RESEARCH BRIEF

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The American Community Survey and Enhanced Community-Level Social Vulnerability Assessment

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Statement of Problem

To date, numerous methods exist to describe the geographic distribution of potential hazards and to determine the likelihood of their occurrence in a specific location (El Morjani, Ebener, Boos, Abdel Ghaffar, & Musani, 2007). Similarly, there are well documented methods available to geographically describe and quantify physical and economic vulnerability (FEMA, 2008).

A third type of vulnerability, social vulnerability, is the potential for loss or destruction of livelihoods, incomes, community resilience, and coping mechanisms (Davis, 2004). Social vulnerability results from constellations of individual and community characteristics that impact the short- and long-term outcomes of hazard exposure. Social vulnerability has recently been defined as “the characteristics or qualities of the social system that create the potential for harm” (Cutter et al., 2008).

This research brief examines approaches to social vulnerability, the current literature on the measurement of social vulnerability, and the use of the American Community Survey (ACS) as a potential source of data for assessing social vulnerability.

Background

Approaches to Social Vulnerability

When exploring social vulnerability, four primary approaches are described in the literature: demographic, taxonomic, situational, and contextual (Wisner, 2004). Each of these is briefly described below.

A **demographic approach** is the most straightforward approach. It categorizes human impacts as *fatalities*, *casualties*, and *affected individuals* but provides minimal detail about a population overall. It is based on the former United Nations Disaster Reduction Organization (UNDRO) definition of vulnerability as "the potential for damage or harm" (Alexander, 2000). It does not attempt to account for the differences in individuals and communities and, as a result, has a tendency to dehumanize individuals and groups in favor of conceptualizing an entire system.

A **taxonomic approach** focuses on the causes of social vulnerability by measuring death, injury, loss, and disruption among different groups in a population and then continues to track the process of recovery within the different groups. This approach operates by dividing vulnerability into different elements and empirical taxonomies (Morrow, 1999).

The elements of vulnerability are social, economic, environmental, and informational. Across these elements, individuals' or groups' vulnerabilities will vary according to their empirical taxonomic classifications with regard to gender, age, disability status, ethnicity, immigration status, poverty status, and health status.

Although a taxonomic approach provides much greater resolution than a demographic approach in differentiating groups and individuals, it still does not account for the truly dynamic nature of hazard and human interaction.

A **situational approach** avoids taxonomic classification altogether and instead focuses on the nature of daily life, actual situations, how situations have changed, and how they are changing. The situational approach is found in Sanderson's "household livelihood security" (2000) and Blaikie's "access model" in Wisner (2004). The situational approach does not classify disasters as exceptional events, but instead as extensions of normal everyday problems. This approach recognizes the following three contingencies:

- The social vulnerability of an individual changes with different hazards.
- An individual's or group's access to resources and (political) power changes on a daily, seasonal, and annual basis.

- There are complex interactions that stem from coinciding characteristics and forms of "empowerment or marginality."

The **contextual approach** differs from the other approaches in that vulnerabilities are defined by those exposed to the potential damage or loss (Wisner, 2004). With this approach, the focus shifts from individual or group characteristics to the political allocation of limited resources. The roots of the contextual approach lie in the situational approach; however, vulnerabilities, capabilities, and levels of acceptable risk are defined by those at risk.

