Identifying and Mapping Community Vulnerability

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Disaster vulnerability is socially constructed, i.e., it arises out of the social and economic circumstances of everyday living. Most often discussed from the perspective of developing nations, this article extends the argument using American demographic trends. Examples from recent disasters, Hurricane Andrew in particular, illustrate how certain categories of people, such as the poor, the elderly, women-headed households and recent residents, are at greater risk throughout the disaster response process. Knowledge of where these groups are concentrated within communities and the general nature of their circumstances is an important step towards effective emergency management. Emergency planners, policy-makers and responding organisations are encouraged to identify and locate high-risk sectors on Community Vulnerability Maps, integrating this information into GIS systems where feasible. Effective disaster management calls for aggressively involving these neighbourhoods and groups at all levels of planning and response, as well as mitigation efforts that address the root causes of vulnerability.

Key words: social vulnerability, vulnerable households, minorities, elderly, children, disabled, transients, women, local mitigation, emergency management, grassroots disaster management, United States, Hurricane Andrew, community vulnerability mapping.

Emergency management organisations and other agencies with disaster-related responsibilities at the local level recognise the importance of tailoring their policies and plans to the needs of the communities they serve. To this end, my intent is to highlight what is known about the relationship between certain social and economic characteristics and increased hazard risk. Most of the research on local vulnerability to date has focused on the developing regions of the world (see Blaikie et al., 1994). Using demographic trends currently under way in the United States, I illustrate how risk is similarly concentrated in certain categories of individuals and households in developed nations. Beginning with economic and material resources, the argument is extended to include human or personal resources (such as education), family and social resources (such as networks of reciprocity) and political resources (such as power and autonomy). While there is overlap among the categories, as in the example of financial assets, and the categories are not mutually exclusive, they can be useful in

identifying the variety of ways in which vulnerability is incurred. Two groups, racial or ethnic minorities and women, are used to illustrate how these factors are often compounded to produce the marginality associated with high risk. Using examples from past events, particularly Hurricane Andrew which devastated the southern part of Florida in 1992, a case is made for local planning based on the development of Community Vulnerability Maps, and for grassroots involvement at the neighbourhood level.

The roots of local disaster vulnerability are increasingly recognised to be the pre-existing patterns of community settlement and development (Anderson, 1994; Varley, 1994; Pulwarty and Riebsame, 1997; Pielke and Pielke, 1997), including 'the on-going social order, its everyday relations to the habitat and the larger historical circumstances' (Hewitt, 1983: 25). The impact of a natural event on any given community, for example, is not random, but determined by everyday patterns of social interaction and organisation, particularly the resulting stratification paradigms which determine access to resources (Oliver-Smith, 1986a; Maskrey, 1989; Blaikie et al., 1994; Bolin and Stanford, 1998). The effect on any particular household, therefore, results from a complex set of interacting conditions, some having to do with geography and location, some with the dwelling, and still others with the social and economic characteristics of the people living there (Hewitt, 1983; Quarantelli, 1987, 1995; Bates and Peacock, 1987). According to Cannon:

> there are no really generalized opportunities and risks in nature, but instead there are sets of *unequal access to opportunities and unequal exposures to risks* which are a consequence of the socio-economic system … It is more important to discern how human systems themselves place people in relation to each other and to the environment than it is to interpret natural systems (1994: 14–15).

A precursor to effective disaster response at the local level is, thus, a comprehensive understanding of these patterns within a particular community.

Household resources and vulnerability

Most people experience and respond to storms as members of households. Even taking into account current trends in household composition in industrialised nations, it continues to be the case that most households are comprised of families, implying some degree of resource sharing. In the disaster context, this includes marshalling the necessary resources to respond to a hazard. In the US, individual households are expected to use their own private resources to mitigate, prepare for, respond to and recover from a disaster. We most often think in terms of economic resources — the association between poverty and vulnerability is easy to make. In contrast, the mechanisms by which certain physical and social attributes (such as age, race, ethnicity and gender) and living arrangements (such as single-parent households) are likely to be associated with limited resources and power, and thus increased vulnerability, are less well understood. In the following discussion of household vulnerability factors, it is useful to remember that, far from being mutually exclusive, these tend to occur in combinations, intensifying risk exponentially.

