BOSTON:

MEASURING DIVERSITY IN A CHANGING CITY

PRODUCED BY
Alvaro Lima, *Director of Research*
Mark Melnik

*Boston Redevelopment Authority,
Research Division*

Boston
Redevelopment
Authority
Peter Meade, Director

CITY OF BOSTON
Thomas M. Menino
Mayor

INTRODUCTION

Large, thriving cities in the 21st century are often thought of as diverse places.

Popularly, conversations regarding diversity focus on the racial or ethnic makeup of a place. Cities with a high concentration of one racial or ethnic group are thought of as non-diverse. Places with a mix of different racial and ethnic groups are typically thought of as being diverse. Thinking of diversity in this way, we find that the 21st-century version of Boston is a city with a great deal of diversity within its neighborhoods. Over the last four decades, Boston has become a much more racially and ethnically diverse place. In 1970, close to 70% of Boston's population was white. Today, whites comprise only 47% of the city's population, making Boston a "majority-minority" city for the second consecutive Census. In addition, the Research Division of the Boston Redevelopment Authority found that most of Boston's neighborhoods experienced some level of increased racial and ethnic heterogeneity between 2000 and 2010.

The concept of "diversity" is more nuanced than simply a mixed spatial distribution of racial and ethnic groups, however. The term "diversity" refers to some variation – difference – in the distribution of a particular characteristic or characteristics among a certain population. Many characteristics could be measured beyond race, including age, educational attainment, religion, sexual orientation, or income. In this paper, we consider other aspects of diversity in addition to race and ethnicity. Overall, diversity (the degree of heterogeneity) in Boston, appears to have increased over the last decade. Much of that change can be attributed to the city's strong and well-balanced economy, long history of immigration, neighborhood redevelopment, and affordable housing construction – a history that was purposefully framed through local and state policies. The drawing power of Boston is enormous attracting young, well-educated, and foreign-born people from around the world.

During the last decade the population of Boston grew, became younger, more college-educated and more racially and ethnically diverse. Boston's total population in 2010 was 617,594, up nearly 5% from the previous decade. In comparison, Boston's population grew by only 2.6% between 1990 and 2000. The 2010 Census also shows that the population of 20 to 34 year-olds increased by 11%, making Boston the city with the highest proportion (35%) of 20 to 34 year-olds among the 25 largest cities in the country. According to the American Community Survey (ACS), the proportion of college-educated residents in Boston is not only higher than that of the country and the Commonwealth, but has grown substantially over the last several decades.

Citywide data tell only part of the story, since cities are collections of neighborhoods that may experience different processes of integration, segregation, and enclave formation that may not be noticeable when looking at a citywide picture. There are places in any city where affluent residents or low-income residents concentrate or where immigrants from a particular country are likely to settle. For this reason, we investigated diversity at the census-tract level citywide to better understand how these processes operate and reveal themselves in Boston.[1] What is the overall picture? How does diversity vary across the city? Have Boston's immigrant communities integrated spatially through the city's neighborhoods? How has diversity changed in the last decade? These are some of the key questions this paper explores with an eye toward helping municipal government officials, researchers, and practitioners better understand how diversity manifests itself in Boston and its neighborhoods.

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[1] There are 181 census tracts in the city of Boston, with populations ranging from 0 to 8,136. Breaking down population statistics by census tracts has the advantage of looking at the characteristics of the population in small geographic units.

Measuring Diversity

We begin by defining diversity and then measuring it across the city using census-tract data for the 2000 and the 2010 Censuses. Of course, there are many ways of describing and measuring diversity. In this paper we use a measure of diversity developed by Philip Meyer of the University of North Carolina and Shawn McIntosh of *USA Today*.

Meyer and McIntosh define and measure diversity as "the probability that any two people chosen at random from a given area are of different races or ethnicities." Using this definition they created the *USA Today Diversity Index*.[2] We expanded their definition to measure diversity along six dimensions as specified below: race and ethnicity, income, age, language, education, and region of birth.[3] In addition, we created a composite score of diversity across the selected dimensions.

RACIAL AND ETHNIC DIVERSITY: defined by the plurality of multiple ethnic and racial groups within a specific area. The U.S. Census defines eight ethnic and racial groups. We used the Census categories but removed one of them – "other races" – from the calculation. This has the same effect as assigning "other race" to the population in proportion to the presence of the officially designated categories. The categories used for this research include:

- White
- Black or African American
- Hispanic or Latino
- American Indian and Alaska native
- Asian
- Native Hawaiian and Other Pacific Islander
- Two or more races

Source: U.S. Census – Summary File 1 Data 2010, BRA Research Division

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[2] For more information on the *USA Today Diversity Index* see http://www.unc.edu/~pmeyer/carstat/tools.html#updating

[3] Of course, there are other forms of diversity. However, because this research is focused on small geographies in a city, such as census tracts, we were limited to those data collected by the U.S. Census Bureau. While our list of variables is very comprehensive, it is certainly not exhaustive.

INCOME DIVERSITY: defined by the variance in household income within a geographic area. Using data from the 2006-2010 ACS, we defined three main income levels:

- Low-income Households: Households with annual incomes of less than $35,000
- Middle-income Households: Households with annual incomes between $35,000 and less than $100,000
- High-income Households: Households with annual incomes of $100,000 or more

Source: American Community Survey 2006-2010, BRA Research Division

AGE DIVERSITY: defined as the variance in ages of the residents in a specific geographic area. Using U.S. Census data, we defined four main age groups:

- Residents under 18 years of age
- Residents between 18 and 34 years of age
- Residents between the ages of 35 and 64
- Residents 65 years and older

Source: U.S. Census – Summary File 1 Data 2010, BRA Research Division

EDUCATIONAL DIVERSITY: defined as the variance in the educational attainment of the residents in a specific geographic area. Using data from the 2006-2010 American Community Survey, we created three categories:[4]

- People without a high school diploma or GED equivalency
- People with a high school diploma or GED equivalency, with perhaps some college, or an associate's degree
- People with a bachelor's degree or higher

Source: American Community Survey 2006-2010, BRA Research Division Analysis

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[4] Limited to residents 25 years of age or older.

LANGUAGE DIVERSITY: defined by the plurality of languages spoken at home by residents of a specific geographic area. The top languages spoken in Boston were aggregated as follows:

- English
- Spanish
- French (including Patois, Cajun, and Creole)
- Italian
- Portuguese
- Russian
- Chinese
- Vietnamese
- Other[5]

Source: American Community Survey 2006-2010, BRA Research Division Analysis

REGION OF BIRTH DIVERSITY: defined as the plurality in the region of birth of a population in a determined geographic area. This variable included nine categories:

- Northern Europe
- Western Europe
- Southern Europe
- Eastern Europe
- Asia
- Africa
- Oceania
- Latin America (includes Mexico and the Caribbean)
- Northern America (the United States and Canada)

Source: American Community Survey 2006-2010, BRA Research Division Analysis

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[5] Includes German, Yiddish, Other West Germanic languages, Scandinavian languages, Greek, Polish, Serbo-Croatian, Other Slavic languages, Armenian, Persian, Gujarati, Hindi, Urdu, Other Indic languages, Other Indo-European languages, Japanese, Korean, Mon-Khmer, Cambodian, Hmong, Thai, Laotian, Other Asian languages, Tagalog, Other Pacific Island languages, Navajo, Other Native North American languages and other unspecified languages.

Calculating Diversity

As mentioned before, we extended the *USA Today Diversity Index*, which measures ethnic and racial variations in a population, to include other variables. It is also important to remember that the index is a probability measure. That is, it measures the likelihood that if two people are selected at random in a given area (for our purposes a census tract), they will be different on a particular trait. The greater the probability that they would be "different" on the characteristic in question, the greater the diversity index score. The formula used for calculating diversity index is:

Diversity Index = $1 - \Sigma p^2$

The process to calculate these probabilities is as follows: the count of a subcategory within a variable is divided by the total population (e.g. the total number of white persons divided by the total population size). This number effectively represents the probability of coming across someone with this characteristic and is represented by p in the formula above. In order to get the probability that two people share the same characteristic, we simply square that probability. For example, if half the population in a particular geography is white, the probability of coming across a white person would be 0.5. After the probabilities are determined for each characteristic, all of the probabilities are added and then subtracted from one, representing "coming across someone different." We then multiplied the diversity score by 100 in order to deal in whole numbers, rather than decimals. This calculation is performed for each diversity dimension cited above and is then combined to create a composite diversity index.[6]

The probability that any two people chosen at random from a given census tract will have different traits is measured on a scale of 0 to 100, with 0 suggesting that a census tract is totally homogeneous and 100 starting a census tract is totally heterogeneous. The greater the diversity index score, the greater the probability of randomly selecting two people with different characteristics.

Finally, once these probabilities are calculated for every census tract in Boston, we sorted the census tracts by their diversity index score, and selected the top ten most diverse and least diverse tracts for each of the variables in 2010. For the least diverse tracts, we highlighted the defining characteristic that makes them "least diverse."[7]

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[6] In order to maintain consistency in scores, the composite diversity index score was normalized to a 100-point scale used for the individual dimensions.

[7] Tracts that were most diverse, by definition, do not have a defining characteristic.

Diversity in Boston and its Neighborhoods

The table below shows the average Diversity Index scores for Boston's census tracts in 2000 and 2010 across our six selected dimensions, as well as the composite score. Boston appears to be more diverse in 2010 than 2000, both overall and across most of the diversity dimensions.