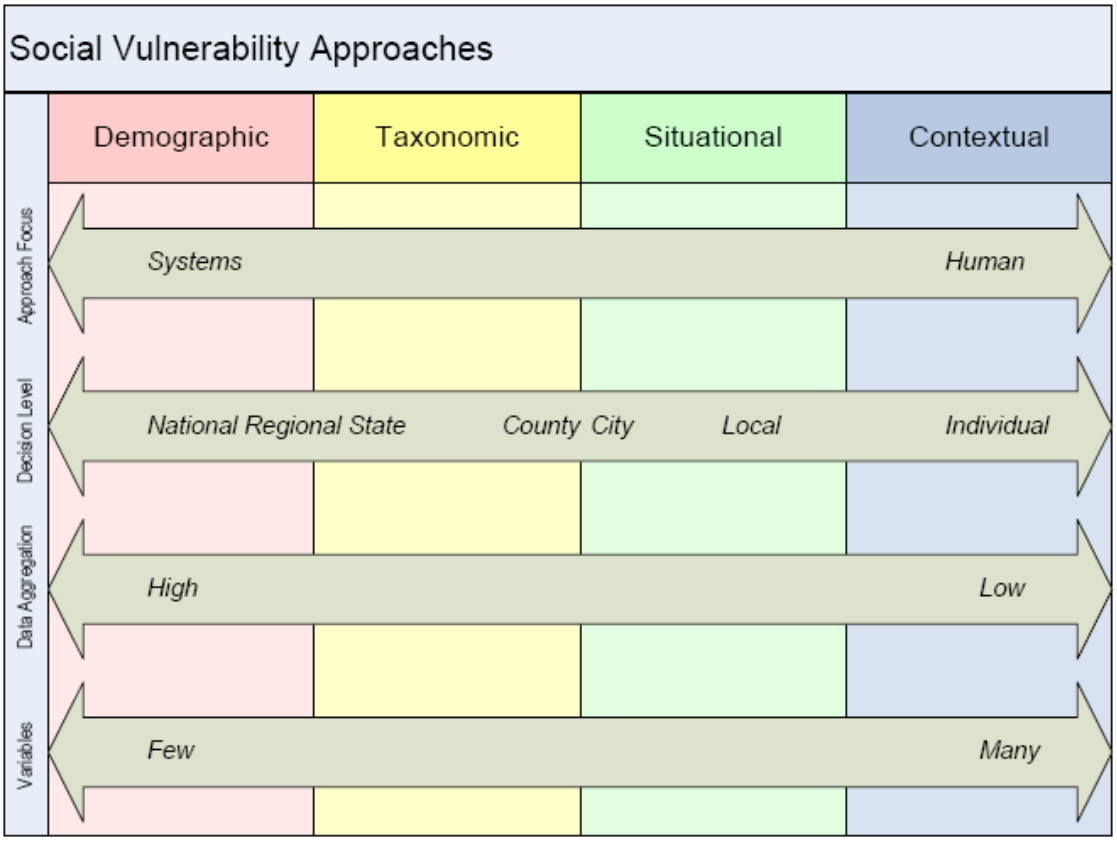
Synthesis

A Spectrum of Approaches

When comparing the approaches, a spectrum emerges that differentiates the approaches on several characteristics. The spectrum, visualized in figure 1, distinguishes the approaches based on the following characteristics: approach focus, decision level, data aggregation, and variables.

The **approach focus** is the degree to which the approach advocates for the needs of society or the individual. At one extreme, the demographic approach itemizes humans as components in a larger economic and ecological system. They are a source of labor, mouths to feed, and bodies to heal and house. At the other end of the spectrum, the contextual approach empowers individuals to define their own vulnerability along with potential responses. This approach seeks to optimize the quality of life of affected individuals through their empowerment and inclusion in the decision making process. The other two approaches lie between the ends of the spectrum. The taxonomic approach, with its classification systems, is closer to the demographic approach while the situational approach, with its notion of conditional vulnerability, is closer to the contextual approach.

Figure 1. The spectrum of approaches to social vulnerability



The **decision level** is the jurisdictional level for which the approach is best suited to provide information for decision making. As one moves from national to local jurisdictions, the mandate of decisions changes accordingly. It is not feasible to expect a federal government to determine where in a town to place cooling stations in the event of a blackout during a heat wave. Similarly, it is unrealistic to expect a single neighborhood to develop the budgeting priorities for the federal government. Within the spectrum, decisions made at a national, regional, or state level may necessarily adopt a demographic approach that recognizes the necessity of having to "paint with broad strokes" when making resource allocation decisions that affect an entire national or state population. At a county or city level a taxonomic approach will allow decision makers to account for the distribution of specific social or economic characteristics among the area's population. Finally, at a neighborhood level, a situational approach can attempt to account for many of the specific conditions affecting the people in an extremely limited geographic area. Unlike the other approaches, the contextual approach is ideal for the empowerment of people in a specific group or area by giving them the tools for self-determination.

Data aggregation is the degree to which data are summarized to geographic areas (e.g., census tracts, counties, states, or countries). As a variant of the modifiable area unit problem (O'Sullivan & Unwin, 2003), logic dictates that aggregated data can only be used for making decisions within a geographic area (country, state, county, city, or neighborhood) if the data are aggregated to smaller, nested, geographic areas (Soobader, LeClere, Hadden, & Maury, 2001; Pappas, 2006; Murray et al., 2006). For example, data that are aggregated to the county level could only be used to make decisions involving two or more counties, presumably at the state level. On the other end of the spectrum, disaggregated data complicate high-level decisions about large populations due to the increased number of records and the variation among the records.

