Nat Hazards (2007) 41:271–282
DOI 10.1007/s11069-006-9035-8

ORIGINAL PAPER

People and community as constituent parts of hazards: the significance of societal dimensions in hazards analysis

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Received: 17 April 2005 / Accepted: 26 April 2006 / Published online: 21 November 2006

Abstract Nature-triggered hazards and disasters have traditionally been treated only from the lens of geophysical and biophysical processes, implying that the root cause of large-scale death and destruction lies in the natural domain rather than in a coupled human–environment system. Conceptually, the physical domain has been seen as discrete and separate from human entities, and solutions were sought in the technological intervention and control of the physical environment—solutions that often ended up being less effective than hoped for and sometimes even counter productive. At all levels, institutions have directed and redirected most of their financial and logistical resources into the search for scientific and engineering solutions without allocating due attention and resources towards the assessment of effects and effectiveness of the applications of such technological outcomes. However, over the last two decades, forceful criticisms of the 'dominant' technocratic approach to hazards analysis have appeared in the literature and consequently there has not only been a shift in thinking of causation of disaster loss in terms of human vulnerability, but also newer questions have arisen regarding distinguishing between the 'physical exposure' of people to threats and societal vulnerability, and linking them with propensity to hazards loss. Though the vulnerability/resilience paradigm has largely replaced the hazards paradigm within the social sciences and much of the professional emergency and disaster management communities, this shift of thinking has not progressed to much of the physical science community, decision-makers and the public, who have not yet accepted the idea that understanding and using human and societal dimensions is equally or more important than trying to deal and control nature through the use of technology. This special issue is intended to further the idea that the aspects of community and peoples' power to mitigate, to improve

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coping mechanisms, to respond effectively, and recover with vigor against the environmental extremes are of paramount conceptual and policy importance.

Keywords Risk · Hazards · Vulnerability · Resilience · Community · Disaster management · Canada · United States · Bangladesh

1 Introduction

This special issue concerns the significance of societal analysis for hazards research and human actions, from the perspective of integrated human–environment systems. In this article, we attempt to examine, from a historical perspective, the magnitude of human cost to nature-induced catastrophes; the changing trends in approaches to risk, hazard and disaster analysis; describe the context of risk and hazards; and summarize the contents of individual articles of this special issue. The argument that we intend to develop here is that without humans, hazards are simply natural events and thus become irrelevant; hence much attention should be paid by concerned institutions to people, community and their capacity to link and deal with nature.

The volume of institutional and financial resources allocated to scientific inquiries of nature- and human-triggered hazards is significant, and an increase in risk and hazards research in recent years has been marked. This has become especially valid since the 1980s when the annual global loss due to catastrophic events surpassed the hundred billion dollar mark and after the September 11, 2001 terrorists' attack in the United States. All levels of institutions in recent years have directed and redirected most of their financial and logistical resources into the search for scientific solutions through technological inventions and innovations, without allocating sufficient attention and resources towards the assessment of the effects and effectiveness of the applications of such technological research outcomes. In Kenneth Hewitt's words, such a trend is prevalent because ''it accords with 'the facts' only insofar as they can be made to fit the assumptions, development and social predicaments of dominant institutions and research that has grown up serving them'' (Hewitt 1983: 3). However, over the last few decades, limited but harsh criticisms of the 'dominant' technocratic approach to hazards analysis appeared in the literature (e.g., Hewitt 1983; Varley 1994; Cannon 1994; Haque 1997).

This special issue is intended to further the idea that the aspects of community and peoples' power to mitigate, to improve coping mechanisms, to respond effectively, and recover with vigor from environmental extremes are of paramount conceptual and policy importance. The articles in this special issue are drawn from presentations made at a symposium on ''Reducing Risk through Partnerships,'' held in Winnipeg, Canada, in November 2004, organized by the Canadian Risk and Hazards Network (CRHNet 2005) and supported by Public Safety Canada, Natural Resources Canada, Environment Canada, and the Natural Resources Institute of the University of Manitoba, Canada. The title ''People, Community and Resilience: Societal Dimensions of Environmental Hazards'' reflects the contributors' shared understanding of risk and hazards as being rooted in complex social and physical systems and their associated processes.