Limited economic and material resources

The number of households living in poverty is increasing in most parts of the world and it is now estimated that 1.2 billion people live in absolute poverty, that is, below any reasonable definition of human decency (Durning, 1989). While the US is affluent by international standards, relative poverty remains a fact of life for nearly 38 million, or about 14.5 per cent of the population (Bureau of the Census, 1996a). Over the past 50 years the trend has been towards greater disparity between the rich and poor, as well as increased isolation of the poorest in settlements on metropolitan fringes, in inner cities and in remote rural areas.

Poor households have insufficient financial reserves for purchasing supplies in anticipation of an event or for buying services and materials in the aftermath. The impact is likely to affect them disproportionately, including higher mortality rates (Blaikie et al., 1994), as well as greater housing damage (Cochrane, 1975). Their economic and material losses, while less in absolute terms, can be devastating. Typically, poor households recover more slowly (Bolin, 1986, 1993; Bolin and Bolton, 1986) and many never fully regain pre-impact levels, increasing their vulnerability to future hazards. According to the US experience, neighbourhoods and communities which were poor or declining before a disaster tend to lose out further during reconstruction (Bolin and Stanford, 1991; Phillips, 1993; Dash et al., 1997). It is useful to look at some of the specific processes by which limited resources place households at risk.

The poor typically live in poorly built and inadequately maintained housing. In the US, low-income families often find affordable housing in mobile or modular homes. According to an analysis after Hurricane Andrew, 'a mobile home was 21 times more likely to be destroyed than a conventional home' (*Miami Herald*, 1998, February 24: 15A). All but nine of the 6,600 mobile homes located in the area where Andrew hit were destroyed (Metro Dade Planning Department, 1992). Effective evacuation meant that only few deaths resulted, but this is only possible in advance-warning hazards. Nearly all of the deaths from recent tornadoes in central Florida involved occupants of mobile homes and recreational vehicles (*Miami Herald*, 1998, February 24).

The dwellings of the poor are often located in vulnerable locations, such as floodplains. While the affluent build large homes in coastal floodplains for the ambiance, the poor are likely to have little alternative if their livelihoods are tied to tourism, fishing and other coastal enterprises. Urban squatter camps are usually concentrated precariously on the most marginal and vulnerable land. Nearly every community has some residents who are totally vulnerable — the homeless living in cardboard boxes, under expressways or in flimsy hovels. In addition to threatening their lives, a flood or storm virtually erases whatever possessions they may have accumulated, and is likely to result in their loss of 'place' (Phillips, 1996). After a disaster, as dislocated families vie for housing, the previously homeless are even less likely to find a place to live and their numbers can be expected to grow (Cherry and Cherry, 1996).

The poor have less access to transport to heed evacuation warnings. There were reports of public-housing residents being left to walk or hitchhike out of evacuation zones before Hurricane Andrew (Morrow, 1997). After an event, lack of access to public or private transport impedes access to relief-supply depots and disaster-assistance centres. Effective emergency response calls for advance planning for

outreach to isolated communities before and after a hazard and for the prompt restoration of public transport to poor neighbourhoods.

Unstable employment is more common in the low-paying jobs of the poor which are more likely to be lost when businesses close or move after a disaster. It is more difficult for low-income workers to relocate or travel to new job locations. Daily survival in poor households is frequently dependent upon informal-sector livelihoods, many of which involve home-based enterprises such as dressmaking or catering. Likewise, domestic service jobs — house cleaning, yard work and child-care — disappear when employers lose their homes or leave damaged areas (Morrow and Enarson, 1996). New jobs associated with environmental clean-up and reconstruction are typically limited to young men with strong backs or construction skills, the latter often supplied by outside labourers and volunteers.

From a community standpoint, the poor are likely to require substantial government assistance. They more commonly become the inhabitants of refugee camps, mass shelters and temporary housing — and tend to remain there longer (Blaikie et al., 1994; Mileti et al., 1992; Bolin, 1993; Phillips, 1993; Peacock et al., 1997). Therefore, mitigation and emergency planning which focuses on the most economically marginal will not only be more humane, but also more cost effective. Public officials must geographically identify and realistically appraise the circumstances of the poorest areas and groups in their communities, thus allowing mitigation initiatives and response programmes to target their needs. It is becoming increasingly evident, however, that reducing community vulnerability in any meaningful way must ultimately address the underlying issues of economic stratification and poverty (Bolin and Stanford, 1998).