Additionally, because of their different foci, different approaches require data derived from different variables and **numbers of variables** for their successful implementation. With a focus on humans as system components, the demographic approach requires the fewest number of variables. In its most basic form, decisions could be made using population counts to estimate the potential numbers of exposed persons and to create general mortality and casualty forecasts. Toward the other end of the spectrum, the situational approach (with a comprehensive examination on a range of human interactions in a variety of conditions) requires numerous quantitative and qualitative variables to provide actionable information to local decision makers.

Applied Social Vulnerability

In practice, the choice of how to approach social vulnerability is dictated by the selected or available data. Basic population counts enable the primary estimation of the number affected by a potential hazard (fatalities, casualties, homeless). More robust data with population and individual characteristics allow for a more detailed description of those affected, ultimately culminating in the ability to discern the causal chains responsible for social vulnerability in the first place. The following examples briefly summarize real-world applications of social vulnerability approaches focusing on their data requirements and the information generated.

The Hazard U.S. Multi-Hazard (HAZUS®MH) software developed by the U.S. Federal Emergency Management Agency (FEMA) provide estimates of physical, economic, and social losses that could results from different hazards. While HAZUS is designed to provide loss estimates down to the census tract level, its provision of human impacts is limited to casualty estimation. HAZUS adopts an overwhelmingly demographic approach to social vulnerability that estimates social losses only in terms of fatalities, injuries, and dispossessed. The only data required to generate the casualty estimates are the population per census tract (FEMA, 2006).

The social vulnerability index (SoVI), developed by Cutter (Cutter, Boruff, & Shirley, 2003), distills the social vulnerability of a county down to a single index measure. To do this the SoVI adopts a taxonomic approach and estimates social vulnerability for all U.S. counties (Cutter, Boruff, & Shirley, 2003).[1] The SoVI obtains data for its numerous input variables from the U.S. census data and is useful for state and federal agencies. However, due to data aggregation issues previously discussed, it does not allow meaningful decision making at the county level and below.

The situational approach employed by the "access model" described in *At Risk: Natural Hazards, People's Vulnerability and Disasters* (Blaikie, Cannon, & Wisner, 2003) closely parallels the "sustainable livelihoods model" promoted by the Department for International Development (DFID) incorporating a large number of input variables (Blaikie, Cannon, & Wisner, 2003), including

- human capital—individual skills, knowledge, health, and energy;
- social capital—networks, groups, and institutions;
- physical capital—infrastructure, technology, and equipment;
- financial capital—savings and credit; and
- natural capital—natural resources, land, water, fauna, and flora.

These data quantify many aspects of social vulnerability, along with many of its causes and mechanisms. This level of information increases understanding and can empower decision making at the local and individual levels. However, collecting and organizing these data requires additional resources and time, thus limiting the approach's practical applicability to less significant samples or over smaller geographic areas.

When these applications of social vulnerability are examined, a pattern emerges. Increasingly robust and descriptive data enable the more accurate targeting of mitigation and preparedness resources further up the casual chain. HAZUS's casualty estimates do not (and are not intended to) address social vulnerability. A decrease in social vulnerability using HAZUS occurs as a by-product of protecting physical and economic resources. The taxonomic approach in the SoVI enables the targeting of mitigation and preparedness resources to areas based on the prevalence of characteristics that make individuals socially vulnerable. This approach does not necessarily seek to eliminate the underlying cause of social vulnerability, but it does seek to protect those that most need protecting in the event of a hazard. Finally, the situational approach of the access model uses extremely robust data to identify the causes of social vulnerability with the idea that changing the mechanisms that cause social vulnerability will prevent the vulnerability in the first place.

[1] Conversations with Dr. Cutter indicate that the SoVI has been calculated to the block group level, but that these data are unpublished.