2 Catastrophes and human deaths: an historical perspective

Data on catastrophic events and their impacts are difficult to gather, compile and analyze; still, it is important to make efforts to examine such information in order to put events into context. Two sources, namely Davis (2002) and Nash (1976), were used to compile a list of catastrophic events, along with their effects upon human losses, over the past 2000 years. The 2004 Asian Tsunami disaster was added to this list. Total estimated numerical deaths caused by major catastrophes were found to be approximately 159 million; an additional 19 disasters are each estimated to have caused deaths of a million or more people, but have no actual estimate of numbers of deaths. In order to examine the human impact of catastrophes, events only with 100,000 or more estimated deaths were included, and the summary of the data is presented in Table 1.

It is evident that direct strikes of nature-triggered events such as major floods and earthquakes have caused the deaths of millions in the last two millennia. However, it is the secondary and tertiary effects of geophysical extreme events that most often cascade into other socioeconomic processes, result in the breakdown of resource thresholds and ultimately cause the most human suffering. Sen's (1981) well-recognized research work on famines in Ethiopia and Bangladesh has demonstrated this point clearly, by proving that floods and droughts cause loss of employment for daily laborers. Such loss of entitlement of the poor to wage earnings and food in turn leads to starvation and famine, leading to human catastrophes. The thesis that Sen advocates is that the root causes of famines and epidemics are social conditions that limit access for the poor to food and nutrition, not natural events such as, floods or heat waves.

Disaster-related deaths in developed countries are limited, but the economic loss due to catastrophic events in these regions is rising astronomically (Munich Reinsurance Company 2003; IFRCRC 2003, 2004). For example, in Canada, the number of human deaths has been small in comparison to those that have occurred in developing nations as a result of extreme events of similar magnitude and intensity. Nevertheless, there have been a number of disasters that have caused enormous disruption and/or damage, including the 1998 Ice Storm, the Prairie droughts of the 1930s, 1980, 1987 and 1989, the Red River flood of 1997, the British Columbia forest fires of 2004, the Saguenay flood of 1997, Hurricanes Hazel (1954) and Juan (2004),

Table 1 Natural disasters resulting in over 100,000 deaths (118 events) in the past 2000 years worldwide

Type	Number of deaths (in million)	Number of catastrophes (million or more deaths)
Famine	75.0	8
Diseases (total)	67.0	9
Drought	9.0	1
Flood	3.0	1
Tsunami	0.3	0

The worst three disasters (influenza, plague, famine) where numerical estimates are available total 70 million or 44% of the 159 million

Recent Tsunami disaster ranks about 76th on the list of 118

Sources: Davis (2002) and Nash (1976)

Severe Acute Respiratory Syndrome (SARS, 2003) and Bovine Spongiform Encephalopathy (BSE). In the 1980s, Canada experienced losses of more than a billion dollars by single environmental events for the first time, and several such events have occurred since. More important to note is that the potential exists for Canadian disasters that are far more damaging than have occurred thus far.

3 Risk and hazards: from 'naturalness' of hazards to human causation of risk and hazards

Traditionally, natural hazards and disasters have been treated only from the lens of geophysical and biophysical processes, implying that the root cause of large-scale death and destruction lies in the natural domain rather than in a coupled human–environment system. Conceptually, the physical domain has been seen as discrete and separate from human entities, and defined natural hazards as those elements of the physical environment harmful to 'man', caused by forces extraneous to him (Burton and Kates 1964). The focus on physical domains yields an incomplete understanding of natural hazards and often results in ineffective or even counter-productive solutions. Cannon (1994) points out that the focus of the 1990s United Nations ''International Decade for Natural Disaster Reduction'' failed to move away from the ''naturalness of hazards'' and to emphasize the human causation of disasters; this was even reflected in its very title. He asserted that by focusing on the behavior of nature, the United Nations initiative actually encouraged technical solutions to ''the supposed excesses of the as yet untamed side of nature'' (Cannon 1994: 17). Gilbert White and his disciples' work in the USA during the last half a century has revealed that technocratic solutions generate a false sense of safety and consequently augment human risk-taking behavior and loss due to disaster (Kates and Burton 1986a, b). Efforts during the International Decade could not therefore make any significant shift in the ever increasing trend in disaster loss globally. Nonetheless, the experience of increasing trend of disaster loss even in the face of remarkable technological advancements and their applications has instigated communities concerned with risk and hazards at different levels (local, regional, national and international) to question prevailing approaches and practices and become increasingly aware of the importance of societal dimensions. A trend towards rethinking on the explanation of hazards and disasters is apparent.

