

Evacuation Vulnerability Around Boston

Exploring Evacuation Problem Spots Based on Social Vulnerability

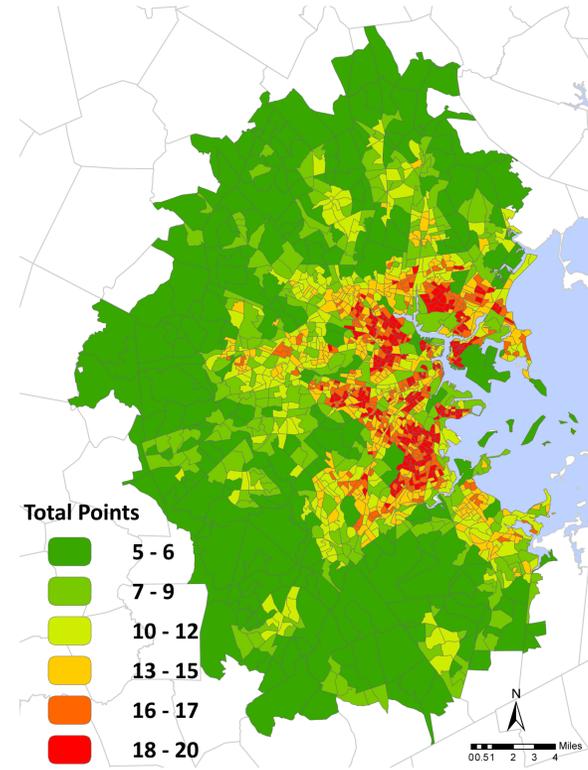
Background:

Although Massachusetts has not seen a major hurricane since 1954, evacuation systems and vulnerability studies need to be updated to deal with current population demographics. The Boston Metro Area resides on the Atlantic Coast where any number of natural disasters could threaten the livelihood of the city. Massachusetts does not have formalized evacuation routes that are available to the public. In the event of a disaster, whether it is a hurricane, a flood or a nuclear meltdown, residents should know how vulnerable they are in any given area and how to get out quickly and easily. Currently, information would have to be given out on a last minute basis, which inevitably leads to confusion, indecision, huge traffic jams and loss of life

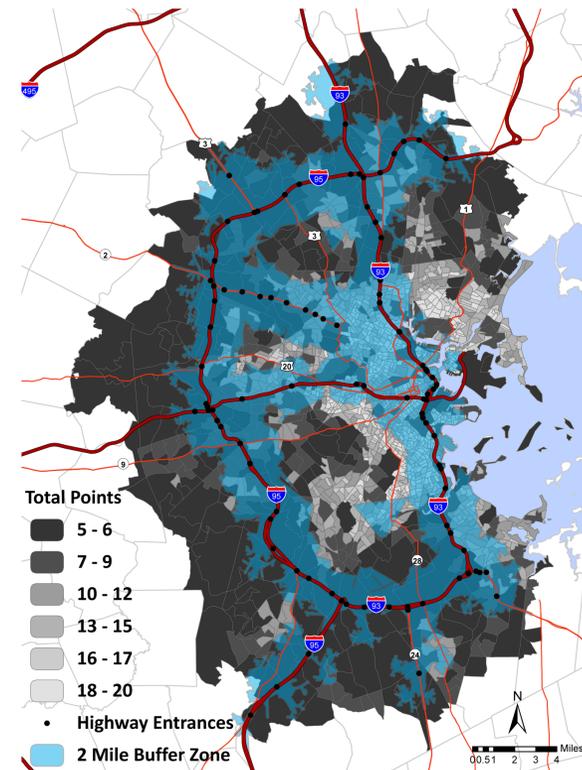
The goal of this project is to see how many people in the Boston Metro Area would be in a vulnerable situation as a natural disaster approaches or is in progress. Are the major highways close enough to socially vulnerable areas? Boston proper has a very high population density and would have an enormous amount of people trying to enter the highway at the same entrances. Where would a phased evacuation plan make sense?

Methods:

This analysis required three major steps. The first involved the gathering of Census Information. There are five social vulnerability factors, which were then split up into four "vulnerability points" categories. The point values range from one to four, increasing with the vulnerability. The five maps along the bottom depict each vulnerability separately.



The field calculator adds up the points to get a total vulnerability score for each block group in the Boston Metro Area (map above). The important aspect of the analysis would see how many people are vulnerable and outside of the two-mile buffer zone from the highway entrances. The same map is depicted to the right in black and white to emphasize the overlay.



On the large map above, each black dot corresponds with an entrance to the highway. The network analysis looks at all of the arterial streets and creates a two-mile buffer zone (highlighted in blue). That is overlaid on the total social vulnerability map (lighter colors are more vulnerable) to depict which areas have both a high number of points and a location outside of the buffer zone. These people would face the most problems when dealing with an evacuation and most likely be the last ones to get out unless they are assisted.

Note About the Results:

The results are underrepresented because many block groups along the edge of the buffer zone are not completely included within the blue highlight, but ArcGIS must count the group as one unit. For the purposes of this analysis, any block group that touches the buffer zone is included in the numbers as if it was completely within 2 miles of the highway entrance. This means that the actual population numbers are underrepresented by thousands of people when looking at totals outside the buffer zone.

Results:

	Total Population	Population Outside Buffer Zone
5 - 6 Points	323,814	82,932
7 - 9 Points	322,506	94,181
10 - 12 Points	321,939	92,000
13 - 15 Points	356,861	105,217
16 - 17 Points	283,150	92,964
18 - 20 Points	350,347	85,662
Total	1,968,617	552,956

The Results depict a situation in which over 25% of people live outside of the evacuation vulnerability zone. Taking into account that the number is actually much higher, it gives an idea of which areas will need to most assistance during an evacuation. The best approach might involve a phased evacuation, allowing these areas to leave first. The next step in this research project would involve analyzing traffic patterns to see how long it would take people to leave the area in heavy traffic. This will allow planners to determine how far in advance an evacuation must start to be effective.