Balancing data availability with the benefits to decision making, the taxonomic approach emerges as the most promising approach for organizations with jurisdictions that contain large numbers of people. With a focus on the population characteristics across geographic areas using readily available data, the taxonomic approach (as implemented by the SoVI) allows for the identification of those counties with both the highest rates of social vulnerability as well as those areas with the highest numbers of socially vulnerable individuals. The demographic approach, while useful for casualty reduction, cannot be used to estimate social vulnerability, because it does not incorporate the characteristics that make individuals socially vulnerable. On the other hand, the situational approach is useful for the long-term reduction of social vulnerability (which may be outside the mandate of some organizations), but it relies on data that are not readily available and that are cost-prohibitive to collect for large populations.

The American Community Survey—A New Source of Social Vulnerability Data

The long form of the U.S. census was ideally suited for developing the SoVI for two main reasons. First, many of the characteristics that predispose a person to being socially vulnerable are captured either directly or indirectly by the long form. Second, the long form results were based on a national sample that allowed the SoVI to be calculated for the entire United States.

While ideal for developing the SoVI, the long form was discontinued after the 2000 decennial census. In its place the U.S. Census Bureau has developed the American Community Survey (ACS). The ACS collects data similar to the decennial census long form (U.S. Census Bureau, 2004), but, instead of collecting a large amount of data every 10 years, the ACS uses a series of monthly samples to produce annually updated data for small geographic areas (census tracts and block groups) (U.S. Census Bureau, 2006). As such, the ACS may provide a useful source of data for the development of a SoVI that can be updated annually as opposed to decennially.

ACS and census data are most commonly available in two forms. “Public use” U.S. Census Bureau (USCB) microdata present users with aggregated values of variables across different levels of census geography (generally most values are aggregated to the county level). The second form, confidential microdata, is made available through USCB Research Data Centers (RDCs) and provides researchers with data aggregated to the census block level, allowing for more detail at smaller geographic units. Access to the confidential microdata is obtained only with the permission of the USCB.

ACS public-use microdata have been used in social science research to quantify disability (Weathers, 2005; Gamboa, Holland, Tierney, & Gibson, 2006); health (Davern, Quinn, Kenney, & Blewett, 2008); ethnicity and age (Minkler & Fuller-Thomson, 2005); and poverty (Stapleton

O'Day, Livermore, & Imparato, 2006; Fuller-Thomson & Gadalla, 2008). ACS and census confidential microdata available at the RDCs have largely been used for economic analyses, with about 30 papers in the last decade addressing health issues mainly centered on health economics (U.S. Census Bureau, 2007). No examples were found of confidential microdata being used to investigate social vulnerability.

The major limitation of using confidential microdata in the construction of the SoVI is gaining access to it through the USCB. Despite this, Cutter's approach (Cutter, Boruff, & Shirley, 2003) coupled with private use microdata could be an ideal vehicle for modeling an improved SoVI for several reasons. First, the ACS can provide more timely estimates of social vulnerability because it is collected on an ongoing basis. This allows for more frequently updated social vulnerability data sets with which to assess population-level changes and, subsequently, program effectiveness. Second, microdata enable analysis of more variables at a higher geographic resolution (census blocks) and can create actionable subcounty information. This may strengthen planning and decision making at the subcounty level. Third, the use of microdata enables the linking of population data with other data sources (e.g., the Census of Business) to allow for the development of a richer understanding of social vulnerability and its linkages to other factors.

Future Directions

Social vulnerability is useful for conceptualizing the potential impacts of hazards on the short- and long-term well-being of a population and methods of assessing and quantifying social vulnerability. To date, data for development of a SoVI have been drawn from the publicly available decennial census data. Spatially, this limits the smallest geographic unit of difference to the county level. This is useful for strategic decision making at the state and federal levels but limits the usefulness at the county and subcounty levels. Because of the disparity between annual funding cycles and decennial census data cycles, the current 10-year timeframe of the decennial census is temporally too coarse for planning and decision making.

We recommend that research continue to develop a better understanding of the spatial distribution of social vulnerability through use of ACS microdata from an RDC to generate SoVI-like estimates of social vulnerability. The resulting analyses and data sets could be further augmented through the integration of other data sources to incorporate a more accurate understanding of social vulnerability into emergency response and recovery plans. To these ends, we recommend that research explore several paths to create more meaningful and actionable estimates of social vulnerability that attempt to develop and provide locally actionable data from national data sets. This will provide decision makers with a relatively low-cost source of social vulnerability data and empower decision making at all levels, from federal to local.

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