Table 1: **Average Diversity Index Scores-Boston 2000 and 2010**

	2000	2010
Race/Ethnicity	66	68
Household Income	60	65
Education	64	62
Age	71	69
Language Spoken at Home	53	55
Region of Birth	42	44
Composite	59	61

Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis

Between 2000 and 2010, Boston became less diverse on educational attainment and age dimensions. While this may seem surprising, it is important to keep in mind that the diversity index essentially measures heterogeneity. Between 2000 and 2010, the percentage of Bostonians with a college degree increased by nearly ten percentage points. Likewise, the percentage of adults between 18 and 34 increased by almost three percentage points.[8] In short, Boston increased the share of the population with a college education and young adults. As a result, it became more homogeneous on these dimensions.

Of course, these average scores are only expressions of diversity in the city in the aggregate. It is important to consider how the city's neighborhoods changed between 2000 and 2010, as it relates to each of our dimensions of diversity.

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[8] This happened at the expense of Bostonians under the age of 18. The percentage of the population 35 or older in 2010 is similar to the year 2000.

Race/Ethnicity

Map 1 shows side-by-side the Race/Ethnicity Diversity Index maps for Boston census tracts in 2000 and 2010. The dark red tracts are the most diverse, or heterogeneous, tracts in the city. The dark green tracts are the least diverse areas in the city. In both 2000 and 2010, the neighborhoods of Dorchester, the South End, and Mission Hill possessed high concentrations of heterogeneous tracts. Tracts in West Roxbury, South Boston, Mattapan, and the North End tended to have the highest concentration of homogeneous tracts. However, the homogeneity of West Roxbury and Mattapan, as well as Jamaica Plain, has clearly decreased since 2000. Also of note, the western part of Brighton, as well as a handful of tracts in Roxbury, moved from green to yellow, indicating more heterogeneity in the racial and ethnic compositions of these areas.

Map 1: **Racial/Ethnic Diversity in Boston Census Tracts, 2000 and 2010**
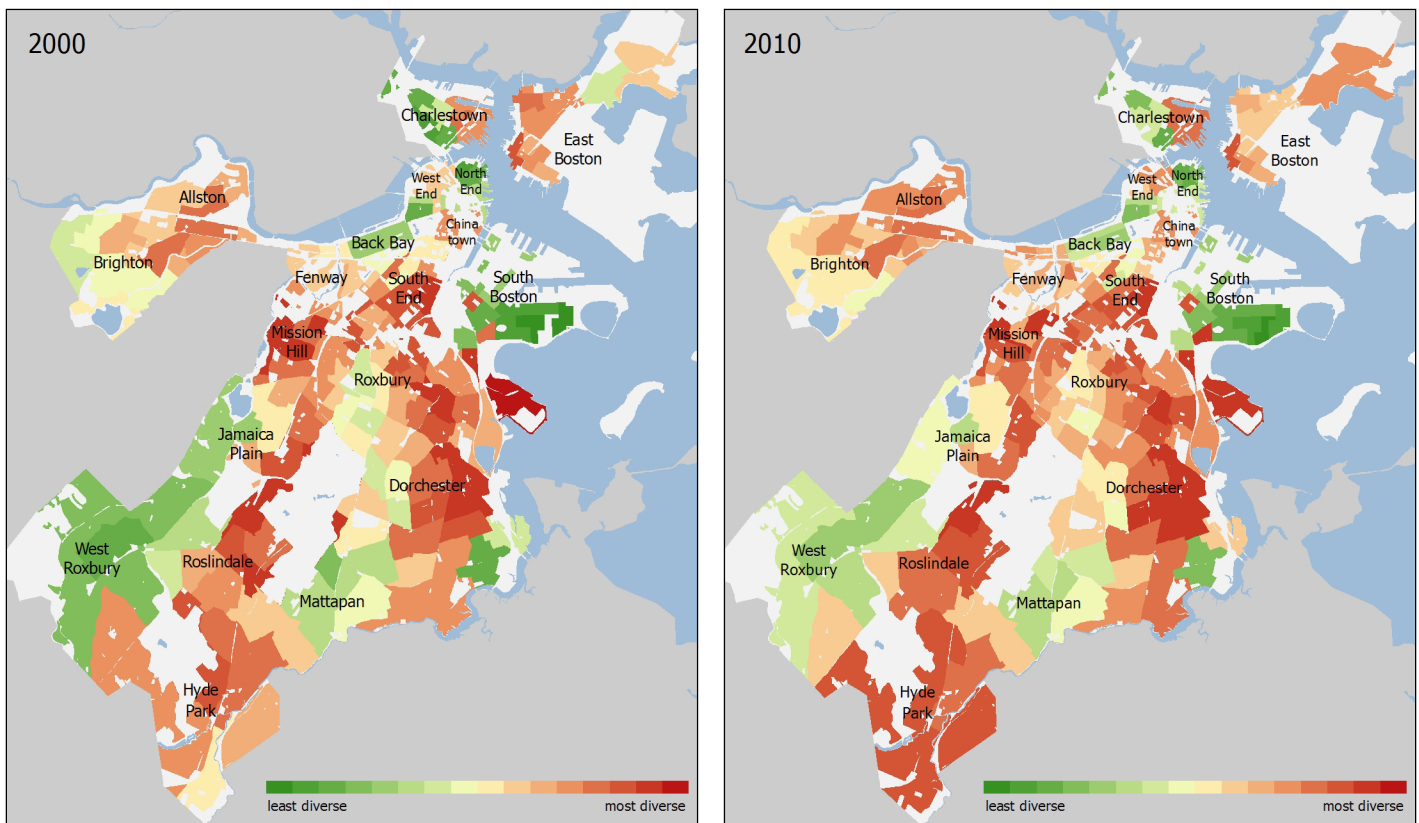
Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Household Income

Map 2 shows the Household Income Diversity Index maps for census tracts in Boston in 2000 and 2010. In general, the 2010 map is much more orange and red than the 2000 version, indicating that Boston census tracts were more economically diverse in 2010 than they were in 2000. This is the case for the vast majority of the city. A couple of notable exceptions are the western and southwestern parts of Jamaica Plain (tracts around Jamaica Pond) and some tracts between northern Roxbury and the South End. Both of these areas are less economically diverse than they were in 2000, but in different ways. The concentration of high-income households in the western and southwestern parts of Jamaica Plain increased between 2000 and 2010 while in tracts around northern Roxbury and the South End, the concentration of low-income households increased.

