

Systems under Stress: An investigation of Community Resilience to Natural Disasters

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Summary:

This study inquires into the factors underlying community resilience to natural disasters. Recent catastrophes such as the 2004 Indian Ocean tsunami and Hurricane Katrina in 2005 serve as vivid reminders that losses from natural disasters worldwide continue to escalate. Moreover, the potential for catastrophes is increasing as urban populations in hazardous regions grow, the built environment ages and economies become increasingly connected. Traditional approaches to addressing this problem have emphasized identifying community vulnerabilities and investing in loss reduction; for example, through strengthening emergency response capabilities and investing in pre-disaster mitigations. Recently, the hazards research and practitioner communities have begun to embrace the broader goal of strengthening communities' resilience—their ability to withstand and bounce back from a stressful event. The mission of the U.N. International Strategy for Disaster Reduction, for example, is to build “disaster-resilient communities.”

This study addresses the pressing need for systematic, integrated, empirically-grounded research on what makes for disaster-resilient communities. It poses a fundamental question: how is the resilience of the community, as a system, related to the resilience of the individual agents (e.g., households and businesses) that comprise the system? Agents within the system interact—for example, businesses employ household labour and households consume business products—so that a community system is more than the sum of its parts. Moreover, the micro-level choices, consequences, and conditions of an individual agent must be contextualized by macro-level influences, such as economic change and public policies. Addressing the core research question of system resilience will therefore involve an interdisciplinary approach that draws on studies of resilience in a broad range of fields, from psychology, sociology, and economics to geography, urban planning, environmental studies, public health, and engineering.

In contrast to many previous studies of resilience, this study adopts an approach based on computer simulation modeling. It builds on the Principal Investigator's recent work on developing a computer model that simulates how communities recover from disasters. This model emphasizes linkages between elements of a community and is based on numerous empirical studies of disaster recovery. It is an agent-based model that simulates the recovery of individual households and businesses. The model has been applied and tested against two major disasters, the 1995 Kobe (Japan) earthquake and the 1994 Northridge (Los Angeles) earthquake.

The current study will build on this model in three significant ways to address the core research question. First, it will develop empirical knowledge about agent-level resilience by conducting a business survey. Second, it will incorporate these empirical findings into the computer model. Third, it will apply the model to a case study of Greater Vancouver and, through a series of “what-if” scenarios, explore how a range of physical, socio-economic, and institutional factors influence resilience.

This research is expected to yield new insights into such policy-relevant questions as what factors have the greatest influence on community resilience, and how communities can most effectively increase their resilience to natural disasters, specifically, and stresses, generally. Such insights can help urban planners, emergency managers, non-governmental organizations involved in disaster relief and recovery, and government decision-makers to make informed decisions that enhance communities' abilities to withstand and recover from future disasters.