Human and societal elements are important not only because people are victims when extreme environmental events take place, but also because humans define the very essence of a 'natural' hazard (see Cannon 1994; Tobin and Montz 1997; Blaikie et al. 1994). Cannon (1994: 14) explains this assertion by stating:

> Nature presents humankind with a set of opportunities and risks which vary greatly in their spatial distribution. Opportunities include the many different ways in which people utilize nature for production (raw materials, energy sources) and to service their livelihoods (absorbing or recycling waste products). The risks inherent in nature consist of a wide range of hazards that put constraints on production (e.g., frosts affecting agriculture) and on other aspects of livelihoods and safety (earthquakes, floods and droughts, etc).

With greater understanding of disaster processes in relation to complex human–physical environmental systems, by the end of the 1970s many institutional approaches began to shift and place more emphasis upon the role of human dimensions in hazards. For instance, the United States Geological Institute (1984) clarified natural hazard as ''a naturally occurring or man-made geologic condition or phenomenon that presents a risk or is potential danger to life and property.''

More than two decades have passed since Hewitt's edited collection *Interpretations of Calamity from the Viewpoint of Human Ecology* was published (Hewitt 1983). Still his position statement is challenging and merits citation. As he explained, the 'dominant' paradigm in hazards and disaster research and practice is characterized by ''a straightforward acceptance of natural disaster as a result of 'extremes' in geophysical processes'' and a technocratic view that the only way to address the hazards *problematique* was by public policy application of geophysical and engineering knowledge (Hewitt 1983: 5–7). For Hewitt, hazards are neither explained by nor uniquely linked with geophysical processes that may initiate damage. This does not imply that geophysical processes are not relevant, but too much causality has been attributed to them. More importantly, human conditions (particularly the awareness of and response to environmental hazards) are not dependent solely upon geophysical domains and their associated processes. Instead, hazards are more dependent on the concerns, pressures, goals, and risk related decisions of society, not least being the effectiveness of measures taken to mitigate calamity (Tobin and Montz 1997). More importantly, as Hewitt portrayed, the causes, features and consequences of environmental hazards and disasters cannot be fully explained by conditions and/or behaviors peculiar to catastrophic events; these can be explained by everyday societal forces and patterns of living. The significant elements are social order, its everyday relations to the habitat, and larger historical conditions that shape society. In the 1990s, these perspectives were reinforced by Blaikie et al. (1994) with evidence from various parts of the developing world, Haque (1997) with his work on floods, riverbank erosion, cyclones and drought hazards in Bangladesh, Brazil and Canada, and several other analysts in this field (Mileti 1999; Wisner 1988; Davis 1987).

During the last decade there has not only been a shift in thinking of causation of disaster loss in terms of human vulnerability, but also newer questions that have been asked regarding distinguishing between 'physical exposure' of people to threats and societal vulnerability, and linking them with propensity to hazards loss. As Fikret Berkes points out in this issue, vulnerability is determined not by exposure to hazards alone, but also resides in the resilience of the human–environment system experiencing the hazard. Terry Cannon clarified societal vulnerability forcefully by stating that vulnerability must not be understood in terms of a given state or condition, but rather from a focus on the social, economic, political and cultural processes that make people or society vulnerable. For him, ''the vulnerability concept is a means of 'translating' known everyday processes of the economic and political separation of people into a more specific identification of those who may be at risk in hazardous environments'' (Cannon 1994: 17). The argument suggests that disasters occur when an environmental hazard strikes vulnerable people. Hence, there is a link between the extent and types of vulnerability generated by people's conditions within political and economic systems and the manner in which society treats hazards in terms of prevention, mitigation, preparedness, response and recovery.