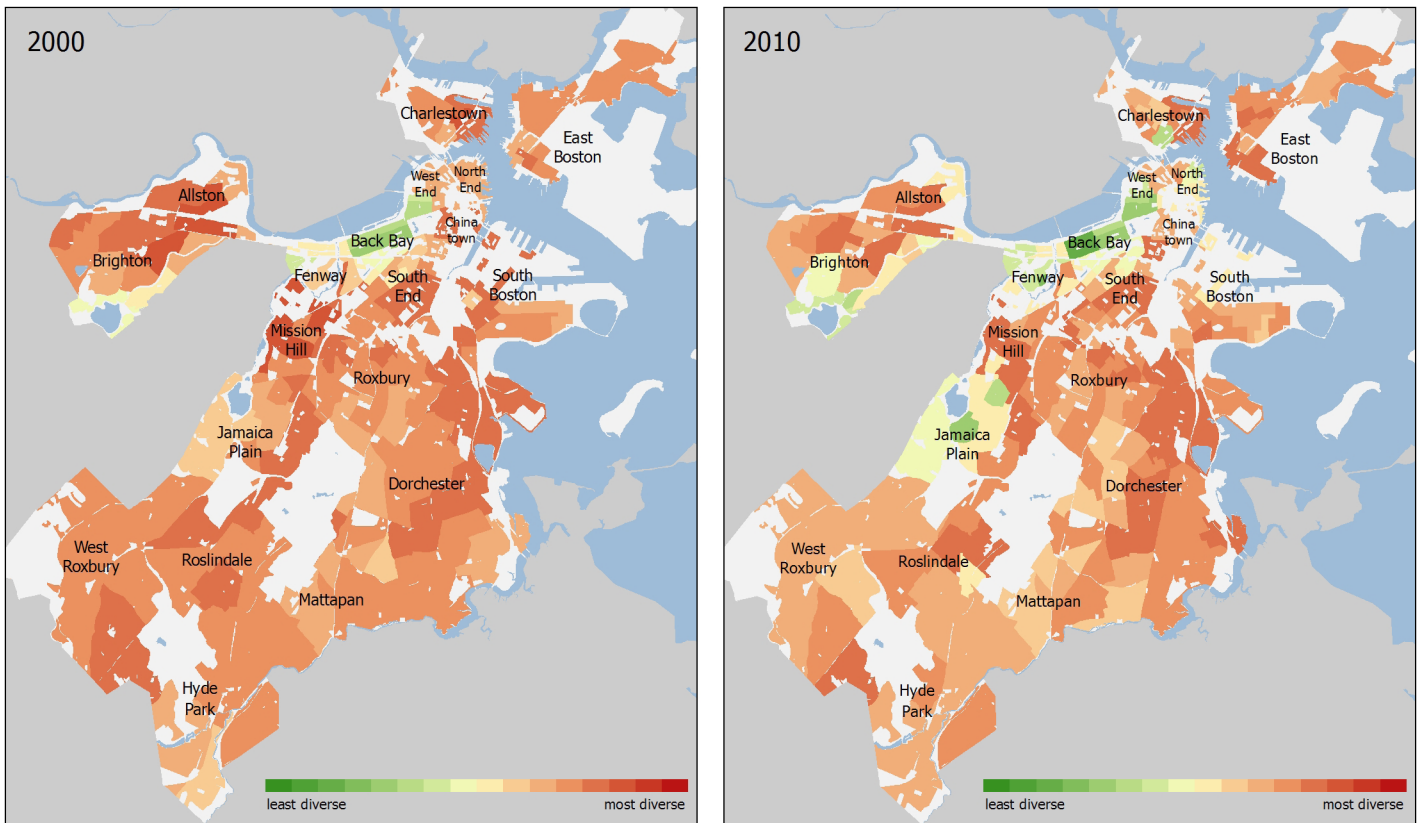Map 2: **Household Income Diversity in Boston Census Tracts, 2000 and 2010**
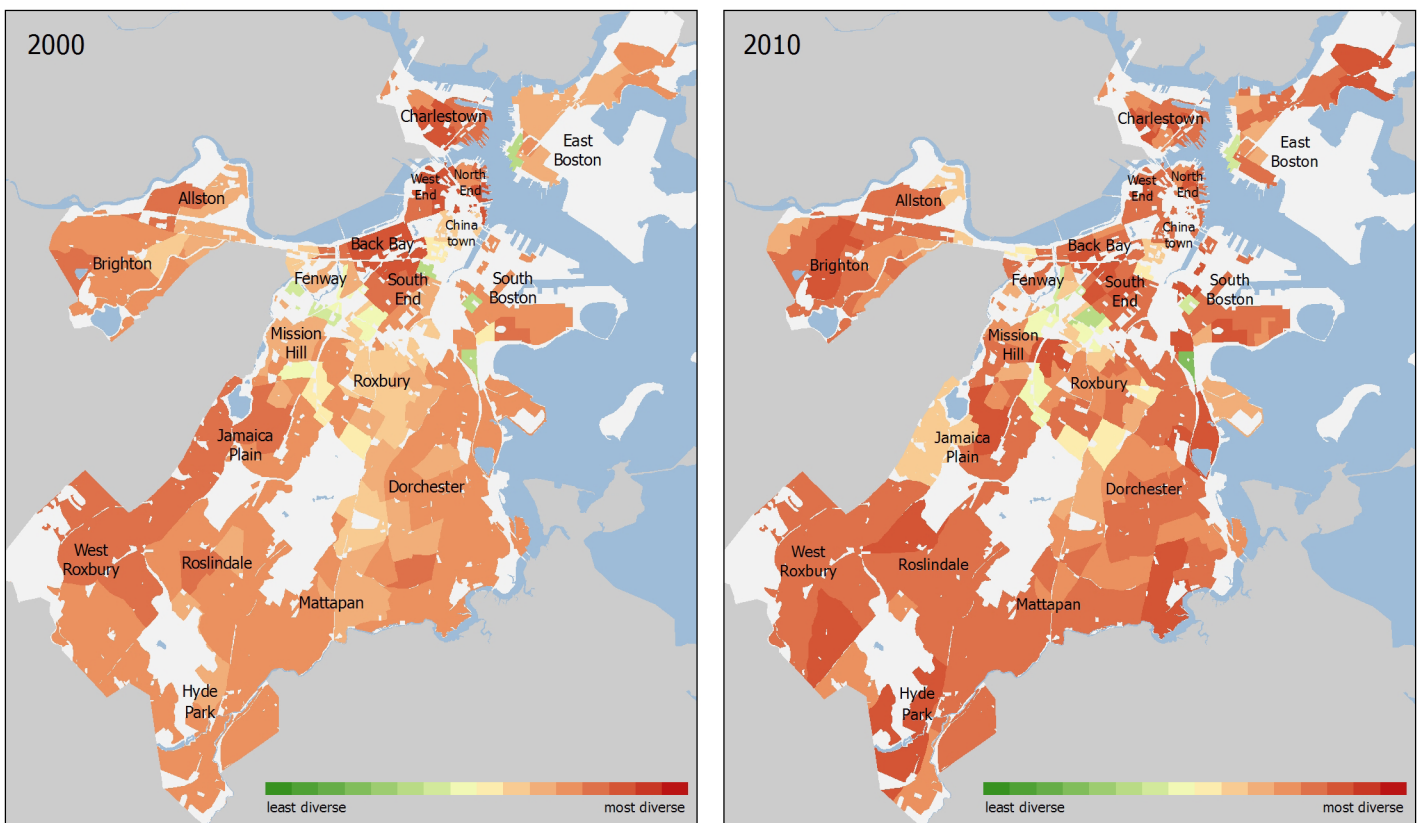
Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Education

Generally speaking, the Education Diversity Index maps look fairly similar between 2000 and 2010. As noted earlier, Boston was actually more homogeneous in terms of educational attainment in 2010 than in 2000. Census tracts in Jamaica Plain, southwestern Brighton, and the Back Bay appear to be driving the increased homogenization in educational attainment in the city. In all of these cases, the concentration of college-educated residents increased significantly from 2000.

Map 3: **Education Diversity in Boston Census Tracts, 2000 and 2010**

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Age

Map 4 illustrates the fact that Boston census tracts are typically very heterogeneous when it comes to age distribution. The exceptions rest in Allston, Brighton, the Fenway, and surrounding areas. These parts of Boston have high concentrations of college students and young adults. This concentration intensified between 2000 and 2010, as these sections of the city became more homogeneous in regard to age.

