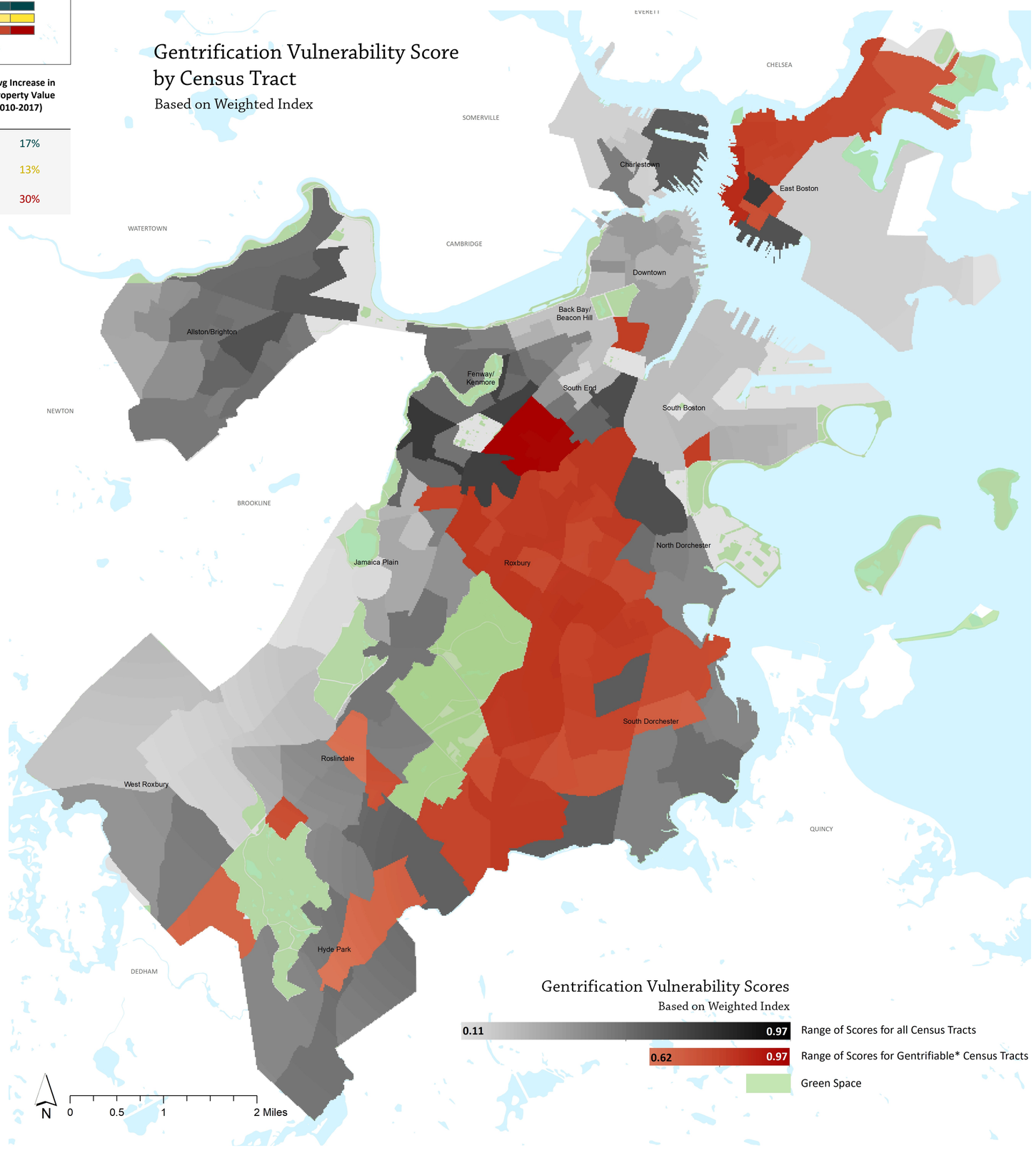
Results

The results of this analysis show a relative vulnerability score range for the sub-study area of .62 through 0.97 (out of 1). Areas with the highest scores were in the East Boston, Roxbury and South Dorchester areas. Many of the highest vulnerability tracts border the parks in the central-southern area of the city. Many of the most vulnerable census tracts are also majority-minority, including areas of the city that have a high percentage of Black or African American residents, as is visible in the adjacent map. When the variable data was categorized by HOLC grade, there were some observable patterns, though analysis was not conducted to determine whether these patterns were statistically significant. However, a general observation shows that Redlined (high risk) or Yellowlined (increasingly risky) census tracts had characteristics that made them more vulnerable to gentrification. Perhaps most notably, census tracts that were redlined in the 1940s have seen the greatest percentage increase in property value between 2010 through 2017. A study by Aaronson et al (2018) showed that HOLC maps had a negative effect on homeownership, house values, rents, and vacancy rates, correlated with the share of African American residents, "suggesting economically significant housing disinvestment in the wake of restricted credit access." As time progresses, demographics shift, and mortgage practices become less discriminatory, there may be a more rapid rise in property values in these historically underinvested areas, perhaps also contributing to a gentrifying effect.

% Residents who are Black or African American
by Census Tract (2017)



Gentrification Vulnerability Score
by Census Tract
Based on Weighted Index



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Data Sources: Analyze Boston, MAssGIS, ESRI, TuftsGIS, American Community Survey (2017)
Projection: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Meters

Aaronson, Daniel, et al. "Effects of the 1930s HOLC Redlining Maps." Federal Reserve Bank of Chicago, Aug. 2018.
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