



FLIGHTS OVERHEAD

Discovering Environmental Justice Communities Around Logan Airport



Introduction

Located in the East Boston neighborhood of Boston, Massachusetts, United States, Logan International Airport covers 2,384 acres, has six runways and four passenger terminals (Massport). It is the largest airport in the New England region and the 17th busiest airport in the United States, with over 36 million passengers and nearly 400,000 aircraft operations annually (Massachusetts Port Authority).

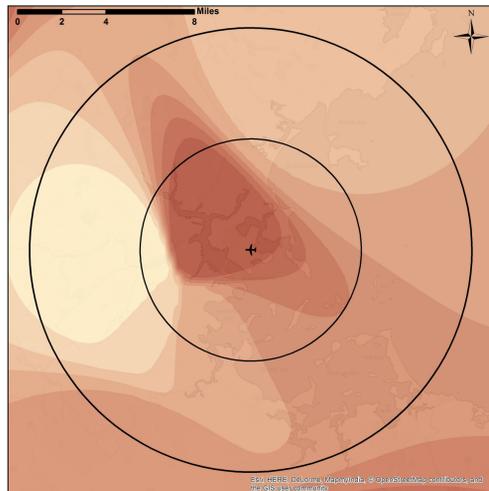
The environmental impact of aviation, including heat, noise, particulates, and gases, is well documented, as are the health impacts of these pollutants. More importantly, the concentration of these pollutants must be substantially greater at, and in the neighborhoods surrounding, an international hub like Logan International Airport. In a 2014 paper published in Environmental Science Technology, emissions from an international airport were said to increase particle number concentrations 4-fold at 10 kilometers downwind (Hudda).

In an effort to better grasp the environmental and human implications of major aviation hubs, this paper will study the intersection of air pollutants and human communities in the neighborhoods surrounding Logan International Airport.

The analysis will culminate in the identification of environmental justice communities through environmental and demographic indicators inspired by the Environmental Protection Agency's Environmental Justice Index definition (EPA).

The pollutants incorporated into the study will include carbon dioxide, nitrous oxide, sulfur dioxide, ozone, and PM10.

