

A Healthy Balance

Equitable and Practical Locations for Bike Share Stations in the Boston Area

Background

Over the last two decades, bike share programs have expanded in size and ridership. These programs provide bicycles that users check out from a docking station for a short-term rental and return to any station in the system. Research suggests that bike share programs can reduce motor vehicle use and improve health (Fisherman, 2015).



Hubway Station

Bike share riders “are on average disproportionately of higher education and income, more likely to be male and white” (Fisherman, 2015). Various methodologies have been proposed to locate new stations, such as a GIS-based method that incorporates population density, zoning, distance from origin, and distance from destination (García-Palomares et al., 2012).

New approaches for selecting station locations are still being developed, with implications for health, equity, and the environment. In Boston, the Hubway bike share system opened in 2011. In August 2016, new stations opened in Roxbury, Dorchester, and East Boston, but many other minority and low-income neighborhoods lack access (Herndon, 2016).

This project identifies potential new Hubway station locations, taking into account environmental justice considerations, the transit environment, and the structure of the existing bike share system.

Analysis

Hubway makes available system data, including current station locations as of April 2016. Final analyses were limited to the four municipalities in which Hubway currently operates: Boston, Brookline, Cambridge, and Somerville. Data from different years may contribute to discrepancies. This analysis does not account for other components of equity (such as ethnicity) or transit environment (such as routes to home and work).

Environmental Justice

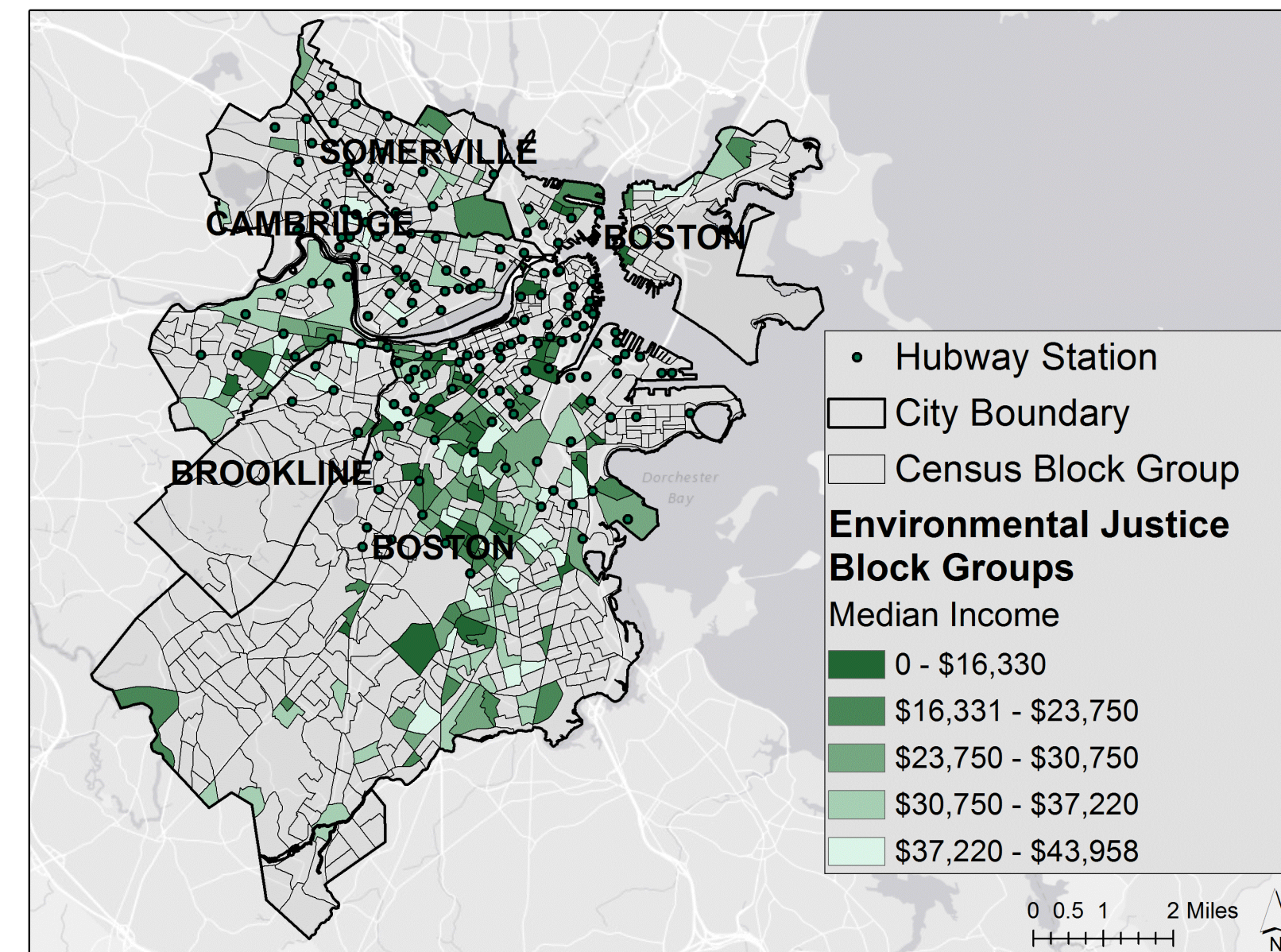
To prioritize disadvantaged populations, the 2010 MassGIS Environmental Justice criteria were adapted. Census block groups with a median household income less than or equal to 65.49% of the 2014 median across Massachusetts, or \$44,432, were defined as environmental justice areas.

