An Exploration of Disaster Planning
Vulnerability Analysis and Shelter Selection of a New York City Evacuation

Background

Disaster planning is an essential precaution for every town and city. Being the most populated city in the U.S. and the third most populated city in the world, New York City tops the list of metropolises that calls for an efficient evacuation plan. In the event of a disaster, a well-developed evacuation plan can minimize damages, reduce mortality, and accelerate restoration.

One major aspect of an evacuation plan is an assessment of which areas are most vulnerable to the catastrophes of a disaster. Depending on the type of disaster, different factors take priority. But generally, those who are most vulnerable during a disaster event are those who need the most assistance. By taking specific social vulnerability factors into account, a vulnerability analysis can be devised to determine how at risk an area is.

With a population of over 8.3 million over 305 square miles, it is practically impossible to completely clear out entire New York City in an event of an emergency. Therefore, it is crucial to look at possible locations of evacuation shelters. Evacuation shelters are often multi-purpose facilities such as schools, churches, or community centers. Different factors formulate the selection of shelters. Shelters should be situated in both physically suitable areas (e.g. not in a flood zone) and socially suitable areas (e.g. in areas with high demand). In addition to location, the capacity of shelters is important to consider. The capacity of a school, for example, is not quite large enough to accommodate those within proximity who are in need.

This project will take a look at these two aspects of disaster planning: vulnerability and shelter selection of evacuation shelters. Five specific social vulnerability factors were focused on for the vulnerability analysis. For the shelter selection, public schools, private schools, and colleges were considered as potential shelter candidates. This project’s aim is not to devise a disaster evacuation plan for NYC. It is very difficult to include all the necessary factors that fall into such an analysis due to availability of data and varying circumstances based on the type of disaster. This goal of this project is to provide insight on how GIS can be a valuable and advantageous tool in planning for disasters.

Methods

Vulnerability Analysis
This project was divided into two steps. The first part of the analysis focused on looking at “Selected facilities and programs” data from nyc.gov. Of all of the facilities listed, schools were selected as potential evacuation shelters.

The school information (e.g. capacity, location, council district) was then spatially joined to NYC census tracts. This spatial join allowed the capacity (represented as total student enrollment) of the all schools within a census tract to be summed together, resulting in a value that represents the total shelter capacity of the census tract. If the school was used as a shelter, the capacity of the school would be less than the total student enrollment due to space demands and time of stay. Therefore, using field calculator, the estimated capacity of the school shelters within a census tract was determined to be 75% of the total shelter capacity.

After finding the estimated capacity of each census tract, estimated capacity was subtracted from total population using field calculator. This depicted how well the capacity of each census tract accommodates its population, if the total population was to retreat to evacuation shelters. This also showed the census tract with surplus capacity and the shelters (schools) in these areas were selected out.

Shelter Selection
This part of the project involved looking at “Selected facilities and programs” data from nyc.gov. Of all of the facilities listed, schools were selected as potential evacuation shelters.

For the second part of this analysis, the point scores of the five factors were combined, using field calculator, to create a vulnerability score, ranging from 1 to 5, with 5 representing the highest vulnerability.

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