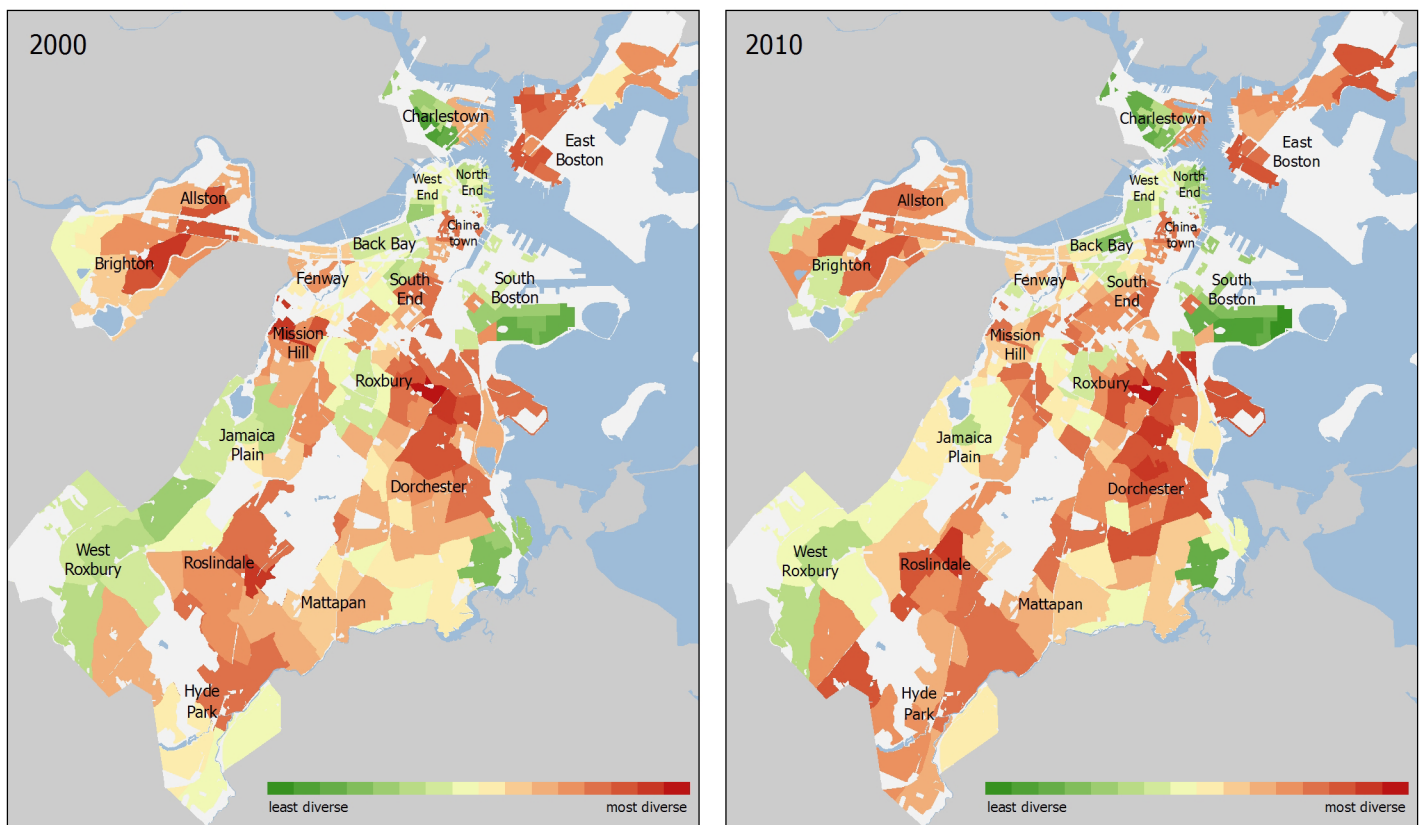Map 4: **Age Diversity in Boston Census Tracts, 2000 and 2010**
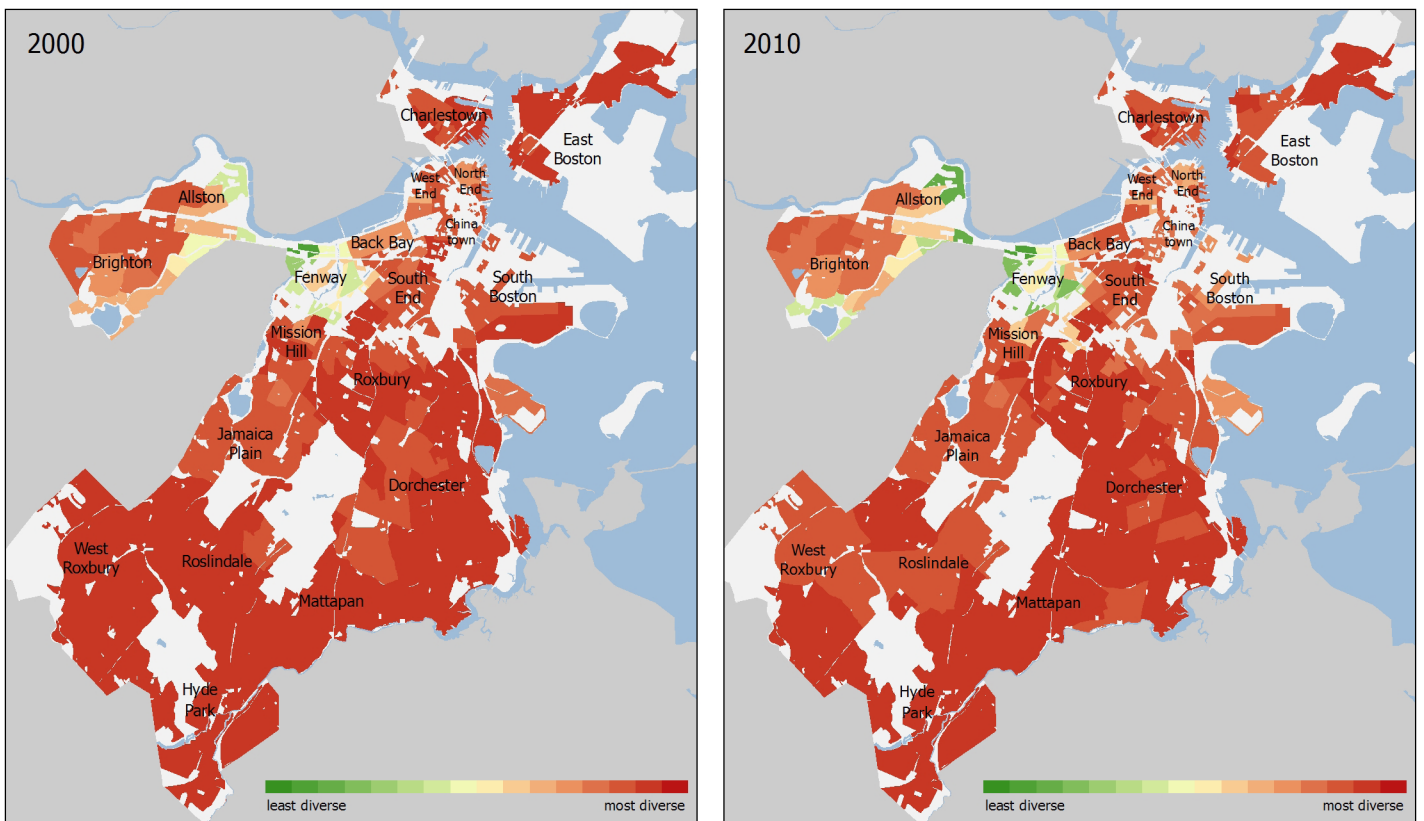
Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Language Spoken at Home

Generally, language diversity increased in Boston from 2000 to 2010. This is evident in **Map 5**, where the concentrations of green areas in 2000 give way to lighter greens and yellows in 2010. Noteworthy shifts occurred in West Roxbury, Jamaica Plain, and parts of Mattapan and Dorchester. In the West Roxbury tracts, while the majority of residents speak English at home, the concentration of English-speaking households decreased between 2000 and 2010. Conversely, the tracts in Mattapan and Dorchester showed an increase in English-speaking households.[9]

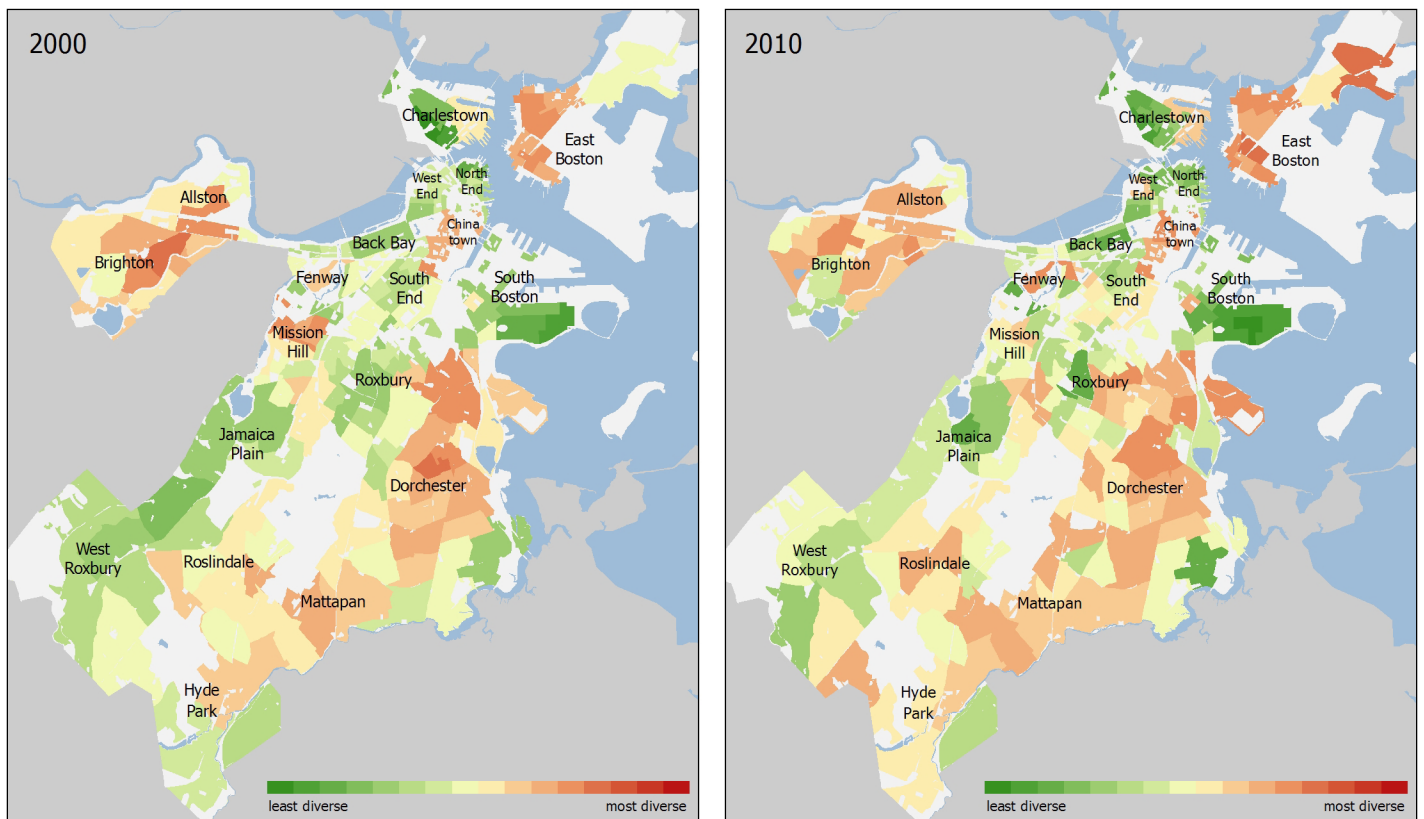Map 5: **Language Diversity in Boston Census Tracts, 2000 and 2010**

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

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[9] Interestingly, the observed change in Jamaica Plain may be related to the split of census tracts between 2000 and 2010. Today there is a tract that runs from the west side of Jamaica Pond southward and another circular tract on the southeastern side of Jamaica Pond. In 2000, these two tracts were combined. Visually, it appears that the tract to the west of the Pond got a lot more diverse, while the tract to the southeast got less diverse. Now that these two areas are separated, it could lead to both areas looking quite different from the previous decade, rather than demographic changes in the tracts themselves.