Transit Environment

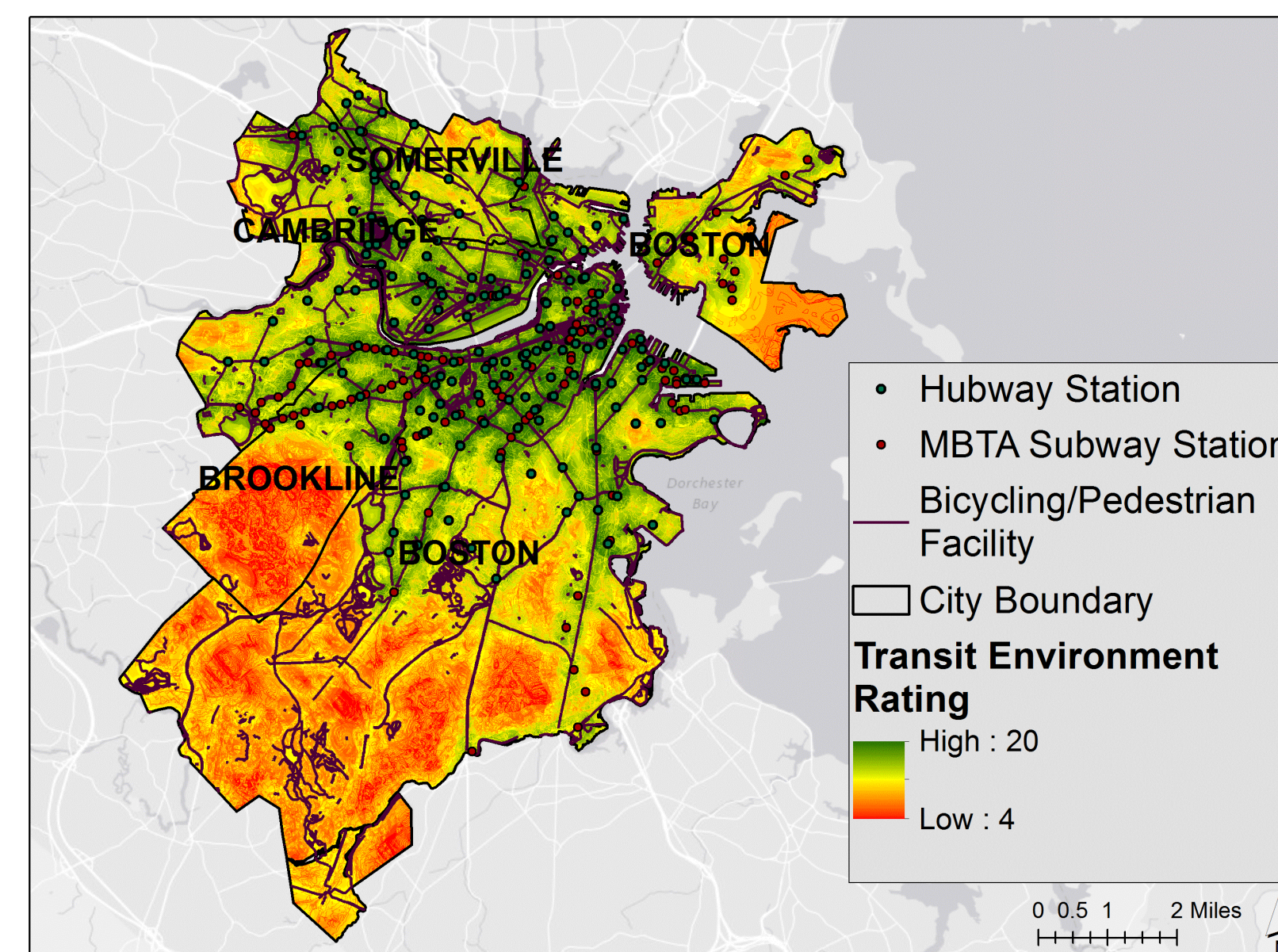
Use of bike share stations depends on a variety of influences. For this analysis, four factors were considered:

- **Elevation:** Changes in elevation are more difficult for biking.

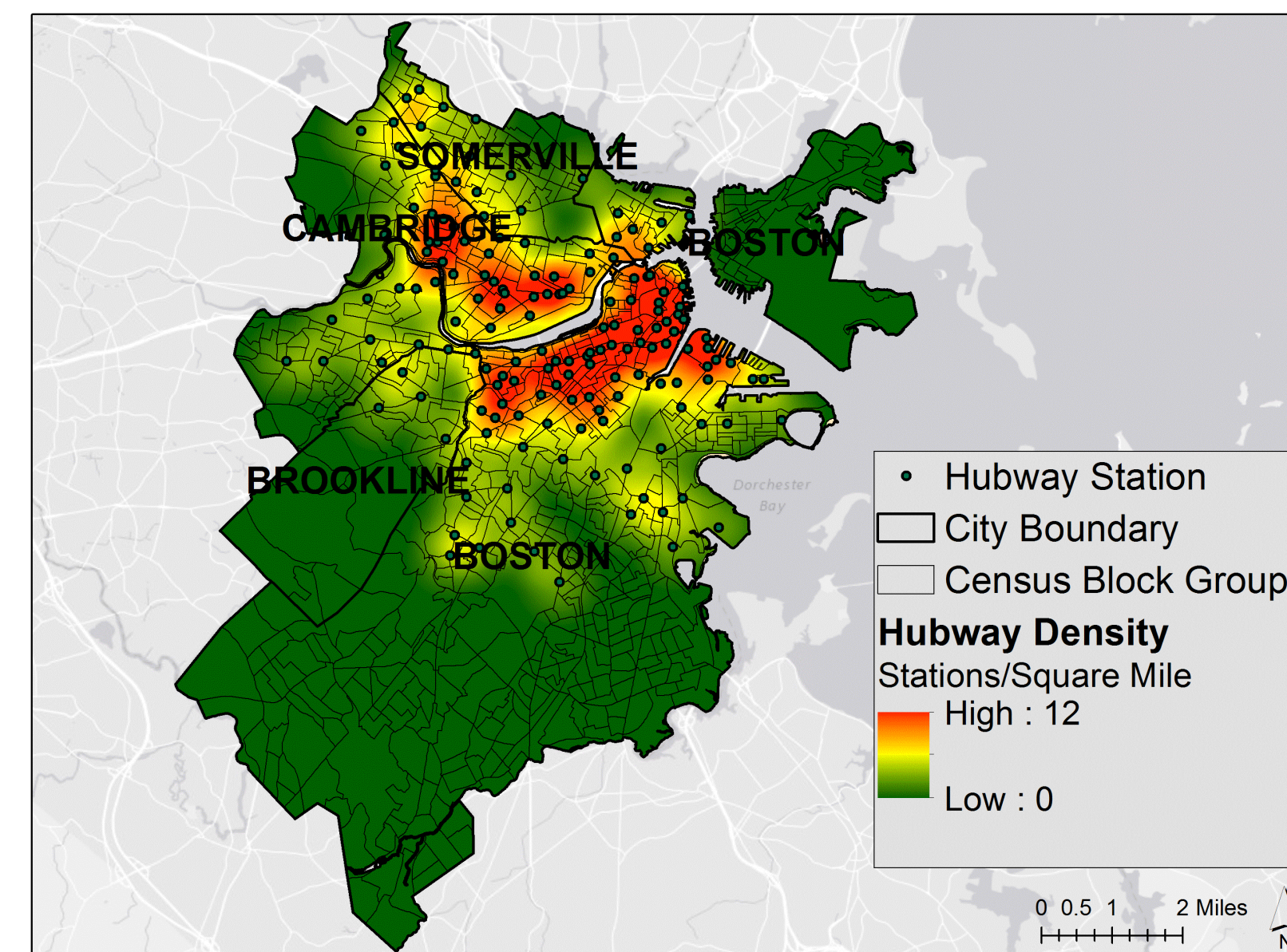
- **Subway stations:** Subway access enables multi-modal transit.
- **Road facilities:** Infrastructure such as bike lanes promotes safer and more comfortable riding.
- **Existing stations:** Nearby bike share stations enable trips within the allowed rental time, as well as convenient pick-up and drop-off.