Human or personal resources

In addition to the disadvantages associated with limited financial resources, households possess different human or personal resources, such as: health and physical ability, relevant experience, education, time and skills. The vulnerability of the elderly varies significantly with age, health, family and economic circumstances. As a group, however, it is safe to assume that older residents are more apt to lack the physical and economic resources necessary for effective response, are more likely to suffer health-related consequences and be slower to recover (Friedsam, 1962; Huerta and Horton 1978; Cutrona et al., 1986; Bolin and Klenow, 1988; Phifer, 1990; Russell and Cutrona, 1991; Phillips, 1991; Tobin and Ollenburger, 1992).

With improvements in medicine and health, the proportion of elderly throughout the world is increasing. In the US, total population has tripled this century, while the proportion over 65 years of age has increased 11-fold and was estimated to be 33.2 million in 1994 (Bureau of the Census, 1996b). It is expected to more than double by 2050 to about 80 million, with the fastest growth rate expected for those over 85 years of age. Similar patterns are occurring throughout the industrialised world. Not all elderly are frail and/or poor, but it can be generalised that older residents are more likely to need disaster-related assistance. Because they tend to be reluctant to leave their homes (Gladwin and Peacock, 1997), their effective evacuation and sheltering require, not only advance knowledge of locations and circumstances, but also community-education programmes targeting their concerns.

At the other end of the age spectrum, the vulnerability of children is self-evident, especially those who lack adequate family support (Sapir, 1993). Many studies have examined the psychological effects of disasters on children (Green et al., 1991; League of Red Cross and Red Crescent Societies, 1991; Jones et al., 1993; Goenjian et al., 1995; Shannon et al., 1994; Parker et al., 1997). It would be useful to have advance knowledge of the number of children likely to require special services in refugee settlements, shelters, temporary housing facilities and disaster-assistance centres. Authorities were not prepared for child victims after Hurricane Andrew. In some cases, child-care facilities and recreational activities were improvised, but often children were forced to wait with parents in long queues, to encounter boring days with nothing to do or play in unsafe environments. During those first days before extensive outside help arrived, many mothers had to scramble for infant food, nappies and other necessities (Enarson and Morrow, 1997). Advance knowledge of, not only how many children and young people live in specific neighbourhoods, but also their likely household circumstances, will facilitate planning for appropriate supplies, housing and public services. School systems in disaster-prone areas should be actively involved in mitigation and evacuation planning, and have realistic plans for re-opening in a timely manner.

Physical and mental limitations can affect disaster response. As a result of improved medical care and rising survival rates from birth defects, life-threatening and chronic diseases and accidents, more people now live with disabilities of some kind (Tierney et al., 1988). According to the 1990 US Census, about 10.4 per cent of the population between the ages of 16 and 64, or about 16.5 million people, are classified as having a work disability, mobility disability or self-care limitation (Bureau of the Census, 1996c). It can be generalised from this that in any community a sizeable segment of the population will require extra assistance in order to respond to a disaster. Emergency planners need to know who they are and where they are concentrated, particularly the location of group living facilities.

Household living arrangements also have disaster-related consequences. The resources available to any household are significantly affected by its ratio of healthy, productive adults to dependants. In many industrial economies, it now takes at least two wage earners to provide a middle-class standard of living. Single-parent families, particularly when headed by women, are likely to live on the economic margins. Similarly, the rising cost of raising children has put extra burdens on large families. Families with many dependants — children, elderly or disabled members — are likely to encounter greater obstacles when responding to an emergency.

Cultural norms regarding family size and household composition vary throughout the world, influenced by economic conditions, demographic trends and housing availability. There are obvious economic reasons for the preference of large, extended families in agricultural economies and small nuclear ones in industrialised societies. A wide variety of household arrangements, however, have resulted from post-industrial economies combined with current patterns of immigration, fertility and longevity.

Housing units occupied by married couples with minor children accounted for only 26.3 per cent of all US households in 1990 (Bureau of the Census, 1992). It is estimated that currently about 9.1 per cent of all families are headed by a single parent, usually female, while 30.0 per cent consist of non-family households, that is, persons living alone or with non-related adults (Bureau of the Census, 1996d). The trend is towards smaller households; in 1997 the average was projected to include 2.6

members. While these smaller households are more mobile in times of disaster, they may lack sufficient economic and human resources with which to mitigate, prepare and respond effectively.