Region of Birth

As mentioned earlier, the city was more diverse in 2010 than in 2000 in terms of region of birth. **Map 6** shows that changes at the tract level are somewhat scattershot. East Boston appears to have experienced the most significant change, as the majority of the neighborhood was orange in 2010, compared to yellow in 2000. There are several census tracts in Mattapan, Hyde Park, and West Roxbury showing increased heterogeneity in regions of birth between 2000 and 2010. In these cases, the concentration of North American born residents decreased over the decade, leading to a more diverse distribution in the regions of birth for the area's residents. On the other hand, there are tracts in Dorchester, South Boston, and Brighton with increased homogeneity in regard to regions of birth. For South Boston and the area of Brighton closest to the Chestnut Hill Reservoir, the concentration of North American born residents increased, leading to more homogeneity in these neighborhoods in regard to this variable. On the other hand, the tract immediately north of the Chestnut Hill Reservoir in Brighton became less diverse through a sharp increase in the number of non-North American born residents. This was also the case for the southern Dorchester tract that turned from a light shade of green to a dark shade of green between 2000 and 2010.

Map 6: **Region of Birth Diversity in Boston Census Tracts, 2000 and 2010**

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Composite Diversity Index

The Composite Diversity Index is a combination of all of the above diversity dimensions. As we can see on **Map 7**, consistent with our discussion to this point, Boston was a more heterogeneous place in 2010 than in 2000. Generally speaking, the 2010 Composite Diversity Index map is more orange and red than the 2000 map. This indicates more diversity in Boston's census tracts. The most significant shifts towards greater heterogeneity appear to have happened in West Roxbury, Jamaica Plain (except the tract closest to Jamaica Pond), and pockets of Dorchester. There are sections of South Boston, the Back Bay, and Charlestown where homogeneity increased between 2000 and 2010, indicating less diversity in general.

Map 7: **Composite Diversity Index in Boston Census Tracts, 2000 and 2010**
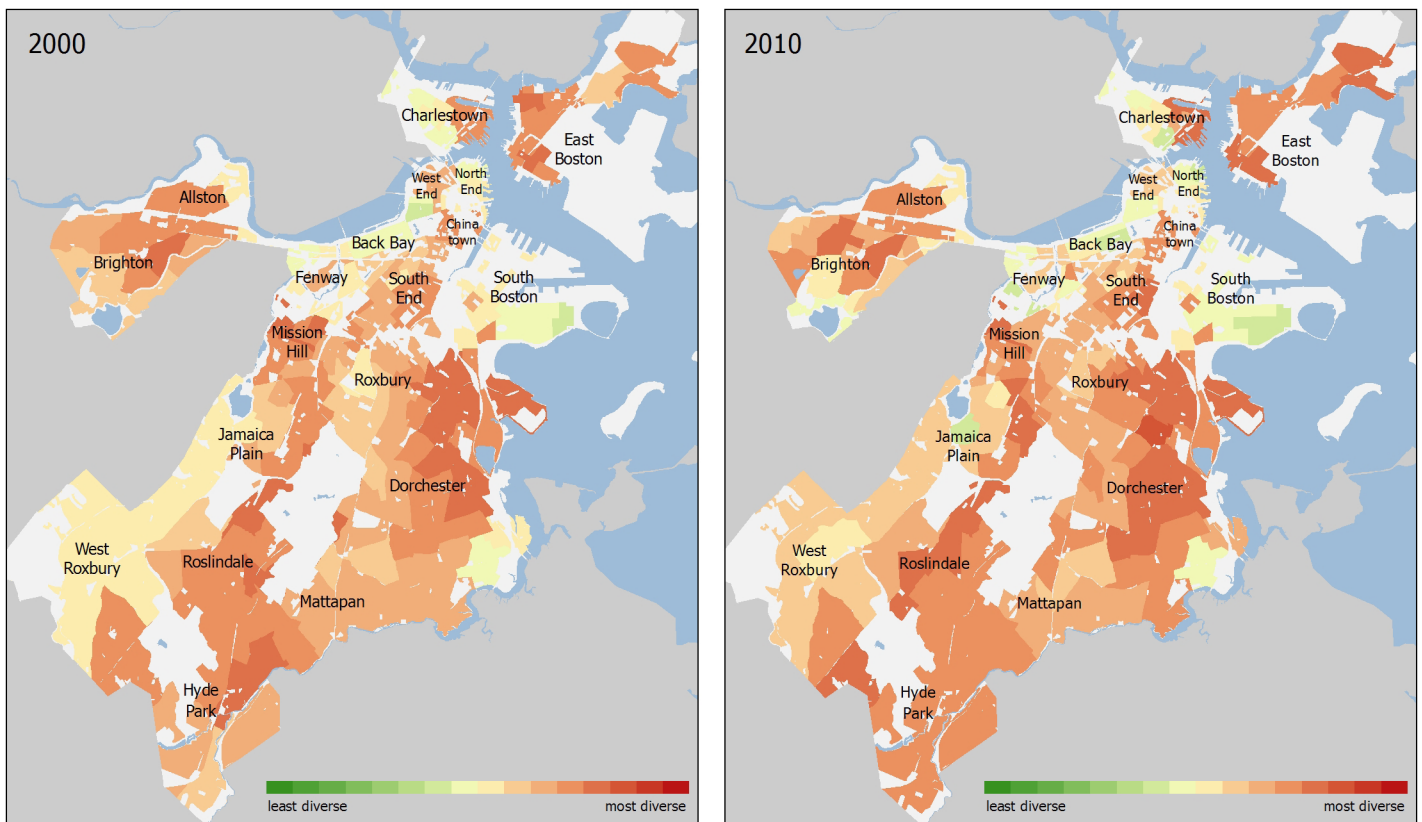
Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis
Maps by BRA Office of Digital Cartography and GIS

Boston's Most and
Least Diverse Tracts

The previous discussion focused primarily on how diversity has changed in various sections of the city between 2000 and 2010. Next we will focus on Boston's ten most heterogeneous and homogeneous tracts by each of our dimensions of diversity in 2010. Interestingly, across all six of our diversity dimensions, the most homogeneous tracts were homogeneous in the same way. For example, the ten least diverse tracts in Boston by race and ethnicity were tracts that were predominantly white. In all of the cases, except household income, the most homogeneous tracts reflected the general dominant characteristics of the population at large (e.g., white as the largest racial group, 18-34 as the largest age group, etc). Regarding household income, the number of households making under $35,000 is slightly less than the number of households making between $35,000 to under $100,000 (a little over 93,000 households for the former and close to 94,000 for the latter). These data suggest that there is not a great deal of "ghettoization" of "minority" populations in Boston, whether based on racial or other demographic dimensions.[10]

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[10] By our definition of diversity, the most diverse tracts lack a defining characteristic. These are tracts that show the greatest amount of heterogeneity, or difference, in the city.

Race and Ethnicity

As displayed in **Map 8**, the least diverse Census tracts in Boston with regard to race and ethnicity are in South Boston, Charlestown, and the North End. On the other hand, the most diverse tracts on race and ethnicity tend to be in Dorchester, with others scattered around Jamaica Plain, Mission Hill, and the South End.

