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Building a Better Bike Network

An Equity Analysis of Boston

Introduction

To accommodate the growing number of cyclists, the City of Boston has committed to expand its bicycle network to 365 miles by 2043.

The city identified two principles—network connectivity and safety—to guide the implementation of its Bike Network Plan. In addition to these, the city should consider an equity principle and seek to understand which communities are most in need of non-motorized transportation investment.

This GIS project uses the Bike Equity Index (BEI), which was developed by the League of American Bicyclists, as a tool to understand the spatial relationship between the distribution of bike infrastructure and historically marginalized communities.

Methodology

The Bike Equity Index was calculated using five vulnerability indicators: zero-car households, youth (under 18), elderly (over 65), poverty and race. These indicators are categorized as indicators of transit dependency or Environmental Justice populations.

Transit dependent populations have no or limited access to motorized vehicles and thus are more likely to depend on non-motorized transportation modes. Environmental Justice (EJ), is an equity framework that addresses the need for the equitable distribution of environmental resources amongst low-income communities of color..

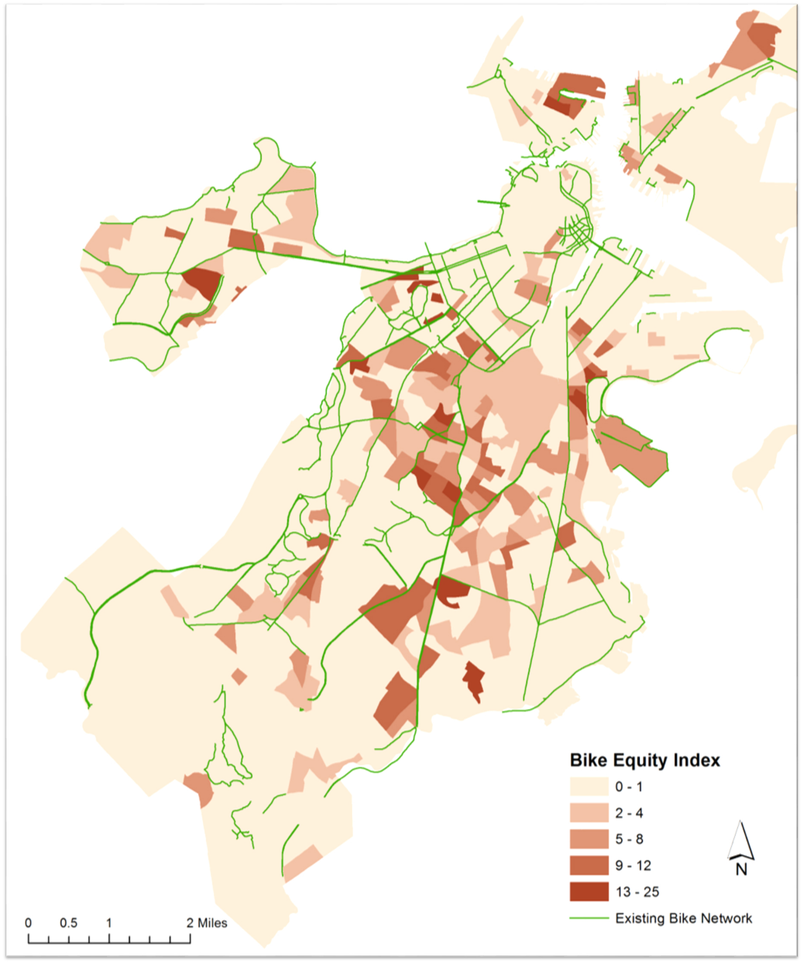
Indicator data were derived from the 2015 American Community Survey (5-Year Estimates). Before combining into the Bike Equity Index, each indicator was standardized using the z-score statistic. The z-score calculates how many standard deviations a value is from the mean. A z-score above zero indicates a value that is greater than the overall average. The z-score statistic formula is as follows:

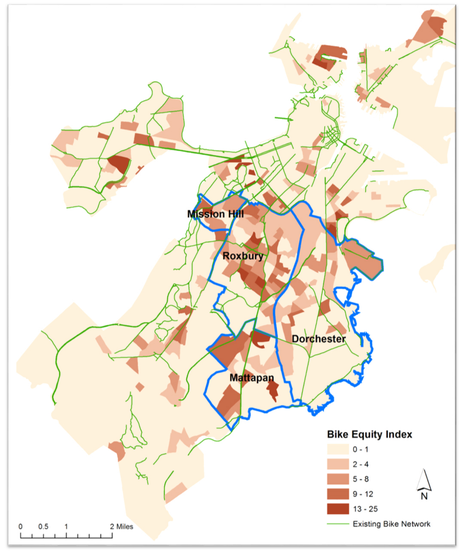
$$z = (X - \mu) / \sigma$$

X = percentage of indicator in block group
μ = mean of indicator in Boston
σ = standard deviation

Once standardized, the z-scores of all five indicators were summed to calculate the Bike Equity Index score for each block group. Each indicator was given equal weight. The table for the Bike Equity Index was then joined to a block group shapefile for the City of Boston.