In spite of the trend towards greater variation in household composition, public policies have been slow to relinquish the post-World War II vision of a 'normal' family as a breadwinner father, homemaker mother and their children. Two recent disasters, the Northridge earthquake in California and Hurricane Andrew in Florida, occurred in multicultural communities where extended or composite families were common, particularly among recent immigrants and migrant agricultural workers. Doubling up is a survival strategy of the poor throughout the world and in many cultures it is the preferred household arrangement. These complex families often have trouble getting appropriate assistance and finding replacement housing in scarce post-disaster markets. The last families remaining in the temporary trailers nearly two years after Andrew were large, three-generation households headed by women (Morrow, 1997). It is important for emergency managers to have up-to-date knowledge of the types of households found in various regions throughout their communities.

The personal experience, education and skills possessed by the adults in a household can significantly influence its resiliency. Scant attention has been paid to the relationship between personal qualities and negotiating the many processes necessary to respond to and recover from a disaster. The disadvantages posed by illiteracy or lack of language proficiency when seeking information and filling in application forms are obvious. Cultural differences can cause misunderstandings and mistrust between response agency workers and minority victims (Phillips, 1993; Morrow and Enarson, 1996). The relationship between education and impact recovery is less well understood, but it can safely be assumed that higher education levels lead to better employment opportunities, even in depressed post-disaster economies, as well as greater proficiency in dealing with bureaucracies and gaining access to assistance programmes.

Information about the effect of prior disaster experience on appropriate response varies, depending on the nature and timing of that experience. A positive effect is mentioned frequently in the literature on preparation, predisposing people to start earlier (Baker, 1991; Gladwin and Peacock, 1997). However, certain circumstances, such as having easily survived a mild hurricane or near-miss, can breed complacency. While knowledge of appropriate mitigation and safety practices is important, it is insufficient to predict appropriate behaviour since many other factors, such as money and access, affect household decisions and actions (Watts, 1983; Varley, 1994).

An important, yet virtually ignored, positive factor is the number of healthy, resourceful adults with available flexible time to devote to the many activities associated with household response and recovery. The higher-than-expected preparation rate for Hurricane Andrew was largely attributed to the warning being broadcast over a weekend when most people were not out at work (Gladwin and Peacock, 1997). Having an adult household member available during the day to forage for supplies, wait in queues to apply for assistance, accept deliveries and meet with insurance adjusters, caseworkers, contractors, construction workers and building inspectors is a tremendous asset during a difficult and prolonged recovery period.

Family and social resources

An important response factor is the extent to which individuals and households possess 'institutional and kinship embeddedness' (Bolin, 1982). Lack of family and social networks can be a limiting factor. Relatives, while not likely to be the primary source of assistance in developed nations, are an important base of disaster-related help for many (Fogelman and Parenton, 1956; Friedsam, 1962; Hill and Hansen, 1962; Drabek et al., 1975; Erickson et al., 1976; Drabek and Key, 1976; Bolin and Trainer, 1978; Bolin, 1982; Nigg and Perry, 1988). A surprising finding in our Hurricane Andrew work was the extent to which families were enmeshed in local kinship networks of reciprocity. About three-fourths had relatives in the area and 41.0 per cent of those living in the most heavily hit area reported that extra-residential kin played a major role in assisting them in the aftermath (Morrow, 1997).

Fast-growing communities with many new residents are more likely to contain isolated households with limited social and family networks to activate in times of crisis. Similarly, recent immigrants may lack connections to the larger community and may hesitate to seek assistance outside their immediate ethnic group for a variety of reasons, including a fear of government officials based on past experiences with repressive regimes in their former countries. Likewise, migrant agricultural workers are not likely to be integrated into community institutions and are, thus, easily overlooked by disaster planners and responders.

Tourists and other transients can be highly vulnerable when a storm strikes. Resorts tend to be located in aesthetically pleasing, but highly vulnerable areas, such as beaches and mountain tops. Often there is insufficient time or capability to evacuate before airports are closed. According to an authority on this issue, the welfare of tourists raises serious questions which are not adequately addressed by the hospitality industry or public officials (Drabek, 1996).