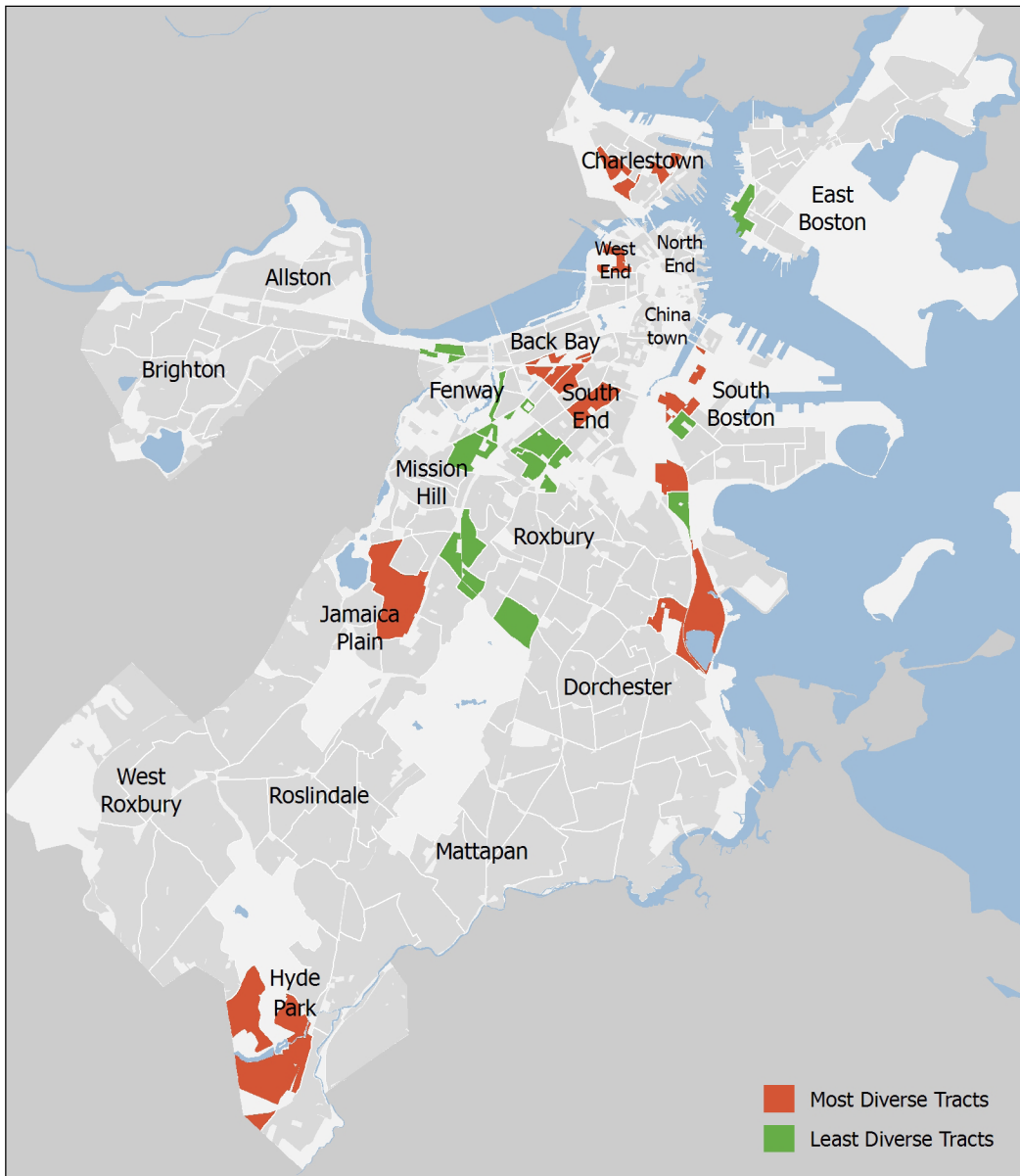Map 8: **Race/Ethnic Diversity Index-Most and Least Diverse Tracts, 2010**
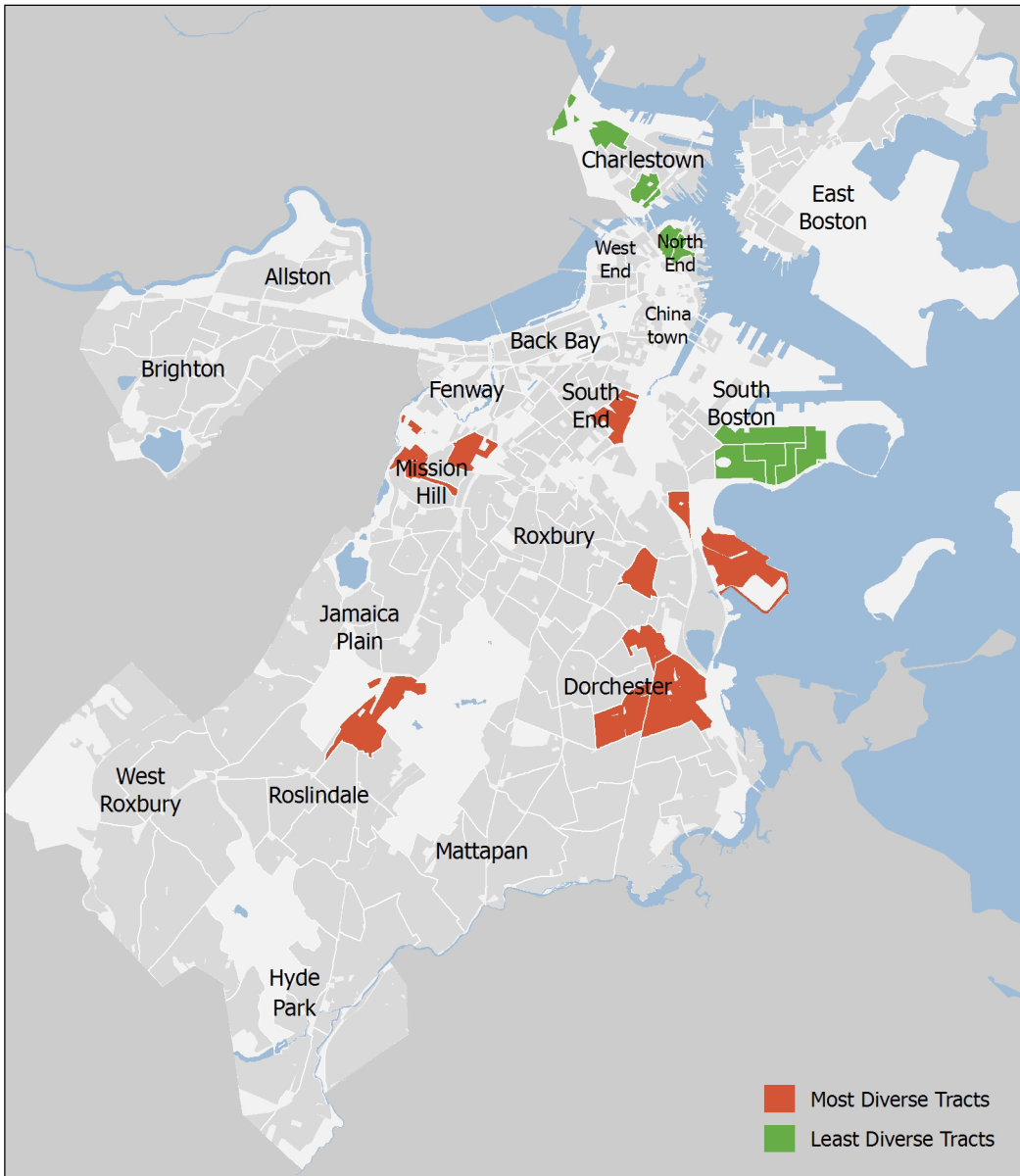
Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Household Income

Map 9 shows Boston's economically heterogeneous and homogeneous tracts in 2010. All ten of the least heterogeneous tracts are areas with high concentrations of households making $35,000 or less a year. These tracts are mainly in Roxbury, with others located in the Fenway, East Boston, and Mission Hill. The ten most economically diverse tracts are scattered throughout the city, including tracts in Charlestown, the Back Bay, the South End, Jamaica Plain, and Hyde Park.

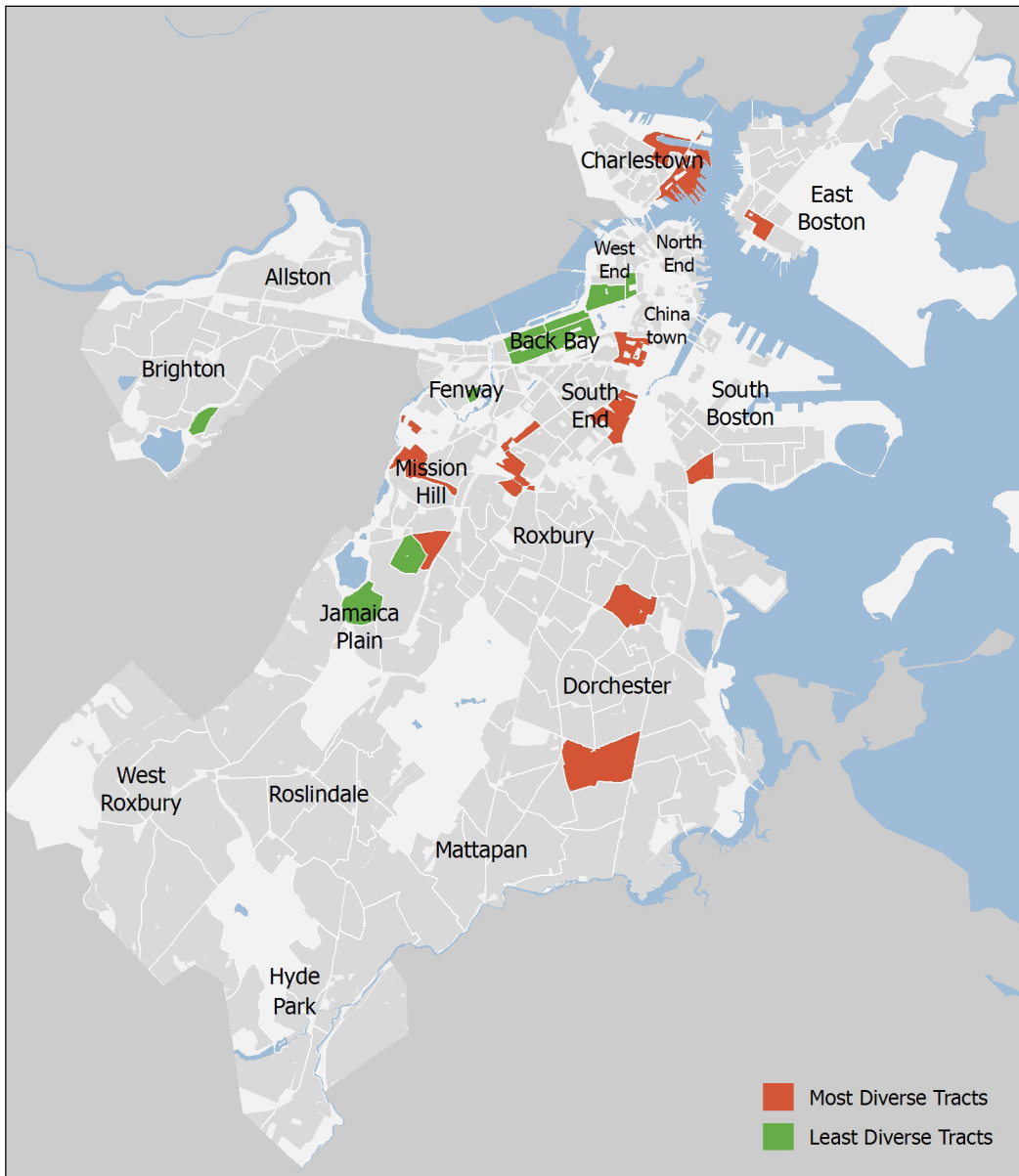Map 9: **Household Income Diversity Index – Most and Least Diverse Tracts, 2010**

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Education

All of Boston's least diverse tracts in terms of educational attainment are places with high concentrations of college-educated residents. **The map below** shows that these tracts are mainly in the Back Bay, Beacon Hill, and Jamaica Plain. The most heterogeneous tracts on educational attainment can be found in Dorchester, Charlestown, and the South End.