It is worth noting here the connection of societal dimensions with climate change-induced hazards. The Intergovernmental Panel on Climate Change (IPCC) Third Assessment (2001) highlighted that climate change will enhance the frequency of extreme climatic hazards such as, hurricanes, droughts and floods. The Climate Change Adaptation research community has subsequently adopted the conceptualization of 'vulnerability' as a function of (Exposure to Hazards ''minus'' Adaptive Capacity), where adaptive capacity is some function of environmental, social, and economic endowments. Although IPCC did not formally define adaptive capacity, but did observe that enhancing adaptive capacity has similar prerequisites as for promotion of sustainable development such as, resource access, poverty reduction, increased equity and increased capability to participate in local decision-making and actions.

From the perspectives of coupled human–environment systems, prevention and mitigation of hazards and disasters is possible not only by intervening into physical domains, but also (and probably more effectively) by changing and modifying societal forces, more specifically by reducing vulnerability and strengthening resilience. Cannon's (1994) observation is worth citing since it is just as valid today as it was 12 years ago. He notes that the vast majority of the efforts of those concerned with disasters are focused either on reducing the impact of the disaster itself (sometimes in expensive and inappropriate ways), or in reducing one rather narrow aspect of vulnerability—social protection through certain forms of technological preparedness. Cannon (1994: 21) finds that the major determinants that make people vulnerable (i.e., social, economic and political factors, which determine the level of resilience of people's livelihoods and their ability to withstand and prepare for hazards) are rarely tackled. Institutionally, it has not changed much since.

Several articles in the special issue, however, discuss that resilient socio-ecological systems have the ability to learn and adjust, use all forms of knowledge, self-organize and develop positive institutional linkages with other systems or sub-systems in the face of hazards. Evidence to support this notion was collected by Gardner and Dekens from mountainous regions of India and Canada. Brenda Murphy adds the point that the mobilization of social capital resources (networks of bonds and trust) improve a community's resilience to risk and hazards. A call for a new approach to deal with risk and hazards came from Markku Nishala, the Secretary General of the International Federation of Red Cross and Red Crescent Societies, who argues that because the faces of risk and hazards are changing,

> ''we need new approaches that boost people's resilience to the full spectrum of physical, social and economic adversities they face. By resilience, I mean people's ability to cope with crisis and bounce back stronger than before. If we fail to shift from short-term relief to longer term support for communities in danger, we risk wasting our money and undermining the resilience we seek to enhance. ...Supporting resilience means more than delivering relief or mitigating individual hazards. Local knowledge, skills, determination, livelihoods, cooperation, access to resources and representation are all vital factors enabling people to bounce back from disaster. This implies a paradigm shift in how we approach [these problems].'' (IFRCRCS 2004: 8–9).

Developing institutional partnerships to integrate public sectors with non-government organizations, the private sector, and local communities can help reduce disaster loss significantly. Recent evidence from Bangladesh's experience reaffirms this notion.