Environmental Index

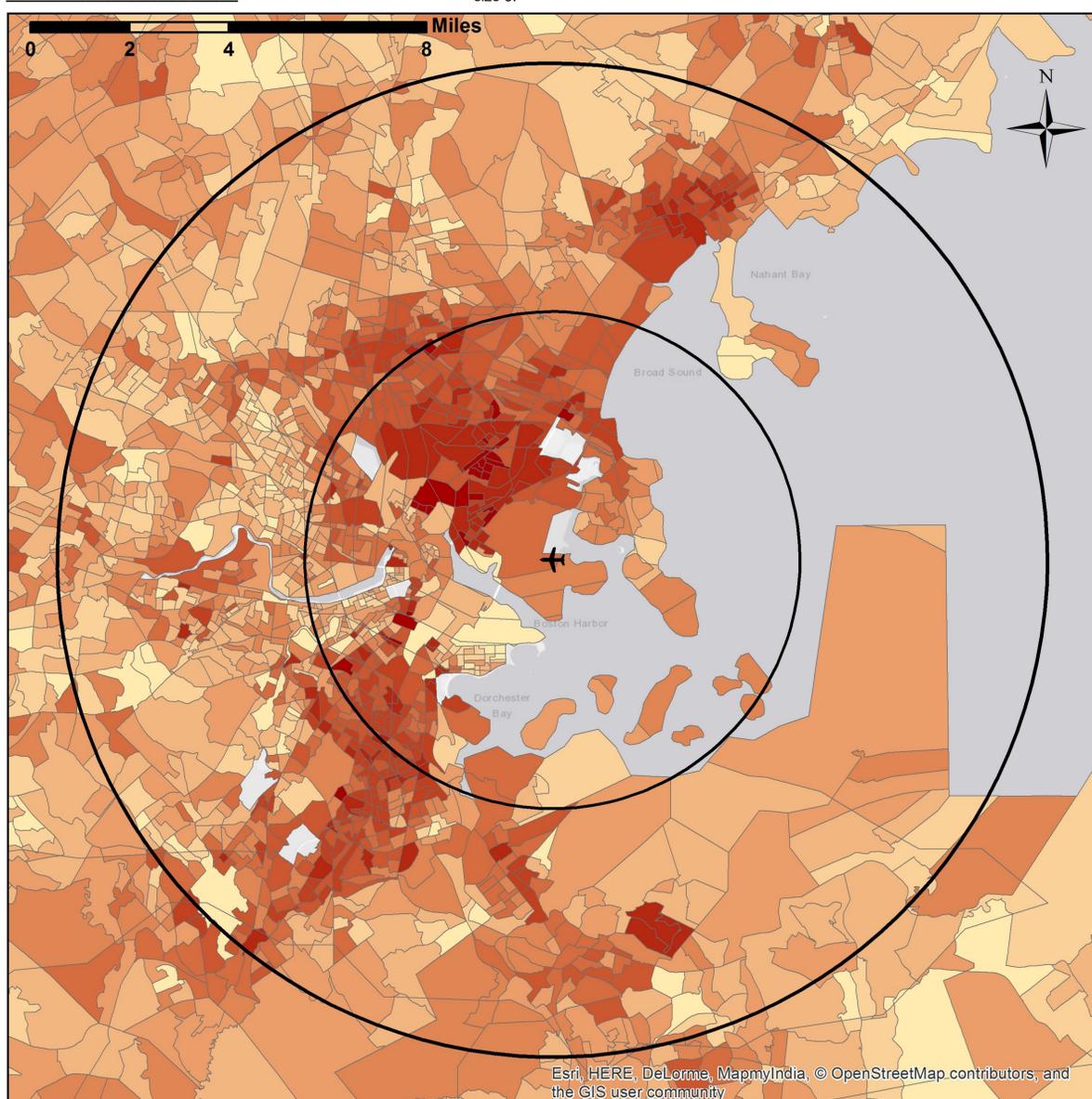


Environmental Index = [Average AQI Correlated to PM10 + Average AQI Correlated to Ozone + Average AQI Correlated to SO2 + Average AQI Correlated to CO2 + Average AQI Correlated to NO] / 5

Source of Error:

The predicted average air quality index map for the Greater Boston area was calculated from 6 monitoring sites, which were predominantly located to the West of Boston due to the coastline. The unevenly spread out monitoring sites and the use of interpolation as opposed to concrete data leave room for error.

Environmental Justice Index



Results:

The Environmental Justice Index map above estimates that the most vulnerable neighborhoods, the Environmental Justice Communities, are situated foremost to the North and Southwest of Logan International Airport. They are furthermore situated nearer to the airport, rather than farther, as is depicted by the darker block groups within the 5 mile buffer around Logan as compared to those between the 5 and 10 mile buffer. In addition to being farther away from Logan, the less vulnerable communities are generally found West of the airport.

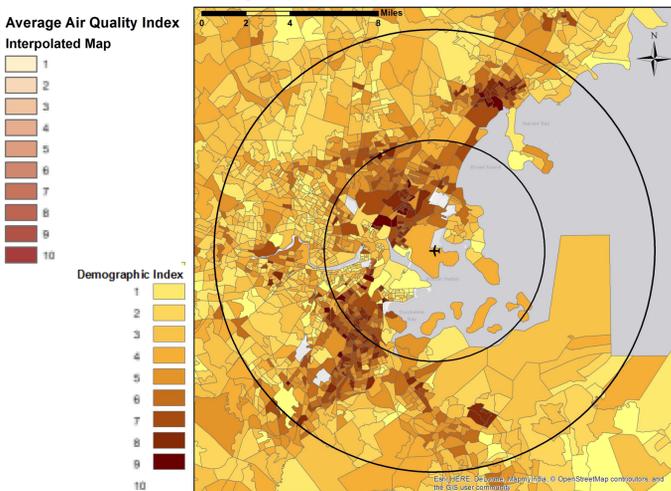
A few block groups directly South of Logan Airport contradict the trends described above. These include the block groups incorporating Boston's commercial port and dry docks, with a very small number of residential units, and Boston's City Point neighborhood, which includes some of Boston's most expensive and gentrified neighborhoods near Pleasure and Dorchester Bays.

