San Diego State University Project Description

Urban vulnerability to natural hazards such as earthquakes describes the degree to which socioeconomic systems and physical assets in urban areas are either susceptible or resilient to the impact of hazards. Although vulnerability represents an essential concept in the development of mitigation strategies at the local, national, and international levels, there is little consensus among researchers, planners, and disaster managers regarding the best way to undertake vulnerability analysis. The basic objective of this research is to move that discussion forward by integrating remote sensing and GIS analysis into new ways of thinking about urban vulnerability.

We conceptualize urban vulnerability to be a characteristic of an urban community that can be assessed through a combination of ecological factors associated with the physical conditions of the geographic space in which the urban community is and the social conditions of the population in that place. We hypothesize that these physical and social conditions are so inextricably bound together in many disaster situations that we can use the former as indicative of the latter. Through this approach, areas with high levels of vulnerability (hot spots) are first located and differentiated from other areas within a defined urban region. Then, these differences are utilized to improve our understanding of the relative importance of the ecological factors. This kind of spatial perspective is substantially aided by the adoption of a GIS-based spatial multicriteria analytical approach that provides a means for measuring the relative importance of different ecological factors through the analysis of satellite images. We test the methodology of this research for the Los Angeles metropolitan area, employing data from the major earthquake in Northridge in 1994.

The results show that the methodology can help answer questions about the ecology of earthquake risk and how differential social vulnerability is connected to variations in the physical settings of urban areas. We believe that this adds to our understanding of how earthquake hazards respond to natural and human-induced changes, and the consequences of land cover alteration on the increasing occurrence worldwide of earthquake disasters. From an empirical viewpoint, the study shows how advanced GIS and remote sensing procedures can be combined to allow planners and decision makers to focus on the more vulnerable communities in their midst, and thus to help develop mitigation measures that could prevent earthquake hazards from becoming major human disasters. In addition, by examining the applicability of remote sensing to social vulnerability analysis, the study may provide a basis for assessing data requirements for future sensors involved in population monitoring. Finally, The US government has spent over $5 million in the development of an earthquake loss estimation software package called HAZUS, the wide implementation of which is still impeded by to the lack of sufficient data at the local level. This study tests the importance of using remote sensing data in vulnerability analysis at the local level, thus laying the foundation of integrating this timely source of information in HAZUS and expediting its wide implementation in local governments.

Lead Presenter: John R. Weeks
Co-PI: Tarek Rashed

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