In the face of arising complexities between human population and nature and increasing connectedness between communities and nations, characteristics of threats, risks, hazards and disasters are changing rapidly in today's world. The depletion of natural resources, environmental degradation, marginalization, poverty and disease are compounding nature-triggered hazards such as floods and droughts to cause chronic adversity. As well, despite unprecedented socioeconomic and technological progress, we are finding our technological and cultural resources inadequate in themselves to deal with such compounding effects, and the result is threshold exceedence and catastrophic loss. Some recent Canadian disasters, such as the 1996 Saguenay and 1997 Red River floods and the 1998 Ice Storm, are testament to our increasing vulnerability to catastrophic events. Even more so, other parts of the world have experienced catastrophes that also illustrate this point; for example, the destruction of New Orleans by Hurricane Katrina or the Asian Tsunami of December 2004. Since our understanding of the emerging complex systems is not rich (in fact, rather poor in many cases), we are confronting a high degree of uncertainty regarding future trends and event prediction, that may best be described within a post-normal scientific framework. In order to underscore such issues, Stephanie Chang and her colleagues have offered, in this issue, a conceptual framework for investigating Infrastructure Failure Interdependencies (IFI), from the standpoint of societal impacts. The article clearly points to the dynamic nature of societal vulnerability, through interdependent critical infrastructure, and the utmost need to account for these perspectives in human decisions and policy making. Also, our conventional institutional measures to deal and cope with many environmental threats and hazards are proving inadequate, particularly in terms of financial and human resources. The discourse has generated a need among concerned community members to analyze and view the problems in new ways. Mileti (1999) asserts this point, when he notes that the recommendations from the second US assessment of natural hazards, intended to create a safer society, are fundamentally philosophical in nature.

4 The context of risk and hazards

Hazard and risk exist within a complex and changing landscape that varies in both space and time. Globally, climate change and continued environmental degradation of the natural landscape is expected to make many nature-triggered disasters more frequent and severe in the future, while social trends such as urbanization, population growth, demographic changes, globalization, increased complexity of technological systems and population migration to areas exposed to hazards combine to alter and increase the vulnerability of our social systems in complex ways. Political decisions also affect hazard and risk. For example, in the United States after the September 11, 2001 terrorists' attack a refocusing of political interest on issues related to terrorism has had very significant impacts on the notions, policy and practice of how institutions and people of the United States deal with natural, social and other risks. Consequently, an examination of hazard management efforts within

the United States suggests that much of the progress that had been achieved in hazards reduction over the past several decades has been reversed (Etkin 2005).

Different countries experience similar hazards in very different ways. For example, an M6.6 earthquake in Iran, such as occurred in the city of Bam in December 2003 killed about 26,000 people (estimates of death tolls have ranged from about 25,000 to 41,000). A similar M6.9 earthquake on January 17, 1994 in Northridge, United States resulted in 57 deaths, but also a great deal of economic damage. The reason for the difference is that buildings in Iran are not constructed in such a way as to be earthquake resistant, as they are in regions of the United States subject to that hazard. Such variation is not because of a lack of knowledge, but rather a result of differences in building codes, economic capacity, cultural elements in building practices, and government regulation and degree of compliance.

To the extent that data on disasters are reliable, it presents a picture of a social problem that is becoming more severe. Trends in the cost of disasters carried out by reinsurance companies, the Red Cross and Public Safety Canada, among others, suggests that the problem of disasters is becoming worse over time. Certainly, there are many difficulties that make disaster data difficult to interpret. For example, there exists no standard methodology to measure or assess the impact of the disaster, and metrics that rely upon single numbers to compare disasters are inevitably gross simplifications. This complexity can be depicted by many paradoxical perspectives; society is becoming more vulnerable to extreme events even while it is effective at protecting its citizens against many of the more commonplace hazards. Though according to many measures (such as life span) the world is generally becoming a safer place, various authors have discussed the issue of how trends in modern society increase vulnerability to extremes. It is worth citing some examples here (Etkin 2005):

- ''The fundamental contradiction in technological and economic growth... At the micro level, we find technical and economic rationality; at the macro level, technical and economic irrationality'' (Willem H. Vanderburg in *The Labyrinth of Technology*).
- ''We live in a world in which information ... has reduced our susceptibility to accidents and diseases at the cost of increasing our vulnerability to massive social and economic catastrophes'' (Paul Slovic in *The Perception of Risk*.)'
- In his book *Normal Accidents*, Charles Perrow argues that in complex and tightly coupled systems accidents are a fundamental property of the system, and all of them cannot be prevented. Thus, catastrophes are therefore unavoidable.
- In *Risk Society: Towards a New Modernity*, Ulrich Beck suggests that society is undergoing a transition, from one based upon capital and production, to one mainly concerned with risks associated with a technological society. He argues that ''[a] risk society is a catastrophic society, where exceptional conditions threaten to become the norm.''
- *Disasters by Design* by Dennis Mileti overviews the second US national assessment of natural hazards. He concludes that ''[t]oo many of the accepted methods of coping with hazards have been shortsighted, postponing losses into the future rather than eliminating them.'' In part, this is because ''[p]eople have sought to control nature and to realize the fantasy of using technology to make themselves totally safe.''
- *The Ingenuity Gap* by Thomas Homer-Dixon is explicit about our adaptation deficit, arguing as follows: ''I'm convinced that if we ... allow the complexity and