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Demographic Indicators:

Household Poverty : Households with an income lesser than twice the federal poverty level.
Linguistic Isolation : Population over age 17 that speaks English less than "very well".
Education : Population over age 25 with less than high school education.
Minority Population : Population other than non-Hispanic whites.
Elder Population : Population over age 64.

Demographic Index

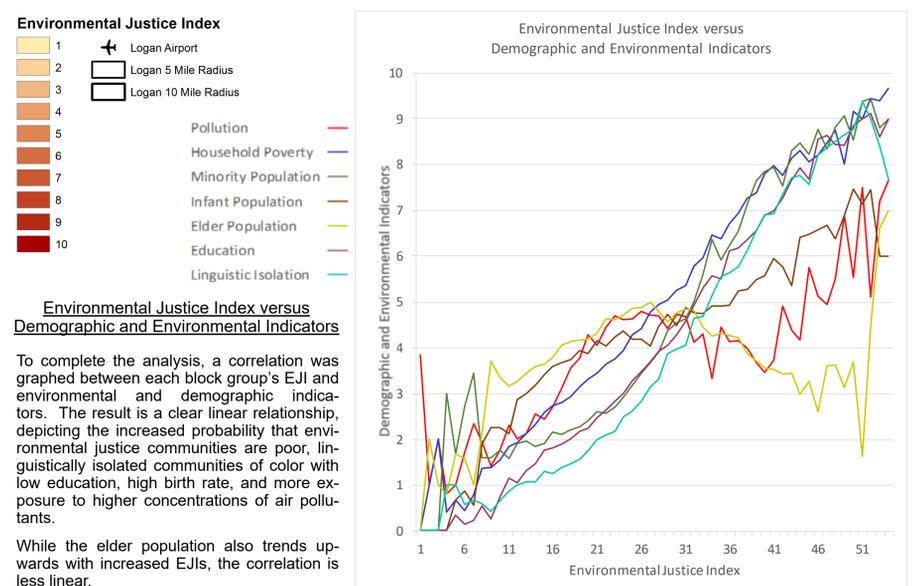
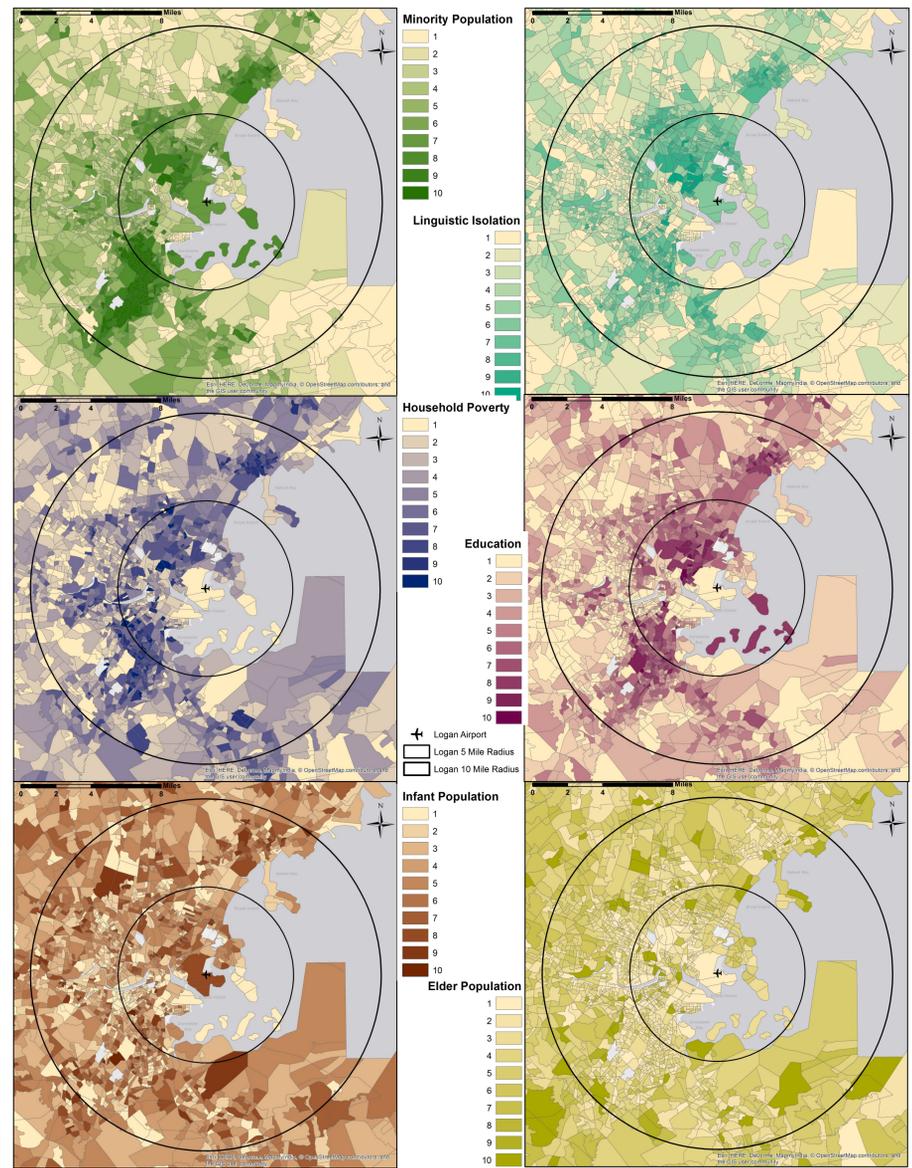