Environmental Justice Areas



Transit Environment Rating



Existing Hubway System Density

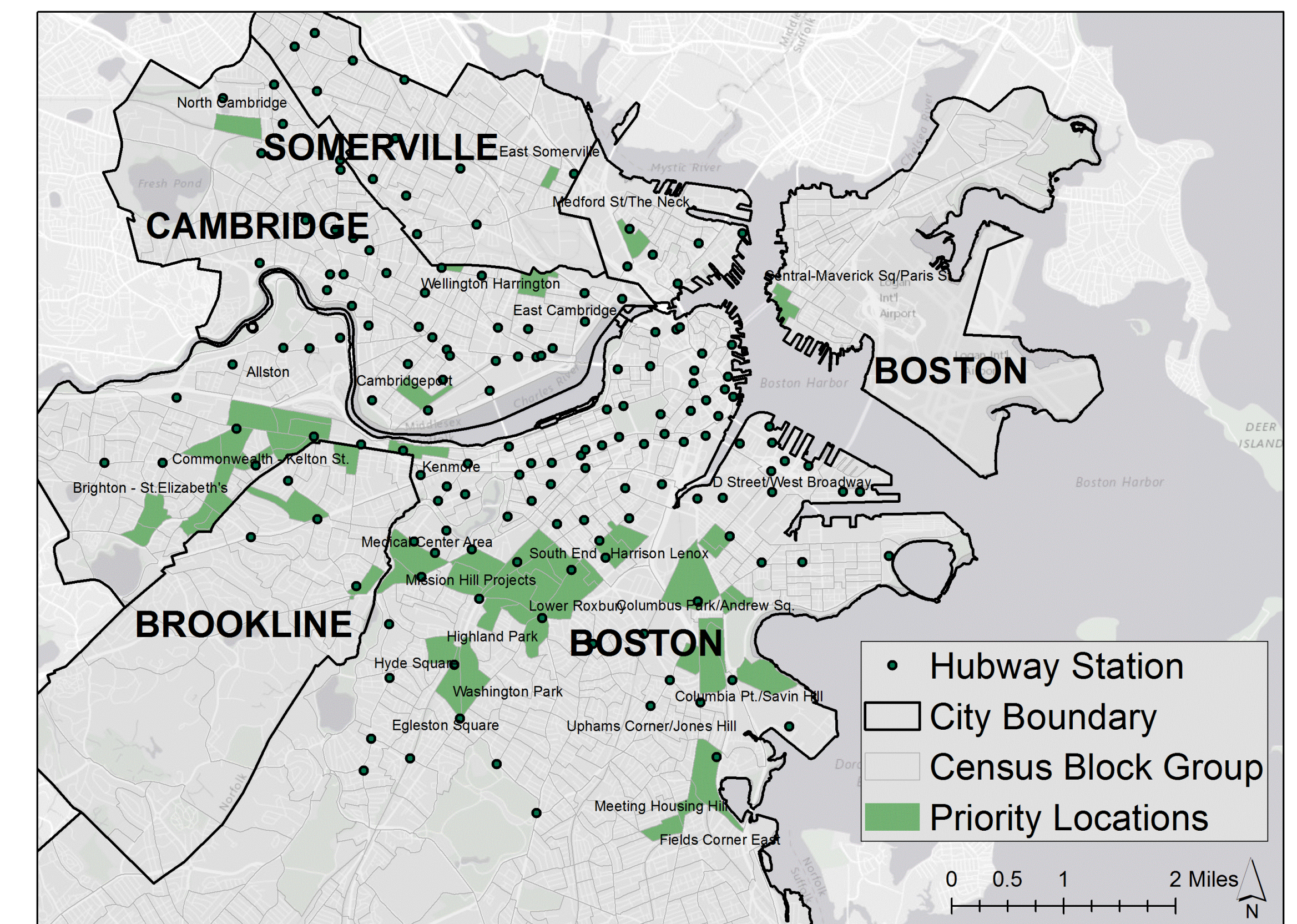
An elevation raster was used to generate a slope map, with higher priority assigned to locations with a smaller percent rise. Euclidean distance was calculated from Massachusetts Bay Transportation Authority (MBTA) subway station, bicycle/pedestrian facilities, and existing Hubway stations. Higher priority was assigned to locations with shorter distances to each transit feature. Each of these measures was given a priority rating from one (lowest) to five (highest). These ratings were combined into a single unweighted transit environment rating from four (lowest) to 20 (highest).

Existing System

To prioritize areas with fewer established stations, kernel density of existing Hubway stations per square mile was calculated. Densities range from zero to 12 stations per square mile.

Overall Priority

Block groups were selected for overall priority if they 1) were categorized as environmental justice areas, 2) received a transit environment rating greater than or equal to 15, and 3) had an existing station density of less than or equal to two stations per square mile.



Overall Priority Locations for New Stations

Conclusions

Highlighted priority locations include areas of Roxbury, Dorchester, and East Boston targeted in the August 2016 expansion. When updated trip data is available, usage of these stations should be evaluated. Other priority locations for future development include areas of Mission Hill, North Cambridge, East Somerville, and East Cambridge. Many high priority areas remain for future expansions. In addition, in many cases environmental justice areas overlap with poor transit environments, suggesting a need for more equitable infrastructure.

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UEP 232: Introduction to Geographical Information Systems (GIS)

NAD 1983 Stateplane Massachusetts Mainland (FIPS 2001), Lambert Conformal Conic Projection

References:

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Resources:

American Community Survey 2014 5-Year Estimates, ESRI, Hubway, MassGIS.