> turbulence of the systems we've created to go on increasing, unchecked—these systems will sometimes fail catastrophically.... I believe this will be the central challenge—as ingenuity gaps widen the gulfs of wealth and power among us, we need imagination, metaphor and empathy more than ever, to help us remember each other's essential humanity.''

In part these insights reflect that many strategies used to mitigate risk only transfer it to other groups of people or to the future. The argument for this is that many mitigation strategies have the unintended result of people and communities engaging in excessive risk-taking behavior, such that their risks to extremes beyond the design standards of their infrastructure or land use planning become so large that the risk reductions achieved to more commonplace events is overwhelmed in comparison. The results of environmental degradation, excessive risk-taking and short-term values are a widening adaptation deficit—a gap between the risks we face and our ability to address them—and catastrophic loss of lives and properties.

Accepting the notion that risk and hazards are socially constructed, which is based on the assumptions that the risks people choose to address and the metrics used to represent them are based upon values, requires addressing the disaster problem in an interdisciplinary manner—one that works to build community and change cultural perspectives.

5 Dealing with hazards: people, community and resilience perspectives

Since the central theme of this special issue is to highlight the significance of societal dimensions in conceptualizing the hazards and disasters *problematique* and in preventing and mitigating losses from disasters more effectively, an explanation of vulnerability is extended beyond the exposure to hazards alone by Fikret Berkes, who has been advocating for a socio-ecological systems approach to natural resource and environmental management since the early years of the relevant debates. He argues that vulnerability also resides in the resilience of the system experiencing the hazard. Understanding resilience is imperative for the discussion of vulnerability for several reasons: it helps assess hazards holistically in coupled human–environment systems; it stresses the ability of a system to deal with a hazard, absorbing the disturbance or adapting to it; and it helps explore policy options for dealing with uncertainty and future change. As building resilience into human–environment systems is an effective way to cope with change characterized by surprises and unknowable risks, it is more central now than ever before.

Fikret Berkes, Brenda Murphy, James Gardner and Julie Dekens have, through their theoretical considerations and empirical investigations, provided the insight that resilient socio-ecological systems are capable of learning and adjusting, using all forms of knowledge, self-organizing and developing positive institutional linkages with other systems or sub-systems in the face of hazards. By emphasizing the notion of 'community', Brenda Murphy argues that communities, whether tied to particular places or not, are posited as being very central, but frequently overlooked resources in both proactive and reactive phases of disaster and emergency management practice. Through the use of two case studies, the 2003 electricity power blackout in the eastern parts of both Canada and the United States and the 2000 water-borne disaster in Walkerton, she shows that social capital resources (networks of strong

and weak ties) can improve a community's resilience to risks and hazards, and thus require policy attention because of their prime importance in hazards and emergency management. Gardner and Dekens assert that the ability of social–ecological systems to build resilience in the context of hazards is an important factor in their long-term sustainability. Through examining examples from Canada and India, they find that resilient social–ecological systems possess the capacity to learn and adjust, employ all forms of knowledge, they self-organize and develop positive institutional linkages in the face of hazards. The study implies that traditional social–ecological systems built resilience through avoidance, which was effective for localized hazards. Also, cross-scale institutional linkages is shown to be a particularly effective means of resilience building in mountain social–ecological systems in the face of all contemporary hazards.

