

CASE STUDY 2:

Assessing Vulnerability to Improve Risk Reduction

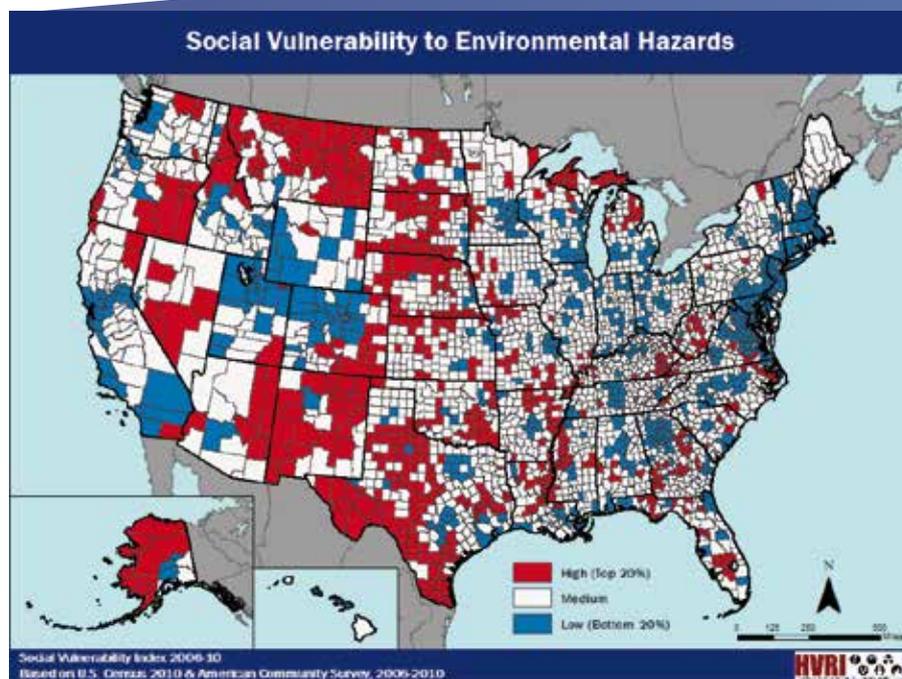


Figure 1: Social Vulnerability Index for the United States, 2006-2010.
Source: Hazards and Vulnerability Research Institute⁵.

The problem

The risk of a disaster depends not only the hazard – the likely severity of flooding or height of a tsunami – but also on the physical and social vulnerability of exposed communities¹. Assessment of vulnerability is therefore essential for effective, targeted disaster risk reduction but our current knowledge of what makes people and places vulnerable to environmental threats is limited.

Until we have an evidence-based method for assessing vulnerability in communities, and for communicating this data in a clear and accessible way, policy-makers cannot make fully informed decisions on effective, targeted disaster risk reduction.

The science

In order to describe the vulnerability of populations, researchers in the United States used social science and risk science to develop a tool for measuring environmental hazard vulnerability²⁻⁴. Data on the impact of disasters on different communities in the United States were analysed and compared with socioeconomic and demographic data for the affected areas. This process identified a set of factors that are associated with a community's ability to prepare for, respond to, and recover from hazards. These included: urbanicity of an area, race/ethnicity of the population, average education levels, percentage of the population living in poverty and percentage under 5 or over 65 years old⁵.

¹ IPCC. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Summary for policymakers (The SREX Report). Cambridge and New York: Cambridge University Press, 2012. Available at: <http://ipcc-wg2.gov/SREX/report/> [accessed 8 April 2013].

² Hazards and Vulnerability Research Institute, University of South Carolina. Social Vulnerability Index [webpage]. 2012. <http://webra.cas.sc.edu/hvri/products/sovi.aspx> [accessed 25 March 2013].

³ Borden K, Schmidtlein MC, Emrich C, Piegorsch WP, Cutter SL. Vulnerability of US Cities to Environmental Hazards. *Journal of Homeland Security and Environmental management*. 2007; 4(2):Article 5.

⁴ Cutter SL, Boruff BJ, Shirley WL. Social Vulnerability to Environmental Hazards. *Social Science Quarterly*. 2000; 84(1):242-261.

⁵ Hazards and Vulnerability Research Institute, University of South Carolina. Social Vulnerability Index [webpage]. 2012. <http://webra.cas.sc.edu/hvri/products/sovi.aspx> [accessed 25 March 2013].

Knowledge of these associations was used to construct an index of vulnerability to environmental hazards. This was named the Social Vulnerability Index (SoVI) and calculates a vulnerability score for individual counties across the United States⁶. By applying the SoVI to case studies of previous disasters, the reliability of the SoVI in predicting vulnerability was assessed and improved (Figure 1)⁷⁻⁹.

The application to policy and practice

The SoVI has been integrated with a mapbased system to produce a decision support tool kit for policy-makers. County-level SoVI data and maps are now produced regularly for the whole of the United States (Figure 2). The Index has been adapted as the theory and practice of vulnerability science has developed, with additional vulnerability factors added, such as vehicle availability and family structure^{10, 11}.

SoVI data are included in county- and State-level mitigation plans throughout the United States as part of government-required vulnerability assessments. Now, instead of solely indicating where hazards are likely to occur – using tools such as the Spatial Hazards Events and Losses Database for the United States (SHELDUS)¹² – a more detailed risk model can be created for a region by layering hazard mapping with social vulnerability. Decision-makers can use this to determine where resources might be used most effectively to reduce pre-existing vulnerability.