Political resources: power and autonomy

An important factor in a household's inability to protect itself is the degree to which it lacks autonomous control over its circumstances. Resiliency depends, not only on economics, but on a household's relation to community decision-makers. Social and political structures are far from objective or impartial and will promote the interests of some, such as business leaders, over those with less power or influence. This is why it serves some 'political interests to maintain the notion that disasters are natural rather than "caused" by political and economic processes' (Cannon, 1994: 18).

Renters have little control over the buildings in which they live, including whether they are structurally sound, have shutters or wind protection, are insured or get repaired. As one important example, public-housing residents have no say in whether their units are disaster protected. In the cases of Hurricane Hugo on St Croix (Morrow, 1992), Hurricane Andrew in Miami (Morrow, 1997) and Hurricane Marilyn on St Thomas (Morrow and Ragsdale, 1996), none of the public-housing units had window protection and many were heavily damaged, some for a second time. As a result, hundreds (thousands in the case of Andrew) of households, mostly women and children, had to be provided for in tent cities, temporary shelters and caravans. Public and government subsidised housing units should be obvious targets for serious

hurricane mitigation efforts, including improving the wind and water resistance of the structures, providing hurricane preparation education and assisting the community in organising its own response initiatives. In addition to reducing human suffering, the economic savings could be substantial.

The recovery of a specific neighbourhood or community can be directly tied to its position in the local political power structure. Unincorporated and/or rural areas can be ignored in the highly politicised environment surrounding a disaster (Morrow and Peacock, 1997). Politically marginalised or disenfranchised groups will require advocacy and support if they are to recover (Dash et al., 1997). Compounding the effects of other risk factors is membership in a devalued social category. Being poor is likely to be the most definitive marginality, but is compounded by membership in a minority or other disenfranchised group. As examples, it is useful to elaborate on two groups likely to encounter additional impediments throughout any disaster experience because of limited economic, human, social and political resources: racial or ethnic minorities and women.

The compounded vulnerability of minorities and women

The many ways in which membership in a racial or ethnic minority results in social and economic marginality and thus influences disaster impact, resiliency and outcome are well documented (Bolin and Bolton, 1986; Phillips, 1993; Blaikie et al., 1994). While data are sometimes contradictory, mortality rates tend to be higher among minorities (Moore, 1958; Bates et al., 1963; Bolin and Bolton, 1986) and their vulnerability continues throughout the disaster response. In the Hurricane Andrew case, there was evidence of minority homes sustaining greater damage, yet receiving less-adequate insurance settlements (Girard and Peacock, 1997; Peacock and Girard, 1997). Marginalised minority groups are often excluded from community disaster planning and preparation activities (Bolin and Bolton, 1986; Aguirre, 1988; Phillips and Ephraim, 1992; Faupel et al., 1992; Phillips, 1993), including mitigation initiatives (Tierney, 1989). Thus, community response programmes are not grounded in an understanding of their culture and circumstances.

Important cultural differences have been found in the way people assess and respond to hazard risk (Perry and Mushkatel, 1986; Perry and Lindell, 1991; Mejer, 1994), with minorities more likely to rely on kin and social networks for information. They may lack fluency in the dominant language, making it crucial that information be delivered in additional languages. It is difficult to separate the effects of mainstream prejudice from minority differences in knowledge of the response process, unfamiliarity with the language, or even cultural preferences, but clearly a first step towards effective disaster planning is better understanding of the minority groups living in the community.

Disaster planning and management, impact and response, even research, are largely social processes. As such, throughout the world they occur in an atmosphere discriminatory to women (Enarson, 1998). Having evolved over a long history, patriarchy is so culturally embedded it is largely subconscious (Hess and Ferree, 1987; Epstein, 1988; Anderson, 1988). Perhaps this explains why so little thought has been given to the ways in which women's needs and outcomes are likely to be different (Morrow and Enarson, 1994; Fothergill, 1997). As expressed by Enarson

and Morrow, 'The social experience of disaster affirms, reflects, disrupts, and otherwise engages gendered social relationships, practices, and institutions. Disasters unfold in these highly gendered social systems' (1998a: 4).