Map 10: **Education Diversity Index – Most and Least Diverse Tracts, 2010**
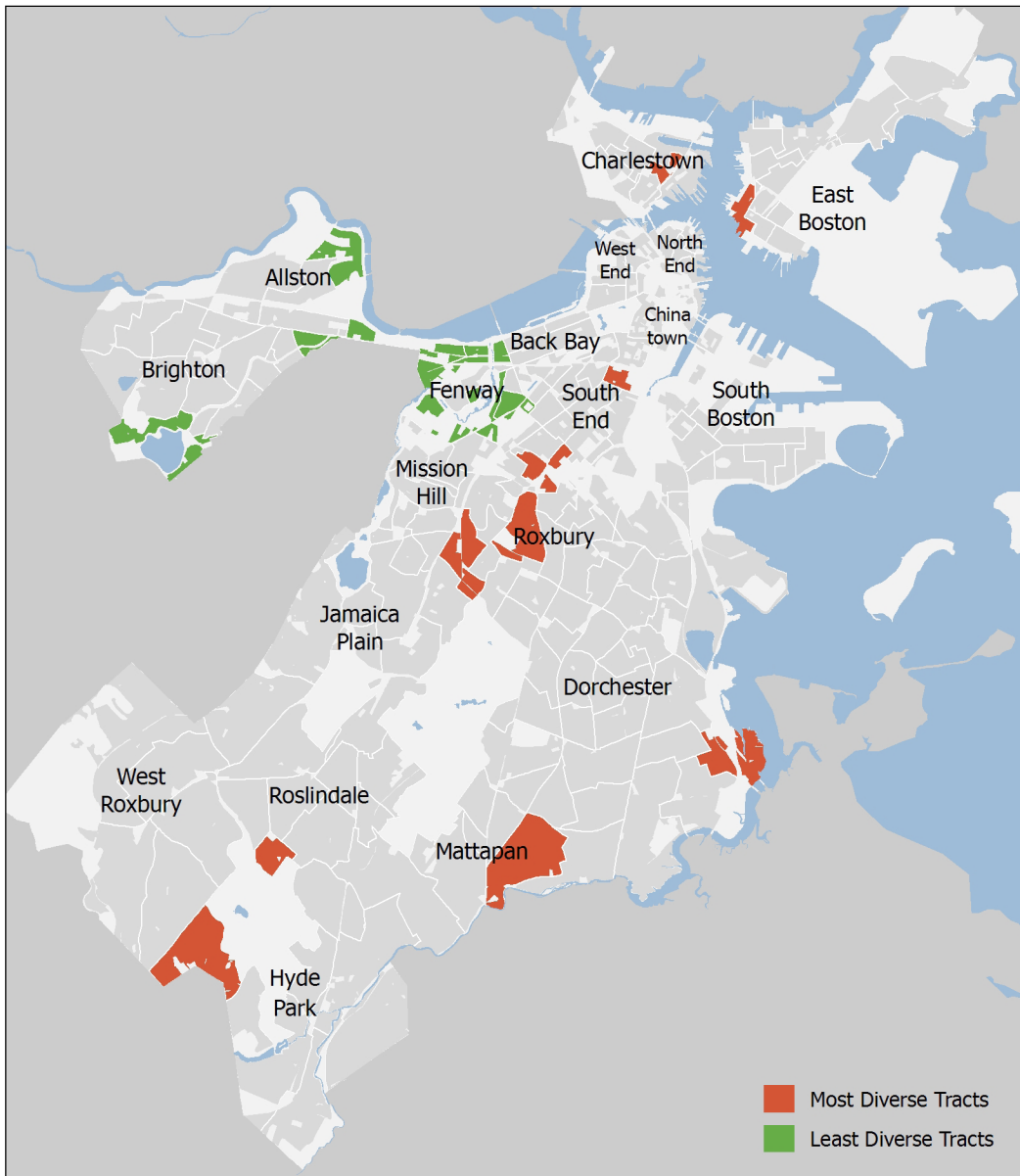

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Age

As displayed in **Map 11**, the least age-diverse census tracts in Boston are all places with high concentrations of adults between the ages of 18-34. These tracts can be mainly found in the Fenway, Allston, and Brighton. This is not surprising because of the high concentration of college students in these areas. The most diverse tracts in terms of age are scattered throughout the city, including Mattapan, Roxbury, Dorchester, and West Roxbury.

Map 11: **Age Diversity Index – Most and Least Diverse Tracts, 2010**
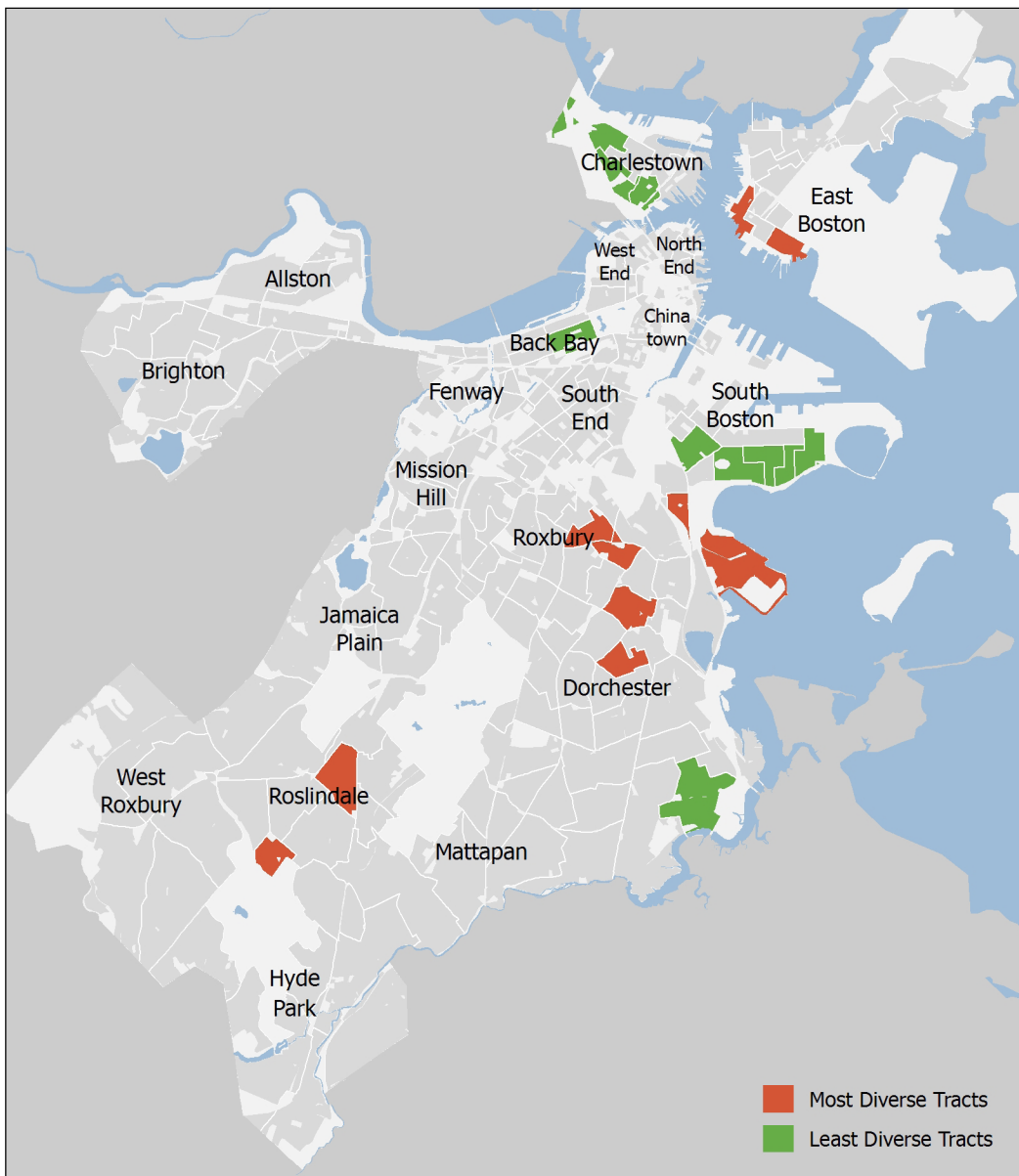

Source: U.S. Census Bureau, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Language Spoken at Home

Generally speaking, the majority of homogeneous tracts in terms of language spoken at home can be found in South Boston and Charlestown. All of the least diverse tracts on language spoken at home are places with high concentrations of English-speaking households. The most diverse tracts in regard to language can be found in Dorchester, Roxbury, and East Boston.