Demographic Index = [Household Poverty + Minority Population + Linguistic Isolation + Infant Population + Elder Population + Education] / 6

Household Size	200% Federal Poverty Line
1	\$24,120
2	\$32,480
3	\$40,480
4	\$49,200
5	\$57,560

Source of Error:

When calculating household poverty, for households of size 2, twice the federal poverty level, \$32,480, did not align with the data's income range, \$30,000 to \$35,000. Since twice the federal poverty level fell at the center of the range, only half of the households within this range were counted towards household poverty with the assumption that household income was evenly spread out within the income range. This same process took place for households of size 5.



Conclusion:
Environmental Justice Communities in Boston, Massachusetts, are predominantly located to the North, in Chelsea, Revere, and Everett, as well as extending farther North to Lynn, and to the South, in Roxbury, Dorchester, and Mattapan. The trend depicted in the final map is easily visible in the demographic indicator maps, suggesting a correlation between minority populations, poverty, lack of education, linguistic isolation, and to a lesser extent high infancy rates. These demographic relationships are confirmed in the line chart above. They are also exposed to higher rates of air pollutants, as is shown in both the graph above and the Environmental Index map, with the communities to the North of Logan more acutely impacted than those to the South.

Further studies could analyse flight paths of planes departing from and arriving in Logan, as well as investigate the pollutants not accounted for in this study, such as noise and heat pollution.

Pictures: NOAA Aeronautical Survey Program
Larry D. Moore CC BY-SA 4.0
U.S. National Archives

Data Sources: U.S. Census Bureau, American Community Survey (2015)
U.S. Environmental Protection Agency, Air Pollutants Daily Data (2015)
MassGIS Bureau of Geographic Information, Statewide Vector Shapefiles (2017)

References: International Civil Aviation Organization, Air Transport Bureau. Aircraft Engine Emissions. Massachusetts Port Authority. Boston-Logan International Airport: Monthly Airport Traffic Summary. N. Hudda, et. al., Emissions from an international airport increase particle number concentrations 4-fold at 10km downwind.



Lambert Conformal Projection
Massachusetts State Plane, Mainland Zone (FIPS 2001)