Urbanization, Disaster Relief, and International Preparedness: Modeling Earthquake Risk and Social Vulnerability in Port-au-Prince

Project overview:
Over the last several decades, the world has been rapidly urbanizing, and in 2008 the percentage of people living in cities passed the 50% mark. In some ways, this is a positive development, since city dwellers (at least in industrialized countries) have smaller carbon footprints than their rural counterparts, and cities have long been thought to incubate innovation. On the other hand, a phenomenon of rapid urbanization also has drawbacks, one significant one having to do with disasters and disaster relief efforts.

International response to natural and man-made crises has become more professional in recent years. The community of relief organizations and workers has adopted universal standards for acceptable provisions of food, shelter, water, and sanitation, and put into place a cluster system intended to coordinate their efforts in any emergency. Until recently, however, most major relief operations have taken place in rural areas, and now urbanization is complicating the paradigm.

The magnitude 7.0 earthquake that struck Haiti in 2010 serves as an example of the devastation that can ensue when disaster strikes a city, particularly a city in an impoverished nation with poor building codes and ample sub-standard housing. As an international community, we must develop a response paradigm appropriate to the context of Port-au-Prince, Kathmandu, or Mumbai, part of which needs to involve planning and preparedness.

This project attempts to use Port-au-Prince’s 2010 experience to show the power of even cursory planning and preparation. It attempts, through the use of historical data, to outline the areas of the city at-risk in an earthquake, and to identify the most socially-vulnerable segments of the population. If relief workers were armed with this information, their efforts and focus on areas of high risk and vulnerability. There is no telling how many lives such an approach could have saved.

Methodology:

In order to prioritize geographic areas for emergency response, the first task was to identify areas at risk for damage in an earthquake. This was done using historical data that documented the number of points of structural damage in 200 m² grids. The next task was to determine the relative social vulnerability of Port-au-Prince residents, based on demographic data and residents distance from public services. The vulnerability index constructed here is a rough depiction of Haitian social reality due to a lack of available data. The indicators that went into the index were population density, the number of young children in the population (under 5 years of age), as well as distance from schools, hospitals, and drinking water access points.

Results:
The devastation of Port-au-Prince in the aftermath of the 2010 earthquake is well-documented, and the damage spread throughout the city. While analyzing and examining concentrations of damage and characteristics of the local population, however, clear priorities for relief efforts emerge. Of a total of 43,313 parcels of land that were analyzed in this study, only 320 fell into the highest categories of both risk and vulnerability. Fewer than 2,000 were categorized in the two highest categories. Armed with this information, relief workers would not have been overwhelmed with what seemed like endless damage and chaos, but instead could have systematically cleared the areas most likely to house large numbers of victims. These results provide some evidence that preparing for disasters in earthquake, hurricane, and flood prone places could be helpful in organizing more systematic effective responses, which would hopefully lead to saving more lives.

Limitations:
As previously mentioned, the data that went into the vulnerability index can provide only a rough estimate of social vulnerability. Additionally, vulnerability indices are often weighted based on the relative importance of each variable in the local context. Lacking contextual knowledge, however, I felt ill-equipped to rank order the variables and thus gave them equal weight. Finally, because the data on earthquake damage was collected in 200 meter² grids, while demographic data was sourced from the 2003 census (thus reflecting administrative geographic boundaries), the affected population estimates are very rough and actually overstated. Nonetheless, the hope is that this project can illustrate the power of planning and preparedness, and encourage those in the relief community to ahead of the next urban disaster that strikes.

References: All cartographic information was derived from data sources available from USAID’s GIST Repository and the Tufts Haiti Geospatial Data Repository. Source agencies include Ithaca, Tufts, Google, ESRI, USAID, and UNMINUSTAH.