Map 12: **Language Diversity Index – Most and Least Diverse Tracts, 2010**

Charlestown
East Boston
West End
North End
Allston
China town
Back Bay
Brighton
Fenway
South End
South Boston
Mission Hill
Roxbury
Jamaica Plain
Dorchester
West Roxbury
Roslindale
Mattapan
Hyde Park

■ Most Diverse Tracts
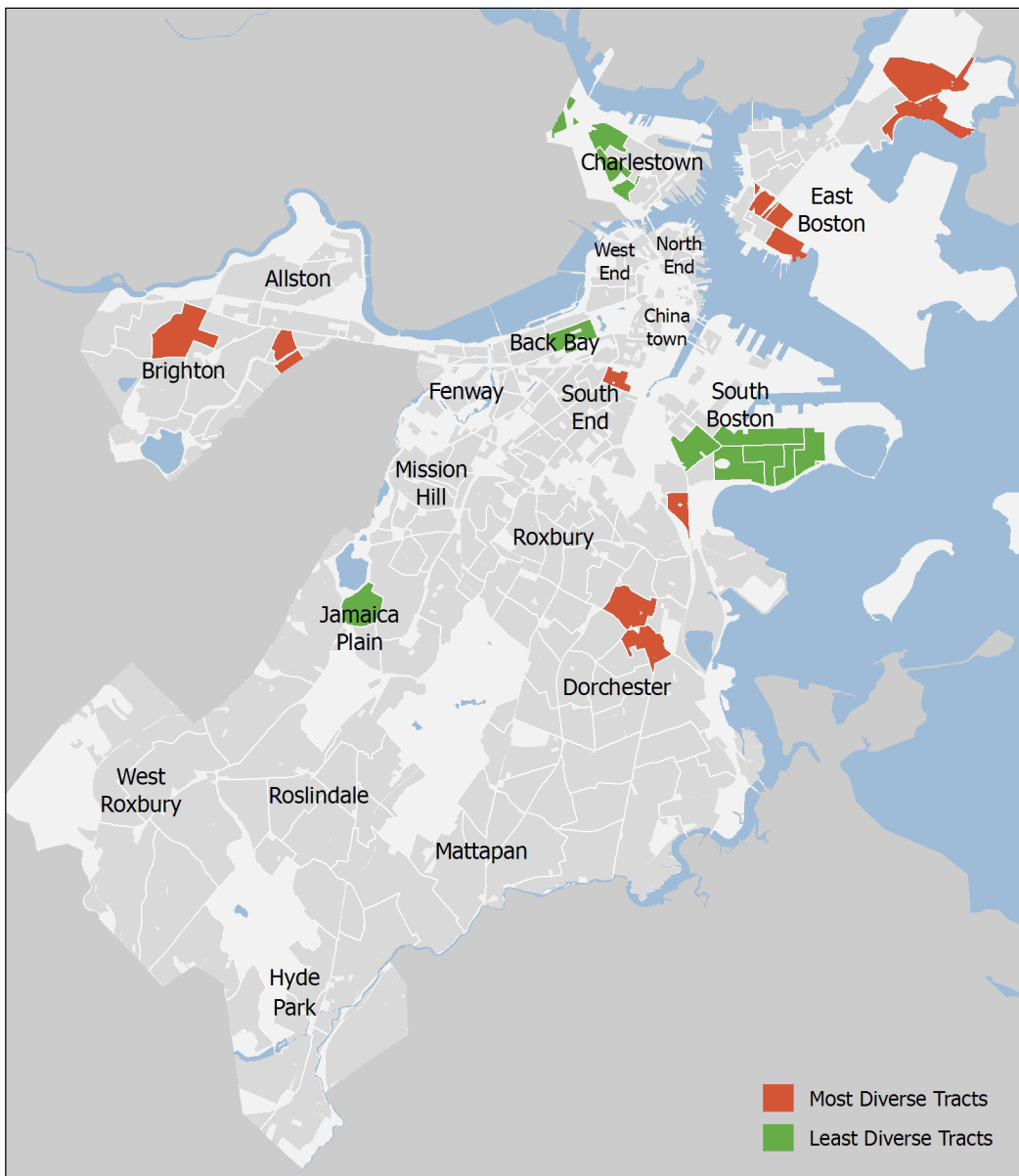■ Least Diverse Tracts

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Region of Birth

As displayed in **Map 13**, the least diverse tracts in Boston on region of birth tend to be located in South Boston and Charlestown. These are all tracts with a high concentration of people born in North America. These also happened to be the same homogeneous tracts observed in the Race and Ethnicity Diversity Index. The most diverse tracts on region of birth are located in East Boston and Dorchester. This is not surprising, as these are areas of the city with significant immigrant populations.

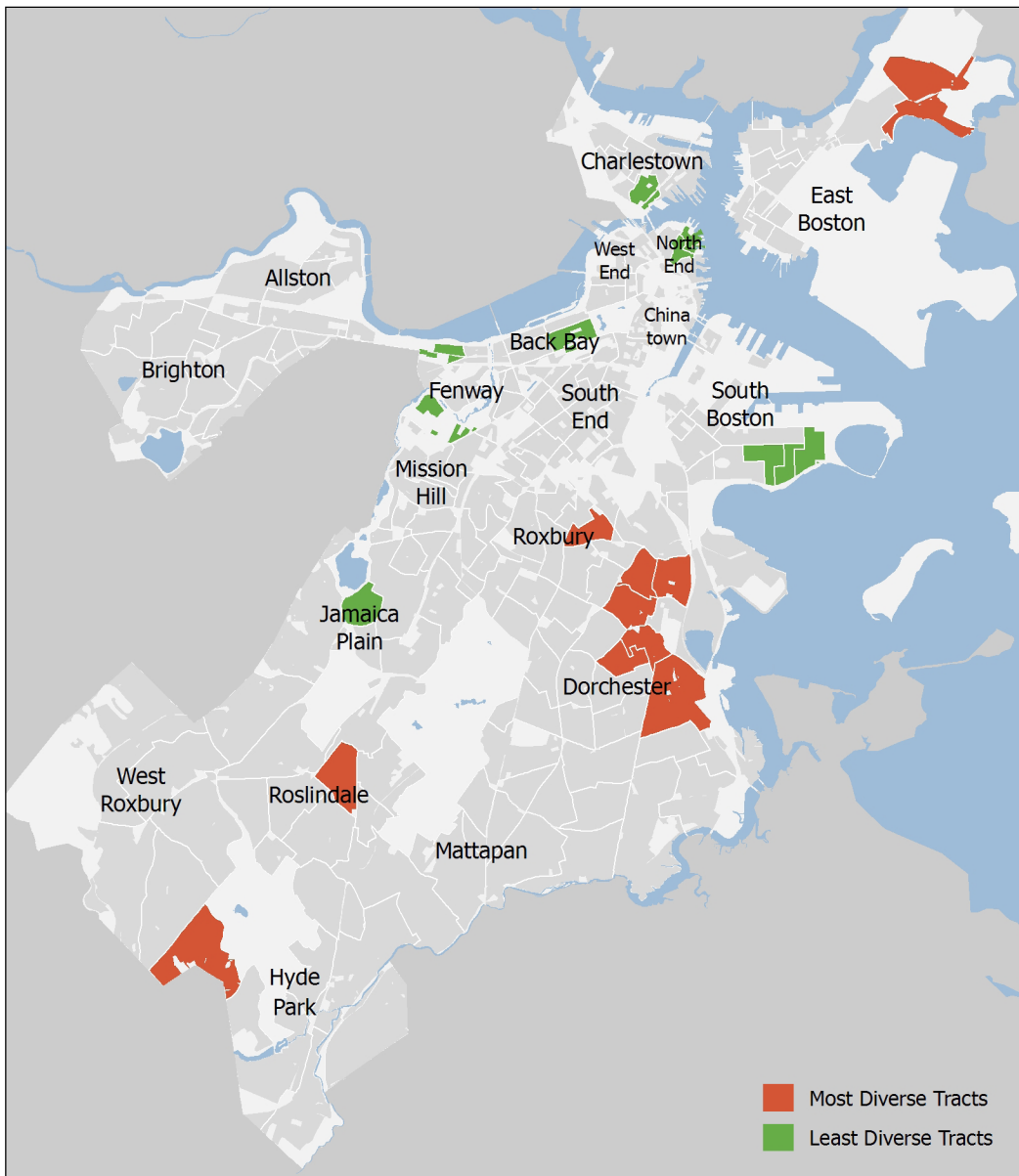Map 13: **Region of Birth Diversity Index – Most and Least Diverse Tracts, 2010**

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

Composite Diversity Index

This last map shows the ten tracts with the highest and lowest Composite Diversity scores for Boston in 2010. Overall, the most homogeneous sections of the city are in South Boston, the Back Bay, the North End, and pockets of Charlestown, Jamaica Plain, and the Fenway area. The most heterogeneous tracts in the city tend to be in Dorchester, Roxbury, and East Boston.

Map 14: Composite Diversity Index – Most and Least Diverse Tracts, 2010

Source: U.S. Census Bureau, American Community Survey 2006-2010, Boston Redevelopment Authority Research Division Analysis
Map by BRA Office of Digital Cartography and GIS

CONCLUSION

Boston's diversity can be seen citywide, with almost all neighborhoods becoming more diverse during the course of the last decade.

These changes are the fruit of local and state policies that resulted in an increased production of affordable housing, better public schools, safer neighborhoods, and a strong economy able to attract and retain immigrants, students, and young professionals while facilitating, at the same time, the education and employment of Boston's own native population. Boston has the right stuff: the brains and talent to compete, the know-how to patent and license its technology, the entrepreneurs who are willing to take risks, and the kind of diverse and tolerant society that attracts and retains creative people.