In order to examine how current emergency and disaster management strategies in the developing world have used social capital, community resilience and other local knowledge-based resources, along with formal institutional efforts, Khan and Rahman investigated current policies and practices in Bangladesh. Evidence from their study in Bangladesh has revealed that despite the presence of some strengths such as long experience in disaster response and recovery, the people's resilience and donor agency support, the country's disaster management strategies suffer seriously from the absence of a functioning partnership among the stakeholders within the formal organizational structure. They find that the weaknesses in the institutional approach are rooted in the lack of a culture of collective decision-making in planning, in resource sharing, and in implementing disaster management policies and programs. It is argued that a partnership framework would be very effective in preventing, mitigating, preparing, responding to and recovering from risks and hazards if it is developed based on a culture of shared thinking and acting.

6 Conclusions

Unless hazards or extreme events affect people, they are simply natural occurrences without social significance. Although it is bringing people into the equation that defines them, nature-triggered disasters have traditionally been treated as resulting from forces external to the human sphere. In contrast to recent social science trends within academic literature, in practice hazards are still often viewed, analyzed, and treated not only as 'natural', and thus as independent entities from the humans, they are also dealt with separately—case by case and hazard by hazard (see Tobin and Montz 1997). In cases where human intervention can change and/or modify geophysical systems such an approach may be partially successful. However, where human awareness of, and preparedness to deal and cope with risk and hazards play a significant role, human dimensions are unavoidable aspects of hazards analysis and management. The post World War II era, which was dominated by a technocratic approach, saw how despite unprecedented allocation of financial and human resources, losses to nature-triggered disasters greatly increased. The North American based research of Gilbert White and his disciples contributed greatly to these findings (Kates and Burton 1986a, b).

During the last two decades, much has been written and said about the need to shift the conceptual and management approach from the technological control of geophysical forces to societal forces where humans have more control. In order to

prepare our emergency/disaster managers, first responders and communities to better deal with emerging risks and hazards, there is a need for improved public education, the design of resilient critical infrastructure, regulation concerning land-use planning and zoning, and resource allocation to improve early warning. On the response and recovery side, improved collaboration and cooperation between institutions, both vertically and horizontally, has been emphasized. A good example of such a shift has been noted after the Red River Valley, Manitoba, Canada floods in 1997. The establishment of the Homeland Security Department in the United States was intended to serve a similar purpose, though its incorporation and marginalization of FEMA has been criticized severely. What is missing is that despite the accumulation of evidence that local community resilience and participatory decision-making through institutional partnerships are key to effective risk and hazards management, minimal efforts are being made to recognize the role of first responders and local communities.

Given that the nature of risk and hazards is rapidly changing in the contemporary world, knowledge institutions, emergency and disaster management practitioners, and first responders need to work within evolving paradigms that emphasize an adaptive approach. These institutions also need to develop culture and relationships to work together to look for and provide more effective solutions. There is an increasing need to shift our focus from post-disaster relief and rehabilitation to vulnerability, resilience and mitigation. Without cross-sectoral and cross-institutional understanding and cooperation, initiatives to deal and cope with risk and hazards will remain significantly less than optimum and inefficient. In addition, top-down interventions and command-and-control approaches to deal with large scale emergencies and disasters are outmoded, and a participatory mode of approach should be at the forefront of public safety and hazards and disaster management.

Acknowledgments The symposium on 'Reducing Risk through Partnerships' was an initiative of the Canadian Risk and Hazards Network (CRHNet), and we would like to thank Leslie King of the Clayton H. Riddell Faculty of Environment, Earth, and Resources of the University of Manitoba for her support and advice. Public Safety Canada, Manitoba Emergency Measures Organization, Earth Science Division of the Natural Resources Canada, Environment Canada, and Health Canada, co-sponsors of the symposium, made major contributions to its success and the follow up publications. For this, we thank Peter Hill, Irwin Itzkovitch, Chuck Sanderson, Valeriah Hwacha, Dave Hutton, and Grace Kosida. Finally, this special issue could not have been accomplished without the help of several research and editorial assistants. We would also like to extend our special thanks to Nancy Powell Quinn, Glenn Bergen and Cameron Zywina for their kind help and contributions to the preparation of this special issue.

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