Bike Equity Index





Conclusion

Areas that scored higher on the Bike Equity Index indicate higher levels of disadvantage and greater need for bicycle infrastructure.

High BEI scores were largely concentrated in the neighborhoods of Roxbury, Mission Hill, Dorchester and Mattapan, which are also historically disinvested neighborhoods with greater shares of low income households and people of color.

Though the bike network extends to some parts of these neighborhoods, much of this infrastructure consists of shared bike lanes or "sharrows", which are marked lanes that cyclists share with drivers.

As they are not exclusive lanes, sharrows have been found to be ineffective at increasing cycling nor safety. This further raises the question of whether high BEI areas receive equitably safe bicycle infrastructure.

As Boston seeks to become a world-class cyclist city, planners should incorporate a social equity criteria in the Bike Network Plan and prioritize the equitable distribution of bike infrastructure so that communities most dependent on alternative transportation options are equitably served.

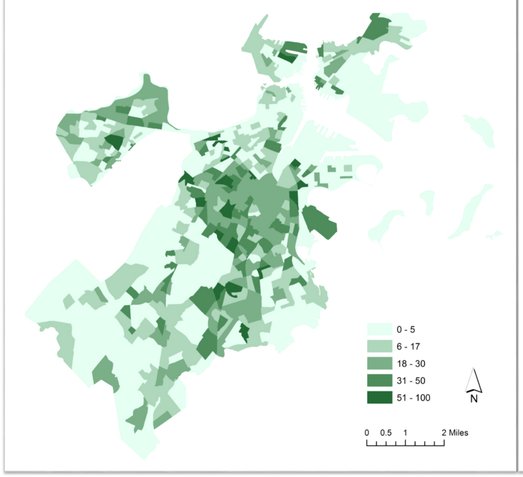
References

Coordinate System: 1983 Massachusetts State Plane
Projection: Lambert Conformal Conic

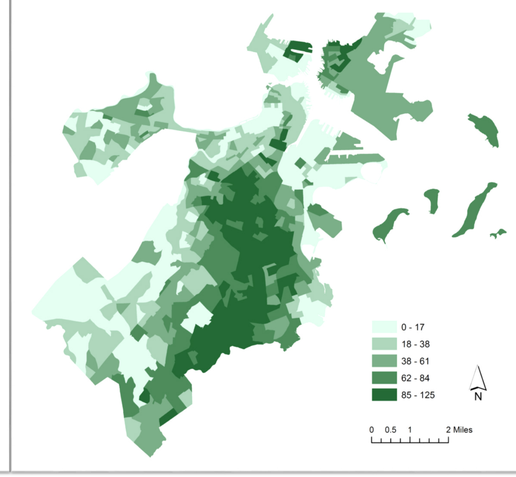
2015 ACS (5-Year) dataset: B01001, B25045, B02001, B17010, US Census Bureau
2010 Census Block Groups: MassGIS
Existing Bike Network: BostonMaps Open Data; http://bostonopendata.boston.opendata.arcgis.com/
Bike Equity Index: League of American Bicyclists, http://bikeleague.org/content/equity-reports-and-resources

Environmental Justice Indicators

% Poverty

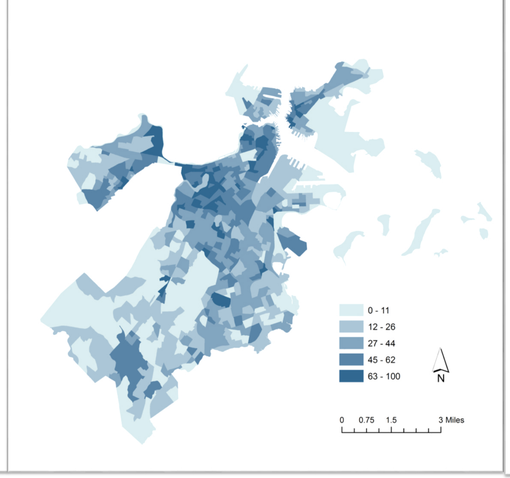


% Persons of Color

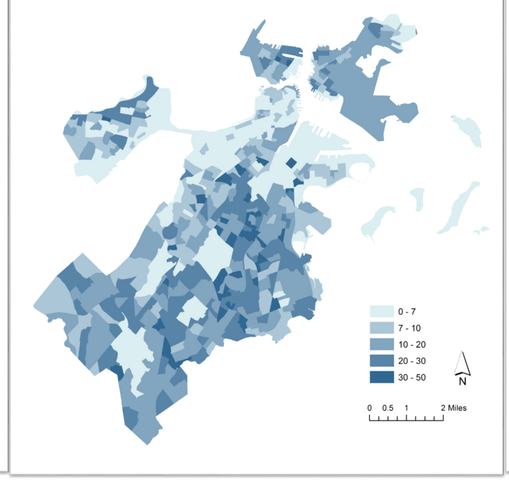


Transit Dependency Indicators

% Zero-Car Households



% Youth (Under 18)



% Elderly (Over 65)