In most societies gender-specific responsibilities, constraints and limited access to resources accentuate the hazard vulnerability of women. Women tend to suffer disproportionately in every stage of disaster response (Rivers, 1982; Blaikie et al., 1994; Walker, 1994; Khondker, 1996; D'Cunha, 1997; Enarson and Morrow, 1997), and their mortality rates have been found to be higher in many disasters (cf. Sapir, 1993; Ikeda, 1995; Krishnaraj, 1997). Yet, the differing sets of response and recovery needs of women have yet to be adequately addressed in either disaster research or response (Enarson, 1998).

The most obvious gender effects are associated with poverty. As a result of the economic inequality, single-women and women-headed households are much more likely to be poor. In 1994, for example, 34.6 per cent of US women-headed households had incomes below the poverty threshold compared to 14.5 per cent of the general population, as were 24.9 per cent of lone women compared to 17.8 per cent of households in which a man lived alone (Bureau of the Census, 1996d). The disadvantages of poor women are compounded when they are additionally marginalised by race, ethnicity and/or old age.

Sex-role stereotypes and expectations profoundly influence the daily lives of women and men and are likely to be accentuated in times of crisis (Hill and Hansen, 1962, Drabek, 1986; Hoffman, 1993). Gender differences appear to affect risk assessment and response, household preparation and evacuation (Drabek and Boggs, 1968; Drabek, 1969; Turner et al., 1981; Neal et al., 1982; Cutter et al., 1992; Flynn et al., 1994) and the use of social and family networks (Drabek et al., 1975).

In the disaster context, it is important to consider women's heavy care-giving responsibilities, both within households (Finch and Groves, 1983; Abel and Nelson, 1990; Blaikie et al., 1994) and in responding organisations (Neal and Phillips, 1990; Reskin and Padavic, 1994). Throughout the world women bear most of the responsibility for meeting the daily needs of family members, particularly dependent children and elders. These domestic responsibilities become more difficult in partially destroyed homes or temporary shelters and expand to include contacts with outside agencies, such as government-assistance programmes, as well as household reconstruction tasks (Morrow and Enarson, 1996).

Women's employment is more likely to be in low-status jobs or in the informal economy — work subject to fluctuation in the best of times and likely to disappear completely after an event, often unnoticed by authorities. There are few job opportunities for women in post-disaster economies (Enarson and Morrow, 1997) and women-owned businesses may have a particularly difficult time surviving a community disaster. In the US women-owned businesses have been found to be less likely to be approved for bank loans (Nigg and Tierney, 1990).

Women typically have fewer resources and less autonomy within households and are, therefore, less able to respond appropriately to a crisis. Their domestic responsibilities and status make it difficult to get to relief and assistance sites. Responding agencies operate on the assumption that the first person applying for assistance from a household, such as a more mobile male, will share it with everyone living there. Unfortunately, there are many examples of misuse by applicants of

disaster resources intended for the entire household (cf. Morrow and Enarson 1996). Major crises are highly stressful, resulting in higher suicide rates (Krug et al., 1998), as well as more personal conflicts. Greater incidence of family violence can be anticipated, particularly aimed at women (Santa Cruz Commission for the Prevention of Violence against Women, 1990; League of Red Cross and Red Crescent Societies, 1991; Anderson and Manuel, 1994; Morrow, 1997; Wilson et al., 1998). It is important for planners to anticipate increased violence against women and to involve local shelters and domestic violence services promptly in community emergency planning (Enarson, 1997a). In recent years several guidelines for assessing the gender-specific needs of women and their dependants have been developed (cf. Myers, 1994; Noel, 1998) and this type of analysis should be at the core of effective disaster preparedness and response planning.

Developing vulnerability maps

Effective planners and managers look beyond geographical vulnerability to understand how unique social and political patterns in their communities result in accentuated risk for some categories of people. The first step is the development of a community vulnerability inventory, sometimes referred to as a community hazard and risk assessment (Geis, 1997) or access profile (Blaikie et al., 1994; Morrow et al., 1994). A precedent in many communities is a registry of disabled people who are likely to need special attention in an emergency. While it is unrealistic to collect other vulnerability data for individual households, it is entirely feasible for planners to maintain databases reflecting the extent to which highly vulnerable groups are represented in each neighbourhood.