The use of SoVI extends beyond the United States. A global database of country-specific vulnerability data is being established for 197 different countries¹³. The governments of countries including Norway, Portugal, the Philippines, Indonesia and Brazil have incorporated SoVI into planning tools to inform preparedness for future events at the municipal and regional levels¹⁴.

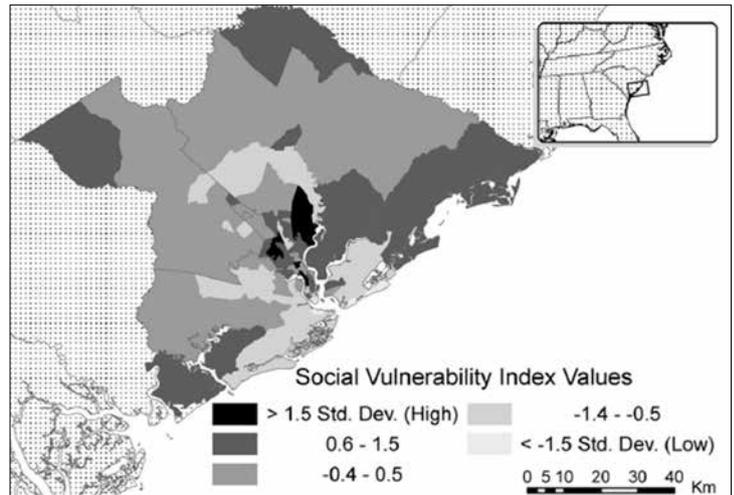


Figure 2: Social Vulnerability Index (SoVI) values for the Charleston area of South Carolina, USA. This was a case study used to test and verify the SoVI. The higher the SoVI value, the greater the social vulnerability in that area. Source: *Schmidtlein et al, 2011*¹⁵.

Did it make a difference?

The impact of this research on policy and practice has been significant, changing the nature of vulnerability assessments in the United States and beyond. Decision-makers now have a tool for making evidence-based decisions regarding hazard preparedness, planning, response, and reduction at the federal, state, and local levels.

In the United States, the SoVI has helped to improve long-term recovery efforts from 2012's Hurricane Sandy. The Federal Emergency Management Agency (FEMA) integrated SoVI into its planning- and decision-support metrics to assess affected communities' likely capacity to respond and recover from the hurricane. This has allowed more targeted allocation of resources for recovery.

SoVI has also had impact on flood control. The US Army Corps of Engineers has responsibility for construction of flood control structures during flood events; in the past, decisions on construction of such structures were based solely on cost-benefit analysis, in terms of the value of property protected. With SoVI, decisions on where to construct flood defences are now be focused on location of vulnerable populations¹⁶.

SoVI data has raised awareness of social vulnerability and the fragility of at risk-populations; it is helping to explain communities' differential recovery from disasters and will help train the next generation of disaster risk reduction scientists and responders.

⁶ Hazards and Vulnerability Research Institute, University of South Carolina. Social Vulnerability Index [webpage]. 2012. <http://webra.cas.sc.edu/hvri/products/sovi.aspx> [accessed 25 March 2013].

⁷ Schmidtlein MC, Shafer JM, Berry M, Cutter SL. Modeled earthquake losses and social vulnerability in Charleston, South Carolina. *Applied Geography*. 2011; 31(1):269-281.

⁸ Cutter SL, Mitchell JT, Scott MS. Revealing the Vulnerability of People and Places: A Case Study of Georgetown County, South Carolina. *Annals of the AAG*. 2000; 90(4): 713-7737.

⁹ Schmidtlein MC, Deutsch R, Piegorsch WW, Cutter SL. A Sensitivity Analysis of the Social Vulnerability Index. *Risk Analysis*. 2008; 28(4): 1099-1114

¹⁰ Hazards and Vulnerability Research Institute, University of South Carolina. Social Vulnerability Index [webpage]. 2012. <http://webra.cas.sc.edu/hvri/products/sovi.aspx> [accessed 25 March 2013].

¹¹ Cutter SL, Finch C. Temporal and Spatial changes in Social Vulnerability to Natural Hazards. *Proceedings, National Academy of Sciences*. 2008; 105(7): 2301-2306.

¹² Borden K, Schmidtlein MC, Emrich C, Piegorsch WP, Cutter SL. Vulnerability of US Cities to Environmental Hazards. *Journal of Homeland Security and Environmental management*. 2007; 4(2):Article 5.

¹³ The GEM Foundation. What We Do – Understanding vulnerability for increased resilience. <http://www.globalquakemodel.org/what/global-projects/social-vulnerability/> [accessed 4 April 2013].

¹⁴ Cutter SL (Editor). *From Social Vulnerability to Resilience: Measuring Progress toward Disaster Risk Reduction*. Source 17/2013, Bonn, Germany: United Nations University Institute for Environment and Human Security, and MunichRe Foundation. Forthcoming.

¹⁵ Schmidtlein MC, Shafer JM, Berry M, Cutter SL. Modeled earthquake losses and social vulnerability in Charleston, South Carolina. *Applied Geography*. 2011; 31(1):269-281.

¹⁶ Dunning M, Durden SE. Handbook on Applying "Other Social Effects" Factors in Corps of Engineers Water Resources Planning. December 2009.