A community vulnerability inventory reflects where at-risk groups such as the following are concentrated:

- residents of group living facilities;
- elderly, particularly frail elderly;
- physically or mentally disabled;
- renters;
- poor households;
- women-headed households;
- ethnic minorities (by language);
- recent residents/immigrants/migrants;
- large households;
- large concentrations of children/youth;
- the homeless; and
- tourists and transients.

These vulnerability categories are not mutually exclusive. Indeed, they are likely to be compounded in ways that place certain geographical areas of the community especially at risk.

Local mapping can pin-point where high-risk groups are concentrated. The resulting *Community Vulnerability Maps* are invaluable tools for emergency managers and disaster responders, both public and non-profit, allowing informed estimates of anticipated community needs at all levels of crisis response (FEMA, 1997). The next step is to tie educational initiatives, mitigation programmes, evacuation plans, humanitarian relief distribution and other response services directly to local neighbourhood needs. These maps should also identify community resources, such as shelters, community centres, parks, local service groups and neighbourhood response networks.

Taking it a step further, agencies possessing the requisite resources can merge these vulnerability data with other spatial community and housing information, as well as flood, surge and other hazard-related databases and/or risk-assessment models, such as HAZUS and TAOS. The resultant Geographic Information System (GIS) 'allows us to integrate social and geographic data in order to understand disaster as a social phenomena' (Dash, 1997). It provides a powerful tool to predict impact while also anticipating local needs before, during and after a disaster, pin-pointing risk and relating it to existing neighbourhood resources (FEMA, 1997). Sophisticated equipment and technologies, however, are not necessary for maintaining a vulnerability profile. A good 'low-tech' example is a grassroots mitigation project in the Philippines where residents of a rural community created a three-dimensional town map on plywood, using flour and water dough to depict the most vulnerable locations and homes (Hall, 1996). Similar neighbourhood projects can be developed in schools, scout groups and citizen organisations.

Beyond vulnerability

In conclusion, while it is widely accepted, if rarely practised, that sustainable development programmes require involvement and leadership at the local level, this important concept is inadequately applied in the disaster context. The proposed identification and targeting of at-risk groups does not imply helplessness or lack of agency on their part. Truly 'disaster-resistant communities' (Geis, 1997) depend on meaningful grassroots activism. Just because groups or neighbourhoods have been disenfranchised in the past does not mean they are unwilling or unable to be an important part of the process. There are many notable examples of grassroots action on the part of poor, elderly, and/or minority communities (Oliver-Smith, 1986b; Bolin, 1993; Guillette, 1993), and of women making a difference in post-disaster decisions and outcomes (Poniatowska, 1988; Neal and Phillips, 1990; Leavitt, 1992; Enarson and Morrow, 1998b).

Planners and managers who make full use of citizen expertise and energy will more effectively improve the safety and survival chances of their communities. One example of a grassroots strategy would be to use the current movement towards sheltering people in their local neighbourhoods as a base for organising neighbour-hood response networks, similar to the crime-watch programmes currently found in many communities. Based on their research after the Northridge earthquake, Bolin and Stanford observed that 'a combination of local activism coupled with financial and organisational support from government and non-government agencies can be an effective means of developing and implementing programmes that go beyond simply "fixing" what the earthquake damaged' (1998: 35). Indeed, a cornerstone in the current US mitigation programme developed by the Federal Emergency Management Agency is the development of Local Mitigation Strategies, including private and public partnerships, to address the root causes of community vulnerability (FEMA, 1997).

It is equally important to recognise women as a seriously under-used resource in disaster management and response, particularly in decision-making roles (Forest, 1978; Neal and Phillips, 1990; Phillips, 1990; Morrow and Enarson, 1994). A recently published volume, *The Gendered Terrain of Disaster*, documents women's

contributions in a multitude of roles from grassroots organising to emergency management (Enarson and Morrow, 1998a). The first step towards organisational and policy change to reflect the realities of women's lives, at the same time strengthening disaster programmes in general, is to engage effectively 'the other half' of the population at every level of planning and response (Anderson and Manuel, 1994; Morrow and Enarson, 1996; Enarson, 1997b).

Effective hazard mitigation and emergency response must begin with an acknowledgement and understanding of the complex ways in which social, economic and political structures result in important differences in the vulnerability of those they are meant to protect and serve. This can best be achieved, indeed can *only* be achieved, with community planning at the local level which genuinely engages even the most disenfranchised stakeholders in the process.

Acknowledgement

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